HINDUSTAN
INSTITUTE OF TECHNOLOGY & SCIENCE
(DEEMED TO BE UNIVERSITY)

DEPARTMENT OF AUTOMOBILE ENGINEERING

CURRICULUM AND SYLLABUS

Under CBCS

(Applicable for Students admitted from Academic Year 2018-19)

B. Tech. Automobile Engineering

DEPARTMENT OF AUTOMOBILE ENGINEERING

SCHOOL OF MECHANICAL SCIENCES

HINDUSTAN INSTITUTE OF TECHNOLOGY & SCIENCE
VISION AND MISSION

MOTTO

"TO MAKE EVERY MAN A SUCCESS AND NO MAN A FAILURE."

VISION

To be an International Institute of Excellence, providing a conducive environment for education with a strong emphasis on innovation, quality, research and strategic partnership blended with values and commitment to society.

MISSION

- To create an ecosystem for learning and world class research.
- To nurture a sense of creativity and innovation.
- To instill highest ethical standards and values with a sense of professionalism.
- To take up activities for the development of Society.
- To develop national and international collaboration and strategic partnership with industry and institutes of excellence.
- To enable graduates to become future leaders and innovators.

VALUE STATEMENT

- Integrity, Innovation, Internationalization

DEPARTMENT OF AUTOMOBILE ENGINEERING
VISION AND MISSION

VISION

To enable the graduates to be successful in their career as an Automobile Engineer.

MISSION

M1: To inculcate knowledge in Automobile Engineering

M2: To impart skills and training on the advancements in Automobile Engineering such as Automotive Electronics, Autonomous Vehicles, etc.

M3: To instill the highest ethical standards to be a Professional Automobile Engineer for social development.

B. Tech. Automobile Engineering

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

PEO 1 : Provide in-depth knowledge in Automobile Engineering and awareness of latest development in allied fields of engineering to the students and make them industry ready engineers (T – shaped engineers).

PEO 2 : Provide a range of specialized modules integrated within the structured learning environment for encouraging the students for higher studies and do research in automobile and related fields.

PEO 3 : Develop a challenging environment that supports and encourages the students to become an entrepreneur.

PEO 4 : Develop a culture that promotes individual and team work for carrying out innovative projects, assignments and research work in engineering sciences.

PEO 5 : A competitive degree structure is provided, that responds to time, need and technology.

PROGRAMME OUTCOMES (PO's)

Engineering Graduates will be able to:

PO1 : **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 : **Problem Analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 : **Design Development of Solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4 : **Conduct Investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5 : **Modern Tool Usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6 : **The Engineer & Society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7 : **Environment & Sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8 : **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9 : **Individual & Team Work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10 : **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11 : **Project Management & Finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12 : **Life-Long Learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES: (PSO's)

PSO1 : Design, Analysis, Fabrication and Testing of vehicles, which enable the students to compete globally.

PSO2 : Carry out research in fuel economy, emission reductions, alternate fuels and solar vehicle for the benefit of the society and environment

ACADEMIC REGULATIONS FOR

B. TECH. / B. TECH. (HONS.) DEGREE PROGRAMME

TABLE OF CONTENTS

I. PREAMBLE

As per the recommendations of UGC, the Hindustan Institute of Technology and Science (HITS) has introduced Choice Based Credit System (CBCS) from the academic year 2015-16. Choice Based Credit System (CBCS) is a proven, flexible mode of learning in higher education which facilitates a student to have guided freedom in selecting his/her own choices of courses in the curriculum for completing a degree program. This revision of regulations, curriculum and syllabi has been carried out further to make it more flexible and adaptive to the technology advancements happening in the world. CBCS offers a flexible system of learning.

The system permits a student to

(i) Learn at their own pace through flexible registration process

(ii) Choose electives from a wide range of courses offered within and outside their departments

(iii) Undergo additional courses and acquire more than required number of credits to obtain B. Tech (Hons)

(iv) Undergo additional courses in their special areas of interest and earn additional credits to obtain B. Tech with Minor Specialization

(v) Adopt an interdisciplinary approach in learning

(vi) Avail transfer of Credits

(vii) Gain Non – CGPA credits to enhance skill/employability by taking up additional project work, entrepreneurship, co-curricular and vocational training.

(viii) Make the best use of the expertise of available faculty.

(ix) Learn and earn credits through MOOC and Project Based Learning

(x) Enhance their Knowledge, Skill and Attitude through participation in innovative Curriculum Design, Delivery and Assessments.

The Curriculum is designed to take into the factors listed in the Choice Based Credit System (CBCS) with focus on Project Based Learning and Industrial Training so as to enable the students become eligible and fully equipped for employment in industries choose higher studies or entrepreneurship.

II. DEFINITIONS AND NOMENCLATURE

In these Regulations, unless the context otherwise requires:

1. “Programme” means Degree Programme like B.Tech. Degree Programme.
2. “Discipline” means specialization or branch of B.Tech. Degree Programme, (e.g. Civil Engineering).
3. “Course” means a theory or practical subject that is normally studied in a semester, (e.g. Mathematics, Physics, etc.).

4. "Vice – Chancellor of HITS" means the Head of the Institution.
5. "Registrar" is the Head of all Academic and General Administration of the Institute.
6. "Dean Academics" means the authority of the University who is responsible for all academic activities of various programmes and implementation of relevant rules of these Regulations pertaining to the Academic Programmes.
7. "Controller of Examinations" means the authority of the University who is responsible for all activities related to the University Examinations, publication of results, award of grade sheets and degrees.
8. "Dean – Student Affairs" is responsible for all student related activities including student discipline, extra and co – curricular activities, attendance and meetings with class representatives, Student Council and parent – teacher meet.
9. "HoD" means the Head of the Department concerned.
10. "Institute" means Hindustan Institute of Technology and Science (HITS), Chennai.
11. "TCH" means Total Contact Hours – refers to the teaching – learning periods.
12. "DEC" means Department Exam Committee.
13. "BoS" means Board of Studies.
14. "BoM" means Board of Management.
15. "ACM" means Academic Council meeting the highest authoritative body for approval for all Academic Policies.
16. "Class Teacher" is a faculty of the class who takes care of the attendance, academic performance and the general conduct of the students of that class.
17. "CIA" is Continuous Internal Assessment which is assessed for every student for every course during the semester.
18. "ESE" is End Semester Examination conducted by the Institute at the End of the Semester for all the courses of that semester.
19. "AICTE" means All India Council for Technical Education.
20. "UGC" means University Grants Commission.
21. "MHRD" means Ministry of Human Resource Development, Govt. of India.

ACADEMIC REGULATIONS FOR B. Tech. / B.Tech. (Hons.)
Under Choice Based Credit System (CBCS)
(Effective from Academic year 2018 - 19)

1.0 Vision, Mission and Objectives

The Vision of the Institute is "To make every man a success and no man a failure".

1.1 The Mission of the institute is

- To create an ecosystem that promotes learning and world class research.
- To nurture creativity and innovation.
- To instil highest ethical standards and values.
- To pursue activities for the development of the Society.
- To develop national and international collaborations with institutes and industries of eminence.
- To enable graduates to become future leaders and innovators.

Value Statement

Integrity, Innovation, Internationalization

1.2 Further, the Institute always strives

- To train our graduates with the latest and the best in the rapidly changing fields of Architecture, Engineering, Technology, Management studies, Science and Humanities and Liberal Arts.
- To develop graduates, with a global outlook, possessing Knowledge, Skills and Attitude and capable of taking up challenging responsibilities in the respective fields.
- To mould our graduates as citizens with moral, ethical and social values so as to fulfil their obligations to the nation and the society.
- To promote research in the field of Architecture, Engineering, Technology, Management studies, Science and Humanities and Liberal Arts and Allied disciplines.

1.3 Aims and Objectives of the Institute are focused on

- Providing state of the art education in Engineering, Technology, Applied Sciences and Management studies.
- Keeping pace with the ever – changing technological scenario and help the graduates to gain proper direction to emerge as competent professionals fully aware of their commitment to the society and the nation.
- To inculcate a flair for Research, Development and Entrepreneurship.

2.0 Admission

The admission policy and procedure shall be decided from time to time by the Board of Management (BOM) of the Institute, based on the guidelines issued by the UGC/ Ministry of Human Resource Development (MHRD), Government of India. The number of seats in each of the B. Tech. degree programme will be decided by the Board of Management of the Institute as per the directives of AICTE/ UGC / MHRD, Government of India, taking into account, the market demands. Seats are also made available up to 20% of the sanctioned intake for Non – Resident Indians and foreign nationals, who satisfy the admission eligibility norms of the Institute.

2.1. Eligibility for Admission

(i) Regular Entry

Passed 10 + 2 examination with Physics and Mathematics as compulsory subjects along with one of the other subjects as Chemistry/ Biotechnology/ Biology/ Technical Vocational course.

The candidates should have obtained the minimum marks as per AICTE norms.

(ii) Lateral Entry

The candidates possessing a Diploma in Engineering/Technology in the relevant discipline of specialization with minimum 50% marks awarded by the State Boards of Technical Education, India or any other competent authority as accepted by the Board of Management of the Institute as equivalent thereto are eligible for admission to the 3rd Semester of the B. Tech degree programme.

2.2 The candidate has to fulfil all the prescribed admission requirements / norms of the Institute.

2.3. In all matters relating to admission to the B. Tech degree programme, the decision of the Board of Management of the Institute shall be final.

2.4. At any time after admission, if found that a candidate has not fulfilled one or many of the requirements stipulated by the Institute, or submitted forged certificates, the Institute has the right to revoke the admission and forfeit the fee paid. In addition, legal action may be taken against the candidate as decided by the Board of Management.

3.0 Student Discipline

Every student is required to observe utmost discipline and decorum both inside and outside the campus and not to indulge in any activity which may affect adversely the prestige reputation of the Institute.

3.1 Any act of indiscipline of a student reported to the Dean (Student affairs) and Head of the Department will be referred to a Discipline Committee constituted for the purpose. The Committee will enquire into the charges and decide on a suitable punishment if the charges are substantiated. The committee will also authorize the Dean (Student Affairs) to recommend to the Vice-Chancellor for the implementation of the decision. The student concerned may appeal to the Vice-Chancellor, whose decision will be the final.

3.2 Ragging in any form is a criminal and non-bailable offence in our country. The current State and Central legislations provide stringent punishments including imprisonment. Once the involvement of a student(s) is established in ragging, offending fellow students/staff, harassment of any nature to the fellow students/staff etc. the student(s) will be liable to be dismissed from the Institute, as per the laid down procedures of the UGC / Govt. /Institute. Every senior student of the Institute, along with their parent, shall give an undertaking every year in this regard and the same should be submitted at the time of Registration.

4.0 Structure of the B. Tech Degree Programme

4.1 All B. Tech. degree Programmes will have the curriculum and syllabi (for 4 years) as approved by the respective Board of Studies and Academic Council of the Institute.

4.2 Credits are the weightages, assigned to the courses based on the following general pattern:

One Lecture / Tutorial period per week	--- 1 credit
Up to Three periods of Practical per week	--- 1 credit
4 periods of Practical per week	--- 2 credits

4.3 The curriculum for B. Tech. programme is designed to have a minimum of **165 credits + 4 Non – CGPA credits** that are distributed across eight semesters of study for the award of degree.

Choice Based Credit System (CBCS) was introduced from the Academic year 2015-16 in the curriculum to provide the students, a balanced approach to their educational endeavour.

Under CBCS, the degree programme will consist of the following categories of courses:

i) **General Core foundation** (**CF**) courses comprising of

- Humanities courses;
- Basic Sciences (BS)including Physics, Chemistry and Mathematics;
- Engineering Sciences (ES), including Basic Engineering courses such as Material Science, Basic Workshop, Engineering Drawing, Engineering Graphics, Digital systems, etc.

ii) Compulsory Courses (CC) consist of the following.

a. **Professional Core (PC)** courses: These courses expose the students to the foundation of Engineering topics related to the chosen programme of study comprising of theory and Practical/ field work/ Design project/ Project.

b. **Departmental Elective** (**DE**): These courses enable the students to take up a group of courses of their interest in the area of specialization offered by the parent Department / School.

iii) Non –Departmental Electives (NE): These courses are offered by Engineering and Non-Engineering departments (across the disciplines) other than their parent Department. Two groups of Electives are available under NE namely, Engineering Electives, offered by the Engineering Departments and Open Electives, offered by the Non – Engineering departments.

iv) Indexed Journal / Conference Publications: If a student publishes a research paper as main author in indexed Journal / Conference, the same can be considered as equivalent to two – credit course under NE.

v) Non-CGPA courses: These courses are offered in certain semesters are compulsory, but are not used for calculation of GPA and CGPA. However, the credits will be mentioned in the grade sheet.

4.4 Non – CGPA courses

The student shall select any two courses /activity listed in **Table 1** during the course of study. The student has to make his / her own efforts for earning the credits. The grades given will be Pass / Fail (P/F). The respective class teachers have to encourage, monitor and record the relevant activities of the students, based on the rules issued from time to time by the Institute and submit the End semester report to the Head of the Department.

Table 1. Non – CGPA Courses

No.	Course / Activity	Credits
1.	Start ups	2
2.	Industrial Training	2
3.	Technical conference, seminar, competitions, Professional Societies	2
4.	Management courses	2
5.	Technical Certification Course	2
6.	Sports	2
7.	NCC	2
8.	NSS	2
9.	YRC	2
10.	Art and Cultural activities	2
11.	English Proficiency Certification	2
12.	Aptitude Proficiency Certification	2
13.	Foreign Languages Level II and above	2
14.	Publication in Conferences / Seminar	2

4.5 A student must earn compulsorily, the credits mentioned under each category shown in **Table 2** and also a minimum total of **169 credits - 165 credits (CGPA) + 4 credits (Non CGPA)** for the award of B. Tech. degree. For Lateral entry students, the 41 credits required for first and second semester of B. Tech shall be deemed to have been earned based on their curriculum in the diploma course. They have to earn a minimum of **128 credits (124 credits + 4 Non CGPA credits)** for the award of B. Tech. degree.

4.6 Students are eligible for award of **B.Tech.(Hons)** upon successful completion of **181 credits (165 regular credits + 12 Additional Credits+ 4 Non CGPA credits)** maintaining a CGPA of 8.0 during their period of study (4 years) and no history of arrears as detailed in clause 7.0.

4.7 Students are eligible for the award of **B.Tech. with Minor specialisation** upon successful completion of 12 additional credits totalling **181 credits (165 regular credits + 12 Additional Credits+ 4 Non – CGPA credits)** as detailed in clause 8.0

Table 2. Distribution of Credits

No.	Category	Credits	Percentage
1	Basic Sciences (BS)	32	20
2	Humanities Courses (HS)	7	4
3	Professional Core (PC)	90	53
4	Department Elective (DE)	15	9
5	Non – Department Electives (NE)	10	6
6	Design Project	3	2
7	Internship	1	0.5
8	Project	8	5
9	Comprehension	1	0.5
	Total Credits	**165**	**100**
NON – CGPA			
10	Professional Development	4	---

4.8 The medium of instruction is English for all courses, examinations, seminar presentations and project reports.

5.0 Faculty Advisor

To help the students in planning their selection of courses and programme of study and for getting general advice on the academic programme, the concerned department will assign a certain number of students to a Faculty member who will be called their Faculty Advisor. Such Faculty Advisor will continue to mentor the students assigned to him/her for the entire duration of the programme.

5.1 Class Committee

5.2 Every section / batch of the B. Tech. Degree programme will have a Class Committee consisting of Faculty and students.

5.3 The constitution of the Class Committee will be as follows:

a. One Professor not associated with teaching the particular class shall be nominated by the Head of the Department to act as the Chairman of the Class Committee as approved by the Dean Academics.
b. Course coordinator of each of the lecture – based courses (for common courses).
c. Class teacher of the class.
d. All Faculty handling the courses for that class in the semester.

e. Workshop Superintendent (for first two semesters); as applicable.
f. Four students from the respective class nominated by Head of the Department
g. Faculty Advisors of the respective class.

5.4 Course committee

A course committee shall be constituted by the HOD for all the common courses, with the faculty who are teaching the courses and with a Professor of the core department as the Chairman. The Course committee shall meet periodically to ensure the quality of progression of the course in the semester.

5.5 The basic responsibilities of the Class Committee and Course committee are

a. To review periodically the progress of the students.
b. To discuss issues concerning curriculum and syllabi and the conduct of the classes.
c. To inform the students about the method of assessment as recommended by the Department Exam Committee ("DEC") at the beginning of the semester. Each class committee / course committee will communicate its recommendations and the minutes of the meetings to the Head of the Department, Dean (Academics) and the Dean (Student Affairs).
d. To conduct meetings at least thrice in a semester as per the Academic Plan issued by the Dean – Academics.
e. To review the academic performance of the students including attendance, internal assessment and other issues like discipline, maintenance etc.

6.0 Registration for courses in a Semester

A student will be eligible for registration of courses only if he/she satisfies the regulation clause 12.0 (progression), and clause 13.0 (maximum duration) and has cleared all dues to the Institute, Hostel and Library up to the end of the previous semester provided that student is not debarred from enrolment on disciplinary grounds.

6.1 The institute follows a flexible Choice Based Credit System and Slot based table. Accordingly, the students shall be given the option for selecting their courses, credits, teachers, slots and create their time table. The student is given the option of selecting the number of credits to undergo in a semester, subject to the curriculum requirements of minimum and maximum.

Except for the first year courses, registration for a semester will be done during a specified week before the start of the semester as per the Academic Schedule.

Late registration /enrolment will be permitted by the Dean – Academics for genuine cases, on recommendation by the Head of the respective department, with a late fee as decided from time to time.

6.2 The student shall make the choice of course in consultation with the Faculty Advisor and as stipulated from time to time.

6.3 Students shall have to pay additional fee as prescribed, for registering in certain elective courses under Non - Departmental Electives courses offered by certain specific Departments and for higher level Foreign Languages, as decided from time to time.

7.0 B. Tech, (Honours) Programme

A new academic programme B.Tech. (Hons.) is introduced in order to facilitate the students to choose additionally the specialized courses of their choice and build their competence in a specialized area. The features of the new programme, include:

a. B.Tech. students in regular stream can opt for B.Tech. (Hons.), provided they have a CGPA of 8.0 up to the end of fourth semester without any history of arrears.
b. The students opting for this program have to take four additional courses of their specialization of a minimum of 3 credits each from 5^{th} to 8^{th} semesters with not more than 2 additional courses in a semester.
c. The list of such additional courses offered by the various Departments of the respective school will be announced in the beginning of the academic year to facilitate the registration process.
d. The student can also opt for post graduate level courses
e. The faculty advisor will suggest the additional courses to be taken by the students based on their choice and level of their academic competence.
f. Students who have obtained “E” or “U” or “RC” / “RA” grade or “DE” category (vide clause 16.0 – Grading) in any course, including the additional credit courses, are not eligible for B.Tech. (Hons) degree.
g. The students have to pay the requisite fee for the additional courses.

8.0 B. Tech with Minor specialization:

Students, who are desirous of pursuing their special interest areas other than the chosen discipline of Engineering / Technology/ Arts/ Fashion/ Humanities/ Management/ Basic Sciences, may opt for additional courses in minor specialisation groups offered by a department other than their parent department. Such students shall select the stream of courses offered with pre – requisites by the respective departments and earn a Minor Specialization.

a. The number of credits to be earned for Minor specialization is 12 credits.

b. The students are permitted to register for their minor specialization courses from the V semester onwards subject to a maximum of two additional courses per semester.

c. The list of such additional courses offered by the various departments and the schedule will be announced in the beginning of the academic year to facilitate the registration process.

d. The students have to pay the requisite fee for the additional courses.

9.0 Attendance

The faculty handling a course must finalise the attendance, 3 calendar days before the last instructional day of the course and submit to the HoD through the class teacher.

a. A student with less than 75% attendance (Total Contact Hours - "TCH") in any course, will **not** be permitted to appear for the end-semester examination in that particular course, irrespective of the reason for the shortfall of the attendance. The student is however permitted to avail **Academic Leave** up to 10% for attending academic related activities like, Industrial Visits, Seminars, Conferences, Competitions etc., with the prior approval of the HoD. After the event, the student should submit the relevant documents for proof to the HoD for approval of the Academic Leave.

b. The remaining 25% allowance in attendance is given to account for activities under NCC / NSS / Cultural / Sports/ Minor Medical exigencies etc.

c. A student with an attendance ("TCH" – Total Contact Hours) between 40% and 75% in any course will fall under the category "RC", which means Repeat the Course during the Summer / Winter break. Students under "RC" category will **not** be permitted to attend the Regular End Semester Examinations for that course. During the Summer / Winter break, the regular courses of the respective semester will be offered as Summer/Winter Courses, to enable the students to get required attendance and internal assessment marks to appear in the Repeat examination.

d. Students under "RC" category in any course shall attend, the immediately following Summer / Winter course as detailed in clause 11.1. The detailed schedule of the Summer / Winter courses offered in every semester will be announced during the end of that semester. The student who have obtained "RC" has to select their appropriate slots and courses, optimally to attend the courses.

e. The student, whose attendance falls below 40% for a course in any semester, will be categorized as "RA", meaning detained in the particular course for want of attendance and they will not be permitted to write the End semester exam for that course. The procedure for repeating the course categorized as "RA" is mentioned in Clause 11.2.

9.1 Additional condonation may be considered in rare and genuine cases which includes, approved leave for attending select NCC / Sports Camps, cases requiring prolonged medical treatment and critical illness involving hospitalization.

For such select NCC / Sports Camps prior permission for leave shall be obtained by the respective faculty coordinator / Director of sports from the designated authority, before deputing the students.

9.2 For medical cases, submission of complete medical history and records with prior information from the parent / guardian to Dean (Student Affairs) is mandatory. The assessment of such cases will be done by the attendance sub – committee on the merit of the case and put up recommendations to the Vice – Chancellor. Such condonation is permitted **only twice** for a student in the entire duration of the programme.
The Vice-Chancellor, based on the recommendation of the attendance sub - committee may then give condonation of attendance, only if the Vice-Chancellor deems it fit and deserving. But in any case, the condonation cannot exceed 10%.

10.0 Assessment Procedure

Every course shall have two components of assessment namely,

a. Continuous Internal Assessment "CIA": This assessment will be carried out throughout the semester as per the Academic Schedule.
b. End Semester Examination "ESE": This assessment will be carried out at the end of the Semester as per the Academic Schedule.

The weightages for the various categories of the courses for CIA and ESE is given in Table 3.

Table 3 Weightage of the CIA and ESE for various categories of the courses

No.	Category of Courses	CIA weightage	CIA Minimum	ESE	ESE Minimum	Passing minimum (CIA + ESE)
1	Theory Course	50%	40%	50%	50%	45%
2	Practical Course	80%	50%	20%	50%	50%
3	Theory Course with Practical Components	60%	40%	40%	50%	45%
4	Department Elective (DE)/ Non – Department Elective (NE)	50%	40%	50%	50%	45%
5	Design Project	100%	50%	---	---	50%
6	Comprehension	100%	50%	---	---	50%
7	Internship	100%	50%	---	---	50%
8	Project and Viva Voce	50%	50%	50%	50%	50%

10.1 Theory Course / DE / NE Assessment weightages

The general guidelines for the assessment of Theory Courses, Department Electives "DE" and Non – Department Electives "NE" shall be done on a continuous basis is given in Table 4.

Table 4(a): Weightage for Assessment

No.		Assessment Theory, DE, NE courses	Weightage Theory, DE, NE courses	Duration
1.	CIA	First Periodical Assessment	5%	1 period
2.		Second Periodical Assessment	10%	1 Period
3.		Third Periodical Assessment	10%	1Period
4.		Seminar/Assignments/Project	15%	--
5.		Surprise Test / Quiz etc.,	10%	--
6.	ESE	End Semester Exam	50%	2 to 3 hours

10.2 Practical Course: For practical courses, the assessment will be done by the course teachers as below:

Weekly assignment/Observation / lab records and viva as approved by the Department Exam Committee "DEC"

a. Continuous Internal Assessment -- 80%
b. End Semester Examination -- 20%

10.3 Theory courses with practical Component: For theory courses with practical component the assessment will be calculated as follows as approved by the "DEC".

a. Continuous Internal Assessment -- 60%
b. End Semester Exam -- 40%

Table 4(b): Weightage for Assessment

No.		Assessment Theory, DE, NE courses	Weightage Theory, DE, NE courses	Duration
1.	CIA	First Periodical Assessment	10%	1 period
2.		Second Periodical Assessment	10%	1 Period
3.		Third Periodical Assessment	10%	1Period
4.		Practical Assessment	30%	----
5.	ESE	End Semester Exam	40%	2 to 3 hours

10.4 Design Project – Assessment

The general guidelines for assessment of Design Project is given in Table 5.

Table 5: Assessment pattern for Design Project

No.	Review / Examination scheme	Broad Guidelines	Weightage
1.	First Review	Concept	20%
2.	Second Review	Design	30%
3.	Third Review	Experiment/Analysis	20%
4.	Project report and Viva – Voce	Results and Conclusion	30%

10.5 Comprehension – Assessment

The general guidelines for assessment of Comprehension is given in Table 6.

Table 6: Assessment pattern for Comprehension

No.	Review / Examination scheme	Broad Guidelines	Weightage
1.	First Periodical Assessment – MCQ	Basic Sciences	20%
2.	Second Periodical Assessment – MCQ	Core Engineering	50%
3.	Third Periodical Assessment – Presentation	Emerging Areas	30%

10.6 Internship

A student has to compulsorily attend Summer / Winter internship during 3rd year for a minimum period of one month.

In lieu of Summer / Winter internship, the student is permitted to register for undertaking case study / project work under an engineering faculty of the Institute and carry out the project for minimum period of one month.

In both the cases, the internship report in the prescribed format duly certified by the faculty in-charge shall be submitted to the HoD. The evaluation will be done through presentation and viva. The course will have a weightage of one credit or as defined in the respective curriculum.

10.7 For final year Project / Dissertation / Design Project/ Internship, the assessment will be done on a continuous basis as given in Table 7

Table 7: Assessment of Project work

No.	Review / Examination scheme	Weightage
1.	First Review	10%
2.	Second Review	20%
3.	Third Review	20%
4.	Project report and Viva – Voce	50%

For the final year project and Viva – Voce end semester examination, the student shall submit a Project Report in the prescribed format issued by the Institute. The first three reviews will be conducted by a Committee constituted by the Head of the Department. The end – semester assessment will be based on the project report and a viva on the project conducted by a Committee constituted by the Registrar / Controller of examination. This may include an external expert.

10.8 For Non – CGPA courses, the assessment will be graded "Satisfactory/Not Satisfactory" and grades as Pass/Fail will be awarded.

10.9 Flexibility in Assessment

The respective Departments under the approval of the Department Exam Committee (DEC) may decide the mode of assessment, based on the course requirements.

10.10 A student securing **less than the minimum** specified internal assessment marks in any course (clause 10.0, Table 3), will **not be permitted** to appear for the end-semester examination in that particular course and will be graded under **"RC"** category for that course. This will be denoted in the grade sheet as "RC", till the course is successfully completed in the subsequent semester(s).

11.0 Procedures for Course Repetition / Repeat Examinations

11.1 Summer / Winter Course: - for "RC" Category

a. Students under RC category i.e.
   i. Attendance between 40% and 75% in any course(s) OR
   ii. CIA marks less than the prescribed minimum as specified in 10.0 Table 3 in any course(s) OR
   iii. Falls under both 1 and 2 above

are eligible for registering for the **Summer / Winter Course** which will be conducted during the Summer / Winter break, to improve their Attendance and/or CIA marks in the courses, by paying the **prescribed registration fee fixed from time to time.**.

b. The Odd semester regular courses will be offered only in the Winter and the even semester regular courses will be offered only in the Summer.
c. **RC** students shall register by payment of prescribed fee and attend the classes during the summer / winter break and take assessments to earn minimum internal marks (clause 10.0, Table 3) and/or required attendance, to become eligible for writing the Repeat Examinations (Clause 11.3).
d. The revised CIA marks shall not exceed 60% of the total internal weightage for any repeat course.
e. Re- Registration for 'RC' category

The students under "RC" category who **fail to improve** their attendance and/or CIA marks and **not** become eligible to write the Repeat Examination through the immediate summer/winter course are permitted to **re – register** for the Summer / Winter course again under "RC" category whenever it is offered in the subsequent semester(s) during their period of study by **paying 50% of the prescribed registration fee** as mentioned in Clause 11.1 (a). It is the responsibility of the student to fix the appropriate slots in the Summer / Winter course time table. The student will not be able to register if he/she is unable to fix the slots in the time table. The course will remain in the "RC" category until he / she successfully completes that course.

11.2 Course – Repetition - "RA" Category

a. Students who secure attendance less than **40%** in any course(s) in a semester will be categorized under "RA" - meaning **Repeat the course(s)** for want of minimum attendance. The CIA marks obtained by the students placed under RA category will become null and void.

b. "RA" category students shall re-register for the same course once again whenever it is offered in the subsequent regular semesters and has to secure required minimum attendance and minimum internal assessment marks to become eligible to appear in the end semester examination for that course, by paying the requisite fee.

c. It is the responsibility of the student to schedule their time table to include the "RA" courses without affecting the attendance of the regular courses of the current semester.

d. Normally, a student will be permitted to register for not more than 3 "RA" courses in a semester. However, the students who wish to register for more than 3 "RA" courses are permitted to register only if the student finds suitable slots for doing the course within the framework of the time table for the regular semester. Request for registrations of additional RA courses over and above 3 in a semester shall be got approved by the respective HoDs.

e. The student has the option to drop their regular courses proportionally in their regular semester during the course registration process without affecting the minimum credit requirement specified. Such dropped courses will be categorized as "RA". However, the student has to complete the dropped courses in the subsequent semesters.

f. It is the responsibility of the student to fix the slots for "RA" courses within the framework of the time table and slot availability without affecting his/her regular courses.

g. Detention

A student who secure RC or RA or both in all the theory courses prescribed in a semester shall repeat the semester by registering for the semester in the next academic year. However, he/she is permitted to appear for arrear examination as per eligibility.

11.3 Repeat Examinations

a. Normally, the results of the End Semester Examinations for Regular Theory courses are announced within a period of 10 days after the last regular examination.

b. During the even semester, the Repeat Examinations will be conducted for even semester courses and during the Odd semester the Repeat Examinations will be conducted for Odd semester courses.

c. The schedule for the Repeat Examinations will be notified through the Academic Calendar which will be published at the beginning of every academic year.
d. The students under "RC" category, who have secured the requisite attendance and internal assessment marks as applicable, by successfully completing the Summer / Winter course, are eligible to register for the Repeat Examinations.
e. The students who fail to secure a pass or being absent for genuine reasons in their End Semester Examination for the regular courses are permitted to appear for the Repeat Exams by paying the prescribed fee.
f. For the **Supplementary examinations (refer: Clause 15.2)**, the students with "U" grade in any course (refer clause 10.0 Table 3 and Clause 16.1) shall register by paying requisite fee and appear in the Repeat Examinations.
g. The students who wish to apply for the revaluation of their answer scripts (Regular/ Supplementary / Repeat Examinations) should apply immediately after the announcement of results.

12.0 Progression to higher semester

12.1 B.Tech.– Regular: Student has to satisfy the following conditions as laid down in Table 8 for progression from one academic year to next.

Table 8. Minimum Eligibility for progression B.Tech.- Regular

To enroll for semester	Minimum no. of credits to be earned for progression
3	NIL
5	15 credits* in Theory courses in 1st, 2nd and 3rd Semesters
7	30 credits* in Theory courses up to 5th Semester

** Credit calculation is applicable for Theory / Theory integrated lab only*

If a student fails to satisfy the above clause 12.1 in an academic year, the student has to take a break in study until they become eligible for progression

12.2 B.Tech.- Lateral Entry

Student has to satisfy the following conditions as laid down in Table 9 for progression from one academic year to next.

Table 9. Minimum Eligibility for progression B.Tech.- Lateral Entry

To enroll for semester	Minimum no. of credits to be earned
5	NIL
7	15 credits* in Theory courses in 3rd, 4th and 5th Semesters

**Credit calculation is applicable for Theory / Theory integrated lab only*

If a student fails to satisfy the above clause 12.2 in an academic year, the student has to take a break in study until they become eligible for progression

12.3 If a student is in **RC** category (due to lack of minimum CIA marks **as specified in clause no. 10. Table 3**) or **RA** category (due to lack of minimum attendance as specified in clause 9.0 e) **in all theory courses prescribed in a semester**, he/she will be detained and will not be allowed to proceed to the next semester. He/she has to re-register for all the courses in the following academic year only.

13.0 Maximum Duration of the Programme

A student may complete the programme at a slower pace than the regular pace, but in any case in **not more than 6 years for B. Tech**, **and not more than 5 years for lateral entry students excluding the semesters withdrawn as per clause 14.0.**

A student completing the B.Tech. programme during the extended period will not be eligible for Institute ranking.

14.0 Temporary Withdrawal from the Programme

a. A student is permitted to take a break, up to a maximum of 2 semesters, during the entire programme to clear the backlog of arrears.
b. A student may be permitted by the Vice- Chancellor to withdraw from the entire programme for a maximum of two semesters for reasons of ill health, Start – up venture or other valid reasons as recommended by a committee consisting of Head of Department, Dean (Academic) and Dean (Student Affairs).

15.0 Declaration of results

15.1 A student shall secure the minimum marks as prescribed in Clause 10.1(Table 3) in all categories of courses in all the semesters to secure a pass in that course.

15.2 **Supplementary Examinations:** If a candidate fails to secure a pass in a course and gets a "U" grade as per clause 16.1 he/she shall register and pay the requisite fee for re-appearing in the End Semester Examination during the following semester(s). Such examinations are called Supplementary Examinations and will be conducted along with the Regular /Repeat Examinations. The Supplementary Exams for the Odd semester courses will be conducted during the odd semester and supplementary exams for the even semester courses will be conducted during the even semester only. The student need not attend any contact course. The Internal Assessment marks secured by the candidate will be retained for all such attempts.

15.3 A candidate can apply for the revaluation of his/her end semester examination answer script in a theory course, after the declaration of the results, on payment of a prescribed fee.

15.4 If a candidate fails to secure a pass in Practical/Theory with Practical component / Design Project / Internship / Comprehension courses, due to not satisfying the minimum passing requirement ("U" grade) – as per clause 16.1 he/she shall register for the courses by paying the prescribed fee in the subsequent semester when offered by the departments.

15.5 Revaluation is **not** permitted for Practical/Theory with Practical component/Design Project / Internship / Comprehension courses. However, only for genuine grievances as decided by the Exam Grievance Committee a student may be permitted to apply for revaluation.

15.6 After 5 years, i.e., completion of one year (2 semesters) from the normal duration of the programme, the internal assessment marks obtained by the candidate will not be considered in calculating the passing requirement. A candidate who secures 50% in the end semester examination will be declared to have passed the course and earned the specified credits for the course irrespective of the score in internal assessment marks earned in that course.

15.7 Candidate who earns required credits for the award of degree after 5 years for B.Tech. programme (on expiry of extended period of 2 semesters over and above normal duration of course) he/she will be awarded only *second class* irrespective of his/her CGPA. However, the period approved under temporary withdrawal, if any, from the programme (13.0) will be excluded from the maximum duration as mentioned above.

15.8 Semester Abroad Programme: Students who are allowed to undergo internship or Training in Industries in India or abroad during their course work or attend any National / International Institute under semester abroad programme (SAP) up to a maximum of 2 semesters will be granted credit transfer for the Course Work/project work done by them in the Industry /Foreign Institute as per the recommendations of the credit transfer committee. The leave period of the students for International internships / Semester Abroad programme etc., will be accounted for attendance.

16.0 Grading

16.1 A grading system as shown in Table 10 will be followed.

Table 10: Grading system

Range of Marks	Letter Grade	Grade Points	Remarks
90 – 100	S	10	Outstanding
80-89	A	09	Excellent
70-79	B	08	Very Good
60-69	C	07	Good
50-59	D	06	Average
45 – 49	E	05	Pass
<45	U	00	To Reappear for end-semester examination
--	RC	00	**Repeat Course (Summer / Winter) due to** Attendance deficiency (between 40% and 75%) and/or I. Lack of minimum CIA marks as specified in clause 10.0 Table 3
--	RA	00	Repeat the course due to (i) Lack of minimum attendance (below 40%) in regular course
	--	00	**DETAINED** "RC" or "RA" or both in all registered theory courses of a semester. The student is detained and has to repeat the entire semester. Clause 12.3

16.2 GPA and CGPA

GPA is the ratio of the sum of the product of the number of credits Ci of course "i "and the grade points P_i earned for that course taken over all courses "i" registered and successfully completed by the student to the sum of Ci for all "i". That is,

$$GPA = \frac{\sum_{i} C_i P_i}{\sum_{i} C_i}$$

CGPA will be calculated in a similar manner, in any semester, considering all the courses enrolled from the first semester onwards.

16.3 The Grade card will not include the computation of GPA and CGPA for courses with letter grade **RA, RC** and **U** until those grades are converted to the regular grades.

16.4 A course successfully completed cannot be repeated.

17.0 Grade Sheet

17.1 Letter grade

Based on the performance, each student is awarded a final letter grade at the end of the semester in each course. The letter grades and corresponding grade points are given in Table 10.

17.2 A student is considered to have completed a course successfully and earned credits if he/she secures a letter grade other than **U, RC, RA** in that course.

17.3 After results are declared, grade sheet will be issued to each student which will contain the following details:

a. Program and discipline for which the student has enrolled.
b. Semester of registration.
c. The course code, name of the course, category of course and the credits for each course registered in that semester
d. The letter grade obtained in each course
e. Semester Grade Point Average (GPA)
f. The total number of credits earned by the student up to the end of that semester in each of the course categories.
g. The Cumulative Grade Point Average (CGPA) of all the courses taken from the first semester.
h. Credits earned under Non CGPA courses.
i. Additional credits earned for B. Tech (Hons.) and B. Tech with Minor specialization.

18.0 Class/Division

18.1 Classification is based on CGPA and is as follows:

CGPA ≥ 8.0: First **Class with distinction**
6.5 ≤ CGPA <8.0: **First Class**
5.0 ≤ CGPA <6.5: **Second Class.**

18.2 (i) Further, the award of **'First class with distinction'** is subject to the candidate becoming eligible for the award of the degree having passed the examination in all the courses in his/her first appearance with effect from II semester, within the minimum duration of the programme.

(ii) The award of **'First Class'** is further subject to the candidate becoming eligible for the award of the degree having passed the examination in all the courses **within 5 years for B. Tech programmes**

(iii) The period of authorized break of the programme (vide clause 14.0) will not be counted for the purpose of the above classification.

(iv) To be eligible for award of **B. Tech (Hons.)** the student must have earned additional 12 credits in the relevant Engineering courses offered by the Departments of the respective Schools, thereby a total of **181 credits (165 regular credits + 12 additional credits + 4 Non CGPA credits) and should have 8.0 CGPA without any history of arrears and should not have secured E, RC, RA, U, in any course during the entire programme.**

(v) To be eligible for award of **B. Tech with Minor Specialization**, the student must have earned additional 12 credits in the relevant courses offered by other than the parent department and has successfully earned **181 credits (165 regular credits + 12 Additional credits + 4 Non CGPA Credits)**

19.0 Transfer of credits

19.1. Within the broad framework of these regulations, the Academic Council, based on the recommendation of the Credit Transfer Committee so constituted may permit students to transfer part of the credit earned in other approved Universities of repute & status in the India or abroad.

19.2 The Academic Council may also approve admission of students who have completed a portion of course work in another approved Institute of repute under lateral entry based on the recommendation of the credit transfer committee on a case to case basis.

19.3 Admission norms for working Professional:

Separate admission guidelines are available for working / experienced professionals for candidates with the industrial / research experience who desire to upgrade their qualification as per recommendation of Credit Transfer Committee.

20.0 Eligibility for Award of the B.Tech. /B. Tech (Hons)/ B. Tech with Minor Specialization Degree

20.1 A student shall be declared to be eligible for award of B. Tech. /B. Tech (Hons) / B. Tech degree with Minor specialization if he/she has satisfied the clauses 4.6 /7.0 / 8.0 respectively within the stipulated time (clause 13, 14).

a. Earned the specified credits in all the categories of courses (vide clause 4.6) as specified in the curriculum corresponding to the discipline of his/ her study ;
b. No dues to the Institute, Hostels, Libraries etc.; and
c. No disciplinary action is pending against him / her.

The award of the degree shall be recommended by the Academic Council and approved by the Board of Management of the Institute.

21.0 Change of Discipline

21.1 If the number of students in any discipline of B.Tech. programme as on the last instructional day of the First Semester is less than the sanctioned strength, then the vacancies in the said disciplines can be filled by transferring students from other disciplines subject to eligibility. All such transfers will be allowed on the basis of merit of the students. The decision of the Vice-Chancellor shall be final while considering such requests.

21.2 All students who have successfully completed the first semester of the course will be eligible for consideration for change of discipline subject to the availability of vacancies and as per norms.

22.0 Power to modify

Notwithstanding all that has been stated above, the Academic Council is vested with powers to modify any or all of the above regulations from time to time, if required, subject to the approval by the Board of Management.

B.TECH - AUTOMOBILE ENGINEERING									
(165 CREDIT STRUCTURE)									
SEMESTER - I									
SL. NO	**COURSE CATEGORY**	**COURSE CODE**	**NAME OF THE COURSE**	**L**	**T**	**P**	**C**	**S**	**TCH**
1	BS	MEA4101/ ELA4101	Engineering Graphics and Computer Aided Design / Professional English and soft skills	1	1	2	3	1	4
2	BS	MAA4101	Matrices and Calculus	3	0	2	4	1	5
3	BS	PHA4101/ CYA4101	Engineering Physics / Engineering Materials	3	0	0	3	1	3
4	PC	CSA4101 GEA4102	Problem Solving Using C* / Sustainable Engineering Systems	2	0	2*	3/2	1	4/3
5	PC	ATB4101/ EEB4101	Engineering and Design/ Introduction to Digital Systems	3	0	0	3	1	3
6	BS	GEA4131	Engineering Immersion Lab	0	0	2	0.5	2	2
7	BS	PHA4131/ CYA4131	Engineering Physics Lab/ Materials Chemistry Lab	0	0	2	1	0	2
Total				**12**	**1**	**10**	**17.5/ 16.5**	**7**	**23/ 22**
***Project based Learning**									

SEMESTER - II									
SL. NO	**COURSE CATEGORY**	**COURSE CODE**	**NAME OF THE COURSE**	**L**	**T**	**P**	**C**	**S**	**TCH**
1	BS	MAA4117	Analytical Mathematics	3	0	2	4	0	5
2	BS	CYA4101/ PHA4101	Engineering Materials / Engineering Physics	3	0	0	3	1	3
3	BS	ELA4101/ MEA4101	Professional English and soft skills / Engineering Graphics and Computer Aided Design	1	1	2	3	1	4
4	PC	GEA4102/ CSA4101	Sustainable Engineering Systems/ Problem Solving Using C*	2	0	2*	2/3	1	3/4
5	PC	EEB4101/ ATB4101	Introduction to Digital Systems / Engineering and Design	3	0	0	3	1	3
6	PC	ATB4117	Engineering Mechanics	3	1	0	4	1	4
7	PC	ATB4118	Manufacturing Technology	3	0	0	3	1	3
8	PC	ATB4141	Manufacturing Technology Lab	0	0	2	1	0	2
9	BS	GEA4131	Engineering Immersion Lab	0	0	2	0.5	2	2
10	BS	CYA4131/ PHA4131	Materials Chemistry Lab / Engineering Physics Lab	0	0	2	1	0	2
Total				**18**	**2**	**10/ 12**	**24.5/ 25.5**	**9**	**30/ 32**

SEMESTER - III									
SL. NO	**COURSE CATEGORY**	**COURSE CODE**	**NAME OF THE COURSE**	**L**	**T**	**P**	**C**	**S**	**TCH**
1	BS	MAA4201	Partial Differential Equations and Transforms	3	1	0	4	0	4
2	PC	ATB4201	Applied Thermodynamics	3	1	0	4	1	4
3	PC	ATB4202	Theory of Machines	3	1	0	4	1	4
4	PC	ATB4203	Automotive Engines	3	1	0	4	1	4
5	BS	GEA4216	Professional Ethics and Life Skills	2	0	0	2	1	2
6	DE		Department Elective - I	3	0	0	3	1	3
7	NE		Non Department Elective - I	2	0	0	2	1	2
8	PC	ATB4231	Automotive Engine Components Laboratory	0	0	2	1	0	2
9	PC	ATB4232	Fuels and Engine Testing Laboratory	0	0	2	1	0	2
Total				**19**	**4**	**4**	**25**	**6**	**27**

SEMESTER - IV									
SL. NO	**COURSE CATEGORY**	**COURSE CODE**	**NAME OF THE COURSE**	**L**	**T**	**P**	**C**	**S**	**TCH**
1	BS	MAA4216	Probability and Statistics	3	1	0	4	0	4
2	PC	ATB4216	Solid Mechanics	3	1	0	4	1	4
3	PC	ATB4217	Fluid Mechanics and Machinery	3	1	0	4	1	4
4	PC	ATB4218	Automotive Chassis	3	0	0	3	1	3
5	DE		Department Elective - II	3	0	0	3	1	3
6	NE		Non Department Elective - II	2	0	0	2	1	2
7	PC	ATB4241	Fluid Mechanics and Machinery Laboratory	0	0	2	1	0	2
8	PC	ATB4242	Automotive Chassis Laboratory	0	0	2	1	0	2
9	PC	ATB4243	Material Testing and Characterization Laboratory	0	0	2	1	0	2
Total				**17**	**3**	**6**	**23**	**5**	**26**

SEMESTER - V									
SL. NO	**COURSE CATEGORY**	**COURSE CODE**	**NAME OF THE COURSE**	**L**	**T**	**P**	**C**	**S**	**TCH**
1	BS	MAA4301	Optimization Techniques	3	1	0	4	0	4
2	PC	ATB4301	Automotive Transmission	3	0	0	3	1	3
3	PC	ATB4302	Automotive Engine Components Design	3	0	2	4	1	5
4	PC	ATB4303	Automotive Electrical and Electronics	3	0	0	3	1	3
5	PC	ATB4304	Electric and Hybrid Vehicles	3	0	0	3	1	3
6	DE		Department Elective - III	3	0	0	3	1	3
7	NE		Non Department Elective - III	2	0	0	2	0	2
8	PC	ATB4331	Automotive Design & Styling Laboratory	0	0	2	1	0	2
9	PC	ATB4332	Automotive Electrical and Electronics laboratory	0	0	2	1	0	2
Total				**20**	**1**	**6**	**24**	**5**	**27**

SEMESTER - VI									
SL. NO	**COURSE CATEGORY**	**COURSE CODE**	**NAME OF THE COURSE**	**L**	**T**	**P**	**C**	**S**	**TCH**
1	PC	ATB4316	Automotive Chassis Design	3	0	2	4	1	5
2	PC	ATB4317	Vehicle Dynamics	3	1	0	4	1	4
3	PC	ATB4318	Control Systems	3	1	0	4	1	4
4	BS	GEA4304	Business Economics	2	0	0	2	1	2
5	DE		Department Elective - IV	3	0	0	3	1	3
6	NE		Non Department Elective - IV	2	0	0	2	1	2
7	PC	ATB4341	Vehicle Dynamics Laboratory	0	0	2	1	0	2
8	PC	ATB4342	Control Systems Laboratory	0	0	2	1	0	2
9	PC	ATB4343	Design Project - I	0	0	2	1	0	2
10	PC	ATB4344	Comprehension	0	0	2	1	0	2
Total				**16**	**2**	**10**	**23**	**6**	**28**

SEMESTER - VII									
SL. NO	**COURSE CATEGORY**	**COURSE CODE**	**NAME OF THE COURSE**	**L**	**T**	**P**	**C**	**S**	**TCH**
1	PC	ATB4401	Vehicle Diagnostics	3	0	0	3	2	3
2	PC	ATB4402/ ATB4404	Finite Element Analysis / Computational Fluid Dynamics	3	1	0	4	2	4
3	PC	ATB4403	Automotive Instrumentation and Embedded system	3	0	2	4	2	5
4	DE		Department Elective - V	3	0	0	3	2	3
5	NE		Non Department Elective - V	2	0	0	2	1	2
6	PC	ATB4431	Vehicle Diagnostics Laboratory	0	0	2	1	0	2
7	PC	ATB4432/ ATB4435	Finite Element Analysis Laboratory / Computational Fluid Dynamics Laboratory	0	0	2	1	0	2
8	PC	ATB4433	Design Project - II	0	0	2	1	0	2
9	PC	ATB4434	Internship	0	0	0	1	0	0
Total				**14**	**1**	**8**	**20**	**9**	**23**

SEMESTER - VIII									
SL. NO	**COURSE CATEGORY**	**COURSE CODE**	**NAME OF THE COURSE**	**L**	**T**	**P**	**C**	**S**	**TCH**
1	PC	ATB4441	Project & Viva - voce	0	0	24	8	0	0
Total				**0**	**0**	**24**	**8**	**0**	**0**
Total							**165**		

LIST OF DEPARTMENTAL ELECTIVES WITH GROUPING - SEMESTER WISE									
SEM	**COURSE CATEGORY**	**COURSE CODE**	**NAME OF THE COURSE**	**L**	**T**	**P**	**C**	**S**	**TCH**
3	DE	ATC4251	Vehicle Body Engineering[1]	3	0	0	3	0	3
3	DE	ATC4252	Automotive Materials and Metallurgy[1]	3	0	0	3	0	3
3	DE	ATC4253	Electronics in Motorsport Engineering[2]	3	0	0	3	0	3
3	DE	ATC4254	Electronic Engine Management System[2]	3	0	0	3	0	3
3	DE	ATC4255	Automotive Product Design and Development	3	0	0	3	0	3
3	DE	ATC4256	Automotive Pollution and Control	3	0	0	3	0	3
4	DE	ATC4266	Automotive Aerodynamics[1]	3	0	0	3	0	3
4	DE	ATC4267	Engine Exhaust System Development[1]	3	0	0	3	0	3
4	DE	ATC4268	Automotive Sensors and Applications[2]	3	0	0	3	0	3
4	DE	ATC4269	Electromagnetic Interference and Compatibility[2]	3	0	0	3	0	3
4	DE	ATC4270	Heat and Mass Transfer	3	0	0	3	0	3
4	DE	ATC4271	Alternate Fuels and Energy Systems	3	0	0	3	0	3
5	DE	ATC4351	Artificial Intelligence[1]	3	0	0	3	0	3
5	DE	ATC4352	Automotive Accident Investigation[1]	3	0	0	3	0	3
5	DE	ATC4353	Manufacturing Process Of Automotive Components[2]	3	0	0	3	0	3
5	DE	ATC4354	ECU Model Based System Design[2]	3	0	0	3	0	3
5	DE	ATC4355	Advanced Theory of IC Engines	3	0	0	3	0	3
5	DE	ATC4356	Off Road Vehicles	3	0	0	3	0	3
6	DE	ATC4366	Vehicle Testing[1]	3	0	0	3	0	3
6	DE	ATC4367	Performance Tuning of I.C. Engines[1]	3	0	0	3	0	3
6	DE	ATC4368	Simulation of IC Engines	3	0	0	3	0	3
6	DE	ATC4369	Electric Vehicle Design [2]	3	0	0	3	0	3
6	DE	ATC4370	Modern Vehicle Technology[2]	3	0	0	3	0	3
6	DE	ATC4371	Fundamentals of Nano Science	3	0	0	3	0	3
7	DE	ATC4451	Vibration and Noise Control[1]	3	0	0	3	0	3
7	DE	ATC4452	Dynamics of Vehicle Control[1]	3	0	0	3	0	3
7	DE	ATC4453	Autonomous Vehicles[2]	3	0	0	3	0	3
7	DE	ATC4454	Virtual Instrumentation in Automotives[2]	3	0	0	3	0	3
7	DE	ATC4455	Modelling of Vehicle systems	3	0	0	3	0	3
7	DE	ATC4456	Digital Manufacturing	3	0	0	3	0	3

[1] Motorsport Specialized Electives, [2] Autotronics Specialized Electives

[1] A student should earn 15 credits from Motorsport specialized DE to get Specialization in Motorsport Engineering

[2] A student should earn 15 credits from Autotronics specialized DE to get Specialization in Autotronics Engineering

LIST OF NON DEPARTMENTAL ELECTIVES OFFERED BY AUTOMOBILE DEPARTMENT WITH GROUPING - SEMESTER WISE									
SEM	**COURSE CATEGORY**	**COURSE CODE**	**NAME OF THE COURSE**	**L**	**T**	**P**	**C**	**S**	**TCH**
3	NE	ATD4251	Automotive Engine Technology	2	0	0	2	0	2
3	NE	ATD4252	Elements of Motorsports Engineering	2	0	0	2	0	2
4	NE	ATD4266	Automotive Vehicle Technology	2	0	0	2	0	2
4	NE	ATD4267	Smart Materials for Automotive Applications	2	0	0	2	0	2
5	NE	ATD4351	Fuel Cells and its Applications	2	0	0	2	0	2
5	NE	ATD4352	Automotive Safety Systems	2	0	0	2	0	2
6	NE	ATD4366	Smart Concepts in Automotive Engineering	2	0	0	2	0	2
6	NE	ATD4367	Surface Coating of Automotive Materials	2	0	0	2	0	2
7	NE	ATD4451	Automotive Air-Conditioning and Climate Control	2	0	0	2	0	2
7	NE	ATD4452	Concept of Engineering Design	2	0	0	2	0	2

SEMESTER – I

COURSE TITLE	ENGINEERING GRAPHICS AND COMPUTER AIDED DESIGN			CREDITS	3
COURSE CODE	MEA4101	COURSE CATEGORY	BS	L-T-P-S	1- 1- 2- 1
CIA	60%			ESE	40%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	Understand drafting and computer aided drafting. Remember the commands used in AutoCAD to generate simple drawings.	1,3,5,10,12
2	Explain details in a drawing and apply the knowledge to solve simple problems involving straight lines, planes and solids	1,3,5,10,12
3	Understand and Visualize solid objects and apply AutoCAD software commands to generate the graphic models	1,3,5,10,12
4	Apply the 3D model commands to generate and solid object	1,3,5,10,12
5	Apply the viewing AutoCAD commands to generate top view, front view and additional or sectional views.	1,3,5,10,12
6	Student can able to develop any graphical model of geometrical and simple mechanical objects in AutoCAD software.	1,3,5,10,12

Prerequisites : Nil

MODULE 1: BASICS OF ENGINEERING GRAPHICS AND PLANE CURVES (12)

Importance of graphics - BIS conventions and specifications - drawing sheet sizes - Lettering – Dimensioning - Scales. Drafting methods - introduction to Computer Aided Drafting – Computer Hardware – Workstation – Printer and Plotter – Introduction to software for Computer Aided Design and Drafting – Exposure to Solid Modelling software – Geometrical Construction-Coordinate Systems/Basic Entities – 3D printer.

Suggested Reading: Solid modeling Software commands

MODULE 2: VISUALIZATION, ORTHOGRAPHIC PROJECTIONS AND FREE HAND SKETCHING (15)

Visualization concepts and Free Hand sketching: Visualization principles —Representation of Three Dimensional objects — Pictorial Projection methods - Layout of views- Free hand sketching of multiple views from pictorial views of objects. Drafting of simple Geometric Objects/Editing

General principles of presentation of technical drawings as per BIS - Introduction to Orthographic projections - Naming views as per BIS - First angle projection method. Conversion to orthographic views from given pictorial views of objects, including dimensioning – Drafting of Orthographic views from Pictorial views.

Suggested Reading: CAD software commands for sketching a drawing

MODULE 3: GEOMETRICAL MODELING ISOMETRIC VIEWS AND DEVELOPMENT OF SURFACES (15)

Principles of isometric projection and solid modelling. Isometric drawing – Iso Planes and 3D Modelling commands. Projections of Principal Views from 3-D Models. Solid Modelling – Types of modelling - Wire frame model, Surface Model and Solid Model – Introduction to graphic software for solid modelling. Development of Surfaces.

***Suggested Reading**: Surface modeling and solid modeling commands*

MODULE 4: COMPUTER AIDED DESIGN AND DRAFTING (15)

Preparation of solid models of machine components like slide block, solid bearing block, bushed bearing, gland, wall bracket, guide bracket, shaft bracket, jig plate, shaft support (open type), vertical shaft support etc using appropriate modelling software.

2D views and sectional view, computer aided drafting and dimensioning. Generate 2D drawing from the 3D models – generate and develop the lateral surfaces of the objects. Presentation Techniques of Engineering Drawings – Title Blocks – Printing/Plotting the 2D/3D drawing using printer and printing solid object using 3D printer.

***Suggested Reading**: CAD commands for modeling and views generation*

MODULE 5: SIMPLE DESIGN PROJECTS - COMPUTER AIDED DESIGN AND DRAFTING (15)

Creation of engineering models and their presentation in standard 2D form, 3D Wire-Frame and shaded solids, meshed topologies for engineering analysis, tool-path generation for component manufacture, geometric dimensioning and tolerancing. Use of solid-modelling software for creating associative models at the components and assembly levels in their respective branch of engineering like building floor plans that include: windows, doors, fixtures such as WC, Sink, shower, slide block, etc. Applying colour coding according to drawing practice.

Suggested Reading: CAD commands for modeling and views generation

TEXT BOOKS

1	Jeyapoovan T, Engineering Drawing and Graphics Using AutoCAD, 7th Edition, Vikas Publishing House Pvt Ltd., New Delhi, 2016

REFERENCE BOOKS

1	Introduction to AutoCAD – 2D and 3D Design, A.Yarmwood, Newnes Elsevier, 2011
2	Engineering Drawing and Graphic Technology-International Edition, Thomas E. French, Charles J. Vierck, Robert J. Foster, McGraw-Hill, 2014
3	Engineering Drawing and Design, Sixth Edition, C. Jensen, J.D. Helsel, D.R. Short, McGraw-Hill, 2012
4	Technical Drawing-Fourteenth Edition, F. E. Giesecke, A. Mitchell, H. C. Spencer, I.L. Hill, J.T. Dygdon, J.E., Novak, Prentice-Hall, 2012,
5	Bhatt N.D and Panchal V.M, Engineering Drawing: Plane and Solid Geometry, Charotar Publishing House, 2017.
6	Warren J. Luzadder and Jon. M. Duff, Fundamentals of Engineering Drawing, Prentice Hall of India Pvt. Ltd., Eleventh Edition, 2016.

E BOOKS

1	http://keralatechnologicaluniversity.blogspot.in/2015/06/engineering-graphics-j-benjamin-pentex-free-ebook-pdf-download.html
2	http://keralatechnologicaluniversity.blogspot.in/2015/06/engineering-graphics-p-i-varghese.html

MOOC

1	http://nptel.ac.in/courses/112103019/
2	http://nptel.ac.in/courses/105104148/

COURSE TITLE	PROFESSIONAL ENGLISH AND SOFT SKILLS			CREDITS	3
COURSE CODE	ELA4101	COURSE CATEGORY	BS	L-T-P-S	1-1-2-1
CIA	60%			ESE	40%
LEARNING LEVEL	BTL – 6				

CO	COURSE OUTCOMES	PO
1.	Understanding the importance of professional communication and applying the knowledge.	6,10,12
2.	Integrate the knowledge of phonetics, enhancing the listening skills in formal and real-life situations; enhance pronunciation skills based on the knowledge of phonetics.	6,10,12
3.	Construct appropriate sentences in English Language, applying grammatical rules and mastery in syntax. Develop reading skills and derive the contextual meaning, case studies and analyzing problems	6,10,12
4.	Integrate creativity in the writing skills both in formal and informal situations, related to environment, society and multidisciplinary environments	6,7,10,12
5.	Imbibing soft skills to excel in interpersonal skills essential for workplace	6,10,12

Prerequisites : Plus Two English-Intermediate Level

MODULE 1 – THE ELEMENTS OF COMMUNICATION (9)

Importance of communication through English -Process of communication and factors that influence speaking- Importance of audience and purpose- Principles of Communication-comparing general communication and business Communication-Professional Communication-barriers to communication –strategies to overcome communication barriers-formal and informal communication

Suggested Activities:

Self-introduction-short Conversations-Situational communication-dialogue writing -Language Functions-analyse the speech and comment-distinguish formal and informal style of communication-using bias-free language- news reports.

Suggested Reading:

Rogerson, Trish Stott & Derek Utley.2011

Elements of Effective Communication: 4th Edition, Plain and Precious Publishing, USA, by Randal S. Chase (Author), Wayne Shamo (Author)

Effective Communication Skills, MTD Training & Ventus Publishing (e book)

MODULE 2 – AURAL –ORAL COMMUNICATION IN ENGLISH (9)

Vowels- diphthongs- consonants - International Phonetic Alphabet (IPA) ; phonemic transcription (simple words)-syllable division and word stress –enunciation-GIE script(General Indian English)-neutral accent- sentence rhythm and weak forms - contrastive stress in sentences to highlight different words - intonation varieties of Spoken English : Standard Indian, American and British-Speaking to Communicate-speech acts - Language Patterns

(Note: This unit should be taught in a simple, non-technical manner, avoiding technical terms as far as possible).

Suggested activities: (Audio CD) Listen and repeat, listen to the sentences and fill in the blanks, Listening to passages and answering questions, marking the stressed syllable, phonemic script of simple words, sentence rhythm and intonation (rising tone and falling tone), short speeches. Individual presentations-dynamics of a group discussion

Suggested sources:

Cambridge IELTS , Professional Speaking Skills by Aruna Koneru, Oxford Press, Face to face series Cambridge University Press, Speaking Effectively, Cambridge University Press, Jeremy Comfort, Pamela

MODULE 3 - GRAMMAR AND DEVELOPMENT OF READING SKILLS (9)

Noun Phrase, Verb Phrase, Tense and Aspect, Articles, Pronouns and determiners, Sentence Pattern, interrogative and negative sentences-subject verb agreement -Vocabulary-word formation: prefixes and suffixes, reading passages-inductive vs deductive reading-newspaper articles- comprehension passages –cloze reading-annotating-editing

Suggested Activities:

Identify the errors in sentences, grammar exercises, book reviews, mini project on suggested reading activity - reading technical passages based on students area of specialization answering questions-reading passage for identifying the contextual meaning

Suggested sources:

Skills for the TOEFL IBT Test, Collins IELTS, Cambridge books Practical English Usage by Michael Swan , Cambridge University Press

MODULE 4 - EFFECTIVE WRITING AND BUSINESS COMMUNICATION (9)

Paragraph writing- topic sentence-connectives - process writing-Memoranda-Business letters-Resumes /Visumes and job applications-drafting a report-agenda and minutes of the meeting-ATR-project proposals-email etiquette- interpreting visual data(bar chart, pie chart, line graphs)

Suggested activities:

Writing short paragraph based on environment protection, societal issues, health, cultural contexts etc., identifying topic sentences, linking pairs of sentences, cause and effect exercises, formal letters, e mails, drafting project proposals, drafting agenda, minutes of the meeting

Suggested sources:

Cambridge Advanced English, Newspapers, library books, IELTS,IELTS Academic Writing 1,New Insights into IELTS, CUP

MODULE 5 – SOFT SKILLS (9)

Introducing Soft Skills &Life Skills- Myers Briggs Type Indicator – the Big Five Model Personality - Employability Skills- Workplace Etiquette- Professional Ethics -Time Management-Stress Management- Lateral Thinking (De Bono's Six Thinking Hats) and Problem Solving Skills

Suggested Activities:

Mock interviews, GD's, short oral presentation, lateral thinking puzzles, Case analysis and self-study assignments, Worksheet activities.

Suggested Sources:

Soft Skills and Employability Skills by Sabina Pillai and Agna Fernandez, Cambridge University Press, 2018.

Soft Skills for Everyone by Jeff Butterfield, Cengage Learning Education and personality development, K. Manoharan English for Life and the Workplace through the LSRW&T skills Lateral Thinking skills by Edward De Bono

TEXT BOOKS	
1.	An Introduction to Profession English and Soft Skills with audio CD by Dr. Bikram K. Das et al. Published by Cambridge University Press. 2009
REFERENCE BOOKS	
1.	Soft Skills & Employability Skills by Sabina Pillai and Agna Fernandez published by Cambridge University Press 2018.
2.	Embark, English for Undergraduates by Steve Hart et al, Cambridge University Press,2016, Edition
3.	Skills for the TOEFL IBT Test, Collins, 2012 edition
4.	Soft Skills for Everyone by Jeff Butterfield, Cengage Learning, 2010 edition
5.	English for Life and the Workplace Through LSRW&T skills, by Dolly John, Pearson Publications, 2014 edition
6.	Professional Speaking Skills by Aruna Koneru, Oxford Publications.
7.	The official Cambridge guide to IELTS for Academic and General Training, Cambridge University Press, 2014 edition.
8.	Cambridge BEC Vantage, Self-Study edition, Practice Tests, CUP, 2002
9.	English for Business Studies, 3rd edition, Ian Mackenzie, Cambridge University Press
10.	Education and Personality Development by Dr. P.K.Manoharan, APH Publishing Corporation, 2015
11.	Speaking Effectively by Jeremy Comfort et al, Cambridge University Press, 2011.
E BOOKS	
1.	https://www.britishcouncil.in/english/courses-business
2.	http://www.bbc.co.uk/learningenglish/english/features/pronunciation
3.	http://www.bbc.co.uk/learningenglish/english/
4.	http://www.antimoon.com/how/pronunc-soundsipa.htm
5.	http://www.cambridgeenglish.org/learning-english/free-resources/write-and-improve/
6.	Oneshopenglish.com
7.	Breakingnews.com
MOOC	
1	https://www.mooc-list.com/tags/english
2	https://www.mooc-list.com/course/adventures-writing-stanford-online
3	http://www.cambridgeenglish.org/learning-english/free-resources/mooc/

COURSE TITLE	MATRICES AND CALCULUS (Common for all Departments)			CREDITS	4
COURSE CODE	MAA4101	COURSE CATEGORY	BS	L-T-P-S	3-0-2-1
CIA	60%			ESE	40%
LEARNING LEVEL	BTL- 4				

CO	COURSE OUTCOMES	PO
1.	Able to study the concepts of matrices and apply them in related engineering problems.	1,2,3,4,5,12
2.	Capable to use the features of Differential Calculus in optimization problems.	1,2,3,4,5,12
3.	Able to extend the concepts of integral calculus in finding area and volume.	1,2,3,4,5,12
4.	Skilled to solve ordinary differential equations in engineering problems.	1,2,3,4,5,12

Prerequisites : Nil

MODULE 1: MATRICES (13L+2P)

Characteristic equation – Eigenvalues and Eigenvectors – Properties – Cayley Hamilton theorem (Statement only) – Verification and inverse of the matrix using Cayley Hamilton theorem- Diagonalization of matrices using similarity transformation. Suggested Reading: Basics of Matrices

Lab 1: Eigenvalues and Eigenvectors, Verification and inverse using Cayley Hamilton theorem- Diagonalization

MODULE 2: DIFFERENTIAL CALCULUS (13L+2P)

Methods of differentiation of functions – Product and Quotient rules – Inverse trigonometric functions – Implicit function – parametric form. Partial differentiation – Total differentiation- Taylor's series – Maxima and minima of functions of two variables

Suggested Reading: Basics of Differentiation

Lab 2: Taylor's series – Maxima and minima of functions of two variables

MODULE 3: INTEGRAL CALCULUS (13L+2P)

Integration – Methods of integration – Substitution method – Integration by parts – Integration using partial fraction – Bernoulli's formula. Applications of Integral Calculus: Area, Surface and Volume.

Suggested Reading: Basics of Integrations

Lab 3: Applications of Integral Calculus: Area, Surface area and Volume.

MODULE 4: ORDINARY DIFFERENTIAL EQUATIONS (13L+2P)

Second order differential equations with constant coefficients – Particular integrals – e^{ax}, $Sinax, Cosax, x^m$, e ax Cos bx, e ax Sin bx. Solutions of homogeneous differential equations with variable coefficients – Variation of parameters.

Suggested Reading: Basics of Differential Equations.

Lab 4: Solution of Second order differential equations.

LAB/MINI PROJECT/FIELD WORK

Theory with practical classes

TEXT BOOKS	
1	Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014
2	Bali N. P and Manish Goyal, "A Text book of Engineering Mathematics", Eighth Edition, Laxmi Publications Pvt Ltd., 2011.
3	Chandrasekaran A, "A Text book of Engineering Mathematics I", Dhanam Publications, Chennai, 2010
REFERENCE BOOKS	
1	Srimantha Pal and Bhunia, S.C, "Engineering Mathematics" Oxford University Press, 2015.
2	Weir, M.D and Joel Hass, Thomas' Calculus, 12th Edition, Pearson India, 2016.
3	Advanced Engineering Mathematics With Matlab, Third Edition, 2011 by CRC Press.
E BOOKS	
1	http://nptel.ac.in/courses/111105035/
2	https://www.edx.org/.../introduction-engineering-mathematics-utarlingtonx-engr3
MOOC	
1.	https://www.mooc-list.com/tags/engineering-mathematics

COURSE TITLE	ENGINEERING PHYSICS (AERO, MECH, AUTO, CHEMICAL, BIOTECH, CIVIL)			CREDITS	3
COURSE CODE	PHA4101	COURSE CATEGORY	BS	L-T-P-S	3-0-0-1
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1.	Solve basic problems in mechanics and also understand the properties of matter.	1,2,3,4,6,12
2.	Have a knowledge of acoustics and ultrasonics which would facilitate in acoustical design of buildings and also be able to employ ultrasonics as an engineering tool.	1,2,3,4,6,12
3.	Knowledge on fundamental concepts of Quantum physics	1,2,3,4,6,12
4.	Fundamental knowledge on semiconductors and discrete devices.	1,2,3,4,6,12
5.	Understand the concept, working and application of lasers and fiber optics.	1,2,3,4,6,12

Prerequisites: Knowledge in fundamentals of physics at higher secondary level.

MODULE 1 – PROPERTIES OF MATTER AND HEAT (9L)

Elasticity - types of moduli of elasticity - Young's modulus - Rigidity modulus - Bulk modulus - Factors affecting elasticity - twisting couple on a wire - Torsional pendulum - determination of rigidity modulus of a wire - depression of a cantilever - Young's modulus by cantilever - uniform and non-uniform bending.

Thermal conductivity – experimental determination of thermal conductivities of good and bad conductors – Forbe's method – theory and experiment – Lee's disc method for bad conductors

MODULE 2 – ACOUSTICS AND ULTRASONICS (9L)
Classification of sound - characteristics of musical sound – intensity - loudness - Weber Fechner law - Decibel - Reverberation - Reverberation time, derivation of Sabine's formula for reverberation time(Jaeger's method) - absorption coefficient and its determination - factors affecting acoustics of building (Optimum reverberation time, loudness, focusing, echo, echelon effect, resonance and noise) and their remedies - Ultrasonics- production – Magnetostriction and Piezoelectric methods – properties – applications.
MODULE 3 – QUANTUM PHYSICS (9L)
Black body radiation- Planck's theory (derivation) – Deduction of Wien's displacement law and Rayleigh – Jean's law from Planck's theory – Compton effect – Theory and experimental verification – Schrödinger's wave equation – Time independent and time dependent equations – Physical significance of wave function – Particle in a one dimensional box Extension to 3 dimension (no derivation)
MODULE 4 –CRYSTAL PHYSICS AND MAGNETISM (9L)
Crystal - Lattice - Unit cell - Bravais lattice - Lattice planes - Miller indices - 'd' spacing in cubic lattice - Calculation of number of atoms per unit cell - Atomic radius - coordination number - Packing factor for SC, BCC, FCC and HCP structures. Magnetic dipole moment - atomic magnetic moments- magnetic permeability and susceptibility - Types of magnetism: diamagnetism - paramagnetism - ferromagnetism - antiferromagnetism – ferrimagnetism - domain structure – hysteresis - hard and soft magnetic materials – applications.
MODULE 5 – PHOTONICS AND FIBRE OPTICS (9L)
Principle of lasers - Stimulated absorption - Spontaneous emission, stimulated emission - population inversion - pumping action - active medium - laser characteristics – Nd-Yag laser -CO_2 laser - Semiconductor laser - applications - optical fiber - principle and propagation of light in optical fibers - Numerical aperture and acceptance angle - types of optical fibers - single and multimode, step index and graded index fibers - fiber optic communication system.
LAB / MINI PROJECT / FIELD WORK
NA

TEXT BOOKS	
1.	P.Mani, " Engineering Physics", Vol-I & II, Dhanam Publications, Chennai. (2011)
2.	Gaur R.K. and Gupta S.L., "Engineering Physics", 8th edition, Dhanpat Rai publications (P) Ltd., New Delhi. (2010)
REFERENCE BOOKS	
1.	Arthur Beiser, "Concepts of Modern Physics", Tata Mc Graw – Hill Publications. (2007)
2.	Rajendran V. Marikani A., "Applied Physics for engineers", 3rd edition, Tata Mc Graw –Hill publishing company Ltd., New Delhi. (2003)
E BOOKS	
1	https://www.bookyards.com/en/book/details/13921/Elements-Of-Properties-Of-Matter
2	http://iopscience.iop.org/book/978-1-6817-4585-5
3	https://www.springer.com/in/book/9783319206295
MOOC	
1	http://nptel.ac.in/courses/115106061/
2	http://nptel.ac.in/courses/117101054/12

COURSE TITLE	ENGINEERING MATERIALS (Common to ALL Branches of Engineering)			CREDITS	3
COURSE CODE	CYA4101	COURSE CATEGORY	BS	L-T-P-S	3-0-0-1
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1.	Student will be able to - Suggest suitable metals for alloying.	1,2,3,4,6,7,12
2.	Identify the materials apt for engineering applications.	1,2,3,4,6,7,12
3	Select high temperature materials for engineering applications.	1,2,3,4,6,7,12
4.	Map the properties of nanomaterials with their applications.	1,2,3,4,6,7,12
5.	Suggest suitable materials for electronic applications.	1,2,3,4,6,7,12

Prerequisites: Knowledge in fundamentals of chemistry at higher secondary level.

MODULE 1 – CRYSTAL STRUCTURE AND PHASE RULE (9L)

Basic Crystal Systems – Types, characteristics, examples – Space lattice, Unit cell – types – X-ray diffraction and crystal structure.

Basic terminology - Derivation of Gibbs Phase rule- Phase diagrams: One component system (water), Two component system –- Reduced phase rule: Simple Eutectic system, examples, Phase diagram: Ag-Pb system, Pb-Sn system – Applications of phase rule.

MODULE 2 – POWDER METALLURGY, INORGANIC MATERIALS AND COMPOSITES. (9L)

Steel – Composition, types, heat-treatment, Abrasives – Classification, Properties, Uses - Refractories – Classification, Properties, Applications. Glasses – Properties, Types, Specialty glasses.

Composites - Introduction - Definition – Constituents – Classification - Fiber-reinforced Composites – Types and Applications.

Powder Metallurgy – Preparation of metal/alloy– Advantages and limitations.

MODULE 3 – NANOMATERIALS AND MOLECULAR SIEVES (9L)

Introduction – Synthesis of Nanomaterials - Bottom-up and Top-down approaches – Methods of preparation – Sol-gel process, Gas-phase condensation, Chemical Vapour Deposition. Properties **–** Optical, Electrical, Magnetic, Chemical properties (introduction only). Characterization **–** FE-SEM, TEM (Principle and Applications only).

Zeolite Molecular sieves – composition, structure, classification - applications – ion exchange, adsorption, separation, laundry, catalysis.

MODULE 4 – MATERIALS FOR ELECTRONIC APPLICATONS (9L)

Liquid Crystals- Introduction – Characteristics – Classification- Thermotropic crystals- - Polymorphism in Thermotropic Liquid Crystals – Molecular arrangement in various states of Liquid Crystals, Lyotropic Liquid Crystals- Applications.

Conducting and Super conducting Organic electronic materials - Applications.

Engineering plastics: Polycarbonate – Properties and uses- Conducting Polymers: Classification, Intrinsic Conducting Polymers, Extrinsic Conducting Polymers, Applications - Biodegradable Polymers, examples and applications.

MODULE 5 – LUBRICANTS, ADHESIVES AND EXPLOSIVES (9L)	
Lubricants – Mechanism of Lubrication, Classification and Properties, Semi Solid Lubricants, Solid Lubricants, MoS_2 and Graphite - Adhesives – Development of Adhesive strength, Physical and Chemical factors influencing adhesive action, Classification of Adhesives – Epoxy Resin (Preparation, Properties and Applications). Explosives – Requisites, Classification, Precautions during storage – Rocket propellants – Requisites - Classification.	
LAB / MINI PROJECT/FIELD WORK	
NA	
TEXT BOOKS	
1	P.C. Jain and Monicka Jain, Engineering Chemistry, Dhanpat Raj Publishing Company (P) Ltd, New Delhi – 2012
2	Puri, Sharma and Pathania, Principles of Physical Chemistry, Vishal Publishing Co. Jalandar, 2004.
3	Composite materials, K.K. Chawala, 3rd ed., (2012) Springer-Verlag, New York
4	Nanocomposite Science and Technology, P. M. Ajayan, L. S. Schadler, P. V. Braun, (2003), Wiley-VCH Verlag GmbH Co. KGaA, Weinheim.
5	Mechanics and Analysis of Composite Materials, V.V. Vasiliev and E.V. Morozov, (2001), Elsevier Science Ltd, The Boulevard, Langford Lane, Kidlington, Oxford OX5 lGB, UK.
E BOOKS	
1	http://www.erforum.net/2016/01/engineering-chemistry-by-jain-and-jain-pdf-free-ebook.html
2	https://abmpk.files.wordpress.com/2014/02/book_maretial-science-callister.pdf `
MOOC	
1	https://www.edx.org/course/materials-science-engineering-misisx-mse1x
2	https://www.mooc-list.com/tags/materials-science

COURSE TITLE	PROBLEM SOLVING USING C			CREDITS	3
COURSE CODE	CSA4101	COURSE CATEGORY	PC	L-T-P-S	2-0-2-0
CIA	60%			ESE	40%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
Upon completion of this course, the students will be able to		
1	Describe the basics of digital computer and programming languages.	1,2,8,12
2	Demonstrate problem solving techniques using flowchart, algorithm/pseudo code to solve the given problem.	1,2,3,5,12
3	Design and Implement C program using Control Statements and Functions.	1,2,3,5,9,10,12
4	Design and Implement C program using Pointers and File operations.	1,2,3,12
5	Identify the need for embedded C in real-time applications.	1,2,6,12

Prerequisites: Nil

MODULE 1 – PROGRAMMING LANGUAGES AND PROBLEM SOLVING TECHNIQUES (6L+6P)

Introduction – Fundamentals of digital computers - Programming languages -Programming Paradigms – Types of Programming Languages – Language Translators – Problem Solving Techniques: Algorithm – Flow Chart - Pseudo code.

Practical Component:

Drawing Flowcharts using E- Chart & Writing pseudo code for the following problems

(i) Greatest of three numbers

(ii) Sum of N numbers

(iii) Computation of nCr

MODULE 2: FUNDAMENTALS OF C (6L+6P)

Evolution of C -Why C language - Applications of C language - Data Types in C – Operators and Expressions – Input and Output statements in C – Decision Statements – Loop Control Statements.

Practical Component:

(i) Program to illustrate arithmetic and logical operators

(ii) Program to read and print data of different types

(iii) Program to calculate area and volume of various geometrical shapes

(iv) Program to compute biggest of three numbers

(v) Program to print multiplication table

(vi) Program to convert days to years, months and days

(vii) Program to find sum of the digits of an integer.

MODULE 3: FUNCTIONS, ARRAYS AND STRINGS (6L+6P)

Functions – Storage Class – Arrays – Strings and standard functions - Pre-processor Statements.

Practical Component:

(i) Program to compute Factorial, Fibonacci series and sum of n numbers using recursion

(ii) Program to compute sum and average of N Numbers stored in an array

(iii) Program to sort the given n numbers stored in an array

(iv) Program to search for the given element in an array

(v) Program to do word count (vi) Program to insert a substring in a string (vii) Program to concatenate and compare two strings (viii) Program using pre-processor statements
MODULE 4: POINTERS, STRUCTURES AND UNION (6L+6P)
Pointers – Dynamic Memory allocation – Structure and Union – Files. **Practical Component:** (i) Program to compute sum of integers stored in a 1-D array using pointers and dynamic memory allocation (ii) Program to read and print records of a student/payroll database using structures (iii) Program to simulate file copy (iv) Program to illustrate sequential access file (v) Program to illustrate random access file
MODULE 5: INTRODUCTION TO EMBEDDED C (6L+6P)
Structure of embedded C program - Data Types - Operators - Statements - Functions - Keil C Compiler. **Practical component:** Simple programs using embedded C
LAB / MINI PROJECT / FIELD WORK
NA

TEXT BOOKS	
1.	Jeyapoovan T, “Fundamentals of Computing and Programming in C”, Vikas Publishing house, 2015.
2.	Mark Siegesmund, "Embedded C Programming", first edition, Elsevier publications, 2014.
REFERENCE BOOKS	
1.	Ashok Kamthane, “Computer Programming”, Pearson Education, 7th Edition, Inc 2017.
2.	Yashavant Kanetkar, “Let us C”, 15th edition, BPP publication, 2016.
3.	S.Sathyalakshmi, S.Dinakar, “Computer Programming Practicals – Computer Lab Manual”, Dhanam Publication, First Edition, July 2013.
E BOOKS	
1.	https://en.wikibooks.org/wiki/C_Programming
MOOC	
1.	https://onlinecourses.nptel.ac.in/noc18-cs10/preview
2.	http://nptel.ac.in/courses/106105085/2
3.	https://www.udemy.com/c-programming-for-beginners/
4.	https://www.coursera.org/specializations/c-programming

COURSE TITLE	SUSTAINABLE ENGINEERING SYSTEMS (Common to ALL Branches of Engineering)			CREDITS	2
COURSE CODE	GEA4102	COURSE CATEGORY	PC	L-T-P-S	2-0-0-1
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1.	Students learn the principles of sustainability with case studies.	2,3,6,7,8,9,10,12
2.	Students will be able to understand assessing technologies and their impact on environment.	2,3,6,7,8,9,10,12
3	To learn the concept of Green Engineering and to apply in their projects at higher semesters.	2,3,6,7,8,9,10,12
4.	Management of natural resources and waste management from various types of industries.	2,3,6,7,8,9,10,12
5.	Students learn water technology and behavioral aspects of humans.	2,3,6,7,8,9,10,12

Prerequisites: Knowledge in fundamentals of chemistry at higher secondary level.

MODULE 1 – PRINCIPLES OF SUSTAINABLE SYSTEMS (5L)

Sustainability Definitions - Principles of Sustainable Design, Sustainable Engineering -Frameworks for Applying Sustainability Principles - Summary & Activities.

MODULE 2 – TECHNOLOGY DEVELOPMENT AND LIFECYCLE ASSESSMENT (5L)

Technology as a part of anthropogenic environment - Technology readiness levels (TRL) – technical metrics - Emerging, converging, disruptive technologies - Life Cycle Assessment (LCA) methodology - Summary & Activities.

MODULE 3 – GREEN ENGINEERING (5L)

Principles of Green Engineering - Frameworks for assessment of alternatives - Green Engineering examples - Multifunctional Materials and Their Impact on Sustainability - Summary & Activities.

MODULE 4 – RESOURCE MANAGEMENT TECHNOLOGIES (5L)

Waste management purpose and strategies - Recycling: open-loop versus closed-loop thinking - Recycling efficiency - Management of food waste and composting technologies - E-waste stream management - Reuse and redistribution programs - LCA approach to waste management systems - Summary and Activities.

MODULE 5 – SUSTAINABLE WATER AND WASTEWATER SYSTEMS (5L)

Water cycle - Water conservation and protection technologies - Water treatment systems Metrics for assessment of water management technologies-Summary & Activities.

MODULE 6 - BEHAVIORAL ASPECTS AND FEEDBACKS (5L)

Collaborative Decision Making - Role of Community and Social Networking - Human Factor in Sustainability Paradigm - Summary & Activities.

TEXT BOOKS	
1.	Vanek, F.M., and L.D. Albright, Energy Systems Engineering. Evaluation and Implementation, McGraw Hill, 2008.
2.	C.U. Becker, Sustainability Ethics and Sustainability Research, Springer 2012.
3.	J.B. Guinee et al., Life Cycle Assessment: Past, Present, and Future, Environ. Sci. Technol., 2011, 45, 90-96.
4.	Anastas, P.T., Zimmerman, J.B., Innovations in Green Chemistry and Green Engineering, Springer 2013.
5.	Solid Waste Technology & Management, Volume 1 & 2, Christensen, T., Ed., Wiley and Sons., *2010.*
6.	Sterman, J.D., in Sustainability Science: The Emerging Paradigm, Weinstein, M.P. and Turner, R.E. (Eds.), Springer Science+Business Media, LLC 2012.
E BOOKS	
1.	David T. Allen, David R. Shonnard, Sustainable Engineering Concepts, Design and Case Studies, Pearson Education, December 2011. (ISBN: 9780132756587)
2.	Gerald Jonker Jan Harmsen, Engineering for Sustainability 1st Edition, A Practical Guide for Sustainable Design, Elsvier 2012. (**ISBN:** 9780444538475).
MOOC	
1.	https://www.coursera.org/learn/sustainability
2.	https://www.academiccourses.com/Certificate/Sustainability-Studies/India/
3.	https://onlinecourses.nptel.ac.in/noc18_ce08/preview
4.	https://www.coursera.org/learn/ecosystem-services

COURSE TITLE	ENGINEERING AND DESIGN			CREDIT	3
COURSE CODE	ATB4101	COURSE CATEGORY	PC	L-T-P-S	3- 0- 0 -1
CIA	60%			ESE	40%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	Students will be able to appreciate the different elements involved in good designs and to apply them in practice when called for.	1,2,3,4,7,10,12
2	Students will be aware of the product oriented and user oriented aspects that make the design a success.	1,2,3,4,7,10,12
3	Students Will be capable to think of innovative designs incorporating different segments of knowledge gained in the course	1,2,3,4,7,10,12
4	Students will have a broader perspective of design covering function, cost, environmental sensitivity, safety and other factors other than engineering analysis.	1,2,3,4,7,10,12
5	Students learn economic and environmental Issues, trade aspects and IPR	1,2,3,4,7,10,12

Prerequisites : Nil

Module 1: INTRODUCTION TO AUTOMOBILE ENGINEERING DESIGN (7L+2P)

Design and its objectives; Design constraints, Design functions, Design means and Design from; Role of Science, Engineering and Technology in design; Engineering as a business proposition; Functional and Strength Designs. Design form, function and strength; How to initiate creative designs? Initiating the thinking process for designing a product of daily use. Need identification; Problem Statement; Market survey-customer requirements; Design attributes and objectives; Ideation; Brain storming approaches; arriving at solutions; Closing on to the Design needs.

Project: An Exercise in the process of design initiation. A simple problem is to be taken up to examine different solutions- Vehicle, Group Presentation and discussion**.**

MODULE 2: PROCESSES IN DESIGN FOR AUTOMOTIVE SYSTEM (7L+2P)

Design process- Different stages in design and their significance; Defining the design space; Analogies and "thinking outside of the box"; Quality function deployment-meeting what the customer wants; Evaluation and choosing of a design. Design Communication; Realization of the concept into a configuration, drawing and model. Concept of "Complex is Simple". Design for function and strength.

Design detailing- Material selection, Design visualization- Solid modelling; Detailed 2D part drawings; Tolerance; Use of standard items in design; Research needs in design; Energy needs of the design, both in its realization and in the applications.

Project: An exercise in the detailed design of any two automobile components

MODULE 3: PROTOTYPING OF AUTOMOBILE COMPONENTS (4L+5P)

Prototyping- rapid prototyping; testing and evaluation of design; Design modifications; Freezing the design; Cost analysis.

Engineering the design – From prototype to product. Planning; Scheduling; Supply chains; inventory; handling; manufacturing/construction operations; storage; packaging; shipping; marketing; feed-back on design

Project: List out the standards organizations. Prepare a list of standard items used in automobile original equipment manufacturers. Develop any design with over 50% standard items as parts.

MODULE 4: QUALITY ASPECTS IN AUTOMOBILE ENGINEERING (4L+5P)
Design for "X"; covering quality, reliability, safety, manufacturing/construction, assembly, maintenance, logistics, handling; disassembly; recycling; re-engineering etc. **Project: Example:** List out the design requirements(x) for designing a car.
Module 5: USER CENTRED DESIGNS IN AUTOMOBILE ENGINEERING (4L+5P)
Product centered and user centered design. Product centered attributes and user centered attributes. Bringing the two closer. Example: Motor Cycle and Car, Aesthetics and ergonomics. Value engineering, Concurrent engineering, Reverse engineering in design; Culture based design; Architectural designs; Motifs and cultural background; Tradition and design; Study the evolution of Wheels; Printed motifs; Role of colours in design. Make sharp corners and change them to smooth curves-check the acceptance. Design as a marketing tool; Intellectual Property rights – Trade secret; patent; copy-right; trademarks; product liability. Group presentation of any such products covering all aspects that could make or mar it. **Project:** Examine the possibility of value addition for an existing product.

REFERENCE BOOKS

1	Balmer, R. T., Keat, W. D., Wise, G., and Kosky, P., Exploring Engineering, Third Edition: An Introduction to Engineering and Design - [Part 3 - Chapters 17 to 27], ISBN13: 978-0124158917 ISBN-10: 0124158919
2	Dym, C. L., Little, P. and Orwin, E. J., Engineering Design - A Project based introduction - Wiley, ISBN-978-1-118-32458-5
3	Eastman, C. M. (Ed.), Design for X Concurrent engineering imperatives, 1996, XI, 489 p. ISBN 978-94-011-3985-4 Springer
4	Haik, Y. And Shahin, M. T., Engineering Design Process, Cengage Learning, ISBN-13: 978-0-495-66816-9
5	Pahl, G., Beitz, W., Feldhusen, J. and Grote, K. H., Engineering Design: A Systematic Approach, 3rd ed. 2007, XXI, 617p., ISBN 978-1-84628-319-2
6	Voland, G., Engineering by Design, ISBN 978-93-325-3505-3, Pearson India

COURSE TITLE	INTRODUCTION TO DIGITAL SYSTEMS			CREDITS	3
COURSE CODE	EEB4101	COURSE CATEGORY	PC	L-T-P-S	3- 0- 0- 1
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	To understand basic operation in digital systems and instruments.	1,3,5,12
2	To gain knowledge on basic functioning of sensors and display units.	1,3,5,12
3	To familiarize the concepts of signal processing and converting elements.	1,3,5,12
4	To acquire the knowledge of microcontrollers and applications	1,3,5,12
5	To attain the basic concepts of consumer electronics and communication devices.	1,3,5,12

Prerequisites : Physics and Mathematics

MODULE 1 – INTRODUCTION TO DIGITAL SYSTEMS (9L)

Analog& Digital signals - Need for digital instruments – Elements of digital instruments – Number systems: - Binary, Hexadecimal - Logic gates - Boolean algebra (Identities and Properties) - Digital controllers (ON-OFF).

Suggested Reading: Basics of number systems.

MODULE 2 –SENSORS AND DISPLAYS (9L)

Sensors and Transducers –Classification, Potentiometer, Strain Gauge, Piezoelectric Sensor, Linear Variable Differential Transformer, Resistance temperature detectors (RTD), Thermocouples, Tactile transducers - Displays: - Light Emitting Diode (including OLED) displays.

Suggested Reading: Primary sensing elements, introduction to displays.

MODULE – 3 : SIGNAL CONDITIONING CIRCUITS (9L)

D.C. Bridge- Unbalanced, Push-Pull configuration, Operational amplifiers- Inverting, Non-Inverting, Instrumentation Amplifier, Active filters: - Low pass, High pass - Analog to Digital Converter – Successive Approximation, Digital to Analog Converter - Weighted Resistor.

Suggested Reading: Basic network theorems.

MODULE – 4 :INTRODUCTION TO MICRO CONTROLLERS (9L)

Introduction: Memory types, peripheral devices- Microcontroller (8 bit), Architecture, Graphics Processing Unit (GPU) - Applications: -Interfacing of Digital Input/Output, Analogue Input/Output, Display. Introduction to Programmable Logic Controller (PLC) and PID (Proportional + Integral + Derivative) Controller.

Suggested Reading: Hobby electronics with Microcontroller interface.

MODULE 5 – CONSUMER ELECTRONICS AND COMMUNICATION SYSTEM (9L)

Consumer Electronics: Television, Mobile Phones, Air conditioners, Refrigerators, Washing Machine. (Block diagram approach only.)

Communication System: Satellite communication, Global Positioning Systems, Global System for Mobile. (Block diagram approach only.)

Suggested Reading: Consumer Electronics User Manuals.

LAB / MINI PROJECT/FIELD WORK	
Field trip to consumer electronics industry.	
TEXT BOOKS	
1	Digital Fundamentals, Thomas l. Floyd, 11th edition, Pearson 2014.
2	Op-amps and Linear Integrated Circuits,Ramakant A. Gayakwad,4th edition,Prentice Hall, 2015.
3	Electronic Instrumentation and Measurements, David A. Bell, Oxford University Press, 2013.
4	The 8051 Microcontroller And Embedded Systems Using Assembly And C, SepehrNaimi, SarmadNaimi, Muhammad Ali Mazidi, Second edition, 2017.
5	Programmable Logic Controllers, Frank D. Petruzella, McGraw-Hill Education, 2016.
REFERENCE BOOKS	
1.	Digital Logic and Computer Design, M. Morris Mano, Prentice-Hall, 2016
2.	Linear Integrated Circuits, Roy Choudhury, New Age International Publishers, 4th edition, 2011
3.	C and 8051, Thomas W. Schultz, Thomas W. Schultz Publishers, 4th edition,2008
4.	Consumer Electronics, S.P Bali, Pearson Education Asia Pvt., Ltd., 2008 Edition
5.	Global Mobile Satellite Communications Applications (For Maritime, Land and Aeronautical Applications Volume 2), 2nd edition, Springer, 2018
E BOOKS	
1	http://www.ee.iitm.ac.in/~giri/pdfs/EE4140/textbook.pdf
2	https://electronics.howstuffworks.com/home-audio-video-channel.htm
MOOC	
1	http://nptel.ac.in/courses/106108099/Digital%20Systems.pdf
2	http://nptel.ac.in/courses/112103174/pdf/mod2.pdf
3	http://www.nptel.ac.in/courses/Webcourse-contents/IISc-BANG/Microprocessors %20and%20Microcontrollers/pdf/Teacher_Slides/mod3/M3L6.pdf
4	http://nptel.ac.in/courses/108105063/pdf/L-09(SS)(IA&C)%20((EE)NPTEL).pdf
5	http://nptel.ac.in/courses/Webcourse-contents/IIT-KANPUR/microcontrollers/micro /ui/Course_home2_5.html

COURSE TITLE	ENGINEERING IMMERSION LAB			CREDIT	0.5
COURSE CODE	GEA4131	COURSE CATEGORY	BS	L-T-P-S	0-0-2-2
CIA	80%			ESE	20%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	Upon successful completion of this course the student should be able to Identify and use of tools, Types of joints used in welding, carpentry and plumbing operations.	1,2,3,4,5,6,9,12
2	Have hands on experience on basic fabrication techniques such as carpentry and plumbing practices.	1,2,3,4,5,6,9,12
3	Have hands on experience on basic fabrication techniques of different types of welding and basic machining practices.	1,2,3,4,5,6,9,12

SLOT X: LIST OF EXPERIMENTS

I. MECHANICAL ENGINEERING WORKSHOP

1. Welding: Arc welding: Butt joints
2. Lap joints.
3. Machining: Facing
4. Turning

II. AUTOMOBILE ENGINEERING

1. Dismantling and Studying of two stroke gasoline engine.
2. Assembling of two stroke gasoline engine.
3. Dismantling and Studying of four stroke gasoline engine
4. Assembling of four stroke gasoline engine.

III. AERONAUTICAL ENGINEERING

1. Study of Flow Pattern around Various Objects.
2. Force measurement on Aircraft Model
3. Determination of Young's Modulus for Aluminum Cantilever Beam
4. Binary Addition & Subtraction using Microprocessor

IV. CIVIL ENGINEERING

1. Plumbing- Basic Pipe Connection using valves, couplings and elbows.
2. Carpentry – Sowing, Planning and making common Joints.
3. Bar Bending
4. Construction of a 50 cm height brick wall without mortar using English Bond.

SLOT Y: LIST OF EXPERIMENTS

V.ELECTRICAL ENGINEERING

1. Study of tools and accessories.
2. Study of cables.
3. Staircase wiring, Tube light and Fan connection.
4. Measurement of energy using single phase energy meter.

VI. ELECTRONICS ENGINEERING

1. Study of Active and Passive Components.
2. Study of Logic Circuits.

3. Making simple circuit using Electronic Components.
4. Measuring of parameters for signal using CRO.

VII. COMPUTER SCIENCE

1. Troubleshooting different parts of the computer peripherals, Monitor, Keyboard & CPU.
2. Installation of various operating systems, their capabilities, Windows, Unix, Linux.
3. Installation of commonly used software like MS Office
4. Assembling digital computer.

VIII. MECHATRONICS ENGINEERING

1. Study of Key Elements of Mechatronics Systems
2. Sensors – Load Cell, Thermocouple
3. Actuators – Linear & Rotary Actuators
4. Interfacing & Measurements – Virtual Instrumentation

REFERENCE

1	Jeyapoovan T and Saravanapandian M., Engineering practices lab manual, 4th Edition, Vikas publishing House, New Delhi, 2015.
2	Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
3	Ibrahim Zeid, CAD/CAM Theory and Practice, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2011
4	Robert Quesada, Jeyapoovan T., Computer Numerical Control Machining and Turning Centers, Pearson Education, New Delhi, 2006

METHOD OF ALLOCATION FOR ENGINEERING IMMERSION LAB

SLOT X : MECH, AERO, AUTO, CIVIL EXPERIMENTS

SLOT Y : EEE, ELECTRONICS, CSE, MECHATRONICS EXPERIMENTS

- EVERY CLASS OF
  - GROUP A (AERO, AUTO, MECH, MCT, CHEM, BIO, CIVIL
  - GROUP B (CSE, IT, ECE, EEE, AEROSPACE)

GETS DIVIDED INTO 4 SUB - GROUPS NAMELY a, b, c, d -- EACH CONSISTING OF 15 TO 20 STUDENTS MAX.

- FOR EXAMPLE: **GROUP A STUDENTS WILL OCCUPY SLOT X**
  - WEEK 1 : SLOT X ---
    - ✓ a – MECH; b – AUTO; c – AERO ; d – CIVIL
  - WEEK 2 : SLOT X ---
    - ✓ b – MECH; c – AUTO; d – AERO ; a – CIVIL
- THE ABOVE SCHEDULE WILL BE ON ROTATION EVERY MONTH (ONE CYLCE PER MONTH)
- **GROUP B STUDENTS WILL OCCUPY SLOT Y**
  - WEEK 1 : SLOT Y ---
    - ✓ a – EEE; b – ECE; c – CSE ; d – MCT
  - WEEK 2 : SLOT Y ---
    - ✓ b – EEE; c – ECE; d – CSE ; a – MCT

THE ABOVE SCHEDULE WILL BE ON ROTATION EVERY MONTH (ONE CYLCE PER MONTH)

COURSE TITLE	ENGINEERING PHYSICS LABORATORY (Common to all engineering branches)			CREDIT	1
COURSE CODE	PHA4131	COURSE CATEGORY	BS	L-T-P-S	0-0-2-0
CIA	80%			ESE	20%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1.	Ability to analyze material's elastic properties	1,2,3,4,6,12
2.	Ability to determine thermal conductivity of bad conductor	1,2,3,4,6,12
3.	Ability to measure coefficient of viscosity of liquids	1,2,3,4,6,12
4.	Ability to determine wavelength of laser	1,2,3,4,6,12
5.	Ability to describe V-I characteristics of diode	1,2,3,4,6,12

Prerequisites: Knowledge in basic physics practical at higher secondary level.

List of Experiments (Any Five Experiments)

1. Torsional Pendulum – Determination of rigidity modulus of the material of a wire.
2. Non Uniform Bending – Determination of Young's Modulus.
3. Uniform Bending – Determination of Young's Modulus.
4. Viscosity – Determination of co-efficient of viscosity of a liquid by Poiseuille's flow.
5. Lee's Disc – Determination of thermal conductivity of a bad conductor.
6. Air – Wedge – Determination of thickness of a thin wire
7. Spectrometer – refractive index of a prism
8. Semiconductor laser – Determination of wavelength of laser using grating
9. Semiconductor diode – VI characteristics

TEXT BOOK

1. P. Mani, engineering Physics Practicals, Dhanam Publications, Chennai, 2005

REFERENCE BOOKS

1. Glenn V.Lo, Jesus Urrechaga - Aituna, Introductory Physics Laboratory Manual, Part-I, Fall 2005 Edition.
2. P. Kulkarni, Experiments in Engineering Physics Bachelor of Engineering and Technology, Edition 2015

E BOOK

1	http://www.aurora.ac.in/images/pdf/departments/humanities-and-sciences/engg-phy-lab-manual.pdf

COURSE TITLE	MATERIALS CHEMISTRY LABORATORY (Common to ALL branches of Engineering)			CREDITS	1
COURSE CODE	CYA4131	COURSE CATEGORY	BS	L-T-P-S	0-0-2-0
CIA	80%			ESE	20%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1.	Students learn to characterize basic properties of refractory ceramics	1,2,3,4,6,7,12
2.	On completion of this course, students learn to prepare resins and composites.	1,2,3,4,6,7,12
3.	Students learn to estimate metal ions present in samples using instrumental techniques.	1,2,3,4,6,7,12
4.	On completion of the course the students learn to develop adsorption isotherm.	1,2,3,4,6,7,12
5.	Students learn to find properties of lubricants and other oil samples.	1,2,3,4,6,7,12

Prerequisites: Knowledge in basic chemistry practical at higher secondary level.

LAB / MINI PROJECT/FIELD WORK

1. Construction of Phenol-Water Phase diagram.
2. Determination of viscosity of polymer using Ostwald Viscometer.
3. Preparation of urea-formaldehyde resin.
4. Determination of porosity of a refractory.
5. Determination of Apparent Density of porous solids.
6. Determination of Viscosity Index of lubricants.
7. Estimation of dye content in the effluent by UV-Visible spectrophotometry.
8. Determination of viscosity of oil using Red-Wood Viscometer.
9. Determination of Copper / iron content in the alloy by colorimetry.
10. Estimation of sodium and potassium ions by Flame Photometry.
11. Verification of Beer-Lambert's law using gold nanoparticles.
12. Determination of adsorption isotherm for acetic acid on activated charcoal.

REFERENCE BOOKS

1.	J. Mendham, R.C. Denney, J.D. Barnes and N.J.K. Thomas, Vogel's Textbook of Quantitative Chemical Analysis, 6th Edition, Pearson Education, 2009
2.	D.P. Shoemaker and C.W. Garland, Experiments in Physical Chemistry, 8th edition, McGraw Hill, London, 2008
3.	S. Sumathi, Laboratory work book for Engineering Chemistry Practical, 2015
4.	Laboratory Manual of Testing Materials, William Kendrick Hatt and Herbert Henry Scofield, Andesite Press, 2017

E BOOKS

1.	http://www.erforum.net/2016/01/engineering-chemistry-by-jain-and-jain-pdf-free-ebook.html

MOOC

1	https://ocw.mit.edu/courses/chemistry/5-111-principles-of-chemical-science-fall-2008/video-lectures/lecture-32/
2	https://www.coursetalk.com/providers/coursera/courses/introduction-to-chemistry-1

SEMESTER – II

COURSE TITLE	ANALYTICAL MATHEMATICS (Except Aeronautical and Aerospace Engineering)			CREDITS	4
Course Code	MAA4117	Course Category	BS	L-T-P-S	3-0-2-0
CIE	60%			ESE	40%
LEARNING LEVEL	BTL:1- 4				

CO	COURSE OUTCOMES	PO
1.	Competent to evaluate surface and volume integrals.	1,2,3,4,5,12
2.	Able to perform vector operations and interpret the results geometrically.	1,2,3,4,5,12
3.	Skilled to solve the system of ordinary differential equations using Laplace Transform	1,2,3,4,5,12
4.	Proficient to know that any periodic function satisfying Dirichlet's conditions can be expressed as a Fourier series	1,2,3,4,5,12
5.	Able to understand complex variable theory, applications of analytic function and harmonic conjugate.	1,2,3,4,5,12

Prerequisites : Nil

MODULE 1:MULTIPLE INTEGRALS (10L+2P)

Double integration – Cartesian and polar co-ordinates – Change of order of integration. Area as a double integral – Triple integration in Cartesian coordinates – Volume as a triple integral – Change of variables between Cartesian and polar coordinates.

Suggested Reading: Line Integrals

Lab: Area and Volume of double integration and triple integration.

MODULE 2:VECTOR CALCULUS (10L+2P)

Gradient, Divergence and Curl – Unit normal vector, Directional derivative – angle between surfaces– Solenoidal and Irrotationalvector fields.Green's theorem - Gauss divergence theorem and Stoke's theorem (without proof) – Verification and evaluation of the above theorems - Simple applications to regions such as square, rectangle, triangle, cuboids and rectangular parallelopipeds.

Suggested Reading: Basics of Vectors

Lab: Area using Green's theorem and Volume using Gauss divergence theorem

MODULE 3:LAPLACE TRANSFORMS (10L+2P)

Laplace transform – Conditions of existence – Transform of elementary functions – properties – Transforms of derivatives– Initial and final value theorems – Transform of periodic functions. Inverse Laplace transforms using partial fraction and convolution theorem. Solution of linear ODE of second order with constant coefficients.

Suggested Reading: Basics of Transform

Lab: Finding Laplace and Inverse Laplace Transform of Elementary Functions, Solutions of Ordinary differential equations using Laplace transform

MODULE 4: FOURIER SERIES (10L+2P)	
Dirichlet's Conditions – General Fourier Series – Odd and even functions – Half range sine and cosine series –Harmonic Analysis. **Suggested Reading**: Basics of series **Lab: Fourier series Expansion of simple functions, Harmonic Analysis**	
MODULE 5: COMPLEX VARIABLES (10L+2P)	
Functions of a complex variable – Analytic function – Cauchy - Riemann equations (Statement only) – Properties of analytic function (Statement only) – Construction of Analytic functions by Milne – Thomson method. **Suggested Reading**: Complex Numbers **Lab:** Complex Numbers	
LAB/MINI PROJECT/FIELD WORK	
Theory with practical classes	
TEXT BOOKS	
1	Kreyszig Erwin, "Advanced Engineering Mathematics ", John Wiley and Sons, 10th Edition, New Delhi, 2016.
2	A.P.Santhakumaran, P.Titus, Engineering Mathematics - II, NiMeric Publications,Nagercoil, 2012
3	Chandrasekaran A, Engineering Mathematics- II, Dhanam Publication, 2014
4	Raj Kumar Bansal, Ashok Kumar Goel, Manoj Kumar Sharma, "MATLAB and its Applications in Engineering", Pearson Publication, Second Edition, 2016.
REFERENCE BOOKS	
1.	Sastry, S.S, —Engineering Mathematics", Vol. I & II, PHI Learning Pvt. Ltd, 4thEdition, New Delhi, 2014
2.	Wylie, R.C. and Barrett, L.C., —Advanced Engineering Mathematics —Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.
3.	Dean G. Duffy., "Advanced Engineering Mathematics with MATLAB", CRC Press, Third Edition 2013.
E BOOKS	
1	http.// nptel.ac.in/courses/122104017/28
2	https://www.khanacademy.org/.../double-integrals.../double-integral.
3	nptel.ac.in/courses/115101005/downloads/lectures-doc/Lecture-1.pdf
4	nptel.ac.in/syllabus/122104017/
5	nptel.ac.in/courses/111105035/22
6	nptel.ac.in/syllabus/111103070/
MOOC	
1.	https://www.edx.org/course/introduction-engineering-mathematics-utarlingtonx-engr3-0x

COURSE TITLE	ENGINEERING MATERIALS (Common to ALL Branches of Engineering)			CREDITS	3
Course Code	CYA4101	Course Category	BS	L-T-P-S	3-0-0-1
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	Student will be able to - Suggest suitable metals for alloying.	1,2,3,4,6,7,12
2	Identify the materials apt for engineering applications.	1,2,3,4,6,7,12
3	Select high temperature materials for engineering applications.	1,2,3,4,6,7,12
4	Map the properties of nano materials with their applications.	1,2,3,4,6,7,12
5	Suggest suitable materials for electronic applications.	1,2,3,4,6,7,12

Prerequisites: Knowledge in fundamentals of chemistry at higher secondary level.

MODULE 1 – CRYSTAL STRUCTURE AND PHASE RULE (9L)

Basic Crystal Systems – Types, characteristics, examples – Space lattice, Unit cell – types – X-ray diffraction and crystal structure.

Basic terminology - Derivation of Gibbs Phase rule- Phase diagrams: One component system (water), Two component system –- Reduced phase rule: Simple Eutectic system, examples, Phase diagram: Ag-Pb system, Pb-Sn system – Applications of phase rule.

MODULE 2 – POWDER METALLURGY, INORGANIC MATERIALS AND COMPOSITES. (9L)

Steel – Composition, types, heat-treatment, Abrasives – Classification, Properties, Uses - Refractories – Classification, Properties, Applications. Glasses – Properties, Types, Specialty glasses.

Composites - Introduction - Definition – Constituents – Classification - Fiber-reinforced Composites –Types and Applications.

Powder Metallurgy – Preparation of metal/alloy– Advantages and limitations.

MODULE 3 – NANOMATERIALS AND MOLECULAR SIEVES (9L)

Introduction – Synthesis of Nanomaterials - Bottom-up and Top-down approaches – Methods of preparation – Sol-gel process, Gas-phase condensation, Chemical Vapour Deposition. Properties **–** Optical, Electrical, Magnetic, Chemical properties (introduction only). Characterization **–** FE-SEM, TEM (Principle and Applications only).

Zeolite Molecular sieves – composition, structure, classification - applications – ion exchange, adsorption, separation, laundry, catalysis.

MODULE 4 – MATERIALS FOR ELECTRONIC APPLICATONS (9L)

Liquid Crystals- Introduction – Characteristics – Classification- Thermotropic crystals- - Polymorphism in Thermotropic Liquid Crystals – Molecular arrangement in various states of Liquid Crystals, Lyotropic Liquid Crystals- Applications.

Conducting and Super conducting Organic electronic materials - Applications.

Engineering plastics: Polycarbonate – Properties and uses- Conducting Polymers: Classification, Intrinsic Conducting Polymers, Extrinsic Conducting Polymers, Applications - Biodegradable Polymers, examples and applications.

MODULE 5 – LUBRICANTS, ADHESIVES AND EXPLOSIVES (9L)	
Lubricants – Mechanism of Lubrication, Classification and Properties, Semi Solid Lubricants, Solid Lubricants, MoS_2 and Graphite - Adhesives – Development of Adhesive strength, Physical and Chemical factors influencing adhesive action, Classification of Adhesives – Epoxy Resin (Preparation, Properties and Applications). Explosives – Requisites, Classification, Precautions during storage – Rocket propellants – Requisites - Classification.	
LAB / MINI PROJECT/FIELD WORK	
NA	
TEXT BOOKS	
1.	P.C. Jain and Monicka Jain, Engineering Chemistry, Dhanpat Raj Publishing Company (P) Ltd, New Delhi – 2012
2.	Puri, Sharma and Pathania, Principles of Physical Chemistry, Vishal Publishing Co. Jalandar, 2004.
3.	Composite materials, K.K. Chawala, 3rd ed., (2012) Springer-Verlag, New York
4.	Nanocomposite Science and Technology, P. M. Ajayan, L. S. Schadler, P. V. Braun, (2003), Wiley-VCH Verlag GmbH Co. KGaA, Weinheim.
5.	Mechanics and Analysis of Composite Materials, V.V. Vasiliev and E.V. Morozov, (2001), Elsevier Science Ltd, The Boulevard, Langford Lane, Kidlington, Oxford OX5 lGB, UK.
E BOOKS	
1.	http://www.erforum.net/2016/01/engineering-chemistry-by-jain-and-jain-pdf-free-ebook.html
2.	https://abmpk.files.wordpress.com/2014/02/book_maretial-science-callister.pdf `
MOOC	
1	https://www.edx.org/course/materials-science-engineering-misisx-mse1x
2	https://www.mooc-list.com/tags/materials-science

COURSE TITLE	ENGINEERING PHYSICS (AERO, MECH, AUTO, CHEMICAL, BIOTECH, CIVIL)			CREDITS	3
Course Code	PHA4101	Course Category	BS	L-T-P-S	3-0-0-1
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1.	Solve basic problems in mechanics and also understand the properties of matter.	1,2,3,4,6,12
2.	Have knowledge of acoustics and ultrasonics which would facilitate in acoustical design of buildings and also be able to employ ultrasonics as an engineering tool.	1,2,3,4,6,12
3.	Knowledge on fundamental concepts of Quantum physics	1,2,3,4,6,12
4.	Fundamental knowledge on semiconductors and discrete devices.	1,2,3,4,6,12
5.	Understand the concept, working and application of lasers and fiber optics.	1,2,3,4,6,12

Prerequisites: Knowledge in fundamentals of physics at higher secondary level.

MODULE 1 – PROPERTIES OF MATTER AND HEAT (9L)

Elasticity - types of moduli of elasticity - Young's modulus - Rigidity modulus - Bulk modulus - Factors affecting elasticity - twisting couple on a wire - Torsional pendulum - determination of rigidity modulus of a wire - depression of a cantilever - Young's modulus by cantilever - uniform and non-uniform bending.

Thermal conductivity – experimental determination of thermal conductivities of good and bad conductors – Forbe's method – theory and experiment – Lee's disc method for bad conductors

MODULE 2 – ACOUSTICS AND ULTRASONICS (9L)

Classification of sound - characteristics of musical sound – intensity - loudness - Weber Fechner law - Decibel - Reverberation - Reverberation time, derivation of Sabine's formula for reverberation time(Jaeger's method) - absorption coefficient and its determination - factors affecting acoustics of building (Optimum reverberation time, loudness, focusing, echo, echelon effect, resonance and noise) and their remedies - Ultrasonics- production – Magnetostriction and Piezoelectric methods – properties – applications.

MODULE 3 – QUANTUM PHYSICS (9L)

Black body radiation- Planck's theory (derivation) – Deduction of Wien's displacement law and Rayleigh – Jean's law from Planck's theory – Compton effect – Theory and experimental verification – Schrödinger's wave equation – Time independent and time dependent equations – Physical significance of wave function – Particle in a one dimensional box Extension to 3 dimension (no derivation)

MODULE 4 –CRYSTAL PHYSICS AND MAGNETISM (9L)

Crystal - Lattice - Unit cell - Bravais lattice - Lattice planes - Miller indices - 'd' spacing in cubic lattice - Calculation of number of atoms per unit cell - Atomic radius - coordination number - Packing factor for SC, BCC, FCC and HCP structures.

Magnetic dipole moment - atomic magnetic moments- magnetic permeability and susceptibility - Types of magnetism: diamagnetism - paramagnetism - ferromagnetism - antiferromagnetism – ferrimagnetism - domain structure – hysteresis - hard and soft magnetic materials – applications.	
MODULE 5 – PHOTONICS AND FIBRE OPTICS (9L)	
Principle of lasers - Stimulated absorption - Spontaneous emission, stimulated emission - population inversion - pumping action - active medium - laser characteristics – Nd-Yag laser -CO_2 laser - Semiconductor laser - applications - optical fiber - principle and propagation of light in optical fibers - Numerical aperture and acceptance angle - types of optical fibers - single and multimode, step index and graded index fibers - fiber optic communication system.	
LAB / MINI PROJECT / FIELD WORK	
NA	
TEXT BOOKS	
1.	P.Mani, " Engineering Physics", Vol-I & II, Dhanam Publications, Chennai. (2011)
2.	Gaur R.K. and Gupta S.L., "Engineering Physics", 8th edition, Dhanpat Rai publications (P) Ltd., New Delhi. (2010)
REFERENCE BOOKS	
1.	Arthur Beiser, "Concepts of Modern Physics", Tata Mc Graw – Hill Publications. (2007)
2.	Rajendran V. Marikani A., "Applied Physics for engineers", 3rd edition, Tata Mc Graw –Hill publishing company Ltd., New Delhi. (2003)
E BOOKS	
1	https://www.bookyards.com/en/book/details/13921/Elements-Of-Properties-Of-Matter
2	http://iopscience.iop.org/book/978-1-6817-4585-5
3	https://www.springer.com/in/book/9783319206295
MOOC	
1	http://nptel.ac.in/courses/115106061/
2	http://nptel.ac.in/courses/117101054/12

COURSE TITLE	PROFESSIONAL ENGLISH AND SOFT SKILLS			CREDITS	3
Course Code	ELA4101	Course Category	BS	L-T-P-S	1-1-2-1
CIA	60%			ESE	40%
LEARNING LEVEL	BTL - 6				

CO	COURSE OUTCOMES	PO
1	Understanding the importance of professional communication and applying the knowledge.	6,10,12
2	Integrate the knowledge of phonetics, enhancing the listening skills in formal and real-life situations, enhance pronunciation skills based on the knowledge of phonetics.	6,10,12
3	Construct appropriate sentences in English Language, applying grammatical rules and mastery in syntax. Develop reading skills and derive the contextual meaning, case studies and analyzing problems	6,10,12
4	Integrate creativity in the writing skills both in formal and informal situations, related to environment, society and multidisciplinary environments	6,7,10,12
5	Imbibing soft skills to excel in interpersonal skills essential for workplace	6,10,12

Prerequisites : Plus Two English-Intermediate Level

MODULE 1 – THE ELEMENTS OF COMMUNICATION (9L)

Importance of communication through English -Process of communication and factors that influence speaking- Importance of audience and purpose- Principles of Communication-comparing general communication and business communication-Professional Communication-barriers to communication –strategies to overcome communication barriers-formal and informal communication

Suggested Activities:

Self-introduction-short conversations-Situational communication-dialogue writing -Language Functions-analyse the speech and comment-distinguish formal and informal style of communication-using bias-free language- news reports.

Suggested Reading:

Rogerson, Trish Stott & Derek Utley.2011

Elements of Effective Communication: 4th Edition, Plain and Precious Publishing, USA, by Randal S. Chase (Author), Wayne Shamo (Author)

Effective Communication Skills, MTD Training & Ventus Publishing (e book)

MODULE 2 – AURAL –ORAL COMMUNICATION IN ENGLISH (9L)

Vowels- diphthongs- consonants - International Phonetic Alphabet (IPA) ; phonemic transcription (simple words)-syllable division and word stress –enunciation-GIE script(General Indian English)-neutral accent- sentence rhythm and weak forms - contrastive stress in sentences to highlight different words - intonation varieties of Spoken English : Standard Indian, American and British-Speaking to Communicate-speech acts - Language Patterns

(Note: This unit should be taught in a simple, non-technical manner, avoiding technical terms as far as possible).

Suggested activities: (Audio CD) Listen and repeat, listen to the sentences and fill in the blanks, Listening to passages and answering questions, marking the stressed syllable, phonemic script of simple words, sentence rhythm and intonation (rising tone and falling tone), short speeches. Individual presentations-dynamics of a group discussion

Suggested sources:

Cambridge IELTS

Professional Speaking Skills by Aruna Koneru, Oxford Press

Face to face series Cambridge University Press

Speaking Effectively, Cambridge University Press, Jeremy Comfort, Pamela

MODULE 3 - GRAMMAR AND DEVELOPMENT OF READING SKILLS (9L)

Noun Phrase, Verb Phrase, Tense and Aspect, Articles, Pronouns and determiners, Sentence Pattern, interrogative and negative sentences-subject verb agreement -Vocabulary-word formation: prefixes and suffixes, reading passages-inductive vs deductive reading-newspaper articles- comprehension passages –cloze reading-annotating-editing

Suggested Activities:

Identify the errors in sentences, grammar exercises, book reviews, mini project on suggested reading activity - reading technical passages based on students area of specialization answering questions-reading passage for identifying the contextual meaning

Suggested sources:

Skills for the TOEFL IBT Test, Collins

IELTS, Cambridge books

Practical English Usage by Michael Swan , Cambridge University Press

MODULE 4 - EFFECTIVE WRITING AND BUSINESS COMMUNICATION (9L)

Paragraph writing- topic sentence-connectives - process writing-Memoranda-Business letters-Resumes /Visumes and job applications-drafting a report-agenda and minutes of the meeting-ATR-project proposals-email etiquette- interpreting visual data(bar chart, pie chart, line graphs)

Suggested activities:

Writing short paragraph based on environment protection, societal issues, health, cultural contexts etc., identifying topic sentences, linking pairs of sentences, cause and effect exercises, formal letters, e mails, drafting project proposals, drafting agenda, minutes of the meeting

Suggested sources:

Cambridge Advanced English, Newspapers, library books, IELTS,IELTS Academic Writing 1,New Insights into IELTS, CUP

MODULE 5 – SOFT Skills (9L)

Introducing Soft Skills &Life Skills- Myers Briggs Type Indicator – the Big Five Model Personality - Employability Skills- Workplace Etiquette- Professional Ethics -Time Management-Stress Management-Lateral Thinking (De Bono's Six Thinking Hats) and Problem Solving Skills

Suggested Activities:

Mock interviews, GD's, short oral presentation, lateral thinking puzzles, Case analysis and self-study assignments, Worksheet activities.

Suggested Sources:

Soft Skills and Employability Skills by Sabina Pillai and Agna Fernandez, Cambridge University Press, 2018.
Soft Skills for Everyone by Jeff Butterfield, Cengage Learning
Education and personality development, K. Manoharan
English for Life and the Workplace through the LSRW&T skills
Lateral Thinking skills by Edward De Bono

TEXT BOOKS	
1.	An Introduction to Profession English and Soft Skills with audio CD by Dr. Bikram K. Das et al. Published by Cambridge University Press. 2009
REFERENCE BOOKS	
1	Soft Skills & Employability Skills by Sabina Pillai and Agna Fernandez published by Cambridge University Press 2018.
2	Embark, English for Undergraduates by Steve Hart et al, Cambridge University Press, 2016, edition
3	Skills for the TOEFL IBT Test, Collins, 2012 edition
4	Soft Skills for Everyone by Jeff Butterfield, Cengage Learning, 2010 edition
5	English for Life and the Workplace Through LSRW&T skills, by Dolly John, Pearson Publications, 2014 edition
6	Professional Speaking Skills by Aruna Koneru, Oxford Publications.
7	The official Cambridge guide to IELTS for Academic and General Training, Cambridge University Press, 2014 edition.
8	Cambridge BEC Vantage, Self-Study edition, Practice Tests, CUP, 2002
9	English for Business Studies, 3rd edition, Ian Mackenzie, Cambridge University Press
10	Education and Personality Development by Dr. P.K.Manoharan, APH Publishing Corporation,
11	Speaking Effectively by Jeremy Comfort et al, Cambridge University Press, 2011.
E BOOKS	
1	https://www.britishcouncil.in/english/courses-business
2	http://www.bbc.co.uk/learningenglish/english/features/pronunciation
3	http://www.bbc.co.uk/learningenglish/english/
4	http://www.antimoon.com/how/pronunc-soundsipa.htm
5	http://www.cambridgeenglish.org/learning-english/free-resources/write-and-improve/
6	Oneshopenglish.com
7	Breakingnews.com
MOOC	
1	https://www.mooc-list.com/tags/english
2	https://www.mooc-list.com/course/adventures-writing-stanford-online
3	http://www.cambridgeenglish.org/learning-english/free-resources/mooc/

COURSE TITLE	ENGINEERING GRAPHICS AND COMPUTER AIDED DESIGN			CREDITS	3
Course Code	MEA4101	Course Category	BS	L-T-P-S	1- 1- 2- 1
CIA	60%			ESE	40%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	Understand drafting and computer aided drafting. Remember the commands used in AutoCAD to generate simple drawings.	1,3,5,10,12
2	Explain details in a drawing and apply the knowledge to solve simple problems involving straight lines, planes and solids	1,3,5,10,12
3	Understand and Visualize solid objects and apply AutoCAD software commands to generate the graphic models	1,3,5,10,12
4	Apply the 3D model commands to generate and solid object	1,3,5,10,12
5	Apply the viewing AutoCAD commands to generate top view, front view and additional or sectional views.	1,3,5,10,12
6	Student can able to develop any graphical model of geometrical and simple mechanical objects in AutoCAD software.	1,3,5,10,12

Prerequisites : Nil

MODULE 1: BASICS OF ENGINEERING GRAPHICS AND PLANE CURVES (12L)

Importance of graphics - BIS conventions and specifications - drawing sheet sizes - Lettering – Dimensioning - Scales. Drafting methods - introduction to Computer Aided Drafting – Computer Hardware – Workstation – Printer and Plotter – Introduction to software for Computer Aided Design and Drafting – Exposure to Solid Modelling software – Geometrical Construction-Coordinate Systems/Basic Entities – 3D printer.

Suggested Reading: Solid modeling Software commands

MODULE 2: VISUALIZATION, ORTHOGRAPHIC PROJECTIONS AND FREE HAND SKETCHING (15L)

Visualization concepts and Free Hand sketching: Visualization principles —Representation of Three Dimensional objects — Pictorial Projection methods - Layout of views- Free hand sketching of multiple views from pictorial views of objects. Drafting of simple Geometric Objects/Editing

General principles of presentation of technical drawings as per BIS - Introduction to Orthographic projections - Naming views as per BIS - First angle projection method. Conversion to orthographic views from given pictorial views of objects, including dimensioning – Drafting of Orthographic views from Pictorial views.

Suggested Reading: CAD software commands for sketching a drawing

MODULE 3: GEOMETRICAL MODELING ISOMETRIC VIEWS AND DEVELOPMENT OF SURFACES (15L)

Principles of isometric projection and solid modelling. Isometric drawing – Iso Planes and 3D Modelling commands. Projections of Principal Views from 3-D Models. Solid Modelling – Types of modelling - Wire frame model, Surface Model and Solid Model – Introduction to graphic software for solid modelling. Development of Surfaces.

Suggested Reading: Surface modeling and solid modeling commands

MODULE 4: COMPUTER AIDED DESIGN AND DRAFTING (15L)
Preparation of solid models of machine components like slide block, solid bearing block, bushed bearing, gland, wall bracket, guide bracket, shaft bracket, jig plate, shaft support (open type), vertical shaft support etc using appropriate modelling software. 2D views and sectional view, computer aided drafting and dimensioning. Generate 2D drawing from the 3D models – generate and develop the lateral surfaces of the objects. Presentation Techniques of Engineering Drawings – Title Blocks – Printing/Plotting the 2D/3D drawing using printer and printing solid object using 3D printer. **Suggested Reading**: CAD commands for modeling and views generation
Module 5: SIMPLE DESIGN PROJECTS - COMPUTER AIDED DESIGN AND DRAFTING (15L)
Creation of engineering models and their presentation in standard 2D form, 3D Wire-Frame and shaded solids, meshed topologies for engineering analysis, tool-path generation for component manufacture, geometric dimensioning and tolerancing. Use of solid-modelling software for creating associative models at the components and assembly levels in their respective branch of engineering like building floor plans that include: windows, doors, fixtures such as WC, Sink, shower, slide block, etc. Applying colour coding according to drawing practice. **Suggested Reading**: CAD commands for modeling and views generation

TEXT BOOKS	
1	Jeyapoovan T, Engineering Drawing and Graphics Using AutoCAD, 7th Edition, Vikas Publishing House Pvt Ltd., New Delhi, 2016.
REFERENCE BOOKS	
1	Introduction to AutoCAD – 2D and 3D Design, A.Yarmwood, Newnes Elsevier, 2011
2	Engineering Drawing and Graphic Technology-International Edition, Thomas E. French, Charles J. Vierck, Robert J. Foster, McGraw-Hill, 2014
3	Engineering Drawing and Design, Sixth Edition, C. Jensen, J.D. Helsel, D.R. Short, McGraw-Hill, 2012
4	Technical Drawing-Fourteenth Edition, F. E. Giesecke, A. Mitchell, H. C. Spencer, I.L. Hill, J.T. Dygdon, J.E., Novak, Prentice-Hall, 2012,
5	Bhatt N.D and Panchal V.M, Engineering Drawing: Plane and Solid Geometry, Charotar Publishing House, 2017.
6	Warren J. Luzadder and Jon. M. Duff, Fundamentals of Engineering Drawing, Prentice Hall of India Pvt. Ltd., Eleventh Edition, 2016.
E BOOKS	
1	http://keralatechnologicaluniversity.blogspot.in/2015/06/engineering-graphics-j-benjamin-pentex-free-ebook-pdf-download.html
2	http://keralatechnologicaluniversity.blogspot.in/2015/06/engineering-graphics-p-i-varghese.html
MOOC	
1	http://nptel.ac.in/courses/112103019/
2	http://nptel.ac.in/courses/105104148/

COURSE TITLE	SUSTAINABLE ENGINEERING SYSTEMS (Common to ALL Branches of Engineering)			CREDITS	2
COURSE CODE	GEA4102	COURSE CATEGORY	PC	L-T-P-S	2-0-0-1
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1.	Students learn the principles of sustainability with case studies.	1,2,3,4,6,7,12
2.	Students will be able to understand assessing technologies and their impact on environment.	1,2,3,4,6,7,12
3	To learn the concept of Green Engineering and to apply in their projects at higher semesters.	1,2,3,4,6,7,12
4.	Management of natural resources and waste management from various types of industries.	1,2,3,4,6,7,12
5.	Students learn water technology and behavioral aspects of humans.	1,2,3,4,6,7,12

Prerequisites: Knowledge in fundamentals of chemistry at higher secondary level.

MODULE 1 – PRINCIPLES OF SUSTAINABLE SYSTEMS (5L)

Sustainability Definitions - Principles of Sustainable Design, Sustainable Engineering -Frameworks for Applying Sustainability Principles - Summary & Activities.

MODULE 2 – TECHNOLOGY DEVELOPMENT AND LIFECYCLE ASSESSMENT (5L)

Technology as a part of anthropogenic environment - Technology readiness levels (TRL) – technical metrics - Emerging, converging, disruptive technologies - Life Cycle Assessment (LCA) methodology - Summary & Activities.

MODULE 3 – GREEN ENGINEERING (5L)

Principles of Green Engineering - Frameworks for assessment of alternatives - Green Engineering examples - Multifunctional Materials and Their Impact on Sustainability - Summary & Activities.

MODULE 4 – RESOURCE MANAGEMENT TECHNOLOGIES (5L)

Waste management purpose and strategies - Recycling: open-loop versus closed-loop thinking - Recycling efficiency - Management of food waste and composting technologies - E-waste stream management - Reuse and redistribution programs - LCA approach to waste management systems - Summary and Activities.

MODULE 5 – SUSTAINABLE WATER AND WASTEWATER SYSTEMS (5L)

Water cycle - Water conservation and protection technologies - Water treatment systems Metrics for assessment of water management technologies-Summary & Activities.

MODULE 6 - BEHAVIORAL ASPECTS AND FEEDBACKS (5L)

Collaborative Decision Making - Role of Community and Social Networking - Human Factor in Sustainability Paradigm - Summary & Activities.

TEXT BOOKS	
1.	Vanek, F.M., and L.D. Albright, Energy Systems Engineering. Evaluation and Implementation, McGraw Hill, 2008.
2.	C.U. Becker, Sustainability Ethics and Sustainability Research, Springer 2012.
3.	J.B. Guinee et al., Life Cycle Assessment: Past, Present, and Future, Environ. Sci. Technol., 2011, 45, 90-96.
4.	Anastas, P.T., Zimmerman, J.B., Innovations in Green Chemistry and Green Engineering, Springer 2013.
5.	Solid Waste Technology & Management, Volume 1 & 2, Christensen, T., Ed., Wiley and Sons., *2010.*
6.	Sterman, J.D., in Sustainability Science: The Emerging Paradigm, Weinstein, M.P. and Turner, R.E. (Eds.), Springer Science+Business Media, LLC 2012.
E BOOKS	
1.	David T. Allen, David R. Shonnard, Sustainable Engineering Concepts, Design and Case Studies, Pearson Education, December 2011. (ISBN: 9780132756587)
2.	Gerald Jonker Jan Harmsen, Engineering for Sustainability 1st Edition, A Practical Guide for Sustainable Design, Elsvier 2012. (**ISBN:** 9780444538475).
MOOC	
1.	https://www.coursera.org/learn/sustainability
2.	https://www.academiccourses.com/Certificate/Sustainability-Studies/India/
3.	https://onlinecourses.nptel.ac.in/noc18_ce08/preview
4.	https://www.coursera.org/learn/ecosystem-services

COURSE TITLE	PROBLEM SOLVING USING C			CREDITS	3
COURSE CODE	CSA4101	COURSE CATEGORY	PC	L-T-P-S	2-0-2-0
CIA	60%			ESE	40%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
Upon completion of this course, the students will be able to		
1	Describe the basics of digital computer and programming languages.	1,2,8,12
2	Demonstrate problem solving techniques using flowchart, algorithm/pseudo code to solve the given problem.	1,2,3,5,12
3	Design and Implement C program using Control Statements and Functions.	1,2,3,5,9,10,12
4	Design and Implement C program using Pointers and File operations.	1,2,3,12
5	Identify the need for embedded C in real-time applications.	1,2,6,12

Prerequisites: Nil

MODULE 1 – PROGRAMMING LANGUAGES AND PROBLEM SOLVING TECHNIQUES (6L+6P)

Introduction – Fundamentals of digital computers - Programming languages -Programming Paradigms – Types of Programming Languages – Language Translators – Problem Solving Techniques: Algorithm – Flow Chart - Pseudo code.

Practical Component:

Drawing Flowcharts using E- Chart & Writing pseudo code for the following problems

(i) Greatest of three numbers

(ii) Sum of N numbers

(iii) Computation of nCr

MODULE 2: FUNDAMENTALS OF C (6L+6P)

Evolution of C -Why C language - Applications of C language - Data Types in C – Operators and Expressions – Input and Output statements in C – Decision Statements – Loop Control Statements.

Practical Component:

(i) Program to illustrate arithmetic and logical operators

(ii) Program to read and print data of different types

(iii) Program to calculate area and volume of various geometrical shapes

(iv) Program to compute biggest of three numbers

(v) Program to print multiplication table

(vi) Program to convert days to years, months and days

(vii) Program to find sum of the digits of an integer.

MODULE 3: FUNCTIONS, ARRAYS AND STRINGS (6L+6P)

Functions – Storage Class – Arrays – Strings and standard functions - Pre-processor Statements.

Practical Component:

(i) Program to compute Factorial, Fibonacci series and sum of n numbers using recursion

(ii) Program to compute sum and average of N Numbers stored in an array

(iii) Program to sort the given n numbers stored in an array

(iv) Program to search for the given element in an array

(v) Program to do word count (vi) Program to insert a substring in a string (vii) Program to concatenate and compare two strings (viii) Program using pre-processor statements
MODULE 4: POINTERS, STRUCTURES AND UNION (6L+6P)
Pointers – Dynamic Memory allocation – Structure and Union – Files. **Practical Component:** (i) Program to compute sum of integers stored in a 1-D array using pointers and dynamic memory allocation (ii) Program to read and print records of a student/payroll database using structures (iii) Program to simulate file copy (iv) Program to illustrate sequential access file (v) Program to illustrate random access file
MODULE 5: INTRODUCTION TO EMBEDDED C (6L+6P)
Structure of embedded C program - Data Types - Operators - Statements - Functions - Keil C Compiler. **Practical component:** Simple programs using embedded C
LAB / MINI PROJECT / FIELD WORK
NA

TEXT BOOKS	
1.	Jeyapoovan T, “Fundamentals of Computing and Programming in C”, Vikas Publishing house, 2015.
2.	Mark Siegesmund, "Embedded C Programming", first edition, Elsevier publications, 2014.
REFERENCE BOOKS	
1.	Ashok Kamthane, “Computer Programming”, Pearson Education, 7th Edition, Inc 2017.
2.	Yashavant Kanetkar, “Let us C”, 15th edition, BPP publication, 2016.
3.	S.Sathyalakshmi, S.Dinakar, “Computer Programming Practicals – Computer Lab Manual”, Dhanam Publication, First Edition, July 2013.
E BOOKS	
1.	https://en.wikibooks.org/wiki/C_Programming
MOOC	
1.	https://onlinecourses.nptel.ac.in/noc18-cs10/preview
2.	http://nptel.ac.in/courses/106105085/2
3.	https://www.udemy.com/c-programming-for-beginners/
4.	https://www.coursera.org/specializations/c-programming

COURSE TITLE	INTRODUCTION TO DIGITAL SYSTEMS			CREDITS	3
COURSE CODE	EEB4101	Course Category	PC	L-T-P-S	3- 0- 0- 1
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	To understand basic operation in digital systems and instruments.	1,3,5,12
2	To gain knowledge on basic functioning of sensors and display units.	1,3,5,12
3	To familiarize the concepts of signal processing and converting elements.	1,3,5,12
4	To acquire the knowledge of microcontrollers and applications	1,3,5,12
5	To attain the basic concepts of consumer electronics and communication devices.	1,3,5,12

Prerequisites : Physics and Mathematics

MODULE 1 – INTRODUCTION TO DIGITAL SYSTEMS (9L)

Analog& Digital signals - Need for digital instruments – Elements of digital instruments – Number systems: - Binary, Hexadecimal - Logic gates - Boolean algebra (Identities and Properties) - Digital controllers (ON-OFF).

Suggested Reading: Basics of number systems.

MODULE 2 –SENSORS AND DISPLAYS (9L)

Sensors and Transducers –Classification, Potentiometer, Strain Gauge, Piezoelectric Sensor, Linear Variable Differential Transformer, Resistance temperature detectors (RTD), Thermocouples, Tactile transducers - Displays: - Light Emitting Diode (including OLED) displays.

Suggested Reading: Primary sensing elements, introduction to displays.

MODULE – 3 : SIGNAL CONDITIONING CIRCUITS (9L)

D.C. Bridge- Unbalanced, Push-Pull configuration, Operational amplifiers- Inverting, Non-Inverting, Instrumentation Amplifier, Active filters: - Low pass, High pass - Analog to Digital Converter – Successive Approximation, Digital to Analog Converter - Weighted Resistor.

Suggested Reading: Basic network theorems.

MODULE – 4 :INTRODUCTION TO MICRO CONTROLLERS (9L)

Introduction: Memory types, peripheral devices- Microcontroller (8 bit), Architecture, Graphics Processing Unit (GPU) - Applications: -Interfacing of Digital Input/Output, Analogue Input/Output, Display. Introduction to Programmable Logic Controller (PLC) and PID (Proportional + Integral + Derivative) Controller.

Suggested Reading: Hobby electronics with Microcontroller interface.

MODULE 5 – CONSUMER ELECTRONICS AND COMMUNICATION SYSTEM (9L)

Consumer Electronics: Television, Mobile Phones, Air conditioners, Refrigerators, Washing Machine. (Block diagram approach only.)

Communication System: Satellite communication, Global Positioning Systems, Global System for Mobile. (Block diagram approach only.)

Suggested Reading: Consumer Electronics User Manuals.

LAB / MINI PROJECT/FIELD WORK

Field trip to consumer electronics industry.

TEXT BOOKS	
1	Digital Fundamentals, Thomas l. Floyd, 11th edition, Pearson 2014.
2	Op-amps and Linear Integrated Circuits, Ramakant A. Gayakwad, 4th edition, Prentice Hall, 2015.
3	Electronic Instrumentation and Measurements, David A. Bell, Oxford University Press, 2013.
4	The 8051 Microcontroller And Embedded Systems Using Assembly And C, SepehrNaimi, SarmadNaimi, Muhammad Ali Mazidi, Second edition, 2017.
5	Programmable Logic Controllers, Frank D. Petruzella, McGraw-Hill Education, 2016.
REFERENCE BOOKS	
1	Digital Logic and Computer Design, M. Morris Mano, Prentice-Hall, 2016
2	Linear Integrated Circuits, Roy Choudhury, New Age International Publishers, 4th edition, 2011
3	C and 8051, Thomas W. Schultz, Thomas W. Schultz Publishers, 4th edition,2008
4	Consumer Electronics, S.P Bali, Pearson Education Asia Pvt., Ltd., 2008 Edition
5	Global Mobile Satellite Communications Applications (For Maritime, Land and Aeronautical Applications Volume 2), 2nd edition, Springer, 2018
E BOOKS	
1	http://www.ee.iitm.ac.in/~giri/pdfs/EE4140/textbook.pdf
2	https://electronics.howstuffworks.com/home-audio-video-channel.htm
MOOC	
1	http://nptel.ac.in/courses/106108099/Digital%20Systems.pdf
2	http://nptel.ac.in/courses/112103174/pdf/mod2.pdf
3	http://www.nptel.ac.in/courses/Webcourse-contents/IISc-BANG/Microprocessors%20and%20Microcontrollers/pdf/Teacher_Slides/mod3/M3L6.pdf
4	http://nptel.ac.in/courses/108105063/pdf/L-09(SS)(IA&C)%20((EE)NPTEL).pdf
5	http://nptel.ac.in/courses/Webcourse-contents/IIT-KANPUR/microcontrollers/micro/ui/Course_home2_5.html

COURSE TITLE	ENGINEERING AND DESIGN			CREDIT	3
COURSE CODE	ATB4101	COURSE CATEGORY	PC	L-T-P-S	3- 0- 0 -1
CIA	60%			ESE	40%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	Students will be able to appreciate the different elements involved in good designs and to apply them in practice when called for.	1,2,3,4,7,10,12
2	Students will be aware of the product oriented and user oriented aspects that make the design a success.	1,2,3,4,7,10,12
3	Students Will be capable to think of innovative designs incorporating different segments of knowledge gained in the course	1,2,3,4,7,10,12
4	Students will have a broader perspective of design covering function, cost, environmental sensitivity, safety and other factors other than engineering analysis.	1,2,3,4,7,10,12
5	Students learn economic and environmental Issues, trade aspects and IPR	1,2,3,4,7,10,12

Prerequisites : Nil

Module 1: INTRODUCTION TO AUTOMOBILE ENGINEERING DESIGN (7L+2P)

Design and its objectives; Design constraints, Design functions, Design means and Design from; Role of Science, Engineering and Technology in design; Engineering as a business proposition; Functional and Strength Designs. Design form, function and strength; How to initiate creative designs? Initiating the thinking process for designing a product of daily use. Need identification; Problem Statement; Market survey-customer requirements; Design attributes and objectives; Ideation; Brain storming approaches; arriving at solutions; Closing on to the Design needs.

Project: An Exercise in the process of design initiation. A simple problem is to be taken up to examine different solutions- Vehicle, Group Presentation and discussion**.**

MODULE 2: PROCESSES IN DESIGN FOR AUTOMOTIVE SYSTEM (7L+2P)

Design process- Different stages in design and their significance; Defining the design space; Analogies and "thinking outside of the box"; Quality function deployment-meeting what the customer wants; Evaluation and choosing of a design. Design Communication; Realization of the concept into a configuration, drawing and model. Concept of "Complex is Simple". Design for function and strength.

Design detailing- Material selection, Design visualization- Solid modelling; Detailed 2D part drawings; Tolerance; Use of standard items in design; Research needs in design; Energy needs of the design, both in its realization and in the applications.

Project: An exercise in the detailed design of any two automobile components

MODULE 3: PROTOTYPING OF AUTOMOBILE COMPONENTS (4L+5P)

Prototyping- rapid prototyping; testing and evaluation of design; Design modifications; Freezing the design; Cost analysis.

Engineering the design – From prototype to product. Planning; Scheduling; Supply chains; inventory; handling; manufacturing/construction operations; storage; packaging; shipping; marketing; feed-back on design

Project: List out the standards organizations. Prepare a list of standard items used in automobile original equipment manufacturers. Develop any design with over 50% standard items as parts.

MODULE 4: QUALITY ASPECTS IN AUTOMOBILE ENGINEERING (4L+5P)
Design for "X"; covering quality, reliability, safety, manufacturing/construction, assembly, maintenance, logistics, handling; disassembly; recycling; re-engineering etc. **Project: Example:** List out the design requirements(x) for designing a car.
Module 5: USER CENTRED DESIGNS IN AUTOMOBILE ENGINEERING (4L+5P)
Product centered and user centered design. Product centered attributes and user centered attributes. Bringing the two closer. Example: Motor Cycle and Car, Aesthetics and ergonomics. Value engineering, Concurrent engineering, Reverse engineering in design; Culture based design; Architectural designs; Motifs and cultural background; Tradition and design; Study the evolution of Wheels; Printed motifs; Role of colours in design. Make sharp corners and change them to smooth curves-check the acceptance. Design as a marketing tool; Intellectual Property rights – Trade secret; patent; copy-right; trademarks; product liability. Group presentation of any such products covering all aspects that could make or mar it. **Project:** Examine the possibility of value addition for an existing product.
REFERENCE BOOKS

1	Balmer, R. T., Keat, W. D., Wise, G., and Kosky, P., Exploring Engineering, Third Edition: An Introduction to Engineering and Design - [Part 3 - Chapters 17 to 27], ISBN13: 978-0124158917 ISBN-10: 0124158919
2	Dym, C. L., Little, P. and Orwin, E. J., Engineering Design - A Project based introduction - Wiley, ISBN-978-1-118-32458-5
3	Eastman, C. M. (Ed.), Design for X Concurrent engineering imperatives, 1996, XI, 489 p. ISBN 978-94-011-3985-4 Springer
4	Haik, Y. And Shahin, M. T., Engineering Design Process, Cengage Learning, ISBN-13: 978-0-495-66816-9
5	Pahl, G., Beitz, W., Feldhusen, J. and Grote, K. H., Engineering Design: A Systematic Approach, 3rd ed. 2007, XXI, 617p., ISBN 978-1-84628-319-2
6	Voland, G., Engineering by Design, ISBN 978-93-325-3505-3, Pearson India

COURSE TITLE	ENGINEERING MECHANICS			CREDITS	4
COURSE CODE	ATB4117	COURSE CATEGORY	PC	L-T-P-S	3-1-0-1
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-4				

CO	COURSE OUTCOMES	PO
1	Able to understand and analyze the condition of equilibrium of a particle	1,2,4,6,12
2	Able to analyze the condition of equilibrium of rigid bodies	1,2,4,6,12
3	Able to apply the concepts of friction in real world applications	1,2,4,6,12
4	Able to calculate centroid and moment of inertia of a given plane area	1,2,4,6,12
5	Able to analyze the dynamic equilibrium conditions of a body	1,2,4,6,12

Prerequisites : Nil

MODULE 1 - BASICS & STATICS OF PARTICLES (10L+2T)

Introduction - Units and Dimensions - Laws of Mechanics – Vectors - Vectorial representation of forces and moments - Vector operations, Coplanar Forces, triangular, Parallelogram and Polygonal Law of forces, Resolution and Composition of forces, Equilibrium of a particle, Lame's theorem, Forces in space - Equilibrium of a particle in space - Equivalent systems of forces - Principle of transmissibility - Single equivalent force.

Suggested Reading: Vector operations

MODULE 2 - EQUILIBRIUM OF RIGID BODIES (10L+2T)

Free body diagram - Types of supports and their reactions - Requirements of stable equilibrium, Static determinacy - 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 - Equilibrium of Rigid bodies in three dimensions. **Suggested Reading**: Equilibrium of Rigid bodies in three dimensions.

MODULE 3 - FRICTION (8L+2T)

Frictional force - Laws of Coulomb friction - Simple contact friction - Belt friction - Transmission of power through belts - Wedge Friction - Screw Jack.

Suggested Reading: Rolling resistance and rolling friction

MODULE 4 - PROPERTIES OF SURFACES (10L+2T)

Determination of Areas, first moment of area, Centroid of sections, Second and product moments of plane area, Parallel axis theorem and perpendicular axis theorem - Polar moment of inertia - Product moment of inertia.

Suggested Reading: Principle moment of inertia

MODULE 5 - DYNAMICS OF PARTICLES (12L+2T)

Displacements, Velocity and acceleration, their relationship - Relative motion – Rectilinear motion, Curvilinear motion, Newton's law of motion - Work Energy Principle - Impulse and Momentum - Impact of elastic bodies.

Suggested Reading: Projectile motion

LAB / MINI PROJECT / FIELD WORK	
TEXT BOOKS	
1	Beer, F.P and Johnson Jr. E.R, Vector Mechanics for Engineers, Vol. 1 Statics and vol. 2 Dynamics, McGraw-Hill International Edition, 2012.
2	Rajasekaran, S, Sankarasubramanian, G., Fundamentals of Engineering Mechanics, Vikas Publishing House Pvt., Ltd., 2010.
REFERENCE BOOKS	
1	Hibbeller, R.C., Engineering Mechanics, Vol. 1 Statics, Vol. 2 Dynamics, Pearson Education Asia Pvt. Ltd., 2010.
2	Irving H. Shames, Engineering Mechanics - Statics and Dynamics, IV Edition - Pearson EducationAsia Pvt., Ltd., 2013.
E BOOKS	
1	https://drive.google.com/open?id=0B9bpsTYXP4ceTnBneXhzRV96dWs
2	https://drive.google.com/open?id=0B9bpsTYXP4ceSUZLaEYyNDRGMWs
3	https://drive.google.com/open?id=0B9bpsTYXP4ceRjBJQjd1UTVmNHM
MOOC	
1	https://ocw.mit.edu/courses/physics/8-01sc-classical-mechanics-fall-2016/
2	http://www.nptel.ac.in/courses/112103109/
3	http://www.nptelvideos.in/2012/11/engineering-mechanics.html

COURSE TITLE	MANUFACTURING TECHNOLOGY			CREDITS	3
COURSE CODE	ATB4118	COURSE CATEGORY	PC	L-T-P-S	3-0-0-1
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	Able to apply the casting principles for automobile components	1,12
2	Able to perform various metal joining process	1,12
3	Able to identify suitable bulk deformation process for automobile applications	1,12
4	Able to perform various machining operation using lathe, milling etc	1,12
5	Able to produce smooth metal surfaces using surface and cylindrical grinding machines	1,12

Prerequisites : Nil

MODULE 1- CASTING PROCESSES (9L)

Sand Casting – Sand Mould – Type of patterns - Pattern Materials – Pattern allowances – Moulding sand Properties and testing – Cores –Types and applications – Melting furnaces – Principle of special casting processes - Shell, investment – Ceramic mould – Pressure die casting – Centrifugal Casting - CO casting - Stir casting - Defects in Sand casting. Plastic moulding - injection and blow moulding

Suggested Reading: Sand casting of cylinder block and liners

MODULE 2- METAL JOINING PROCESSES (9L)
Fusion welding processes – Type of Gas welding – Flame characteristics – Filler and Flux materials – Arc welding, Electrodes, Coating and specifications – Principles and types of Resistance welding – Gas metal arc welding – Submerged arc welding – Electro slag welding – Gas Tungsten arc welding – Principle and application of special welding processes – Plasma arc welding – Thermit Welding – Electron beam welding – Friction welding – Diffusion welding – Weld defects – Brazing and soldering. **Suggested Reading:** welding of vehicle body frame and chassis
MODULE 3 - METAL FORMING PROCESSES (9L)
Hot and cold working processes - rolling, forging, drawing and extrusion processes, bending, hot spinning, shearing, tube and wire drawing, shot peening. Sheet metal working - blanking, piercing, punching, trimming, Bending - types of dies - progressive, compound and combination dies. **Suggested Reading:** forging of connecting rod
MODULE 4 - MACHINING PROCESSES (9L)
Lathe: working principle, classification, specification, accessories, work and tool holders, different operations on a lathe, turret and capstan lathes. Drilling and boring: machines - classification, specification, cutters speed & feed, jig borer - description, types and hole location procedures. Milling: classification, principle, parts – specification, milling cutters, indexing, milling processes and operations. **Suggested Reading:** manufacturing of transmission gears
MODULE 5 - METAL FINISHING PROCESSES (9L)
Surface finishing processes: grinding processes, various types of grinders, work holding devices, grinding wheels and specification, selection of grinding wheels for specific applications - selection of cutting speed and work speed. Fine Finishing Process: Lapping, honing, and super finishing process. **Suggested Reading:** surface finishing of engine components

TEXT BOOKS	
1	Hajra Choudhary S.K., "Elements of Manufacturing Technology", Vol. I & Vol. II, 11th edition, Media Publishers, Mumbai, 2011.
2	Rao.P.N., "Manufacturing Technology I & 2, Metal Cutting and Machine Tools", Tata McGraw-Hill,2010
REFERENCE BOOKS	
1	Jain K.C. Agarwal, L.N. "Metal Cutting Science and Production Technology", 1st edition, Khanna Publishers, 2010.
2	Chapman W.A.J., "Workshop Technology", Vol. II, Arnold Publishers.
E BOOKS	
1	MikellP.Groover https://drive.google.com/file/d/0B7JWdKw_4Q07M1F1Nm92TEUzczA/view
2	Kalpakjian file:///C:/Users/Admin/Downloads/Serope%20Kalpakjian%20Steve%20Schmid%20Manufacturing.pdf
3	http://www.erexams.com/2017/07/mechanical-all-subjects-ebook-free-pdf.html
MOOC	
1	https://www.mooc-list.com/tags/manufacturing-processes
2	https://www.edx.org/course/fundamentals-manufacturing-processes-mitx-2-008x-0

COURSE TITLE	MANUFACTURING TECHNOLOGY LAB			CREDITS	1
COURSE CODE	ATB4141	COURSE CATEGORY	PC	L-T-P-S	0-0-2-0
CIA	80%			ESE	20%
LEARNING LEVEL	BTL-2				

CO	COURSE OUTCOMES	PO
1	Able to operate lathe machine and perform different operation	1 - 12
2	Able operate special machines like milling, shaping, and perform different operation	1 - 12

Prerequisites : Nil

LIST OF EXPERIMENTS

1. Lathe - Turning, Facing, Step turning, Taper Turning, Thread Cutting
2. Milling – Polygon surface, Gear milling, Keyway cutting, Engraving using vertical milling machine
3. Grinding - Surface grinding, Cylindrical grinding, centerless grinding
4. Shaping – V slot and rectangular slot shaping
5. Gear Hobbing –Spur, Helical.

LIST OF EQUIPMENT

1. Centre Lathes
2. Turret and Capstan Lathe
3. Horizontal Milling Machine
4. Vertical Milling Machine
5. Surface Grinding Machine
6. Gear Hobbing Machine
7. CNC Lathe (Trainer or Industrial Type)

COURSE TITLE	ENGINEERING IMMERSION LAB			CREDIT	0.5
COURSE CODE	GEA4131	COURSE CATEGORY	BS	L-T-P-S	0-0-2-2
CIA	80%			ESE	20%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	Upon successful completion of this course the student should be able to Identify and use of tools, Types of joints used in welding, carpentry and plumbing operations.	1,2,4,6,12
2	Have hands on experience on basic fabrication techniques such as carpentry and plumbing practices.	1,2,4,6,12
3	Have hands on experience on basic fabrication techniques of different types of welding and basic machining practices.	1,2,4,6,12

SLOT X - LIST OF EXPERIMENTS

I. MECHANICAL ENGINEERING WORKSHOP

5. Welding: Arc welding: Butt joints
6. Lap joints.
7. Machining: Facing
8. Turning

II. AUTOMOBILE ENGINEERING

5. Dismantling and Studying of two stroke gasoline engine.
6. Assembling of two stroke gasoline engine.
7. Dismantling and Studying of four stroke gasoline engine
8. Assembling of four stroke gasoline engine.

III. AERONAUTICAL ENGINEERING

5. Study of Flow Pattern around Various Objects.
6. Force measurement on Aircraft Model
7. Determination of Young's Modulus for Aluminum Cantilever Beam
8. Binary Addition & Subtraction using Microprocessor

IV. CIVIL ENGINEERING

5. Plumbing- Basic Pipe Connection using valves, couplings and elbows.
6. Carpentry – Sowing, Planning and making common Joints.
7. Bar Bending
8. Construction of a 50 cm height brick wall without mortar using English Bond.

SLOT Y - LIST OF EXPERIMENTS

V.ELECTRICAL ENGINEERING

5. Study of tools and accessories.
6. Study of cables.
7. Staircase wiring, Tube light and Fan connection.
8. Measurement of energy using single phase energy meter.

VI. ELECTRONICS ENGINEERING

5. Study of Active and Passive Components.
6. Study of Logic Circuits.
7. Making simple circuit using Electronic Components.
8. Measuring of parameters for signal using CRO.
9.

VII. COMPUTER SCIENCE

5. Troubleshooting different parts of the computer peripherals, Monitor, Keyboard & CPU.
6. Installation of various operating systems, their capabilities, Windows, Unix, Linux.
7. Installation of commonly used software like MS Office
8. Assembling digital computer.

VIII. MECHATRONICS ENGINEERING

5. Study of Key Elements of Mechatronics Systems
6. Sensors – Load Cell, Thermocouple
7. Actuators – Linear & Rotary Actuators
8. Interfacing & Measurements – Virtual Instrumentation

REFERENCE BOOKS

1	Jeyapoovan T and Saravanapandian M., Engineering practices lab manual, 4th Edition, Vikas publishing House, New Delhi, 2015.
2	Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
3	Ibrahim Zeid, CAD/CAM Theory and Practice, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2011
4	Robert Quesada, Jeyapoovan T., Computer Numerical Control Machining and Turning Centers, Pearson Education, New Delhi, 2006

METHOD OF ALLOCATION FOR ENGINEERING IMMERSION LAB

SLOT X : MECH, AERO, AUTO, CIVIL EXPERIMENTS

SLOT Y : EEE, ELECTRONICS, CSE, MECHATRONICS EXPERIMENTS

- EVERY CLASS OF
  - GROUP A (AERO, AUTO, MECH, MCT, CHEM, BIO, CIVIL
  - GROUP B (CSE, IT, ECE, EEE, AEROSPACE)

GETS DIVIDED INTO 4 SUB - GROUPS NAMELY a, b, c, d -- EACH CONSISTING OF 15 TO 20 STUDENTS MAX.

- FOR EXAMPLE: **GROUP A STUDENTS WILL OCCUPY SLOT X**
  - WEEK 1 : SLOT X ---
    - ✓ a – MECH; b – AUTO; c – AERO ; d – CIVIL
  - WEEK 2 : SLOT X ---
    - ✓ b – MECH; c – AUTO; d – AERO ; a – CIVIL
- THE ABOVE SCHEDULE WILL BE ON ROTATION EVERY MONTH (ONE CYLCE PER MONTH)
- **GROUP B STUDENTS WILL OCCUPY SLOT Y**
  - WEEK 1 : SLOT Y ---
    - ✓ a – EEE; b – ECE; c – CSE ; d – MCT
  - WEEK 2 : SLOT Y ---
    - ✓ b – EEE; c – ECE; d – CSE ; a – MCT
- THE ABOVE SCHEDULE WILL BE ON ROTATION EVERY MONTH (ONE CYLCE PER MONTH)

COURSE TITLE	ENGINEERING PHYSICS LABORATORY (Common to all engineering branches)			CREDIT	1
Course Code	PHA4131	Course Category	BS	L-T-P-S	0-0-2-0
CIA	80%			ESE	20%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1.	Ability to analyze material's elastic properties	1,2,3,4,6,12
2.	Ability to determine thermal conductivity of bad conductor	1,2,3,4,6,12
3.	Ability to measure coefficient of viscosity of liquids	1,2,3,4,6,12
4.	Ability to determine wavelength of laser	1,2,3,4,6,12
5.	Ability to describe V-I characteristics of diode	1,2,3,4,6,12

Prerequisites: Knowledge in basic physics practical at higher secondary level.

List of Experiments (Any Five Experiments)

1. Torsional Pendulum – Determination of rigidity modulus of the material of a wire.
2. Non Uniform Bending – Determination of Young's Modulus.
3. Uniform Bending – Determination of Young's Modulus.
4. Viscosity – Determination of co-efficient of viscosity of a liquid by Poiseuille's flow.
5. Lee's Disc – Determination of thermal conductivity of a bad conductor.
6. Air – Wedge – Determination of thickness of a thin wire
7. Spectrometer – refractive index of a prism
8. Semiconductor laser – Determination of wavelength of laser using grating
9. Semiconductor diode – VI characteristics

TEXT BOOK

1.	P. Mani, engineering Physics Practicals, Dhanam Publications, Chennai, 2005

REFERENCE BOOKS

1.	Glenn V.Lo, Jesus Urrechaga - Aituna, Introductory Physics Laboratory Manual, Part-I, Fall 2005 Edition.
2.	P. Kulkarni, Experiments in Engineering Physics Bachelor of Engineering and Technology, Edition 2015

E BOOK

1	http://www.aurora.ac.in/images/pdf/departments/humanities-and-sciences/engg-phy-lab-manual.pdf

COURSE TITLE	MATERIALS CHEMISTRY LABORATORY (Common to ALL branches of Engineering)			CREDITS	1
Course Code	CYA4131	Course Category	BS	L-T-P-S	0-0-2-0
CIA	80%			ESE	20%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1.	Students learn to characterize basic properties of refractory ceramics	1,2,3,4,6,7,12
2.	On completion of this course, students learn to prepare resins and composites.	1,2,3,4,6,7,12
3.	Students learn to estimate metal ions present in samples using instrumental techniques.	1,2,3,4,6,7,12
4.	On completion of the course the students learn to develop adsorption isotherm.	1,2,3,4,6,7,12
5.	Students learn to find properties of lubricants and other oil samples.	1,2,3,4,6,7,12

Prerequisites: Knowledge in basic chemistry practical at higher secondary level.

LAB / MINI PROJECT/FIELD WORK

1. Construction of Phenol-Water Phase diagram.
2. Determination of viscosity of polymer using Ostwald Viscometer.
3. Preparation of urea-formaldehyde resin.
4. Determination of porosity of a refractory.
5. Determination of Apparent Density of porous solids.
6. Determination of Viscosity Index of lubricants.
7. Estimation of dye content in the effluent by UV-Visible spectrophotometry.
8. Determination of viscosity of oil using Red-Wood Viscometer.
9. Determination of Copper / iron content in the alloy by colorimetry.
10. Estimation of sodium and potassium ions by Flame Photometry.
11. Verification of Beer-Lambert's law using gold nanoparticles.
12. Determination of adsorption isotherm for acetic acid on activated charcoal.

REFERENCE BOOKS

1.	J. Mendham, R.C. Denney, J.D. Barnes and N.J.K. Thomas, Vogel's Textbook of Quantitative Chemical Analysis, 6th Edition, Pearson Education, 2009
2.	D.P. Shoemaker and C.W. Garland, Experiments in Physical Chemistry, 8th edition, McGraw Hill, London, 2008
3.	S. Sumathi, Laboratory work book for Engineering Chemistry Practical, 2015
4.	Laboratory Manual of Testing Materials, William Kendrick Hatt and Herbert Henry Scofield, Andesite Press, 2017

E BOOKS

1.	http://www.erforum.net/2016/01/engineering-chemistry-by-jain-and-jain-pdf-free-ebook.html

MOOC

1	https://ocw.mit.edu/courses/chemistry/5-111-principles-of-chemical-science-fall-2008/video-lectures/lecture-32/
2	https://www.coursetalk.com/providers/coursera/courses/introduction-to-chemistry-1

SEMESTER – III

COURSE TITLE	PARTIAL DIFFERENTIAL EQUATIONS AND TRANSFORMS (Common For all Department)			CREDITS	4
Course Code	MAA4201	Course Category	BS	L-T-P-S	3-1-0-0
CIA	50%			ESE	50%
LEARNING LEVEL	BTL: 1-4				

CO	COURSE OUTCOMES	PO
1.	Able to formulate and solve some of the physical problems involving partial differential equations	1,2,3,4,5,12
2.	Skilled to classify and solve the Wave and Heat equations	1,2,3,4,5,12
3.	Able to classify and solve two dimensional heat equations.	1,2,3,4,5,12
4.	Able to solve problems related to engineering applications by using Fourier Transform techniques.	1,2,3,4,5,12
5.	Able to understand the discrete transform applied to engineering problems.	1,2,3,4,5,12

Prerequisites : Nil

MODULE 1: PARTIAL DIFFERENTIAL EQUATIONS (9L+3T)

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

Suggested Reading: Partial Differentiation

MODULE 2: ONE DIMENSIONAL WAVE AND HEAT FLOW EQUATION (9L+3T)

Classification of second order linear partial differential equations – Solutions of one dimensional wave equation (without proof) – One dimensional heat flow equation (without proof) and application in string and rod problems.

Suggested Reading: Partial Differential Equations, Half range sine series.

MODULE 3: TWO DIMENSIONAL HEAT FLOW EQUATION (9L+3T)

Steady state solution of two dimensional heat equations and applications in finite plates and infinite plates problems.

Suggested Reading: Partial Differential Equations, Half range sine series.

MODULE 4: FOURIER TRANSFORM (9L+3T)

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

Suggested Reading: Basic integration.

MODULE 5: Z-TRANSFORM AND DIFFERENCE EQUATIONS (9L+3T)	
Z-Transform – Elementary Properties – Inverse Z-Transform – Convolution theorem – Formation of Difference equations – Solution of difference equations using Z-Transform **Suggested Reading**: Basic calculus	
LAB/MINI PROJECT/FIELD WORK	
Theory only	
TEXT BOOKS	
1	P. Sivarama Krishna Das, C. Vijayakumari., "Transforms and partial differential equations", Pearson Publication, 2016.
2	Grewal. B.S., "Higher Engineering Mathematics", 42nd Edition, Khanna Publishers, Delhi, 2012.
3	Chandrasekaran A, "A Text Book of Transforms and Partial Differential Equations", Dhanam Publication, 2015
REFRENCE BOOKS	
1.	Bali.N.P and Manish Goyal, "A Textbook of Engineering Mathematics", 7th Edition, Laxmi Publications Pvt Ltd , 2007.
2.	Datta.K.B., "Mathematical Methods of Science and Engineering", Cengage Learning India Pvt Ltd, Delhi, 2013.
3.	Veerarajan. T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., New Delhi, Second reprint, 2012.
E BOOKS	
1	nptel.ac.in/courses/122107037/
2	nptel.ac.in/courses/122107037/22
MOOC	
1	https://www.mooc-list.com/tags/laplace-transforms
2	https://www.edx.org/course/introduction-differential-equations-bux-math226-1x-1

COURSE TITLE	APPLIED THERMODYNAMICS			CREDITS	4
COURSE CODE	ATB4201	COURSE CATEGORY	PC	L-T-P-S	3-1-0-1
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-4				

CO	COURSE OUTCOMES	PO
1	Describe the principles of first and second law of thermodynamics.	1,2,3,4,6,7,12
2	Apply the concept of Heat Engine and heat pump in engineering.	1,2,3,4,6,7,12
3	Identify and describe the gas power cycles, vapour power cycles and refrigerator cycles.	1,2,3,4,6,7,12
4	Analyze the performance of reciprocating air compressors.	1,2,3,4,6,7,12
5	Apply the concepts of Heat Transfer	1,2,3,4,6,7,12

Prerequisites : Nil

MODULE 1 - BASIC CONCEPTS AND FIRST LAW OF THERMODYNAMICS (10L + 2T)

System, thermodynamic equilibrium, state, property, process, cycle, Zeroth law of thermodynamics, energy, work, heat, first law of thermodynamics, PMM I, ideal gases, application of first law of thermodynamics to closed and open systems, pressure - volume diagrams, steady flow process, application of steady flow energy equation.

Simulation Module : Steady flow analysis of fluids in various components using suitable simulation software

MODULE 2 - SECOND LAW OF THERMODYNAMICS (10L + 2T)

Limitations of first law, statements of second law of thermodynamics, PMM II, Clausius inequality, heat engine, heat pump, refrigerator, carnot cycle, carnot theorem, entropy, temperature - Entropy diagram, entropy changes for a closed system.

MODULE 3 - BRAYTON CYCLE AND STEAM POWER CYCLE (10L + 2T)

Air standard Brayton cycle with inter-cooling, reheating and regeneration, Formation of steam and its thermodynamic properties, Dryness fraction, Quality of steam by steam tables and Mollier chart – Rankine cycle, Work done.

MODULE 4 - COMPRESSORS AND REFRIGERATION SYSTEMS (10L + 2T)

Single acting and double acting air compressors, work required effect of clearance volume, volumetric efficiency, isothermal efficiency, free air delivery, multistage compression, condition for minimum work. Fundamentals of refrigeration, C.O.P., reversed Carnot cycle, simple vapour compression refrigeration system, (Descriptive only) simple vapour absorption refrigeration system, desirable properties of an ideal refrigerant.

MODULE 5 - INTRODUCTION TO HEAT TRANSFER (10L + 2T)

Modes of heat transfer, Fourier's law of conduction, one dimensional steady state conduction through plane and composite walls, cylinders. Free and forced convection, dimensionless numbers, thermal boundary layer, heat transfer co-efficient, simple problems overall heat transfer coefficient, heat exchangers, LMTD, concept of radiation- Stefan Boltzmann law, Black body and Grey body radiation.

Simulation Module: Heat transfer analysis of fluids using suitable simulation software Suggested Reading : **Compact Heat Exchangers**

LAB / MINI PROJECT / FIELD WORK	
NA	
TEXT BOOKS	
1	R.K.Rajput - "A Textbook of Engineering Thermodynamics"- Laxmi Publications (P) Ltd, New Delhi-2001. 2014
2	Biray K. Dutta - "Heat Transfer Principles and Applications"- Prentice hall of India, New Delhi - 2013
3	R.Rudramoorthy - "Thermal Engineering" - Tata McGraw Publishing Co. Ltd, New Delhi 2013
4	P.K. Nag - "Engineering Thermodynamics" Tata McGraw Hill.-2015
5	R.C.Sachdeva- “Fundamentals of Engineering Heat and Mass Transfer (SI Units)” – New Age International Publishers, New Delhi – 2017
REFERENCE BOOKS	
1	R.S.Khurmi, J.K.Gupta - "A textbook of Thermal Engineering"- S.Chand & company Ltd- 2013.
2	Yunus A. Cengel, Michael A.Boles - "Thermodynamics An Engineering approach"- Third Edition- 2012.
3	Y.V.C.Rao - Heat transfer - University press, Hyderabad - 2011.
E BOOKS	
1	http://www.springer.com/in/book/9783319061870
2	http://www.springer.com/in/book/9780278000520
MOOC	
1	https://onlinecourses.nptel.ac.in/noc17_ae04
2	http://nptel.ac.in/courses/101104067/

COURSE TITLE	THEORY OF MACHINES			CREDITS	4
COURSE CODE	ATB4202	COURSE CATEGORY	PC	L-T-P-S	3-1-0-1
CIA	50%			ESE	50%
LEARNING LEVEL	BTL -4				

CO	COURSE OUTCOMES	PO
1	Able to analyses the types of mechanism involved in automobiles	1,2,3,4,6,7,12
2	Able to apply the concept of friction in various drives.	1,2,3,4,6,7,12
3	Able to design and analyze a gear train for automobile application	1,2,3,4,6,7,12
4	Able to evaluate the balancing of reciprocating and rotary masses	1,2,3,4,6,7,12
5	Able to design Cam profile for various applications	1,2,3,4,6,7,12

Prerequisites : Nil

MODULE 1 – MECHANISMS (9L + 3T)

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 for simple mechanisms

MODULE 2 – FRICTION (9L+3T)

Friction in screw and nut – Pivot and collar – Thrust bearing– Belt and rope drives. Ratio of tensions – Effect of centrifugal and initial tension – Condition for maximum power transmission.

MODULE 3 – GEARS (9L+3T)

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

MODULE 4 – BALANCING (9L+3T)

Static and dynamic balancing – Single and several masses in different planes – Balancing of reciprocating and rotary masses - primary balancing and secondary balancing

MODULE 5 – CAM AND CONTROL MECHANISMS (9L+3T)

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.

Governors - Basics of governors and its types - Gyroscopes - Gyroscopic effects in Automobiles

LAB / MINI PROJECT/FIELD WORK

NA

TEXT BOOKS

1	Rattan.S.S, —Theory of Machines‖, Tata McGraw–Hill Publishing Co., New Delhi, 2014.
2	Ballaney.P.L, —Theory of Machines‖, Khanna Publishers, New Delhi, 2012
3	R.S. Khurmi and J.K. Gupta, —Theory of Machines‖, S.Chand&co-2015.

REFERENCE BOOKS	
1	Rao,J.S and Dukkipati, R.V, —Mechanism and Machine Theory‖, Second Edition, Wiley Eastern Ltd., 2012.
2	Malhotra, D.R and Gupta, H.C., —The Theory of Machines‖, SatyaPrakasam, Tech. India Publications.
3	Gosh, A. and Mallick, A.K., —Theory of Machines and Mechanisms‖, Affiliated East West Press.
4	Shigley, J.E. and Uicker, J.J., —Theory of Machines and Mechanisms‖, McGraw-Hill.
5	Burton Paul, —Kinematics and Dynamic of Planer Machinery‖, Prentice Hall.
E BOOKS	
1	https://books.google.co.in/books?id=YI7vAwAAQBAJ&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false
2	https://books.google.co.in/books?id=9418a7eck0YC&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false
3	https://books.google.co.in/books?id=RWWgwVoSBWwC&dq=theory+of+machines&hl=en&sa=X&ved=0ahUKEwjEvvDagdrZAhWMQY8KHSDiAE4Q6wEINDAC
MOOC	
1	https://www.edx.org/course/dynamics-and-control
2	https://www.coursebuffet.com/course/928/edx/dynamics-mit
3	https://www.class-central.com/course/nptel-mechanism-and-robot-kinematics-10104

COURSE TITLE	AUTOMOTIVE ENGINES			CREDITS	4
Course Code	ATB4203	Course Category	PC	L-T-P-S	3-1-0-1
CIA	50 %			ESE	50 %
LEARNING LEVEL	BTL- 3				

CO	COURSE OUTCOMES	PO
1	Acquire the basic knowledge of Automotive Engines constructions and working principles	1,6,7,12
2	Attain the knowledge on air and fuel intake systems	1,6,7,12
3	Obtain the knowledge on combustion in Automotive Engines.	1,6,7,12
4	Acquire the knowledge on cooling and lubrication in Automotive Engines	1,6,7,12
5	Gain the Knowledge on engine testing procedures	1,6,7,12

Prerequisites : Nil

MODULE 1 – INTRODUCTION TO IC ENGINES (9L+3T)

Basic Terminology and Concepts of IC Engines – Classification- Working of Two Stroke and Four Stroke Engine - Construction and Operation of Petrol and Diesel Engines - Otto Cycle - Diesel Cycle – Dual cycle.

MODULE 2 – AIR AND FUEL INTAKE SYSTEM (9L+3T)

Air intake systems –Function- Components – Conventional air induction and Fuel Injection system in diesel engine – Types of injection nozzle- Mechanical and pneumatic governors- Supercharging and

turbocharging -Common Rail Direct Injection (CRDI) -Port Injection – Manifold Injection- Electronic fuel injection-Operation of Carburetor –requirements, working principle, types, Ignition system– Magneto coil and battery coil spark ignition system. Electronic ignition System.

MODULE 3 - COMBUSTION AND COMBUSTION CHAMBERS (9L+3T)

Air Motion- Swirl, Squish and Tumble. Stages of combustion in diesel engine. Delay period – factors affecting delay period. Knock in CI Engines. Factors affecting knocking- controlling knocking. Direct and indirect injection combustion chambers. Air cell chamber - M-Combustion chamber. Combustion in SI engine – Stages of combustion – Flame propagation – Rate of pressure rise – Abnormal combustion – pre ignition and knock in SI engines – effect of engine variables on knock – Combustion chambers for SI engine.

MODULE 4 -COOLING AND LUBRICATION SYSTEMS (9L+3T)

Need for cooling- Types of cooling system – air cooling and Liquid cooled systems. Forced circulation system, pressure cooling system. Thermostat- Anti-freeze solutions – properties of coolant. Need for Lubrication system. Splash, pressure and mist lubrication systems. Wet & Dry sump lubrication, Properties of lubricants–oil filters, oil pumps-crank case ventilation.

MODULE 5 – TESTING AND PERFORMANCE (9L+3T)

Automotive and stationary engine testing and related standards – Variable Load Test- Dynamometers –Types. Engine power and Efficiencies – performance, emission and combustion characteristics. Combustion Study – Pressure measurement – Heat Release Rate Analysis -Variables affecting the characteristics – Nozzle Test – Pump Calibration- Heat Balance – Frictional Power- Measurement Procedures – Methods to improve engine performance - Introduction to Stratified charge engine, LHR engines, Dual Fuel Engines, HCCI Engine.

LAB / MINI PROJECT/FIELD WORK

NA

TEXT BOOKS

1.	Mathur and Sharma. Internal Combustion Engines, Dhanpat Rai and sons publications, 2014
2.	Ganesan.V., Internal Combustion Engines, Tata McGraw Hill Publishing Co., 2017
3.	John B.Heywood Fundamentals of Internal combustion engines, McGraw Hill Publishers, 2017

REFERENCE BOOKS

1.	Heldt.P.M. High Speed Combustion Engines, Oxford IBH Publishing Co., Calcutta, 2011.
2.	Obert E.F., Internal Combustion Engines Analysis and Practice.
3.	Maleev, V.M., Diesel Engine Operation and Maintenance, McGraw Hill, 2010.
4.	Heinz Heitzler Advanced engine tech- McGraw Hill, 2012
5.	William.H.Crouse, Automotive Engines, McGraw Hill Publishers, 2014

E BOOKS

1.	https://myxfpzg.files.wordpress.com/2015/08/robert-bosch-automotive-electronics-handbook-pdf.pdf
2.	http://opac.vimaru.edu.vn/edata/EBook/NH2014/CSDL_CS2014_2/HH0074.pdf

MOOC

1.	http://nptel.ac.in/downloads/112104033/
2.	https://ocw.mit.edu/courses/mechanical-engineering/2-61-internal-combustion-engines-spring-2008/

COURSE TITLE	PROFESSIONAL ETHICS AND LIFE SKILLS			CREDITS	2
COURSE CODE	GEA4216	COURSE CATEGORY	BS	L-T-P-S	2-0-0-1
CIA	50%			ESE	50%
LEARNING LEVEL	BTL - 3				

CO	COURSE OUTCOMES	PO
1	An understanding of business ethics, levels, myths, use and train oneself to be ethical.	6,8,12
2	Knowledge on Ethical principles, reasoning, roles & responsibilities.	6,8,12
3	An understanding of stake holder theory, Individual and corporate responsibilities towards stake holders.	6,8,12
4	Understanding on Corporate responsibilities towards Product Safety & Reliability and environment friendly approach.	6,8,12
5	Understanding between the Employee & Corporate on responsibilities on aspects of contracts, equal opportunity , Affirmative action, sexual harassment etc.,	6,8,12

Prerequisites : An open mind to understand ethical practices

MODULE 1 - HUMAN VALUES (6L)

Definition of ethics-Morals values and ethics – integrity-Work ethics- Service learning-Civic virtue-Respect for others-Caring-Sharing-Honesty-Courage-Valuing time-Cooperation-Commitment-Empathy-Self-confidence-Character-Spirituality-Introduction to Yoga and meditation for professional excellence and stress management.

Suggested Reading: Case study of Discovery failure

MODULE 2 - ENGINEERING ETHICS (6L)

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories.

Suggested Reading: Study the Bhopal gas tragedy

MODULE 3- SAFETY, RESPONSIBILITIES AND RIGHTS (6L)

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.

Suggested Reading: Chernobyl explosion, Nuclear and thermal power plant issues

MODULE 4 - LIFE SKILLS (6L)

Definition, Relevance, Types of values, changing concepts of values-aims and values of value education- basic etiquette-morals and values in life-dealing with people. Personal values – Self – Strengths (self-confidence, self-assessment, self-reliance, self-discipline, determination, self-restraint, contentment, humility, sympathy and compassion, gratitude, forgiveness) Weaknesses

Suggested Reading: Influences - Peer pressure, familial and societal expectations, media

MODULE 5 - SOCIETIES IN PROGRESS (6L)	
Definition of society; Units of society; Communities – ancient and modern – Agents of change – Sense of survival, security, desire for comfort and ease sense of belonging, social consciousness and responsibility **Suggested Reading**: Personal value and professional value of Engineers on societies perception	
LAB / MINI PROJECT / FIELD WORK	
NA	
TEXT BOOKS	
1	Subramanian R., Professional ethics, Oxford University press
REFERENCE BOOKS	
1	Megan J. Murphy (Editor), Lorna Hecker (Editor), Ethics and Professional Issues in Couple and Family Therapy
2	Andrew Belsey (Editor), Ruth Chadwick (Editor), Ethical Issues in Journalism and the Media (Professional Ethics)
3	Warwick Fox (Editor), Ethics and the Built Environment (Professional Ethics)
4	RuchikaNath, Value Education, APH Publishing Corporation, New Delhi, 2012
5	Manoharan P.K., Education and Personality Development, APH Publishing Corporation, New Delhi, 2012
E BOOKS	
1	https://www.bkconnection.com/static/Business_Ethics_EXCERPT.pdf
2	https://bookboon.com/en/business-ethics-ebook
MOOC	
1	https://www.mooc-list.com/course/global-impact-business-ethics-coursera

COURSE TITLE	AUTOMOTIVE ENGINE COMPONENTS LABORATORY			CREDITS	1
COURSE CODE	ATB4231	COURSE CATEGORY	PC	L-T-P-S	0-0-2-0
CIA	80%			ESE	20%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	Dismantle, Study and Reassemble the engine components	1,9,12
2	Identify various Engine components and its sub systems	1,9,12

Prerequisites : Nil

LIST OF EXPERIMENTS

1. Dismantling, Study and Assembling of Single cylinder and Multi Cylinder SI Engine
2. Dismantling, Study and Assembling of Single cylinder and Multi Cylinder C I Engine
3. Study of oil filter, fuel filter, fuel injection system and carburetor
4. Study of MPFI and CRDI Systems
5. Study of Ignition Systems – Battery coil, Magneto and Electronic
6. Study of engine cooling system components
7. Study of engine lubrication system components

LIST OF EQUIPMENT

1. Single cylinder and Multi Cylinder SI Engine
2. Single cylinder and Multi Cylinder CI Engine
3. Oil filter, Fuel filter, Fuel Injection System(Inline and Rotary) , carburetor
4. MPFI and CRDI Systems
5. Ignition Systems – Battery coil, Magneto and Electronic
6. Engine cooling system components
7. Engine lubrication system components

COURSE TITLE	FUELS AND ENGINE TESTING LABORATORY			CREDITS	1
COURSE CODE	ATB4232	COURSE CATEGORY	PC	L-T-P-S	0-0-2-0
CIA	80%			ESE	20%
LEARNING LEVEL	BTL-2				

CO	COURSE OUTCOMES	PO
1	Able to analyze the engine performance characteristics	1,2,5,6,7,12
2	Able characterize the automotive fuels and lubricants	1,2,5,6,7,12

Prerequisites : Nil

LIST OF EXPERIMENTS

1. Port timing and Valve timing Diagram
2. Performance test on SI Engine
3. Performance test on C I Engine
4. Heat Balance test on Multi Cylinder C I Engine
5. Morse test on Multi Cylinder SI Engine
6. Performance test on vehicle using Two Wheeler Chassis Dynamometer
7. Fuel Viscosity Measurement using Redwood Viscometer and Say bolt Viscometer
8. Flash, Fire and Pour Point Measurement of a fuel .
9. ASTM distillation test
10. Study of Bomb Calorimeter
11. Drop point of grease
12. Mechanical penetration test of grease

LIST OF EQUIPMENT

1. Two Stroke Engine and Four Stroke Engine Cut Model
2. Two Wheeler Chassis Dynamometer
3. Single cylinder SI engine Test Rig
4. Multi Cylinder SI engine Test Rig
5. Single cylinder C I engine Test Rig
6. Multi Cylinder C I engine Test Rig
7. Redwood Viscometer
8. Say bolt Viscometer
9. ASTM distillation test apparatus
10. Bomb Calorimeter
11. Flash and fire point apparatus
12. Drop point of grease testing apparatus
13. Mechanical penetration test of grease apparatus

SEMESTER IV

COURSE TITLE	PROBABILITY AND STATISTICS (Department of IT, Auto, Mechanical, Civil)			CREDITS	4
COURSE CODE	MAA4216	COURSE CATEGORY	BS	L-T-P-S	3-1-0-0
CIA	50%			ESE	50%
LEARNING LEVEL	BTL:1 - 4				

CO	COURSE OUTCOMES	PO
1.	Able to understand the concept of Probability and one dimensional random variable	1,2,3,4,5,12
2.	To improve the ability to understand the importance of discrete and continuous distributions	1,2,3,4,5,12
3.	To explore the random experiments specified by two dimensional random variables	1,2,3,4,5,12
4.	Perform test of hypothesis as well as calculate confidence interval for the population parameter.	1,2,3,4,5,12
5.	Proficient to obtain knowledge on design of experiments	1,2,3,4,5,12

Prerequisites : Nil

MODULE 1: PROBABILITY AND RANDOM VARIABLES (9L+3T)

Axioms of Probability- Bayes' Theorem -Random variables – Moments – Moment generating functions.

Suggested Reading: Basic Probability

MODULE 2: STANDARD DISTRIBUTIONS (9L+3T)

Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions

Suggested Reading: Discrete and Continuous Functions

MODULE 3: TWO-DIMENSIONAL RANDOM VARIABLES (9L+3T)

Joint distribution – Marginal and conditional distribution – Co-variance – Correlation and Regression

Suggested Reading: Random Variables

MODULE 4: TESTING OF HYPOTHESIS (9L+3T)

Sampling distributions – Testing of Hypothesis – Small samples – t Test, F Test and Chi-square Test – Large samples – Single mean – Difference in means – single proportion and difference in proportions.

Suggested Reading: Sampling Problems

MODULE 5: DESIGN OF EXPERIMENTS (9L+3T)

Analysis of variance – One Way Classification – Completely Randomized block design – Two Way Classification – Randomized block design – Latin Square design

Suggested Reading: Analysis of variance

LAB/MINI PROJECT/FIELD WORK	
Theory only	
TEXT BOOKS	
1	Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics",Tata McGraw Hill, 4th Edition, 2007.
2	Johnson. R.A. and Gupta. C.B., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 7th Edition, 2007
3	A. Chandrasekaran, G. Kavitha, "Probability, Statistics, Random Processes and Queuing Theory", Dhanam Publications, 2014
4	Raj Kumar Bansal,Ashok Kumar Goel, Manoj Kumar Sharma, "MATLAB and its Applications in Engineering", Pearson Publication, Second Edition, 2016.
REFERENCE BOOKS	
1.	Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum's Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill Edition, 2004 .
2.	Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2012.
3.	Dean G. Duffy., "Advanced Engineering Mathematics with MATLAB", CRC Press, Third Edition 2013.
E BOOKS	
1.	http.// nptel.ac.in/courses/IIT-MADRAS/Principles_of_Communication1/Pdfs/1_5.pdf https://www.khanacademy.org
MOOC	
1	https://www.edx.org/course/introduction-probability-science-mitx-6-041x-2

COURSE TITLE	SOLID MECHANICS			CREDITS	4
COURSE CODE	ATB4216	COURSE CATEGORY	PC	L-T-P-S	3-1-0-1
CIA	50%			ESE	50%
LEARNING LEVEL	BTL 3				

CO	COURSE OUTCOMES	PO
1	Acquire the knowledge on basics of Solid Mechanics	1,2,4,12
2	Attain the Knowledge of stress acting on the beams	1,2,4,12
3	Gain the knowledge of deflection of beams	1,2,4,12
4	Obtain the acquaintance in loading on Shaft, springs, columns	1,2,4,12
5	Develop the basic understanding of Biaxial Stresses	1,2,4,12

Prerequisites : Nil

MODULE 1- INTRODUCTION TO SOLID MECHANICS (9L + 3T)

Definition of stress, strain and their relations – Relations between material constants – Axial loading - Statically determinate and indeterminate problems in tension & compression – Plane truss analysis – method of joints – method of sections – 3-D trusses – Thermal stresses –Impact loading.

MODULE 2 - STRESS IN BEAMS (9L+3T)

Shear force & bending moment diagrams: Bending and shear stress variation in beams of Symmetric sections, a typical spar section: Beams of uniform strength - beams of two materials.

MODULE 3- DEFLECTION OF BEAMS (9L+3T)

Double integration method – Macaulay's method – moment area method – conjugate beam Method – principle of superposition – Maxwell's reciprocal theorem.

MODULE 4- TORSION – SPRINGS- COLUMNS (9L+3T)

Torsion of solid and hollow circular shafts – shear stress variation – open and closed-coiled helical springs – stresses in helical springs – classification of columns – Euler buckling –columns with different end conditions.

MODULE 5- BIAXIAL STRESSES (9L+3T)

Stresses in thin-walled pressure vessels – combined loading of circular shaft with bending, torsion and axial loadings – Mohr's circle and its construction – determination of principal stresses.

LAB / MINI PROJECT/FIELD WORK

NA

TEXT BOOKS	
1	Popov E.P, "Engineering Mechanics of Solids", Prentice-Hall of India, New Delhi 2014.
2	R S Khurmi Strength of Materials, KHANNA Publications New-Delhi 2014.
REFERENCE BOOKS	
1	Nash W.A, Theory and problems in Strength of Materials, Schaum Outline Series, McGraw-Hill Book Co, New York, 2012
2	Kazimi S.M.A, Solid Mechanics, Tata McGraw-Hill Publishing Co, New Delhi, 2011
3	Ryder G.H, Strength of Materials, Macmillan India Ltd., Third Edition, 2012
4	Ray Hulse, Keith Sherwin & Jack Cain, Solid Mechanics, Palgrave ANE Books, 2014.
5	Singh D.K, Mechanics of Solids" Pearson Education 2012.
E BOOKS	
1	https://books.google.co.in/books?id=QV3qBwAAQBAJ&pg=PA193&lpg=PA193&dq=mohr%27s+circles+simulation&source=bl&ots=KX1uJDqIVX&sig=WvLFnPPiTRfq8Sv463CExdkMO7g&hl=en&sa=X&ved=0ahUKEwi-k7rjhd_ZAhXLMo8KHW-ICdEQ6AEIczAI#v=onepage&q=mohr's%20circles%20simulation&f=false
2	https://books.google.co.in/books?id=2IHEqp8dNWwC&printsec=frontcover&dq=strength+of+materials&hl=en&sa=X&ved=0ahUKEwiSstLJiN_ZAhVBRY8KHY2iCVgQ6wEIJzAA#v=onepage&q=strength%20of%20materials&f=false
3	https://books.google.co.in/books?id=UUAi8JrJqDIC&printsec=frontcover&dq=strength+of+materials&hl=en&sa=X&ved=0ahUKEwiSstLJiN_ZAhVBRY8KHY2iCVgQ6wEIMzAC#v=onepage&q=strength%20of%20materials&f=false
MOOC	
1	https://www.mooc-list.com/course/mechanics-materials-i-fundamentals-stress-strain-and-axial-loading-coursera
2	https://ocw.mit.edu/courses/mechanical-engineering/2-001-mechanics-materials-i-fall-2006/

COURSE TITLE	FLUID MECHANICS AND MACHINERY			CREDITS	4
COURSE CODE	ATB4217	COURSE CATEGORY	PC	L-T-P-S	3-1-0-1
CIA	50 %			ESE	50 %
LEARNING LEVEL	BTL 4				

CO	COURSE OUTCOMES	PO
1	Apply the fundamental concepts in the design of flow measuring devices	1,2,3,4,5,6,7,12
2	Apply the governing equation in flow through conduits	1,2,3,4,5,6,7,12
3	Analyze incompressible fluid flow through pipes	1,2,3,4,5,6,7,12
4	Demonstrate and analyze the performance of hydraulic turbines	1,2,3,4,5,6,7,12
5	Describe and analyze the performance of hydraulic pumps	1,2,3,4,5,6,7,12

Prerequisites : Nil

MODULE 1 – FUNDAMENTALS OF FLUID MECHANICS (9L + 3T)

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

MODULE 2 – FLUID KINEMATICS AND FLUID DYNAMICS (9L + 3T)

Fluid Kinematics – Flow visualization – Lines of flow – types of flow – velocity field and acceleration– continuity equation (one and three dimensional forms) Equation of stream line - stream function - velocity potential function – flow net.

Fluid dynamics – equation of motion – Euler's equation along streamline – Bernoulli's equation – applications - Venturimeter, Orificemeter, Pitot tube

MODULE 3 - INCOMPRESSIBLE FLUID FLOW (9L + 3T)

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)-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.

MODULE 4 - HYDRAULIC TURBINES (9L + 3T)

Dimensional analysis - Buckingham's theorem- applications - similarity laws and models.

Turbines: Definition and classifications - Pelton turbine - Francis turbine - propeller turbine - Kaplan turbine - working principles - velocity triangles - workdone - specific speed efficiencies - performance curve for turbines.

MODULE 5 – HYDRAULIC PUMPS (9L + 3T)

Pumps: definition and classifications - Centrifugal pump: classifications, working principles, velocity triangles, specific speed, efficiency and performance curves.

Reciprocating pump: classification, working principles, indicator diagram, work saved by air vessels - performance curves.

Rotary pumps: working principles of gear and vane pumps.

LAB / MINI PROJECT/FIELD WORK	
NA	
TEXT BOOKS	
1	Bansal, R.K., "Fluid Mechanics and Hydraulics Machines", (5th edition), Laxmi publications (P) Ltd., New Delhi, 2014.
2	Vasandani, V.P., "Hydraulic Machines - Theory and Design", Khanna Publishers, 2014.
3	Ramamirtham, S., "Fluid Mechanics and Hydraulics and Fluid Machines", DhanpaRai and Sons, Delhi, 2012.
REFERENCE BOOKS	
1	White, F.M., "Fluid Mechanics", Tata McGraw-Hill, 5th Edition, New Delhi, 2013.
2	Som, S.K., and Biswas, G., "Introduction to fluid mechanics and fluid machines", Tata McGraw-Hill, 2nd edition, 2014.
3	Streeter, V.L., and Wylie, E.B., "Fluid Mechanics", McGraw-Hill, 2013.
4	Kumar, K.L., "Engineering Fluid Mechanics", Eurasia Publishing House (P) Ltd., New Delhi (7th edition), 2014.
E BOOKS	
1	https://drive.google.com/open?id=0B9bpsTYXP4ceMklKTlRMSUlPakE
2	https://drive.google.com/open?id=0B-IbNSAhk4D2dFh4NmZySXJCSGs
3	https://drive.google.com/open?id=0B0-N9SbCFhV8UXhDNmN5R19BT28
MOOC	
1	http://nptel.ac.in/courses/112104118
2	http://nptel.ac.in/courses/112104117
3	http://nptel.ac.in/courses/112105183
4	http://nptel.ac.in/courses/112105218
5	http://nptel.ac.in/courses/105103095

COURSE TITLE	AUTOMOTIVE CHASSIS			CREDITS	3
COURSE CODE	ATB4218	COURSE CATEGORY	PC	L-T-P-S	3-0-0-1
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-2				

CO	COURSE OUTCOMES	PO
1	Acquire the knowledge of different types of chassis.	1,3,4,6,12
2	Attain the concept of various front axles and steering systems	1,3,4,6,12
3	Gain the knowledge of various Drive line systems	1,3,4,6,12
4	Obtain the knowledge in Suspension system	1,3,4,6,12
5	Develop the basic knowledge of Braking systems	1,3,4,6,12

Prerequisites : Nil

MODULE 1 - INTRODUCTION (9L)

Types of chassis layout with reference to power plant locations and drives, vehicle frames, various types of frames, monocoque structure, constructional details, materials, testing of vehicle frames, auto body styles.

Suggested Reading: Study of Isuzu passenger vehicle

MODULE 2 - FRONT AXLE AND STEERING SYSTEM (9L)

Types of front axles, construction details, materials, front wheel geometry: castor, camber, king pin inclination, toe-in. conditions for true rolling motion of wheels during steering, steering geometry, Ackermann steering system, constructional details of steering linkages, different types of steering gear boxes, steering linkages and layouts, turning radius, wheel wobble, power assisted steering, steering of crawler tractors and Electronic Steering System.

Suggested Reading: Study of steering system in a sports vehicle

MODULE 3 - DRIVE LINE (9L)

Effect of driving thrust and torque reactions, Hotchkiss drive, torque tube drive and radius rods, propeller shaft, universal joints, front wheel drive, different types of final drive, double reduction and twin speed final drives, differential principle, construction details of differential unit, non-slip differential, differential locks, differential housings, construction of rear axles, types of loads acting on rear axles, fully floating, three quarter floating and semi floating rear axles, rear axle housing, construction of different types of axle housings, multi axle vehicles, wheels and tyres.

Suggested Reading: Study differential system in Toyota car

MODULE 4 - SUSPENSION SYSTEM (9L)

Need of suspension system, types of suspension, suspension springs, constructional details and characteristics of leaf, coil and torsion bar springs, rubber suspension, pneumatic suspension, shock absorbers, independent suspension, semi-active and active suspension system.

Suggested Reading: Suspension system in Ashok Leyland Goods vehicle

MODULE 5- BRAKING SYSTEM (9L)

Classification of brakes, drum brakes and disc brakes, constructional details, theory of braking, concept of dual brake system, parking brake, material, hydraulic system, vacuum assisted system, air

brake system, antilock braking system, retarded engine brakes, eddy retarders and electronic braking system. **Suggested Reading:** Braking system in JCB loader	
TEXT BOOKS	
1	James D. Halderman , 'Automotive Chassis Systems', Pearson Series, 2017.
2	Kirpal Singh - "Automobile Engineering, Vol.1 "- Standard Publishers Distributors , New Delhi - 2013
3	NK. Giri – Automobile Engineering - Khanna Publishers – 2015
REFERENCE BOOKS	
1	Newton, Steeds and Garrotte- "The Motor Vehicles"- Butterworths, London- 2000.
2	Jornsen Reimpell , Helmut Stoll and Jurgen Betzler , " The Automotive Chassis: Engineering Principles", 2001.
3	Tim Gilles, " Automotive Chassis", CENGAGE Delmar Learning, 2004.
E BOOKS	
1	www.engineering108.com/.../Automobile.../Automotive-chassis-ebooks-free-downloa...
2	https://www.booktopia.com.au/the-automotive-chassis.../prod9780080527734.htm
3	https://www.takealot.com/the-automotive-chassis-ebook/PLID37930702
MOOC	
1	https://www.edx.org/course/subject/engineering
2	https://www.class-central.com/tag/automotive%20industry
3	https://nptel.ac.in/courses/107106080/

COURSE TITLE	FLUID MECHANICS AND MACHINERY LABORATORY			CREDITS	1
COURSE CODE	ATB4241	COURSE CATEGORY	PC	L-T-P-S	0-0-2-0
CIA	80%			ESE	20%
LEARNING LEVEL	BTL – 4				

CO	COURSE OUTCOMES	PO
1	Apply the laws of fluid mechanics and measure parameters of fluid flow.	1,2,3,4,5,6,7,12
2	Analyze the performance of Hydraulic turbines and pumps	1,2,3,4,5,6,7,12
3	Evaluate performance of Impinging jet on vanes	1,2,3,4,5,6,7,12

Prerequisites : Nil

LIST OF EXPERIMENTS

1. Determination of coefficient of discharge of given Orifice meter.
2. Determination of coefficient of discharge of given Venturimeter.
3. Determination of friction factor of given set of pipes.
4. Performance study of Centrifugal pumps
5. Performance study of reciprocating pumps.
6. Performance study of Gear pump.
7. Performance characteristics of a Pelton wheel.
8. Performance test on a Francis Turbine.
9. Performance test on a Kaplan Turbine.

LIST OF EQUIPMENT

1. Orifice meter setup
2. Venturi meter setup
3. Pipe Flow analysis setup
4. Centrifugal pump setup
5. Reciprocating pump setup
6. Gear pump setup
7. Pelton wheel setup
8. Francis turbine setup
9. Kaplan turbine setup

COURSE TITLE	AUTOMOTIVE CHASSIS LABORATORY			CREDITS	1
COURSE CODE	ATB4242	COURSE CATEGORY	PC	L-T-P-S	0-0-2-0
CIA	80%			ESE	20%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	The students should be able to dismantle, Study and Reassemble the Chassis components and its sub systems.	1,3,4,6,12
2	The students should be expertise in conducting the various performance tests in two and three wheeler systems.	1,3,4,6,12

LIST OF EXPERIMENTS

1. Study and measurement of the chassis frames: Heavy duty vehicle & Light duty vehicle
2. Dismantle, study and assemble of Front Axle, Rear Axle and Differential
3. Dismantle study and assemble of various Steering systems.
4. Dismantle, study and assemble of various Braking systems – including ABS
5. Dismantle, study and assembling of dependent and independent suspension systems
6. Dismantle, study and assembling of various clutch assemblies
7. Dismantle, study and assembling of various gear boxes and transfer case
8. Dismantle, study and assembling of various joints and propeller shafts.
9. Road performance test of a two wheeler using chassis dynamometer.
10. Performance test of a shock absorber and coil spring.
11. Two wheeler chain tension test, brake and clutch adjustment as per specification.
12. Dismantling and assembling of two & three wheeler gear boxes and finding gear ratios.
13. Dismantling and assembling of three wheeler steering system.
14. Study of three wheeler chassis frame and power transmission system.

LIST OF EQUIPMENT

The List of Equipment - Each 1 No (For a Batch of 30 Students)

1. Heavy duty vehicle chassis frame (Leyland, Tata etc)
2. Light duty vehicle chassis frame (VW, Ford, Lexus, Hyundai etc.)
3. Front axle and Rear axle
4. Steering system
5. Steering gear box (Rack and pinion, re-circulating ball type)
6. Hydraulic brake, Air brake system and ABS (Trainer Kit)
7. Leaf spring, coil spring, torsion bar and Hydraulic shock absorber
8. Clutch – Single Plate, Multi plate, Centrifugal and Semi Centrifugal
9. Gear box (light duty, heavy duty)
10. Transfer case
11. UV joint , CV Joint ,Slip joint and propeller shaft
12. Two wheeler chassis dynamometer
13. Shock absorber test rig.
14. Two & three wheeler gearbox
15. Two-wheeler clutch
16. Three-wheeler brake assembly
17. Three-wheeler steering assembly

COURSE TITLE	MATERIAL TESTING AND CHARACTERIZATION LABORATORY			CREDITS	1
Course Code	ATB4243	Course Category	PC	L-T-P-S	0-0-2-0
CIA	80%			ESE	20%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	The students should acquire the knowledge on mechanical properties and testing procedure of engineering materials	1,6,7,12

Prerequisites : Nil

LIST OF EXPERIMENTS

1. Tension test on a mild steel rod
2. Double shear test on Mild steel and Aluminium rods
3. Torsion test on mild steel rod
4. Impact test on metal specimen
5. Hardness test on metals - Brinell and Rockwell Hardness Number
6. Deflection test on beams
7. Compression test on helical springs
8. Strain Measurement using Rosette strain gauge
9. Effect of hardening- Improvement in hardness and impact resistance of steels
10. Tempering- Improvement Mechanical properties Comparison
    (i) Unhardened specimen
    (ii) Quenched Specimen and
    (iii) Quenched and tempered specimen.
11. Microscopic Examination of
    i. Hardened samples and
    ii. Hardened and tempered samples.

LIST OF EQUIPMENT

1. Universal Tensile Testing machine with double shear attachment - 40 Ton Capacity
2. Torsion Testing Machine (60 NM Capacity)
3. Impact Testing Machine (300 J Capacity)
4. Brinell Hardness Testing Machine
5. Rockwell Hardness Testing Machine
6. Spring Testing Machine for tensile and compressive loads (2500 N)
7. Metallurgical Microscopes
8. Muffle Furnace (800^{o}C)

SEMESTER V

COURSE TITLE	OPTIMIZATION TECHNIQUES (Except CSE and Mechatronics)			CREDITS	4
COURSE CODE	MAA4301	COURSE CATEGORY	BS	L-T-P-S	3-1-0-0
CIA	50%			ESE	50%
LEARNING LEVEL	BTL :1- 4				

CO	COURSE OUTCOMES	PO
1.	Able to formulate engineering problems as mathematical optimization problems.	1,2,3,4,5,12
2.	Skilled to apply the concept of linear and nonlinear programming problem to the engineering problem	1,2,3,4,5,12
3.	Competent to apply the concept of integer programming problem to the engineering problem	1,2,3,4,5,12
4.	Proficient to recognize the solution for assignment problem and transportation problem for optimal solution.	1,2,3,4,5,12
5.	Able to understand the designs of networks	1,2,3,4,5,12

Prerequisites : Nil

MODULE 1: INTRODUCTION TO OPTIMIZATION (9L+3T)

Introduction to operations research – objective – scope of OR – Limitations of OR – Introduction and formulation of linear programming – Solving LPP using Graphical method.

Suggested Reading: Basics of inequalities

MODULE 2: LINEAR PROGRAMMMING PROBLEM (9L+3T)

Solving LPP using simplex method – Big-M method – Two phase method – conversion of primal to dual.

Suggested Reading: System of equations

MODULE 3: INTEGER PROGRAMMING (9L+3T)

Integer programming – Cutting plane method – Gomory's Mixed integer method – Branch and Bound method

Suggested Reading: System of equations

MODULE 4: ASSIGNMENT AND TRANSPORTATION PROBLEM (9L+3T)

Hungarian Method – Maximization and unbalanced assignment problem – Basic feasible solution of transportation problem – Modi method – Degeneracy – Unbalanced Transportation problem.

Suggested Reading: Arithmetic Calculation

MODULE 5: PERT AND CPM (9L+3T)

Network diagram – Representation – Labeling – CPM – PERT probabilities of CPM – PERT probabilities of project duration.

Suggested Reading: Basics of graphs

TEXT BOOKS	
1	Chandrasekaran A, "A Text book of Operation Research", Dhanam Publications, Chennai, 2017
2	V. Sundaresan, K. S. Ganapathy Subramanian, K. Ganesan, "Resource Management Techniques", A. R. Publications, 2004
3	S. D. Sharma, "Operation Research", Kedarnath Ramnath & Co, 2002
REFERENCE BOOKS	
1	Hamdy A. Taha, "Operations Research: An Introduction (9th Edition)", Prentice Hall, 2010
2	D S Hira & Prem Kumar Gupta**, "**Introduction to Operations Research**",** S. Chand Publishing, 2012
E BOOKS	
1	http://nptel.ac.in/courses/112106134/1
2	https://onlinecourses.nptel.ac.in/noc17_mg10/preview
MOOC	
1.	https://www.edx.org/course/operations-management-iimbx-om101-1x

COURSE TITLE	AUTOMOTIVE TRANSMISSION			CREDITS	3
COURSE CODE	ATB4301	COURSE CATEGORY	PC	L-T-P-S	3-0-0-1
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	Familiarize the various types of Clutch and Gear Box.	1,2,3,4,6,12
2	Acquire the knowledge on Fluid Coupling & Torque Convertor.	1,2,3,4,6,12
3	Develop the knowledge on various planetary gear systems and overdrives	1,2,3,4,6,12
4	Gain knowledge on hydrostatic drive and electric drives.	1,2,3,4,6,12
5	Gain the information about modern automatic transmissions	1,2,3,4,6,12

Prerequisites : Nil

MODULE 1 - CLUTCH and GEAR BOX (9L)

Clutch: Principle, construction and working principle of single plate, multi plate, centrifugal, semi centrifugal clutches, Applications and Limitations, Clutch Materials.

Gear Box: Principle, construction and working principle of sliding mesh, constant mesh, synchromesh gear boxes, Applications and Limitations, Gear, performance characteristics Lubrication.

Suggested Reading: Automated Manual Transmission

MODULE 2 - HYDRODYNAMIC DRIVE (9L)

Fluid coupling: advantages and limitations, construction details, torque capacity, slip in fluid coupling, performance characteristics. Means used to reduce drag torque in fluid coupling.

Principal of torque conversion, single, multi stage and poly-phase torque converters, performance characteristics, constructional and operational details of typical hydraulic transmission drives.

Suggested Reading: Hydraulic torque converter

MODULE 3 - AUTOMOTIVE TRANSMISSION (9L)	
All spur and internal gear type planetary gearboxes, Ford T-model, Cotal and Wilson Gear box, determination of gear ratios, automatic overdrives. **Suggested Reading:** Smaller dual-clutch transmissions	
MODULE 4 - HYDROSTATIC DRIVE AND ELECTRIC DRIVE (9L)	
Hydrostatic drives: advantages and disadvantages, principles of hydrostatic drive systems, construction and working of typical hydrostatic drives, Janney Hydrostatic drive. Electrical drives: advantages and limitations, principles of Ward Leonard system of control Modern electric drive for buses and performance characteristics. **Suggested Reading:** Electric motor drives	
MODULE 5 - AUTOMATIC TRANSMISSION APPLICATIONS (9L)	
Automatic transmission: relative merits and demerits when compared to conventional transmission, automatic control of gears, study of typical automatic transmissions, Ford and Chevrolet drive, automatic control of gear box, Electronically Controlled Transmission and CVT. Case study for the Transmission of Nissan, Mercedes Benz, Toyota. **Suggested Reading:** Mercedes Benz transmission	
TEXT BOOKS	
1	N.K.Giri Automobile Engineering ,Khanna Publishers 2014
2	Newton and Steeds - Motor Vehicle- Illiffee Publisher- 2010
REFERENCE BOOKS	
1	Design Practices, passenger Car Automotive Transmissions- SAE Hand book- 2014.
2	kirpal Singh , Automobile Engineering, Standard Publisher and distributors
E BOOKS	
1	Harald Naunheimer, Bernd Bertsche, Joachim Automotive Transmissions – Fundamentals, Springer, second edition.2014
MOOC	
1	https://www.youtube.com/watch?v=u_y1S8C0Hmc
2	https://www.youtube.com/watch?v=QPaUJfA1KsY

COURSE TITLE	AUTOMOTIVE ENGINE COMPONENTS DESIGN			CREDITS	4
COURSE CODE	ATB4302	COURSE CATEGORY	PC	L-T-P-S	3-0-2-1
CIA	60%			ESE	40%
LEARNING LEVEL	BTL-4				

CO	COURSE OUTCOMES	PO
1.	Familiarize on various types of materials and their properties.	1,6,12
2.	Acquire knowledge on geometrical dimensioning.	1,2,3,4,7,12
3.	Develop the knowledge on design procedure of cylinder and piston	1,2,3,4,12
4.	Develop the knowledge on design procedure of connecting rod**,** crankshaft	1,2,3,4,12
5.	Develop the knowledge on design procedure of valves and flywheel	1,2,3,4,12

Prerequisites : Nil

MODULE 1 – INTRODUCTION (15)

Engineering materials and their physical properties applied to design, selection of materials, factor of safety, endurance limit, notch sensitivity, principles of design optimization, future trends, computer aided drafting.

MODULE 2 – LIMITS, FITS, TOLERANCES, SURFACE FINISH, SHAFTS AND SPRINGS (15)

Definitions, types of tolerances and fits, design considerations for interference fits, surface finish, surface roughness, design of power transmission shafts, design of helical springs.

Simulation Module:

1. Transmission shaft model to be simulated at various loads and rotation speed.
2. Spring load to be studied in both tension and compression with various loads.

MODULE 3 – DESIGN OF CYLINDER AND PISTON (15)

Choice of material for cylinder and piston, piston friction, piston slap, design of cylinder, piston, piston pin, piston rings, piston failures, lubrication of piston assembly.

Simulation Module:

Combine Piston, piston pin, piston rings and Cylinder model to simulate the Stress and Thermal behavior over its surface.

MODULE 4 – DESIGN OF CONNECTING ROD, CRANKSHAFT (15)

Material for connecting rod, determining minimum length of connecting rod, small end and big end design, shank design, design of big end cap bolts, connecting rod failures, balancing of I.C. Engines, significance of firing order, material for crankshaft, design of crankshaft under bending and twisting, balancing weight calculations.

Simulation Module:

1. Buckling analysis of connecting rod to be simulated.
2. Bending stress and twisting moment of the crankshaft and balancing weight to be simulated.

MODULE 5 – DESIGN OF VALVES AND FLYWHEEL (15)

Design aspects of intake and exhaust manifolds, inlet and Exhaust valves, valve springs, tappets, valve train. Materials and design of flywheel.

Simulation Module:

1. Structural and thermal analysis of Inlet and Exhaust valves to be simulated. 2. Modeling of the flywheel.	
LAB / MINI PROJECT/FIELD WORK	
Simulation Practices	
TEXT BOOKS	
1	R.K. Jain, "Machine Design", Khanna Publishers, New Delhi, 2012.
2	"Design Data Book", PSG College of Technology, Coimbatore, 2015.
3	P.M.Heldt "High Speed Combustion Engines", Oxford-IBH Publishing Co., Calcutta, 2011.
REFERENCE BOOKS	
1	A.Kolchin and V.Demidov, "Design of Automotive Engines", MIR Publishers, Moscow, 2014.
2	Sundararaja Murthy T.V "Machine Design", Khanna Publishers, New Delhi, 2011.
3	R.S.Khurmi, Machine design.2015
E BOOKS	
1	http://ebooks.asmedigitalcollection.asme.org/book.aspx?bookid=277
2	http://160592857366.free.fr/joe/ebooks/Mechanical%20Engineering%20Books%20Collection/MACHINE%20DESIGN/Standard%20Handbook%20of%20Machine%20Design.pdf
MOOC	
1	https://www.mooc-list.com/tags/machine-design

COURSE TITLE	**AUTOMOTIVE ELECTRICAL AND ELECTRONICS**			**CREDITS**	**3**
COURSE CODE	**ATB4303**	**COURSE CATEGORY**	**PC**	**L-T-P-S**	**3-0-0-1**
CIA	**50%**			**ESE**	**50%**
LEARNING LEVEL	**BTL-3**				

CO	**COURSE OUTCOMES**	**PO**
1	Familiarize with lead acid battery and accessories.	1,6,12
2	Acquire the knowledge of starting system.	1,12
3	Develop the knowledge on charging system.	1,12
4	Gain knowledge on automotive electronics.	1,12
5	Gain the information about sensors and activators.	1,12

Prerequisites : Basic electrical and electronics knowledge

MODULE 1 - BATTERIES AND ACCESSORIES (9L)

Principle and construction of lead acid battery, characteristics of battery, rating capacity and efficiency of batteries, various tests on batteries, maintenance and charging. Lighting system: insulated and earth return system, details of head light and side light, LED lighting system, headlight dazzling and preventive methods - Horn, wiper system and trafficator.

MODULE 2 - STARTING SYSTEM (9L)

Condition at starting, behavior of starter during starting, series motor and its characteristics, principle and construction of starter motor, working of different starter drive units, care and maintenances of starter motor, starter switches.
MODULE 3 - CHARGING SYSTEM (9L)
Generation of direct current, shunt generator characteristics, armature reaction, third brush regulation, cutout, Voltage and current regulators, compensated voltage regulator, alternators principle and constructional aspects and bridge rectifiers, new developments.
MODULE 4 - FUNDAMENTALS OF AUTOMOTIVE ELECTRONICS (9L)
Current trends in automotive electronic engine management system, electromagnetic interference suppression, electromagnetic compatibility, electronic dashboard instruments, onboard diagnostic system, security and warning system.
MODULE 5 - SENSORS AND ACTUATORS (9L)
Types of sensors: sensor for speed, throttle position, exhaust oxygen level, manifold pressure, crankshaft position, coolant temperature, exhaust temperature, air mass flow for engine application. Solenoids, stepper motors, relay.
LAB / MINI PROJECT/FIELD WORK
NA

	TEXT BOOKS
1	Young A.P. & Griffiths. L. "Automotive Electrical Equipment", ELBS & New Press- reprint 2010.
2	Crouse, W.H "Automobile Electrical Equipment", McGraw-Hill Book Co., Inc., New York, 3rd edition, reprint 2010.
	REFERENCE BOOKS
1	Kholi.P.L "Automotive Electrical Equipment", Tata McGraw-Hill Co., Ltd., New Delhi, reprint 2011
2	Robert Bosch "Automotive Hand Book", SAE (5th Edition), 2010.
	E BOOKS
1	https://books.google.co.in/books?id=PaznCAAAQBAJ&printsec=frontcover&dq=isbn:9401168814&hl=en&sa=X&ved=0ahUKEwiIrKC9sN7ZAhXKQY8KHTrwB1gQ6AEIJjAA#v=onepage&q&f=false
2	https://books.google.co.in/books?id=PaznCAAAQBAJ&printsec=frontcover&dq=isbn:9401168814&hl=en&sa=X&ved=0ahUKEwiIrKC9sN7ZAhXKQY8KHTrwB1gQ6AEIJjAA#v=onepage&q&f=false
	MOOC
1	http://nptel.ac.in/courses/108108076/
2	http://nptel.ac.in/courses/108108176/

COURSE TITLE	ELECTRIC AND HYBRID VEHICLES			CREDITS	3
COURSE CODE	ATB4304	COURSE CATEGORY	PC	L-T-P-S	3-0-0-1
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	The students should be able to Familiarize on concepts of electric vehicle & performance of electric vehicles	1,6,12
2	The students should be able to Gain knowledge on Electric Propulsion Systems & Generators	1,12
3	The students should be able to Acquire the knowledge on hybrid electric drive train systems	1,12
4	The students should be able to Attain the knowledge on Energy Storages - Fuel Cells & Solar Cars And Control Systems	1,12

Prerequisites : Nil

MODULE 1- ELECTRIC VEHICLES (9L)

Layout of an electric vehicle, performance of electric vehicles – traction motor characteristics, tractive effort, transmission requirements, vehicle performance, energy consumption, advantage and limitations, specifications, system components, electronic control system.

MODULE 2- ELECTRIC PROPULSION SYSTEMS & GENERATORS (9L)

DC motors, AC motors, permanent magnet motors, brushless DC and reluctance motors, characteristics, regenerative braking. DC generators, AC generators, voltage and frequency regulations

MODULE 3- HYBRID VEHICLES (9L)

Concepts of hybrid electric drive train, types, architecture of series and parallel hybrid electric drive train, merits and demerits, series and parallel hybrid electric drive train design.

MODULE 4- MOTOR CONTROLLERS AND CONTROL SYSTEMS & ENERGY STORAGES (9L)

Control system principles, speed and torque control – DC motors and AC motors. Electromechanical batteries- types of batteries –lead acid batteries, nickel based batteries, lithium based batteries, electrochemical reactions, thermodynamic voltage, specific energy, specific power, energy efficiency, ultra-capacitors.

MODULE 5- FUEL CELLS & SOLAR CARS (9L)

Fuel cell, construction, working, equations, possible fuel sources, fuel reformer, design. Solar cars- photovoltaic cells, tracking, efficiency and cost comparison.

TEXT BOOKS

1. Mehrdad Ehsani, Yimin Gao, sebastien E. Gay and Ali Emadi, “Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design”, CRS Press, 2014.
2. James Larminie and John Loury, “Electric Vehicle Technology-Explained”, John Wiley & Sons Ltd., 2013.

REFERENCE BOOKS

1. Sandeep Dhameja, “Electric Vehicle Battery Systems”, Butterworth –Heinemann, 2012.
2. Donwhite Consultant Incorporate – Handbook of EMI / EMC – Vol I – 2015

3	Ronald K Jurgen, "Electric and Hybrid – Electric Vehicles", SAE, 2012
4	Ron Hodkinson and John Fenton, "Light Weight Electric/Hybrid Vehicle Design", Butterworth-Heinemann, 2011.
E-BOOK	
1	http://ceb.ac.in/knowledge-center/E-BOOKS/Modern%20Electric,%20Hybrid%20Electric%20&%20Fuel%20Cell%20Vehicles%20-%20Mehrdad%20Ehsani.pdf
MOOC	
1	http://nptel.ac.in/downloads/108103009/

COURSE TITLE	**AUTOMOTIVE DESIGN & STYLING LABORATORY**			**CREDITS**	**1**
COURSE CODE	**ATB4331**	**COURSE CATEGORY**	**PC**	**L-T-P-S**	**0-0-2-0**
CIA	**80%**			**ESE**	**20%**
LEARNING LEVEL	**BTL 6**				

CO	**COURSE OUTCOMES**	**PO**
1.	Familiarize on sketching in various automotive exterior parts.	1,5,8,12
2.	Acquire the knowledge on design and styling of cars	1,5,8,12

Prerequisites : Interest in automotive sketching is desirable

LIST OF EXPERIMENTS

1. Neat sketch of FRONT DOOR
2. Neat sketch of DOOR PILLAR OR FULL FRAME
3. Neat sketch of DASH BOARD
4. Exterior drawing of SEDAN
5. Exterior drawing of HATCHBACK
6. Exterior drawing of MULTI UTILITY VEHICLE (MUV)
7. Designing of Own car model in software (fusion 360 or 3ds max or alias)
8. Making of Clay Model (Own car design)

LIST OF EQUIPMENT/ SOFTWARE

1. Computer Nodes
2. Software Like 3D Max, Maya, Autodesk Alias, Adobe Illustrator And Photoshop etc

TEXT BOOKS	
1.	Lab Manual prepared by Faculty of Automobile Engineering
REFERENCE BOOKS	
1	http://www.carbodydesign.com/directory/car-design/car-design-books
2	http://launchpadacademy.in/top-10-car-design-books/
E BOOKS	
1	http://www.designersandbooks.com/content/20-books-car-design
MOOC	
1	https://www.lynda.com/Automotive-Design-training-tutorials/6579-0.html
2	www.carbodydesign.com › Directory › Design Schools

COURSE TITLE	AUTOMOTIVE ELECTRICAL AND ELECTRONICS LABORATORY			CREDITS	1
COURSE CODE	ATB4332	COURSE CATEGORY	PC	L-T-P-S	0-0-2-0
CIA	80%			ESE	20%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	Familiarize with various testing procedures of Battery, Alternator and Starter motor.	1,6,12
2	Acquire the Diagnosis of ignition system and automotive electrical wiring.	1,12
3	Develop the Skills on Off Board Diagnostics Systems (OBDS) procedure.	1,12
4	Gain the knowledge about the rectifier, IC timer and microprocessor 8085.	1,12
5	Acquire the skill on ALP program, Interfacing and data acquisition using 8085 MEL Kit	1,12

Prerequisites : basic electrical and electronics knowledge

LIST OF EXPERIMENTS

Electrical

1. Battery testing
2. Alternator testing.
3. Starter motor testing.
4. Diagnosis of ignition system.
5. Diagnosis of automotive electrical wiring.
6. Fault finding of relay & fuses in car using Off Board Diagnostics Systems (OBDS).
7. Relay & fuse Fault diagnostic of a car using OBDS

Electronics

1. Characteristics of rectifier
2. Study of IC timer
3. Study of Microprocessor 8085
4. Simple ALP program using 8085 MEL Kit
5. Data acquisition from sensors using 8085 MEL Kit
6. Interfacing of stepper motor with 8085 MEL Kit
7. Fault finding location of sensor in car using OBDS

LIST OF EQUIPMENT

1. Battery, hydrometer, voltage tester
2. Starter motor, regulator, cutout relay
3. Distributor, ignition coil, spark plug
4. Auto electrical wiring system
5. Rectifiers, filters
6. Amplifier
7. IC timer
8. Data logger
9. 8085 MEL kit.
10. OBDS kit.

SEMESTER – VI

COURSE TITLE	AUTOMOTIVE CHASSIS DESIGN			CREDITS	4
COURSE CODE	ATB4316	COURSE CATEGORY	PC	L-T-P-S	3-0-2-1
CIA	60%			ESE	40%
LEARNING LEVEL	BTL-4				

CO	COURSE OUTCOMES	PO
1	Acquire the knowledge on design of various types of clutches.	1,2,3,5,6,12
2	Familiarize on the performance of vehicles and design of gear ratio calculations.	1,2,3,5,6,12
3	Attain knowledge on design of ladder type chassis frame and suspension components.	1,2,3,5,6,12
4	Obtain the knowledge on design procedure of front axle and steering systems.	1,2,3,5,6,12
5	Gain the knowledge on design of propeller shaft and rear axle.	1,2,3,5,6,12

Prerequisites : Nil

MODULE 1- DESIGN OF CLUTCHES (9L+6P)

Design of single plate clutch, multi plate clutch, centrifugal clutch and cone clutch; energy dissipated by clutches, torque transmission capacity of clutches, design of clutch components.

Lab Practice: Modeling & simulation of single plate clutch.

Suggested Reading: Working principles of various clutches

MODULE 2 - DESIGN OF GEAR BOX (9L+6P)

Performance of vehicles, total resistances to vehicle motion, traction and tractive effort, geometric progression for calculation of gear ratios, design of three speed and four speed gear ratios.

Lab Practice: Modeling & simulation of 3 speed and 4 speed gear boxes.

Suggested Reading: Working principles of different gear boxes.

MODULE 3 - DESIGN OF CHASSIS FRAME AND SUSPENSION (9L+6P)

Study of loads, moments and stresses on Chassis frame members, design procedure of ladder type chassis frame, design procedure of leaf springs, coil springs and torsion bar springs.

Lab Practice: Modeling & simulation of ladder type chassis frame, leaf spring, coil spring and torsion bar spring.

Suggested Reading: Working principles of suspension components.

MODULE 4 - DESIGN OF FRONT AXLE AND STEERING SYSTEMS (9L+6P)

Study of loads, moments and stresses on front axle, design procedure of front axle; Condition for true rolling motion, Ackermann steering principles, calculation of turning circle radius.

Lab Practice: Modeling and stress analysis of front axle.

Suggested Reading: Working principles of steering systems.

MODULE 5 - DESIGN OF PROPELLER SHAFT AND REAR AXLE (9L+6P)

Design procedure of propeller shaft, design procedure of rear axles.

Lab Practice: Modeling and stress analysis of propeller shaft and rear axle shaft.

Suggested Reading: Working principles of different rear axle drives.

TEXT BOOKS	
1	Giri.N.K- "Automobile Mechanics"- Khanna Publisher, New Delhi- 2012
REFERENCE BOOKS	
1	An Introduction to Modern Vehicle Design. *Editor, Julian Happian-Smith. Edition, illustrated, reprint. Publisher, SAE International, 2014.*
2	Handbook of Vehicle Design Analysis *by John Fenton, 9781560919032*
E BOOKS	
1	www.springer.com/in/book/9781402086748
2	https://www.amazon.in/Chassis-Design-Principles-Analysis-Premiere/.../0768008263
3	https://books.google.co.in/books/.../Motorcycle_Handling_and_Chassis_Design.html
4	https://www.elsevier.com/books/introduction-to...design/happian.../978-0-08-052304
MOOC	
1	https://www.mooc-list.com/tags/vehicle-dynamics
2	https://www.shortcoursesportal.com/disciplines/250/automotive-engineering.html
3	https://www.myigetit.com/.../CourseDetails/6027...Automotive_Chassis...Course
4	https://study.com/articles/Automobile_Design_Colleges_and_Courses.html

COURSE TITLE	VEHICLE DYNAMICS			CREDITS	4
COURSE CODE	ATB4317	COURSE CATEGORY	PC	L-T-P-S	3-1-0-1
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-4				

CO	COURSE OUTCOMES	PO
1	To Understand vibrating systems and its analysis, modeling and simulation and modal analysis	1,2,4,5,7,12
2	To Understand various Suspension systems, selection of springs and dampers	1,2,4,5,7,12
3	To Understand the stability of vehicles on curved track and slope, gyroscopic effects and cross wind handling	1,2,4,5,7,12
4	To Know about tyres, ride characteristics and effect of camber, camber thrust	1,2,4,5,7,12
5	To Learn about vehicle handling under different steering conditions and directional stability of vehicles	1,2,4,5,7,12

Prerequisites : Nil

MODULE 1 - INTRODUCTION (10+2)

Classification of vibration, definitions, mechanical, vibrating systems, mechanical vibration and human comfort. Modelling and simulation studies. Model of an automobile, one degree of freedom, two degree of freedom systems, free, forced and damped vibrations - Random vibration - Magnification and Transmissibility. Vibration absorber. Multidegree of Freedom Systems-Closed and far coupled system, Orthogonally of modal shapes, Modal analysis

MODULE 2 - SUSPENSION (10+2)	
Requirements. Spring mass frequency. Wheel hop, wheel wobble, wheel shimmy, Choice of suspension spring rate. Calculation of effective spring rate. Vehicle suspension in fore and aft directions. Hydraulic dampers and choice of damper characteristics. Independent, compensated, rubber and air suspension systems. Roll axis and vehicle under the action of side forces	
MODULE 3 - STABILITY OF VEHICLES (10+2)	
Load distribution. Stability on a curved track and on a slope. Gyroscopic effects, weight transfer during acceleration and braking, over turning and sliding. Rigid vehicle – stability and equations of motion. Cross wind handling.	
MODULE 4 - TYRES (10+2)	
Types. Relative merits and demerits. Ride characteristics. Behaviour while cornering, slip angle, cornering force, power consumed by a tyre. Effect of camber, camber thrust	
MODULE 5 - VEHICLE HANDLING (10+2)	
Over steer, under steer, steady state cornering. Effect of braking, driving torques on steering. Effect of camber, transient effects in cornering. Directional stability of vehicles.	
LAB / MINI PROJECT / FIELD WORK	
NA	
TEXT BOOKS	
1	Thomas D.Gillespie, “Fundamentals of vehicle dynamics”,2012
2	J. Y. Wong, ‘Theory of Ground Vehicles’, John Wiley and Sons Inc., New York, 2011
REFERENCE BOOKS	
1	Hans Pacejka, Tire and Vehicle Dynamics, Elsevier, 2012.
2	Garrett T K, Newton K and Steeds W, “Motor Vehicle”, Butter Worths & Co., Publishers Ltd., New Delhi, 2001.
E BOOKS	
1	https://books.google.co.in/books?id=FnyGjktn5aMC&dq=Garrett+T+K,+Newton+K+and+Steeds+W,+%22Motor+Vehicle%22,+Butter+Worths+%26+Co.,+Publishers+Ltd.,+New+Delhi,+2001.&hl=en&sa=X&ved=0ahUKEwi4nryukZHaAhWLPY8KHSM7CCMQ6AEILDAB
2	https://books.google.co.in/books?id=Blp2D1DteTYC&printsec=frontcover&dq=Garrett+T+K,+Newton+K+and+Steeds+W,+%22Motor+Vehicle%22,+Butter+Worths+%26+Co.,+Publishers+Ltd.,+New+Delhi,+2001.&hl=en&sa=X&ved=0ahUKEwi4nryukZHaAhWLPY8KHSM7CCMQ6AEIMzAC#v=onepage&q&f=false
MOOC	
1	http://nptel.ac.in/courses/107106080/
2	https://iversity.org/en/courses/vehicle-dynamics-i-accelerating-and-braking
3	https://www.mooc-list.com/course/vehicle-dynamics-ii-cornering-iversity

COURSE TITLE	CONTROL SYSTEMS			CREDITS	4
COURSE CODE	ATB4318	COURSE CATEGORY	PC	L-T-P-S	3-1-0-1
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-4				

CO	COURSE OUTCOMES	PO
1	Familiarize with various methods of representation of control systems and their transfer function.	1,2,4,5,6,7,12
2	Apply time response analysis and determine steady state error.	1,2,4,5,6,7,12
3	Analyze the stability of the system using frequency response plots	1,2,4,5,6,7,12
4	Obtain the stability of the system by applying various stability criterion.	1,2,4,5,6,7,12
5	Familiarize with Design of state space equation in various forms.	1,2,4,5,6,7,12

Prerequisites : Nil

MODULE 1 – SYSTEMS AND THEIR REPRESENTATION (9L+3T)

Basic elements in control systems – Open and closed loop systems – Electrical analogy of mechanical and thermal systems – Transfer function – Synchros – AC and DC servomotors – Block diagram reduction techniques – Signal flow graphs.

MODULE 2 – TIME RESPONSE (9L+3T)

Time response – Time domain specifications – Types of test input – I and II order system response – Error coefficients – Generalized error series – Steady state error – P, PI, PID modes of feedback control

MODULE – 3 : FREQUENCY RESPONSE (9L+3T)

Frequency response – Bode plot – Polar plot. Determination of closed loop response from open loop response – Correlation between frequency domain and time domain specifications.

MODULE – 4 : STABILITY OF CONTROL SYSTEM (9L+3T)

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 criterions.

MODULE 5 – STATE SPACE ANALYSIS (9L+3T)

Introduction to State Space Analysis – Phase variable and Canonical Forms – State Transition Matrix – Solutions to state space equation – Discretization of state space equation, controllability and observability of systems.

LAB / MINI PROJECT/FIELD WORK

NA

TEXT BOOKS

1	K. Ogata, —Modern Control Engineering‖, 5th edition, Pearson Education, New Delhi, 2013 / PHI
2	I.J. Nagrath& M. Gopal, —Control Systems Engineering‖, New Age International Publishers,2013.
3	AshishTewari, —Modern Control Design with Matlab-Simulink, John Wiley, New Delhi 2012

REFERENCE BOOKS	
1	B.C. Kuo, —Automatic Control Systems‖, Prentice Hall of India Ltd., New Delhi, 2015.
2	M. Gopal, —Control Systems, Principles & Design‖, Tata McGraw Hill, New Delhi, 2012.
3	M.N. Bandyopadhyay, —Control Engineering Theory and Practice‖, Prentice Hall of India, 2013.
4	M. Gopal, —Modern Control System Theory‖, New Age International Publishers, 2012.
E BOOKS	
1	https://books.google.co.in/books?id=FnyGjktn5aMC&dq=Garrett+T+K,+Newton+K+and+Steeds+W,+%22Motor+Vehicle%22,+Butter+Worths+%26+Co.,+Publishers+Ltd.,+New+Delhi,+2001.&hl=en&sa=X&ved=0ahUKEwi4nryukZHaAhWLPY8KHSM7CCMQ6AEILDAB
2	https://books.google.co.in/books?id=Blp2D1DteTYC&printsec=frontcover&dq=Garrett+T+K,+Newton+K+and+Steeds+W,+%22Motor+Vehicle%22,+Butter+Worths+%26+Co.,+Publishers+Ltd.,+New+Delhi,+2001.&hl=en&sa=X&ved=0ahUKEwi4nryukZHaAhWLPY8KHSM7CCMQ6AEIMzAC#v=onepage&q&f=false
MOOC	
1	http://nptel.ac.in/courses/107106080/
2	https://iversity.org/en/courses/vehicle-dynamics-i-accelerating-and-braking
3	https://www.mooc-list.com/course/vehicle-dynamics-ii-cornering-iversity

COURSE TITLE	BUSINESS ECONOMICS			CREDITS	2
COURSE CODE	GEA4304	COURSE CATEGORY	BS	L-T-P-S	2-0-0-1
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-2				

CO	COURSE OUTCOMES	PO
1	Demonstrate an understanding the introduction of economics	8,10,11,12
2	Demonstrating to know knowledge about cost analysis	8,10,11,12
3	Able to build knowledge about consumer's and producer's behavior	8,10,11,12
4	Enabling to know about budget	8,10,11,12
5	Educate about financial services	8,10,11,12

Prerequisites : Basic Economics knowledge

MODULE – 1: INTRODUCTION TO ECONOMICS (6L)
Introduction to Economics- Flow in an economy, Law of supply and demand, Concept of Engineering Economics – Engineering efficiency, Economic efficiency, Scope of engineering economics
MODULE – 2: COST ANALYSIS (6L)
Types of Cost, Element of costs, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost, Break-even analysis, Economies of Scale Cost Classification
MODULE – 3: CONSUMER'S AND PRODUCER'S BEHAVIOUR (6L)
Consumer Behavior: Law of Diminishing Marginal utility – Equi marginal Utility – Consumer's Equilibrium - Indifference Curve – Production: Law of Variable Proportion – Laws of Returns to Scale – Producer's equilibrium – Economies of Scale Cost Classification

MODULE – 4: BUDGET	**(6L)**
Process of budgeting in India –classification of budgets trends – evaluation systems – types of deficits – fiscal policy – indicators –– taxation – centre, state and local – public debt and management.	
MODULE – 5: FINANCE	**(6L)**
Basics of finance and financial environment – instruments of financial markets – financial intermediation – investment banking and brokerage services – securities – types of securities – market for securities – how and where traded – initial public offering (IPO) – secondary markets – trading on exchanges and trading with margins.	
TEXT BOOKS	
1	S.Shankaran, Business Economics - Margham Publications.
2	H.L. Ahuja, Business Economics – Micro & Macro - Sultan Chand & Sons - New Delhi – 55.
REFERENCE BOOKS	
1	S.A.Ross, R.W.Westerfield, J.Jaffe and Roberts: Corporate Finance, McGraw-Hill.
2	Joseph E Stiglitz: Economics of the Public Sector.
E BOOKS	
1	https://sites.google.com/site/readbookpdf7734/pdf-download-business-economics-by---mark-taylor-read-online
2	https://bookboon.com/en/economics-ebooks

COURSE TITLE	VEHICLE DYNAMICS LABORATORY			CREDITS	1
COURSE CODE	ATB4341	COURSE CATEGORY	PC	L-T-P-S	0-0-2-0
CIA	80%			ESE	20%
LEARNING LEVEL	BTL-4				

CO	COURSE OUTCOMES	PO
1	To find the natural frequency of the given model	1,2,4,5,7,12
2	To study vibration characteristics of a vehicle using quarter car / half car model	1,2,4,5,7,12
3	To find displacement, Velocity and acceleration with the use of Mathematical software Using various sensors	1,2,4,5,7,12
4	To familiarize using MATLAB- SIMULINK software to solve simple mechanical systems.	1,2,4,5,7,12
5	To familiarize using Multi Body dynamics software to solve simple Car model.	1,2,4,5,7,12

Prerequisites : Nil

LIST OF EXPERIMENTS

1. Testing of natural frequency
2. Measurement of displacement velocity and acceleration
3. Whirling of Shafts
4. Critical Speed Determination
5. Camber angle measurement
6. Introduction to MAT Lab – Simulink, solving simple MCK problems
7. Modal Analysis of given structure
8. Study of LS Dyna / Adams

LIST OF EQUIPMENT

a) Quarter Car Model / Half Car Model - 1 No.
b) Four Wheeler Chassis Dynamometer - 1 No.
c) Shock absorber test rig - 1 No.
d) Measuring Devices – Displacement, Velocity and acceleration - 1 No.
e) Piston and Valves - 5 Nos.
f) MAT Lab Software - 30 Users
g) Adams / L.S. Dyna - 30 Users
h) Modal Analysis Setup - 1 No.

COURSE TITLE	CONTROL SYSTEMS LABORATORY			CREDITS	1
COURSE CODE	ATB4342	COURSE CATEGORY	PC	L-T-P-S	0-0-2-0
CIA	80%			ESE	20%
LEARNING LEVEL	BTL-4				

CO	COURSE OUTCOMES	PO
1	Familiarize the transfer function parameters for any type of system	1,2,4,5,6,7,12
2	Acquire and Simulate(Digital and Analog)time response characteristics oftype-0 and type-1 system	1,2,4,5,6,7,12
3	Develop skill on linear and nonlinear Systems design	1,2,4,5,6,7,12
4	Familiarize with stability Analysis of the linear system.	1,2,4,5,6,7,12

Prerequisites : Nil

List of Experiments

1. Determination of transfer function parameters of AC servomotor
2. Analog simulation of type-0 and type-1 system.
3. Digital simulation of linear systems and non-linear systems
4. Design and implementation of compensators.
5. Design of P, PI and PID controllers.
6. Stability analysis of linear systems.

List of Equipment

1. AC Servomotor
2. DC Motor
3. Rheostat
4. Ammeter
5. Voltmeter
6. Single Phase Auto Transformer
7. RPS
8. Resistor
9. Inductor
10. Capacitor
11. IC 741
12. Multimeter PC with MatLab

COURSE TITLE	DESIGN PROJECT - I			CREDITS	1
COURSE CODE	ATB4343	COURSE CATEGORY	PC	L-T-P-S	0-0-2-0
CIA	80%			ESE	20%
LEARNING LEVEL	BTL-4				

CO	COURSE OUTCOMES	PO
1	Students will be able to model, analyze and animate /fabricate a functional model of any component, sub system or a mechanism used in automobiles.	1 to 12

Prerequisites : Nil

DESCRIPTION

Students should model, analyze and animate /fabricate a functional model of any component, sub system or a mechanism used in automobile. They should prepare a design project report and submit. The assessment will be done on a continuous basis as follows:

Review / Exam	Weightage
First Review	20%
Second Review	20%
Third Review	20%
Report	20%
Final Viva- Voce	20%
TOTAL	**100%**

COURSE TITLE	COMPREHENSION			CREDITS	1
COURSE CODE	ATB4344	COURSE CATEGORY	PC	L-T-P-S	0-0-2-1
CIA	80%			ESE	20%
LEARNING LEVEL	BTL-4				

CO	COURSE OUTCOMES	PO
1	Students will be able to remember and recall all the subjects studied so far and write comprehension test.	1 to 12

Prerequisites : Nil

DESCRIPTION

Students should write a test (may be of objective type and MCQ) comprising of all the subjects studied during the course of study up to sixth semester and grades will be awarded based on their performance.

Review / Exam	Weightage
First Test	20%
Second Test	20%
Third Test	20%
Fourth Test	20%
Final Exam	20%
TOTAL	**100%**

SEMESTER VII

COURSE TITLE	VEHICLE DIAGNOSTICS			CREDITS	3
Course Code	ATB4401	COURSE CATEGORY	PC	L-T-P-S	3-0-0-2
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	Familiarize on vehicle maintenance procedures	1,2,5,8,9,12
2	Gain knowledge in maintenance procedures for various engine component and chassis component systems	1,2,5,8,9,12
3	Acquire the knowledge in maintenance procedures for various Electrical component and accessories.	1,2,5,8,9,12

Prerequisites : Nil

MODULE 1 - MAINTENANCE OF RECORDS AND SCHEDULES (9L)

Importance of maintenance, preventive (scheduled) and breakdown (unscheduled) maintenance, requirements of maintenance, preparation of check lists. Inspection schedule, Maintenance of records, log sheets and other forms, safety precautions in maintenance.

MODULE 2 - ENGINE MAINTENANCE - REPAIR AND OVERHAULING (9L)

Dismantling of engine components and cleaning, cleaning methods, visual and dimensional inspections, minor and major reconditioning of various components, reconditioning methods, engine assembly, special tools used for maintenance overhauling, engine tune up.

MODULE 3 - CHASSIS MAINTENANCE - REPAIR AND OVERHAULING (9L)

Mechanical and automobile clutch and gear box, servicing and maintenance, maintenance servicing of propeller shaft and differential system. Maintenance servicing of suspension systems. Brake systems, types and servicing techniques. Steering systems, overhauling and maintenance. Wheel alignment, computerized alignment and wheel balancing.

MODULE 4 - ELECTRICAL SYSTEM MAINTENANCE - SERVICING AND REPAIRS (9L)

Testing methods for checking electrical components, checking battery, starter motor, charging systems, DC generator and alternator, ignitions system, lighting systems. Fault diagnosis and maintenance of modern electronic controls, checking and servicing of dash board instruments.

MODULE 5 - MAINTENANCE OF FUEL SYSTEM, COOLING SYSTEMS, LUBRICATION SYSTEMAND VECHICLE BODY (9L)

Servicing and maintenance of fuel system of different types of vehicles, calibration and tuning of engine for optimum fuel supply. Cooling systems, water pump, radiator, thermostat, anti-corrosion and antifreeze additives. Lubrication maintenance, lubricating oil changing, greasing of parts. Vehicle body maintenance, Minor and major repairs. Door locks and window glass actuating system maintenance.

LAB / MINI PROJECT / FIELD WORK	
TEXT BOOKS	
1	John Duke "Fleet Management", McGraw-Hill Co. reprint 2012.
REFERENCE BOOKS	
1	James D Halderman - Advanced Engine Performance Diagnosis - PHI - 2011.
2	Service Manuals from Different Vehicle Manufacturers.
E BOOKS	
1	https://books.google.co.in/books?id=WMAwBToKbvgC&pg=PA8&dq=vehicle+diagnostics&hl=en&sa=X&ved=0ahUKEwiXxd2Jst7ZAhWMo48KHQhfAAcQ6AEILDAB#v=onepage&q=vehicle%20diagnostics&f=false
2	https://books.google.co.in/books?id=gnE1DgAAQBAJ&printsec=frontcover&dq=automotive+technology&hl=en&sa=X&ved=0ahUKEwicvrO-st7ZAhUGSY8KHa04A3UQ6AEIOzAD#v=onepage&q=automotive%20technology&f=false
MOOC	
1	https://www.youtube.com/watch?v=u36QUjrWhA0
2	https://www.youtube.com/watch?v=n1NvtUwfRJc

COURSE TITLE	FINITE ELEMENT ANALYSIS			CREDITS	4
COURSE CODE	ATB4402	COURSE CATEGORY	PC	L-T-P-S	3-1-0-2
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-4				

CO	COURSE OUTCOMES	PO
1	To enable the students understand the mathematical and physical principles underlying the Finite Element Method (FEM) as applied to solid mechanics and thermal analysis	1,2,4,5,12
2	Introduce students to the theory of elasticity	1,2,4,5,12
3	To teach students the characteristics of various elements in structural and thermal analysis and selection of suitable elements for the problems being solved	1,2,4,5,12
4	To introduce students to various field problems and the discretization of the problem	1,2,4,5,12
5	To make the students derive finite element equations for simple and complex elements	1,2,4,5,12

Prerequisites : Nil

MODULE 1 - INTRODUCTION (10L + 2T)

Engineering design analysis-meaning and purpose, steady state, propagation and transient problems. Concepts of FDM, FEM, FVM. Steps involved in FEM. Applicability of FEM to structural analysis, heat transfer and fluid flow problems. Advantages and limitations of FEM. Test for convergence. Element choice. Commercial finite element packages. Solution of Boundary value problem – Integral formulation for numerical solution - Variational methods - Minimum total potential energy formulation.

MODULE 2 - ONE DIMENTIONAL ELEMENTS (10L + 2T)	
Use of bar and beam elements in structural analysis. Bar Element – Stiffness matrix formulation by direct and polynomial methods. Boundary condition and assemblage concepts. Beam element characteristics matrix. Global, local, natural coordinates.	
MODULE 3 -TWO DIMENTIONAL ELEMENTS (10L + 2T)	
Rectangular elements - Quadratic quadrilateral elements - Linear Triangular elements - 2D elements applications for plane stress, plane strain and axi-symmetric problems. Treatment of boundary condition. Mesh generation techniques. Numerical integration schemes. Iso Parametric elements. Introduction to 3D Elements.	
MODULE 4 - STRUCTURAL AND DYNAMIC ANALYSIS (10L + 2T)	
1D & 2D problems in Solid mechanics. Dynamics problems representation in FE. Free vibration problem formulation. Torsion of non circular shaft - axisymmetric problem. Case Studies like Structural analysis of Chassis Frame, Whirling speed of propeller shaft, contact analysis of gears, modal analysis of suspension system, impact, crash worthiness etc.	
MODULE 5 - HEAT TRANSFER ANALYSIS AND FLOW ANALYSIS (10L + 2T)	
1D & 2D problems in fluid mechanics and heat transfer by conduction and convection. Transient thermal analysis. Case Studies like Heat transfer analysis of piston, fins.	
LAB / MINI PROJECT / FIELD WORK	
TEXT BOOKS	
1	Robert D. Cook, David S. Malkus, Michael E. Plesha, Robert J. Witt, “Concepts and applications of finite element analysis”, 4th edition, John Wiley & Sons, 2017
2	Singiresu S. Rao, “The Finite Elements Methods in Engineering”, 4th Edition, USA, 2015
REFERENCE BOOKS	
1	J. N. Reddy, “Finite Element Methods”, 2nd Edition, 6th Reprint, Tata McGraw Hill, 2015
2	Krishnamurthy,C.S., Finite Element Analysis, Tata McGraw Hill. 2013
E BOOKS	
1	https://books.google.co.in/books/about/The_Finite_Element_Method_in_Engineering.html?id=nBgZqyepUGwC
2	https://books.google.co.in/books/about/FINITE_ELEMENT_METHODS.html?id=CUDPzsiA3msC&redir_esc=y
3	https://books.google.co.in/books/about/Introductory_Finite_Element_Method.html?id=UVa4HSaixi4C&redir_esc=y
MOOC	
1	https://www.mooc-list.com/tags/finite-element-method
2	https://www.my-mooc.com/en/mooc/finite-element-method-fem-analysis-tsinghuax-70120073x-1/

COURSE TITLE	COMPUTATIONAL FLUID DYNAMICS			CREDITS	4
COURSE CODE	ATB4404	COURSE CATEGORY	PC	L-T-P-S	3-1-0-2
CIA	50%			ESE	50%
LEARNING LEVEL	BTL- 4				

CO	COURSE OUTCOMES	PO
1	The students should be able to Familiarize on the numerical modeling, governing equations of fluid flow and heat transfer	1,2,4,5,12
2	The students should be able know the importance of grid generation.	1,2,4,5,12
3	The students should be able to understand the conduction, convection and diffusion concepts.	1,2,4,5,12
4	The students will be able to understand the importance of turbulence modeling methods	1,2,4,5,12

Prerequisites : Nil

MODULE 1 – GOVERNING EQUATIONS AND BOUNDARY CONDITIONS (12)

Basics of computational fluid dynamics - Governing equations of fluid dynamics - Continuity, Momentum and Energy equations - Physical boundary conditions - Time-averaged equations for Turbulent flow Turbulence -Kinetic -Energy Equations

MODULE 2 – GRID GENERATION AND TYPES OF GRID (12)

Grid- Types of grid- Unstructured mesh- polyhedral mesh- tetrahedral mesh, Structured Mesh- prismatic mesh, Grid Independence study, Advantages of Grid generation

MODULE 3– HEAT CONDUCTION (12)

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 4- CONVECTION AND DIFFUSION (12)

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 5- TURBULENCE MODELLING (12)

Reynold's averaged Navier-Stokes equations and closure problem- Prandtl's mixing length theory and eddy viscosity- Turbulence models- k-epsilon and k-omega- One equation model- two equation model- LES, DNS

TEXT BOOKS

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

REFERENCE BOOKS

1. Patankar, S.V., Numerical Heat Transfer and Fluid Flow, McGraw-Hill, 2015. Ane - Books Indian Edition.2015.

2.	Muralidhar, K and Sundarajan .T., Computational Fluid Flow and Heat Transfer, Narosa Publishing House, New Delhi,2nd Edition 2010.
3.	Bose, T.K., Numerical Fluid Dynamics, Narosa publishing House, 2017.
4.	Muralidhar, K and Biswas Advanced Engineering Fluid Mechanics, Narosa Publishing House, New Delhi, 2nd Edition, 2016.
5.	Anderson, J.D., Computational fluid dynamics - the basics with applications, 2015.
E-BOOK	
1	https://engineeringstudymaterial.net/tag/computational-fluid-dynamics-books/
2	http://nptel.ac.in/syllabus/syllabus_pdf/112104030.pdf
MOOC	
1	https://www.class-central.com/tag/cfd
2	https://www.learncax.com/about-us/news-events/learncax-becomes-first-massive-open-online-course-mooc-platform-for-cfd-learning
3	http://nptel.ac.in/courses/112107080/

COURSE TITLE	**AUTOMOTIVE INSTRUMENTATION AND EMBEDDED SYSTEM**			**CREDITS**	**4**
COURSE CODE	**ATB4403**	**COURSE CATEGORY**	**PC**	**L-T-P-S**	**3-0-2-2**
CIA	**60%**			**ESE**	**40%**
LEARNING LEVEL	**BTL-3**				

CO	**COURSE OUTCOMES**	**PO**
1	Familiarize on measurement characteristics	1,2,5,6,7,12
2	Acquire the knowledge on working of automotive instruments	1,2,5,6,7,12
3	Gain knowledge on measurement analysis	1,2,5,6,7,12
4	Develop the knowledge on embedded systems	1,2,5,6,7,12
5	Attain the knowledge on real time operating system(RTOS)	1,2,5,6,7,12

Prerequisites : Control Systems, Automotive Electricals and Electronics knowledge

MODULE-1 MEASUREMENT CHARACTERSTICS (9L + 6P)

Instrument Classification, Characteristics of Instruments - Static and dynamic, experimental error analysis, Systematic and random errors, Statistical analysis, Uncertainty, Experimental planning and selection of measuring instruments, Reliability of instruments

MODULE -2 AUTOMOTIVE INSTRUMENTATION (9L + 6P)

Modern automotive instrumentation - computerized instrumentation system, multiplexing, sampling and advantages - Measurements - fuel quality, coolant temperature, oil pressure vehicles speed, Display devices - LED, LCD, VFD, CRT and types, CAN network, the glass cockpit and information system.

Onboard diagnostics - fault code displays. Off board diagnostics - engine data display, expert system occupant protection system - Airbag deployment system security and warning systems.

MODULE – 3 MEASUREMENT ANALYSIS (9L + 6P)

Chemical, thermal, magnetic and optical gas analyzers, measurement of smoke, dust and moisture, gas chromatography, spectrometry, measurement of pH, Review of basic measurement techniques.

MODULE – 4 INTRODUCTION TO EMBEDDED SYSTEM (9L + 6P)
Introduction to functional building blocks of embedded systems - Register, memory devices, ports, timer, interrupt controllers using circuit block diagram representation for each categories -Devices & buses for devices network - serial communication using I2C, CAN, USB buses - parallel communication using ISA, PCI - device drivers in a system - Serial port & parallel port.
MODULE -5 REAL TIME OPERATING SYSTEM (RTOS) (9L + 6P)
Introduction to basic concepts of RTOS, Basics of real time & embedded system operating systems, RTOS - Interrupt handling, task scheduling; embedded system design issues in system development process - Action plan, use of target system, emulator, use of software tools
TEXT BOOKS

1	WilliamB.Riddens - Understanding Automotive Electronics, 5th edition- Butter worth Heinemann, Woburn- 2015
2	Rajkamal, 'Embedded System - Architecture, Programming, Design', Tata McGraw Hill, 2013.
3	Daniel W. Lewis 'Fundamentals of Embedded Software', Prentice Hall of India, 2014.
4	Holman, J.P., Experimental methods for engineers, McGraw-Hill, 2013
5	Raman, C.S., Sharma, G.R., Mani, V.S.V., Instrumentation Devices and Systems, TataMcGraw

COURSE TITLE	VEHICLE DIAGNOSTICS LABORATORY			CREDITS	1
COURSE CODE	ATB4431	COURSE CATEGORY	PC	L-T-P-S	0-0-2-0
CIA	80%			ESE	20%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	Familiarize on workshop layout, vehicle maintenance procedures and fault finding techniques.	1,2,5,8,9,12
2	Acquire the knowledge on maintenance and reconditioning procedure for automotive engines, chassis and auxiliary systems	1,2,5,8,9,12

Prerequisites : Nil

LIST OF EXPERIMENTS

1. Study the layout of automobile repair shop, tools and instruments.
2. Fault diagnosis of ignition, starting and charging system.
3. Fault diagnosis of petrol and diesel fuel system and filters & air cleaners.
4. Adjustment of pedal play in clutch, brake, hand brake and steering wheel.
5. Removal of tyre & tube.
6. Cylinder reboring.
7. Valve grinding and valve lapping.
8. Calibration of fuel injection pump
9. Wheel balancing and alignment
10. Brake bleeding and adjustment

LIST OF EQUIPMENT
1. Engine Analyzer 2. Cylinder compression pressure gauge 3. Vacuum gauge 4. Tachometer 5. Wheel balancer and 6. Wheel aligner 7. Tyre remover 8. Bearing puller 9. Cylinder reboring machine 10. Valve grinding machine 11. Valve lapping machine 12. Fuel injection calibration test bench with nozzle tester

COURSE TITLE	FINITE ELEMENT ANALYSIS LABORATORY			CREDITS	1
COURSE CODE	ATB4432	COURSE CATEGORY	PC	L-T-P-S	0-0-2-0
CIA	80%			ESE	20%
LEARNING LEVEL	BTL-4				

CO	COURSE OUTCOMES	PO
1	To understand the different kinds of analysis and apply the basic principles to find out the stress and other related parameters of bars, beams loaded with loading conditions.	1,2,4,5,12
2	To lean to apply the basic principles to carry out dynamic analysis to know the natural frequency of different kind of beams.	1,2,4,5,12
3	To Demonstrate the deflection of beams subjected to point, uniformly distributed and varying loads further to use the available results to draw shear force and bending moment diagrams.	1,2,4,5,12
4	To Analyze the given problem by applying basic principle to solve and demonstrate 1D and 2D heat transfer with conduction and convection boundary conditions	1,2,4,5,12
5	To Simulate spring-mass system using MAT LAB	1,2,4,5,12

Prerequisites : Nil

LIST OF EXPERIMENTS
1. Force and stress analysis of trusses 2. Stress and deflection analysis in various beam with different load types 3. Stress analysis of a rectangular plate with circular hole 4. Stress analysis of a the corner angle bracket 5. Stress analysis of an axis-symmetric component

6. Thermal stress analysis within the rectangular plate 7. Convective heat transfer analysis of a 2D component 8. Modal analysis of various beam with different load types 9. Harmonic analysis of a 2Dcomponent 10. Simulation of spring-mass system using MAT LAB
LIST OF EQUIPMENT
Computer nodes 30 Nos. Ansys 30 licenses MATlab 30 licenses

COURSE TITLE	**COMPUTATIONAL FLUID DYNAMICS LABORATORY**			**CREDITS**	**1**
COURSE CODE	**ATB4435**	**COURSE CATEGORY**	**PC**	**L-T-P-S**	**0-0-2-0**
CIA	**80%**			**ESE**	**20%**
LEARNING LEVEL	**BTL-4**				

CO	**COURSE OUTCOMES**	**PO**
1	Familiarize on the numerical modeling, governing equations of fluid flow and heat transfer	1,2,4,5,12
2	Gain knowledge on the various discretization methods and solving methodologies.	1,2,4,5,12
3	Acquire the knowledge to solve complex problems in the field of different modes of heat transfer.	1,2,4,5,12
4	Attain the knowledge on the process of converting the PDE to difference equations using various discretization techniques.	1,2,4,5,12

Prerequisites : Nil

LIST OF EXPERIMENTS

1. Mesh generation for a symmetric and un-symmetric component.
2. Mesh generation for an aerofoil
3. Mesh generation for a convergent divergent nozzle
4. Grid independence study to be conducted for the above component.
5. To run the simulation using k-epsilon model for an aerofoil and for a convergent divergent nozzle.

LIST OF EQUIPMENT

Computer nodes 30 Nos.
ANSYS 30 licenses
MATLAB 30 licenses

COURSE TITLE	DESIGN PROJECT – II			CREDITS	1
COURSE CODE	ATB4433	COURSE CATEGORY	PC	L-T-P-S	0-0-2-0
CIA	80%			ESE	20%
LEARNING LEVEL	BTL-5				

CO	COURSE OUTCOMES	PO
1	The student should be able to Demonstrate a model / concept / system by applying the theoretical and practical knowledge gained through the course of study.	1 to 12

Prerequisites : Nil

Students should design and fabricate an electronics control unit used in automobiles and prepare project report and submit.

(OR)

Students should start first phase of the final semester project involving theoretical and experimental studies related to the automobile engineering and will have to submit a project phase I report which comprises of title, objective, Literature review, and project detailed execution plan for phase II.

The assessment will be done on a continuous basis as follows:

Review / Exam	Weightage
First Review	20%
Second Review	20%
Third Review	20%
Report	20%
Final Viva- Voce	20%
TOTAL	**100%**

COURSE TITLE	INTERNSHIP			CREDITS	1
COURSE CODE	ATB4434	COURSE CATEGORY	PC	L-T-P-S	0-0-0-0
CIA	-			ESE	100%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	The students should be able to exhibit knowledge on automotive design and manufacturing industries	1 to 12

Prerequisites : Nil

Students should undergo industrial training in reputed industries for a period of 2 weeks (minimum) during the vacation period at the end of 2nd or 4th or 6th semester. Assessment will be conducted along with the 7th semester as a practical subject. Students should prepare a report and seminar presentation for the final exam.

Review / Exam	Weightage
Final Viva- Voce	50%
Report	50%
Total	100%

SEMESTER VIII

COURSE TITLE	PROJECT & VIVA - VOCE			CREDITS	8
COURSE CODE	ATB4441	COURSE CATEGORY	PC	L-T-P-S	0-0-24-0
CIA	80%			ESE	20%
LEARNING LEVEL	BTL-5				

CO	COURSE OUTCOMES	PO
1	The student should be able to Demonstrate a model / concept / system by applying the theoretical and practical knowledge gained through the course of study.	1 to 12

Prerequisites : Nil

The objective of the project work is to enable the students in convenient groups of not more than 4 members on a project involving theoretical and experimental studies related to the automobile engineering. Every project work shall have a supervisor who is the member of the faculty of the institution. Six periods per week shall be allotted in the time table and this time shall be utilized by the students to receive the directions from the supervisor on library reading, laboratory work, computer analysis or field work as assigned by the supervisor and also to present in periodical seminars on the progress made in the project.

Each student will be assigned any one of the following types of project/thesis work:

(a) Industrial case study

(b) Preparation of a feasibility report

(c) Thesis by experimental research, and

(d) Design and development of equipment.

Each report must contain student's own analysis or design presented in the approved format.

Sessional marks will include

(a) Evaluation of the student's progress,

(b) Degree of involvement and participation,

(c) Merit of the project.

A student will have to defend his project/thesis and credit will be given on the merit of viva-voce examination.

Review / Exam	Weightage
First Review	20%
Second Review	20%
Third Review	20%
Report	20%
Final Viva- Voce	20%
TOTAL	**100%**

LIST OF DEPARTMENTAL ELECTIVES - SEMESTER III

COURSE TITLE	VEHICLE BODY ENGINEERING			CREDITS	3
COURSE CODE	ATC4251	COURSE CATEGORY	DE	L-T-P-S	3-0-0-0
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	To broaden the understanding of details of car body and safety design aspects	1,2,3,4,5,6,7,12
2	To introduce bus body details and types of metal sections used	1,2,3,4,5,6,7,12
3	To broaden the understanding of vehicle aerodynamics and wind tunnel technology	1,2,3,4,5,6,7,12
4	To introduce commercial vehicle body details and driver's seat design	1,2,3,4,5,6,7,12
5	To underline the importance of bus body loads and stress analysis	1,2,3,4,5,6,7,12

Prerequisites : Nil

MODULE 1 - CAR BODY DETAILS **9hrs**

Types car bodies – Visibility: regulations, driver's visibility, methods of improving visibility – Safety: Safety Design, constructional details of roof, under floor, bonnet, boot, wings etc

MODULE 2 -BUS BODY DETAILS **9hrs**

kTypes of bus bodies. Floor height, engine location – Entrance and exit location, Constructional details, frame construction, Double skin construction, Types of metal sections used, regulations, Conventional and integral type construction.

MODULE 3 - VEHICLE AERODYNAMICS **9hrs**

Objects – Vehicle drag and types. Various types of forces and moments. Effects of forces and moments various body optimization techniques for minimum drag. Principle of wind tunnel technology. Flow visualization techniques. Tests with scale models

MODULE 4 - COMMERCIAL VEHICLE DETAILS **9hrs**

Types of bodies – Flat platform, drop side, fixed side, tipper body, tanker body. Construction of commercial vehicle bodies. Dimensions of driver's seat in relation to controls. Drivers cab design.

MODULE 5 - BODY LOADS AND STRESS ANALYSIS **9hrs**

Scaled structure – Structural surface – Shear panel method – Symmetric and Asymmetrical vertical loads in a car – Longitudinal loads – Different loading situations – Load distribution on vehicle structure – Stress analysis of bus body structure under bending and torsion – Stress analysis in integral bus body. Analysis of shock and impulse.

LAB / MINI PROJECT / FIELD WORK

Development of blue print of a vehicle
Developing clay model of a vehicle

TEXT BOOKS

1	Powloski, J., 'Vehicle Body Engineering', Business Books Ltd., 2012
2	John Fenton, 'Vehicle Body Layout and Analysis', Mechanical Engineering Publication Ltd., London,2013

REFERENCE BOOKS	
1	Vehicle aerodynamics, SAE
2	David Crolla , "Automotive Engineering: Powertrain, Chassis System and Vehicle Body"
E BOOKS	
1	https://books.google.co.in/books?id=Ek0Cxo4rfnMC&printsec=frontcover&dq=vehicle+body+engineering&hl=en&sa=X&ved=0ahUKEwjVwbegk5HaAhUMpY8KHWrYCl8Q6AEIODAD#v=onepage&q=vehicle%20body%20engineering&f=false
2	https://books.google.co.in/books?id=Y11GAAAAYAAJ&q=vehicle+body+engineering&dq=vehicle+body+engineering&hl=en&sa=X&ved=0ahUKEwjVwbegk5HaAhUMpY8KHWrYCl8Q6AEIPTAE
MOOC	
1	http://nptel.ac.in/courses/112104122/6
2	saeiss.org/saeiss/uploads/2016/05/Vehicle-Body-Engineering

COURSE TITLE	AUTOMOTIVE MATERIALS AND METALLURGY			CREDITS	3
COURSE CODE	ATC4252	COURSE CATEGORY	DE	L-T-P-S	3-0-0-0
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	The students should be able to Familiarize on the constitutions of alloys and their phase diagrams	1,6,7,12
2	The students should be able to understand the various heat treatment process	1,6,7,12
3	The students should be able to Gain knowledge on the selection criteria of materials	1,6,7,12
4	The students should be able to Attain knowledge about the nonmetallic materials	1,6,7,12
5	The students should be able to Develop knowledge on the mechanical properties and testing of materials	1,6,7,12

Prerequisites : Nil

MODULE 1- CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS (9L)

Constitution of alloys - Solid solutions, substitutional and interstitial - phase diagrams, Isomorphous, eutectic, peritectic, eutectoid and peritectroid reactions, Iron - Iron carbide equilibrium diagram. Classification of steel and cast Iron micro-structure, properties and application.

MODULE 2 - HEAT TREATMENT (9L)

Definition - Full annealing, stress relief, recrystallisation and spheroidizing - Normalising, hardening and Tempering of steel. Isothermal transformation diagrams - Cooling curves superimposed on I.T. diagram CCR - Hardenability, Jominy end quench test - Austempering, martempering - Case hardening, carburising, nitriding, cyaniding, carbonitriding - Flame and Induction hardening

MODULE 3 - SELECTION OF MATERIALS (9L)	
Criteria of selecting materials for automotive components viz cylinder block, Cylinder head, piston, piston ring. Gudgeon pin, connecting rod, crank shaft, crank case, cam, cam shaft, engine valve, gear wheel , clutch plate, axle, bearings, chassis, spring, body panel, radiator, brake lining.	
MODULE 4 - NON-METALLIC MATERIALS (9L)	
. Polymers - types of polymer, commodity and engineering polymers - Properties and applications of PE, PP, PS, PVC, PMMA, PET, PC, PA, ABS, PI, PAI, PPO, PPS, PEEK, PTFE Polymers - Urea and Phenol formaldehydes - Engineering Ceramics - Properties and applications of Al2O3, SiC, Si3N4, PSZ and Sialon - Fibber and particulate reinforced composites.	
MODULE 5 - MECHANICAL PROPERTIES AND TESTING (9L)	
Mechanism of plastic deformation, slip and twinning - Types of fracture - Testing of materials under tension, compression and shear loads - Hardness tests (Brinell, Vickers and Rockwell) Impact test Izod and charpy, fatigue and creep test.	
TEXT BOOKS	
1	Kenneth G.Budinski and Michael K.Budinski "Engineering Materials" Prentice-Hall of India Private Limited, 4th Indian Reprint 2012.
REFERENCE BOOKS	
1	William D Callister "Material Science and Engineering", John Wiley and Sons 2012
2	Raghavan.V.Materials Science and Engineering, Prentice Hall of India Pvt. Ltd., 2010
3	Sydney H.Avner "Introduction to Physical Metallurgy" McGraw-Hill Book Company 2012
E BOOKS	
1	http://www.cognella.com/pdf/Mechanical-Testing-of-Engineering-Materials_sneak_preview.pdf
2	http://weldguru.com/OLDSITE/mechanical-properties-of-metals.html#table
MOOC	
1	http://www.icterm.net/assets/Instron%20Materials%20Test%20Guide.pdf
2	https://www.nde-ed.org/EducationResources/CommunityCollege/Materials/Mechanical/Mechanical.htm

COURSE TITLE	ELECTRONICS IN MOTORSPORT ENGINEERING			CREDITS	3
COURSE CODE	ATC4253	COURSE CATEGORY	DE	L-T-P-S	3-0-0-0
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	The students should be able to Familiarize on concepts of vehicle electrical and electronic circuits	1,5,6,7,12
2	The students should be able to Gain knowledge on the operation of vehicle sensors, actuators and display units	1,5,6,7,12
3	The students should be able to Acquire the knowledge on the electronic principles, circuit components and test procedures	1,5,6,7,12
4	The students should be able to Attain the knowledge on operation of microprocessor hardware and suppression methods used in vehicle circuits	1,5,6,7,12

Prerequisites : Nil

MODULE 1 - ANALYSIS AND TEST VEHICLE ELECTRICAL AND ELECTRONIC CIRCUITS (9L)

Electrical calculations: voltage; emf; current; power; resistance; capacitance; inductance; series and parallel circuits Semiconductor devices: electrical properties and characteristics of semiconductor material; P-N junction diode; Zener diode; N-P-N junction transistor; P-N-P junction transistor and thyristor; analyse them operation of a semiconductor based circuit, eg electronic ignition amplifier Circuit diagrams: electrical and electronic component and circuit symbols; circuit diagram layouts

MODULE 2 - OPERATION OF VEHICLE SENSORS, ACTUATORS AND DISPLAY (9L)

Sensors: principles of operation and electrical characteristics of sensors used in vehicles eg sensors used in anti-lock braking systems (ABS), electronic fuel injection (EFI), engine management systems, airbags, security, driver information and vehicle condition monitoring systems); relevant test procedures for sensors Actuators: principles of operation and electrical characteristics of vehicle actuators eg relays, solenoids, electro-hydraulic/pneumatic valves, rotary actuators, stepper motors; relevant tests procedures for actuators Information display devices: types of devices eg analogue gauges, light emitting diodes, liquid crystal displays, vacuum fluorescent displays, cathode ray tubes; relevant test procedures for displays

MODULE 3 - MCU CONTROL TECHNOLOGY (9L)

Micro-computer hardware system components, addressing modes, storage, control and operation principle of bus architecture, interrupt system, interface principle, and assembly language programming methods. Require students to master computer information processing, control and storage methods, understanding of computer systems and components are working process.

MODULE 4 - OPERATION OF MICROPROCESSOR HARDWARE AND SUPPRESSION METHODS (9L)

Microprocessor hardware: implementation, operation and relevant developments of microprocessor systems in vehicles eg computer area network (CAN) bus links; packaging; microcontrollers; integrated circuits; reliability; electromagnetic compatibility Suppression methods: resistive suppression of oscillations; screening; use of inductors; capacitors and filter networks in interference suppression

MODULE 8 - SYSTEMATIC FAULT DIAGNOSIS AND REPAIRS ON VEHICLE ELECTRONIC SYSTEMS (9L)	
Systematic testing: testing of input/output sensors, cables, supplies, earths, output actuators, display devices and microprocessor systems, correct use of multimeters and oscilloscope for measuring circuit and component values Self-diagnosis: signal plausibility checks; open and short circuit checks; processor operation and memory test routines; error/trouble codes; standardization of connectors and codes; continuity checks; sensor output; resistance checks Fault repairs: correct procedures for removal/refitting eg following manufacturer's recommendations; repair and replacement of system components	
TEXT BOOKS	
1.	Hillier's Fundamentals of Automotive Electronics, Book 2 Sixth Edition 2014.
2.	Standard Handbook of Electronic Engineering, Fifth Edition, Donald Christiansen, Charles K.Alexander, Ronald K. Jurgen 2013.
REFERENCE BOOKS	
1	Judge A.W —Modern Electrical Equipment of Automobiles‖, Chapman & Hall, London, 2011
2	Kholi.P.L —Automotive Electrical Equipment‖, Tata McGraw-Hill Co., Ltd., New Delhi, 2015
3	Robert Bosch —Automotive Hand Book‖, SAE (5th Edition), 2010
E-BOOK	
1	http://www.powerelectronics.com/learning-resources/ebooks
MOOC	
1	http://www.nptel.ac.in/syllabus/117108046/

COURSE TITLE	ELECTRONIC ENGINE MANAGEMENT SYSTEM			CREDITS	3
COURSE CODE	ATC4254	COURSE CATEGORY	DE	L-T-P-S	3-0-0-0
CIA	50%			ESE	50%
LEARNING LEVEL	BTL – 2				

CO	COURSE OUTCOMES	PO
1	Familiarize with automotive instruments and sensors	1,5,6,7,12
2	Gain knowledge about the measurement of engine parameter by using sensor	1,5,6,7,12
3	Attain knowledge on the working Electronic Ignition System	1,5,6,7,12
4	Attain the Principles of Digital Control systems and its applications	1,5,6,7,12
5	Familiarize with the concept of Engine mapping	1,5,6,7,12

Prerequisites : Nil

MODULE 1 - FUNDAMENTALS OF AUTOMOTIVE ELECTRONICS (6L)

Microprocessor architecture, open and closed loop control strategies, PID control, Look up tables, introduction to modern control strategies like Fuzzy logic and adaptive control. A/D and D/A controllers.

Suggested Reading: Advancements in closed loop control, Programme in look up table

MODULE 2 – SENSORS (9L)
Types – Mass Air flow, Manifold Absolute Pressure, Temperature, Speed, EGO, Knock, and Crankshaft Position-Hall Effect-Principle of operation, construction, material and characteristics. **Suggested Reading**: Types of MAP sensors, Camshaft Position sensor, Speed sensor
MODULE 3 - SI ENGINE MANAGEMENT (9L)
Mono point, Multi point and Direct injection systems - Principles and Features, Bosch injection systems- L-Jetronic and LH –Jetronic- Layout and working, Open loop control and Lambda loop control in injection. **Suggested Reading:** K-Jetronic, KE-Jetronic, Motronic Systems
MODULE 4 - CI ENGINE MANAGEMENT (9L)
Fuel injection system parameters affecting combustion, noise and emissions in CI engines. Inline injection pump, Rotary pump and injector - Construction and principle of operation, Electronically controlled Unit Injection system. Layout of the common rail fuel injection system. **Suggested Reading**: Nozzle spray characteristics, Types of Nozzles, Types of combustion Chambers
MODULE 5 - IGNITION SYSTEMS AND ENGINE MAPPING (12L)
Ignition fundamentals, Types of solid state ignition systems, High energy ignition distributors, Electronic spark timing and control. Combined ignition and fuel management systems. Digital control techniques - Dwell angle, Ignition timing and Injection duration calculation. **Suggested Reading:** Electronic Ignition system, Optimization techniques in ignition and injection timing
LAB / MINI PROJECT/FIELD WORK

	TEXT BOOKS
1	Bosch Technical Instruction Booklets.
2	Tom Denton, Automotive Electrical and Electronic Systems, Edward Amold.
3	William B Ribbens “Understanding Automotive Electronics”, SAE Publications.
4	Eric Chowanietz “Automobile Electronics” SAE Publications.
	REFERENCE BOOKS
1	Robert Bosch “Diesel Engine Management” SAE Publications.
2	Robert Bosch, “Gasoline Engine Management” SAE Publications.
3	Robert N.Brady, “Automotive Computers and Digital Instrumentation”, Prentice Hall.
4	Duffy Smith, Auto Fuel Systems, The god Heart Willcox Company Inc., Publishers.
5	Heinz Heisler, Advanced Engine Technology. SAE Publications.
	E BOOKS
1	https://books.google.co.in/books?id=wsuPPQAACAAJ&dq=ELECTRONIC+ENGINE+MANAGEMENT+SYSTEM&hl=en&sa=X&ved=0ahUKEwiJ3bz4lOHZAhWDwI8KHfF1AmkQ6AEIJjAA
2	https://books.google.co.in/books?id=OdklBAAAQBAJ&printsec=frontcover&dq=ELECTRONIC+ENGINE+MANAGEMENT+SYSTEM&hl=en&sa=X&ved=0ahUKEwiJ3bz4lOHZAhWDwI8KHfF1AmkQ6AEILzAC

3	https://books.google.co.in/books?id=Nu_TBgAAQBAJ&printsec=frontcover&dq=engine+mapping&hl=en&sa=X&ved=0ahUKEwipl8e2leHZAhVGPo8KHU0fD9kQ6AEILzAC
4	https://books.google.co.in/books?id=TzqIDQAAQBAJ&printsec=frontcover&dq=engine+ignition+system&hl=en&sa=X&ved=0ahUKEwjw2qHJleHZAhWHv48KHR-hCjoQ6AEIJjAA
MOOC	
1	https://www.edx.org/course?search_query=Electronic+engine+management+system
2	http://autoeducation.co.uk/courses/engine-management
3	https://study.com/articles/Automotive_Electronics_Courses_and_Training_Program_Information.html

COURSE TITLE	**AUTOMOTIVE PRODUCT DESIGN AND DEVELOPMENT**			**CREDITS**	**3**
COURSE CODE	**ATC4255**	**COURSE CATEGORY**	**DE**	**L-T-P-S**	**3-0-0-0**
CIA	**50%**			**ESE**	**50%**
LEARNING LEVEL	**BTL-2**				

CO	**COURSE OUTCOMES**	**PO**
1	Familiarize on the basics of engineering design process	1,2,3,4,5,6,7,12
2	Acquire the concepts of benchmarking for quality improvement	1,2,3,4,5,6,7,12
3	Gain knowledge on the systematic methods of creative designing	1,2,3,4,5,6,7,12
4	Expertise in the various steps involved in automotive product design	1,2,3,4,5,6,7,12
5	Expertise in the various processes involved in automotive product development	1,2,3,4,5,6,7,12

Prerequisites : Nil

MODULE 1 - ENGINEERING DESIGN PROCESS (9L)

Need for developing products – the importance of engineering design – types of design –the design process – relevance of product lifecycle issues in design –designing to codes and standards- societal considerations in engineering design –generic product development process –various phases of product development-planning for products –establishing markets- market segments- relevance of market research. Introduction to Automotive design , History of Automotive design, Car design brands & brand values and Brand history and Styling DNA and Case studies.

Suggested Reading: Prototype model for vehicle systems

MODULE 2 - BENCH MARKING (9L)

Identifying customer needs –voice of customer –customer populations- hierarchy of human needs need gathering methods – affinity diagrams – needs importance- establishing engineering characteristics-competitive benchmarking- quality function deployment- house of quality- product design specification-case studies

Suggested Reading: Case Study of working employees affinity in cars

MODULE 3 - CREATIVE DESIGN (9L)
Creative thinking –creativity and problem solving- creative thinking methods- generating design concepts-systematic methods for designing –functional decomposition – physical decomposition – functional representation –morphological methods **Suggested Reading:** 3D models for styling of cars
MODULE 4 - PRODUCT DESIGN (9L)
Decision making –decision theory –utility theory –decision trees –concept evaluation methods – Pugh concept selection method- weighted decision matrix –analytic hierarchy process –introduction to embodiment design –product architecture – types of modular architecture –steps in developing product architecture **Suggested Reading:** Simulation of aerodynamic design
MODULE 5 - PRODUCT DEVELOPMENT (9L)
Industrial design –Advance product Quality plan(APQP)- human factors design –user friendly design – design for serviceability – design for environment – prototyping and testing – Production part approval process(PPAP) –Feedback assessment and Corrective action- cost evaluation **Suggested Reading:** Prototype Model for a passenger vehicle

TEXT BOOKS	
1	George E.Dieter, Linda C.Schmidt, “Engineering Design”, McGraw-Hill International Edition, 4th Edition, 2009, ISBN 978-007-127189-9
2	Anita Goyal, Karl T Ulrich, Steven D Eppinger, “Product Design and Development “, 4th Edition, 2009, Tata McGraw-Hill Education, ISBN-10-007-14679-9
3	Julian Happian-Smith, “An Introduction to Modern Vehicle Design”, First print 2013, Butterworth-Heinemann, ISBN:978-0-7506-5044-1.
REFERENCE BOOKS	
1	Kevin Otto, Kristin Wood, “Product Design”, Indian Reprint 2004, Pearson Education,ISBN 9788177588217.
2	YousefHaik, T. M. M. Shahin, “Engineering Design Process”, 2nd Edition Reprint, Cengage Learning, 2010, ISBN 0495668141
3	Clive L.Dym, Patrick Little, “Engineering Design: A Project-based Introduction”, 3rd Edition, John Wiley & Sons, 2009, ISBN 978-0-470-22596-7
E BOOKS	
1	ceb.ac.in/.../E-BOOKS/The%20Automotive%20Development%20Process%20-%20Da.
2	web.mit.edu/.../Chapter%208%20Hauser_Dahan%20Book%20Chapter%20on%20
3	https://www.plm.automation.siemens.co, Automotive & Transportationdemo.spletna-tiskarna.si/tr.../product-management-and-new-product-development.pdf
4	https://www.crcpress.com/Automotive-Product-Development-A.../9781498706810
MOOC	
1	https://www.class-central.com/tag/automobile%20software
2	https://onlinecourses.nptel.ac.in/noc17_me16/
3	https://knowledgelover.com/best-mooc-massive-open-online-course-providers-list/
4	https://online-learning.tudelft.nl › Find courses › Electric Cars: Introduction

COURSE TITLE	AUTOMOTIVE POLLUTION AND CONTROL			CREDITS	3
COURSE CODE	ATC4256	COURSE CATEGORY	DE	L-T-P-S	3-0-0-0
CIA	50 %			ESE	50 %
LEARNING LEVEL	BTL- 3				

CO	COURSE OUTCOMES	PO
1	The students should be able familiarize the effect of various automotive emissions.	1,2,6,7,12
2	The students should be able to gain Knowledge about the formation of various types of pollutants from SI and CI engines.	1,2,6,7,12
3	The students should be able to acquire the significance of emission control techniques.	1,2,6,7,12
4	The students should be able to familiarize the construction and working of emission measuring instruments.	1,2,6,7,12
5	The students should be able to gain information on various emission standards and test procedures.	1,2,6,7,12

Prerequisites : Nil

MODULE 1 – INTRODUCTION (9L)

Vehicle population assessment in **International, National and Metropolitan cities** and contribution to pollution, effects on human health and environment, global warming, types of emission, transient operational effects on pollution. Emission Norms and Regularity Body – Challenges.

MODULE 2 – POLLUTANT FORMATION IN SI ENGINES (9L)

Pollutant formation in SI Engines, mechanism of HC and CO formation in four stroke and two stroke SI engines. NOx formation in SI engines. Effects of design and operating variables on emission formation, Flame Quenching- Kinetic Effect- Mixture Strength- crevice effect- oil film HC. Source and Control of evaporative emission. Two stroke engine pollution.

MODULE 3- POLLUTANT FORMATION IN CI ENGINES (9L)

Pollutant formation in CI engines. Smoke and particulate Formation in CI engines- Composition of particulates, soot structure- stoichiometric considerations, nucleation, growth and oxidation. Formation of NO and NO_2 in CI engines, NO formation in premixed and diffusion combustion periods. Formation of HC in CI engines, undermining and over mixing. Effect of engine variables effects of design and operating variables on CI engine emissions.

MODULE 4- CONTROL OF SI AND CI ENGINES EMISSIONS (9L)

Design of engine, optimum selection of operating variables for control of emissions, Crankcase and evaporative emission control, Thermal and catalytic reactors, Elements of catalytic reactors, catalysts and substrates, Cold start HC control. EGR, Lean de-NOx catalysts, water injection, NOx traps and SCR. Diesel particulate filters (DPF), DPF regeneration, Secondary air injection. Fuel modifications. Two stroke engine pollution control.

MODULE 5–MEASUREMENT TECHNIQUES EMISSION STANDARDS AND TEST (9L)

Measurement of emissions, instrumentation for CO HC, NOx, PM. NDIR, FID, Chemiluminescent analyzers, Gas Chromatograph and Smoke meters. Noise and Vibration Measurement – Harshness. Emission standards, driving cycles - USA, Japan, Euro and India. Test procedures - ECE, FTP Tests. SHED Test - chassis dynamometers, dilution tunnels-BS VI Norms

LAB / MINI PROJECT/FIELD WORK	
TEXT BOOKS	
1	Paul Degobert - Automobiles and Pollution - SAE International ISBN-1-56091-563-3, 2015.
2	Ganesan, V- "Internal Combustion Engines"- Tata McGraw-Hill Co.- 2013.
REFERENCE BOOKS	
1	SAE Transactions- "Vehicle Emission"- 2012 (3 volumes).
2	Obert.E.F.- "Internal Combustion Engines"- 2015
3	Marco Nute- " Emissions from two stroke engines, SAE Publication - 2015.
E BOOKS	
1	http://nptel.ac.in/courses/112104033/pdf_lecture/lecture2.pdf
2	http://www.un.org/esa/gite/iandm/faizpaper.pdf
MOOC	
1	http://freevideolectures.com/Course/88/Environmental-Air-Pollution/11
2	http://www.iitg.ac.in/scifac/qip/public_html/cd_cell/chapters/uk_saha_internal_combustion_engine/qip-ice-27-emissions%20&%20pollutions.pdf

LIST OF DEPARTMENTAL ELECTIVES - SEMESTER IV

COURSE TITLE	AUTOMOTIVE AERODYNAMICS			CREDITS	3
COURSE CODE	ATC4266	COURSE CATEGORY	DE	L-T-P-S	3-0-0-0
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-5				

CO	COURSE OUTCOMES	PO
1	To understand Fundamentals of Aerodynamics	1,2,3,4,5,6,7,12
2	To familiarize the Stability, Safety and Comfort of ground vehicles	1,2,3,4,5,6,7,12
3	To understand measurement techniques in Wind Tunnels and	1,2,3,4,5,6,7,12
4	To familiarize the computational fluid dynamics	1,2,3,4,5,6,7,12
5	To design and develop the simulation methods of ground vehicles	1,2,3,4,5,6,7,12

Prerequisites : Nil

MODULE 1 - FUNDAMENTALS OF AERODYNAMICS (9L)

Scope – Concept of bluff body, Generic shapes, Relevance of these shapes to ground vehicles, Pressure drag & Viscous drag. – Flow phenomena related to vehicles – External and Internal flow problems – Performance of cars and light vans – Resistance to vehicle motion – Flow field around car – Aerodynamic development of cars – Optimization of car bodies for low drag.

MODULE 2 - STABILITY, SAFETY AND COMFORT (9L)

The origin of forces and moments – effects – vehicle dynamics under side wind – Force and Moment coefficients – Safety limit Design stage measures, Modifications of other details & their effect, Important factors affecting Aerodynamics - Rear slant, Engine cooling air drag, Crosswinds, Underside flows, Wheel Rotation – dirt accumulation on vehicle - wind noise – Air flow around individual components – High performance vehicles – Very log drag cars – Design alternatives – High efficiency radiator arrangement – Development and simulation methods.

MODULE 3 - WIND TUNNELS AND TEST TECHNIQUES (9L)

Principles of wind technology – Limitations of simulation – Simulation based optimization of geometries, Drag reduction Technologies – Surface shaping Scale models – Existing automobile wind tunnels Wind Tunnel Experiments – Measurement of Pressure Coefficient , Measurement of Drag Force .Wind Tunnel limitations & Corrections – Boundary Layer Control , Pressure Gradient , Wind Tunnel Blockages. – Climatic tunnels – Measuring equipment and transducers. Pressure measurement – velocity measurements – Flow visualization techniques – Road testing methods – Wind noise measurements.

MODULE 4 - APPLICATION OF CFD (9L)

Methods to solve Navier–Stokes equation – Forces acting in a fluid element – Compressibility effects in a flow field – Inviscid flow – Governing equations – Irrotation flow field and consequences – Potential flows – Boundary layer methods Important requirements of CFD solver – Geometric / Dynamic similarity, Robust Flow solver / Numerical scheme, Convergence level, Transition prediction, Turbulence models. – Numerical modelling of fluid flow around vehicle body

MODULE 5 - AERODYNAMIC DESIGN (9L)	
Development and simulation methods –cars, buses, trucks. Surface Motion, Surface permeability, Mass addition, Energizing the external flow	
LAB / MINI PROJECT / FIELD WORK	
TEXT BOOKS	
1	W.H. Hucho, 'Aerodynamics of Road Vehicles', Butterworth and Co., 2014.
2	A. Pope, "Wind Tunnel Testing", 2nd Edition, John Wiley & Sons New York,
REFERENCE BOOKS	
1	E.L.Houghton & P.L.Carpenter, "Aerodynamics for Engineering students", Butterworth Heinman(2013)
2	Milliken and Milliken, "Race Car Vehicle Dynamics".
E BOOKS	
1	https://books.google.co.in/books?id=IZsrDAAAQBAJ&pg=PA1&source=gbs_toc_r&cad=3#v=onepage&q&f=false
2	https://books.google.co.in/books?id=psP8BAAAQBAJ&pg=PA1&source=gbs_toc_r&cad=3#v=onepage&q&f=false
3	https://books.google.co.in/books?id=psP8BAAAQBAJ
MOOC	
1	https://www.edx.org/course/introduction-aerodynamics-mitx-16-101x-0
2	https://ocw.mit.edu/courses/aeronautics-and.../16-100-aerodynamics-fall-2005/

COURSE TITLE	ENGINE EXHAUST SYSTEM DEVELOPMENT			CREDITS	3
COURSE CODE	ATC4267	COURSE CATEGORY	DE	L-T-P-S	3-0-0-0
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	Gain knowledge in the global environmental air pollution control bureaus	1,2,3,4,6,7,8,12
2	Familiarize with emission control systems and noise control devices.	1,2,3,4,6,7,8,12
3	Design and validate full exhaust system for on-road, off-road and non-road applications.	1,2,3,4,6,7,8,12
4	Gain knowledge on the advanced technology development on exhaust system for SI and CI engines.	1,2,3,4,6,7,8,12
5	Familiarize with automobile design and computational simulation environments.	1,2,3,4,6,7,8,12

Prerequisites : Nil

MODULE 1 - INTRODUCTION TO ENGINE EXHAUST (9L)

Introduction of exhaust system – Engine Exhaust Technology Evolution – India automotive emission regulation – Noise limits for vehicles at manufacturing stage – Basics of Exhaust System from Engine head face to tail pipe – Components of exhaust system – Exhaust catalytic converter – Silencer (Muffler) – System integration.

Suggested Reading: IC engine exhaust, Layout of IC engine systems

MODULE 2 - EMISSION CONTROL SYSTEMS (9L)
Understanding of Gasoline and diesel engine out pollutants – Emission Norms – Air to Air – Converter Hot end components – TWC – Manifold – Cone Profiles – Substrate – Types of Substrate – Wash coat – Mat – Types of Mats – Shell – Canning – Types of Canning – Controlled canning – GBD (Gab Bulk Density) – Temperature Sensor – Oxygen Sensor – Thermal Management – Insulators – Heat Shields – (Gasoline / Diesel) – Advancement in substrates – Technology for gasoline engine – Three way converter (TWC) – Gasoline particulate filter (GPF) – Lean NOx Trap (LNT) – Technology for diesel engine – Exhaust gas recirculation (EGR) – Diesel oxidation catalyst (DOC) – Partial flow filter (PFF) – Diesel particulate filter (DPF) – Selective catalytic reduction (SCR) – Selective catalytic reduction filter (SCRF) – Global regulations and testing protocols – System integration. Carbon di oxide (CO2) control systems. **Suggested Reading**: carbon di oxide emissions
MODULE 3 - NOISE CONTROL SYSTEMS (9L)
Basics of Acoustics – Fundamentals of sound – Terminologies – Noise cancellation – Destructive & Constructive interferences – Engine exhaust noise introduction – Gasoline & Diesel engine operation & exhaust noise characteristics – Vehicle Pass by Noise – Exhaust noise measurement standards – Types of exhaust noises – Pulsation noises – Flow noises – Booming noises – Shell radiation noises – Passive noise reduction techniques – Types of mufflers – Reflective – Absorptive Hybrid mufflers – Muffler design constrains – Muffler internal design – Tri flow muffler – Straight though muffler – Helmholtz resonator – Internal resonators – Baffle plates – Perforations – shells – End Plates – Pipe diameters – Absorptive materials – Development methodologies – Muffler performance parameters – Sound transmission loss – Insertion loss – Noise reduction – Tail pipe noise level – back pressure – Vehicle interior noise levels – Advanced muffler technologies – Cat con integrated muffler – variable flow muffler – Twin mufflers – Active noise cancellation – Sporty sound mufflers – Sound engineering, Off Road – On Road – Non Road muffler applications Examples – Manufacturing Types & Process – Roll & Spot welding – Lock seaming – Double seaming – Web forming – Clinching – Cold metal transfer – Hydro forming – Piercing – Stamping – Muffler examples. **Suggested Reading**: Muffler design
MODULE 4 - COMPUTATIONAL ANALYSIS (CFD, FEA) (9L)
CFD for vehicle exhaust system – Governing equation of fluid flow and heat transfer – Flow Uniformity – Pressure loss through exhaust system – Flow Eccentricity – HEGO Index – Conjugate Heat Transfer Analysis – Introduction to finite element analysis.Present, Past, Future FEA – Introduction to Pre-processing ID, 2D, 3D Elements – Meshing, Processing Techniques – Statics of strength of materials – Types of Analysis – Modal Analysis – Linear Static Analysis – Introduction to Non-linear Analysis – Dynamic Analysis – Thermal Analysis – RLDA & Fatigue Analysis – Post processing techniques of different Analysis – Process Flows and Targets – Case Study 1-2-3. **Suggested Reading**: Finite element analysis
MODULE 5 - TESTING AND VALIDATION (9L)
Vehicle noise measurement – Operational vibration analysis – Experimental modal analysis – Air leak test Thermal Shock Tests – Thermal fatigue test – Back pressure measurement test – Hot end

system: Hot Vibration Test – Cold vibration test – Flow noise measurement – Shell deformation test – Cold end: Biaxial fatigue test – Uni-axial fatigue test – Salt spray test – Condensate Water Noise Test – Transmission loss measurement – Shell stiffness measurement – Glass wool endurance test – Resonance frequency measurement – Shell radiation noise measurement – Tail pipe noise measurement – Water drainage ability test. **Suggested Reading**: Automotive testing

TEXT BOOKS	
1	Engine Emissions: Pollutant Formation and Advances in Control Technology,Alpha science publisher,2015
2	Noise and Bivration Control Engineering (Principles and applications) Istvan L. Ver and Leo L.
REFERENCE BOOKS	
1	Beranek, - 2nd Edition 2006, John Wiley & Sons Inc
2	Acoustics of Ducts and Mufflers with Applications to Exhaust and Ventilation System Design, M.L. Munjal – 2ndEdition, Wiley – Inter Science.
MOOC	
1	https://www.youtube.com/watch?v=W6dIsC_eGBI

COURSE TITLE	**AUTOMOTIVE SENSORS AND APPLICATIONS**			**CREDITS**	**3**
COURSE CODE	**ATC4268**	**COURSE CATEGORY**	**DE**	**L-T-P-S**	**3-0-0-0**
CIA	**50%**			**ESE**	**50%**
LEARNING LEVEL	**BTL-3**				

CO	**COURSE OUTCOMES**	**PO**
1	Familiarize on automotive instruments and sensor	1,5,6,7,12
2	Gain knowledge on the measurement of engine parameter by using sensor.	1,5,6,7,12
3	Acquire the concept on working of actuators.	1,5,6,7,12
4	Attain the knowledge on working of sensors.	1,5,6,7,12
5	Familiarize on application of intelligent sensors.	1,5,6,7,12

Prerequisites : basic knowledge in electrical and engines

MODULE 1 - INTRODUCTION (9L)

Introduction to automotive sensors and instrumentation, Market perspective for sensors and instrumentation techniques. Sensor electronics and techniques. Overview of sensor measurements. Sensor linearization and characterization. Sensor classification. Signals and systems Sensor product selection guide.

MODULE 2 - SENSORS FOR ENGINES (9L)

Sensors and interfacing- Pressure, position, flow, temperature, humidity, speed, acceleration, oxygen, torque, light, distance and level.

MODULE 3 – ACTUATORS (9L)	
Principles of actuation and control. DC motors, stepper motors. Relays and solenoids. Hydraulic and pneumatic actuators.	
MODULE 4 - SENSORS FOR CHASSIS (9L)	
Sensors and interfacing techniques for Engine control, adaptive cruise control, braking control, traction control, steering and stability.	
MODULE 5 - INTELLIGENT SENSORS (9L)	
Sensors for intelligent transport systems. Lighting, wipers, climate control and electronic displays. Sensors for occupant safety .The digital vehicle intelligent vehicle systems	
LAB / MINI PROJECT / FIELD WORK	
TEXT BOOKS	
1	E Q Doebelin, Measurement Systems, Application and Design, 4th edition, McGraw-Hill, 2012
2	William B. Ribbens, Understanding Automotive Electronics, 5th edition, Newnes, 2016
REFERENCE BOOKS	
1	Ronald k. Jurgen, Automotive Electronics Handbook, 2nd edition, McGraw-Hill, 2010.
E BOOKS	
1	https://books.google.co.in/books?id=hSX0curtUWkC&printsec=frontcover&dq=automotive+sensor&hl=en&sa=X&ved=0ahUKEwiOtcHQs97ZAhXLMo8KHW-ICdEQ6AEIJjAA#v=onepage&q=automotive%20sensor&f=false
MOOC	
1	https://www.youtube.com/watch?v=0xI94ZDF54Y&list=PLBB950866E777EBE4
2	https://www.youtube.com/watch?v=AAbSwQlczDU

COURSE TITLE	ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY			CREDITS	3
COURSE CODE	ATC4269	COURSE CATEGORY	DE	L-T-P-S	3-0-0-0
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	The students should be able to Familiarize on concepts of EMI & EMC and Classification	1,5,6,7,12
2	The students should be able to Gain knowledge on EMI measuring instruments	1,5,6,7,12
3	The students should be able to Acquire the knowledge on National and Intentional standardizing organizations	1,5,6,7,12
4	The students should be able to Attain the knowledge on the process of Control Methods And Fixes of EMC & EMI	1,5,6,7,12

Prerequisites : Nil

MODULE 1 - BASIC CONCEPTS OF EMI & EMC (9L)

Definition of EMI and EMC with examples, Classification of EMI/EMC - CE, RE, CS, RS, Units of Parameters, Sources of EMI, EMI coupling modes - CM and DM, ESD Phenomena and effects, Transient phenomena and suppression.

MODULE 2 – EMI MEASUREMENTS (9L)

Basic principles of RE, CE, RS and CS measurements, EMI measuring instruments- Antennas, LISN, Feed through capacitor, current probe, EMC analyzer and detection t6echnique open area site, shielded anechoic chamber, TEM cell.

MODULE 3– EMC STANDARD AND REGULATIONS (9L)

National and Intentional standardizing organizations- FCC, CISPR, ANSI, DOD, IEC, CENEEC, FCC CE and RE standards, CISPR, CE and RE Standards, IEC/EN, CS standards, Frequency assignment - spectrum conversation.

MODULE 4- EMI CONTROL METHODS AND FIXES (9L)

Shielding, Grounding, Bonding, Filtering, EMI gasket, Isolation transformer, opto isolator.

MODULE 5- EMC DESIGN AND INTERCONNECTION TECHNIQUES (9L)

Cable routing and connection, Component selection and mounting, PCB design- Trace routing, Impedance control, decoupling, Zoning and grounding

TEXT BOOKS

1. Prasad Kodali.V – Engineering Electromagnetic Compatibility – S.Chand&Co – New Delhi – 2010
2. Clayton R.Paul – Introduction to Electromagnetic compatibility – Wiley & Sons – 2012

REFERENCE BOOKS

1 Keiser – Principles of Electromagnetic Compatibility – Artech House – 3rd Edition – 2014

2 Donwhite Consultant Incorporate – Handbook of EMI / EMC – Vol I – 2015

E-BOOK

1 https://books.google.co.in/books/about/A_Handbook_Series_on_Electromagnetic_Int.html?id=2OpSAAAAMAAJ&redir_esc=y

MOOC

1 http://www.nptel.ac.in/syllabus/syllabus_pdf/117108043.pdf

COURSE TITLE	HEAT AND MASS TRANSFER			CREDITS	3
COURSE CODE	ATC4270	COURSE CATEGORY	DE	L-T-P-S	3-0-0-0
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-4				

CO	COURSE OUTCOMES	PO
1	Familiarize on the concept and application of conduction.	1,2,3,4,6,7,12
2	Acquire the knowledge on concept and application of convection	1,2,3,4,6,7,12
3	Gain knowledge on the concept and application of radiation	1,2,3,4,6,7,12
4	Attain knowledge on the principle of heat transfer and heat exchangers.	1,2,3,4,6,7,12
5	Familiarize with the principle of mass transfer	1,2,3,4,6,7,12

Prerequisites : Nil

MODULE 1 - CONDUCTION (9L)

Basic Concepts - Mechanism of Heat Transfer - Conduction, Convection and Radiation General Differential equation of Heat Conduction - Fourier Law of Conduction Cartesian and Cylindrical Coordinates - One Dimensional Steady State Heat Conduction - Conduction through Plane Wall, Cylinders and Spherical systems - Composite Systems - Conduction with Internal Heat Generation - Extended Surfaces - Unsteady Heat Conduction - Lumped Analysis - Use of Heislers Chart.

MODULE 2 – CONVECTION (9L)

Basic Concepts - Convective Heat Transfer Coefficients - Boundary Layer Concept - Types of Convection - Forced Convection - Dimensional Analysis - External Flow - Flow over Plates, Cylinders and Spheres - Internal Flow - Laminar and Turbulent Flow - Combined Laminar and Turbulent – Flow over Bank of tubes - Free Convection - Dimensional Analysis - Flow over Vertical Plate, Horizontal Plate, Inclined Plate, Cylinders and Spheres

Suggested Reading: Frank P. Incropera and David P. DeWitt, "Fundamentals of Heat and Mass Transfer", John Wiley and Sons, 1998.

MODULE 3 - HEAT TRANSFER AND HEAT EXCHANGERS (9L)

Nusselts theory of condensation-pool boiling, flow boiling, correlations in boiling and condensation. Types of Heat Exchangers - LMTD Method of heat Exchanger Analysis - Effectiveness - NTU method of Heat Exchanger Analysis - Overall Heat Transfer Coefficient - Fouling Factors.

MODULE 4 – RADIATION (9L)

Basic Concepts, Laws of Radiation - Stefan Boltzman Law, Kirchoff Law -Black Body Radiation - Grey body radiation Shape Factor Algebra - Electrical Analogy - Radiation Shields -Introduction to Gas Radiation.

MODULE 5 - MASS TRANSFER (9L)

Basic Concepts - Diffusion Mass Transfer - Fick's Law of Diffusion - Steady state Molecular Diffusion - Convective Mass Transfer - Momentum, Heat and Mass Transfer Analogy - Convective Mass Transfer Correlations

LAB / MINI PROJECT / FIELD WORK

TEXT BOOKS	
1	1.Sachdeva R C, "Fundamentals of Engineering Heat and Mass Transfer" New Age International, 1995.
2	2.Yadav R "Heat and Mass Transfer" Central Publishing House, 2015.
REFERENCE BOOKS	
1	Ozisik M.N, "Heat Transfer", McGraw-Hill Book Co., 2014.
2	Nag P.K, "Heat Transfer", Tata McGraw-Hill, New Delhi, 2012.
3	Holman J.P "Heat and Mass Transfer" Tata McGraw-Hill, 2010.
4	Kothandaraman C.P "Fundamentals of Heat and Mass Transfer" New Age International
E BOOKS	
1	http://www.springer.com/in/book/9780792356370
2	http://www.springer.com/in/book/9783540250012
MOOC	
1	https://www.mooc-list.com/course/heat-transfer-saylororg
2	https://onlinecourses.nptel.ac.in/noc18_ch08

COURSE TITLE	ALTERNATE FUELS AND ENERGY SYSTEMS			CREDITS	3
COURSE CODE	ATC4271	COURSE CATEGORY	DE	L-T-P-S	3-0-0-0
CIA	50 %			ESE	50 %
LEARNING LEVEL	BTL- 3				

CO	COURSE OUTCOMES	PO
1	The students should be able to familiarize on various alternate fuels.	1,2,6,7,12
2	The students should be able to gain knowledge on the details of methanol and ethanol usage, storage, chemical structure.	1,2,6,7,12
3	The students should be able to acquire knowledge of natural gas, LPG, hydrogen and biogas.	1,2,6,7,12
4	The students should be able to attain the performance characteristics of various vegetable oils.	1,2,6,7,12
5	The students should be able to familiarize with electric and hybrid vehicles.	1,2,3,5,6,7,12

Prerequisites : Nil

MODULE 1 – INTRODUCTION (9L)

Need for alternate fuel- Evolution- Availability and properties of alternate fuels, general use of alcohols, LPG, Hydrogen, Ammonia, CNG and LNG, Vegetable oils, water and biogas, Merits and demerits of various alternate fuels. Government norms and Subsidiary. Introduction to alternate energy sources. Like EV, Hybrid, Semi-Hybrid, Fuel cell, Nuclear Cars and Solar car,

MODULE 2 – ALCOHOLS (9L)

Availability –Source- Types of Alcohols- Properties as engine fuel – Octane Number- Self Ignition Temperature- Calorific Value. Fuel and Engine Modification. Blending with diesel and gasoline- Dual Fuel Operation- Energy share Calculation. Performance in SI engine- Combustion characteristics in CI engines- Emission characteristics. Problems of using alcohols in diesel engine. DME, DEE properties- storage, Performance in SI & CI Engines.

MODULE – 3 NATURAL GAS, LPG, HYDROGEN AND BIOGAS (9L)
Availability of CNG, properties, Difficulties of using gaseous fuel in IC engines - Modification required using in engines, Performance and emission characteristics of CNG using LPG in SI & CI engines, Performance and emission of LPG. Hydrogen; Storage and handling, properties – flame speed- flammability. Performance emission and Combustion behavior of hydrogen in CI engine - safety aspects and design of gaseous fuel induction system.
MODULE – 4 VEGETABLE OILS (9L)
Design of engine, optimum selection of operating variables for control of emissions, Crankcase and evaporative emission control, Thermal and catalytic reactors, Elements of catalytic reactors, catalysts and substrates, Cold start HC control. EGR, Lean de-NOx catalysts, water injection, NOx traps and SCR. Diesel particulate filters (DPF), DPF regeneration, Secondary air injection. Fuel modifications. Two stroke engine pollution control.
MODULE 5 – ELECTRIC, HYBRID, FUEL CELL AND SOLAR CARS (9L)
Need of E-Vehicle. Layout of an electric vehicle, Advantage and limitations, Specifications, System components, Electronic control system, High energy and power density batteries, battery design - Charging Station – Cost analysis. Hybrid vehicle – type- advantages and limitations. Fuel cell vehicles, Solar powered vehicles.
LAB / MINI PROJECT/FIELD WORK

TEXT BOOKS	
1	Richard.L.Bechfold - Alternative Fuels Guide Book - SAE International Warrendale - 2007.
2	Ganesan, V- "Internal Combustion Engines"- Tata McGraw-Hill Co.- 2013.
REFERENCE BOOKS	
1	MaheswarDayal - "Energy today & tomorrow" - I & B Horishr India - 2012.
2	Nagpal - "Power Plant Engineering" - Khanna Publishers - 2011.
3	Alcohols as motor fuels progress in technology" - Series No.19 - SAE Publication USE - 1980. SAE paper nos. 840367, 841333, 841334, 841156, Transactions, SAE, USA.
E BOOKS	
1.	https://books.google.co.in/books/about/The_Biodiesel_Handbook_Second_Edition.html?id=kI8cQAAACAAJ&redir_esc=y
2.	http://www.liu.umd.edu/files/Handbook%20of%20Alternative%20Fuel%20Technologies.pdf
MOOC	
1	http://www.liu.umd.edu/files/Handbook%20of%20Alternative%20Fuel%20Technologies.pdf
2	http://www.liu.umd.edu/files/Handbook%20of%20Alternative%20Fuel%20Technologies.pdf

LIST OF DEPARTMENTAL ELECTIVES - SEMESTER V

COURSE TITLE	ARTIFICIAL INTELLIGENCE			CREDITS	3
COURSE CODE	ATC4351	COURSE CATEGORY	DE	L-T-P-S	3-0-0-0
CIA	50%			ESE	50%
LEARNING LEVEL	BTL - 3				

CO	COURSE OUTCOMES	PO
1	Study the concepts of Artificial Intelligence.	1,2,3,5,6,8
2	Learn the methods of solving problems using Artificial Intelligence	1,2,3,5,6,8
3	Introduce the concepts of Expert Systems and machine learning	1,2,3,5,6,8
4	Identify problems that are amenable to solution by AI methods	1,2,3,5,6,8
5	Formalize a given problem in the language/framework of different AI methods.	1,2,3,5,6,8

Prerequisites : Nil

MODULE –1 : INTRODUCTION TO Al AND PRODUCTION SYSTEMS (9L)

Introduction to AI-Problem formulation, Problem Definition -Production systems, Control strategies, Search strategies. Problem characteristics, Production system characteristics - Specialized production system- Problem solving methods - Problem graphs, Matching, Indexing and Heuristic functions -Hill Climbing-Depth first and Breath first, Constraints satisfaction - Related algorithms, Measure of performance and analysis of search algorithms

MODULE –2 : REPRESENTATION OF KNOWLEDGE (9L)

Game playing - Knowledge representation, Knowledge representation using Predicate logic, Introduction to predicate calculus, Resolution, Use of predicate calculus, Knowledge representation using other logic-Structured representation of knowledge.

MODULE – 3 : KNOWLEDGE INFERENCE (9L)

Knowledge representation -Production based system, Frame based system. Inference - Backward chaining, Forward chaining, Rule value approach, Fuzzy reasoning - Certainty factors, Bayesian Theory-Bayesian Network-Dempster - Shafer theory

MODULE – 4 : PLANNING AND MACHINE LEARNING (9L)

Basic plan generation systems - Strips -Advanced plan generation systems – K strips -Strategic explanations -Why, Why not and how explanations. Learning- Machine learning, adaptive Learning.

MODULE –5 : EXPERT SYSTEMS (9L)

Expert systems - Architecture of expert systems, Roles of expert systems - Knowledge Acquisition – Meta knowledge, Heuristics. Typical expert systems - MYCIN, DART, XOON, Expert systems shells.

LAB / MINI PROJECT/FIELD WORK

TEXT BOOKS

1. Kevin Night and Elaine Rich, Nair B., “Artificial Intelligence (SIE)”, Mc Graw Hill- 2018.
2. Stuart Russel and Peter Norvig “AI – A Modern Approach”, 2 nd Edition, Pearson Education 2010.

REFERENCE BOOKS	
1.	Deepak Khemani “Artificial Intelligence”, Tata Mc Graw Hill Education 2013
E BOOKS	
1.	http://www.springer.com/gp/book/9781402081507
MOOC	
1.	www.nptel.ac.in

COURSE TITLE	AUTOMOTIVE ACCIDENT INVESTIGATION			CREDITS	3
COURSE CODE	ATC4352	COURSE CATEGORY	DE	L-T-P-S	3-0-0-0
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	The students should be able to Familiarize on the effect of the forces acting on a vehicle in motion and during a collision	1,2,4,6,12
2	The students should be able to Acquire the knowledge on brake and tyre characteristics and their Influence on a vehicle.	1,2,4,6,12
3	The students should be able to Develop knowledge on the Accident reconstruction techniques	1,2,4,6,12
4	The students should be able to Gain knowledge on damage assessment and cost estimation	1,2,4,6,12

Prerequisites : Nil

MODULE 1 – FORCES, EFFECT OF FRICTION & VEHICLE COLLISION (9L)

Understand the forces acting on a vehicle when in motion and during a collision Forces and motion: applications of mass, weight, force, Newton‘s Laws of motion and equations of motion on a moving vehicle; determination and effect of tractive effort and tractive resistance.

Effect of friction: definition of friction and the co-efficient of friction; factors affected e.g. skidding, sliding, rolling; calculations e.g. to determine stopping distances, cornering speeds, effects of gradient, rolling and air friction; deceleration and braking theory; brake efficiency; Vehicle collision: Collision with moving and stationary bodies; principle of conservation of momentum; principle of conservation of energy; calculation of impact speeds; interpretation of projective behavior e.g. objects projected from a vehicle on impact; load transfer.

MODULE 2 – BRAKES AND ITS BEHAVIOUR (9L)

Understand the influence of vehicle brake characteristics on the behavior of a vehicle Types of brake circuits: single line braking circuit; front and rear split circuit; diagonally split circuit; H-split; L-split; full dual circuit; air/hydraulic circuits; air brake circuits; Types of pressure valves: pressure limiting valves; load sensing valve; inertia sensing valve. Characteristics of brake fluid: types of fluid; constituents; contamination boiling point; vapor lock point Brake defects: braking faults eg effect of air in brake fluid, temporary loss of breaking, air contamination, heat soak, uneven braking, brake

fade, drum expansion. Legal requirements: legal requirements with respect to hydraulic and air braking systems eg the design and use of braking systems are governed by two sets of regulations, the Construction and Use regulations OF ARAI and International standards.

MODULE 3- TYRE BEHAVIOUR AND CHARACTERISTICS (9L)

Understand the influence of vehicle tyre characteristics on the behavior of a vehicle Tyre markings: car and truck markings; nominal rim diameter; nominal section width; overall diameter; section height; load index; speed index; nominal aspect ratio; load capacity Vehicle handling and tyre behavior: slip angle; self-aligning torque; cornering force; centrifugal force; cornering power; instantaneous center; neutral steer; under steer; over steer; effects of fault suspension dampers on vehicle handling Factors affecting adhesion: co-efficient of friction; effect on adhesion as retardation is increased on various types of surface and weather conditions; skidding; aquaplaning Tyre defects: under inflation; over inflation; lumps; bulges; casing break-up; cuts; exposed cords; inspection of tyre valve; reasons for tyre blow-out; effects of impact or concussion damage.

MODULE – 4 ACCIDENT RECONSTRUCTION TECHNIQUES (9L)

Tyre marks and vehicle damage: skid marks; scuff marks; deceleration scuff and Tyre prints; debris; secondary impact; vehicle position before and after impact. Accident scene construction plans: the immediate scene, intermediate scene, extended scene; sketch plans and scale plans; triangulation, base line and offsets; use of computer software e.g. CAD

MODULE- 5 DAMAGE ASSESSMENT AND COST EVALUATION (9L)

Damage assessment: vehicle details; vehicle condition; body repair; mechanical components; geometry; production of damage assessment report; post-repair inspection. Repair costing Thatcham repair times; manufacturers repair times computer estimating paint and materials; cash in lieu of repairs Repair methods and materials: suitability of repair methods; vehicle construction; materials used in vehicle construction; method and types of joining; plastic repairs

REFERENCE BOOKS

1.	Vehicular Accident Investigation and Reconstruction, Donald J Van Kirk CRC Press, 01-Jan-2012 - Law - 512 pages
2.	Accident investigation in the private sector - Volume One, Two and Three By Jack Murray, M.B.A., C.L.I., C.F.E.
3.	Road Vehicle Dynamics, Rao S, Dukkipatti
4.	Vehicle Accident Analysis and Reconstruction Methods, Second Edition, Raymond M. Brach, Matthew Brach - Published by SAE International with a Product Code of R-397, ISBN of 978-0-7680-3437-0, and 442 pages in a hardbound binding.

MOOC

1	Motorsport websites like www.motorsport.com www.motorsportwebsites.co.uk / www.motorsportmagazine.com

COURSE TITLE	MANUFACTURING PROCESS OF AUTOMOTIVE COMPONENTS			CREDITS	3
COURSE CODE	ATC4353	COURSE CATEGORY	DE	L-T-P-S	3-0-0-0
CIA	50%			ESE	50%
LEARNING LEVEL	BTL- 3				

CO	COURSE OUTCOMES	PO
1	The students should be able to familiarize on powder metallurgy technology	1,6,7,12
2	The students should be able to acquire the knowledge on forming process involved in various automotive components	1,6,7,12
3	The students should be able to obtain knowledge on casting & machining process of various automotive components	1,6,7,12
4	The students should be able to gain knowledge on various gears manufacturing process	1,6,7,12
5	The students should be able to expertise in recent trends of Automotive manufacturing	1,6,7,12

Prerequisites : Nil

MODULE 1 - POWDER METALLURGY (9L)

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 2 - FORMING PROCESS (9L)

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. Hydro forming: Process, hydro forming 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 3 - CASTING AND MACHINING (9L)

Sand casting of cylinder block and liners - Centrifugal casting of flywheel, piston rings, bearing bushes and liners, permanent mould casting of piston, pressure die casting of carburetor and other small auto parts. Machining of connecting rods - crank shafts - cam shafts - pistons - piston pins - piston rings - valves - front and rear axle housings - flywheel - Honing of cylinder bores - copy turning and profile grinding machines.

MODULE 4 - GEAR MANUFACTURING (9L)

Gear milling, Hobbing and shaping - Gear finishing and inspection.

MODULE 5 - RECENT TRENDS IN MANUFACTURING OF AUTO COMPONENTS (9L)

Powder injection molding - Shot peen hardening of gears - Production of aluminum MMC liners for engine blocks - Plasma spray coated engine blocks and valves - Recent developments in auto body panel forming - Squeeze casting of pistons - aluminum composite brake rotors. Friction welding of Dissimilar metal components.

TEXT BOOKS	
1	Heldt.P.M., High Speed Combustion Engines, Oxford publishing co., New York, 2010.
REFERENCE BOOKS	
1	Haslehurst.S.E., Manufacturing Technology, ELBS, London, 2010.
2	Rusinoff., Forging and forming of metals, D.B, Taraporevla Son & co Pvt ltd, Mumbai, 2005
3	Sabroff.A.M. & Others, Forging Materials & Processes, Reinhold Book Corporation, NewYork, 2008
4	Upton, Pressure Die Casting, Pergamon Press, 1985.
5	High Velocity Forming of metals, ASTME, Prentice Hall of India (P) Ltd., New Delhi, 2010.
E BOOKS	
1	http://ceb.ac.in/knowledge-center/E-BOOKS/The%20Automotive%20Development%20Process%20-%20Daniel%20Sorensen.pdf
2	https://www.niir.org/books/book_pdf/101230/niir-complete-book-on-production-automobile-components-allied-products.pdf
MOOC	
1	https://www.mooc-list.com/course/advanced-manufacturing-process-analysis-coursera
2	https://www.mooc-list.com/course/advanced-manufacturing-enterprise-coursera

COURSE TITLE	ECU MODEL BASED SYSTEM DESIGN			CREDITS	3
Course Code	ATC4354	Course Category	DE	L-T-P-S	3-0-0-0
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	The students should be able to Familiarize on concepts of ECU design for automotive applications.	1,3,4,5,8,12
2	The students should be able to Gain knowledge on software modules and hardware modules for ECU design	1,3,4,5,8,12
3	The students should be able to Acquire the knowledge to solve complex problems in Model based system design & hardware in-the-loop simulation	1,3,4,5,8,12
4	The students should be able to Attain the knowledge on the process of Verification and Validation of HIL test results with real world result Hardware in-the-Loop testing.	1,3,4,5,8,12

Prerequisites : Nil

MODULE 1 – ECU DESIGN CONCEPT (9L)

The concepts of ECU design for automotive applications- Need for ECUs- advances in ECUs for automotive- design complexities of ECUs-V-Model for Automotive ECU ‘s Architecture of an advanced microcontroller used in the design of automobile ECUs -analog and digital Interfaces-Controllers for ECUs: Understanding different ECUs in an automobile-challenges and design requirements of ECU design - selection of sensors and interfaces for ECU design.

MODULE 2 – MATHEMATICAL MODELING AND VALIDATION (9L)
Top level blocks diagram development for ECUs- design of software modules and hardware modules for ECU design- mathematical modeling of automotive Applications-Designing-modelling and porting of software models on ECUs-development of test setup for ECU testing- System level testing: Experimental setup for ECU validation-system level optimization for cost- reliability check and endurance check of ECUs- signal integrity check and EMI/EMC analysis- integration of ECUs into automotive
MODULE 3– MODEL BASED SYSTEM DESIGN (9L)
Introduction to Model based system design -hardware in-the-loop simulation- continuous and discrete simulation basics-modeling basics. Connection between Hardware and Simulation-Coupling concepts-simulator coupling and co-simulation, synchronization of co-simulations, basic coupling principles- Event Discrete Simulation-Real Time Workshop-Introduction to basic Simulink blocks, xPC target, Real Time Workshop-State flow and Real Time Embedded coder.
MODULE – 4 MODEL BUILDING WITH SIMULINK (9L)
Model Building with Simulink: Controller programming using model based system design for an automotive application using Simulink-Plant Modelling- Plant modelling using Simulink for the automotive application-PID controller design, analog output, targeting a processor for plant-Hardware Implementation-Design of ECU for automotive applications, interfacing of sensors and Actuators-System modelling and validation using test setup- Interfacing of software models with hardware design.
MODULE- 5 HARDWARE IN LOOP SIMULATION (9L)
System programming and development of experimental setup for hardware in loop simulation. Hardware in-the-Loop-Testing of plant separately, testing of controller separately and testing of plant and controller in the loop-System Verification and Validation-Comparing the HIL test results with real world result Hardware in-the-Loop testing- Experimental setup for HIL-HIL testing using dSPACE micro autobox, introduction to carmaker, building scenarios and vehicle analysis using carmaker- interfacing dSPACE with carmaker and case studies on micro autobox

TEXT BOOKS	
1	Frank Vahid and Tony Givargis, (2002)Embedded System Design: A Unified Hardware/Software Introduction, John Wiley & Sons Ronald K. Jurgen ,(1999), Automotive Electronics Handbook, McGraw-Hill .
2	Heywood, John B. (2018) Internal Combustion Engine Fundamentals, McGraw-Hill, New York
3	Hall, Douglas V, (2015) Microprocessors and Interfacing: Programming and Hardware, 2nd edition, Tata McGraw Hill
REFERENCE BOOKS	
1.	David E. Simon, (2015), An Embedded Software Primer, Pearson Education
2.	Ferguson, Colin R. (2010) Kirkpatrick, Allan T., Internal Combustion Engine - Applied
E-BOOK	
1	http://estc.dsr-company.com/images/b/b5/Automotive-embedded-systems.pdf
MOOC	
1	https://nptel.ac.in/courses/108103009/download/M10.pdf

COURSE TITLE	ADVANCED THEORY OF IC ENGINES			CREDITS	3
COURSE CODE	ATC4355	COURSE CATEGORY	DE	L-T-P-S	3-0-0-0
CIA	50%			ESE	50%
LEARNING LEVEL	BTL – 3				

CO	COURSE OUTCOMES	PO
1	Understand the concept of combustion in IC engines.	1,2,4,5,8,12
2	Gain knowledge about the combustion in SI and CI engines.	1,2,4,5,8,12
3	Gain insight on the development on recent technologies in IC engines.	1,2,4,5,8,12
4	Familiarize with the applications of engine management system on the engine performance and emissions.	1,2,4,5,8,12

Prerequisites : Nil

MODULE 1 - COMBUSTION PRINCIPLES (6L)

Combustion – Combustion equations, heat of combustion – chemical equilibrium and Dissociation -Theories of Combustion - Flammability Limits - Reaction rates - Laminar and Turbulent Flame Propagation in Engines. Introduction to spray formation and characterization.

Suggested Reading: Fuel properties, Adiabatic Flame temperature

MODULE 2 - COMBUSTION IN SI ENGINES (9L)

Stages of combustion, normal and abnormal combustion, knocking, variables affecting knock, Features and design consideration of combustion chambers. Flame structure and speed, Cyclic variations, Lean burn combustion, Stratified charge combustion systems. Heat release correlations.

Suggested Reading: Fuel qualities affecting knocking, Types of combustion chambers, p-theta graphs, HRR curves, Cumulative Heat release, ignition delay, combustion duration.

MODULE 3 - COMBUSTION IN CI ENGINES (9L)

Stages of combustion, vaporisation of fuel droplets and spray formation, air motion, swirl measurement, knock and engine variables, Features and design considerations of combustion chambers, delay period correlations, heat release correlations, Influence of the injection system on combustion, Direct and indirect injection systems.

Suggested Reading: K-Jetronic, KE-Jetronic, Motronic Systems

MODULE 4 - ADVANCES IN IC ENGINES (9L)

Surface ignition concept and multi fuel engines, Lean Burn Engines, LHR engines, Stratified charge Engines, HCCI engines - Performance and emission characteristics, Merits and demerits. Use of Nano Technology in IC engines.

Suggested Reading: Fuel qualities affecting knocking, Types of combustion chambers, p-theta graphs, HRR curves, Cumulative Heat release, ignition delay, combustion duration.

MODULE 5 - IGNITION SYSTEMS AND ENGINE MAPPING (12L)

Computer control of SI & CI engines for better performance and low emissions, Closed loop control of engine parameters of fuel injection and ignition.

Suggested Reading: Electronic ignition systems, ECU for controlling emissions, Ignition and Injection timing calculations.

LAB / MINI PROJECT/FIELD WORK

TEXT BOOKS	
1	John B. Haywood, "Internal Combustion Engine Fundamentals", McGraw-Hill Automotive Technology series.
REFERENCE BOOKS	
1	R.B. Mathur and R.P.Sharma, Internal Combustion Engines, Dhanapat Rai Publications,2010.
2	Richard Stone - "Introduction to IC Engines" – 4th edition – Macmilan.
3	B.P. Pundir Engine Combustion and Emission, Narosa Publishing House, 2011.,
4	Obert., Internal Combustion Engine and Air Pollution, International Text Book Publishers, 2009.
E BOOKS	
1	https://books.google.co.in/books?id=s9QNRTeYlXsC&printsec=frontcover&dq=advanced+theory+of+ic+engines&hl=en&sa=X&ved=0ahUKEwidgc_x5OrZAhWDx7wKHcKnDRsQ6AEIJjAA
2	https://books.google.co.in/books?id=Il2KBAAAQBAJ&printsec=frontcover&dq=advanced+theory+of+ic+engines&hl=en&sa=X&ved=0ahUKEwidgc_x5OrZAhWDx7wKHcKnDRsQ6AEIMTAC
3	https://books.google.co.in/books?id=UtxI5gXM1yQC&printsec=frontcover&dq=advanced+theory+of+ic+engines&hl=en&sa=X&ved=0ahUKEwidgc_x5OrZAhWDx7wKHcKnDRsQ6AEINzAD
4	https://books.google.co.in/books?id=mX1-OJBQ6ngC&printsec=frontcover&dq=advanced+theory+of+ic+engines&hl=en&sa=X&ved=0ahUKEwidgc_x5OrZAhWDx7wKHcKnDRsQ6AEISTAG
MOOC	
1	https://onlinecourses.iitk.ac.in/course/me359me359a-internal-combustion-engines
2	https://ocw.mit.edu/courses/mechanical-engineering/2-61-internal-combustion-engines-spring-2008/
3	https://www.ifptraining.com/course/ic-engine-training-for-engineers.html

COURSE TITLE	OFF ROAD VEHICLES			CREDITS	3
COURSE CODE	ATC4356	COURSE CATEGORY	DE	L-T-P-S	3-0-0-0
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	The students should be able to Familiarize with the construction and working of various Earth moving equipment	1,6,7,8,12
2	The students should be able to Acquire the knowledge on construction and working of various constructional equipment	1,6,7,8,12
3	The students should be able to Gain knowledge on the construction and working of Farm equipment	1,6,7,8,12
4	The students should be able to Familiarize with the working of Industrial equipment	1,6,7,8,12
5	The students should be able to Develop the knowledge on working of Military equipment	1,6,7,8,12

Prerequisites : Nil

MODULE 1 - EARTH MOVING AND MINING EQUIPMENT (9L)

Construction layout, capacity and applications of earthmovers like dumpers, front-end loaders, bulldozers, backhoe loaders etc. Selection criteria of prime mover for dumpers and front end loaders based on vehicle performance characteristics. Rock drilling machines, Mineral handling Equipment.

Suggested Reading: Scrappers

MODULE 2 - CONSTRUCTIONAL AND ROAD EQUIPMENT (9L)

Layout of Constructional and Road equipment: Tower cranes, hoist, excavators, motor graders, Soil Compactors, Road paving machines, concrete ready mixers for construction of bridges and their working principles.

Suggested Reading: Road Rollers

MODULE 3 - FARM AND FORESTRY EQUIPMENT (9L)

Classification of tractors – Main components of tractor. Working attachment of tractors – Auxiliary equipment – Trailers and body tipping mechanism - plowing - paddy plantation machine, harvesting machines, Tree cutting and log handling machines.

Suggested Reading: Tractor hydraulic system

MODULE 4 - INDUSTRIAL EQUIPMENT (9L)

Constructional features, capacity and stability of Overhead cranes, Mobile cranes, jib cranes. Forklifts. Towing vehicles, Container Handing machines.

Suggested Reading: Material handling equipment

MODULE 5 - MILITARY VEHICLES (9L)

Special features and constructional details of tankers, gun carriers and Military transport vehicles, 360° Surveillance platforms.

Suggested Reading: Main Battle Tank(MBT)

TEXT BOOKS	
1	Wong.J.T., " Theory of Ground vehicles ", John Wiley & Sons, New York.
2	Construction planning, Equipment and Methods - Robert L. Peurifoy, William B. Ledbrtter, Clifford J. Schexnayder - McGrawHill, Fifth Edition.
REFERENCE BOOKS	
1	Construction Equipment Management by John Schaufelberger
2	Abrosimov. K. Bran berg.A. andKatayer.K., " Road making Machinery ", MIR Publishers, Moscow
3	Rodichev and G.Rodicheva, Tractor and Automobiles, MIR Publishers.
E BOOKS	
1	*https://www.studynama.com/.../construction-techniques-equipment-practices-ebook-n...*
2	*https://www.kopykitab.com/Construction-Equipment-and-Job-Planning-eBook*
3	https://bizreport.tradepub.com/category/construction-equipment/1018
MOOC	
1	https://www.iti.com/heavy-equipment-training
2	www.news.mit.edu/2015/mitx-mooc-helps-farmer-develop-autonomous-tractor-app

LIST OF DEPARTMENTAL ELECTIVES - SEMESTER VI

COURSE TITLE	VEHICLE TESTING			CREDITS	3
COURSE CODE	ATC4366	COURSE CATEGORY	DE	L-T-P-S	3-0-0-0
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	Know the dynamics of the vehicle.	1,5,12
2	Appreciate the tools available for solving the problems in the vehicle dynamics	1,5,12
3	Appreciate the problems associated with the vehicle development	1,5,12
4	Use the various vehicle testing methods to extract the maximum performance	1,5,12

Prerequisites : Nil

MODULE 1 - TYRE CHARACTERISTICS (8L)

Tyre Rating, Terminology & Axis system, Cornering properties, Camber thrust, Tyre forces & Moments, Rolling Resistance, Tractive Effort & Longitudinal Slip, Performance of Tyres in Wet surfaces, Ride properties, Tyre Vibrations.

MODULE 2- AERODYNAMICS (10L)

SAE Aerodynamic Axis System, Mechanics of Air Flow around a Vehicle, Pressure Distribution, Aerodynamic Forces, Drag Component, Drag, Side & Lift forces, Various Moments, Cross Wind Sensitivity, Aerodynamic Testing.

MODULE 3 – VEHICLE DYNAMICS DEVELOPMENT & RACE CAR DESIGN (10L)

Diagram – Conceptual Development, General Uses. Vehicle Capability, Race Car Applications.

Race Car Design – Design process, Constraints & Specification. Phases of Vehicle Dynamics Development

MODULE 4 - CHASSIS SETUP, DEVELOPMENT & TESTING (8L)

Chassis Set-Up: Primary & Secondary, Driver-Vehicle Relationship, Desirable Vehicle Characteristics, Fundamentals of Testing, Track Test Program Planning, Test Methodology, Circular Skid pad testing.

MODULE 5 - CONTROL SYSTEM TECHNIQUES (9L)

Control system techniques frequency domain analysis, robust control design, root locus, optimal control, online parameter identification, control of nonlinear systems and adaptive control.

TEXT BOOKS

1	Philip H Smith, John C Morrison- Scientific design of exhaust intake systems, Bentley publishers III edition.
2	P M Heldt- High speed combustion engines, Oxford Publishers.

REFERENCE BOOKS

1.	Hong Cheng ,Autonomous Intelligent Vehicles: Theory, Algorithms, and Implementation, ISBN-13: 978-0768079937 ,Springer 2010
2.	Markus Maurer , Autonomous Driving: Technical, Legal and Social Aspects , ISBN-13: 978-3662488454 Springer 2012

E- BOOKS	
1	http://www.ebooklibrary.org/articles/autonomous_car
2	https://link.springer.com/book/10.1007/978-3-662-48847-8
MOOC	
1.	https://www.mooc-list.com/tags/autonomous-vehicles
2.	https://www.edx.org/course/autonomous-mobile-robots-ethx-amrx-2

COURSE TITLE	PERFORMANCE TUNING OF I.C. ENGINES			CREDITS	3
COURSE CODE	ATC4367	COURSE CATEGORY	DE	L-T-P-S	3-0-0-0
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	The opportunity to know the engines better.	1,5,6,8,12
2	The understanding of the performance needs of the	1,5,6,8,12
3	motorsports	1,5,6,8,12
4	Impact of the components on the working aspects of	1,5,6,8,12

Prerequisites : Nil

MODULE 1 - INTRODUCTION (8L)

Engine Design features-Bore dia, stroke Length, Con rod-crank ratio,no and arrangement of cylinders, overall engine dimensions, compression ratio, piston, Connecting Rod, Crank Shaft, Cam Shaft design, use of emerging technologies in engine design, new materials, balancing, valve geometry.

MODULE 2- ENGINE PERFORMANCE CHARACTERISTICS , MAPPING AND PERFORMANCE CURVES (10L)

Torque, power (IP & BP), mechanical, thermal and volumetric efficiency, mep ,sfc ,emission control assessment.Effect of Injection timing, Influence of Spark Advanced / Retarder on engine power emissions, Graphical account of the role of map data, mapping procedure, visual interpretation of a fuel map and ignition map, for different engine performance applications like economy ,power, torque etc.,

Curves for SI/CI and pressure charged, rotary engines ,engine test at various speeds, critical evaluation of a/f ratio,T,P,CC,FC, significance of the standards used to measure engine power BSAU/DIN/SAE/EEC, application of engine performance curves and design to the selection of appropriate power units for specific tasks

MODULE 3 – INTAKE DESIGN AND CYLINDER FILLING (10L)

General requirements- eliminatory interferences- long branches- duct length- individual pipe- pipe shape-varying diameter- diffuser shape- designers comments- fact and fancy- combined systems- manifold pressure- triumph- Vauxhall design. Flow through inlet valve- cylinder pressure- manifold pressure-individual duct- air intake length- combined ramming.

MODULE – 4 : INTAKE & EXHAUST DESIGN MODIFICATION (8L)	
Propagation of sound waves and its importance- pressure phenomena and its application includes- resonance, pressure in long pipe and independence of vibration. Silencer design and considerations- sound reduction- tail pipe size- silencing motorcycle type engines- back pressure silencer and testing methods with further experiments.	
MODULE – 5 : NUMERICAL ANALYSIS (9L)	
Numerical analysis techniques of flow and combustion characteristics of an engine using FEA/CFD softwares, methodology, procedures constraints	
TEXT BOOKS	
1	Philip H Smith, John C Morrison- Scientific design of exhaust intake systems, Bentley publishers III edition.
2	P M Heldt- High speed combustion engines, Oxford Publishers.
REFERENCE BOOKS	
1.	Hong Cheng ,Autonomous Intelligent Vehicles: Theory, Algorithms, and Implementation, ISBN-13: 978-0768079937 ,Springer 2010
2.	Markus Maurer , Autonomous Driving: Technical, Legal and Social Aspects , ISBN-13: 978-3662488454 Springer 2012
E- BOOKS	
1	http://www.ebooklibrary.org/articles/autonomous_car
2	https://link.springer.com/book/10.1007/978-3-662-48847-8
MOOC	
1.	https://www.mooc-list.com/tags/autonomous-vehicles
2.	https://www.edx.org/course/autonomous-mobile-robots-ethx-amrx-2

COURSE TITLE	SIMULATION OF IC ENGINES			CREDITS	3
COURSE CODE	ATC4368	COURSE CATEGORY	DE	L-T-P-S	3-0-0-0
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	Know about the heat of reaction in an engine and how the complete combustion occurring in an engine.	1,2,3,4,5,12
2	Know about the adiabatic flame temperature for constant volume and constant pressure process for combustion and the deviation between an actual and an air standard cycle of an IC engine	1,2,3,4,5,12
3	Know the concept of fuel vaporization and its effect in the performance of an engine during combustion and the working of an engine during part-throttle and full throttle condition.	1,2,3,4,5,12
4	Know the concept of progressive combustion, gas exchange process during combustion how the computer coding is done to understand the concept of combustion in an IC engine	1,2,3,4,5,12
5	Know about the simulation in a 2 stroke engine such as scavenging and the main difference between an SI and CI engine, and to know about the heat transfer and gas exchange process.	1,2,3,4,5,12

Prerequisites : Nil

MODULE 1 - INTRODUCTION (9L)

Introduction. Heat of reaction, complete combustion in C/H/O/N Systems, Constant volume adiabatic combustion, Constant pressure adiabatic combustion. Calculation of adiabatic flame temperature.

Suggested Reading: IC engine combustion

MODULE 2 - SI ENGINE SIMULATION WITH FUEL AIR AS WORKING MEDIUM (9L)

Deviation between actual and air standard cycles of operation- problems, SI engine simulation with adiabatic constant volume combustion with fuel and air being considered, Calculation of temperature drop due to fuel vaporization, Calculation of mean effective pressure, Torque and thermal efficiency at full throttle, Part throttle and supercharged conditions.

Suggested Reading: Air fuel rations

MODULE 3 - ACTUAL CYCLE SIMULATION IN SI ENGINES (9L)

Progressive combustion; Gas exchange process, Heat transfer process, Friction. Validation of the computer code with experimental data based on performance parameters and pressure crank angle diagram.

Suggested Reading: SI engine performance and emission

MODULE 5 - SIMULATION OF 2-STROKE SI ENGINE (9L)

Simulation of the scavenging process, determination of the pressure-crank angle variation, computation of performance parameters.

Suggested Reading: Two stroke engine

MODULE 5 - DIESEL ENGINE SIMULATION (9L)	
Main difference between SI and CI engine simulation, differences between ideal and actual cycles, Zero dimensional combustion model for diesel engine, Heat transfer and gas exchange processes. Performance prediction and comparison of results. **Suggested Reading:** Diesel engine combustion	
TEXT BOOKS	
1	Ganesan. V. - Computer Simulation of spark ignition engine process, -Universities Press (I) Ltd, Hyderabad - 2016.
2	Ganesan. V. - Computer Simulation of compression ignition engine process - Universities Press (I) Ltd, Hyderabad - 2010.
REFERENCE BOOKS	
1	Benson.R.S., Whitehouse. N.D., - Internal Combustion Engines - Pergamon Press, oxford .
2	Ramoss.A.L., - Modelling of Internal Combusion Engines Processes - McGraw-Hill Publishing Co., - 2012
MOOC	
1	https://www.youtube.com/watch?v=MDaN4I1DPKI
2	https://www.youtube.com/watch?v=t6D8S33qmTE

COURSE TITLE	ELECTRIC VEHICLE DESIGN			CREDITS	3
COURSE CODE	ATC4369	COURSE CATEGORY	DE	L-T-P-S	3-0-0-0
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	Understand the electrical vehicle functions and will be able to recognize various components required for different electrical vehicles.	1,2,3,4,5,8,12
2	Be able to choose components for a given electrical vehicle design and dimension them according to the specification.	1,2,3,4,5,8,12
3	Be able to integrate electrical vehicle components into a system and design for necessary controls.	1,2,3,4,5,8,12
4	Understand the requirement for the infrastructure, including various charging and power distribution solutions, required for electrical vehicles.	1,2,3,4,5,8,12
5	Be competent to evaluate an electrical vehicle design and infrastructure, design using simulation tools.	1,2,3,4,5,8,12

Prerequisites : basic electrical and electronic knowledge

MODULE 1 - BASICS OF ELECTRIC VEHICLE (9L)
Basics of Electric Vehicles, Electrical vehicles and their impact on CO2 and other exhaust emissions. Infrastructure required for electrical vehicles including charging, maintenance and repair.

MODULE 2 - TYPES OF MOTOR AND CONTROL (9L)
Basics of electric motors, induction motors, synchronous motors, torque production characteristics, Electrical motor topologies and operations principles: radial, axial and transversal flux motors. Torque production and characteristics of induction, permanent magnet and reluctance motors.
MODULE 3 - BATTERY AND CHARGING (9L)
The most common battery chemistries. The principles of the fuel cell operation. The energy storage system integrations and safety aspects. Requirements for charging and fueling infrastructure.
MODULE 4 - ELECTRIC VEHICLE DESIGN CONSIDERATIONS (9L)
Specification of the electrical vehicle in concordance with driving cycle and range requirements. Electrical vehicle design and design evaluation using the computational model. Basics of vehicle dynamics. The impact of electrical powertrain on vehicle dynamics. The opportunities provided by electrical power train. Electrical vehicle as a part of transport system, smart mobility, smart cities.
MODULE 5 - ELECTRIC VEHICLE INSTRUMENTATION (9L)
Refinement of the electrical vehicle power train model for the design power transmission efficiency assessment. Driving cycle estimation, electrical vehicle energy usage System level design for electrical vehicles in a transport system. Route planning, charging infrastructure. State-of-the-art-review, case: charging stations, electrical vehicles. Projections for the future
LAB / MINI PROJECT / FIELD WORK

TEXT BOOKS	
1	James Larminie and John Lowry, “Electric Vehicle Technology Explained “ John Wiley & Sons,2013
2	Iqbal Husain, “ Electric Vehicles-Design Fundamentals”, CRC Press,2012
REFERENCE BOOKS	
1	Ron HodKinson, “ light Weight Electric/ Hybrid Vehicle Design”, Butterworth Heinemann Publication,2015
2	Lino Guzzella, “Vehicle Propulsion System” Springer Publications,2005.
E BOOKS	
1	1.https://books.google.co.in/books?id=7AAWH_63HuAC&printsec=frontcover&dq=hybrid+and+electric+vehicle&hl=en&sa=X&ved=0ahUKEwignMeCtd7ZAhVJMI8KHaSSAx4Q6AEIUzAI#v=onepage&q=hybrid%20and%20electric%20vehicle&f=false
MOOC	
1	. https://www.youtube.com/watch?v=m2qvGJwTuBo
2	https://www.youtube.com/watch?v=AAbSwQlczDU

COURSE TITLE	MODERN VEHICLE TECHNOLOGY			CREDITS	3
COURSE CODE	ATC4370	COURSE CATEGORY	DE	L-T-P-S	3-0-0-0
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	The students should be able to Know about the hybrid vehicles, battery vehicles and magnetic track vehicles.	1,6,7,8,12
2	The students should be able to Describe the working of stratified charged/lean burn engines and hydrogen engines and the working of air suspension and closed loop suspension system.	1,6,7,8,12
3	The students should be able to Describe the working of antiskid braking system, regenerative braking safety cage and passenger comfort system and the internal and external pollution control through alternate fuels and power plants	1,6,7,8,12
4	The students should be able to Describe the working of catalytic converters and particulate filters, about noise pollution, measurement and control, the computer control for pollution and noise control for fuel economy	1,6,7,8,12
5	The students should be able to Describe the preparation and maintenance of proper road network and national highway network with automated roads and vehicles and the working of vehicle operation for safe and fast travel by using satellite.	1,6,7,8,12

Prerequisites : Nil

MODULE 1 - TRENDS IN POWER PLANTS (9L)

Hybrid vehicles - stratified charged / lean burn engines - Hydrogen engines – battery vehicles - Electric propulsion with cables - magnetic track vehicles.

MODULE 2 - SUSPENSION BRAKES AND SAFETY (9L)

Air suspension - Closed loop suspension - antiskid braking system, Retarders, Regenerative braking safety cage - air bags - crash resistance - passenger comfort.

MODULE 3 - NOISE & POLLUTION (9L)

Reduction of noise - Internal & external pollution control through alternate fuels / power plants - Catalytic converters and filters for particulate emission.

MODULE 4 - VEHICLE OPERATION AND CONTROL (9L)

Computer control for pollution and noise control and for fuel economy - Transducers and actuators - Information technology for receiving proper information and operation of the vehicle like optimum speed and direction.

MODULE 5 - VEHICLE AUTOMATED TRACKS (9L)

Preparation and maintenance of proper road network - National highway network with automated roads and vehicles - Satellite control of vehicle operation for safe and fast travel.

TEXT BOOKS	
1	Heinz Heisler, "Advanced Vehicle Technology" - Arnold Publication.
REFERENCE BOOKS	
1	Beranek.L.L., Noise reduction, McGraw Hill Book Co., Inc., Newyork, 2013.
2	Bosch Hand Book, 3rd Edition, SAE, 2013
E BOOKS	
1	https://books.google.co.in/books?id=aLgNET9YkS0C&pg=PA368&dq=modern+vehicle+technology+by+heinz&hl=en&sa=X&ved=0ahUKEwjsq9nVpZHaAhVKo48KHfXqDaAQ6AEIJjAA#v=onepage&q=modern%20vehicle%20technology%20by%20heinz&f=false
2	https://books.google.co.in/books?id=Ek0Cxo4rfnMC&printsec=frontcover&dq=modern+vehicle+technology+by+heinz&hl=en&sa=X&ved=0ahUKEwjsq9nVpZHaAhVKo48KHfXqDaAQ6AEINTAD#v=onepage&q=modern%20vehicle%20technology%20by%20heinz&f=false
MOOC	
1	www.moditech.com/en/training/modern-vehicle-technology-special
2	https://www.edx.org/course/hybrid-vehicles

COURSE TITLE	FUNDAMENTALS OF NANO SCIENCE			CREDITS	3
COURSE CODE	ATC4371	COURSE CATEGORY	DE	L-T-P-S	3-0-0-0
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	Will familiarize about the science of Nano materials	1,6,7,8,12
2	Will demonstrate the preparation of Nano materials	1,6,7,8,12
3	Will develop knowledge in Nano material	1,6,7,8,12
4	Will develop knowledge in characteristic Nano material	1,6,7,8,12
5	Will use Nano material in various applications	1,6,7,8,12

Prerequisites : Nil

MODULE 1 - INTRODUCTION (9L)

Nano scale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering- Classifications of nano structured materials- nano particles- quantum dots, nano wires-ultra-thin films multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only)

MODULE 2 - GENERAL METHODS OF PREPARATION (9L)

Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE

MODULE 3 - NANO MATERIALS (9L)	
Nano forms of Carbon - Buckminster fullerene- graphene and carbon nano tube, Single wall carbon Nano tubes (SWCNT) and Multi wall carbon nano tubes (MWCNT)- methods of synthesis(arc-growth, laser ablation, CVD routes, Plasma CVD), structure-property Relationships applications- Nano metal oxides-ZnO, TiO2,MgO, ZrO2, NiO, nano alumina, CaO, AgTiO2, Ferrites, Nano clays functionalization and applications-Quantum wires, Quantum dots-preparation, properties and applications	
MODULE 4 - CHARACTERIZATION TECHNIQUES (9L)	
X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques- AFM, SPM, STM, SNOM, ESCA, SIMS-Nano indentation	
MODULE 5 – APPLICATIONS (9L)	
Nano InfoTech: Information storage- nano computer, molecular switch, super chip, nano crystal, Nano biotechlogy: nano probes in medical diagnostics and biotechnology, Nano medicines, Targetted drug delivery, Bioimaging - Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS)- Nano sensors, nano crystalline silver for bacterial inhibition, Nano particles for sunbarrier products - In Photostat, printing, solar cell, battery	
LAB / MINI PROJECT / FIELD WORK	
TEXT BOOKS	
1	Edelstein. A.S. and R.C. Cammearata, eds., “Nano materials: Synthesis, Properties and Applications”, Institute of Physics Publishing, Bristol and Philadelphia.
2	John Dinardo. N, “Nano scale Characterisation of surfaces & Interfaces”, 2nd edition, Weinheim Cambridge, Wiley-VCH, 2010
REFERENCE BOOKS	
1	Timp .G, “Nano technology”, AIP press/Springer.
2	Akhlesh Lakhtakia (Editor),“The Hand Book of Nano Technology, Nano meter Structure, Theory, Modeling and Simulations”. Prentice-Hall of India (P) Ltd, New Delhi, 2012.
E BOOKS	
1	www.intechopen.com/books/advances-in-diverse-industrial-applications-of-nanocomposites
MOOC	
1	www.coursera.org/learn/nanotechnology

LIST OF DEPARTMENTAL ELECTIVES - SEMESTER VII

COURSE TITLE	VIBRATION AND NOISE CONTROL			CREDITS	3
COURSE CODE	ATC4451	COURSE CATEGORY	DE	L-T-P-S	3-0-0-0
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	Understand the various types of vibration with damping and without damping.	1,5,12
2	Understand the Various types of noise and it's measurement and analysis techniques.	1,5,12
3	Understand the various sources of noise from automobiles.	1,5,12
4	Understand the various noise controlling techniques.	1,5,12

Prerequisites : Nil

MODULE 1 – INTRODUCTION (9L)

Single degree of freedom, two degree of freedom, free, forced and damped vibrations modeling and simulation studies, model of an automobile, magnification factor, transmissibility, vibration absorber. Two degree of freedom system. modal analysis

MODULE 2 - NUMERICAL METHODS (9L)

Approximate methods for determining fundamental frequency, Dunkerleys lower bound, Rayleighs upper bound, Holzer method for closed coupled system and branched system.

MODULE 3 - CONTROL TECHNIQUES (9L)

Vibration isolation, tuned absorbers, untuned viscous dampers, damping treatments, application dynamic forces generated by IC engines, engine isolation, crank shaft damping, modal analysis of the mass elastic model shock absorbers.

MODULE 4 - AUTOMOTIVE NOISE SOURCES (9L)

Noise Characteristics of engines, engine overall noise levels, assessment of combustion noise, assessment of mechanical noise, engine radiated noise, intake and exhaust noise, engine accessory contributed noise, transmission noise, aerodynamic noise, tyre noise, brake noise.

MODULE 5 - SOURCE OF NOISE AND CONTROL (9L)

Methods for control of engine noise, combustion noise, mechanical noise, predictive analysis, palliative treatments and enclosures, automotive noise control principles, sound in enclosures, sound energy absorption, sound transmission through barriers

TEXT BOOKS

1	Singiresu S.Rao - "Mechanical Vibrations" - Pearson Education, ISBM -81-297-0179-0 - 2004.
2	Kewal Pujara "Vibrations and Noise for Engineers, Dhanpat Rai & Sons.

REFERENCE BOOKS

1	Liou L.W. and Liou F.W., “Rapid Prototyping and Engineering applications: A tool box for prototype development”, CRC Press, 2010.
2	Kamrani A.K. and Nasr E.A., “Rapid Prototyping: Theory and practice”, Springer, 2010.
3	Hilton P.D. and Jacobs P.F., “Rapid Tooling: Technologies and Industrial Applications”, CRC press, 2012

E BOOKS	
1	www.springer.com/gp/book/9780857295637
2	https://pro.sculpteo.com/en/ebooks/
3	https://www.amazon.in/...DIGITAL-MANUFACTURING-KL-ebook/dp/B074V42ZZ..
MOOC	
1	https://www.coursera.org/specializations/digital-manufacturing-design-technology
2	https://www.coursera.org/learn/digital-manufacturing-design
3	https://www.coursera.org/specializations/cad-design-digital-manufacturing

COURSE TITLE	DYNAMICS OF VEHICLE CONTROL			CREDITS	3
COURSE CODE	ATC4452	COURSE CATEGORY	DE	L-T-P-S	3-0-0-0
CIA	50%			ESE	50%
LEARNING LEVEL	BTL- 3				

CO	COURSE OUTCOMES	PO
1	The students will have the basic knowledge on mathematical modeling of various automotive system, time domain specification.	1,2,6,7,12
2	At the end of the course the students will have through knowledge over safety and security system, comfort system and intelligent vehicle system.	1,2,6,7,12

Prerequisites : Nil

MODULE 1 – INTRODUCTION (9L)

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

MODULE 2 - DRIVELINE CONTROL SYSTEM (9L)

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 tilt able steering column – steer by wire

MODULE 3 - SAFETY AND SECURITY SYSTEM (9L)

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 4 - COMFORT SYSTEM (9L)

Active suspension systems, requirement and characteristics, different types, Vehicle Handling and Ride characteristics of road vehicle, pitch, yaw, bounce control, power windows, thermal management system, adaptive noise control.

MODULE 5 - INTELLIGENT TRANSPORTATION SYSTEM (9L)

Traffic routing system - Automated highway systems - Lane warning system – Driver Information System, driver assistance systems - Data communication within the car, Driver conditioning warning

- Route Guidance and Navigation Systems – vision enhancement system - In-Vehicle Computing – Vehicle Diagnostics system – Hybrid / Electric and Future Cars – Case studies.	
TEXT BOOKS	
1	U. Kiencke, and L. Nielsen,Automotive Control Systems,SAE and Springer-Verlag, 2000.
2.	Ljubo Vlacic, Michel Parent, Fumio Harashima, "Intelligent Vehicle Technologies", Butterworth-Heinemann publications, Oxford, 2001.
REFERENCE BOOKS	
1	Crouse, W.H. & Anglin, D.L., "Automotive Mechanics", Intl. Student edition, 9th edition, TMH, NewDelhi, 2002.
2	William B.Ribbens -Understanding Automotive Electronics, 5th edition, Butter worth Heinemann Woburn, 2008.
3	Bosch, "Automotive Hand Book", 6th edition, SAE, 2004

COURSE TITLE	**AUTONOMOUS VEHICLES**			**CREDITS**	**3**
COURSE CODE	**ATC4453**	**COURSE CATEGORY**	**DE**	**L-T-P-S**	**3-0-0-0**
CIA	**50%**			**ESE**	**50%**
LEARNING LEVEL	**BTL-3**				

CO	**COURSE OUTCOMES**	**PO**
1	Gain the knowledge on Automated, Connected and Intelligent Vehicles	1,2,3,5,6,8,12
2	Familiarize with various Sensor Technology and Wireless Networking Advanced Driver Assistance Systems	1,2,3,5,6,8,12
3	Develop the knowledge Connected car display and Technology	1,2,3,5,6,8,12

Prerequisites : Knowledge in Basic electricity/electronics theory and/or automotive electronics

MODULE 1 - INTRODUCTION TO AUTOMATED, CONNECTED, AND INTELLIGENT VEHICLES (8L)

Introduction to the Concept of Automotive Electronics , Automotive Electronics Overview History & Evolution , Infotainment, Body, Chassis, and Powertrain Electronics , Advanced Driver Assistance Electronic Systems Connected and Autonomous Vehicle Technology ,Basic Control System Theory applied to Automobiles , Overview of the Operation of ECUs , Basic Cyber-Physical System Theory and Autonomous Vehicles , Role of Surroundings Sensing Systems and Autonomy , Role of Wireless Data Networks and Autonomy.

MODULE 2- SENSOR TECHNOLOGY FOR ADVANCED DRIVER ASSISTANCE SYSTEMS (10L)

Basics of Radar Technology and Systems, Ultrasonic Sonar Systems, Lidar Sensor Technology and Systems , Camera Technology ,Night Vision Technology , Other Sensors ,Use of Sensor Data Fusion , Integration of Sensor Data to On-Board Control Systems. Overview of Wireless Technology , Wireless System Block Diagram and Overview of Components , Transmission Systems – Modulation/Encoding , Receiver System Concepts – Demodulation/Decoding , Signal Propagation Physics ,Basic Transmission Line and Antenna Theory, Wireless System Standards and Standards Organizations , Role of Standards , Standards Organizations, Present Standards for Autonomous Applications

MODULE 3 – WIRELESS NETWORKING AND APPLICATIONS TO VEHICLE AUTONOMY (10L)
Basics of Computer Networking – the Internet of Things ,Wireless Networking Fundamentals , Integration of Wireless Networking and On-Board Vehicle Networks ,Review of On-Board Networks – Use & Function, Connected Car Technology , Connectivity Fundamentals, , Navigation and Other Applications ,Vehicle-to-Vehicle Technology and Applications , Vehicle-to-Roadside and Vehicle-to-Infrastructure Applications , Wireless Security Overview Advanced Driver Assistance System Technology , Basics of Theory of Operation ,Applications – Legacy , Applications – New ,Applications - Future , Integration of ADAS Technology into Vehicle Electronics , System Examples , Role of Sensor Data Fusion
MODULE – 4 : CONNECTED CAR DISPLAY TECHNOLOGY (8L)
Center Console Technology , Gauge Cluster Technology , Heads-Up Display Technology ,Warning Technology – Driver Notification Impaired Driver Technology , Driver Impairment Sensor Technology , Sensor Technology for Driver Impairment Detection , Transfer of Control Technology
MODULE – 5 : .VEHICLE PROGNOSTICS TECHNOLOGY (9L)
Monitoring of Vehicle Components , Basic Maintenance , End-of-Life Predictions , Advanced Driver Assistance System Sensor Alignment and Calibration , Autonomous Vehicles , Driverless Car Technology ,Moral, Legal, Roadblock Issues , Technical Issues ,Security Issues ,.Present Advanced Driver Assistance System Technology Examples : Toyota, Nissan, Honda, Hyundai, Volkswagen, BMW, Daimler , Fiat Chrysler Automobiles , Ford, General Motors, Troubleshooting and Maintenance of Advanced Driver Assistance Systems , Failure Modes – Self Calibration , Sensor Testing and Calibration , Redundant Systems , Standard Manufacturing Principles

TEXT BOOKS	
1	G. Mullett, Wireless Telecommunications Systems and Networks, Thomson – Delmar Learning, ISNB#1-4018-8659-0, 2006 •
2	G. Mullett, Basic Telecommunications : The Physical Layer, Thomson – Delmar Learning, ISBN#1-4018-4339-5, 2003
REFERENCE BOOKS	
1.	Hong Cheng ,Autonomous Intelligent Vehicles: Theory, Algorithms, and Implementation, ISBN-13: 978-0768079937 ,Springer 2010
2.	Markus Maurer , Autonomous Driving: Technical, Legal and Social Aspects , ISBN-13: 978-3662488454 Springer 2012
E- BOOKS	
1	http://www.ebooklibrary.org/articles/autonomous_car
2	https://link.springer.com/book/10.1007/978-3-662-48847-8
MOOC	
1.	https://www.mooc-list.com/tags/autonomous-vehicles
2.	https://www.edx.org/course/autonomous-mobile-robots-ethx-amrx-2

COURSE TITLE	VIRTUAL INSTRUMENTATION IN AUTOMOTIVES			CREDITS	3
COURSE CODE	ATC4454	COURSE CATEGORY	DE	L-T-P-S	3-0-0-0
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
	The students should be able to	
1	Familiarize on concepts of architecture of a virtual instrument	1,2,3,5,6,8,12
2	Gain knowledge on charts, arrays, clusters and graphs, case and sequence structures	1,2,3,5,6,8,12
3	Acquire the knowledge on data acquisition on PC, Sampling fundamentals	1,2,3,5,6,8,12
4	Attain the knowledge on the process of Instrument Interfaces and database management system	1,2,3,5,6,8,12

Prerequisites : Nil

MODULE -I VIRTUAL INSTRUMENTATION (9L)

Historical perspective, advantages, block diagram and architecture of a virtual instrument, data-flow techniques, graphical programming in data flow, comparison with conventional programming. Development of Virtual Instrument using GUI, Real-time systems, Embedded Controller, OPC, HMI / SCADA software, Active X programming.

MODULE 2 – PROGRAMMING TECHNIQUES (9L)

VIS and sub-VIS, loops and charts, arrays, clusters and graphs, case and sequence structures, formula nodes, local and global variables, string and file I/O, Instrument Drivers, Publishing measurement data in the web.

MODULE 3– DATA ACQUISITION BASICS (9L)

Introduction to data acquisition on PC, Sampling fundamentals, Input/output techniques and buses. ADC, DAC, Digital I/O, counters and timers, DMA, Software and hardware installation, Calibration, Resolution, Data acquisition interface requirements.

MODULE 4- CHASSIS REQUIREMENTS (9L)

Common Instrument Interfaces: Current loop, RS 232C/RS485, GPIB. Bus Interfaces: USB, PCMCIA, VXI, SCSI, PCI, PXI, Fire wire. PXI system controllers, Ethernet control of PXI. Networking basics for of fice & Industrial applications, VISA and IVI. VI toolsets, Distributed I/O modules.

MODULE 5- APPLICATION OF VIRTUAL INSTRUMENTATION (9L)

Instrument Control, Development of process database management system, Simulation of systems using VI, Development of Control system, Industrial Communication, Image acquisition and processing, Motion control.

TEXT BOOKS

1. 1.Gary Johnson, LabVIEW Graphical Programming, Second edition, McGraw Hill, Newyork.
2. Lisa K. wells & Jeffrey Travis, LabVIEW for everyone, Prentice Hall, New Jersey.

REFERENCE BOOKS

1. Kevin James, PC Interfacing and Data Acquisition: Techniques for Measurement, Instrumentation and Control, Newnes.

E-BOOK	
1	http://www.srmuniv.ac.in/sites/default/files/files/WEB-PPT3-EIE-dept(1).pdf
MOOC	
1	http://nptel.ac.in/courses/Webcourse-c

COURSE TITLE	MODELLING OF VEHICLE SYSTEMS			CREDITS	3
COURSE CODE	ATC4455	COURSE CATEGORY	DE	L-T-P-S	3-0-0-0
CIA	50%			ESE	50%
LEARNING LEVEL	BTL- 3				

CO	COURSE OUTCOMES	PO
1	The students will have the basic knowledge on mathematical model of various sub components like passive and active suspension along with its functions.	1,6,7,8,12
2	At the end of the course the students will have command knowledge over longitudinal dynamics and control, lateral dynamics and control, recent development in the area of modern vehicle technologies.	1,6,7,8,12

Prerequisites : Nil

MODULE 1 - LONGITUDINAL DYNAMICS AND CONTROL (9L)

Aerodynamic drag force - Longitudinal tyre force - Rolling resistance - Calculation of normal tyre forces - Calculation of effective tyre radius - Driveline Dynamics - Torque converter – Transmission dynamics - Engine dynamics - Wheel dynamics - Cruise Control - Anti-Lock Brake Systems - Automated Highway Systems - Longitudinal Control Architecture.

MODULE 2 - LATERAL DYNAMICS AND ELECTRONIC STABILITY CONTROL (9L)

Lateral Systems - Kinematic Model - Bicycle Model. Motion of Particle Relative to a rotating Frame. Dynamic Model in Terms of Error with Respect to Road, Yaw Rate and Slip Angle. Road Model. Differential Braking Systems - Independent All Wheel Drive Torque Distribution

MODULE 3 - MODELING OF PASSIVE AUTOMOTIVE SUSPENSIONS (9L)

Introduction - Modal Decoupling - Performance Variables - Natural Frequencies and Mode Shapes -Approximate Transfer Functions - Analysis of Vibrations in the Sprung Mass Mode and Unsprung Mass Mode - Verification Using Quarter Model. Half-Car and Full-Car Suspension Models.

MODULE 4 - MODELING OF SEMIACTIVE AND ACTIVE AUTOMOTIVE SUSPENSIONS (9L)

Semi-Active Suspension Model - Optimal Semi-Active Control Law - Calculation of Transfer Function Plots - Performance of Semi-Active Suspension Systems. Active Automotive Suspensions – Tradeoffs and Limitations - Invariant Points and Their Influence - Hydraulic Actuators for Active Suspensions

MODULE 5 - LATERAL AND LONGITUDINAL TYRE FORCES (9L)

Tyre Forces - Tyre Structure - Longitudinal Tyre Force at Small Slip Ratios - Lateral Tyre Force at Small Slip Angles - Magic Formula Tyre Model - Dugoff's Tyre Model - Dynamic Tyre Model - Development of Lateral Tyre Model for Uniform Normal Force Distribution and Parabolic Normal Pressure Distribution - Combined Lateral and Longitudinal Tyre Force Generation.

TEXT BOOKS	
1	Rajesh Rajamani, "Vehicle Dynamics and Control", Springer, 2010.
REFERENCE BOOKS	
1	Reza N.Jazar, "Vehicle Dynamics: Theory and Applications", Springer, 2008.

COURSE TITLE	DIGITAL MANUFACTURING			CREDITS	3
COURSE CODE	ATC4456	COURSE CATEGORY	DE	L-T-P-S	3-0-0-0
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
1	Understand the right method for low cost customization.	1,5,6,7,8,12
2	Designing of part either RE or by computation/analysis	1,5,6,7,8,12
3	Come out with mini project of his / her design innovation	1,5,6,7,8,12

Prerequisites : Nil

MODULE 1 - NEED FOR DIGITAL MANUFACTURING (9L)

Introduction to Future Manufacturing : three – legged stool concept, Definition of DM, Need for DM, 10 disruptive principles of DM process, SM Vs DM

Suggested Reading: Modern manufacturing processes

MODULE 2 – PROTOTYPING (9L)

Introduction to 3D printer, Role of 3D in product development, Classification of 3D Printer Technology.

Suggested Reading: Advantages of 3D printing

MODULE 3 - CAD & REVERSE ENGINEERING (9L)

Basic Concept – Digitization techniques – Model Reconstruction – Data Processing for Additive Manufacturing Technology: CAD model preparation – Part Orientation and support generation – Model Slicing –Tool path Generation – Basic Software for Additive Manufacturing Technology: MIMICS, MAGICS.

Suggested Reading: CAM and its merits

MODULE 4 - LIQUID BASED AND SOLID BASED ADDITIVE MANUFACTURING SYSTEMS (9L)

Classification – Liquid based system – Stereo lithography Apparatus (SLA)- Principle, process, advantages and applications – Solid based system –Fused Deposition Modeling – Principle, process, advantages and applications, Laminated Object Manufacturing

Suggested Reading: Additives and its applications.

MODULE 5 - POWDER BASED ADDITIVE MANUFACTURING SYSTEMS (9L)

Selective Laser Sintering – Principles of SLS process – Process, advantages and applications, Three Dimensional Printing – Principle, process, advantages and applications- Laser Engineered Net Shaping (LENS), Electron Beam Melting.

Suggested Reading: Powder based additives.

TEXT BOOKS	
1	Chua C.K., Leong K.F., and Lim C.S., “Rapid prototyping: Principles and applications”, Third Edition, World Scientific Publishers, 2010.
2	Gebhardt A., “Rapid prototyping”, Hanser Gardener Publications, 2012.
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1	Liou L.W. and Liou F.W., “Rapid Prototyping and Engineering applications: A tool box for prototype development”, CRC Press, 2010.
2	Kamrani A.K. and Nasr E.A., “Rapid Prototyping: Theory and practice”, Springer, 2016.
3	Hilton P.D. and Jacobs P.F., “Rapid Tooling: Technologies and Industrial Applications”, CRC press, 2010
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