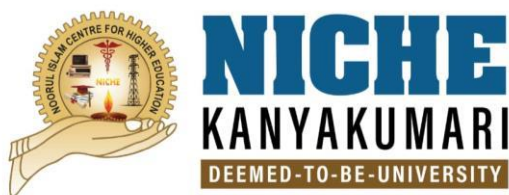


NOORUL ISLAM CENTRE FOR HIGHER EDUCATION

(Deemed to be University Under Section 3 of the UGC Act, 1956)

Kumaracoil, Thuckalay

DEPARTMENT OF AUTOMOBILE ENGINEERING



B.E. AUTOMOBILE ENGINEERING

CURRICULUM AND SYLLABI

REGULATION 2021

NOORUL ISLAM CENTRE FOR HIGHER EDUCATION, Kumaracoil

Regulation: 2021

Curriculum and Syllabi

B.E Programme

DEPARTMENT OF AUTOMOBILE ENGINEERING

B.E. AUTOMOBILE ENGINEERING

Vision of the University

To be recognized by the Government and society at large as an institution able to deliver excellence with relevance in the field of higher education and research focusing on the needs of the nation in tune with the technological revolution to cope with the knowledge explosion and global competence.

Mission of the University

To develop the institution as a Centre of Excellence, keeping pace with the advances in the field, so as to provide quality higher education to the students and instill in them high standards of discipline and ethics so that they become enlightened individuals in the service of humanity and to carry out focused research in the frontier areas of science and technology.

Faculty of Mechanical Engineering

Department of Automobile Engineering

Vision of the Department

Our vision is to serve the society for providing education skills suitable to the development approaching generation. We strive a deep sense of promise to bring the opportunity for student, providing quality education and teaching methodology for the development of overall individuality to meet all requirements for the challenging global expectation.

Mission of the Department

M1: To provide quality education and to prepare nationally and internationally competitive students for a successful career in safety, occupational health, environmental management and fire protection using global standards.

M2: To impart high-quality professional training and to prepare graduates to achieve sound knowledge in safety.

M3: To nurture leading-edge research in the fast-changing field of safety engineering and make students to be successful professionals, committed to lifelong learning.

M4: Encourage students to upgrade the latest technology in the field of fire and safety and to improve the safety standards to large extent and make positive contributions towards society by creating a safe atmosphere.

Description of the programme

With Industry tuned Outcome Based Curriculum, Well qualified and Experienced Faculty Members and Excellent Infrastructure towards Academic and Field Training Automobile Engineering Program specialize engineers in, alternative fuels, chassis, electronics, emissions, ergonomics, manufacturing, materials, motorsport, power train, rapid prototyping, vehicle and pedestrian safety etc to meet all requirements for the challenging global expectation.

Programme Educational Objectives – PEO	
PEO-01	To provide a solid foundation in basic science and general engineering principles, equipping students with the essential scientific and engineering fundamentals needed to formulate, analyze, evaluate, and solve complex engineering problems effectively
PEO-02	To demonstrate professional and innovative skills in designing, implementing, and evaluating safety systems and components that meet the needs of society and various industries
PEO-03	To provide comprehensive guidelines for effective communication, professionalism, and ethical behavior, while delivering high-quality training in teamwork to address technical problems, ultimately enhancing safety engineering and management practices
PEO-04	To foster sustained learning through advanced studies, professional development opportunities, self-directed learning, and value-added courses, enabling adaptation to changes in safety technologies within both local and global contexts
PEO-05	To impart knowledge of modern engineering tools that effectively identify solutions to real-time challenges in the automotive sector

Programme Outcome – PO	
PO-1	Apply knowledge of mathematics, science, and engineering fundamentals and specialized engineering knowledge to solve the problems related to safety engineering.
PO-2	Identify, formulate and analyze the complex safety problems using the principles of mathematics, natural sciences, and engineering concepts.
PO-3	Design and conduct experiments, analyze and interpret data through appropriate methods in order to provide a valid conclusion.
PO-4	Design solutions for complex safety problems and design system components or processes to meet the desired needs in public health, safety and environmental consideration.
PO-5	Gain and use knowledge on contemporary issues and apply appropriate techniques, skills and engineering tools necessary for implementation in real-time safety issues.
PO-6	Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary settings
PO-7	Communicate effectively to the engineering community and with the society through effective reports, documents, presentations, symbols, guidelines, and drawings
PO-8	Assess the societal needs in the field of occupational health and safety and to bring effective solutions through professional engineering practice.
PO-9	Understand the impact of professional engineering solutions in the context of social, cultural and environmental responsibilities and the need for sustained development

PO-10	To provide excellent guidelines to exhibit ethical behaviour and to enrol as a professional in a competitive engineering society
PO-11	Demonstrate the knowledge and understanding of the safety engineering and management principles and apply these to manage and execute projects, safety audits in the multidisciplinary environment.
PO-12	Recognize the need for, and have the preparation ability to effectively engage in the fast-changing field of safety engineering and make students to be successful safety professionals, committed to lifelong learning.

Mapping of Graduate Attributes and Programme Outcome

GA's PEOs	GA-01	GA-02	GA-03	GA-04	GA-05	GA-06	GA-07	GA-08	GA-09	GA-10	GA-11	GA-12
PO-1	H	A	Not	Not	Not	Not	Not	Not	Not	Not	Not	Not
PO-2	A	H	Not	Not	Not	Not	Not	Not	Not	Not	Not	Not
PO-3	Not	Not	H	A	Not	Not	Not	Not	Not	Not	Not	Not
PO-4	Not	Not	A	H	Not	Not	Not	Not	A	Not	Not	Not
PO-5	A	Not	Not	Not	H	Not	Not	Not	Not	Not	Not	Not
PO-6	Not	Not	Not	Not	Not	H	Not	Not	Not	Not	Not	Not
PO-7	Not	Not	Not	Not	Not	Not	H	Not	Not	Not	Not	Not
PO-8	Not	Not	Not	Not	Not	Not	Not	H	Not	Not	Not	Not
PO-9	Not	Not	Not	Not	Not	Not	Not	Not	H	Not	Not	Not
PO-10	Not	Not	Not	Not	Not	Not	Not	A	Not	H	Not	Not
PO-11	Not	Not	Not	Not	Not	A	Not	Not	Not	Not	H	Not
PO-12	Not	Not	Not	Not	Not	Not	Not	Not	Not	Not	Not	H

H- Highly Associated

A- Associated

Not – Not Associated

Mapping of Programme Educational Objective (PEOs) and Programme Outcomes(POs)

PEO PO	PEO-01	PEO-02	PEO-03	PEO-04	PEO-05
PO-1	H	A	Not	Not	Not
PO-2	H	H	Not	Not	Not
PO-3	Not	H	Not	Not	Not
PO-4	Not	H	Not	Not	A
PO-5	Not	A	Not	Not	H
PO- 6	Not	Not	Not	H	Not
PO-7	Not	Not	H	Not	Not
PO-8	Not	A	H	Not	Not
PO-9	Not	H	Not	A	Not
PO-10	Not	Not	H	Not	Not
PO-11	Not	A	H	Not	Not
PO-12	Not	Not	Not	H	A

H- Highly Associated

A- Associated

Not – Not Associated

Duration of the program : Four Years/ Eight Semesters

Total credits : 164

CURRICULUM & SYLLABI
SEMESTER I

Sl. No	Course Code	Course Title	L	T	P	C
THEORY						
1.	EG3101	Technical English	3	1	0	4
2.	MA3101	Engineering Mathematics – I	3	1	0	4
3.	BS3101	Engineering Physics	3	0	0	3
4.	BS3102	Engineering Chemistry	3	0	0	3
5.	CS3101	Fundamentals of Computing and Python Programming	3	0	0	3
PRACTICALS						
6.	CS3171	Fundamentals of Computing and Python Programming Laboratory	0	0	4	2
7.	BS3171	Physics and Chemistry Laboratory	0	0	4	2
TOTAL			15	2	8	21

SEMESTER II

Sl. No	Course Code	Course Title	L	T	P	C
THEORY						
1.	EG3102	Communicative English	3	0	0	3
2.	MA3102	Engineering Mathematics – II	3	1	0	4
3.	BE3101	Basic Electrical and Electronics Engineering	3	0	0	3
4.	BE3102	Basic Civil and Mechanical Engineering	3	0	0	3
5.	ME3101	Engineering Graphics	3	0	2	4
PRACTICALS						
6.	BE3171	Basic Electrical and Electronics Engineering Laboratory	0	0	2	1
7.	BE3172	Basic Civil and Mechanical Engineering Laboratory	0	0	2	1
TOTAL			15	1	6	19

SEMESTER III

Sl. No	Course Code	Course Title	L	T	P	C
THEORY						
1.	MA3201	Engineering Mathematics - III	3	1	0	4
2.	AM3201	Advanced Applied Mechanics	3	0	0	3
3.	AM3202	Automotive Components and Systems	3	0	0	3
4.	AM3203	Automotive Engines	3	0	0	3
5.	AM3204	Strength of Materials	3	1	0	4
6.	AM3205	Thermodynamics and Thermal Systems	3	1	0	4
PRACTICAL						
7.	AM3271	Automotive Components Laboratory	0	0	2	1
8.	AM3272	Engine and Fuel Testing Laboratory	0	1	2	1
9.	AM3273	Strength of Materials Laboratory	0	0	2	1
TOTAL			18	4	6	24

SEMESTER IV

Sl. No	Course Code	Course Title	L	T	P	C
THEORY						
1.	MA3207	Probability and Statistics	2	1	0	3
2.	BS3201	Environmental Studies	2	0	0	3
3.	AM3206	Automotive Electrical and Electronics Systems	3	0	0	4
4.	AM3207	Fluid Mechanics and Machinery	3	1	0	4
5.	AM3208	Manufacturing of Automotive Components	3	0	0	3
6.	AM3209	Theory of Machines	3	1	0	3
PRACTICAL						
7.	AM3274	Automotive Electrical and Electronics Systems Laboratory	0	0	2	1
8.	AM3275	Fluid Mechanics and Dynamics Laboratory	0	0	2	1
9.	AM32P1	Summer Internship-I	0	0	0	2
TOTAL			16	3	4	24

SEMESTER V

Sl. No	Course Code	Course Title	L	T	P	C
THEORY						
1.	MS3201	Professional and Business Ethics	2	0	0	2
2.	AM3210	Automotive Power Trains	3	0	0	3
3.	AM3211	Engineering Design	3	1	0	4
4.	AM3212	Materials Science and Engineering	3	0	0	3
5.	AM3213	Applied Hydraulics and Pneumatics	3	0	0	3
6.	AM3214	Vehicle Body Engineering	3	0	0	3
PRACTICALS						
7.	AM3276	Automotive Chassis Laboratory	0	0	2	1
8.	AM3277	Instrumentation ,metrology and metallurgy laboratory	0	0	2	1
9.	AM3278	Machine Drawing Laboratory	0	0	4	2
TOTAL			17	1	8	22

SEMESTER VI

Sl. No	Course Code	Course Title	L	T	P	C
THEORY						
1.	CS32D1	Fundamentals of Artificial Intelligence	3	0	0	3
2.	AM3215	Vehicle Dynamics	3	0	0	3
3.	AM3216	Design of Vehicle Components	3	1	0	4
4.	AM3217	Automotive Pollution and Control	3	0	0	3
5.	AM32**	Professional Elective II	3	0	0	3
6.	AM32**	Professional Elective III	3	0	0	3
PRACTICALS						
7.	AM3279	Computer Aided Vehicle Manufacturing laboratory	0	0	2	1
8.	AM3280	Automotive Engine Components Laboratory	0	0	2	1
9.	AM32P2	Summer Internship II	0	0	0	2
TOTAL			18	1	4	22

SEMESTER VII

Sl. No	Course Code	Course Title	L	T	P	C
THEORY						
1.	MS3202	Principles of management	2	0	0	2
2.	AM32DX	Open Elective II	3	0	0	3
3.	AM3218	Vehicle Maintenance	3	0	0	3
4.	AM3219	Automotive Mechatronics	3	0	0	3
5.	AM32XX	Professional Elective- III	3	0	0	3
PRACTICALS						
7.	AM3281	Automotive Maintenance Laboratory	0	0	2	1
8.	AM3282	Vehicle Mechatronics Laboratory	0	0	2	1
9.	AM32P3	Design and Fabrication Project	0	0	3	2
TOTAL			14	0	6	18

SEMESTER VIII

Sl. No	Course Code	Course Title	L	T	P	C
THEORY						
1.	AM32**	Professional Elective- IV	3	0	0	3
2.	AM32**	Professional Elective – V	3	0	0	3
PRACTICALS						
4	AM32P5	Project Work	0	0	16	8
TOTAL			6	0	16	14

LIST OF ELECTIVES (REGULATION-2021)

Sl. No	Course Code	Course Title	L	T	P	C
1.	AM32A1	Autotronics	3	0	0	3
2.	AM32A2	Electric vehicle motors	3	0	0	3
3.	AM32A3	Electric vehicles technology	3	0	0	3
4.	AM32A4	Alternate Fuels and Energy Systems	3	0	0	3
5.	AM32A5	Modern Automobile Technologies	3	0	0	3
6.	AM32A6	Automotive Safety	3	0	0	3
7.	AM32A7	Transport Management	3	0	0	3
8.	AM32A8	HVAC (Heat Ventilation and Air-Conditioning) System	3	0	0	3
9.	AM32A9	Quality Control and Reliability Engineering	3	0	0	3
10.	AM32B1	Composite Materials	3	0	0	3
11.	AM32B2	Industrial Robotics and Automation	3	0	0	3
12.	AM32B3	Two and Three Wheeled Vehicles	3	0	0	3
13.	AM32B4	Advanced Theory of ICE	3	0	0	3
14.	AM32B5	Off road Vehicles	3	0	0	3
15.	AM32B6	Total Quality Management	3	0	0	3

LIST OF OPEN ELECTIVES (REGULATION -2021)

Sl.No	Subject Code	Subject Name	L	T	P	C
1	AM32D1	Automotive Test Instrumentation	3	0	0	3
2	AM32D2	Vehicle Motor Engineering	3	0	0	3
3	MS32D1	Entrepreneurship Development	3	0	0	3

SYLLABUS
SEMESTER I

Sl. No	Course Code	Course Title	L	T	P	C
THEORY						
1.	EG3101	Technical English	3	1	0	4
2.	MA3101	Engineering Mathematics – I	3	1	0	4
3.	BS3101	Engineering Physics	3	0	0	3
4.	BS3102	Engineering Chemistry	3	0	0	3
5.	CS3101	Fundamentals of Computing and Python Programming	3	0	0	3
PRACTICALS						
6.	CS3171	Fundamentals of Computing and Python Programming Laboratory	0	0	4	2
7.	BS3171	Physics and Chemistry Laboratory	0	0	4	2
TOTAL			15	2	8	21

EG3101	TECHNICAL ENGLISH	L	T	P	C
		3	1	0	4

OBJECTIVES

- To develop the linguistic, communicative and critical thinking competencies of First Year Engineering students
- To enhance the understanding of the complex grammatical structures of the English language to students
- To improve the language proficiency of students in English with emphasis on Vocabulary, Grammar, Listening, Speaking, Reading, and Writing skills
- To introduce the students to the basic phonetics of English and make them grasp the various sounds of the English language to improve their pronunciation

Course Outcomes		Cognitive Skill
CO-01	The students will be able to improve their vocabulary relating to Engineering Technology and use articles and prepositions effectively in sentences.	R

CO-02	The students will be able to learn grammatical items like tense, voice, compound nouns etc. and thereby enhance their linguistic competence.	U
CO-03	The students will be able to learn definitions of technical terms, relative pronouns etc. which will develop their language competence.	R
CO-04	The students will be able to acquire the essentials of writing skills relating to CV, resume, Formal and Business Letters.	U
CO-05	The students will be able to learn English phonemes such as Vowels, Diphthongs and Consonants which will be instrumental in improving their pronunciation and speaking skills.	R

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcomes with Programme Outcomes

PO CO	PO-A	PO-B	PO- C	PO-D	PO- E	PO- F	PO-G	PO-H	PO - I	PO- J
CO-01	S	S	L	M	L	L	M	N	M	L
CO-02	S	S	L	M	L	L	M	N	M	L
CO-03	S	S	L	M	L	L	M	N	M	L
CO-04	S	S	L	M	L	L	M	N	M	L
CO-05	S	S	L	M	L	L	M	N	M	L

S-Strong, M-Medium, L-Low, N-Not relevant

UNIT: I

9

Word formation with prefixes and suffixes – Articles – Conjunctions – Prepositions – Expansion of Abbreviations and Acronyms – Writing Checklists – Writing Instructions.

UNIT-II

9

Tense – Voice – Punctuation – Expansion of Compound Nouns – Writing Recommendations – Paragraph Writing – Types, Structures and Features of a Paragraph – Creating Coherence-- Organizing Principles of Paragraphs in Documents.

UNIT-III

9

Discourse Markers – Gerunds and Present Participles – Relative Pronouns – Conditional Clauses – Definitions of Technical Terms – Transcoding : Bar Chart - Flow Chart - Pie Chart - Tree Diagram - Tabular Column.

UNIT –IV

9

Concord – Clauses – Phrases – Numerical Adjectives – CV/Resume Writing – Virtual Communication: E-Mail Writing – Essay Writing : Basic Format of an Essay - Types – Examples.

UNIT-V

9

Basic Phonetics : Phonemes – Vowels, Diphthongs and Consonants – Classification : Pure Vowels/ Monophthongs – Vowel Glides /Diphthongs.

L: 45 + T: 15, TOTAL: 60 HOURS

EXTENSIVE READING:

Shiv Khera, You Can Win, Milan, Delhi, 2004.

NOTE:

The book given under Extensive Reading is meant for inculcating the reading habit of the students. They need not be used for testing purposes.

MA3101	ENGINEERING MATHEMATICS - I	L	T	P	C
		3	1	0	4

OBJECTIVE:

The course objective is to develop the required skill of the students in the area of Engineering Mathematics with special emphasis on the characteristic equation of matrices, differential calculus, Beta and Gamma functions and to develop basic knowledge to the students in double and triple integration.

Course Outcome – Cos		Cognitive Skill
CO-01	Students able to understand the characteristic equation and find eigen values and Eigen vector of a real matrix. Compute the eigen value and eigen vector using properties. Verify Cayley Hamilton theorem and its applications. Apply orthogonal transformation of a symmetric matrix.	U, A ,E, R
CO-02	Students able to define the definitions and formula for curvature, radius of curvature, circle of curvature. Apply the formula and solve problems using the required formulas also find the evolute of the curves.	U, A ,E, An
CO-03	Students able to know about the differentiation formulae and apply on partial derivatives, total derivatives and Jacobians. Verify the functions be maximum or minimum and Lagrange's multiplier method. Express the Taylor's expansion for two variables.	U, A ,E, R
CO-04	Students able to know the Fundamental concepts of improper integrals, Beta and gamma function and their properties. Develop the skill in the relation between Beta and Gamma Functions. Calculate definite integral values using Beta and Gamma Functions.	U, A , An,E
CO-05	Students able to evaluate the double and multiple integrals and can apply these concepts to find areas of regions on a plane or in space. Graph Cartesian and polar equations. Convert Cartesian coordinates into polar coordinates.	U, A , An,E

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO-I	PO-J
CO-01	S	M	S	M	S	S	S	S	M	S
CO-02	S	M	M	M	S	S	M	S	M	M

CO-03	S	M	M	M	S	S	M	M	M	S
CO-04	S	M	S	M	S	M	S	S	M	S
CO-05	S	M	S	M	S	M	S	S	M	S

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT I: MATRICES

9

Characteristic equation – Eigen values and Eigenvectors of areal matrix -Properties of Eigen values and eigenvectors (without proof) Cayley Hamilton on theorem (statement only), verification and its applications – Orthogonal and Symmetric matrices and their properties (excluding proof)-Orthogonal transformation of asymmetric matrix to diagonal form.

UNIT II: DIFFERENTIAL CALCULUS

9

Curvature - Cartesian co-ordinates and parametric form-Centre and radius of curvature, Circle of curvature - Evolutes.

UNIT III: FUNCTIONS OF SEVERAL VARIABLES

9

Partial derivatives-Total derivatives-Jacobians-Properties-Maxima and minima for functions of two variables-Lagrange Multiplier method-Taylor's expansion.

UNIT IV: IMPROPER INTEGRALS

9

Evaluation of improper integrals – Beta and Gamma functions - Properties-Relation between Beta and Gamma functions-Evaluation of integrals using Beta and Gamma functions.

UNIT V: MULTIPLE INTEGRALS

9

Evaluation of double and triple integrals-Area enclosed by plane curves as double integration cartesian and polar co-ordinates –Change of order of integration- Transformation of Cartesian coordinates in to polar coordinates.

L:45+ T:15,TOTAL:60 HOURS

OUTCOMES:

At the end of the course, the students will be familiar with various concepts of calculus which are essential for engineering. They also become acquainted with the basic ideas of multiple integrals and their usage.

TEXTBOOKS:

1. Grewal B.S. "Higher Engineering Mathematics"- 40th Edition, Khanna Publishers, Delhi 2007.

REFERENCES:

1. M. Immaculate Mary, K. Uma Samundesvari, "Engineering Mathematics - I" Revised Edition, R. K Publishers, 2016.
2. Veerarajan T, "Engineering Mathematics (for first year)", Fourth Edition, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2007.
3. Erwin Kreyszig, "Advanced Engineering Mathematics", Seventh Edition, Wiley India, 2007.
4. P. Kandasamy, K. Thilagavathy, K. Gunavathy, "Engineering Mathematics" Vol. 1, S. Chand & Company Ltd., 2002.
5. B.V. Ramana, "Higher Engineering Mathematics" Second Edition Tata McGraw- Hill, Publishing Company Ltd., New Delhi, 2006.

BS3101	ENGINEERING PHYSICS	L	T	P	C
		3	0	0	3

OBJECTIVES

The course objective is to provide basic ideas about the principles of physics related to properties of matter, wave optics, heat, quantum concepts and materials. Engineering problems.

Course Outcome–Cos		Cognitive Skill
CO-01	Students will be able to understand and apply knowledge about the properties of materials.	R, U, A
CO-02	Students will be able to understand the types of oscillations and the wave nature of light in interference, diffraction and polarization phenomenon.	R,U,A,E
CO-03	Students will be able to state and explain the various laws of thermodynamics, understand entropy and its application.	,A,An,,E
CO-04	Students gain basic knowledge about quantum mechanics and will be able to solve time dependent and time independent Schrodinger equation for simple potentials.	,A,E,S
CO-05	Students will be able to know the different types of crystal structures and also gain basic knowledge about nonmaterial and biomaterials.	R,U,A,E

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate,S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO-I	PO-J
CO-01	S	M	S	M	S	S	S	S	M	S
CO-02	S	M	M	M	S	S	M	S	M	M
CO-03	S	M	M	M	S	S	M	M	M	S
CO-04	S	M	S	M	S	M	S	S	M	S
CO-05	S	M	S	M	S	M	S	S	M	S

S-Strong, M-Medium, L-Low, N-Not Relevant

UNIT I: PROPERTIES OF MATTER

9

Elasticity – Poisson's ratio – Stress-strain diagram – factors affecting elasticity – bending of beams – cantilever depression – Young's Modulus- theory and experiment of Young's modulus determination (uniform and non-uniform bending) –Shear Modulus – twisting

couple – hollow cylinder – torsion pendulum – determination of rigidity modulus - Bulk Modulus - applications of elastic behaviours of materials.

UNIT II: OSCILLATIONS AND WAVE OPTICS

9

Oscillations - Rectilinear motion - Oscillations or Vibrations - Simple Harmonic Motion - Damped Harmonic motion - Real oscillatory system - Forced or Driven oscillation. Wave optics -Interference of light – Photons - Young's Double Slit Experiment - Huygens's Principle - Diffraction - Diffraction Grating - Polarization.

UNIT III: THERMAL PHYSICS

9

Transfer of heat energy (conduction, convection and radiation) - thermal expansion of solids and liquids – expansion joints – bimetallic strips-Thermal conductivity- Forbe's and Lee's disc methods (theory and experiment)- thermal insulation in buildings -Laws of thermodynamics- heat exchanger -solar power- applications of solar power (solar water heater, photo voltaic cell)

UNIT IV: QUANTUM PHYSICS

9

Matter waves- de-Broglie wavelength - Schrodinger's wave equation-time independent and time dependent equations- physical significance of wave function- uncertainty principle and its application- energy and momentum operators-particle in a one dimensional box- scanning electron microscope- transmission electron microscope-scanning tunnelling microscope.

UNIT V: MATERIAL PHYSICS

9

Single crystalline, polycrystalline and amorphous materials- Single crystals: unit cell, crystal systems, Bravais lattices, directions and planes in a crystal, miller indices – inter planar distances. Introduction and applications of Metallic glasses, Shape Memory Alloys (SMA), Nano materials, Biomaterials.

TOTAL: 45 HOURS

TEXT BOOKS

1. Engineering Physics I by Bindhu B, Sagi Rani C, Meenadevi V N, Ganapathi Raman R, RK Publishers 2015.
2. Engineering Physics II by Bindhu B, Geetha Kumari R, Sugirtha Suni N Y, RK Publishers 2016.
3. Engineering Physics by R K Gaur And S L Gupta, Dhanpat Rai Publications 2011.
4. A Text Book Oscillations, Waves & Acoustics by Dr. M. Gosh, Dr. D. Battacharya, S. Chand, Revised Edition.

REFERENCES:

1. Engineering Physics by Rajendran V, McGraw-Hill, New Delhi, 2013
2. Engineering Physics by Arumugam M, Anuradha Publications, 2014.
3. Principles of Physics by Halliday D, Resnick R and Walker J, Wiley 2015.
4. Physics for scientist and Engineers by Serway R A and Jewett J W, Cengage Learning 2010.
5. Engineering Physics by Bhattacharya D K and Poonam T, Oxford University Press 2015.
6. Engineering Physics by Pandey B K and Chaturvedi, Cengage Learning India 2011

BS3102	ENGINEERING CHEMISTRY	L	T	P	C
		3	0	0	3

OBJECTIVES

To make the students conversant with the principles of the following topics:

(i) Use of free energy in chemical equilibrium (ii) Water chemistry (iii) Periodic properties (iv) Spectroscopic techniques and applications and (v) Organic reactions and synthesis of a drug molecule.

Course Outcome		Cognitive Skill
CO-01	Students will be able to understand the estimation of free energy and entropy	U,A,An
CO-02	Students will be able to apply the different techniques in water technology	R,A
CO-03	Students will be able to analyze the properties of periodic tables.	E,A,E
CO-04	Students will be able to describe the different types of spectroscopic techniques.	An,U
CO-05	Students will be able to predict the structure of organic molecules.	S,U

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO-I	PO-J
CO-01	S	M	S	L	S	N	N	N	N	N
CO-02	M	S	L	S	S	N	N	N	N	N
CO-03	S	S	S	M	S	N	N	N	N	N
CO-04	S	M	S	S	S	N	N	N	N	N
CO-05	S	S	L	M	L	L	M	N	M	L

S-Strong, M-Medium, L-Low, N-Not relevant

Unit I: USE OF FREE ENERGY IN CHEMICAL EQUILIBRIA

9

Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Corrosion. Use of free energy considerations in metallurgy through Ellingham diagrams.

Unit II: WATER CHEMISTRY

9

Water as a universal solvent – hard and soft water – reasons for hardness – disadvantages of hard water in washing and industrial purposes - estimation of hardness by EDTA method, problems; boiler feed water – characteristics- softening methods - external conditioning – demineralization (ion exchange) process, desalination by reverse osmosis method- internal

conditioning (phosphate, calgon and carbonate conditioning methods); stages in domestic water treatment – disinfection by chlorination, ozone and UV treatments.

Unit III: PERIODIC PROPERTIES

9

Effective nuclear charge, penetration of orbital, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electro negativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries.

Unit IV: SPECTROSCOPIC TECHNIQUES AND APPLICATIONS

9

Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and its applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Nuclear magnetic resonance and magnetic resonance imaging, surface characterization techniques. Diffraction and scattering.

Unit V: ORGANIC REACTIONS AND SYNTHESIS OF A DRUG MOLECULE

9

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule.

TOTAL: 45 HOURS

TEXT BOOKS

1. University chemistry, by B. H. Mahan
2. Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane
3. Fundamentals of Molecular Spectroscopy, by C. N. Banwell
4. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan Physical Chemistry, by P. W. Atkins
5. Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition.

CS3101	FUNDAMENTALS OF COMPUTING AND PYTHON PROGRAMMING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To know the basics of algorithmic problem solving
- To read and write simple Python programs.
- To develop Python programs with conditionals and loops.
- To define Python functions and call them.
- To use Python data structures — lists, tuples, dictionaries.

Course Outcome – Cos		Cognitive Skill
CO-01	Understand the basics of algorithmic problem solving.	R,U
CO-02	Ability to analyze various techniques for read and write simple Python programs.	A
CO-03	Introduce Python programs with conditionals and loops.	An
CO-04	Evaluate and Define Python functions call them and use Python data structures – lists, tuples, and dictionaries.	E
CO-05	Apply input/output with files in Python.	A

R - Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO- C	PO-D	PO- E	PO- F	PO-G	PO-H	PO - I	PO- J
CO-01	S	M	S	L	S	N	N	N	N	N
CO-02	M	S	L	S	S	N	N	N	N	N
CO-03	S	S	S	M	S	N	N	N	N	N
CO-04	S	M	S	S	S	N	N	N	N	N
CO-05	S	L	M	S	S	N	N	N	N	N

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT I: ALGORITHMIC PROBLEMS SOLVING

9

Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

UNIT II: DATA, EXPRESSIONS, STATEMENTS

9

Python interpreter and interactive mode; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

UNIT III: CONTROLFLOW, FUNCTIONS

9

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

UNIT IV: LISTS, TUPLES, DICTIONARIES

9

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: selection sort, insertion sort, merge sort, histogram.

UNIT V: FILES, MODULES, PACKAGES

9

Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file.

TOTAL: 45 HOURS

TEXT BOOKS:

1. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist,,,,, 2nd edition, Updated for Python 3, Shroff /O,,Reilly Publishers, 2016
2. Guido van Rossum and Fred L. Drake Jr, —An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd.,2011.

REFERENCES:

1. John V Guttag, —Introduction to Computation and Programming Using Python,,,,, Revisedand Revised and expanded Edition, MIT Press ,2013
2. Robert Sedgewick, Kevin Wayne, Robert Dondero, —Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd.,2016.
3. Timothy A. Budd, —Exploring Python®, Mc-Graw Hill Education (India) Private Ltd.,,2015.
4. KennethA.Lambert,—Fundamentals of Python:First Programs®, CENGAGE Learning,2012.
12. Charles Dierbach, —Introduction to Computer Science using Python: A Computational Problem Solving Focus, Wiley India Edition,2013.
5. Paul Gries, Jennifer Campbell and Jason Montojo, —Practical Programming: An Introduction to Computer Science using Python 3®, Second edition, Pragmatic Programmers, LLC,2013.

BS3171	PHYSICS & CHEMISTRY LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVE:

The course objective is to teach students, the importance of physics through involvement in experiments and to have knowledge of the world due to constant interplay between observations and hypothesis.

Course Outcome – Cos		Cognitive Skill
CO-01	The students will be able to analyse the physical principle involved in various instruments and also relate the principle to new applications.	R, U, A, An, E
CO-02	Various experiments in the areas of optics, properties of matter and ultrasonic will nurture the students in all branches of engineering.	R, U, A,
CO-03	The students will be able to think innovatively and also improve the creative skills that are essential for engineering.	R, A, An, E
CO-04	The students will be able to gain knowledge of new concept in the solution of practical oriented problems and theoretical problems.	R,U, An, E
CO-05	The students will be able to understand measurement technology, usage of new instruments and real time applications in engineering studies.	R,U,A,

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO- C	PO-D	PO- E	PO- F	PO-G	PO-H	PO - I	PO- J
CO-01	S	M	S	L	S	N	N	N	N	N
CO-02	M	S	L	S	S	N	N	N	N	N
CO-03	S	S	S	M	S	N	N	N	N	N
CO-04	S	M	S	S	S	N	N	N	N	N
CO-05	S	L	M	S	S	N	N	N	N	N

S- Strong, M- Medium, L-Low, N- Not Relevant

List of experiments: Physics Laboratory (Any Five Experiments)

1. Determination of velocity of ultrasonic waves and compressibility of the given liquid by Ultrasonic interferometer. (Real and Virtual Lab)
2. Determination of rigidity modulus by Torsional pendulum. (Real and Virtual Lab)
3. Determination of coefficient of viscosity by Poiseulli's method.
4. Determination of Young's modulus by non-uniform bending method.(Real and Virtual Lab)
5. Determination of LASER parameters using LASER diode. (Real and Virtual Lab)
6. Determination of band gap of the semi-conductor.(Real and Virtual Lab)
7. Determination of wavelength of mercury spectrum by diffraction grating.(Real and virtual lab)
8. Determination of wavelength of light by Newton's rings.(Real and Virtual Lab)
9. Determination of angle of the prism using spectrometer. (Real and Virtual Lab)

CHEMISTRY LAB (Any FIVE experiments)

OBJECTIVE:

The objective of the course is to develop the interest among the students regarding chemistry and their applications in engineering.

Course Outcomes

Course Outcome – Cos		Cognitive Skill
CO-01	Students will learn and apply basic techniques used in chemistry laboratory for small/large scale water analyses/purification.	U, A
CO-02	Students be able estimate the ions/metal ions present in domestic/industry waste water.	R, An
CO-03	Students utilize the fundamental laboratory techniques for analyses such as titrations, separation/purification and spectroscopy.	U
CO-04	Students able to analyze and gain experimental skill.	R

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO- C	PO-D	PO- E	PO- F	PO-G	PO-H	PO - I	PO- J
CO-01	S	M	S	L	S	N	N	N	N	N
CO-02	M	S	L	S	S	N	N	N	N	N
CO-03	S	S	S	M	S	N	N	N	N	N
CO-04	S	M	S	S	S	N	N	N	N	N
CO-05	S	L	M	S	S	N	N	N	N	N

List of Experiments

1. Determination of conductance of solutions
2. Potentiometer - determination of redox potentials and emfs
3. Synthesis of drug
4. Determination of Chloride content
5. Determination of hardness of water sample
6. Determination of Alkalinity of water sample
7. Virtual lab experiments

CS3171	FUNDAMENTALS OF COMPUTING AND PYTHON PROGRAMMING LAB	L	T	P	C
		0	0	4	2

OBJECTIVES:

- To write, test, and debug simple Python programs.
- To implement Python programs with conditionals and loops.
- Use functions for structuring Python programs.
- Represent compound data using Python lists, tuples, dictionaries.
- Read and write data from/to files in Python

Course Outcome – Cos		Cognitive Skill
CO-01	Understand the basic syntax of python	U
CO-02	Understand the problem solving techniques	An,U
CO-03	Analyze data structure concept in python	U
CO-04	Understand all tools of python	An
CO-05	Understand pygame with simulation	E

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

CO \ PO	PO-A	PO-B	PO- C	PO-D	PO- E	PO- F	PO-G	PO-H	PO - I	PO- J
CO-01	S	M	S	N	N	N	N	N	N	N
CO-02	M	S	L	N	N	N	N	N	N	N
CO-03	S	S	S	N	N	N	N	N	N	N
CO-04	S	M	S	N	N	N	N	N	N	N
CO-05	S	L	M	N	N	N	N	N	N	N

S- Strong, M- Medium, L-Low, N- Not Relevant

LIST OF PROGRAMS:

1. Compute the GCD of two numbers.
2. Find the square root of a number (Newton's method)
3. Exponentiation (power of a number)
4. Find the maximum of a list of numbers
5. Linear search and Binary search
6. Selection sort, Insertion sort
7. Merge sort
8. First n prime numbers
9. Multiply matrices
10. Programs that take command line arguments (word count)
11. Find the most frequent words in a text read from a file
12. Simulate elliptical orbits in Pygame
13. Simulate bouncing ball using Pygame

PLATFORM NEEDED:

Python 3 interpreter for Windows/Linux

TOTAL: 45 HOURS

SEMESTER II

Sl. No	Course Code	Course Title	L	T	P	C
THEORY						
1.	EG3102	Communicative English	3	0	0	3
2.	MA3102	Engineering Mathematics – II	3	1	0	4
3.	BE3101	Basic Electrical and Electronics Engineering	3	0	0	3
4.	BE3102	Basic Civil and Mechanical Engineering	3	0	0	3
5.	ME3101	Engineering Graphics	3	0	2	4
PRACTICALS						
6.	BE3171	Basic Electrical and Electronics Engineering Laboratory	0	0	2	1
7.	BE3172	Basic Civil and Mechanical Engineering Laboratory	0	0	2	1
TOTAL			15	1	6	19

EG3102	COMMUNICATIVE ENGLISH	L	T	P	C
		3	0	0	3

OBJECTIVES

- To widen and expand students' knowledge of English vocabulary
- To develop skills of students in the areas of vocabulary, grammar, listening, speaking, reading, and writing
- To develop the knowledge, skills and strategies the student must possess to become proficient readers
- To make the students learn the importance and purpose of communication skills and overcome the communication barriers by gaining confidence
- To make the students understand how to apply technical information and knowledge in practical documents

Course Outcomes		Cognitive Skill
CO-01	The students will be able to understand the basic vocabulary items, sentence structures and error detection and correction which will expand their knowledge of the English language.	R
CO-02	The students will be able to grasp the LSRW Skills and gain exposure to assimilate comprehension and Note-making.	U
CO-03	The students will get real time practice in speaking through oral presentation, small talk, role play, debate, Group Discussion etc.	A

CO-04	The students will be able to develop writing skills through exposure to Report Writing and Letter Writing.	U
CO-05	The students will be able to learn the Theory of Communication , the importance of communication, and will be introduced to the various facets of Verbal and Non verbal Communication.	R

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcomes with Programme Outcomes

PO CO	PO-A	PO-B	PO- C	PO-D	PO- E	PO- F	PO-G	PO-H	PO - I	PO- J
CO-01	S	M	M	S	S	M	S	S	N	N
CO-02	M	S	M	M	S	S	M	S	N	N
CO-03	S	M	M	S	M	M	S	M	N	N
CO-04	M	S	M	M	S	M	S	M	N	N
CO-05	S	M	S	S	M	S	M	S	N	N

S-Strong, M-Medium, L-Low, N-Not relevant

UNIT I: VOCABULARY AND GRAMMAR

9

Parts of Speech – Sentence Structures – Technical Vocabulary – Synonyms – Antonyms – Homonyms – Homophones – Misspelled Words – One word Substitutes – Odd Words Out – Changing words from one form to another– Common Errors in English – Correction of Errors in Sentences.

UNIT II: LISTENING AND READING

9

Reading Comprehension – Skimming – Scanning – Predicting the Content – Comprehension Questions – Inductive Reading – Close Reading – Note Making – Précis Writing.

UNIT III: SPEAKING

9

Introducing Oneself – Exchanging Personal Information – Small Talk : Family, Friends, Studies, Profession – Speaking : Greeting , Taking Leave – Product Description – Completing information – Gap Exercises – Presentation / Public Speaking Skills – Group Discussion – Debate – Role Play.

UNIT IV: TECHNICAL WRITING

9

Report Writing – Characteristics of a Report – Categories of Reports – Letter Writing (Formal Letters) : Job Application Letter with Resume – Letter Seeking Permission – Letter of Invitation – Letter Declining an Invitation – Letter of Complaint – Letter of Requisition.

UNIT V: TECHNICAL COMMUNICATION

9

The Theory of Communication – Definition and Scope – Nature, Importance and Types – Different Communication Models – Barriers to Communication – Effective Communication (Verbal / Non-verbal).

TOTAL: 45 HOURS

EXTENSIVE READING:

Can Field Jack, Chicken Soup for the Soul, Westland, Chennai, 1999.

NOTE:

The book given under Extensive Reading is meant for inculcating the reading habit of the students. They need not be used for testing purposes.

REFERENCE BOOKS:

1. Communication Skills. Oxford University Press.
2. Wood, F. T. (2007). Remedial English Grammar. Macmillan.
3. Zinsser, William. (2001). On Writing Well. Harper Resource Book.
4. The Four Skills for Communication – Josh Sreedharan – Foundation Books
5. Communicative English – E. Sureshkumar and P. Sreehari – Orient Blackswan

MA3102	ENGINEERING MATHEMATICS – II	L	T	P	C
		3	1	0	4

OBJECTIVE:

To develop basic knowledge to the students in differential equations and vector calculus. This subject is further broadened to the functions of complex variables and complex integration. A thorough knowledge about Laplace transforms is also covered to aid the students solve the differential equations.

Course Outcome – Cos		Cognitive Skill
CO-01	The students will be able to solve ordinary differential equations	An , E , S
CO-02	The students will be able to solve complex variables	E
CO-03	The students will be able to synthesize complex integration	S
CO-04	The students will be able to solve Vector Calculus	E , S
CO-05	The students will be able to Synthesize Laplace transforms	S

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO-I	PO-J
CO-01	M	S	M	S	S	N	M	M	S	S
CO-02	S	M	L	N	L	M	S	L	L	S
CO-03	S	L	S	S	L	L	S	S	M	M
CO-04	S	L	M	S	N	L	S	S	M	S
CO-05	S	L	M	M	M	L	N	S	M	M

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT I ORDINARY DIFFERENTIAL EQUATIONS**9**

Linear differential equations of second order with constant and variable coefficients- Cauchy's and Legendre's linear equations – Method of variation of parameters.

UNIT II: COMPLEX VARIABLES**9**

Functions of a complex variable – Analytic function – Necessary conditions- Cauchy-Riemann equations in cartesian and polar co-ordinates - Sufficient conditions(excluding proof) –Properties of analytic function – Harmonic and its conjugate – Construction of analytic function by Milne Thomson method – Conformal mappings $w = z + c$, cz , $1/z$ and Bilinear transformation.

UNIT III: COMPLEX INTEGRATION**9**

Statement and applications of Cauchy's integral theorem and Cauchy's integral formula – Laurent's expansion – Singular points – Residues – Cauchy's Residue theorem – Evaluation of real definite integral using contour integration(excluding poles on the real axis) -

$$\int_0^{2\pi} f(\cos \theta, \sin \theta) d\theta \text{ and } \int_{-\infty}^{\infty} \frac{f(x)}{g(x)} dx$$

UNIT IV: VECTOR CALCULUS**9**

Gradient, Divergence and Curl – Directional derivative – Irrigational and solenoidal vector fields – Vector integration – Green's theorem in a plane, Gauss divergence theorem and Stokes' theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelepipeds.

UNIT V: LAPLACE TRANSFORMS**9**

Laplace transform –Existence condition– Transforms of elementary functions – Basic properties – Transforms of derivatives and integrals – Transform of Periodic functions. Inverse Laplace transform – Convolution, Initial and Final value theorems (statement only) – Solutions of linear ordinary differential equation of second order with constant coefficients using Laplace transform techniques.

L: 45 + T: 15 = TOTAL 60 HOURS**TEXT BOOKS:**

Grewal B.S., "Higher Engineering Mathematics"- 40th Edition , Khanna Publishers, Delhi 2007.

REFERENCES:

1. M.Immaculate Mary , K.Uma Samundesvari, Engineering Mathematics – II" First Edition, Anuradha Publications, ,2013.
2. Erwin Kreyszig, " Advanced engineering Mathematics", Seventh Edition, Wiley India, 2007.
3. Veerarajan T, " Engineering Mathematics (for first year)", Tata McGraw- Hill Publishing Company Ltd.,New Delhi,2007.
4. P.Kandasamy , K.Thilagavathy , K.Gunavathy" Engineering Mathematics" S.Chand & Company Ltd.2002.

BE3101	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basic solutions of AC and DC circuits.
- To study the basic principle and operation of AC and DC machines.
- To study the fundamental operations of measuring instruments.
- To study the layout of power system
- To understand the fundamental operation and characteristics of Electron devices
- To understand the implementation of Boolean expression using logic gates.
- To become familiar with basic concepts of Communication system.

Course Outcome – Cos		Cognitive Skill
CO-01	The Students will be able to solve ordinary differential equations	An , E , S
CO-02	The Students will be able to solve complex variables	E
CO-03	The Students will be able to synthesize complex integration	S
CO-04	The Students will be able to solve Vector Calculus	E , S
CO-05	The Students will be able to Synthesize Laplace transforms	S

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO \ CO	PO-A	PO-B	PO- C	PO-D	PO- E	PO- F	PO-G	PO-H	PO - I	PO- J
CO-01	M	S	M	S	S	N	M	M	S	S
CO-02	S	M	L	N	L	M	S	L	L	S
CO-03	S	L	S	S	L	L	S	S	M	M
CO-04	S	L	M	S	N	L	S	S	M	S
CO-05	S	L	M	M	M	L	N	S	M	M

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT: 1 – ELECTRICAL CIRCUITS

9

Ohms Law, Kirchhoff's laws, Mesh and Nodal Analysis for DC Circuits. Introduction to AC Circuits, Faraday's Law of Electromagnetic Induction, Lenz law, Inductor, Capacitor, Power factor, Waveforms and RMS value, Average Value, Peak factor and Form factor, Single phase circuits- Series and Parallel, Three phase balanced circuits. Fundamentals of wiring and earthing.

UNIT: II – ELECTRICAL MEASUREMENTS, MACHINES AND POWER SYSTEM

Operating principles of Moving coil and Moving iron instruments (Ammeter and voltmeter), Dynamometer type watt meter and Energy meter, Errors in Measurements.

Construction, Principle of operation and Applications of DC Generators, DC Motors, Single phase transformers. Structure of power system.

UNIT- III SEMI CONDUCTOR DEVICES

9

Introduction to Semiconductors, PN Junction diode-Zener diode and its characteristics-Half wave and Full wave Rectifiers-Bipolar Junction transistor-CB,CE,CC Configuration and characteristics-JFET and MOSFET construction, operation ,characteristics (CS only) and uses.

UNIT-IV DIGITAL ELECTRONICS

9

Number systems-binary arithmetic--Boolean algebra-laws and theorems-Simplification of Boolean expression- logic gates –Implementation of Boolean expression using logic gates-standard forms of Boolean expression.

UNIT – V COMMUNICATION SYSTEMS

9

Block diagram of basic communication system-need for modulation-Types of modulation-Principles of Amplitude and Frequency modulation – pulse analog and digital modulation-AM and FM transmitter and receiver (Block diagram description only) –Satellite Communication Radar Systems-Data transmission and MODEM.

TOTAL: 45 HOURS

REFERENCES:

1. Muthusubramanian R, Salivahanan S and Muraleedharan K A, “Basic Electrical,
2. Electronics and Computer Engineering”, Tata McGraw Hill, Second Edition, (2006).
3. V.N. Mittle “Basic Electrical Engineering”, Tata McGraw Hill Edition, New Delhi, 1990.
4. V.K.Mehta “Principles of Power System”, S.Chand & Company Ltd, New Delhi, 2001.
5. R.S.Sedha,”Applied electronics”S.Chand&Co.,2006.

BE3102	BASIC CIVIL AND MECHANICAL ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVE:

Enable the students to understand the Basic Civil and Mechanical Engineering concepts.

Course Outcome – Cos		Cognitive Skill
CO-01	To gain the basic knowledge in Surveying and civil Engineering materials.	An , E , S
CO-02	Students can attain the basic knowledge in basic civil structures and building components.	E
CO-03	Can obtain the basic fundamental knowledge of Engineering Mechanics	S
CO-04	Students can expand their knowledge in knowing about IC engines and power plants	E , S
CO-05	Can increase the skill in basic manufacturing processes.	S

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO- C	PO-D	PO- E	PO- F	PO-G	PO-H	PO - I	PO- J
CO-01	M	S	M	S	S	N	M	M	S	S
CO-02	S	M	L	N	L	M	S	L	L	S
CO-03	S	L	S	S	L	L	S	S	M	M
CO-04	S	L	M	S	N	L	S	S	M	S
CO-05	S	L	M	M	M	L	N	S	M	M

S- Strong, M- Medium, L-Low, N- Not Relevant

A- CIVIL ENGINEERING

UNIT I: SURVEYING AND CIVIL ENGINEERING MATERIALS 9

Surveying: Objects – types – classification – principles – measurements of distances – angles –leveling–determination of areas–illustrative examples.

Civil Engineering Materials: Bricks–stones–sand–cement–concrete–steel sections.

UNIT II: BUILDING COMPONENTS AND STRUCTURES 9

Foundations: Types, Bearing capacity– Requirement of good foundations.

Superstructure: Brick masonry – stone masonry – beams – columns – lintels – roofing – flooring –plastering – Mechanics – Internal and external forces – stress – strain – elasticity – Types of Bridges and Dams–Basics of Interior Design and Landscaping.

B- MECHANICAL ENGINEERING

UNIT III: FUNDAMENTALS OF ENGINEERING MECHANICS 9

Statics –Basics Concepts, Fundamental principles & concepts: Newton’s laws, gravitation, force, couple, moment (about point and about axis), Varignon’s theorem, resultant of concurrent and non-concurrent coplanar forces, Problem formulation concept; 2-D statics, two and three force members, alternate equilibrium equations, 3-D statics.

UNIT IV: BASIC CONCEPTS OF THERMAL ENGINEERING 9

Introduction to IC Engines, working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles, Working principle of steam, Gas, Diesel, Hydro-electric and Nuclear Power plants, Principle of vapour compression and absorption system.

UNIT V: BASIC MANUFACTURING PROCESSES 9

Foundry-Investment casting, Die casting, Centrifugal casting, Continuous casting, Stir casting, Squeeze casting. Metal fusion welding processes- Oxyfuel gas welding – Arc welding processes. Additive Manufacturing-3D Printing.

TOTAL: 45 HOURS

TEXT BOOKS:

1. Shanmugam G and Palanichamy MS, “Basic Civil and Mechanical Engineering”, Tata McGraw Hill Publishing Co., New Delhi,(1996).
2. amamrutham S., “Basic Civil Engineering”, DhanpatRai Publishing Co.(P)Ltd. (1999).

REFERENCES:

1. Seetharaman S., "Basic Civil Engineering", Anuradha Agencies, (2005).
2. Venugopal K. and Prahu Raja V., "Basic Mechanical Engineering", Anuradha Publishers, Kumbakonam, (2000).
3. Shantha KumarSRJ., "Basic Mechanical Engineering", Hi-tech Publications, Mayiladuthurai, (2000).

ME3101	ENGINEERING GRAPHICS	L	T	P	C
		3	0	2	4

OBJECTIVES

1. To develop skills for communication of concepts, ideas and design of Engineering Products.
2. To expose them to existing national standards related to technical drawings

Course Outcome – Cos		Cognitive Skill
CO-01	Able to draw parabola, ellipse, hyperbola, in volute and cycloidal curves	A
CO-02	Able to draw projection of points, lines and planes	A
CO-03	Able to draw projection of solids and section of solids	A
CO-04	Able to draw isometric projection of solids	A
CO-05	Able to draw development of surfaces and orthographic projection.	A

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	P0-A	P0-B	P0-C	P0-D	P0-E	P0-F	P0-G	P0-H	P0-I	P0-J	P0-K	P0-L
CO-01	N	N	N	N	N	N	S	N	N	N	N	N
CO-02	N	N	N	N	N	N	S	N	N	N	N	N
CO-03	N	N	N	N	N	N	S	N	N	N	N	N
CO-04	N	N	N	N	N	N	S	N	N	N	N	N
CO-05	N	N	N	N	N	N	S	N	N	N	N	N

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT I: INTRODUCTION**9**

Concepts and conventions: Use of drafting instruments, BIS conventions and specifications – Size, layout and folding of drawing sheets, Lettering and dimensioning. General principles of orthographic projection, First angle projection – Layout of views. **(Not for examination)**

General Plane Curves

Conic sections including the Rectangular Hyperbola (General method); Cycloid, Epicycloids, Hypocycloid and involute.

UNIT II: PROJECTION OF POINTS, LINES & PLANES

9

Projection of points, Projection of straight lines located in the first quadrant. Determination of true lengths and true inclinations. Projection of planes- parallel to any one reference plane, perpendicular to any one reference plane, Inclined to any one reference plane and inclined to both reference planes

UNIT III: PROJECTION OF SOLIDS & SECTION OF SOLIDS

9

Prisms, pyramids, cylinder and cone, axis perpendicular to any one reference plane. Axis parallel to both the planes. Axis inclined to any one reference plane. Sectioning of solids- Prisms, pyramids, cylinder and cone in simple vertical position by cutting planes inclined to one reference plane. Obtaining the true shape of section

UNIT IV: DEVELOPMENT OF SURFACES & ISOMETRIC PROJECTION

9

Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone, Isometric view, Isometric scale to draw Isometric projection, Non-Isometric lines, construction of Isometric view from given orthographic views and to construct Isometric view of a Pyramid, Cone, Sphere.

UNIT V: ORTHOGRAPHIC PROJECTION & PERSPECTIVE PROJECTION

9

Fundamental of projection along with classification, Projections from the pictorial view of the object on the principal planes for view from front, top and sides using first angle projection method and third angle projection method, full sectional view. Perspective Projection of Solids (Any one Method).

L: 45+P: 15 = TOTAL: 60 HOURS

TEXT BOOKS:

1. Venugopal K and Prabhu Raja V, "Engineering Graphics", New Age International Publishers, 2007.
2. Luzadder W J, "Fundamentals of Engineering Drawing", Prentice Hall Book Co., New York, 1998
3. Bhat, N.D.& M. Panchal, Engineering Drawing, Charotar Publishing House, 2008

REFERENCES:

1. Kumar M S, "Engineering Graphics", Ninth Edition, DD Publications, Chennai, 2007.
2. Bureau of Indian Standards, "Engineering Drawing Practices for Schools and Colleges SP 46-2003", BIS, New Delhi, 2003.
3. Shah, M.B. & B.C. Rana, Engineering Drawing and Computer Graphics, Pearson Education, 2008

BE3171	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To make basic electrical connection
- To measure the electrical parameters
- To obtain the characteristics of Electron devices
- To verify the operation of logic gates.

Course Outcome – Cos		Cognitive Skill
CO-01	Learn the history of aircraft & developments over the years	An , E , S
CO-02	Ability to identify the types & classifications of components and control systems	E
CO-03	Understand the basic concepts of flight & Physical properties of Atmosphere	S
CO-04	An ability to differentiate the types of fuselage and constructions	E , S
CO-05	Different types of Engines and principles of Rocket	S

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	P0-A	P0-B	P0-C	P0-D	P0-E	P0-F	P0-G	P0-H	P0-I	P0-J	P0-K	P0-L
CO-01	M	S	M	S	S	N	M	M	S	S	M	M
CO-02	S	M	L	N	L	M	S	L	L	S	M	M
CO-03	S	L	S	S	L	L	S	S	M	M	S	S
CO-04	S	L	M	S	N	L	S	S	M	S	S	M
CO-05	S	L	M	M	M	L	N	S	M	M	M	S

S- Strong, M- Medium, L-Low, N- Not Relevant

I. Electrical Engineering Lab

1. Study of Symbols, Cables and Earthing.
2. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
3. Fluorescent lamp wiring.
4. Stair case wiring / Lamp control from three different places/ Doctor Room control/ Go down control
5. Measurement of electrical quantities – voltage, current, power & computation of power factor in RLC circuit.
6. Measurement of energy using single phase energy meter.
7. Fan Wiring.

II. Electronics Engineering Lab

1. Study of Electronic components and equipments – Resistor, colour coding, Measurement of AC signal parameter (peak-peak, rms period, frequency) using CRO.
2. Characteristics of PN Junction diode
3. Characteristics of Zener diode
4. Voltage Regulator using Zener diode
5. Measurement of ripple factor of HWR and FWR.
6. Study of logic gates AND, OR, EX-OR and NOT, NAND and NOR.
7. Generation of Clock Signal.
8. Soldering practice – Components, Devices and Circuits – Using general purpose PCB.

TOTAL: 30 HOURS

BE3172	BASIC CIVIL AND MECHANICAL ENGINEERING LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVE:

To provide exposure to the students with hands on experience on various basic Engineering practices in Civil & Mechanical Engineering.

Course Outcome – Cos		Cognitive Skill
CO-01	Students can gain fundamental knowledge about Buildings and pipe line works.	An , E , S
CO-02	One can able to handle Carpentry and power tools.	E
CO-03	Can gain knowledge in basic welding and machining process.	S
CO-04	Can attain the practice of using gyroscope in dynamics.	E , S
CO-05	Can understand the fundamental knowledge in foundry, fitting, sheet metal and IC engines.	S

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	P0-A	P0-B	P0-C	P0-D	P0-E	P0-F	P0-G	P0-H	P0-I	P0-J	P0-K	P0-L
CO-01	M	S	M	S	S	N	M	M	S	S	M	M
CO-02	S	M	L	N	L	M	S	L	L	S	M	M
CO-03	S	L	S	S	L	L	S	S	M	M	S	S
CO-04	S	L	M	S	N	L	S	S	M	S	S	M
CO-05	S	L	M	M	M	L	N	S	M	M	M	S

S- Strong, M- Medium, L-Low, N- Not Relevant

CIVIL ENGINEERING PRACTICE

Buildings:

1. Study of plumbing and carpentry components of residential and industrial buildings.
Safety aspects.

Plumbing Works:

- a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in house hold fittings.
- b) Study of pipe connections requirements for pumps and turbines.
- c) Preparation of plumbing line sketches for water supply and sewage works.
- d) Hands-on-exercise: Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.
- e) Demonstration of plumbing requirements of high-rise buildings.

Carpentry using Power Tools only:

- a) Study of the joints in roofs, doors, windows and furniture.

Hands-on-exercise:

Wood work, joints by sawing, planing and cutting.

MECHANICAL ENGINEERING PRACTICE

Welding:

Preparation of arc welding of butt joints, lap joints and tee joints.

Basic Machining:

Simple Turning and Taper turning

Dynamics:

Experiment using Gyroscope/Four bar link mechanism.

Demonstration on:

- a) Demonstration on foundry, fitting and sheet metal exercises.
- b) Demonstration on the working principle of two stroke and four stroke I.C. engines.

TOTAL: 30 HOURS

SEMESTER III

Sl. No	Course Code	Course Title	L	T	P	C
THEORY						
1.	MA3201	Engineering Mathematics - III	3	1	0	4
2.	AM3201	Advanced Applied Mechanics	3	0	0	3
3.	AM3202	Automotive Components and Systems	3	0	0	3
4.	AM3203	Automotive Engines	3	0	0	3
5.	AM3204	Strength of Materials	3	1	0	4
6.	AM3205	Thermodynamics and Thermal Systems	3	1	0	4
PRACTICAL						
7.	AM3271	Automotive Components Laboratory	0	0	2	1
8.	AM3272	Engine and Fuel Testing Laboratory	0	1	2	1
9.	AM3273	Strength of Materials Laboratory	0	0	2	1
TOTAL			18	4	6	24

MA3201	ENGINEERING MATHEMATICS III	L	T	P	C
		3	1	0	4

Objectives:

To develop the skill of the students in the areas of boundary value problems and Transform techniques. This will be necessary for their effective studies in a large number of Engineering subjects like heat conduction, communication systems, electro-optics and electromagnetic theory. This course will also serve as a prerequisite for post graduate and specialized studies and research.

Course Outcomes		Cognitive Skills
CO-01	Recognize a Partial Differential Equation and formulate a Partial Differential Equation from a given equation. Solve linear Partial Differential Equation of both first and second order using various methods.	R,U,A,An, E, S

CO-02	Derive a Fourier series expansion for a given periodic function by evaluating Fourier coefficient and expand Fourier cosine and Sine series for given function. Also find the Fourier series expansion for a given set of numerical values by applying harmonic analysis.	R,U,A,An, E, S
CO-03	Classify the second order Partial Differential Equation and solve second order Partial Differential Equations such as wave equation, heat equation and Laplace equation with boundary and initial conditions applying Fourier series expansion.	R,U,A,An, E, S
CO-04	Know fundamental and mathematical properties of Fourier transform. Calculate the Fourier transform of a given function and inverse Fourier transform of function. Know the applications of Parseval's and convolution theorem.	R,U,A,An, E, S
CO-05	Understand the characteristics and properties of Z-transform. Compute Z-transform of simple functions and inverse z transform of given functions and apply Z-transform for solving difference equations.	R,U,A,An, E, S

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	P0-A	P0-B	P0-C	P0-D	P0-E	P0-F	P0-G	P0-H	P0-I	P0-J	P0-K	P0-L
CO-01	S	S	M	M	N	N	N	N	N	N	N	N
CO-02	S	S	M	M	N	N	N	N	N	N	N	N
CO-03	S	S	M	M	N	N	N	N	N	N	N	N
CO-04	S	S	M	M	N	N	N	N	N	N	N	N
CO-05	S	S	M	M	N	N	N	N	N	N	N	N

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT I: Partial Differential Equations

12

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solutions of Clairaut's equations – Lagrange's linear equation – Homogeneous linear partial differential equations of second order with constant coefficients.

UNIT II: Fourier Series

12

Dirichlet's conditions – Fourier series – Change of interval - Odd and Even functions – Half range sine and cosine series – Parseval's identity – Harmonic Analysis.

UNIT III: Boundary Value Problems

12

Classification of second order linear partial differential equations – One dimensional wave and heat equations – Assumptions – Fourier series solution – Steady state solution of two dimensional heat equation (insulated edges excluded) – Fourier series solution in Cartesian co-ordinates.

UNIT IV :Fourier Transforms**12**

Statement and meaning of Fourier integral theorem – Fourier transform — Properties - Inverse Fourier transform – Fourier Sine and Cosine transforms – Inverse sine and cosine transforms – Properties -Transforms of simple functions – Convolution theorem – Parseval's identity.

UNIT V: Z-Transforms**12**

Z- transform – Elementary properties – convolution theorem-Inverse Z-transform –Partial fraction Method, Inversion integral method and Convolution – Initial and Final value theorems –Formation of difference equations – Solution of difference equations using Z-transform

L:45+ T:15,TOTAL:60 HOURS**Text Book**

1. Grewal B.S., “Higher Engineering Mathematics” – 40th Edition , Khanna Publishers, Delhi 2011.

References

1. Erwin Kreyszig, “Advanced Engineering Mathematics”, 10th Edition, John Wiley & Sons, Inc., USA, 2011
2. Kandasamy P, Thilagavathy K, and Gunavathy K., “Engineering Mathematics Volume III”, First Edition, S.Chand & Company Ltd., New Delhi.
3. Veerarajan T., “Engineering Mathematics(for Semester III), Third Edition, Tata McGraw – Hill Publishing Company Limited, New Delhi 2007.
4. Bali, N.P. and Manish Goyal, A Text Book of Engineering Mathematics, Seventh Edition, Lakshmi Publications Pvt. Ltd., New Delhi, 2009

AM3201	Advanced Applied Mechanics	L	T	P	C
		3	0	0	3

Objectives

To develop capacity to predict the effect of force and motion in the course of carrying out the design functions of engineering

Course Outcome		Cognitive Skill
CO-01	Students can understand the different types of force and their characteristics in the rigid bodies	P
CO-02	Students can study the forces acting on the reciprocating bodies	An
CO-03	Students will be able to understand the forces acting on the dynamic bodies, torque, impulse and momentum	U

CO-04	Students can study the simple mechanisms	S
CO-05	Students can understand the basics of friction and types of friction, friction acting on the screw jack.	A

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	P0-A	P0-B	P0-C	P0-D	P0-E	P0-F	P0-G	P0-H	P0-I	P0-J	P0-K	P0-L
CO-01	M	N	N	N	N	L	S	N	S	N	S	N
CO-02	N	M	L	N	N	N	S	N	N	N	N	N
CO-03	N	N	S	N	L	N	L	N	N	N	N	N
CO-04	M	N	N	L	N	N	S	N	M	S	N	N
CO-05	N	N	N	N	N	N	S	N	N	N	N	N

S-Strong, M-Medium, L-Low, N-Not relevant

Unit I: Forces in rigid bodies

9

Introduction – Units and Dimensions – Laws of Mechanics – Lami's theorem, Parallelogram and triangular Law of forces – Vectorial representation of forces – Vector operations of forces -additions, subtraction, dot product, cross product – Coplanar Forces – rectangular components – Equilibrium of a particle. Free body diagram – Types of supports – Action and reaction forces – stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar components of a moment – Varignon's theorem – Single equivalent force -Equilibrium of Rigid bodies in two dimensions

Unit II: Forces in reciprocating bodies

9

Introduction, Resultant effect of a system of forces, D'Alembert's principle, velocity and acceleration of the reciprocating parts in engines, Klein's construction, Ritterhaus's construction, Bennett's construction, approximate analytical method for velocity and acceleration of the piston, Angular velocity and acceleration of the connecting body, Forces on reciprocating parts of the engine, Equivalent dynamical system, correction couple, Analytical method of inertia torque.

Unit III: Dynamics of particles

9

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

Unit IV: Simple mechanism

9

Introduction – Links – Pairs – Chain – Mechanism – Machine structure – Degrees of freedom – Four bar chains – Terminology and definition – Planar, Spherical and Spatial Mechanisms – Grashoff's law – Kutzbach criterion – Grubler's criterion for plane mechanism. Inversion of mechanisms – Four bar, single slider crank and double slider crank mechanisms– Hooke's joint –Double Hooke's joint – Velocity and Acceleration of Four bar and single slider crank mechanisms by relative velocity Method.

Unit V:Friction and elements of rigid body dynamics**9**

Friction force – Laws of sliding friction – equilibrium analysis of simple systems with sliding friction –wedge friction-. Rolling resistance, General Plane motion of simple rigid bodies such as cylinder, disc/wheel and sphere. Applications – Friction in screw and nut – Effort calculations –Efficiency– Self locking and overhauling of screws. Pivot and collar – Thrust bearing

TOTAL: 45 HOURS**TEXT BOOKS**

1. Beer, F.P and Johnston Jr. E.R., “Vector Mechanics for Engineers (In SI Units): Statics and Dynamics”, 8th Edition, Tata McGraw-Hill Publishing company, New Delhi (2004).
2. Vela Murali, “Engineering Mechanics”, Oxford University Press (2010)
3. Shigley, J.E. and Uicker, J.J., “Theory of Machines and Mechanisms”, McGraw-Hill, 2004.

REFERENCES:

1. Hibbeler, R.C and Ashok Gupta, “Engineering Mechanics: Statics and Dynamics”, 11th Edition, Pearson Education (2010).
2. Irving H. Shames and Krishna MohanaRao. G., “Engineering Mechanics – Statics and Dynamics”, 4th Edition, Pearson Education (2006)
3. Meriam J.L. and Kraige L.G., “ Engineering Mechanics- Statics - Volume 1, Dynamics- Volume 2”, Third Edition, John Wiley & Sons, (1993)
4. Rajasekaran S and Sankarasubramanian G., “Engineering Mechanics Statics and Dynamics”, 3rd Edition, Vikas Publishing House Pvt. Ltd., (2005).
5. Rattan.S.S, “Theory of Machines”, Tata McGraw–Hill Publishing Co., New Delhi, 2009.
6. Kumar, K.L., “Engineering Mechanics”, 3rd Revised Edition, Tata McGraw-Hill Publishing company, New Delhi (2008)

AM3202	Automotive Components and Systems	L	T	P	C
		3	0	0	3

Objectives

Students are able to understand the basics of the automotive components and their working nature.

Course Outcome		Cognitive Skill
CO-01	Understand and examine fundamental concepts of automobiles	P
CO-02	Ability to understand, analyze and design various power trains.	An
CO-03	Ability to understand, analyze and design various suspension systems	U
CO-04	Ability to study various types of braking systems	S
CO-05	Knowledge and use of frame and body of vehicles	A

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	P0-A	P0-B	P0-C	P0-D	P0-E	P0-F	P0-G	P0-H	P0-I	P0-J	P0-K	P0-L
CO-01	M	N	N	N	N	L	S	N	S	N	S	N
CO-02	N	M	L	N	N	N	S	N	N	N	N	N
CO-03	N	N	S	N	L	N	L	N	N	N	N	N
CO-04	M	N	N	L	N	N	S	N	M	S	N	N
CO-05	N	N	N	N	N	N	S	N	N	N	N	N

S-Strong, M-Medium, L-Low, N-Not relevant

Unit I: History and introduction of vehicles

9

Introduction to automobiles - Types of cars and buses – special utility vehicles - vehicle body technology, special goods vehicle. Different layout of engine and drives – Fuel cells-Three wheelers.

Unit II: Automotive power and drive trains

9

Engines –classifications- working of two and four stroke engines – modern I.C engines – fuel requirement and classification. Automotive Clutches, Types, Construction and Working Principle of Manual Transmission and Transaxles – Four speed and Five speed Transmission, Auto transmission–AMT- DDCT-Drive lines and Universal Joints, Differentials and Drive Axles

Unit III: Suspension& steering system

9

Suspension Types – Coil Spring, Leaf spring, Torsion Bar for Front and Rear Wheels, Types and working principle of Shock absorbers, Active and Passive Suspension systems
Steering Systems: Types and construction of steering system – Manual and Power steering including - Collapsible Steering System, Re-circulated Ball Rack and Pinion Mechanism, Steering wheels and columns, Wheel alignment geometry.

Unit IV: Braking system

9

Need, characteristics of good braking system Friction – Static and Kinetic, Types- Drum and Disc Brakes- Construction and Working Principle, Types of brake actuating systems – Mechanical brakes, hydraulic brakes, power brakes, servo brakes, Fail safe brake – Air brake – Introduction to ABS- Hill Assistance

Unit V: Frame and body

9

Role and requirement of a chassis frame. Types of chassis – Light, medium and heavy duty vehicle chassis, ladder chassis, integral body construction techniques. Design features of a body – Types of bodies, Materials used in construction of bodies.

TOTAL: 45 HOURS

TEXT BOOKS

1. JnuszPawlowski, “Vehicle Body Engineering”, Business books limited, 1989.
2. Thomas D Gillespie, “Fundamentals of Vehicle dynamics”, SAE USA 1992.

REFERENCES:

1. John Fenton, "Hand book of automotive power train and chassis design", SAE, 1998.
2. Ian Andrew Norman, "Heavy Duty Vehicle systems", third edition, Delmar-Thomson Learning ltd.
3. William H Crouse and Donald L Anglin "Automotive Mechanics" GLENCOE McGraw-Hill Book Company, 2000.
4. Garrett T K, Newton K and Steeds W "Motor Vehicle" Butter Worths & Co., 2001
5. Heinz Heister "Vehicle and Engine Technology" SAE Second Edition, 1999.

AM3203	Automotive Engines	L	T	P	C
		3	0	0	3

Objectives

To understand the basic principles of engines used for automobiles and different systems

Course Outcome		Cognitive Skill
CO-01	Students can understand the principle and operation of SI and CI engines and their respective cycles of operation	P
CO-02	Students can study the basic operation of fuel supply system in SI and CI engines and more about the carburetors	An
CO-03	Students will be able to understand the combustion for the SI and CI engines	U
CO-04	Students can study the Super charging, turbo charging and engine testing	S
CO-05	Students can understand the cooling and lubrication systems	A

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO \ CO	P0-A	P0-B	P0-C	P0-D	P0-E	P0-F	P0-G	P0-H	P0-I	P0-J	P0-K	P0-L
CO-01	M	N	N	N	N	L	S	N	S	N	S	N
CO-02	N	M	L	N	N	N	S	N	N	N	N	N
CO-03	N	N	S	N	L	N	L	N	N	N	N	N
CO-04	M	N	N	L	N	N	S	N	M	S	N	N
CO-05	N	N	N	N	N	N	S	N	N	N	N	N

S-Strong, M-Medium, L-Low, N-Not relevant

Unit I: Construction and operation

9

Constructional details of spark ignition (SI) and compression ignition (CI) engines. Working principles. Two stroke SI and CI engines—construction and working. Comparison of SI and CI

engines and four stroke and two stroke engines. Engine classification, firing order. Otto, diesel and dual cycles.

Unit II: Fuel systems

9

Air fuel ratio requirements of SI engines, Air fuel ratio and emissions, Working of a simple fixed venture carburetor, Constant vacuum carburetor. Diesel fuel injection systems-Jerk pumps, distributor pumps, pintle and multi hole nozzles, Unit injector and common rail injection systems. Injection pump Calibration. Need for a governor for diesel engines. Description of a simple diesel engine governor.

Unit III: Combustion and combustion chambers

9

Introduction to combustion in SI and diesel engines and stages of combustion. Dependence of ignition timing on load and speed. Knock in SI and CI engines. Combustion chambers for SI and CI engines. Direct and indirect injection combustion chambers for CI engines. Importance of Swirl, squish and turbulence. Factors controlling combustion chamber design

.Unit IV: Supercharging, turbo charging and engine testing

9

Supercharging and Turbo charging, Different methods of turbo charging, Double turbo charging, Inter-cooling, Turbocharger controls including, waster gate, variable geometry, variable nozzle types. Dynamometers, Indicated thermal, brake thermal and volumetric efficiencies. Measurement of friction, Cylinder pressure measurement. Engine performance maps, Engine testing standards

Unit V: Cooling and lubrication systems

9

Need for cooling, types of cooling systems-air and liquid cooling systems. Thermo syphon and forced circulation and pressurized cooling systems. Properties of coolants.Requirements of lubrication systems. Types-mist, pressure feed, dry and wet sump systems. Properties of lubricants.

. TOTAL: 45 HOURS

TEXT BOOKS

1. Ganesan V., "Internal Combustion Engines", Tata McGraw Hill, 2007
2. Ramalingam K.K., "Internal Combustion Engines", Sci-Tech Publications, 2005.
3. Devaradjane. Dr. G., Dr. M. Kumaresan, "Automobile Engineering", AMK, Publishers, 2013.

REFERENCES:

1. Heisler, "Advanced Engine Technology"SAE Publication, 1995
2. Edward F. Obert" Internal Combustion Engines"3Edition, 1970
3. Gupta. H.N."Fundamentals of Internal Combustion Engines", reprint, PHI Learning Pvt. Ltd.2006
4. Mathur and Sharma"Fundamental Combustion Engines" DhanpatRai and Sons,2002.

AM3204	Strength of Materials	L	T	P	C
		3	0	0	3

Objectives

To gain knowledge of simple stresses, strains and deformation in components due to external loads and study the effects of stresses and deformations through mathematical models of beams, twisting bars also understand the effect of component dimensions and shape on stresses and deformations. To understand the basic principles of engines used for automobiles and different systems

Course Outcome		Cognitive Skill
CO-01	Students can understand the principles of stress, strain and basic deformation characteristics	P
CO-02	Students can study the basics of beams and how the load is acting on the beams	An
CO-03	Students will be able to understand the bending characteristics	U
CO-04	Students can study the torsion in shafts and springs	S
CO-05	Students can understand the deflection in beams by various methods of analysis	A

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	P0-A	P0-B	P0-C	P0-D	P0-E	P0-F	P0-G	P0-H	P0-I	P0-J	P0-K	P0-L
CO-01	M	N	N	N	N	L	S	N	S	N	S	N
CO-02	N	M	L	N	N	N	S	N	N	N	N	N
CO-03	N	N	S	N	L	N	L	N	N	N	N	N
CO-04	M	N	N	L	N	N	S	N	M	S	N	N
CO-05	N	N	N	N	N	N	S	N	N	N	N	N

S-Strong, M-Medium, L-Low, N-Not relevant

Unit I: Stress, strain and deformation of solids

12

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

Unit II: Beams and loads

12

Types of beams: Supports and Loads – Shear force and Bending Moment in beams – Cantilever, Simply supported and Overhanging beams – Word diagram – Column and struts

Unit III: Theory of simple bending

12

Theory of simple bending – Stresses in beams, Stress variation along the length and in the beam section – Effect of shape of beam section on stress induced – Leaf spring - Shear stresses in beams Shear flow.

Unit IV: Torsion

12

Stresses and deformation in circular and hollow shafts – stepped shaft – Shaft fixed at both ends – stresses in helical springs – Deflection of springs, Biaxial state of stresses - Thin Cylindrical and spherical shells – Deformation in thin cylindrical and spherical shells

Unit V: Beam deflection

Elastic curve of Neutral axis of the beam under normal loads – Evaluation of beam deflection and slope: Double integration method, McCauley Method, and Moment-area Method - stresses on inclined plane - principal stresses and principle planes – Mohr circle of stresses

TOTAL: 60 HOURS**TEXT BOOKS**

1. Popov E.P, “Engineering Mechanics of Solids”, Prentice-Hall of India, New Delhi, 1997.
2. Beer F. P. and Johnston R, “Mechanics of Materials”, McGraw-Hill Book Co, Third Edition, 2002.

REFERENCES:

1. Nash W.A, “Theory and problems in Strength of Materials”, Schaum Outline Series, McGraw-Hill Book Co, New York, 1995
2. Kazimi S.M.A, “Solid Mechanics”, Tata McGraw-Hill Publishing Co, New Delhi, 1981

AM3205	Thermodynamics and Thermal Systems	L	T	P	C
		3	1	0	4

Objectives

To make the students understand thermodynamic Principles, Compressible flow and fundamentals of heat transfer with its concepts in the operation of automotive engines.

Course Outcome		Cognitive Skill
CO-01	Students can understand the principles of thermodynamics and to plot P-V, T-S diagrams	P
CO-02	Students can study the second law and its usage in heat engine, pump, and refrigerator. Also they will be taught entropy concept and its changes	An
CO-03	Students will be taught the air standard cycles and techniques to solve problems related to gas and vapour power cycles	U
CO-04	Students can study the compressible flow concepts, reciprocating and rotary compressors and its applications in engine	S
CO-05	Students can understand the heat transfer concepts in the operation of automotive engines	A

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	P0-A	P0-B	P0-C	P0-D	P0-E	P0-F	P0-G	P0-H	P0-I	P0-J	P0-K	P0-L
CO-01	M	N	N	N	N	L	S	N	S	N	S	N
CO-02	N	M	L	N	N	N	S	N	N	N	N	N

CO-03	N	N	S	N	L	N	L	N	N	N	N	N
CO-04	M	N	N	L	N	N	S	N	M	S	N	N
CO-05	N	N	N	N	N	N	S	N	N	N	N	N

S-Strong, M-Medium, L-Low, N-Not relevant

Unit I: First law of thermodynamics

12

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.

Unit II: Second law of thermodynamics

12

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.

Unit III: Gas and vapour power cycles

12

Carnot cycle, , Overview of Reciprocating engines, Air standard cycles, Otto cycle, Diesel cycle, Brayton cycle, B – Rankine Combine cycle, Simple Problems.

Unit IV: Reciprocating and rotary compressors

12

General aspects, Classifications, Reciprocating Compressors – Single stage multistage, Volumetric efficiency, Various effects on compressor output, Rotary Compressors – Displacement, Steady flow Compressors, Comparison, Simple Problems.

Unit V: Thermal systems

12

Heat exchangers, Based on application flow pattern, Cooling towers, Pressure vessels, Boilers and types, Mountings and Accessories, Furnaces, evaporators, Condensers.

TOTAL: 60 HOURS

TEXT BOOKS

1. Yunus A. Cengel, Michael A.Boles – “Thermodynamics An Engineering approach”- Sixth Edition- 2009
2. Cengel,, Michael A.Boles – “Fundamentals of Heat Transfer”- Sixth Edition- 2009.
3. Nag.P.K., “Engineering Thermodynamics”, Tata McGraw-Hill, New Delhi, 2013.
4. R.K.Rajput– “A Textbook of Engineering thermodynamics”-Laxmi Publications (P) Ltd, New Delhi-2012.
5. P.L Ballaney, Thermal Engineering, Khanna Publishers, 1996.

REFERENCES:

1. R.Rudramoorthy- “Thermal Engineering” - Tata McGraw Publishing Co. Ltd, New Delhi- 2006
2. R.S.Khurmi, J.K.Gupta – “A textbook of Thermal Engineering”- S.Chand& company Ltd- 2014.
3. E.Ratha Krishnan “Fundamentals of Engineering thermodynamics”, Eastern Economy Edition-Prentice Hall of India Private Limited, New Delhi–110 001, 2010.

AM3271	Automotive Components Laboratory	L	T	P	C
		0	0	2	1

Objectives

Students can gather the thorough knowledge about the internal combustion engine components and analyze their performance of operation.

Course Outcome		Cognitive Skill
CO-01	Student will be able to understand and analyze the working of vehicles.	P
CO-02	Student will be able to construct and design basic petrol and diesel engines	An
CO-03	Student will be able to analyze, build transmission systems	U
CO-04	The students will be able to explain various methods of manufacturing.	S
CO-05	The students will be able to explain the basic working principles of automobiles.	A

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	P0-A	P0-B	P0-C	P0-D	P0-E	P0-F	P0-G	P0-H	P0-I	P0-J	P0-K	P0-L
CO-01	M	N	N	M	L	L	S	N	S	N	S	N
CO-02	N	M	L	N	N	N	S	N	N	N	N	N
CO-03	N	N	S	N	L	N	L	N	N	N	L	N
CO-04	M	N	N	L	N	N	S	N	M	S	N	N
CO-05	N	N	N	N	N	N	S	N	N	N	N	N

S-Strong, M-Medium, L-Low, N-Not relevant

1. Study of the various Systems in a vehicle
2. Demo of various Engines – petrol, diesel, four and two-strokes.
3. Study of Transmission – clutch, gearbox, transaxle and transfer case.
4. Study of Axles, final drive, differential, wheels and tyres.
5. Study of Chassis and super structure.
6. Study of Suspension systems, leaf springs, coil springs and shock absorbers.
7. Study of Steering systems, steering gear-box and its linkages.
8. Study of Brakes types and accelerator mechanisms.
9. Study of Automotive electrical systems.
10. Study of Automotive electronic systems.

TOTAL: 30 HOURS

LIST OF EQUIPMENTS

(For a batch of 30 students)

- | | |
|---|-----------|
| 1. Four cylinder petrol engine | -1No. |
| 2. Six cylinder diesel engine | -1No. |
| 3. Suspension systems, leaf springs, coil springs and shock absorbers | -1No.each |
| 4. Clutch, gearbox, transaxle and transfer case | -1No.each |
| 5. leaf springs, coil springs and shock absorbers | -1No.each |
| 6. Lub oil pump, pressure relief valve, filter, oil pressure gauge | -1No.each |
| 7. Light and heavy duty chassis | -1No.each |
| 8. Automotive electrical systems kit | -1 No |
| 9. Automotive electronics systems kit | -1 No |
| 10. Automotive braking systems kit | -1 No |

AM3272	Engine and Fuel Testing Laboratory	L	T	P	C
		0	0	2	1

Objectives

Students can gather the thorough knowledge about the internal combustion engine components and analyze their performance of operation.

Course Outcome		Cognitive Skill
CO-01	Student will be able to understand the function of Valves and Ports in IC engines.	P
CO-02	Student will be able to understand the properties of the fuels and lubricants	An
CO-03	Student will be able to analysis the different types of the IC engines	U

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	P0-A	P0-B	P0-C	P0-D	P0-E	P0-F	P0-G	P0-H	P0-I	P0-J	P0-K	P0-L
CO-01	M	N	N	M	L	L	S	N	S	N	S	N
CO-02	N	M	L	N	N	N	S	N	N	N	N	N
CO-03	N	N	S	N	L	N	L	N	N	N	L	N

S-Strong, M-Medium, L-Low, N-Not relevant

1. Study of hydraulic, electrical and eddy current dynamometers
2. Valve timing and port timing diagram
3. Performance test on two stroke SI engine
4. Performance test on automotive multi-cylinder SI engine
5. Performance test on automotive multi-cylinder CI engine
6. Retardation test on I.C. Engines.
7. Heat balance test on automotive multi-cylinder SI engine
8. Heat balance test on automotive multi-cylinder CI engine
9. Morse test on multi-cylinder SI engine
10. Temperature dependence of viscosity of lubrication oil by Redwood Viscometer

11. Viscosity Index of lubricating oil by Saybolt Viscometer
12. Flash and Fire points of fuels.
13. Flash and Fire points of lubricants
14. Calorific value of liquid and gaseous fuel.

TOTAL: 30 HOURS

LIST OF EQUIPMENTS (for a batch of 30 students)

1. Hydraulic dynamometer - 1 No.
2. Eddy current dynamometer - 1 No.
3. Electrical dynamometer - 1 No.
4. Single cylinder two stroke cut section engine - 1 No.
5. Single cylinder four stroke cut section engine - 1 No.
6. Two-wheeler engine test rig. - 1 No.
7. Automotive multicylinder SI engine test rig with heat balance arrangement- 1 No.
8. Automotive multicylinder CI engine test rig with heat balance arrangement- 1 No.
9. Redwood Viscometer - 1 No.
10. Say bolt Viscometer - 1 No.
11. Flash and Fire point apparatus - 1 No.
12. Bomb Calorimeter - 1 No.
13. Gas Calorimeter

AM3273	Strength of Materials Laboratory	L	T	P	C
		0	0	2	1

Objectives

To supplement the theoretical knowledge gained in Strength of Materials with practical testing for determining the strength of materials under externally applied loads. This would enable the student to have a clear understanding of the design for strength and stiffness

Course Outcome		Cognitive Skill
CO-01	Student will be able to understand the stress and strain characteristics of the various materials.	P
CO-02	Student will be able to understand the deflection and bending characteristics of the various materials.	An
CO-03	Student will be able to analysis the different types of the heat treatment process	U

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	P0-A	P0-B	P0-C	P0-D	P0-E	P0-F	P0-G	P0-H	P0-I	P0-J	P0-K	P0-L
CO-01	L	N	L	M	L	L	S	N	S	N	M	N
CO-02	N	M	L	N	N	N	S	N	N	N	N	N
CO-03	N	N	S	N	L	N	L	N	N	N	L	N

S-Strong, M-Medium, L-Low, N-Not relevant

LIST OF EQUIPMENTS (for a batch of 30 students)

1. Tension test on a mild steel rod
2. Double shear test on Mild steel and Aluminum rods
3. Torsion test on mild steel rod
4. Impact test on metal specimen
5. Hardness test on metals - Brinnell 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

i) Quenched Specimen and (iii) Quenched and tempered specimen.

11. Microscopic Examination of (i) Hardened samples and
(ii) Hardened and tempered samples.

- Ability to perform different destructive testing
- Ability to characteristic materials

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

Sl.No	Name Of The Equipment	Quantity
1	Universal Tensile Testing machine with double 1 shear attachment – 40 Ton Capacity	1
2	Torsion Testing Machine (60 NM Capacity)	1
3	Impact Testing Machine (300 J Capacity)	1
4	Brinell Hardness Testing Machine	1
5	Rockwell Hardness Testing Machine	1
6	Spring Testing Machine for tensile and compressive loads (2500 N)	1
7	Metallurgical Microscopes	3
8	Muffle Furnace (800 C)	1

SEMESTER IV

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	MA3207	Probability and Statistics	2	1	0	3
2.	BS3201	Environmental Studies	3	0	0	3
3.	AM3206	Automotive Electrical and Electronics Systems	3	0	0	3
4.	AM3207	Fluid Mechanics and Machinery	3	1	0	4
5.	AM3208	Manufacturing of Automotive Components	3	0	0	3
6.	AM3209	Theory of Machines	3	1	0	4
PRACTICAL						
7.	AM3274	Automotive Electrical and Electronics Systems Laboratory	0	0	2	1
8.	AM3275	Fluid Mechanics and Dynamics Laboratory	0	0	2	1
9.	AM32P1	Summer Internship-I	0	0	0	2
TOTAL			17	3	4	24

MA3207	PROBABILITY AND STATISTICS	L	T	P	C
		2	1	0	3

Objective:

To provide the necessary basic concepts of a few statistical and numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology.

Course Outcomes		Cognitive Skills
At the end of the course students should be able to		
CO-01	Know the basic concepts of probability and random variables. Understand the characteristic of density random variable and continuous random variable. Able to compute mean, variance and generate moment generating functions. Understand the different distributions (ie) Binomial, Poission, Uniform, Exponential, Gamma and Normal distribution and its properties.	R,U,A,An,E, S
CO-02	Acquire skills in handling situations involving more than one random variable and functions of random variables. Understand the central tendency, correlation and correlation coefficient and also regression.	R,U,A,An,E, S

CO-03	Apply t – test , F-test, Chi square test and large sample test by the transformation of hypothesis and analyze their conclusions using various level of significance.	R,U,A,An,E, S
CO-04	Apply various principles of analyzing the variance and also apply Monte Carlo simulation method to solve simultaneous problems	R,U,A,An,E, S
CO-05	Expose the basic characteristic features of quality control chart for mean, range, attributes, p chart and c chart.	R,U,A,An,E, S

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	P0-A	P0-B	P0-C	P0-D	P0-E	P0-F	P0-G	P0-H	P0-I	P0-J	P0-K	P0-L
CO-01	S	S	M	M	N	N	N	N	N	N	L	N
CO-02	S	S	M	M	M	N	N	N	N	N	M	N
CO-03	S	S	M	M	L	N	N	N	N	N	M	N
CO-04	S	S	M	M	M	N	N	N	N	N	M	N
CO-05	S	S	M	M	M	N	N	N	N	N	M	N

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT I: Probability and Random variables

9

Axioms of Probability – Independent events – Conditional Probability – Random Variable – Probability mass function – Probability density function – Distribution function – Properties – Expectation – Binomial, Poisson, Uniform, Exponential and Normal distributions (Problems only).

UNIT II: Two Dimensional Random Variables

9

Joint distributions - Marginal and Conditional distributions –Expectation-Independence-Covariance – Correlation and Regression.

UNIT III: Testing of Hypothesis

9

Sampling distribution – Standard error – Sample size –Type I error and Type II error - One tailed and Two tailed tests – large sample tests- Proportions – means and difference of means – Small sample tests – t-tests : Single mean, difference of means – F test for variances – Chi square test for independence of attributes and goodness of fit.

UNIT IV: Analysis of Variance and Simulation

9

Analysis of Variance- Principles of design of experiments - Completely randomized design Randomized block design and Latin Square Design. Discrete Event Simulation - Monte Carlo Simulation - Generation of Random Numbers using Congruent method (Simple Production Problems)

UNIT V: Statistical Quality Control**9**

Quality Control –Chance causes and Assignable causes - Control charts for variables – Control chart for Mean ($\bar{X}$) and Range (R). Control charts for Attributes, Proportion of defective (p chart), Number of defectives per unit (c chart).

TOTAL: 30+15 = 45**TEXT BOOKS**

1. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, Eight Edition, Sultan Chand & Sons, 1996. Unit 1 ,2,3
2. Venkatraman M.K, “Numerical Methods” Fifth Edition, National Pub. Company, Chennai 2005 Unit 4, 5

BS3201	ENVIRONMENTAL STUDIES	L	T	P	C
		3	0	0	2

Objectives

- To understand the basic concepts in environmental science
- To gain the knowledge about structure and natural cycles of environment.
- To get an idea about control methods of pollution.
- To know the information about conservation methods of forest and wild life.

Course Outcome		Cognitive Skill
CO-01	Student will be able to demonstrate a general understanding of interdisciplinary nature of environmental uses and able to characterize natural resources.	U, A, An
CO-02	Students will be able to explain the effects of air, water, soil, noise and thermal pollution environment and suggest ways to reduce them.	R, E ,A
CO-03	Students will be able to explain the effects of air, water, soil, noise and thermal pollution environment and suggest ways to reduce them.	R, U, A
CO-04	Students will be able to understand the effects of human population and know about the awareness programme.	R, A, E
CO-05	Students apply systems concept and methodologies to analyse and understand interaction between social and environmental process.	R, A, An

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	P0-A	P0-B	P0-C	P0-D	P0-E	P0-F	P0-G	P0-H	P0-I	P0-J	P0-K	P0-L
CO-01	S	M	S	M	M	S	S	S	M	S	S	M
CO-02	M	M	S	M	S	S	S	S	M	S	S	M
CO-03	M	M	S	M	S	S	S	S	M	S	S	M
CO-04	M	M	S	S	M	S	S	S	M	S	S	M
CO-05	M	M	S	S	L	S	M	S	M	S	S	L

S-Strong, M-Medium, L-Low, N-Not relevant

Unit I: NATURE OF ENVIRONMENT STUDIES AND NATURAL RESOURCES 9

Environment studies- definition – scope and importance- need for public awareness-Methods to create environmental awareness- Natural resources- Forest resources- energy resources- food resources- water resources – land resources - mineral resources.

Unit II: ECO SYSTEMS AND BIO-DIVERSITY 9

Concept and component of eco systems- producer, consumer, decomposer- structure and function of eco system- food chain and food web- energy flow model- aquatic eco system forest eco system- desert eco system- pyramid of biomass- ocean eco system- grass land eco system- Bio diversity in India- value of bio diversity- biodiversity threatens- biodiversity protection- In-situ and Ex-situ conservation.

Unit III: ENVIRONMENTAL POLLUTION 9

Meaning of environmental pollution- air pollution- acid rain – global warming- water pollution- water pollution control- soil pollution- urban waste and soil pollution- marine pollution- noise pollution- thermal pollution- solid and hazardous waste management- waste disposal methods- solid waste and India- natural disaster and disaster management.

Unit IV: HUMAN POPULATION AND ENVIRONMENT 9

Population growth- distribution of population- factors affecting variation in population theories of population- future of human population- family welfare programme- HIV and AIDS- environment and human health- human rights- value education- women and child welfare.

Unit V: SOCIAL ISSUES AND THE ENVIRONMENT 9

Unsustainable to sustainable development- sustainable development in India- water conservation, watershed management and water harvesting- environmental ethics- role of engineer in environmental protection.

TOTAL: 45 HOURS

TEXT BOOKS

1. Cunningham & saigo: „Environmental science :A global concern“ 4th Ed.W.c. Brown Publishers. USA. 1997
2. Chauhan A.S, „Environmental studies“ 2nd revised ed.2004, Jain Brother publishers, New Delhi

REFERENCES:

1. Benny Joseph : „Environmental Science and Engineering“, 2006, Tata McGraw- Hill Publication.
2. Siddique K.A. : Elements of Ecology and Environmental Pollution, 1st Ed. 2002, Kushal Publication, Varanasi. M

AM3206	Automotive Electrical and Electronics System	L	T	P	C
		3	0	0	3

Objectives

Students can understand the basics of the electrical and electronics components and how the components are used in the automotive vehicles.

Course Outcome		Cognitive Skill
CO-01	Able to learn about automotive wiring	P
CO-02	Able to understand the storage of automotive batteries.	An
CO-03	Able to understand the concepts of charging and starting system operation.	U
CO-04	Able to learn about the automotive electronics in context of industrial needs.	S
CO-05	Able to get awareness of sensors and actuators.	A

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	P0-A	P0-B	P0-C	P0-D	P0-E	P0-F	P0-G	P0-H	P0-I	P0-J	P0-K	P0-L
CO-01	S	M	S	M	M	S	S	S	M	S	S	M
CO-02	M	M	S	M	S	S	S	S	M	S	S	M
CO-03	M	M	S	M	S	S	S	S	M	S	S	M
CO-04	M	M	S	S	M	S	S	S	M	S	S	M
CO-05	M	M	S	S	L	S	M	S	M	S	S	L

S-Strong, M-Medium, L-Low, N-Not relevant

Unit I: Automotive wiring and accessories

9

Introduction- Wire types and materials – wire size – connectors and terminals- Ground paths common electrical parts – wire color coding – system diagrams – lighting system – detail of head light and side light – head light aiming alignment – horn – wiper system – fault analysis on lighting system

Unit II: Automotive battery

9

Introduction to fuel cell – Electro chemical action – types of battery Chemical reaction in the battery – Battery rating – battery size collection – Battery efficiency- Battery testing – Battery testing – Battery life – Battery Installation components – Battery charging – Battery Maintenance.

Unit III: Automotive electronics and engine controls

9

Current trends in automotive electronic engine management system, electromagnetic interference suppression, electromagnetic compatibility, electronic dashboard instruments, onboard diagnostic system, security and warning system – Common fault and fault analysis

Concept of an electronic engine control system, electronic fuel injection - throttle body fuel injection, multi point fuel injection, gasoline direct injection, common rail direct injection, electronic ignition control, engine mapping, on-board diagnostics – engine control module and power train control module - – Common fault and fault analysis

Unit IV: Charging and starting system operation

9

Generation of DC current – Construction of DC generator – types of DC generator – Characteristics of DC generator - Regulators for DC generator – Principle and Construction of AC generator –Starting motor _ Principle and Construction of starting motor – Starting motor drive arrangements –.Common fault and fault analysis

Unit V: Sensors and activators

9

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..

TOTAL: 45 HOURS

TEXT BOOKS

1. William B.Riddens -Understanding Automotive Electronics, 7th edition- Butter worth Heinemann Woburn- 2014.
2. Mohammed Ismail and Terri Faiz Analog VLSI Signal and Information Process, McGraw Hill Book Company, 1994.
3. Randall L. Geiger, Phillip E. Allen, Noel R. Strader, "VLSI Design Techniques for Analog and Digital Circuits", McGraw Hill, International Edition 1990.
4. Crouse W.H. "Automobile Electrical Equipment" McGraw Hill Book Co., Inc., New York 3rd edition,1986

REFERENCES:

1. Jose E. Franca HannisTsividis, "Design of Analog - Digital VLSI Circuits for Telecommunication and Signal Processing", Prentice Hall, International Edition, 2002.
2. David A. Johns, Ken Martin, "Analog Integrated Circuit Design" John Wiley & Sons, 2008.
3. BenhardRazavi, "Data Converters" Kluwer Publishers, 2000.
4. Phillip Allen and Douglas Holmberg "CMOS Analog Circuit Design" Oxford University Press, 2nd Edn2004.
5. Robert Bosch, "Automotive Hand Book" SAE, 7th edition, 2014.
6. Jacob Baker R., Lee H.W. and Boyce D.E., "CMOS Circuit Design, Layout and Simulation"" Prentice Hall of India, 1998.

AM3207	Fluid Mechanics and Machinery	L	T	P	C
		3	1	0	4

Objectives

- To understand the structure and the properties of the fluid.
- To analyze and appreciate the complexities involved in solving the fluid flow problems.

- To study the mathematical techniques already in vogue and apply them to the solutions of practical flow problems.
- To understand the energy exchange process in fluid mechanics handling incompressible fluids.

Course Outcomes		Cognitive Skills
CO-01	Student will be able to remember the principles of fluid properties	P
CO-02	Student will be able to know incompressible fluid flow.	An
CO-03	Student will gain knowledge on fluid statics.	U
CO-04	Student will understand the purpose hydraulic turbine.	S
CO-05	Student will gain knowledge on different hydraulic pump.	A

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	P0-A	P0-B	P0-C	P0-D	P0-E	P0-F	P0-G	P0-H	P0-I	P0-J	P0-K	P0-L
CO-01	S	M	S	M	M	S	S	S	M	S	S	M
CO-02	M	M	S	M	S	S	S	S	M	S	S	M
CO-03	M	M	S	M	S	S	S	S	M	S	S	M
CO-04	M	M	S	S	M	S	S	S	M	S	S	M
CO-05	M	M	S	S	L	S	M	S	M	S	S	L

S-Strong, M-Medium, L-Low, N-Not relevant

Unit I: Fluid statics

12

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.

Unit II: Fluid kinematics and fluid dynamics

12

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

Unit III: Incompressible fluid flow**12**

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 - Boundary layer flows, boundary layer thickness, boundary layer separation - drag and lift coefficients.

Unit IV: Hydraulic turbines**12**

Fluid machines: definition and classification - exchange of energy - Euler's equation for turbo machines - Construction of velocity vector diagrams - head and specific work - components of energy transfer - degree of reaction. Hydro turbines: definition and classifications - Pelton turbine - Francis turbine - propeller turbine - Kaplan turbine - working principles - velocity triangles - work done - specific speed - efficiencys -performance curve for turbines.

Unit V:Hydraulic pumps**12**

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

TOTAL: 60 HOURS**TEXT BOOKS**

1. Streeter, V.L., and Wylie, E.B., “Fluid Mechanics”, McGraw-Hill, 1983.
2. Kumar, K.L., “Engineering Fluid Mechanics”, Eurasia Publishing House (P) Ltd, New Delhi (7th edition), 1995.
3. Vasandani, V.P., “Hydraulic Machines - Theory and Design”, Khanna Publishers.1992

REFERENCES:

1. Bansal, R.K., “Fluid Mechanics and Hydraulics Machines”, (5th edition), Laxmi publications (P) Ltd, New Delhi, 1995.
2. White, F.M., “Fluid Mechanics”, Tata McGraw-Hill, 5th Edition, New Delhi, 2003.
3. Ramamirtham, S., "Fluid Mechanics and Hydraulics and Fluid Machines", DhanpatRai and Sons, Delhi, 1998
4. Som, S.K., and Biswas, G., “Introduction to Fluid Mechanics and Fluid Machines”, Tata McGraw-Hill, 2nd Edition, 2004.

AM3208	Manufacturing of Automotive Components	L	T	P	C
		3	0	0	3

Objectives

Students can get the thorough knowledge in the manufacturing of various components of the automotive.

Course Outcome		Cognitive Skill
CO-01	Acquire strong fundamental knowledge in the engine engineering concepts.	P
CO-02	Understands the concepts of manufacturing clutch.	An
CO-03	Analyze the design concepts of automotive body.	U
CO-04	An ability to be familiar with types of heat treatments.	S
CO-05	Evaluate the practices in modern manufacturing systems	A

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	P0-A	P0-B	P0-C	P0-D	P0-E	P0-F	P0-G	P0-H	P0-I	P0-J	P0-K	P0-L
CO-01	L	N	N	M	L	L	S	N	S	N	S	N
CO-02	N	M	L	N	N	N	S	N	N	N	N	N
CO-03	N	N	M	N	L	N	L	N	N	N	L	N
CO-04	M	N	N	L	N	N	S	N	M	S	N	N
CO-05	N	N	N	N	N	N	S	N	N	N	N	N

S-Strong, M-Medium, L-Low, N-Not relevant

Unit I: Manufacturing of engine components

9

Casting of engine block - conventional and expendable pattern, Preparation of casting for cylinder heads, forging of crank shaft, connecting rod and gudgeon pins, casting of piston by gravity casting, Casting of gear box squeeze casting, low and high pressure casting - upset forging of valves, cylinder liners and piston ring manufacturing - Jigs and Fixtures.

Unit II: Manufacture of clutch & propeller shaft components

9

Manufacturing of friction plates using conventional blanking and fine blanking - precision forging of gears, gear hobbing, shaping, powder metallurgy, orbital forming of spur, helical, and bevel gears, hypoid gears-Casting and extrusion of propeller shaft- Forging of front and rear axles, casting of rear axle casing -wheels, brake drum and tyre manufacturing.

Unit III: Body components

9

Introduction, thermoforming and hydro forming, press forming, welding of body panels, principle of injection moulding, injection moulding of instrument panel, moulding of bumpers, reinforced reaction injection moulding, manufacture of metal/polymer/metal panels. Adhesives and sealants, manufacturing of leaf spring, composite leaf spring, wrap forming of coil springs.

Unit IV: Heat treatment and surface improvements**9**

Iron carbon equilibrium diagram, cooling curves, Heat treatment techniques-Chemical vapour deposition, physical vapour deposition, sol-gel processing, spraying, plating, painting, paint booth, electro plating of metals, metal coatings, case hardening, thermal spraying, electro-less plating, anodizing – Chromatin – Sputtering – Hot dipping.

Unit V: Modern manufacturing systems**9**

Introduction –production systems – Basic elements of an Automated Systems – Robotics – Application in Automobile Industries – Introduction to Material Handling – Manufacturing systems - Group technology- Basis of FMS –Inspection – CMM - Elements of CIM – JIT – Kanban – Lean manufacturing system – E Manufacturing, Reverse Engineering, Tooling, RPT.

TOTAL: 45 HOURS**REFERENCES:**

1. Philip F. Ostwald & Jairo Munuz, “Manufacturing Processes and Systems”, John Wiley & Sons, New York, 1998.
2. Degarmo E.P., “Materials and process in Manufacturing”, Macmillan Publishing Co., 1997.
3. Heldt P.M., “High Speed Combustion Engines”, Oxford IBH publishing Co., Calcutta, 1996.
4. Kalpakjian, “Manufacturing and Engineering and Technology”, Addison Wesley, Publishing Company, 1995.
5. Sanjay K Mazumdar, “Composites Manufacturing”, CRC Press, NY, 2003. Mikell P Groover, Automation, Production Systems and Computer – Integrated Manufacturing, Third Edition, Prentice Hall International

AM3209	Theory of Machines	L	T	P	C
		3	1	0	4

Objectives

To expose the students the different mechanisms, their method of working, Forces involved profiles and their motions.

Course Outcome		Cognitive Skill
CO-01	Student will be able to remember the principles of vibration	P
CO-02	Student will be able to know gear and gear train.	An
CO-03	Student will gain knowledge on balancing of masses.	U
CO-04	Student will understand the purpose of turning moment diagram	S
CO-05	Student will gain knowledge on different Cams and governors.	A

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	P0-A	P0-B	P0-C	P0-D	P0-E	P0-F	P0-G	P0-H	P0-I	P0-J	P0-K	P0-L
CO-01	L	N	N	M	L	L	S	N	S	N	S	N
CO-02	N	M	L	N	N	N	S	N	N	N	N	N
CO-03	N	N	M	N	L	N	L	N	N	N	L	N
CO-04	M	N	N	L	N	N	S	N	M	S	N	N
CO-05	N	N	N	N	N	N	S	N	N	N	N	N

S-Strong, M-Medium, L-Low, N-Not relevant

Unit I: Vibrations (12)

Types of vibratory motion, Natural frequency of vibrations – longitudinal, transverse and torsional, free, forced and damped vibrations of single degree of freedom systems – Critical speed of shaft, Magnification factor- Force transmitted to supports .Torsional vibration – single, two and three rotor systems, Torsionally equivalent shaft, vibrations of a geared system

Unit II: Gears and gear trains (12)

Classification of gears, Law of gearing, Forms of teeth, Spur gear terminology, velocity ratio, Contact ratio, InterferenceGear trains: simple, compound, reverted and epicyclic – Velocity ratio and torque calculation in gear trains – Automobile differential.

Unit III: BALANCING OF MASSES (12)

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

Unit IV: Gyroscope, turning moment diagram and flywheels (12)

Gyroscopes: Gyroscopic forces and couple – Forces on bearing due to gyroscopic action – Gyroscopic effect in ship, motor cycle, car and aircraft. Turning moment diagrams: four stroke IC engines, multi cylinder engines, fluctuation of energy - Fly wheels – energy stored, dimension of rim, Application of flywheel – Punching presses.

Unit V:Cams and governors (12)

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

Types of governor – watt, porter, proell, hartnell and hartung, Governor -Pickering, Stability, Sensivity, Isochronous, hunting, coefficient of insensitiveness

TOTAL: 60 HOURS

TEXT BOOKS

1. Shigley, J.E. and Uicker, J.J., “Theory of Machines and Mechanisms”, McGraw-Hill, 1995.
2. Rattan.S.S, “Theory of Machines”, Tata McGraw–Hill Publishing Co., New Delhi, 2009.
3. Ballaney.P.L, “Theory of Machines”, Khanna Publishers, New Delhi, 2005.

REFERENCES:

1. Hibbeler, R.C and Ashok Gupta, “Engineering Mechanics: Statics and Dynamics”, 11th Rao, J.S and Dukupati, R.V, “Mechanism and Machine Theory”, Second Edition, Wiley Eastern Ltd., 2007.
2. Malhotra, D.R and Gupta, H.C., “The Theory of Machines”, SatyaPrakasam, Tech. India Publications, 6th Edn 2010.
3. Gosh, A. and Mallick, A.K., “Theory of Machines and Mechanisms”, Affiliated East West Press, 3rd Edn 2006.

AM3274	Automotive Electrical and Electronics System Laboratory	L	T	P	C
		0	0	2	1

Objectives

- Understand the usage of fluid machineries
- Analysis the performance power drives

Course Outcome		Cognitive Skill
CO-01	Able to learn about automotive wiring	P
CO-02	Able to understand the testing of automotive batteries.	An
CO-03	Able to understand the concepts of charging and starting system operation.	U

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	P0-A	P0-B	P0-C	P0-D	P0-E	P0-F	P0-G	P0-H	P0-I	P0-J	P0-K	P0-L
CO-01	L	N	N	M	L	L	S	N	S	N	S	N
CO-02	N	M	L	N	N	N	S	N	N	N	N	N
CO-03	N	N	M	N	L	N	L	N	N	N	L	N

S-Strong, M-Medium, L-Low, N-Not relevant

a. Electrical Laboratory

1. Testing of batteries and battery maintenance
2. Testing of starting motors and generators
3. Testing of regulators and cut – outs
4. Diagnosis of ignition system faults
5. Automobile electrical wiring
6. Study of lighting and accessories in automobiles

b. Electronics Laboratory

1. Study of rectifiers and filters
2. Study of logic gates, adder and flip-flops
3. Study of SCR and IC timer

4. Interfacing A/D converter and simple data acquisition
5. Micro controller programming and interfacing
6. Study of sensors & Actuators (Charge-Air pressure sensor, Temperature Sensor, Pump Speed sensor, Rack travel sensor, Vehicle speed sensor)

TOTAL: 45 HOURS

LIST OF EQUIPMENTS (for a batch of 30 students)

- | | |
|--------------------------------------|-------------|
| 1. Starter motor, regulator, cut-out | -1 No. Each |
| 2. Auto electrical wiring system | -1 No. |
| 3. Rectifiers, filters | -1 No. Each |
| 4. Amplifier | -1 No |
| 5. IC timer | -1 No. |
| 6. Data logger | -1 No |
| 7. Charge-Air pressure sensor | -1 No |
| 8. Temperature sensor | -1 No |
| 9. Pump speed sensor | -1 No |
| 10. Rack travel sensor | -1 No |
| 11. Vehicle speed sensor | -1 No |

AM3275	Fluid Mechanics and Dynamics Laboratory	L	T	P	C
		0	0	2	1

Objectives

- Understand the usage of fluid machineries
- Analysis the performance power drives

Course Outcome		Cognitive Skill
CO-01	Understanding the basics of Venturimeter.	P
CO-02	Gaining knowledge regarding the orifice meter	An
CO-03	Understanding the performance of pumps.	U

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	P0-A	P0-B	P0-C	P0-D	P0-E	P0-F	P0-G	P0-H	P0-I	P0-J	P0-K	P0-L
CO-01	S	L	N	N	S	N	M	L	N	N	M	N
CO-02	N	N	S	L	L	S	M	S	S	N	N	S
CO-03	S	M	L	S	L	M	M	N	N	S	N	L

S-Strong, M-Medium, L-Low, N-Not relevant

LIST OF EXPERIMENTS

1. Determination of the Coefficient of discharge for given Orifice meter
2. Determination of the Coefficient of discharge for given Venturi meter.
3. Calculation of the rate of flow using Rota meter.
4. Determination of friction factor for a given set of pipes.
5. To investigate the performance of the centrifugal pump and draw its characteristic curves.
6. To investigate the performance of the reciprocating pump and draw its characteristic curves.
7. To investigate the performance of the Pelton Wheel turbine with different range of flow and draw its characteristic curves.
8. To investigate the performance of the Francis turbine with different range of flow and draw its characteristic curves.
9. Governors - Determination of sensitivity, effort, etc. for Watt, Porter, Proell, Hartnell governors
10. Transverse vibration –free- Beam. Determination of natural frequency and deflection of beam
11. Cam - Study of jump phenomenon and drawing profile of the cam
12. Motorized Gyroscope-Verification of laws -Determination of gyroscopic couple
13. Whirling of shaft-Determination of critical speed of shaft with concentrated loads
Balancing of reciprocating masses Balancing of rotating masses
14. Determination of moment of inertia by oscillation method for connecting rod and flywheel
15. Vibrating system - Spring mass system-Determination of damping co-efficient of single degree of freedom system
16. Determination of influence co-efficient for multi degree freedom suspension system
17. Determination of transmissibility ratio - vibrating table
18. Determination of tensional frequencies for compound pendulum and flywheel system with lumped Moment of inertia

LIST OF EQUIPMENTS *(for a batch of 30 students)*

1. Orifice meter setup
2. Venturing meter setup
3. Rota meter setup
4. Pipe Flow analysis setup
5. Centrifugal Pump setup
6. Reciprocating Pump setup
7. Pelton wheel turbine setup.
8. Francis turbine setup
9. Governors.

AM32P1	Summer Internship I	L	T	P	C
		0	0	0	2

OBJECTIVES

- This training is to provide an industrial exposure.
- To gain knowledge about role of automobile engineers in Industries.
- To provide a learning platform to know about the role of Automobile Engineer

Course Outcome		Cognitive Skill
CO-01	Provide basic knowledge about the importance of automobile concepts in various industries	P
CO-02	Gain knowledge about engineering applications in automobile sector	An
CO-03	Gain knowledge about the automobile engineers used in various industries	U

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	P0-A	P0-B	P0-C	P0-D	P0-E	P0-F	P0-G	P0-H	P0-I	P0-J	P0-K	P0-L
CO-01	N	N	N	N	L	N	N	N	N	N	L	S
CO-02	N	N	N	N	L	N	N	N	N	N	M	S
CO-03	N	N	N	N	M	N	N	N	N	N	M	S

S-Strong, M-Medium, L-Low, N-Not relevant

- The students may undergo Industrial training during summer / winter vacation. In this case the training has to be undergone continuously for the entire period.
- Students may practice in industry about how to carry out vehicle maintenance in workshops.
- The students may undergo Internship at Depots / Auto components manufacturing companies after due approval from the Department Consultative Committee In lieu of Industrial training.
- The students should produce valid certificate from the industries and also submit a detailed report about the training to the review committee.
- Industrial training and seminar shall carry 100 marks and shall be evaluated through internal and external assessment.

TOTAL: 45 HOURS

SEMESTER V

Sl. No	Course Code	Course Title	L	T	P	C
THEORY						
1.	MS3201	Professional and Business Ethics	2	0	0	2
2.	AM3210	Automotive Power Trains	3	0	0	3
3.	AM3211	Engineering Design	3	1	0	4
4.	AM3212	Materials Science and Engineering	3	0	0	3
5.	AM3213	Applied Hydraulics and Pneumatics	3	0	0	3
6.	AM3214	Vehicle Body Engineering	3	0	0	3
PRACTICALS						
7.	AM3276	Automotive Chassis Laboratory	0	0	2	1
8.	AM3277	Instrumentation ,metrology and metallurgy laboratory	0	0	2	1
9.	AM3278	Machine Drawing Laboratory	0	0	4	2
TOTAL			17	1	8	22

MS3201	PROFESSIONAL AND BUSINESS ETHICS	L	T	P	C
		3	0	0	3

Objectives:

1. To Recognize legal and ethical issues in business decision-making.
2. To Understand and apply ethical rules and constraints.
3. To enhance analytical problem-solving skills and ethical decision-making abilities.

Course Outcome – Cos		Cognitive Skill
CO-01	To understand human values.	R,U
CO-02	To gain knowledge in engineering ethics.	U
CO-03	To practice engineering as social experimentation.	A
CO-04	To understand safety responsibilities and rights.	An
CO-05	To understand and evaluate global issues regarding engineering.	U,E

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	P0-A	P0-B	P0-C	P0-D	P0-E	P0-F	P0-G	P0-H	P0-I	P0-J	P0-K	P0-L
CO-01	M	M	S	L	S	L	S	N	N	N	N	N
CO-02	N	N	M	M	L	N	M	N	N	N	N	N
CO-03	L	S	M	N	M	S	N	N	N	N	N	N
CO-04	S	M	N	L	N	M	L	N	N	N	N	N
CO-05	N	L	L	S	N	N	N	N	N	N	N	N

S- Strong, M- Medium, L-Low, N- Not Relevant

Unit I: Human Values

9

Morals, Values, and Ethics- Integrity and Work Ethic- Service Learning and Civic Virtue- Respect for Others and Living Peacefully- Caring, Sharing, and Honesty- Courage, Valuing Time, and Co-operation- Commitment, Empathy, and Self-Confidence- Character and Spirituality

Unit II: Engineering Ethics

9

Senses of 'Engineering Ethics' and Moral Issues- Types of Inquiry and Moral Dilemmas- Moral Autonomy and Ethical Theories- Models of Professional Roles- Self-Interest, Customs, and Religion.

Unit III: Engineering as Social Experimentation

9

Engineering as Experimentation- Engineers as Responsible Experimenters- Codes of Ethics and Legal Perspectives- Case Study: The Challenger Incident

Unit IV: Safety, Responsibilities, and Rights

9

Safety, Risk, and Risk Assessment- Risk-Benefit Analysis and Risk Reduction- Case Studies: Three Mile Island and Chernobyl- Collegiality, Loyalty, and Respect for Authority- Conflicts of Interest and Occupational Crime - Professional and Employee Rights - Intellectual Property Rights (IPR) and Discrimination

Unit V: Global Issues

Multinational Corporations and Environmental Ethics- Computer Ethics and Weapons Development- Engineers as Managers, Consultants, and Expert Witnesses- Sample Codes of Ethics from Professional Organizations.

TOTAL: 45 HOURS

Textbooks:

1. Mike Martin and Roland Schinzinger, "Ethics in Engineering," McGraw-Hill, New York, Latest edition: 4th edition (2022).
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics," Prentice Hall of India, New Delhi, Latest edition: 2nd edition (2021).

References:

1. Charles D. Fleddermann, "Engineering Ethics," Pearson Education/Prentice Hall, New Jersey, Latest edition: 4th edition (2022).
2. Charles E. Harris, Michael S. Protchard, and Michael J. Rabins, "Engineering Ethics- Concepts and Cases," Wadsworth Thompson Learning, United States, Latest edition: 2nd edition (2023).

3. JohnRBoatright, "EthicsandtheConductofBusiness,"PearsonEducation,NewDelhi, Latest edition: 8th edition (2021).
4. EdmundGSeebauerandRobertLBarry, "FundamentalsofEthicsforScientistsan Engineers," Oxford University Press, Oxford, Latest edition: 2nd edition (2022).

AM3210	AUTOMOTIVE POWER TRAINS	L	T	P	C
		3	0	0	3

Objective:

Upon completion of this course the student will be able to: Demonstrate the principle of power transmission components Design power train system and components for a new vehicle

Course Outcome		Cognitive Skill
CO-01	Students can understand the different types of clutch	P
CO-02	Students can study the forces acting on the gearbox	An
CO-03	Students will be able to understand the forces acting on the dynamic bodies, torque, impulse and momentum	U
CO-04	Students can study the driveline	S
CO-05	Students can understand the basic so friction and types power train design	A

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	P0-A	P0-B	P0-C	P0-D	P0-E	P0-F	P0-G	P0-H	P0-I	P0-J	P0-K	P0-L
CO-01	M	M	S	L	S	L	S	N	N	N	N	N
CO-02	N	N	M	M	L	N	M	N	N	N	N	N
CO-03	L	S	M	N	M	S	N	N	N	N	N	N
CO-04	S	M	N	L	N	M	L	N	N	N	N	N
CO-05	N	L	L	S	N	N	N	N	N	N	N	N

S- Strong, M- Medium, L-Low, N- Not Relevant

Unit1: Clutch

9

Clutches- need, types-design of single plate clutch, multi plate clutch, centrifugal clutch, cone clutch , electromagnetic clutch , over running clutch - fluid coupling – clutch linkage – mechanical and hydraulic-clutch energy dissipated, torque capacity of clutch-trouble shooting service procedure.

Unit II : Gearbox

9

Gearbox– need, speed selection– sliding mesh, constant mesh, synchromesh– over drives– gear shift mechanisms-total resistance to motion- traction and tractive effort- acceleration- calculation of gear ratio for vehicles- design of three speed gear box and four speed gear boxes- performance characteristics in different speeds- speed synchronizing devices, gear materials, lubrication– transfer case.

Unit III: Torque Converter and Automatic Transmission**9**

Principal of torque conversion, single, multistage and polyphase torque converters, performance characteristics, constructional and operational details of typical hydraulic transmission drives . Automatic transmission: relative merits and demerits when compared to conventional transmission– epicyclic and hydrometric transmission– continuously variable transmission -

Unit IV: Driveline**9**

Effect of driving thrust and torque reactions- Hotchkiss drive, torque tube drive and radius rods- propeller shaft, universal joints, slip joint-front wheel drive-different types of final drive, double reduction and twin speed final drives differential construction details ,nonslip differential, differential locks-rear axle assembly-types-multi axle vehicles–power train for hybrid vehicles.

Unit V: Power train design**9**

Design of complete power train for a given engine power and vehicle load- clutch, gearbox propeller shaft, differential, rear axle and wheel.

Textbooks

1. Crouse W.H-“Automotive chassis and body”-McGraw-Hill, New York-1971.
2. Giri. N.K. “Automobile Mechanics ”Khanna Publishers– New Delhi– 2002.

References

1. Heldt P.M-Torque converters-Chilton Book Co.-1992
2. Newton Steeds & Garret- “Motor Vehicle”-Illiffe Books Ltd., London– 2000
3. Automotive chassis system– Thomas W. Birch.

AM3211	ENGINEERING DESIGN	L	T	P	C
		3	1	0	4

OBJECTIVE:

Students are taught to be familiar with various concepts of knowledge on design of various automobile components

Course Outcome		Cognitive Skill
CO-01	Students can understand the different types of loads	P
CO-02	Students can study the forces acting on shaft	An
CO-03	Students will be able to understand the forces acting on the bearing	U
CO-04	Students can study the welded joints	S
CO-05	Students can understand the basics of friction and types of belt and chain drive	A

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	P0-A	P0-B	P0-C	P0-D	P0-E	P0-F	P0-G	P0-H	P0-I	P0-J	P0-K	P0-L
CO-01	N	N	S	M	M	L	S	L	L	S	M	N
CO-02	M	S	M	L	S	L	M	S	L	S	L	L
CO-03	S	L	S	M	L	L	L	L	L	L	S	N
CO-04	N	N	M	L	S	S	N	L	S	S	M	M
CO-05	N	N	S	M	M	L	S	L	L	S	M	N

S- Strong, M- Medium, L-Low, N- Not Relevant

UNITI: DESIGN FOR STATIC AND FLUCTUATING LOAD

12

Concepts of design, preferred numbers- concurrent engineering- static stress equation in axial, bending and torsional loading- criteria for failure- factor of safety. Static loading- Combination of normal stresses – combination of normal and shear stresses -principal stresses -theories of failure. Fluctuating load- Mechanism of fatigue failure, fatigue limit and fatigue strength, S-N curves, Soderberg, Goodman and Gerber equations.

UNITII: DESIGN OF SHAFTS, KEYS AND COUPLINGS

12

Forces on shafts due to gears, belts and chains, estimation of shaft size based on strength, rigidity and critical speed. Design of keys and keyways. Design of rigid and flexible couplings- Muff, Clamp and Flange Couplings -knuckle joints

UNITIII: DESIGN OF BEARINGS AND SPRINGS

12

Sliding contact and rolling contact bearings, cubic mean load, variable load, probability of survival, selection of bearings. Helical springs, stresses and deflection in round wires, concentric rings-accounting for variable stresses. Design of leaf springs-stress and deflection equations.

UNITIV: RIVETED, BOLTED AND WELDED JOINTS

12

Strength equations, efficiency, design of riveted joints. Thread forms, initial stress, stresses due to external loads, elastic analysis of bolted joints for pressure vessels. Welded joints- types, weld symbols, strength of welds, centrally loaded unsymmetrical sections, axially loaded and eccentrically loaded joints..

UNITV: BELT AND CHAIN DRIVES

12

Design of Flat belts and pulleys – Selection of V belts and pulleys- Selection of hoisting wire ropes and pulleys-Design of Transmission chains and Sprockets.

TOTAL: 60 HOURS

TEXTBOOKS

1. Shigley and Mischke, "Mechanical Engineering Design", McGraw Hill, 2011
2. Bandari V.B., "Design of Machine Elements", Tata McGraw Hill, 2016

REFERENCE:

1. John L. Hennessey and David A. Patterson, "Computer Architecture-A Quantitative Approach", Morgan Kaufmann/Elsevier, 5th edition, 2012.

2. Faculty of Mechanical Engineering, PSG College of Technology, "Design Data Book", M/s. Kalaikathir Achagam, Coimbatore, 2013.
3. Maitra GM, "Handbook of Gear Design", Tata McGraw Hill, New Delhi, 2004.40
4. Gope P.C., "Machine Design: Fundamentals and applications", PHI Learning, 2012.
5. Robert L Mott, "Machine Elements in Mechanical Design", Macmillan Publishing Co, 2003.

AM3212	MATERIALS SCIENCE AND ENGINEERING	L	T	P	C
		3	0	0	3

AIM:

To impart knowledge on various mechanical properties of various materials & application of the senatorial sin practice

OBJECTIVE:

To impart knowledge on the structure, properties, treatment, testing and applications of metals and non-metallic materials so as to identify and select suitable materials for various engineering applications.

Course Outcome		Cognitive Skill
CO-01	Students can understand the different types of force and their characteristics in the rigid bodies	P
CO-02	Students can study the forces acting on the reciprocating bodies	An
CO-03	Students will be able to understand the forces acting on the dynamic bodies, torque, impulse and momentum	U
CO-04	Students can study the simple mechanisms	S
CO-05	Students can understand the basics of friction and types of friction, friction acting on the screw jack.	A

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO \ CO	P0-A	P0-B	P0-C	P0-D	P0-E	P0-F	P0-G	P0-H	P0-I	P0-J	P0-K	P0-L
CO-01	N	N	S	M	M	L	S	L	L	S	M	N
CO-02	M	S	M	L	S	L	M	S	L	S	L	L
CO-03	S	L	S	M	L	L	L	L	L	L	S	N
CO-04	N	N	M	L	S	S	N	L	S	S	M	M
CO-05	N	N	S	M	M	L	S	L	L	S	M	N

S- Strong, M- Medium, L-Low, N- Not Relevant

UNITI: ELASTICANDPLASTICBEHAVIOROFMATERIALS**9**

Elasticity. Stress and strain relationship in engineering materials. Deformation mechanism. Strain hardening, alloying, polyphase mixture, martensitic, precipitation, dispersion, fibre and texture strengthening

UNITII: HEATTREATMENTANDSURFACETREATMENT**9**

Heat treatment of steel–Iron carbon diagram-TTT diagram. Annealing -types, normalizing, hardening - Quenching and tempering – Austempering, Mar tempering with specific relevance to automotive components, Casehardening techniques- Carburizing, Nitriding, Cyaniding – induction hardening – flame hardening and chemical hardening. Coating and corrosion resistance. Electroplating, phosphate, anodizing, hot dipping thermal spraying, hard-facing and thin film coatings.

UNITIII: FRACTURE, FATIGUE AND CREEP**9**

Fracture, classification and types, Griffith's theory, notch effects, stress concentration, concept of fracture toughness. Ductile brittle transition. Fatigue Mechanism of crack initiation and growth, factors affecting fatigue creep, creep curve, Ashby deformation mechanism maps, and creep mechanism, metallurgical variables of creep.

UNITIV: ALLOYS AND COMPOSITE MATERIALS**9**

Cast ability, machinability, formability and weld ability of engineering materials such as steel, cast iron, alloy steels, brass, bronze and aluminum alloys. Composite materials: fabrication techniques, materials for high temperature. Cryogenic wear, corrosion fatigued creep and oxidation resistance application.

UNITV: MATERIALSFORAUTOMOTIVEAPPLICATIONS**9**

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 etc. Application of non metallic materials such as composite, ceramic and polymers in automobile.

TOTAL: 45HOURS**TEXTBOOKS:**

1. Khanna.O.P.MaterialScienceandMetallurgy,DhanpatRai&Sons,2004.
2. Kapoor,MaterialScienceandProcesses,NewIndiaPublishingHouse,1987.

REFERENCES:

1. Dieter,G.E.,MechanicalMetallurgy,McGrawHill,NewYork,2001.
2. Avner,S.H. Introduction to physical metallurgy, McGraw Hill,NewYork,2ndEdn2009.
Raghavan.V. Physical Metallurgy, Principle and Practice, 2nd Edn. 2012

AM3213	APPLIED HYDRAULICS AND PNEUMATICS	L	T	P	C
		3	0	0	3

OBJECTIVE:

This course will give an appreciation of the fundamental principles, design and operation of hydraulic and pneumatic machines, components and systems and their application in recent automation revolution

Course Outcome		Cognitive Skill
CO-01	Students can understand the fluid power principles	P
CO-02	Students can study the forces acting on the reciprocating bodies	An
CO-03	Students will be able to understand the hydraulic system and components	U
CO-04	Students can study the simple circuits and pneumatic systems	S
CO-05	Students can understand the basics of design of pneumatic and hydraulic systems	A

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	P0-A	P0-B	P0-C	P0-D	P0-E	P0-F	P0-G	P0-H	P0-I	P0-J	P0-K	P0-L
CO-01	N	N	S	M	M	L	S	L	L	S	M	N
CO-02	M	S	M	L	S	L	M	S	L	S	L	L
CO-03	S	L	S	M	L	L	L	L	L	L	S	N
CO-04	N	N	M	L	S	S	N	L	S	S	M	M
CO-05	N	N	S	M	M	L	S	L	L	S	M	N

S-Strong, M-Medium, L-Low, N-Not relevant

UNITI: FLUIDPOWERPRINCIPLESANDFUNDEMENTALS

9

Introduction to Fluid power- Advantages and Applications- Fluid power systems - Types of fluids-Properties of fluids Basics of Hydraulics- Pascal's Law -Principles of flow-Work, Power and Torque. Properties of fluid- Perfect Gas Laws.

UNITII: HYDRAULICSYSTEMANDCOMPONENTS

9

Sources of Hydraulic power: Pumping Theory - Pump Classification- Construction, Working, Design, Advantages, Disadvantages, Performance, Selection criterion of Linear, Rotary-Fixed and Variable displacement pumps, Hydraulic Actuators: Cylinders - Types and construction, Hydraulic motors Control Components: Direction control, Flow control and Pressure control valves- Types, Construction and Operation- Applications - Types of

actuation. Accessories: Reservoirs, Accumulators, Intensifiers, Pressure Switches-Applications- Fluid Power ANSI Symbol.

UNITIII: HYDRAULIC CIRCUIT

9

Industrial hydraulic circuits-Regenerative, Pump Unloading, Double-pump, Pressure Intensifier, Air- over oil, Sequence, Reciprocation, Synchronization, Fail-safe, Speed control, Hydro static transmission ,Accumulators, Electro hydraulic circuits, Mechanical Hydraulic servo systems.

UNITIV: PNEUMATIC SYSTEM

9

Compressors- Filter, Regulator, Lubricator, Muffler, Air control Valves, Quick Exhaust valves, Pneumatic actuators, Servo systems. Introduction to Fluidics, Pneumatic logic circuits.

UNITV: DESIGN OF HYDRAULIC AND PNEUMATIC CIRCUITS

9

Design of circuits using the components of hydraulic system for Drilling, Planning, Shaping, Punching, Press.-Selection, fault finding and maintenance of hydraulic components- Sequential circuit design for simple application using cascade method, Electropneumatic circuits. Selection criteria of pneumatic components - Installation fault finding and maintenance of pneumatic components. Microprocessor and PLC- Applications in Hydraulic and Pneumatics- Low cost Automation-Hydraulic and Pneumatic power packs.

TOTAL: 45 HOURS

TEXTBOOK:

1. Anthony Esposito, "Fluid Power with Applications", PHI/Pearson Education, 2005

REFERENCES:

1. Shanmugasundaram.K, "Hydraulic and Pneumatic controls", Chand & Co, 2006.
2. Majumdar, S.R., "Oil Hydraulics Systems-Principles and Maintenance", Tata McGraw Hill, 2001
3. Majumdar, S.R., "Pneumatic Systems Principles and Maintenance", Tata McGraw Hill, 2001
4. Micheal J, Pinches and Ashby, J.G., "Power Hydraulics", Prentice Hall, 1989.
5. Dudley, A. Pease and John Pippenger, "Basic Fluid Power", Prentice Hall, 1987.

AM3214	VEHICLE BODY ENGINEERING	L	T	P	C
		3	0	0	3

AIM:

To impart students the fundamental principles, design of different vehicle structures

OBJECTIVE:

This course will give an appreciation of the fundamental principles, design of vehicle body and their applications.

Course Outcome		Cognitive Skill
CO-01	Students can understand the different types car body	P
CO-02	Students can study the different details of bus body	An
CO-03	Students will be able to understand the analysis of vehicle body	U

CO-04	Students can study the safety and fatigue	S
CO-05	Students can understand the aerodynamics principles	A

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	P0-A	P0-B	P0-C	P0-D	P0-E	P0-F	P0-G	P0-H	P0-I	P0-J	P0-K	P0-L
CO-01	N	N	S	M	M	L	S	L	L	S	M	N
CO-02	M	S	M	L	S	L	M	S	L	S	L	L
CO-03	S	L	S	M	L	L	L	L	L	L	S	N
CO-04	N	N	M	L	S	S	N	L	S	S	M	M
CO-05	N	N	S	M	M	L	S	L	L	S	M	N

S-Strong, M-Medium, L-Low, N-Not relevant

UNIT I: DETAILS OF CAR BODY

9

Necessarily of vehicle body – Classification- Saloon- Convertible-Limousine –SUV- Racing and Sports Car-Terminology- Visibility – Safety - Design – Crash equipments – Body Materials- Corrosion and Anticorrosion Methods

UNITII: BUS BODY DETAILS

9

TYPES – classification- Based on shape, Layout – Floor height, Engine Location, Inlet and Exit, Terminology. Construction of conventional and Integral type Bus, Construction of Commercial vehicles -Body Materials.

UNITIII: VEHICLE BODY ANALYSIS

9

Introduction, criteria for vehicle body design, design based on deflection criteria, sheet metal representation, curved panels, equation for flexure, torsion, twist and differential bending, beam idealization and flexural axis, instability of thin walled structures.

UNITIV: SAFETY AND FATIGUE ASPECTS

9

Design of body, forces in roll over, head on impact, plastic collapse and analysis, fatigue and vibration, test on box sections, structural vibration. Idealization for analysis, Unit load method and structural deflection, observed deflections of a car, torsional stiffness car body idealization, symmetric bending and torsional loading, closed integral car structure, bus body idealization for analysis, bus body in torsion.

Structural design for production: Gravimetric analysis, design for press working, design for spot welding, adhesives and sealants, goods vehicle structure design, chassis frame configuration, structural properties of chassis frame members.

UNITV: AERODYNAMICS

9

Vehicle drag and types, effects of forces (lift, drag) and moments (pitch, roll and yaw), side wind effects on forces and moments, various body optimization techniques for minimum drag – wind tunnel testing, scale model testing, flow visualization, spoilers and deflectors

TOTAL: 45 Hours

TEXT BOOKS:

1. JnuszPawlowski, "Vehicle Body Engineering", Business books limited, 1989.
2. Thomas D Gillespie, "Fundamentals of Vehicle dynamics", SAE USA 1992.

REFERENCES:

1. John Fenton, "Hand book of automotive power train and chassis design", SAE, 19
2. Ian Andrew Norman, "Heavy Duty Vehicle systems", third edition, Delmar-Thomson Learning ltd.

PRACTICALS

AM3276	AUTOMOTIVE CHASSIS LABORATORY	L	T	P	C
		0	0	2	1

AIM:

To impart knowledge on assembling and Dismantling of various automobile components

OBJECTIVE:

Students get knowledge on assembling and dismantling of various automobile components
Study and measurement of the following chassis frames

Course Outcome		Cognitive Skill
CO-01	Students will have a knowledge on assembling and dismantling of various automobile components	P
CO-02	Assembly of heavy duty vehicles	An
CO-03	Assembly of light weight vehicles	U

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	P0-A	P0-B	P0-C	P0-D	P0-E	P0-F	P0-G	P0-H	P0-I	P0-J	P0-K	P0-L
CO-01	N	N	S	M	M	L	S	L	L	S	M	N
CO-02	M	S	M	L	S	L	M	S	L	S	L	L
CO-03	S	L	S	M	L	L	L	L	L	L	S	N

S-Strong, M-Medium, L-Low, N-Not relevant

LIST OF EQUIPMENTS:

1. Heavy duty vehicle frame (Leyland, Tata etc)
2. Light duty vehicle frame (Ambassador, Maruthi
3. Study, Dismantling, inspect and assembling of Front Axle, Rear Axle, Differential
4. Steering systems along with any two types of steering gearbox
5. Braking systems-hydraulic servo vacuum, compressed air power brakes.
6. Leaf spring, coil spring, torsion bar spring, Hydraulic shock absorber
7. Study, Dismantling ,inspect and Assembling of Clutch assembly of different types Gear Box, Transfer case
8. Performance Test of Bold Wind Tunnel.

LIST OF EQUIPMENTS

(for a batch of 30 students)

1. Four cylinder petrol engine	-1No.
2. Six cylinder diesel engine	-1No.
3. Fuel filter, fuel injection pump, Injector, carburetor, MPFI component	-1No.each
4. Ignition coil, magneto, electronic ignition system components	-1No.each
5. Water pump, thermostat, radiator, temperature gauge	-1No.each
6. Lub oil pump, pressure relief valve, filter, oil pressure gauge	-1No.each
7. Internal micrometer, external micrometer, dial gauges	-3Nos.each
8. Bore Dial gauge	-3Nos.each
9. Vernier Caliper Inside and Outside	-3Nos.each
10. Cylinder Head 4cylinder Engine	-2No
11. Heavy duty vehicle chassis frame(Leyland or Tata)	-1No.
12. Light duty vehicle chassis frame	-1No.
13. Front axle	-1No.
14. Rear axle	-1No.
15. Steering system	-1No
16. Steering gear box(Rack and pinion, re- circulating ball type)	-1No.each
17. Hydraulic brake system	-1No.
18. Air brake system	-1No
19. Leaf spring, coil spring, torsion bar	-1No.each
20. Hydraulics hock absorber	-1No.
21. Diaphragm clutch assembly	-1No.
22. Gearbox (light duty ,heavy duty)	-1No.each
23. Transfer case	-1No.
24. Tool box	-3Sets.
25. Torque wrench	-1No.

TOTAL: 45HOURS

AM3277	INSTRUMENTATION,METROLOGYANDMETALLURGY LABORATORY	L	T	P	C
		0	0	2	1

AIM:

To make students to have a knowledge on study and calibration of various components

OBJECTIVE:

Students may receive knowledge on study and calibration of various components

Course Outcome		Cognitive Skill
CO-01	Students will have a knowledge on study and calibration of various measuring instruments	P
CO-02	Students can understand the checking of dimensional tolerances	An
CO-03	Students can analysis the metallurgical properties of the metal by heat treatment	U

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate

Mapping of Course Outcome with Programme Outcome

PO CO	P0-A	P0-B	P0-C	P0-D	P0-E	P0-F	P0-G	P0-H	P0-I	P0-J	P0-K	P0-L
CO-01	N	N	S	M	M	L	S	L	L	S	M	N
CO-02	M	S	M	L	S	L	M	S	L	S	L	L
CO-03	S	L	S	M	L	L	L	L	L	L	S	N

S-Strong, M-Medium, L-Low, N-Not relevant

LIST OF EXPERIMENTS:

1. Measurement of Taper Angle using sine bar/tool makers micro scope
2. Calibration of Vernier /Micrometer/Dial Gauge
3. Checking Dimensions of part using slip gauges
4. Measurements of Gear Tooth Dimensions
5. Measurement of straightness and flatness
6. Measurement of thread parameters
7. Checking the limits of dimensional to clearances using comparators
8. (Mechanical/Pneumatic/Electrical)
9. Measurement of Temperature using Thermo couple /Pyrometer
10. Measurement of Displacement(Strain Gauge/LVDT/Wheat stone Bridge)
11. Measurement of Force
12. Measurement of Torque
13. Measurement of Vibration/Shock
14. Effect of hardening-Improvement in hardness and impact resistance of steels.
15. Tempering-Improvement and comparison Mechanical properties
Unhardened specimen
Quenched Specimen and
Quenched and tempered specimen.

TOTAL: 45HOURS

AM3278	MACHINE DRAWING LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVE:

To train the students to prepare good and accurate drawing of various machine elements and assembly drawing of selected machine tool parts.

Course Outcome		Cognitive Skill
CO-01	Practice for the codes of the machines	P
CO-02	Various views of the machine parts and their cut sections	An
CO-03	Students can draw a assembled views of the machine components	U

R-Remember, U-Understand, An-Analyze, E-Evaluate.

Mapping of Course Outcome with Programme Outcome

PO CO	P0-A	P0-B	P0-C	P0-D	P0-E	P0-F	P0-G	P0-H	P0-I	P0-J	P0-K	P0-L
CO-01	N	N	S	M	M	L	S	L	L	S	M	N
CO-02	M	S	M	L	S	L	M	S	L	S	L	L
CO-03	S	L	S	M	L	L	L	L	L	L	S	N

S-Strong, M-Medium, L-Low, N-Not relevant

Ability to develop engineering drawing for the industrial components using India Standard Code of Practice.

1. Fundamentals of machine drawing [8Hours]Code of practice for Machine Drawing- Conventions, Abbreviation and Symbols
 2. Sectional views-Types of sectional views Selection of Fits and Tolerances-Method of placing limit dimensions. Basic machine elements [24Hours]
 3. There quire sectional views of the following machine elements are to be drawn as per the standards.
 - Threaded joints
 - Riveted joints
 - Welded joints
 - Key, Cotter and Pin joints
 - Shaft coupling
 - Bearing
 - Pipe joints
 - Gears Surface finish and its representation
 4. Assembly drawing [28Hours]
- The assembly drawing of the following machine tool parts is to be drawn from the given detailed drawing.
- Screw jack, machine vice, swivel bearing
 - Lathe tail stock, Lathe tool post-Tool head of a shaper
 - Drilling jig-Drilling machine spindle
 - Engine piston and connecting rod
 - Re circulating ball screw, LM guide ways,
 - Hydraulic and Pneumatic chuck of CNC machine.
5. Microscopic Examination of
 - Hardened samples and
 - Hardened and tempered samples.

TOTAL: 45HOURS

SEMESTER VI

Sl. No	Course Code	Course Title	L	T	P	C
THEORY						
1.	CS32D1	Fundamentals of Artificial Intelligence	3	0	0	3
2.	AM3215	Vehicle Dynamics	3	0	0	3
3.	AM3216	Design of Vehicle Components	3	1	0	4
4.	AM3217	Automotive Pollution and Control	3	0	0	3
5.	AM32**	Professional Elective II	3	0	0	3
6.	AM32**	Professional Elective III	3	0	0	3
PRACTICALS						
7.	AM3279	Computer Aided Vehicle Manufacturing laboratory	0	0	2	1
8.	AM3280	Automotive Engine Components Laboratory	0	0	2	1
9.	AM32P2	Summer Internship II	0	0	0	2
TOTAL			18	1	4	22

CS32D1	FUNDAMENTALSOF ARTIFICIAL INTELLIGENCE	L	T	P	C
		3	0	0	3

OBJECTIVES

- Understand the basic concept of intelligent agents.
- Develop general-purpose problem solving agents, logical reasoning agents, and agents that reason under uncertainty.
- Employ AI techniques to solve some of today's real world problems.

Course Outcome At the end of the course students should be able to,		Cognitive Skill
CO-01	Explain autonomous agents that make effective decisions in fully informed, partially observable, and adversarial settings.	U
CO-02	Choose appropriate algorithms for solving given AI problems	A
CO-03	Design and implement logical reasoning agents	R,A
CO-04	Design and implement agents that can reason under uncertainty	R,A

CO-05	Understand the basic areas of artificial intelligence including problem solving, knowledge representation, reasoning, decision making, planning, perception and action.	U
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R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	P0-A	P0-B	P0-C	P0-D	P0-E	P0-F	P0-G	P0-H	P0-I	P0-J	P0-K	P0-L
CO-01	N	N	S	M	M	L	S	L	L	S	M	N
CO-02	M	S	M	L	S	L	M	S	L	S	L	L
CO-03	S	L	S	M	L	L	L	L	L	L	S	N
CO-04	N	N	M	L	S	S	N	L	S	S	M	M
CO-05	N	N	S	M	M	L	S	L	L	S	M	N

S-Strong, M-Medium, L-Low, N-Not relevant

UNIT I: AI AGENTS

9

Introduction to AI –Agents and Environments–Concept of rationality–Nature of environments –Structure of agents – Problem solving agents–Search algorithms– Uninformed search strategies.

UNIT II: PROBLEM SOLVING

9

Heuristic search strategies–heuristic functions-Local search and optimization problems– Local search in continuous space–Search with on-deterministic actions–Search in partially observable environments– On line search agents and unknown environments.

UNIT III: THEORY OF GAME PLAYING

9

Game theory–Optimal decision in games–Alpha-beta search–Monte-Carlo tree search – Stochastic games– Partially observable games. Constraint Satisfaction Problems–Constraint propagation–Back tracking search for CSP– Local search for CSP– Structure of CSP.

UNIT IV: KNOWLEDGE BASED LOGICAL AGENTS

9

Knowledge-based agents–Propositional logic–Propositional theorem proving– Propositional model checking– Agents based on propositional logic. First-order logic– Syntax and semantics–Knowledge representation and engineering–Inferences in first-order logic– Forward chaining–Backward chaining– Resolution.

UNIT V: KNOWLEDGE REPRESENTATION

9

Ontological engineering–Objects and categories–Events–Mental objects and Modal logic– Reasoning systems for categories– Reasoning with default information. Classical planning– Algorithms for classical planning–Heuristics for planning– Hierarchical planning–Non-deterministic domains–Time, Schedule, and Resources– Analysis

TOTAL: 45 Hours

TEXTBOOKS:

1. Stuart Russell and Peter Norvig, “Artificial Intelligence: A Modern Approach”, Fourth Edition, Pearson Education, 2020

REFERENCES

1. Dan W. Patterson, "Introduction to A and ES", Pearson Education, 2007.
2. Kevin Night, Elaine Rich, and Nair B., "Artificial Intelligence", McGraw Hill, 2008.
3. Patrick H. Winston, "Artificial Intelligence", Third edition, Pearson Edition, 2006.
4. Deepak Khemani, "Artificial Intelligence", Tata McGraw Hill Education, 2013.
5. Artificial Intelligence by Example: Develop machine intelligence from scratch using real artificial intelligence use cases - by Dennis Rothman, 2018.

AM3215	VEHICLE DYNAMICS	L	T	P	C
		3	0	0	3

OBJECTIVE:

At the end of the course students will have knowledge about Total resistance to a moving vehicle, Stability and road loads of a vehicle

OUTCOMES:

Course Outcome		Cognitive Skill
CO-01	Students can understand the different resistance	P
CO-02	Students can study the forces acting road	An
CO-03	Students will be able to understand the vehicle handling	U
CO-04	Students can study the stability of vehicles	S
CO-05	Students can understand the types of Suspension	A

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	P0-A	P0-B	P0-C	P0-D	P0-E	P0-F	P0-G	P0-H	P0-I	P0-J	P0-K	P0-L
CO-01	S	N	S	M	M	L	S	L	L	S	M	S
CO-02	M	S	M	L	S	L	M	S	L	S	L	L
CO-03	S	L	S	M	L	S	L	L	L	L	S	N
CO-04	N	N	M	L	S	S	N	L	S	S	M	M
CO-05	N	S	S	M	M	L	S	L	L	S	M	S

S-Strong, M-Medium, L-Low, N-Not relevant

UNITI: Resistance

9

Total resistance to a moving vehicle- air, rolling and grade resistance, power for propulsion, traction and tractive effort, Performance of cars and light trucks- Vehicle drag-deformation of the wheel, deformation of the ground, Road performance curves- acceleration, grad ability and draw bar pull, acceleration time and elasticity, fuel consumption and fuel economy, strategy for lowest fuel consumption, factors affecting fuel economy, Corporate Average Fuel

Economy(CAF), driving schedules – EP Aruban and high way cycles, European driving cycles.

UNITII: Road Loads

9

Air resistance-Mechanics of air flow around a vehicle, pressure distribution on a vehicle, factors affecting rolling resistance, aerodynamic forces - aerodynamic drag, drag components, drag coefficient, aerodynamic aids, aerodynamic side force, lift force, pitching moment, yawing moment, rolling moment, crosswind sensitivity,

UNITIII: Vehicle handling

9

Steering angle, cornering force, low speed turning, high speed cornering, suspension effects on cornering, self righting torque, slip angle, over steer, under steer, steady state cornering, driving torques on steering, effect of camber, camber thrust, transient effects in cornering,

UNITIV: Stability of vehicle

9

Distribution of weight(Three wheeled and four wheeled vehicles), stability of a vehicle on a slope, Dynamics of vehicle running on a banked track, Stability of a vehicle taking a turn, Braking requirements, stopping distance, braking efficiency, work done in braking, tyre adhesion, braking of vehicles. Road testing methods: Measurement of aerodynamic drag force in a coast - down test, cross wind tests, engine cooling road test, wind noise measurement on the road.

UNITV: Suspension

9

Vehicle dynamics and suspension requirements, choice of suspension spring rate, chassis springs and theory of chassis springs, Gas & hydraulic dampers, and choice of damper, damper Characteristics, Roll axis and the vehicle under the action of side forces. Tyres: Tyre dimensions and specifications, Ride characteristics of tyres, wheel hop, wheel wobble, wheel wander, wheel shimmy, behavior while cornering, cornering force, power consumed by a tyre, effect of driving and braking torque, factors affecting tyre life, tread designs.

TOTAL: 45 HOURS

TEXTBOOK:

1. John L. Hennessey and David A. Patterson, "Computer Architecture - A Quantitative Approach", Morgan Kaufmann/Elsevier, 5th edition, 2012.

REFERENCES:

1. W. Steeds - Mechanics of road vehicles - Wildlife book Ltd, London, 1990
2. Thomas D. Gillespie - Fundamentals of road vehicles - SAE, 1992
3. N.K. Giri - Automobile mechanics, Khanna Publishers, Delhi, 1986
4. Wolf-Heinrich Hucho - Aerodynamics of road vehicles, SAE
5. J.G. Giles - steering, suspension and tyres, Wildlife books Ltd, London, 1968
6. P.M. Heldt - Automotive chassis, Chilton Co., New York, 1952
7. T.Y. Wong - Theory of ground vehicles, John Wiley and sons Inc, New York
8. Kripal Singh - Automobile Engineering - Vol-I, Standard Publishers, Delhi
9. R.P. Sharma - Accurse in Automobile Engineering, Dhanpat Rai publications.

AM3216	DESIGN OF VEHICLE COMPONENTS	L	T	P	C
		3	1	0	4

OBJECTIVE:

This course will give an appreciation of the fundamental principles, design of vehicle and their applications.

Course Outcome		Cognitive Skill
CO-01	Students can understand the introduction of vehicle components	P
CO-02	Students can study the tolerances and limits	An
CO-03	Students will be able to understand the design of cylinder and piston	U
CO-04	Students can design the connecting rod and crankshaft	S
CO-05	Students can understand the design of flywheel, clutch.	A

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	P0-A	P0-B	P0-C	P0-D	P0-E	P0-F	P0-G	P0-H	P0-I	P0-J	P0-K	P0-L
CO-01	S	N	S	M	M	L	S	L	L	S	M	S
CO-02	M	S	M	L	S	L	M	S	L	S	L	L
CO-03	S	L	S	M	L	S	L	L	L	L	S	N
CO-04	N	N	M	L	S	S	N	L	S	S	M	M
CO-05	N	S	S	M	M	L	S	L	L	S	M	S

S-Strong, M-Medium, L-Low, N-Not relevant

UNITI: INTRODUCTION

12

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 .Principles, design of engine based on vehicle characteristics, engine mounting and its types.

UNITII: LIMITS, FITS, TOLERANCES, SURFACEFINISH, SHAFTSAND SPRINGS

12Definitions, types of

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

UNITIII: DESIGN OFCYLINDER AND PISTON

12

Calculation of gas forces, variation of gas forces, Choice of material for cylinder and piston, piston friction, piston slap ,design of cylinder, piston, piston pin, piston rings, materials, piston failures, lubrication of piston assembly

UNITIV: DESIGN OF CONNECTING ROD, CRANKSHAFT**12**

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 crank shaft under bending and twisting, balancing weight calculations.

UNITV: DESIGN OF VALVES, FLYWHEEL, CLUTCHES AND GEARS**12**

Design of valves, valve springs, tappet. Cam design, cam profile generation, cam shaft design, rocker and rocker shaft design considerations, materials Design aspects of intake and exhaust manifolds, inlet and Exhaust valves, valve springs, tappets, valve train. Materials and design of flywheel. Design of single and multi-plate clutches, materials. Design of spur, helical, straight, spiral bevel gears and herringbone gears, Gear box design.

TOTAL: 60HOURS**TEXT BOOKS:**

1. Prabhu T J, "Design of Transmission Elements", PR Lithographers, 2003.
2. Lichty, "IC Engines", Kogakusha Co., Limited, Tokyo, 1986
3. Sundararaja Murthy T.V "Machine Design", Khanna Publishers, New Delhi, 1991.
4. A.Kolchinand V.Demidov, "Design of Automotive Engines", MIR Publishers, Moscow, 1984.
5. Design Data Book", PSG College of Technology, Coimbatore, 2000

REFERENCES:

1. Giles J G, "Engine Design", Illiffee Books Ltd., London 1968.
2. John Fenton., "Gasoline Engine analysis for CAD", MEP, London 1986.
3. Fred Scarfer & Richard Van Basshuysen, "Internal Combustion Engine" Handbook- Basic Components, Systems and Perspectives", SAE 2004.
4. Hall, Allen S Holowenko, Alfred R Laughlin, Herman G, "Schaum's Outline of Theory and Problems of Machine Design", Tata Mc Graw Hill Publishers, 2002.
5. Heldt PM, "High Speed Combustion Engines", Oxford IBH Publishing Co., Calcutta, 1996.

AM3217	AUTOMOTIVE POLLUTION AND CONTROL	L	T	P	C
		3	0	0	3

OBJECTIVE:

To make the students to realize the impact of automobile emissions on the environment and expose student of actor affecting the formation and control of automobile pollutants

Course Outcome		Cognitive Skill
CO-01	Students can understand the different types of pollution	P
CO-02	Students can study the pollutant formation in Singings	An
CO-03	Students will be able to understand the pollutant formation in CI engines	U
CO-04	Students can study the control pollutant formation in SI& CI engines	S
CO-05	Students can understand the measurement techniques of pollution	A

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	P0-A	P0-B	P0-C	P0-D	P0-E	P0-F	P0-G	P0-H	P0-I	P0-J	P0-K	P0-L
CO-01	S	N	S	M	M	L	S	L	L	S	M	S
CO-02	M	S	M	L	S	L	M	S	L	S	L	L
CO-03	S	L	S	M	L	S	L	L	L	L	S	N
CO-04	N	N	M	L	S	S	N	L	S	S	M	M
CO-05	N	S	S	M	M	L	S	L	L	S	M	S

S-Strong, M-Medium, L-Low, N-Not relevant

UNITI: INTRODUCTION

9

Pollutants–sources–formation, effects on human health and environment, global warming, types of emission, transient operational effects on pollution. Regulated–Unregulated emissions- Emission Standards-Introduction to BS-VI

UNITII: POLLUTANTFORMATIONINSIENGINES

9

Chemistry of SI engine combustion, Pollutant formation in SI Engines ,mechanism of HC and CO formation in four stroke and two stroke SI engines, NO_x formation in SI engines, effects of design and operating variables on emission formation.

UNITIII: POLLUTANT FORMATION IN CI ENGINES

9

Basics of diesel combustion, smoke and particulate emissions in CI engines ,effects of design and operating variables on CI engine emissions. NO_x formation and control. Color, odor, Sulphur and Al dehyde emissions.

UNITIV: CONTROLOFEMISSIONSFROMSIANDCIENGINES

9

Design of engine, optimum selection of operating variables for control of emissions, Evaporative emission control, EGR, Air injector PCV system, Thermal reactors, secondary air injection, catalytic converters, catalysts, fuel modifications, fuel cells, Fumigation, Use of unleaded petrol, Two stroke engine pollution control.

UNITV: MEASUREMENT TECHNIQUES EMISSION STANDARDS AND TEST PROCEDURE

9

NDIR ,FID, Chemiluminescent analyzers, Gas Chromatograph, smoke meters,, driving cycles- USA, Japan, Euro and India. Test proceduresCVS1, CVS3- ECE, FTP Tests. SHED Test- chassis dynamo meters, dilution tunnels.

TOTAL: 45HOURS

TEXTBOOK:

1. Pundir. B.P., “IC Engines Combustion and Emissions ”Narosa Publishers, 2010
2. PaulDegobert-AutomobilesandPollution-SAEInternationalISBN-156091-563-3,1991.
3. Ganesan,V-”Internal Combustion Engines”-TataMcGraw-HillCo.-2003.
4. SpringerandPatterson,EngineEmission,PlenumPress,1990

REFERENCES:

1. SAE Transactions-"Vehicle Emission"-1982 (3volumes).
2. Obert. E.F.-"Internal Combustion Engines"-1988
3. Marco Nute-"Emissions from two stroke engines, SAE Publication-1998

PRACTICALS

AM3279	COMPUTER AIDED VEHICLE MANUFACTURING LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVE:

To make the students understand the basic principles involved in the computer aided vehicle design and apply the same for the optimum designing of the vehicle components.

Course Outcome		Cognitive Skill
CO-01	Learning of 3D part modeling	P
CO-02	Understanding the concepts of Editing of patterns	A
CO-03	Understanding the concepts of 3 D automotive components	U

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	P0-A	P0-B	P0-C	P0-D	P0-E	P0-F	P0-G	P0-H	P0-I	P0-J	P0-K	P0-L
CO-01	S	N	S	M	M	L	S	L	L	S	M	S
CO-02	M	S	M	L	S	L	M	S	L	S	L	L
CO-03	S	L	S	M	L	S	L	L	L	L	S	N
CO-04	N	N	M	L	S	S	N	L	S	S	M	M
CO-05	N	S	S	M	M	L	S	L	L	S	M	S

S-Strong, M-Medium, L-Low, N-Not relevant

LIST OF EXPERIMENTS:

A)	COMPUTER AIDED VEHICLE COMPONENTS DESIGN(CAD)
1.	3D Part modeling– protrusion, cut, sweep, draft, loft, blend, rib
2.	Editing– Move, Pattern, Mirror, Round, Chamfer
3.	3D modeling of Vehicle components.
4.	Assembly– creating assembly from parts– assembly constraints
5.	Conversion of 3D solid model to 2D drawing-different views, sections, isometric view and dimensioning
6.	Introduction to File Import, Export– DXF,IGES,STL, STEP

Note: Anyoneofthe3DMODELINGsoftwareslikePro/E,IDEAS,CATIA,UNIGRAPHICS, AutoCAD to be used.

B) COMPUTER AIDED VEHICLE MANUFACTURING (CAM)

a) MANUAL PART PROGRAMMING (Using G and M Codes) in CNC lathe

1. Part programming for Linear and Circular interpolation, Chamfering and Grooving
2. Part programming using standard canned cycles for Turning, Facing, Taper turning and Thread cutting

b) MANUAL PART PROGRAMMING (using G and codes) in CNC milling

1. Part programming for Linear and Circular interpolation and Contour motions.
2. Part programming involving canned cycles for Drilling, Peck drilling, and Boring.

C) SIMULATION AND NC CODE GENERATION

c) NCcodegenerationusingCAD/CAMsoftwares-PostprocessingforstandardCNCControls like FANUC, Hiedenhain etc.

TOTAL: 45 PERIODS

AM3280	AUTOMOTIVE ENGINE COMPONENTS LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVE:

To make the students understand the various components of engine.

Course Outcome		Cognitive Skill
CO-01	Students should able to understand dismantling of engines	P
CO-02	Students should able to understand assembly of engines	An
CO-03	Students should able to understand engine cooling.	U

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	P0-A	P0-B	P0-C	P0-D	P0-E	P0-F	P0-G	P0-H	P0-I	P0-J	P0-K	P0-L
CO-01	S	N	S	M	M	L	S	L	L	S	M	S
CO-02	M	S	M	L	S	L	M	S	L	S	L	L
CO-03	S	L	S	M	L	S	L	L	L	L	S	N

S-Strong, M-Medium, L-Low, N-Not relevant

LIST OF EXPERIMENTS

1. Dismantling of 4 cylinder petrol engine.
2. Assembling of 4 cylinder petrol engine.
3. Dismantling of 6 cylinder diesel engine.
4. Assembling of 6 cylinder diesel engine.

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

TOTAL: 45 HOURS

LIST OF EQUIPMENTS

(For a batch of 30students)

1.	Four cylinder petrol engine	-1No.
2.	Six cylinder diesel engine	-1No.
3.	Fuel filter, fuel injection pump, injector, carburetor, MPFI component	1No.each
4.	Ignition coil, magneto, electronic ignition system components	-1No.each
5.	Water pump, thermostat, radiator, temperature gauge	1No.each
6.	Lub oil pump, pressure relief valve, filter, oil pressure gauge	-1No.each
7.	Internal micrometer, external micrometer, dial gauges	-3No.each
8.	Bore Dial gauge	-3Nos.each
9.	Vernier Caliper Inside and Outside	-3Nos.each
10.	Cylinder Head 4 cylinder Engine	-2 No
11.	Tool box	-3 Sets
12.	Torque wrench	-1 No.

AM32P2	SUMMER INTERNSHIP II	L	T	P	C
		0	0	0	2

OBJECTIVE:

Visit to local industries arranged by the Department of study the industrial practices •
Lectures by industrial experts will be arranged to gain exposure to the trends in design, manufacturing and quality control in industries.

Course Outcome		Cognitive Skill
CO-01	Students can understand the industrial environment	P
CO-02	Students can expose their knowledge	An
CO-03	Students will be able to understand the industrial world and problems	U

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	P0-A	P0-B	P0-C	P0-D	P0-E	P0-F	P0-G	P0-H	P0-I	P0-J	P0-K	P0-L
CO-01	S	N	S	M	M	L	S	L	L	S	M	S
CO-02	M	S	M	L	S	L	M	S	L	S	L	L
CO-03	S	L	S	M	L	S	L	L	L	L	S	N

S-Strong, M-Medium, L-Low, N-Not relevant

- Visit to local industries arranged by the Department of study the industrial practices
- Lectures by industrial experts will be arranged to gain exposure to the trends in design, manufacturing and quality control in industries

SEMESTER VII

S.No.	Course Code	Course Title	L	T	P	C
THEORY						
1	MS3202	Principles of Management	2	0	0	2
2	MS3202	Common Elective	2	0	0	2
3	AM3218	Vehicle Maintenance	3	0	0	3
4	AM3219	Automotive Mechatronics	3	0	0	3
5	AM32XX	Professional Elective III	3	0	0	3
PRACTICAL						
7	AM3281	Vehicle Maintenance Laboratory	0	0	3	1
8	AM3282	Automotive Mechatronics Laboratory	0	0	3	1
9	AM32P3	Design and Fabrication Project	-	-	-	2
TOTAL			14	0	6	17

MS3202	PRINCIPLES OF MANAGEMENT	L	T	P	C
		3	0	0	2

OBJECTIVES

- To introduce students to the basic concepts and functions of management.
- To understand the role and responsibilities of managers in various organizational settings.
- To develop an understanding of the planning, organizing, leading, and controlling functions of management.
- To examine the impact of management theories and practices on organizational performance.
- To equip students with the skills necessary to manage people and processes effectively in a technical environment.

Course Outcome – Cos		Cognitive Skill
CO-01	Define and explain the key concepts and functions of management.	U
CO-02	Analyse the roles and responsibilities of managers in different organizational contexts.	U
CO-03	Apply planning, organizing, leading, and controlling principles to real-world scenarios.	U
CO-04	Evaluate the effectiveness of different management theories and practices	U.A
CO-05	Demonstrate management skills necessary for leading teams and projects in a technical environment	U, A

Mapping of Course Outcome with Programme Outcome

PO CO	P0-A	P0-B	P0-C	P0-D	P0-E	P0-F	P0-G	P0-H	P0-I	P0-J	P0-K	P0-L
CO-01	N	N	N	N	N	M	N	L	L	N	S	S
CO-02	N	N	N	N	N	M	N	L	L	N	M	M
CO-03	N	N	N	N	N	M	N	L	L	N	S	M
CO-04	N	N	N	N	N	M	N	L	L	N	M	L
CO-05	N	N	N	N	N	M	N	L	L	N	S	L

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT I: INTRODUCTION TO MANAGEMENT

7

Definition, nature, and importance of management - Functions of management: Planning, Organizing, Leading, Controlling - Roles and skills of managers - Evolution of management thought: Classical, Behavioral, and Modern theories - Scientific Management (Taylor) - Administrative Theory (Fayol) - Human Relations Movement (Mayo) - Contemporary approaches (Systems Theory, Contingency Theory)

UNIT II: PLANNING

5

Nature and purpose of planning - Types of plans: Strategic, Tactical, Operational - Planning process and techniques - SWOT Analysis, SMART Goals, Scenario Planning - Decision making:

Process, types, and tools- Rational Decision-Making Model - Bounded Rationality - Group Decision-Making Techniques (Brainstorming, Delphi Technique)

UNIT III: ORGANIZING

5

Organizational structure and design - Types of organizational structures: Functional, Divisional, Matrix, Network - Authority, responsibility, and delegation - Coordination and communication within organizations - Formal and Informal Communication Channels - Role of Technology in Organizational Communication (Emails, Video Conferencing, Collaborative Tools)

UNIT IV: LEADING

7

Leadership theories and styles - Trait Theory - Behavioral Theories (Ohio State Studies, Michigan Studies) - Contingency Theories (Fiedler's Model, Path-Goal Theory) - Transformational vs. Transactional Leadership - Motivation theories and practices, Maslow's Hierarchy of Needs, Herzberg's Two-Factor Theory, McClelland's Theory of Needs, Modern Approaches (Self-Determination Theory) - Group dynamics and team management - Stages of Team Development (Forming, Storming, Norming, Performing) - Managing Virtual Teams

UNIT V: CONTROLLING

6

Nature and purpose of control - Control process and techniques, Establishing Standards, Measuring Performance, Correcting Deviations - Types of control: Feed forward, Concurrent, Feedback - Quality control and management, Total Quality Management (TQM), Six Sigma, Lean Management, Use of Data Analytics in Quality Control

TOTAL: 30 PERIODS

TEXTBOOKS

1. Robbins, S. P., Coulter, M., & DeCenzo, D. A. (2020). *Fundamentals of Management* (11th ed.). Pearson.
2. Griffin, R. W. (2022). *Management: Principles and Practices* (12th ed.). Cengage Learning.
3. Jones, G. R., & George, J. M. (2021). *Essentials of Contemporary Management* (9th ed.). McGraw-Hill Education.

REFERENCE BOOKS

1. Bateman, T. S., & Snell, S. A. (2020). *Management: Leading & Collaborating in a Competitive World* (14th ed.). McGraw-Hill Education.
2. Schermerhorn, J. R. (2021). *Management* (14th ed.). Wiley.
3. Hill, C. W. L., Schilling, M. A., & Jones, G. R. (2020). *Strategic Management: Theory & Cases* (13th ed.). Cengage Learning.
4. Kinicki, A., & Williams, B. K. (2021). *Management: A Practical Introduction* (10th ed.). McGraw-Hill Education.

AM 3218	VEHICLE MAINTENANCE	L	T	P	C
		3	0	0	3

Objectives

To gain knowledge of vehicle maintenance systems. To understand the basic principles of maintenance used for automobiles and different systems

Course Outcome		Cognitive Skill
CO-01	Students can understand the maintenance principles of vehicles	P
CO-02	Students can study the basics of beams and how the load is acting on the beams	An
CO-03	Students will be able to understand the electrical maintenance system	U
CO-04	Students can study the fuel cooling systems	S
CO-05	Students can understand the maintenance of electric/hybrid vehicles	A

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	P0-A	P0-B	P0-C	P0-D	P0-E	P0-F	P0-G	P0-H	P0-I	P0-J	P0-K	P0-L
CO-01	M	N	N	N	N	L	S	N	S	N	S	N
CO-02	N	M	L	N	N	N	S	N	N	N	N	N
CO-03	N	N	S	N	L	N	L	N	N	N	N	N
CO-04	M	N	N	L	N	N	S	N	M	S	N	N
CO-05	N	N	N	N	N	N	S	N	N	N	N	N

S-Strong, M-Medium, L-Low, N-Not relevant

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, carriage tools, special tools and equipments Steering Systems and Wheel Alignment.

Dismantling of engine components cleaning methods, visual and dimensional inspections, minor and major reconditioning of various components, reconditioning methods, engine assembly, engine tune up, engine diagnosis and trouble shooting

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, On Board Diagnosis (OBD) tools - diagnosis and trouble shooting

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, anticorrosion and antifreeze additives. Lubrication maintenance, lubricating oil changing, greasing of parts. Vehicle body maintenance. Door locks and window glass actuating system maintenance, diagnosis and trouble shooting. Body rust proofing & paintings.

Motor, Motor Controller, Battery Pack, Battery Management System, Safely remove, repair and replace high voltage battery pack- Charging System, regenerative braking. Fault finding & breakdown maintenance of related components. Testing and diagnosing the systems and related circuits. Preventive and breakdown maintenance of associated components.

TOTAL: 45 PERIODS

TEXT BOOK

1. John Doe “Fleet Management”, McGraw-Hill Co. 1984.

REFERENCES

1. James D Halderman - Advanced Engine Performance Diagnosis – PHI - 1998.
2. Service Manuals from Different Vehicle Manufacturers.
3. Advanced Electric Drive Vehicles, Edited By Ali Emadi, ISBN 9781138072855, 616 Pages 492 B/W Illustrations, Published April 21, 2017 by CRC Press

AM 3219	AUTOMOTIVE MECHATRONICS	L	T	P	C
		3	0	0	3

Objectives

To gain knowledge of different mechatronics systems in automobiles

Course Outcome		Cognitive Skill
CO-01	Students can understand the principles of automotive mechatronics system	P
CO-02	Students can study the basics of actuating and feed back devices	An
CO-03	Students will be able to understand the electronics EMS	U
CO-04	Students can study the tools diagnostics and networking	S
CO-05	Students can understand lighting domain and systems	A

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	P0-A	P0-B	P0-C	P0-D	P0-E	P0-F	P0-G	P0-H	P0-I	P0-J	P0-K	P0-L
CO-01	M	N	N	N	N	L	S	N	S	N	S	N
CO-02	N	M	L	N	N	N	S	N	N	N	N	N
CO-03	N	N	S	N	L	N	L	N	N	N	N	N
CO-04	M	N	N	L	N	N	S	N	M	S	N	N
CO-05	N	N	N	N	N	N	S	N	N	N	N	N

S-Strong, M-Medium, L-Low, N-Not relevant

UNIT I: Fundamentals of Automotive Mechatronics & Control System

9

Fundamentals of Mechatronics, Electronics Components, Microprocessor, Ports, Memory, Buses, Microcontroller, Fetch-Execute sequence, Programming, Electronic Control Unit, Testing of Microcontroller Systems. Control System: Open and closed loop control, PID control, PLC System and Ladder Logic Diagram.

UNIT II: Integrated actuating and feedback devices

9

Hall Effect, hot wire, thermistor, piezo electric, piezo resistive, based sensors. Introduction, basic sensor arrangement, types of sensors, oxygen concentration sensor, lambda sensor, crankshaft angular position sensor, cam position sensor, Mass Air flow (MAF) rate, Manifold absolute pressure (MAP), Throttle plate angular position, engine oil

pressure sensor, vehicle speed sensor, detonation sensor, emission sensors, Actuators: solenoid actuator, stepper motors, relays,

UNIT III: Electronic Engine Management System **9**

Electronic Fuel Injection, Types of EFI, TBI, MPFI & GDI, Ignition System, Electronic Ignition System and its advantages, Fuel control maps, CI Engine Management. Fuel injection system, parameters affecting combustion, noise and emissions in CI engines. Pilot, main, advanced, post injection and retarded post injection. Electronically controlled Unit Injection system. Exhaust emission control systems, 2 and 3-way catalytic converter.

UNIT IV: Automotive Tools, Diagnosis & Networking **9**

Wiring Harness, Limitations of Wiring Harness, Multiplex data bus, Basic principle of Networking, Classification of automotive multiplex bus, Controller Area Network, Local Interconnect Network, Flex Ray, Most, Automotive Ethernet, Connected Cars. Diagnosis: tools and equipment, Oscilloscope, onboard diagnosis system, Electromagnetic compatibility & tests for EMC.

UNIT V: Applications for different domains and current trends **9**

Lighting systems: LED, adaptive front lighting system, Comfort systems: Cruise control, adaptive cruise control, central locking, Electric mirrors, windows, multimedia systems, Safety & security systems: Airbag, Chassis Systems: ABS, TC, ESP, TPMS, Active Suspension, Active Steering system, Automatic Transmission, Body control Modules.

Total Periods =45

REFERENCE BOOKS:

1. Automotive Mechatronics: Automotive Networking- Driving Stability Systems- Electronics (Bosch Professional Automotive Information)- by Konrad Reif- Springer Fachmedien Wiesbaden- 2014.
2. Automobile Electrical & Electronic Equipments - Young- Griffiths - Butterworths-London.
3. Understanding Automotive Electronics- William B. Ribbens- 5th Edition- Newnes- Butterworth-Heinemann.
4. Diesel Engine Management by Robert Bosch- SAE Publications- 3rd Edition- 2004
5. Gasoline Engine Management by Robert Bosch- SAE Publications- 2nd Edition- 2004
6. Understanding Automotive Electronics – Bechfold SAE 1998
7. Automobile Electronics by Eric Chowanietz SAE.
8. Automotive Computer & Control System – Tomwather J. R.- Cland Hunter- Prentice Inc.NJ
9. Automotive Computers & Digital Instrumentation – Robert N. Brandy- Prentice Hall Eaglewood- Cliffs- NJ
10. Automobile Electrical & Electronic Systems – Tom Denton- Allied Publishers Pvt. Ltd.
11. James D. Halderman- Advanced Automotive Electricity and Electronics- Pearson- 2013.
12. Tom Denton- Advanced Automotive Fault Diagnosis- Routledge- 2006.

AM 3281	VEHICLE MAINTENANCE LABORATORY	L	T	P	C
		0	0	3	1

OBJECTIVES

- To Study the layout of an automobile repair, service and maintenance shop
- Basic knowledge about Simple tinkering, soldering works of body panels, study of door lock and window glass rising mechanisms.
- To provide basic knowledge about gasoline and diesel engines.
- To provide knowledge about electrical ignition systems.

Course Outcome		Cognitive Skill
CO-01	Study the layout of an automobile repair, service and maintenance shop	P
CO-02	Have a knowledge about Simple tinkering, soldering works of body panels, study of door lock and window glass rising mechanisms	An
CO-03	Have basic knowledge about gasoline and diesel engines.	U
CO-04	Have knowledge about electrical ignition systems.	S
CO-05	Acquire knowledge about servicing of electric vehicles.	A

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcomes and Program outcomes

PO CO	P0-A	P0-B	P0-C	P0-D	P0-E	P0-F	P0-G	P0-H	P0-I	P0-J	P0-K	P0-L
CO-01	M	N	N	N	N	L	S	N	S	N	S	N
CO-02	N	M	L	N	N	N	S	N	N	N	N	N
CO-03	N	N	S	N	L	N	L	N	N	N	N	N
CO-04	M	N	N	L	N	N	S	N	M	S	N	N
CO-05	N	N	N	N	N	N	S	N	N	N	N	N
S – Strong M – Medium L – Low N – Not Relevant												

LIST OF EXPERIMENTS

1. Study the layout of an automobile repair, service and maintenance shop.
2. Study the preparation of different statements/records required for the repair and maintenance works.
3. Fault diagnosis in electrical ignition system, gasoline fuel system, diesel fuel system and rectification.
4. Simple tinkering, soldering works of body panels, study of door lock and window glass rising mechanisms.
5. Practice the following:

- i) Adjustment of pedal play in clutch, brake, hand brake lever and steering wheel play
 - ii) Air bleeding from hydraulic brakes, air bleeding of diesel fuel system
 - iii) Wheel bearings tightening and adjustment.
6. Practice the following
 - i) Adjustment of head lights beam.
 - ii) Removal and fitting of tyre and tube.
7. Wheel alignment – testing of camber, caster.
Testing kingpin inclination, toe in and toe out, Chassis Alignment testing.
8. Study the operations of crank shaft grinding machine.
9. Demo-Wheel Balancing.
10. Assembly and disassembly of carburetor.
11. Study the Layout of the EV Vehicle
12. Procedures for the Maintenance of EV Motor
13. Analyze the Control Module of EV

TOTAL: 45 PERIODS

LIST OF EQUIPMENTS

(for a batch of 30 students)

- | | | |
|-----|---|---------|
| 1. | Engine Analyzer | - 1 No. |
| 2. | Cylinder compression pressure gauge | - 1 No. |
| 3. | Vacuum gauge | - 1 No. |
| 4. | Spark plug cleaner and tester | - 1 No. |
| 5. | Cam angle and rpm tester | - 1 No. |
| 6. | Tachometer | - 1 No. |
| 7. | Wheel alignment apparatus | - 1 No. |
| 8. | Gas welding equipment | - 1 No. |
| 9. | Tyre remover | - 1 No. |
| 10. | Bearing puller | - 1 No. |
| 11. | Head light alignment gauge | - 1 No. |
| 12. | Service manuals of petrol, diesel engines | - 1 No. |
| 13. | Wheel Balancer | - 1 No. |
| 14. | EV Demo Kit | - 1 No. |

AM 3282	AUTOMOTIVE MECHATRONICS LABORATORY	L	T	P	C
		0	0	3	1

OBJECTIVES

1. To Design and test the fluid power circuits to control. (i) Velocity (ii) direction and (iii) force of single and double acting actuators.
2. To have a knowledge about operation of servo controllers in vehicles.
3. To provide basic knowledge about stepper motors.
4. To provide knowledge about computerized data logging system with control for process variables like pressure, flow and temperature.

Course Outcome		Cognitive Skill
CO-01	The students will : Design and test the fluid power circuits to control	P
CO-02	The students will : have a knowledge about operation of servo controllers in vehicles	An
CO-03	The students will : familiar in stepper motor controls used in automotive	U
CO-04	The students will : gain knowledge in data logging and e-controls	S

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcomes and Program outcomes

PO CO	P0-A	P0-B	P0-C	P0-D	P0-E	P0-F	P0-G	P0-H	P0-I	P0-J	P0-K	P0-L
CO-01	M	N	N	N	N	L	S	N	S	N	S	N
CO-02	N	M	L	N	N	N	S	N	N	N	N	N
CO-03	N	N	S	N	L	N	L	N	N	N	N	N
CO-04	M	N	N	L	N	N	S	N	M	S	N	N

S – Strong

M – Medium

L – Low

N – Not Relevant

LIST OF EXPERIMENTS

- Design and testing of fluid power circuits to control.
 - Velocity
 - direction
 - force of single and double acting actuators.
- Design of circuits with logic sequence using Electro pneumatic trainer kits.
- Simulation of basic Hydraulic, Pneumatic and Electric circuits using software.
- Circuits with multiple cylinder sequences in Electro pneumatic using PLC.
- Servo controller interfacing for open loop
- Servo controller interfacing for closed loop
- PID controller interfacing
- Stepper motor interfacing with 8051 Micro controller
 - Full step resolution
 - half step resolution
- Modeling and analysis of basic electrical, hydraulic and pneumatic systems using lab view
- Computerized data logging system with control for process variables like pressure, flow and temperature.
- Adaptive control Braking System using Lab view
- Temperature, Flow, Liquid level, Pressure control
- Motion Control Experiments using
 - Stepper Motor
 - Servo Trainer kit

TOTAL: 45 PERIODS

LIST OF EQUIPMENTS/ SOFTWARE

(for a batch of 30 students)

- | | |
|---|------------------|
| 1. Electro pneumatic trainer kits | - 2 Nos. |
| 2. Electro pneumatic using PLC | - 1 No |
| 3. Stepper motor interfacing with 8051 Micro controller | - 1 No |
| 4. Servo Trainer kit | - 1 No |
| 5. Lab view Software (Adaptive control Braking | - 5 Liscenses |
| | System – module) |

AM32P3	DESIGN AND FABRICATION PROJECT	L	T	P	C
		0	0	3	3

OBJECTIVES:

The main objective is to give an opportunity to the student to fabrication of one or more components of a complete working model applicable in Automobile field, which is designed by them.

Course Outcome – Cos		Cognitive Skill
CO-01	Use of design principles and develop conceptual and engineering design of any components.	A,An
CO-02	Ability to fabricate any components relevant to automobile using different manufacturing tools.	A,An

Mapping of Course Outcomes and Program outcomes

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO-I	PO-J	PO-k	PO-L
CO-01	N	M	S	M	M	N	N	N	N	S	N	L
CO-02	N	M	S	M	M	N	N	N	N	S	N	L

S – Strong M – Medium L – Low N – Not Relevant

GUIDELINE FOR REVIEW AND EVALUATION

- The students may be grouped and work under a project supervisor.
- The device/ system/component(s) to be fabricated may be decided in consultation with the supervisor and if possible, with an industry.
- A project report to be submitted by the group and the fabricated model, which will be reviewed and evaluated for internal assessment by a committee constituted by the Head of the Department.
- At the end of the semester examination the project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.
- It is mandatory to file patent for their fabrication works before the end of the semester examination.

SEMESTER VIII

S.No.	Course Code	Course Title	L	T	P	C
THEORY						
1	PE404	Professional Elective IV	3	0	0	3
2	PE 405	Professional Elective V	3	0	0	3
PRACTICAL						
1	AM32P5	Project Work	0	0	16	8
TOTAL			6	0	16	14

AM32P5	PROJECT WORK	L	T	P	C
		0	0	20	10

OBJECTIVES:

1. To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same.
2. To train the students in preparing project reports and to face reviews and viva voce examination.

Course Outcome - COs		Cognitive Skill
CO-01	On Completion of the project work students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology.	A
CO-02	Ability to solve the real time safety problem.	A, E
CO-03	Gain knowledge about present scenario in Automobile domain	A, C

Mapping of Course Outcomes and Program outcomes

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO-I	PO-J	PO-k	PO-L
CO-01	N	S	N	N	S	M	N	N	N	N	L	L
CO-02	N	M	N	N	M	L	N	N	N	N	L	L
CO-03	N	L	N	N	M	L	N	N	N	N	N	N

S – Strong

M – Medium

L – Low

N – Not Relevant

GUIDELINE FOR REVIEW AND EVALUATION

- The students should be carryout industrial projects in reputed central and state government industries.
- The students should take the latest problem in industries and solve these using Engineering concepts.
- The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member and prepare a comprehensive project report after completing the work to the satisfaction of the supervisor.
- The progress of the project is evaluated based on a minimum of three reviews.
- The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester.
- The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Controller of examination.

TOTAL: 60 PERIODS

LIST OF ELECTIVES (REGULATION-2021)

Sl.No	Subject Code	Subject Name	L	T	P	C
1.	AM32A1	Autotronics	3	0	0	3
2.	AM32A2	Electric vehicle motors	3	0	0	3
3.	AM32A3	Electric vehicles technology	3	0	0	3
4.	AM32A4	Alternate Fuels and Energy Systems	3	0	0	3
5.	AM32A5	Modern Automobile Technologies	3	0	0	3
6.	AM32A6	Automotive Safety	3	0	0	3
7.	AM32A7	Transport Management	3	0	0	3
8.	AM32A8	HVAC (Heat Ventilation and Air-Conditioning) System	3	0	0	3
9.	AM32A9	Quality Control and Reliability Engineering	3	0	0	3
10.	AM32B1	Composite Materials	3	0	0	3
11.	AM32B2	Industrial Robotics and Automation	3	0	0	3
12.	AM32B3	Two and Three Wheeled Vehicles	3	0	0	3
13.	AM32B4	Advanced Theory of ICE	3	0	0	3
14.	AM32B5	Off road Vehicles	3	0	0	3
15.	AM32B6	Total Quality Management	3	0	0	3

AM32A1	AUTOTRONICS	L	T	P	C
		3	0	0	3

OBJECTIVES

At the end of the course, the student will be able to acquire knowledge of filters sensor and understand various energy systems for using the automobiles

Course Outcome		Cognitive Skill
CO-01	Students can understand the different types of amplifiers	P
CO-02	Students can study the sensors	An

CO-03	Students will be able to understand the ECU	U
CO-04	Students can study the Engine electronics	S
CO-05	Students can understand the basics of Transmission electronics	A

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	P0-A	P0-B	P0-C	P0-D	P0-E	P0-F	P0-G	P0-H	P0-I	P0-J	P0-K	P0-L
CO-01	S	N	S	M	M	L	S	L	L	S	M	S
CO-02	M	S	M	L	S	L	M	S	L	S	L	L
CO-03	S	L	S	M	L	S	L	L	L	L	S	N
CO-04	N	N	M	L	S	S	N	L	S	S	M	M
CO-05	N	S	S	M	M	L	S	L	L	S	M	S

S-Strong, M-Medium, L-Low, N-Not relevant

OBJECTIVES:

1. To understand the principle of electronics devices.
2. To understand the Sensors and actuators
3. To have knowledge about the EMS
4. To enable the students to learn engine electronics.
5. To have the knowledge about transmission electronics cooling and lubrication maintenance system in vehicles

UNIT I: AMPLIFIERS AND FILTERS

9

MOS and BJT inverting amplifier-Improving performance of inverting amplifier- CMOS and BJT differential amplifiers-Characterization of Op-Amp-The BJT two stage op-amp-The CMOS two stage op-amp- Op-amps without put stage, Folded Cascade op-amp, Trans-conductance Amplifier. Low pass filters-High pass filters- Band Pass filters- Phase Locked Loops.

UNIT II: SENSORS AND ACTUATORS

9

Types of sensors, sensor for speed, throttle position, exhaust oxygen level, manifold pressure, crank shaft position, coolant temperature, exhaust temperature, air mass flow for engine application. Solenoids, stepper motors, relay.

UNIT III: ELECTRONIC CONTROL UNIT

9

Microprocessors, microcontrollers, types of memory, memory interface, interrupts, input/output interfacing. Engine control module, power train control module, hardware and software components, interfacing with sensors, system integration.

UNIT IV: ENGINE ELECTRONICS**9**

Throttle body fuel injection, multi point fuel injection, gasoline direct injection, common rail direct injection, variable timing ignition, distributor less ignition. Engine mapping, on-board diagnostics.

UNIT V: TRANSMISSION ELECTRONICS**9**

Basic electronic controls-Multiplexing and De-multiplexing electronically controlled automatic transmission system. Electronics control transmission-Continuously variable transmission system-Hybrid transmission.

TOTAL: 45 HOURS**REFERENCES:**

1. JoseE .Franca Hannis Tsvividis, "Design of Analog Digital VLSI Circuits for Telecommunication and gv Signal Processing", Prentice Hall, International Edition, 2002.
2. David A. Johns, KenMartin, "Analog Integrated Circuit Design "John Wiley & Sons, 2002.
3. Benhard Razavi, "Data Converters "Kluwer Publishers, 2000.
4. Phillip Allen and Douglas Holmberg "CMOSAnalog Circuit Design" Oxford University Press, 2000.
5. Robert Bosch, "Automotive Hand Book "SAE, 5th edition, 2000.
6. Jacob Baker R.,LeeH.W.and BoyceD.E., "CMOS Circuit Design, Layout and Simulation"" Prentice Hall of India, 1998.
7. WilliamB.Riddens-UnderstandingAutomotiveElectronics,5thedition-Butterworth Heinemann Woburn-1998.
8. MohammedIsmailandTerriFaizAnalogVLSISignalandInformationProcess,Mc-Graw Hill Book Company, 1994.
9. RandallL.Geiger,PhillipE.Allen,NoelR.Strader,"VLSIDesignTechniquesforAnalogand Digital Circuits",

AM32A2	ELECTRIC VEHICLE MOTORS	L	T	P	C
		3	0	0	3

OBJECTIVE:

At the end of the course, the student will enable to acquire knowledge of EV motors and understand various systems for use in the automobiles.

Course Outcome		Cognitive Skill
CO-01	Students can understand the different types motors-EV	P
CO-02	Students can study the operation of DC motor	An
CO-03	Students will be able to understand the operation of AC motor	U
CO-04	Students can study the configuration of motors	S
CO-05	Students can understand the special type of motors.	A

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	P0-A	P0-B	P0-C	P0-D	P0-E	P0-F	P0-G	P0-H	P0-I	P0-J	P0-K	P0-L
CO-01	S	N	S	M	M	L	S	L	L	S	M	S
CO-02	M	S	M	L	S	L	M	S	L	S	L	L
CO-03	S	L	S	M	L	S	L	L	L	L	S	N
CO-04	N	N	M	L	S	S	N	L	S	S	M	M
CO-05	N	S	S	M	M	L	S	L	L	S	M	S

S-Strong, M-Medium, L-Low, N-Not relevant

UNIT I: CLASSIFICATIONS OF MOTORS

9

EV motors introductions– requirements-challenges- comparisons of EV motors and industrial motors-Motors (DC,Induction,BLDC,PMSM)–Types,Principle,Construction,Control-Electric, Drive Train and its types

UNIT II: DC MOTOR OPERATION CHARACTERISTICS

9

DC motor operation and its types-BLDC Motor and Control-Operation of BLDC Motor-Torque and Rotating Field Production–Torque-Speed Characteristics and Typical Technical Parameters-Sensor less BLDC Motor Control.

UNIT III: AC MOTOR OPERATION CHARACTERISTICS

9

AC Induction Motor and Control- Basic Principle of AC Induction Motor Operation-Controls of AC Induction Motor- Selection and sizing of Motor-RPM and Torque calculation of motor-Motor Controllers.

UNIT IV: CONFIGURATION OF MOTORS

9

Configuration and control of DC Motor drives-Configuration and control of Induction Motor drives - configuration and control of Permanent Magnet Motor drives.

UNIT V: SPECIAL ELECTRICAL MOTORS

9

Switched Reluctance Motor :Basic Magnetic Structure, Torque Production -SRM Drive Converter- Modes of Operation- Generating Mode of Operation(Regenerative Braking)- Sensor less Control- Phase Flux Linkage based Method.

TOTAL: 45 HOURS

Reference Books:

1. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2010.
2. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2009.
3. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003

AM32A3	ELECTRIC VEHICLES TECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVE:

At the end of the course, the student will be able to acquire knowledge of EV and the changes in the engine design for handling them and understand various EV systems for use in the automobiles.

Course Outcome		Cognitive Skill
CO-01	Students can understand the different types of amplifiers	P
CO-02	Students can study the sensors	An
CO-03	Students will be able to understand the ECU	U
CO-04	Students can study the Engine electronics	S
CO-05	Students can understand the basics of Transmission electronics	A

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	P0-A	P0-B	P0-C	P0-D	P0-E	P0-F	P0-G	P0-H	P0-I	P0-J	P0-K	P0-L
CO-01	S	N	S	M	M	L	S	L	L	S	M	S
CO-02	M	S	M	L	S	L	M	S	L	S	L	L
CO-03	S	L	S	M	L	S	L	L	L	L	S	N
CO-04	N	N	M	L	S	S	N	L	S	S	M	M
CO-05	N	S	S	M	M	L	S	L	L	S	M	S

S-Strong, M-Medium, L-Low, N-Not relevant

UNIT I: INTRODUCTION

9

Overview of EVs and challenges-components of EVs-architecture of EVs- EV market and promotion- infrastructure needs-EV makers-Comparison in reference of: Energy source, Pollution, Energy diversification, Efficiency, Capital & operating cost, Performance.

UNIT II: CLASSIFICATIONS OF EV

9

Classification of EVs in reference of: Propulsion devices, Energy sources, Energy carriers, Pure Electric Vehicles (PEV)-Hybrid Electric Vehicles (HEV)and Plug-in Hybrid Electric Vehicles(PHEV)- Configurations: BEV, FCEV.

UNIT III: EV DRIVES

9

Challenges: BEV, HEV, FCEV, EV motor drive technologies-IC engine vehicle force– speed characteristics(5-gears), BEV force - speed characteristics (fixed gears)- Comparison between

ICE vehicles & BEV- Requirement of EV motor compared to industrial motors- classification of EV motors.

UNIT IV: ENERGY STORAGE

9

EV energy source technologies: Energy sources used in EVs & HEVs - Medium of power transfer (conductive and wireless)-wireless power transfer-Battery Management System (BMS).

UNIT V: EV COMMUNICATION

9

V2V, V2G and its applications in power system- power saving & coordinated charging-layout of power converters for V2G operation- EV configurations: converted & purpose built EVs- components of EV system.

TOTAL: 45 HOURS

REFERENCES

1. Hybrid Electric Vehicle System Modeling and Control-WeiLiu, General Motors, USA, John Wiley & Sons, Inc., 2017.
2. Hybrid Electric Vehicles– Teresa Donato, Published by ExLi4EvA, 2017
3. Electric and Hybrid Vehicles Power Sources, Models, Sustainability, Infrastructure and the Market Gianfranco Pistoia Consultant, Rome, Italy, Elsevier Publications, 2017.
4. Modern Electric, Hybrid Electric, and Fuel Cell Vehicles, Mehrdad Ehsani, Yimin Gao, Stefan Longo, Kambiz M. Ebrahimi, Taylor & Francis Group, LLC, 2018.

AM32A4	ALTERNATE FUELS AND ENERGY SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVE:

At the end of the course, the student will be able to acquire knowledge of alternate fuels and the changes in the engine design for handling them and understand various energy systems for use in the automobiles.

Course Outcome		Cognitive Skill
CO-01	Students will be understand the properties of the various fuels and the power trains of the hybrid vehicles	P
CO-02	Blending of fuels, fuels and its effect in engine performances (Liquid fuels)	An
CO-03	Performance and engine characterization of gaseous alternate fuels	U
CO-04	Esterification and engine performance using vegetable oil	S
CO-05	Study the layout of hybrid vehicles and energy sources	A

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	P0-A	P0-B	P0-C	P0-D	P0-E	P0-F	P0-G	P0-H	P0-I	P0-J	P0-K	P0-L
CO-01	S	N	S	M	M	L	S	L	L	S	M	S
CO-02	M	S	M	L	S	L	M	S	L	S	L	L
CO-03	S	L	S	M	L	S	L	L	L	L	S	N
CO-04	N	N	M	L	S	S	N	L	S	S	M	M
CO-05	N	S	S	M	M	L	S	L	L	S	M	S

S-Strong, M-Medium, L-Low, N-Not relevant

UNIT I: INTRODUCTION

9

Need for alternate fuel, availability and properties of alternate fuels, general use of alcohols, LPG, hydrogen, ammonia, CNG and LNG, vegetable oils and biogas, merits and demerits of various alternate fuels, introduction to alternate energy sources. Like EV, hybrid, fuel cell and solar cars.

UNIT II: ALCOHOLS

9

Properties as engine fuel, alcohols and gasoline blends, performance in SI engine, methanol and gasoline blends, combustion characteristics in CI engines, emission characteristics, DME, DEE properties performance analysis, performance in SI& CI Engines.

UNIT III: NATURAL GAS, LPG, HYDROGEN AND BIOGAS

9

Availability of CNG, properties, modification required to use in engines, performance and emission characteristics of CNG using LPG in SI & CI engines, performance and emission of LPG. Hydrogen; storage and handling, performance and safety aspects.

UNIT IV: VEGETABLE OILS

9

Various vegetable oils for engines, esterification, performance in engines, performance and emission characteristics, bio diesel and its characteristics

UNIT V: ELECTRIC, HYBRID, FUEL CELL AND SOLAR CARS

9

Layout of an electric vehicle, advantage and limitations, specifications, system components, electronic control system, high energy and power density batteries, hybrid vehicle, fuel cell vehicles, solar powered vehicles.

TOTAL: 45 HOURS

TEXT BOOK

1. Richard. L. Bechfold– Alternative Fuels Guide Book-SAE International Warrendale - 1997.

REFERENCES

1. Maheswar Dayal-“Energy today & tomorrow“-I& B HorishrIndia -1982.
2. Nagpal-“Power Plant Engineering“-KhannaPublishers-1991.
3. “Alcohols as motor fuels progress in technology“-Series No.19-SAE Publication USE -1980.

AM32A5	MODERN AUTOMOBILE TECHNOLOGIES	L	T	P	C
		3	0	0	3

OBJECTIVE:

To explain the principle of chassis management system and different sensors used in the systems.

Course Outcome		Cognitive Skill
CO-01	Students can understand the different types of amplifiers	P
CO-02	Students can study the sensors	An
CO-03	Students will be able to understand the ECU	U
CO-04	Students can study the Engine electronics	S
CO-05	Students can understand the basics of Transmission electronics	A

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	P0-A	P0-B	P0-C	P0-D	P0-E	P0-F	P0-G	P0-H	P0-I	P0-J	P0-K	P0-L
CO-01	S	N	S	L	M	L	S	L	S	S	M	S
CO-02	L	S	M	L	S	L	M	S	L	S	L	L
CO-03	S	S	S	M	L	S	L	L	S	L	S	N
CO-04	L	N	M	L	S	L	N	L	S	S	M	M
CO-05	N	S	S	M	M	L	S	L	L	S	M	L

S-Strong, M-Medium, L-Low, N-Not relevant

UNIT I: INTRODUCTION:

9

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.

UNIT II: DRIVELINE CONTROL SYSTEM:

9

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 till table steering column – steer by wire.

UNIT III COMFORT SYSTEM:

9

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.

UNIT IV: ENGINE MANAGEMENT SYSTEMS**9**

Electronically controlled SI and CI engine fuel injection systems, related hard ware and software. Closed loop ignition system. Catalytic converters and particulate traps.

UNIT V: INTELLIGENT TRANSPORTATION SYSTEM**9**

Traffic routing system -Automated high way systems -Lane warning system –Driver Information System, driver assistance systems-Data communication with in 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.

TOTAL: 45 HOURS**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

REFERENCES:

1. Crouse, W.H. & Anglin, D.L., “Automotive Mechanics” ,Intl. Student edition, 9th edition, TMH, New Delhi, 2002.
2. William B. Ribbens-Understanding Automotive Electronics, ^{5th} edition, Bosch, “Automotive Hand Book”, 6th edition, SAE, 2004

AM32A6	AUTOMOTIVE SAFETY	L	T	P	C
		3	0	0	3

OBJECTIVE:

At the end, the student will have good exposure to automotive safety aspects including safety equipment.

Course Outcome		Cognitive Skill
CO1	Students can study the designing of automotives for safety	P
CO2	Students can understand the safety concepts of automobiles	An
CO3	Understand the various types of safety equipment	U
CO4	Students can understand collision warning and avoidance systems used in the automobile	S
CO5	Understand the need of comfort and convenience of travelling using light motor vehicles	A

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO \ CO	P0-A	P0-B	P0-C	P0-D	P0-E	P0-F	P0-G	P0-H	P0-I	P0-J	P0-K	P0-L
CO-01	S	N	S	M	M	L	S	L	L	S	M	S

CO-02	M	S	M	L	S	L	M	S	L	S	L	L
CO-03	S	L	S	M	L	S	L	L	L	L	S	N
CO-04	N	N	M	L	S	S	N	L	S	S	M	M
CO-05	N	S	S	M	M	L	S	L	L	S	M	S

S-Strong, M-Medium, L-Low, N-Not relevant

UNIT I: INTRODUCTION

9

Design of the body for safety, energy equation, engine location, deceleration of vehicle inside passenger compartment, deceleration on impact with stationary and movable obstacle, concept of crumple zone, safety sandwich construction.

UNIT II: SAFETY CONCEPTS

9

Active safety: drivingsafety, conditionalsafety, perceptibilitysafety, operatingsafety- passive safety: exterior safety, interior safety, deformation behavior of vehicle body, speed and acceleration characteristics of passenger compartment on impact.

UNIT III: SAFETY EQUIPMENTS

9

Seatbelt, regulations, automatic seat belt tightened system, collapsible steering column, tilt able steering wheel, airbags, electronic system for activating airbags, bumper design for safety.

UNIT IV: COLLISION WARNING AND AVOIDANCE

9

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

UNIT V: COMFORT AND CONVENIENCE SYSTEM

9

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

TOTAL: 45 HOURS

TEXT BOOK

1. Bosch - "Automotive Handbook" -5th edition- SAE publication-2000.

REFERENCES

1. J.Powloski- "Vehicle Body Engineering"-Business books limited, London -1969.
2. Ronald.K.Jurgen-"AutomotiveElectronicsHandbook"-Secondedition-McGraw-HillInc.,-1999.

AM32A7	TRANSPORT MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVE:

After completion of this course the students are able to manage a transport fleet and their related activities for minimizing operational cost.

Course Outcome		Cognitive Skill
CO-01	Students can understand the fleet management system	P
CO-02	Students can understand the motor transport sector for the public transport	An
CO-03	Understand the various types scheduling and fare collection methods	U
CO-04	Students can understand vehicle motor act used by the country	S
CO-05	Understand the service and maintenance of vehicles systems	A

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	P0-A	P0-B	P0-C	P0-D	P0-E	P0-F	P0-G	P0-H	P0-I	P0-J	P0-K	P0-L
CO-01	S	N	S	M	M	L	S	L	L	S	M	S
CO-02	M	S	M	L	S	L	M	S	L	S	L	L
CO-03	S	L	S	M	L	S	L	L	L	L	S	N
CO-04	N	N	M	L	S	S	N	L	S	S	M	M
CO-05	N	S	S	M	M	L	S	L	L	S	M	S

S-Strong, M-Medium, L-Low, N-Not relevant

UNIT I: FLEET MANAGEMENT

9

Purpose and Scope- Responsibilities- Headquarters- Region- Field Division- Management Sectional Center (MSC)-Vehicle Post Offices- Fleet Management Organization-Vehicle Operation- Vehicle Maintenance. Fleet Management Programs-Model Vehicle Service Program, Training, Testing and Certification- Fleet Management Advisory Council – Transportation Subsystem Audit -Model Vehicle Operation Maintenance Assistant Program-Fleet Stratification Program-Long Life Vehicle

UNIT II: TRANSPORT SYSTEMS

9

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

UNIT III: SCHEDULING AND FARE STRUCTURE

9

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

UNIT IV: MOTOR VEHICLE ACT

9

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

UNIT V: MAINTENANCE**9**

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

TOTAL:45 HOURS**TEXTBOOK**

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

REFERENCES

1. Government Motor Vehicle Act– Eastern Book Company, Lucknow -1989
2. Kitchin.L.D., -Bus Operation-Illiffee and Sons Co., London, III edition– 1992
3. MOTOR Vehicles Act, 1988 along with Central Motor Vehicle Rules, 1989,U.R.Sarkar (Advocate)5th edition, Hard Back, Jain Book Agency, Delhi, 2014.
4. Fleet Management– Hand Book PO-701, March 1991-2008.

AM32A8	HVAC (Heat, Ventilation and Air Conditioning) SYSTEM	L	T	P	C
		3	0	0	3

AIM:

To impart students will have good exposure to understand the components of the automotive air- conditioning and their functions and the latest developments in this field.

OBJECTIVE:

At the end of the course, the students will be able to understand the components of the automotive air-conditioning and their functions and the latest developments in this field.

Course Outcome		Cognitive Skill
CO1	Students can understand the air conditioning fundamentals	P
CO2	Students can understand the air conditioning and heating systems	An
CO3	Understand the various types of refrigerants	U
CO4	Understand the air routing and temperature control in interior vehicle	S
CO5	Understand the service and maintenance of air conditioning systems	A

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	P0-A	P0-B	P0-C	P0-D	P0-E	P0-F	P0-G	P0-H	P0-I	P0-J	P0-K	P0-L
CO-01	N	N	S	M	M	L	S	L	L	S	M	S
CO-02	M	S	S	L	S	L	M	S	L	S	L	M
CO-03	L	L	S	M	L	S	S	L	L	L	S	N
CO-04	M	N	M	L	S	S	N	L	S	S	M	M
CO-05	S	S	S	M	M	L	S	L	L	S	M	L

S-Strong, M-Medium, L-Low, N-Not relevant

UNIT I: AIRCONDITIONING FUNDAMENTALS**9**

Basic air-conditioning system-location of air conditioning components in a car, schematic layout of a refrigeration system, compressor components, condenser and high pressure service ports, thermostatic expansion valve, expansion valve calibration, controlling evaporator temperature, evaporator pressure regulator, evaporator temperature regulator.

UNIT II: AIR CONDITIONER– HEATING SYSTEM**9**

Automotive heaters, manually controlled air conditioner, heater system, automatically controlled air conditioner and heater systems, automatic temperature control, air conditioning protection, engine protection.

UNIT III: REFRIGERANT**9**

Containers handling refrigerants, tapping into the refrigerant container, refrigeration system diagnosis, diagnostic procedure, ambient conditions affecting system pressures.

UNIT IV: AIR ROUTING AND TEMPERATURE CONTROL**9**

Objectives, evaporator air flow through the recirculating unit, automatic temperature control, duct system, controlling flow, vacuum reserve, testing the air control and handling systems.

UNIT V: AIR CONDITINING SERVICE**9**

Air conditioner maintenance and service, servicing heater system removing and replacing components, trouble shooting of air controlling system, compressor service.

TOTAL: 45HOURS**TEXT BOOK**

1. WilliamH.Crouse and DonaldI.Anglin-“Automotive Air conditioning”-McGrawHillInc.-1990.

REFERENCES

1. MitchellinformationServices,Inc-“MitchellAutomaticHeatingandAirConditioningSystems”-PrenticeHall Ind.-1989.
2. Paul Weiser -“Automotive Air Conditioning”-Reston Publishing Co., Inc., -1990.
3. MacDonald, K.I., -“Automotive Air Conditioning”-Theodore Audel series-1978
4. Goings,L.F. – “Automotive Air Conditioning”-American Technical services-1974.
5. BoyceH.Dwiggins-”Automotive Air Conditioning”-Delmar – 2002

AM32A9	QUALITY CONTROL AND RELIABILITY ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVE:

- To introduce the concept of SQC
- To understand process control and acceptance sampling procedure and their application.
- To learn the concept of reliability.

Course Outcome		Cognitive Skill
CO1	Students can understand the process control techniques	P
CO2	Students can understand the process control attributes	An
CO3	Understand the acceptance and sampling methods	U
CO4	Understand the reliability and life testing of components	S
CO5	Understand the reliability and redundancy of components	A

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	P0-A	P0-B	P0-C	P0-D	P0-E	P0-F	P0-G	P0-H	P0-I	P0-J	P0-K	P0-L
CO-01	N	N	S	M	M	L	S	L	L	S	M	S
CO-02	M	S	S	L	S	L	M	S	L	S	L	M
CO-03	L	L	S	M	L	S	S	L	L	L	S	N
CO-04	M	N	M	L	S	S	N	L	S	S	M	M
CO-05	S	S	S	M	M	L	S	L	L	S	M	L

S-Strong, M-Medium, L-Low, N-Not relevant

UNIT I: INTRODUCTION AND PROCESS CONTROL FOR VARIABLES 9

Introduction, definition of quality, basic concept of quality, definition of SQC, benefits and limitation of SQC, Quality assurance, Quality cost-Variation in process- factors-process capability-process capability studies and simple problems-Theory of control chart-uses of control chart-Control chart for variables- X chart, R chart and σ chart.

UNIT II: PROCESS CONTROL FOR ATTRIBUTES 9

Control chart for attributes-control chart for proportion or fraction defectives-p chart and np chart- control chart for defects-C and U charts, State of control and process out of control identification in charts.

UNIT III: ACCEPTANCE SAMPLING 9

Lot by lot sampling- types-probability of acceptance in single, double, multiple sampling techniques- O.C. curves - producer's Risk and consumer's Risk. AQL, LTPD, AOQL concepts-standard sampling plans for AQL and LTPD-uses of standard sampling plans.

UNIT IV: LIFE TESTING-RELIABILITY 9

Life testing-Objective-failure data analysis, Mean failure rate, meantime to failure ,mean time between failure, hazard rate, system reliability, series, parallel and mixed configuration - simple problems. Maintainability and availability-simple problems. Acceptance sampling based on reliability test- O.C Curves.

UNIT V: QUALITY AND RELIABILITY 9

Reliability improvements-techniques- use of Pareto analysis-design for reliability-redundancy unit and stand by redundancy-Optimization in reliability- Product design-Product analysis- Product development- Product life cycles.

TOTAL: 45 HOURS

TEXT BOOKS

1. GRANT, EUGENE .L“Statistical Quality Control“, McGraw-Hill, 1996
2. L.S.SRINATH, ”Reliability Engineering” Affiliated East west press, 1991

REFERENCES

1. MONOHAR MAHAJAN, “Statistical Quality Control”, DhanpatRai&Sons, 2001.
2. R.C.GUPTA, “Statistical Quality control”, Khanna Publishers, 1997
3. BESTERFIELD D.H., “Quality Control”, Prentice Hall, 1993
4. SHARMA S.C., “Inspection Quality Control and Reliability”, Khanna Publishers, 1998
5. DANNY SAMSON, “Manufacturing & Operations Strategy”, Prentice Hall, 1991
6. CONNOR, P.D.T.O., “Practical Reliability Engineering”, John Wiley, 1993

AM32B1	COMPOSITE MATERIALS	L	T	P	C
		3	0	0	3

OBJECTIVE:

This subject introduces to the students the different types of composite materials, their properties and applications.

Course Outcome		Cognitive Skill
CO1	Students can understand he various materials used in automobiles	P
CO2	Understand the polymer matrix composites and their usages	An
CO3	Understand the metal matrix composites and their usages	U
CO4	Understand the ceramic matrix composites and their usages	S
CO5	Get an idea of future materials for the automobile application	A

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	P0-A	P0-B	P0-C	P0-D	P0-E	P0-F	P0-G	P0-H	P0-I	P0-J	P0-K	P0-L
CO-01	S	N	S	M	M	L	S	L	L	S	M	S
CO-02	M	S	L	L	S	L	M	S	L	S	L	L
CO-03	L	L	S	M	L	S	S	L	S	L	S	N
CO-04	M	N	M	L	S	S	N	L	S	S	M	M
CO-05	S	S	S	M	M	L	S	L	L	S	M	S

S-Strong, M-Medium, L-Low, N-Not relevant

UNIT I: INTRODUCTION TO COMPOSITES**8**

Fundamentals of composites -need for composites –Enhancement of properties - classification of composites–Matrix-Polymer matrix composites (PMC),Metal matrix composites(MMC),Ceramic matrix composites (CMC) – Reinforcement – Particle

reinforced composites, Fibre reinforced composites. Applications of various types of composites.

UNIT II: POLYMER MATRIX COMPOSITES

12

Polymer matrix resins–Thermosetting resins, thermoplastic resins–Reinforcement fibres–Rovings– Woven fabrics–Non woven random mats– various types of fibres. PMC processes–Hand lay up processes–Spray up processes–Compression moulding–Reinforced reaction injection moulding - Resin transfer moulding– Pultrusion–Filament winding–Injection moulding. Fibre reinforced plastics (FRP), Glass fibre reinforced plastics (GRP).

UNIT III: METAL MATRIX COMPOSITES

9

Characteristics of MMC, Various types of Metal matrix composites Alloy vs. MMC, Advantages of MMC, Limitations of MMC, Metal Matrix, Reinforcements–particles–fibres. Effect of reinforcement- Volume fraction– Rule of mixtures. Processing of MMC – Powder metallurgy process - diffusion bonding – stir casting– squeeze casting.

UNIT IV: CERAMIC MATRIX COMPOSITES

9

Engineering ceramic materials–properties–advantages–limitations–Monolithic ceramics–Need for CMC–Ceramic matrix- Various types of Ceramic Matrix composites- oxide ceramics–non oxide ceramics–aluminiumoxide–siliconnitride–reinforcements–particles–fibres–whiskers.Sintering- Hot pressing– Cold isostatic pressing (CIPing)–Hot isostatic pressing (HIPing).

UNIT V: ADVANCES IN COMPOSITES

7

Carbon/carbon composites–Advantages of carbon matrix–limitations of carbon matrix Carbon fibre– chemical vapour deposition of carbon on carbon fibre perform. Sol gel technique. Composites for aerospace applications.

TOTAL: 45 HOURS

TEXT BOOKS

1. Mathews F.L.and Rawlings R.D., Composite materials: Engineering and Science, Chapman and Hall, London, England, 1st edition, 1994.
2. Chawla K.K., Composite materials, Springer– Verlag, 1987

REFERENCES

1. Clyne T.W.and Withers P.J., Introduction to Metal Matrix Composites, Cambridge University Press, 1993.
2. Strong A.B., Fundamentals of Composite Manufacturing, SME, 1989.
3. Sharma S.C., Composite materials, Narosa Publications, 2000.
4. Short Term Course on Advances in Composite Materials, Composite Technology Centre, Department of Metallurgy, IIT-Madras, December 2001.

AM32B2	INDUSTRIAL ROBOTICS AND AUTOMATION	L	T	P	C
		3	0	0	3

OBJECTIVE:

- To introduce the basic concepts, parts of robots and types of robots
- To make the student familiar with the various drive systems for robot, sensors and their applications in robots, programming of robots

Course Outcome		Cognitive Skill
CO1	know the basic concepts, parts of robots and types of robots	P
CO2	Understand the robot drive systems and the robot hand catching	An
CO3	Understand the robot vision system	U
CO4	Familiar with the various drive systems automation	S
CO5	understand the various applications of materials handling	A

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	P0-A	P0-B	P0-C	P0-D	P0-E	P0-F	P0-G	P0-H	P0-I	P0-J	P0-K	P0-L
CO-01	S	N	S	M	M	L	S	L	L	S	M	S
CO-02	M	S	L	L	S	L	M	S	L	S	L	L
CO-03	L	L	S	M	L	S	S	L	S	L	S	N
CO-04	M	N	M	L	S	S	N	L	S	S	M	M
CO-05	S	S	S	M	M	L	S	L	L	S	M	S

S-Strong, M-Medium, L-Low, N-Not relevant

UNIT I: FUNDAMENTALS OF ROBOT

9

Robot– Definition– Robot Anatomy – Co-ordinate Systems, Work Envelope, types and classification– Specifications– Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load– Robot Parts and Their Functions– Need for Robots– Different Applications

UNIT II: SENSORS AND MACHINE VISION

9

Requirements of a sensor, Principles and Applications of the following types of sensors– Position of sensors (Piezo Electric Sensor, LVDT, Resolvers, Optical Encoders, Pneumatic Position Sensors), Range Sensors (Triangulation Principle, Structured, Lighting Approach, Time of Flight Range Finders, Laser Range Meters), Proximity Sensors (Inductive, Hall Effect, Capacitive, Ultrasonic and Optical Proximity Sensors), Touch Sensors, (Binary Sensors, Analog Sensors), Wrist Sensors, Compliance Sensors, Slip Sensors Camera, Frame Grabber, Sensing and Digitizing Image Data– Signal Conversion, Image Storage, Lighting Techniques.

UNIT III: IMPLEMENTATION OF ROBOTS

9

Implementation of Robots in Industries–Welding, Forming, Casting, Machining, Materials handling, Spray Painting– Body Painting, Quality Assurance, Packaging and Inspection

UNIT IV: INTRODUCTION TO AUTOMATION

9

Fundamentals of automation, necessity and architecture of automated systems. Principles and Architectures for automation in industry. Levels of automation, automation safety, maintenance, error detection and repair diagnostics. Elements of automated system, types of systems such as hydraulic, pneumatic, hybrid systems. Assembly-line automation- Conveyor, part feeders, material transport systems, and automated assembly

UNIT V: MATERIAL HANDLING&STORAGE**9**

Overview of material handling equipment, automated material handling equipment-A.G.V, features, function, type sand safety consideration of AGV, Conveyers.

TOTAL: 45 HOURS**TEXT BOOK**

1. M.P. Groover, Industrial Robotics– Technology, Programming and Applications, McGraw-Hill,2001

REFERENCES

1. Fu.K.S. Gonzalz.R.C., and Lee C.S.G., Robotics Control, Sensing, Vision and Intelligence, Mc Graw Hill Book Co.,1987
2. Yoram Koren, Robotics for Engineers, McGraw-Hill Book Co., 1992
3. Janakiraman.P.A., Robotics and Image Processing, Tata Mc Graw-Hill, 1995

AM32B3	TWO AND THREE WHEELED VEHICLES	L	T	P	C
		3	0	0	3

OBJECTIVE:

The aim of this course is to make the students to know and understand the constructional details operating characteristics and vehicle design aspects.

Course Outcome		Cognitive Skill
CO1	Students can understand the various systems used in the two and three wheelers	P
CO2	Understand the chassis and frame types, clutch types and suspension system and to analysis the power drive	An
CO3	Understand the brake and wheel types and to analysis the tyres and tubes	U
CO4	Analysis the various types mopeds and motorcycles manufactured by different companies	S
CO5	Get an idea of three wheeler and analysis the different types of three wheeler	A

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	P0-A	P0-B	P0-C	P0-D	P0-E	P0-F	P0-G	P0-H	P0-I	P0-J	P0-K	P0-L
CO-01	S	N	S	M	M	L	S	L	L	S	M	S
CO-02	M	S	L	L	S	L	M	S	L	S	L	L
CO-03	L	L	S	M	L	S	S	L	S	L	S	N
CO-04	M	N	M	L	S	S	N	L	S	S	M	M
CO-05	S	S	S	M	M	L	S	L	L	S	M	S

S-Strong, M-Medium, L-Low, N-Not relevant

UNIT I: POWER UNIT**9**

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

UNIT II: CHASSIS AND SUB-SYSTEMS**9**

Main frame and its types. Chassis and shaft drive, Single, multiple plates and centrifugal clutches. Gear box and gear controls. Front and rear suspension systems. Shock absorbers. Panel meters and control son handlebar.

UNIT III: BRAKES, WHEELSAND TYRES**9**

Drum brakes, disc brakes, front and rear brake links, layouts. Spoked wheel, cast wheel, disc wheel, disc types. Tyres and tubes.

UNIT IV: TWO WHEELERS**9**

Case study of major Indian models of motorcycles, scooters and mopeds. TVS mopeds and motorcycles, Hero Honda motorcycles, Bajaj scooters and motorcycles, Yamaha, Enfield motorcycles. Servicing and maintenance.

UNIT V: THREE WHEELERS**9**

Case study of Indian models. Auto rickshaws, pickup van, delivery van and trailer. Maintenance: daily, weekly, monthly, Fault tracing.

TOTAL: 45 HOURS**TEXT BOOK**

1. Irving.P.E. –Motor Cycle Engineering-Temple Press Book, London– 1992.

REFERENCES

1. The Cycle Motor Manual-Temple Press Limited,London-1990
2. Encyclopedia of Motor cycling-20 volume Marshall, Cavensih, UK-1989
3. BrayantR.V,Vespa-Maintenance and Repair Series– S.Chand& Co., New Delhi-1986.
Raymond Broad Lambretta-APractical Guideto maintenance and repair– S.Chand&Co.,New Delhi-1987.

AM32B4	ADVANCED THEORY OF ICE	L	T	P	C
		3	0	0	3

OBJECTIVE:

To explain the theory of combustion processes in SI and CI. Engines and the gas exchange processes and the various possible alternate fuels and the developments in the recent years in this area.

Course Outcome		Cognitive Skill
CO1	Students should able to understand the combustion in SI engines	P
CO2	Students should able to understand gas exchanging process in engines.	An

CO3	Students should able to analysis the different types of engine test	U
CO4	Students should able to understand the availability of alternate fuels	S
CO5	Students can gather the knowledge for future vehicles	A

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	P0-A	P0-B	P0-C	P0-D	P0-E	P0-F	P0-G	P0-H	P0-I	P0-J	P0-K	P0-L
CO-01	L	N	S	M	M	L	S	L	L	S	M	S
CO-02	M	S	L	L	S	M	L	S	L	S	L	L
CO-03	L	L	S	M	L	M	S	L	S	L	S	N
CO-04	M	N	M	L	S	S	N	L	S	S	M	M
CO-05	S	S	S	M	M	L	S	L	L	S	M	L

S-Strong, M-Medium, L-Low, N-Not relevant

UNIT I COMBUSTION IN SI ENGINES

9

Stages of combustion- ignition, flame propagation, factors affecting flame structure and speed, cycle by cycle variations, misfire, knock and pre-ignition. Factors controlling combustion chamber design. Combustion in diesel engines, comparison of different combustion systems, fuel spray structure and factors affecting it. Models for combustion in SI and CI engines.

UNIT II GASEXCHANGE PROCESSES

9

Gas exchange processes in two and four stroke engines, factors affecting volumetric efficiency, flow through valves and ports, multivalve concept. Charge motion with in the cylinder. Turbo charging and Turbo charger control. Different methods of charging and scavenging two stroke engines.

UNIT III: COMBUSTION ANALYSIS

9

Introduction to HWA, LDA and PIV systems to analyse engine flows. Engine heat transfer and energy balance, correlations for heat transfer co efficient, variables affecting heat transfer in engines. Cylinder pressure data acquisition and thermodynamic analysis of engine pressure data to yield heat release rates.

UNIT IV: ALTERNATIVE FUELS

9

Alternative gaseous and liquid fuels for SI and CI engines, Alcohols, Biogas, LPG, CNG, Hydrogen, Biodiesel and Straight Vegetable oils, their properties and characteristics when used as engine fuels. Production, storage and distribution of different alternative fuels.

UNIT V RECENT DEVELOPMENTS

9

Homogeneous charge compression ignition, Stratified charge and gasoline direct injection, Dual fuel, lean burn and Hot surface Ignition engine concepts. Hybrid Electric Drives

TOTAL: 45 HOURS

TEXT BOOKS:

1. Internal Combustion Engines by V. Ganesan, 2007, TataMcGraw Hill
2. Internal Combustion Engine Fundamentals, John B Heywood, McGrawHill
3. Advanced Engine Technology by Heisler, SAE Publication

REFERENCES:

1. Internal Combustion Engines by Richard Stone, Macmillan Book Company also SAE Publications
2. Internal Combustion Engines by Colin R Ferguson, John Wiley and Sons
3. Design and Simulation of Two Stroke Engines, GPB air SAE Publications

AM32B5	OFF ROAD VEHICLES	L	T	P	C
		3	0	0	3

OBJECTIVE:

At the end of the course, the students will be able to understand the various features of Off road vehicles and their systems.

Course Outcome		Cognitive Skill
CO1	Student will be able to clearly understand the different classification of off road vehicles	P
CO2	Student will get knowledge of the earth moving machines	An
CO3	Student will be able to understand scrapper systems	U
CO4	The candidate will get knowledge of farm equipments	S
CO5	Student will be able to design and implement vehicle systems in future	A

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	P0-A	P0-B	P0-C	P0-D	P0-E	P0-F	P0-G	P0-H	P0-I	P0-J	P0-K	P0-L
CO-01	S	N	S	M	M	L	S	L	M	S	M	S
CO-02	M	S	L	L	S	M	L	S	L	S	L	L
CO-03	L	L	S	M	L	M	S	L	M	L	S	N
CO-04	M	S	M	L	S	S	N	M	S	S	M	S
CO-05	S	M	S	M	M	L	S	L	L	S	M	L

S-Strong, M-Medium, L-Low, N-Not relevant

UNIT I: CLASSIFICATION AND REQUIREMENTS OF OFF ROAD VEHICLES

Construction layout, capacity and applications. Power Plants, Chassis and Transmission, Multi axle vehicles.

UNIT II: EARTH MOVING MACHINES**10**

Earthmovers like dumpers, loaders - single bucket, Multi bucket and rotary types - bulldozers, excavators, backhoe loaders, scrappers, drag and self powered types, Bush cutters, stumpers, tree dozer, rippers etc.– Power and capacity of earth moving machines.

UNITY III: SCRAPPERS,GRADERS, SHOVELSAND DITCHERS**10**

Scrappers, elevating graders, motor graders, self powered scrappers and graders, Power shovel, revolving and stripper shovels– drag lines– ditchers– capacity of shovels.

UNIT IV: FARMEQUIPMENTS, MILITARY AND COMBAT VEHICLES**8**

Power take off, special implements. Special features and constructional details of tankers, gun carriers and transport vehicles.

UNIT V: VEHICLE SYSTEMS,FEATURES**11**

Brake system and actuation–OCDB and dry disc caliper brakes. Body hoist and bucket operational hydraulics. Hydro-pneumatic suspension cylinders. Power steering system. Kinematics for loader and bulldozer operational linkages. Safety features, safe warning system for dumper. Design aspects on dumper body, loader bucket and water tank of sprinkler.

TOTAL: 45 HOURS**TEXT BOOKS:**

1. Robert LPeurifoy, “Construction, planning, equipment and methods” Tata McGrawel Hill Publishing company Ltd.
2. NakraC.P., “Farm machines and equipments”Dhanparai Publishing company Pvt. Ltd.
3. Abrosimov.K.Branberg.AandKatayer.K.,Roadmakingmachinery,MIRPublishers,Moscow,1971
4. SAEHandboobVol.III.Wong.J.T.,TheoryofGroundVehicles”,JohnWiley&Sons,New York, 1987.

REFERENCES:

1. Off the road wheeled and combined traction devices– Ashgate Publishing Co. Ltd.1988.
2. Schulz Erich.J, Diesel equipment I&II, McGraw Hill company, London.
3. Bart H Vanderveen, Tanks and Transport vehicles, Frederic Warne and Co Ltd., London.
4. Satyanarayana. B., Construction planning and equipment, standard publishers and distributors, New Delhi.

AM32B6	TOTAL QUALITY MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVE:

At the end of the course, the students will be able to understand the various features of TQM, tools and their quality systems

Course Outcome		Cognitive Skill
CO1	Students should able to understand the need of quality	P
CO2	Students should able to understand basic quality of TQM.	An

CO3	Students should able to do different levels of TQM tools.	U
CO4	Students should able to do different levels of TQM tools II.	S
CO5	Students should able to plan the different quality systems.	A

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	P0-A	P0-B	P0-C	P0-D	P0-E	P0-F	P0-G	P0-H	P0-I	P0-J	P0-K	P0-L
CO-01	S	N	S	M	M	L	S	L	M	S	M	S
CO-02	M	S	L	L	S	M	L	S	L	S	L	L
CO-03	L	L	S	M	L	M	S	L	M	L	S	N
CO-04	M	S	M	L	S	S	N	M	S	S	M	S
CO-05	S	M	S	M	M	L	S	L	L	S	M	L

S-Strong, M-Medium, L-Low, N-Not relevant

UNIT I INTRODUCTION

9

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

UNIT II TQM PRINCIPLES

9

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

UNIT III TQM TOOLS & TECHNIQUES I

9

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

UNIT IV TQM TOOLS & TECHNIQUES II

9

Quality circles- Quality Function Deployment (QFD) - Taguchi quality loss function - TPM -Concepts, improvement needs- Cost of Quality- Performance measures.

UNIT V QUALITY SYSTEMS

9

Need for ISO9000-ISO9000-2000 Quality System-Elements, Documentation, Quality auditing-QS 9000-ISO 14000-Concepts, Requirements and Benefits-Case studies of TQM implementation in manufacturing and service sectors including IT

TOTAL: 45 HOURS

TEXT BOOK

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

REFERENCES

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

LIST OF OPEN ELECTIVES (REGULATION -2021)

Sl.No	Subject Code	Subject Name	L	T	P	C
1	AM32D1	Automotive Test Instrumentation	3	0	0	3
2	AM32D2	Vehicle Motor Engineering	3	0	0	3
3	MS32D1	Entrepreneurship Development	3	0	0	3

AM32D1	Automotive Test Instrumentation	L	T	P	C
		3	0	0	3

OBJECTIVE:

Students should understand the various features of measurement systems, tools and their experimental system for vehicles.

Course Outcome		Cognitive Skill
CO1	Students should able to understand the need of measurement	P
CO2	Students should able to understand basic transducers.	An
CO3	Students should able to do different levels mechanical measurements	U
CO4	Students should able to do understand the engine testing and standards	S
CO5	Students should able to do understand the overall vehicle testing and standards	A

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	P0-A	P0-B	P0-C	P0-D	P0-E	P0-F	P0-G	P0-H	P0-I	P0-J	P0-K	P0-L
CO-01	N	M	M	M	L	N	S	N	N	S	L	S
CO-02	M	L	L	N	M	L	N	L	L	N	L	N
CO-03	S	M	M	L	L	M	S	L	S	N	M	L
CO-04	N	S	L	M	S	S	N	N	M	M	L	M
CO-05	S	L	M	S	M	N	L	N	N	L	N	L

S-Strong, M-Medium, L-Low, N-Not relevant

UNIT I: MEASUREMENT SYSTEMS

6

Introduction to Measurement systems-static and dynamic measurement-closed and open loop system- Requirements and characteristics- Analysis of experimental detail. Error analysis

UNIT II: TRANSDUCERS, MODIFIERS AND TERMINATING DEVICES

6

Transducers for Automotive Applications-Amplifiers-filters-data Acquisition-Indicators, Printers and displays-Signal Analyzing.

UNIT III: MECHANICAL MEASUREMENT**10**

Instrumentation for measuring Weight, Force, torque, pressure power, temperature, fluid flow, vibration, rotational speed, velocity, acceleration and angular motion.

UNIT IV: ENGINE EXPERIMENTAL TECHNIQUES**12**

I.S Code for Engine testing–Instrumentation for performance testing of engine, Instrumentation for Research and development, Instrumentation for noise, vibration, in cylinder gas flow, flame temperature Dynamic Cylinder pressure measurements.

UNIT V VEHICLE EXPERIMENTAL TECHNIQUES**9**

Laboratory tests-test tracks-Endurance Tests-crash tests-Vehicle performance test– Brake tests.

TOTAL: 45 HOURS**REFERENCES:**

1. A.W. JUDGE, Engineering Precision Measurement, Chapman and Hall Ltd, Essex Street W.C., 1951,
2. T.G. Beck with and Buck, Mechanical Measurements, Oxford and IBH Publishing House, New Delhi, 1995
3. D. Patambis, Principle of Industrial Instrumentation, Tata McGraw Hill Publishing Co, New Delhi, 1990.
4. Rangan, Sharma and Mani, Instrumentation Devices and systems, Tata McGraw Hill Publishing Co., Ltd., 1990
5. J.G. Giles, Engine and Vehicle Testing, Illiffe books Ltd., London, 1968.

AM32D2	Vehicle Motor Engineering	L	T	P	C
		3	0	0	3

OBJECTIVE:

1. To understand the history of vehicles
2. To understand the working principles of power and drive systems
3. To understand the concept of suspension and steering systems
4. To understand the concepts of braking system.

Course Outcome		Cognitive Skill
CO1	Students will gain knowledge about the history and introduction to different types of vehicles.	R,U
CO2	Students will gain adequate knowledge about automotive drive and power trains.	U,R
CO3	Students will gain knowledge about different types of suspension and steering system.	R,A
CO4	Students will gain knowledge in different types of braking system.	R
CO5	Students will gain knowledge about different types of frame and body.	U,A

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	P0-A	P0-B	P0-C	P0-D	P0-E	P0-F	P0-G	P0-H	P0-I	P0-J	P0-K	P0-L
CO-01	M	M	L	N	N	N	M	N	M	M	N	N
CO-02	S	M	M	M	N	N	M	M	M	N	M	L
CO-03	S	S	M	L	M	N	L	M	M	N	L	L
CO-04	M	M	L	L	M	N	L	N	L	M	M	L
CO-05	S	M	L	M	L	N	N	M	L	M	M	L

S-Strong, M-Medium, L-Low, N-Not relevant

UNIT – I HISTORY AND INTRODUCTION OF VEHICLES

9

Introduction to automobiles - Types of cars and buses – special utility vehicles - vehicle body technology, special goods vehicle. Different layout of engine and drives. Three wheelers.

UNIT – II AUTOMOTIVE POWER AND DRIVE TRAINS

9

Engines –classifications- working of two and four stroke engines – modern I.C engines – fuel requirement and classification.

Automotive Clutches, Types, Construction and Working Principle of Manual Transmission and Transaxles – Four speed and Five speed Transmission, Auto transmission- Drive lines and Universal Joints, Differentials and Drive Axles

UNIT – III SUSPENSION & STEERING SYSTEM

9

Suspension Types – Coil Spring, Leaf spring, Torsion Bar for Front and Rear Wheels, Types and working principle of Shock absorbers, Active and Passive Suspension systems

Steering Systems: Types and construction of steering system – Manual and Power steering including - Re-circulated Ball Rack and Pinion Mechanism, Steering wheels and columns, Wheel alignment geometry.

UNIT – IV BRAKING SYSTEM

9

Need, characteristics of good braking system Friction – Static and Kinetic, Types- Drum and Disc Brakes- Construction and Working Principle, Types of brake actuating systems – Mechanical brakes, hydraulic brakes, power brakes, servo brakes, Fail safe brake – Air brake – Introduction to ABS.

UNIT – V FRAME AND BODY

9

Role and requirement of a chassis frame. Types of chassis – Light, medium and heavy duty vehicle chassis, ladder chassis, integral body construction techniques. Design features of a body – Types of bodies, Materials used in construction of bodies.

TOTAL: 45 HOURS

REFERENCE BOOKS:

1. Jnusz Pawlowski, “Vehicle Body Engineering”, Business books limited, 1989.
2. Thomas D Gillespie, “Fundamentals of Vehicle dynamics”, SAE USA 1992.

Course Description: This course offers a comprehensive study of entrepreneurship and innovation, focusing on starting and managing ventures. It covers the evolution and different theories of entrepreneurship, its economic significance, and traits of successful entrepreneurs. Key topics include idea generation, opportunity evaluation, venture planning, innovation strategies, and growth management. Additionally, the course addresses social entrepreneurship, women and minority entrepreneurship, intrapreneurship, and entrepreneurial failure.

Course Objectives:

1. To Learn fundamental concepts, theories, and the significance of entrepreneurship in the economy.
2. To acquire skills for idea generation, opportunity evaluation, and feasibility analysis.
3. To explore business plan creation, financing, team building, legal structures, and intellectual property rights.
4. To apply the role of innovation, strategies, risk management, and fostering an innovative culture.
5. To examine challenges and strategies for scaling, leadership transitions, team management, financial management, and exit strategies.

Unit 1: Introduction to Entrepreneurship

9

Defining Entrepreneurship: Evolution and Different Schools of Thought - Importance of Entrepreneurship in the Economy - Traits and Characteristics of Successful Entrepreneurs - Types of Entrepreneurs: Lifestyle vs. Growth-Oriented - The Entrepreneurial Mindset and Attitude - Social Entrepreneurship - Women and Minority Entrepreneurship - Intrapreneurship: Entrepreneurship within Organizations - Entrepreneurial Failure and Lessons Learned

Unit 2: Idea Generation and Opportunity Evaluation

9

Idea Generation: Techniques and Methods - Creativity and Innovation in Idea Generation - Identifying and Assessing Opportunities - Conducting a Feasibility Analysis - The Business Model Canvas - Market Research and Analysis for Entrepreneurs - Understanding Customer Needs - Competitive Analysis - The Value Proposition.

Unit 3: Planning and Launching a Venture

9

Writing a Business Plan: Structure and Components - The Elevator Pitch - Sources of Financing for Start-ups - Crowd funding and Venture Capital - Building a Balanced Team: Roles and Responsibilities - Legal Structure of the Business: Sole Proprietorship, Partnership, LLC, Corporation - Understanding Intellectual Property Rights - Setting Up

Operations: Location, Layout, Equipment - Launching the Venture: Timing, Process, Challenges

Unit 4: Innovation and Entrepreneurship 9

Understanding Innovation: Definition, Types, and Importance - Sources of Innovation - The Process of Innovation: From Idea to Market - Innovation Strategies: Incremental vs. Radical Innovation - Innovation Leadership - Open Innovation and Co-Creation - Innovation Culture and Environment - Managing Risks in Innovation - Disruptive Innovation and Industry Change

Unit 5: Scaling and Managing Growth 9

Growth Strategies for Start-ups: Organic Growth vs. M&A - Identifying and Entering New Markets - The Challenges of Scaling a Business - Leadership Transition and the Role of the Founder - Building and Managing Teams in a Growing Company - Financial Management for Growth - Exit Strategies: Acquisition, IPO, Succession - Failure, Turnaround, and the Role of Pivot - Case Studies of Successful Growth and Scale

Course Learning Outcomes:

1. To understand the concepts entrepreneurship and its economic impact.
2. To Identify and evaluate business opportunities and conduct feasibility analyses.
3. To Develop comprehensive business plans and understand venture financing and legal structures.
4. To apply innovation strategies and manage entrepreneurial risks effectively.
5. To implement strategies for startup growth, manage teams, and plan for leadership transitions and exits.

Text Books:

1. Kuratko, D. F. (2020). *Entrepreneurship: Theory, Process, and Practice* (11th ed.). Cengage Learning. ISBN: 9780357033890.
2. Bessant, J. R., & Tidd, J. (2024). *Innovation and Entrepreneurship* (4th ed.). March. ISBN 978-1-394-21970-4.
3. Drucker, P. (2016). *Innovation and Entrepreneurship*. Harper Business. ISBN: 9780060851132.

Books for Reference:

4. Ries, E. (2011). *The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses*. Crown Business. ISBN: 9780307887894.
5. Gonzalez, A. (2016). *The Art of Startup Fundraising*. Wiley. ISBN: 9781119191834.
6. Christensen, C. M. (2016). *The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail* (Updated Edition). Harvard Business Review Press. ISBN: 9781633691780.
7. Thiel, P., & Masters, B. (2014). *Zero to One: Notes on Startups, or How to Build the Future*. Crown Business. ISBN: 9780804139298.