JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India
DEPARTMENT OF AUTOMOBILE ENGINEERING

COURSE STRUCTURE-R19

COURSE STRUCTURE AND SYLLABUS

For

B. TECH AUTOMOBILE ENGINEERING

(Applicable for batches admitted from 2019-2020)

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

KAKINADA - 533 003, Andhra Pradesh, India

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I Year – I SEMESTER

Sl. No	Course Code	Subjects	L	T	P	Credits
1	BS1101	Mathematics – I	3	0	0	3
2	BS1102	Mathematics – II	3	0	0	3
3	BS1110	Engineering Chemistry	3	0	0	3
4	ES1101	Programming for Problem Solving Using C	3	0	0	3
5	ES1104	Engineering Mechanics	3	0	0	3
6	HS1102	English Lab	0	0	2	1
7	BS1111	Engineering Chemistry Laboratory	0	0	3	1.5
8	ES1102	Programming for Problem Solving Using C Lab	0	0	3	1.5
9	MC1101	Environmental Science	3	0	0	0
Total Credits			**18**	**0**	**8**	**19**

I Year – II SEMESTER

Sl. No	Course Code	Subjects	L	T	P	Credits
1	HS1201	English	3	0	0	3
2	BS1203	Mathematics – III	3	0	0	3
3	BS1208	Engineering Physics	3	0	0	3
4	ES1206	Basic Electrical & Electrical Engineering	3	0	0	3
5	ES1203	Engineering Drawing	1	0	3	2.5
6	HS1203	Communication Skills Lab	0	0	2	1
7	BS1209	Engineering Physics Lab	0	0	3	1.5
8	ES1208	Electrical and Electronics Engineering lab	0	0	3	1.5
9	ES1220	Engineering Workshop & IT Workshop	0	0	2	1.5
10	PR1201	Engineering Exploration Project	0	0	3	1
Total Credits			**13**	**0**	**16**	**21**

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II Year - I Semester

Course Code	Subjects	L	T	P	Credits
ME 2101	Metallurgy & Materials Science	3	0	0	3
ME 2102	Mechanics of Solids	3	0	0	3
ME 2103	Thermodynamics	3	0	0	3
ME 2104	Fluid Mechanics & Hydraulic Machines	3	0	0	3
AU 2101	Basic elements of Automobile Chassis	3	0	0	3
ME 2105	Computer Aided Engineering Practice	3	0	0	3
AU 2102	Automotive Components lab	0	0	3	1.5
ME 2106	Mechanics of Solids & Metallurgy Lab	0	0	3	1.5
MC 2101	Constitution of India	0	0	0	0
	Total Credits	**18**			**21**

II Year - II Semester

Course Code	Subjects	L	T	P	Credits
ME 2207	Kinematics of Machinery	3	0	0	3
ME 2208	Applied Thermodynamics	3	0	0	3
AU 2203	Automotive Engines	3	0	0	3
ME 2209	Production Technology	3	0	0	3
AU 2204	Automotive Electrical and Electronics	3	0	0	3
AU 2205	Automobile Assembly Drawing	1	0	0	2
ME 2210	Thermal Engineering Lab	0	0	3	1.5
ME 2211	Fluid Mechanics & Hydraulic Machines lab	0	0	3	1.5
MC 2202	Essence of Indian Traditional Knowledge	3	0	0	0
	Total Credits				**20**

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III Year - I Semester

Course Code	Subjects	L	T	P	Credits
ME 3112	Dynamics of Machinery	3	0	0	3
AU 3106	Fuels and Combustion	3	0	0	3
AU 3107	Automotive Components Design	3	0	0	3
EC 3101	Micro Processors and Micro Controllers	3	0	0	3
ME 3113	Machine Tools & Metrology	3	0	0	3
AU 3108	Automotive Engines & Fuels Lab	3	0	0	1.5
EC 3102	Micro Processors and Micro Controllers Lab	0	0	3	1
ME 3114	Production Technology Lab	0	0	3	1
MC 3103	IPR & Patents	3	0	0	0
PROJ 3101	Socially Relevant Project	0	0	3	1
	Total Credits				**19.5**

III Year- II Semester

Course Code	Subjects	L	T	P	Credits
ME 3215	Heat Transfer	3	0	0	3
AU 3209	Electrical Vehicles & Hybrid Technology	3	0	0	3
AU 3210	Automotive Chassis Design	3	0	0	3
AU 3211	Automotive Pollution and Control	3	0	0	3
AUOE 01 AUOE 02 AUOE 03	**OPEN ELECTIVE(offered to other students)** 1 Basic Automobile Engineering 2. Automotive Maintenance and Safety 3. Automotive Emissions and Effects	3	0	0	3
AU 3212	Automotive Electrical And Electronics Lab	0	0	3	1.5
ME 3216	Metrology & Machine Tools Lab	0	0	3	1.5
AU 3213	Auto Scanning & Vehicle Testing Lab	0	0	3	1.5
PROJ 3202	Summer Internship/Skill Development	0		60 hrs	1
MC 3204	Professional Ethics & Human Values	0	3	0	0
	Total Credits				**20.5**

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IV Year - I Semester

Course Code	Subjects	L	T	P	Credits
ME4117	Industrial Engineering & Management	3	0	0	0
AU 4114	Vehicle Dynamics	3	0	0	3
AU 4115	Vehicle Body Engineering	3	0	0	3
AU 4116	Alternative Energy sources for Automobiles	3	0	0	3
ME 4118 AU 4117 AU 4118 ME 4119 AU 4119	**Elective I** 1. CAD/CAM 2. Two and Three Wheelers 3. Automotive Aerodynamics 4. Finite Element Methods 5. Vehicle Infotronics	3	0	0	3
ME 4120 ME 4121 ME 4122 ME 4123 CS 4101	**Elective II** 1. Mechatronics 2. Computational Fluid Dynamics 3. Condition Monitoring 4. Managerial Economics and financial analysis 5. Internet of Things	3	0	0	3
AU 4120	Vehicle Design and simulation Lab				2
PROJ 4103	Project I	0	0	6	2
	Total Credits				19

IV Year - II Semester

Course Code	Subjects	L	T	P	Credits
AU 4221	Noise, Vibrations and Harshness	3	0	0	3
AU 4222	Vehicle Maintenance	3	0	0	3
AU 4223	Certification and Homologation	3	0	0	3
AU 4224 AU 4225 AU 4226	**Elective III** I. Automotive Safety 2. Automotive HVAC 3. Special Purpose Vehicles	3	0	0	3
PROJ 4204	Project II	0	0	12	8
	Total Credits				20

Total Course Credits— 40+41 + 40+ 39 = 160

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I Year - I Semester		L	T	P	C
		3	0	0	3
Mathematics-I (BS1101) **(Common to all Branch's for I Year B. Tech)**					

Course Objectives:

- This course will illuminate the students in the concepts of calculus.
- To enlighten the learners in the concept of differential equations and multivariable calculus.
- To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real world problems and their applications.

Course Outcomes: At the end of the course, the student will be able to

- utilize mean value theorems to real life problems (L3)
- solve the differential equations related to various engineering fields (L3)
- familiarize with functions of several variables which is useful in optimization (L3)
- Apply double integration techniques in evaluating areas bounded by region (L3)
- students will also learn important tools of calculus in higher dimensions. Students will become familiar with 2- dimensional and 3-dimensional coordinate systems (L5)

UNIT I: Sequences, Series and Mean value theorems: (10 hrs)

Sequences and Series: Convergences and divergence – Ratio test – Comparison tests – Integral test – Cauchy's root test – Alternate series – Leibnitz's rule.

Mean Value Theorems (without proofs): Rolle's Theorem – Lagrange's mean value theorem – Cauchy's mean value theorem – Taylor's and Maclaurin's theorems with remainders.

UNIT II: Differential equations of first order and first degree: (10 hrs)

Linear differential equations – Bernoulli's equations – Exact equations and equations reducible to exact form.
Applications: Newton's Law of cooling – Law of natural growth and decay – Orthogonal trajectories – Electrical circuits.

UNIT III: Linear differential equations of higher order: (10 hrs)

Non-homogeneous equations of higher order with constant coefficients – with non-homogeneous term of the type e^{ax}, sin ax, cos ax, polynomials in x^n, e^{ax} V(x) and x^nV(x) – Method of Variation of parameters.
Applications: LCR circuit, Simple Harmonic motion.

UNIT IV: Partial differentiation: (10 hrs)

Introduction – Homogeneous function – Euler's theorem – Total derivative – Chain rule – Jacobian – Functional dependence – Taylor's and Mc Laurent's series expansion of functions of two variables.
Applications: Maxima and Minima of functions of two variables without constraints and Lagrange's method (with constraints).

UNIT V: Multiple integrals: (8 hrs)

Double and Triple integrals – Change of order of integration – Change of variables.
Applications: Finding Areas and Volumes.

Text Books:

1. **B. S. Grewal,** Higher Engineering Mathematics, 43rd Edition, Khanna Publishers.
2. **B. V. Ramana,** Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.

Reference Books:

1. **Erwin Kreyszig,** Advanced Engineering Mathematics, 10th Edition, Wiley-India.
2. **Joel Hass, Christopher Heil and Maurice D. Weir,** Thomas calculus, 14th Edition, Pearson.
3. **Lawrence Turyn,** Advanced Engineering Mathematics, CRC Press, 2013.
4. **Srimantha Pal, S C Bhunia,** Engineering Mathematics, Oxford University Press.

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I Year - I Semester		L	T	P	C
		3	0	0	3
MATHEMATICS - II (BS1102) **(Common to all Branch's for I Year B. Tech)**					

Course Objectives:

- To instruct the concept of Matrices in solving linear algebraic equations
- To elucidate the different numerical methods to solve nonlinear algebraic equations
- To disseminate the use of different numerical techniques for carrying out numerical integration.
- To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real world problems and their applications.

Course Outcomes: At the end of the course, the student will be able to

- develop the use of matrix algebra techniques that is needed by engineers for practical applications (L6)
- solve system of linear algebraic equations using Gauss elimination, Gauss Jordan, Gauss Seidel (L3)
- evaluate approximating the roots of polynomial and transcendental equations by different algorithms (L5)
- apply Newton's forward & backward interpolation and Lagrange's formulae for equal and unequal intervals (L3)
- apply different algorithms for approximating the solutions of ordinary differential equations to its analytical computations (L3)

Unit I: Solving systems of linear equations, Eigen values and Eigen vectors: (10 hrs)

Rank of a matrix by echelon form and normal form – Solving system of homogeneous and non-homogeneous equations linear equations – Gauss Elimination for solving system of equations – Eigen values and Eigen vectors and their properties.

Unit-II: Cayley-Hamilton theorem and Quadratic forms: (10 hrs)

Cayley-Hamilton theorem (without proof) – Finding inverse and power of a matrix by Cayley-Hamilton theorem – Reduction to Diagonal form – Quadratic forms and nature of the quadratic forms – Reduction of quadratic form to canonical forms by orthogonal transformation.

Singular values of a matrix, singular value decomposition (Ref. Book – 1).

UNIT III: Iterative methods: **(8 hrs)**

Introduction – Bisection method – Secant method – Method of false position – Iteration method – Newton-Raphson method (One variable and simultaneous Equations) – Jacobi and Gauss-Seidel methods for solving system of equations.

UNIT IV: Interpolation: **(10 hrs)**

Introduction – Errors in polynomial interpolation – Finite differences – Forward differences – Backward differences – Central differences – Relations between operators – Newton's forward and backward formulae for interpolation – Interpolation with unequal intervals – Lagrange's interpolation formula – Newton's divide difference formula.

UNIT V: Numerical integration and solution of ordinary differential equations: **(10 hrs)**

Trapezoidal rule – Simpson's $1/3^{rd}$ and $3/8^{th}$ rule – Solution of ordinary differential equations by Taylor's series – Picard's method of successive approximations – Euler's method – Runge-Kutta method (second and fourth order).

Text Books:

1. **B. S. Grewal,** Higher Engineering Mathematics, 43^{rd} Edition, Khanna Publishers.
2. **B. V. Ramana,** Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.

Reference Books:

1. **David Poole,** Linear Algebra- A modern introduction, 4^{th} Edition, Cengage.
2. **Steven C. Chapra,** Applied Numerical Methods with MATLAB for Engineering and Science, Tata Mc. Graw Hill Education.
3. **M. K. Jain, S. R. K. Iyengar and R. K. Jain,** Numerical Methods for Scientific and Engineering Computation, New Age International Publications.
4. **Lawrence Turyn,** Advanced Engineering Mathematics, CRC Press.

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I Year - I Semester		L	T	P	C
		3	0	0	3
ENGINEERING CHEMISTRY (BS1110)					

Knowledge of basic concepts of Chemistry for Engineering students will help them as professional engineers later in design and material selection, as well as utilizing the available resources.

Learning Objectives:

- ***Importance*** of usage of plastics in household appliances and composites (FRP) in aerospace and automotive industries.
- ***Outline*** the basics for the construction of electrochemical cells, batteries and fuel cells. Understand the mechanism of corrosion and how it can be prevented.
  Express the increase in demand as wide variety of advanced materials are introduced; which have excellent engineering properties.
  Classify and discuss the materials used in major industries like steel industry, metallurgical industries and construction industries and electrical equipment manufacturing industries. Lubrication is also ***summarized***.
- ***Relate*** the need of fuels as a source of energy to any industry, particularly industries like thermal power stations, steel industry, fertilizer industry etc., and hence introduced.
- ***Explain*** the importance and usage of water as basic material in almost all the industries; ***interpret*** drawbacks of steam boilers and also how portable water is supplied for drinking purposes.

UNIT I: POLYMER TECHNOLOGY

Polymerisation:- Introduction-methods of polymerization (emulsion and suspension)-physical and mechanical properties.
Plastics: Compounding-fabrication (compression, injection, blown film, extrusion) - preparation, properties and applications of PVC, polycarbonates and Bakelite-mention some examples of plastic materials used in electronic gadgets, recycling of e-plastic waste.
Elastomers:- Natural rubber-drawbacks-vulcanization-preparation, properties and applications of synthetic rubbers (Buna S, thiokol and polyurethanes).
Composite materials: Fiber reinforced plastics-conducting polymers-biodegradable polymers-biopolymers-biomedical polymers.
Learning Outcomes: ***At the end of this unit, the students will be able to***

- ***Outline*** the properties of polymers and various additives added and different methods of forming plastic materials.
- ***Explain*** the preparation, properties and applications of some plastic materials.
- ***Interpret*** the mechanism of conduction in conducting polymers .
- ***Discuss*** natural and synthetic rubbers and their applications.

UNIT II: ELECTROCHEMICAL CELLS AND CORROSION

Single electrode potential-Electrochemical series and uses of series-standard hydrogen electrode, calomel electrode-concentration cell-construction of glass electrode-Batteries: Dry cell, Ni-Cd cells, Ni-Metal hydride cells, Li ion battery, zinc air cells–Fuel cells: H_2-O_2, CH_3OH-O_2, phosphoric acid, molten carbonate.

Corrosion:-Definition-theories of corrosion (chemical and electrochemical)-galvanic corrosion, differential aeration corrosion, stress corrosion, waterline corrosion-passivity of metals-galvanic series-factors influencing rate of corrosion-corrosion control (proper designing, cathodic protection)-Protective coatings: Surface preparation, cathodic and anodic coatings, electroplating, electroless plating (nickel). Paints (constituents, functions, special paints).

Learning Outcomes: ***At the end of this unit, the students will be able to***

- ***Explain*** the theory of construction of battery and fuel cells.
- ***Categorize*** the reasons for corrosion and study some methods of corrosion control.

UNIT III: CHEMISTRY OF MATERIALS

Part- A:

Nano materials:- Introduction-sol-gel method-characterization by BET, SEM and TEM methods-applications of graphene-carbon nanotubes and fullerenes:Types, preparation and applications

Thermal analysis techniques: Instrumentation and applications of thermogravimetric analysis (TGA), differential thermal analysis (DTA), differential scanning calorimetry (DSC).

Part-B:

Refractories: - Definition, classification, properties (refractoriness, refractoriness under load, porosity and thermal spalling), failure of refractories.

Lubricants: - Definition, mechanism of lubricants and properties (definition and importance).

Cement: - Constituents, manufacturing, parameters to characterize the clinker formation: lime saturation factor (LSF), silica ratio (SR) and alumina ratio (AR), chemistry of setting and hardening, deterioration of cement.

Learning Outcomes: ***At the end of this unit, the students will be able to***

- ***Outline*** the awareness of materials like nanomaterials and fullerenes and their uses.
- ***Explain*** the techniques that detect and measure changes of state of reaction.
- ***Illustrate*** the commonly used industrial materials.

UNIT IV: FUELS

Introduction-calorific value-HCV and LCV-problems using Dulong's formula-proximate and ultimate analysis of coal sample-significance of these analyses-problems-Petroleum (refining-cracking)-Synthetic petrol (Fischer Tropsch and Bergius)-petrol knocking-diesel knocking-octane and cetane ratings-anti-knock agents-Introduction to alternative fuels (Bio-diesel, ethanol, methanol, Natural gas, LPG, CNG)-Flue gas analysis by Orsat apparatus-Rocket fuels.

Learning Outcomes: ***At the end of this unit, the students will be able to***

- ***Differentiate*** petroleum, petrol, synthetic petrol and have knowledge how they are produced.
- ***Study*** alternate fuels.
- ***Analyse*** flue gases.

UNIT V: WATER TECHNOLOGY

Hardness of water-determination of hardness by complexometric method-boiler troubles (priming and foaming, scale formation, boiler corrosion, caustic embrittlement)-internal treatments-softening of hard water (zeolite processs and related sums, ion exchange process)-treatment of industrial waste water

Portable water and its specifications-steps involved in purification of water-chlorination, break point chlorination-reverse osmosis and electro dialysis.

Learning Outcomes: ***At the end of this unit, the students will be able to***

- ***Explain*** the impurities present in raw water, problems associated with them and how to avoid them are understood.

Standard Books:

1. Engineering Chemistry by Jain and Jain; Dhanpat Rai Publicating Co. Latest edition
2. Engineering Chemistry by Shikha Agarwal; Cambridge University Press, 2019 edition.
3. A text book of engineering Chemistry by S. S. Dara; S. Chand & Co Ltd., Latest Edition
   Engineering Chemistry by Shashi Chawla; Dhanpat Rai Publicating Co. Latest edition

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I Year - I Semester		L	T	P	C
		3	0	0	3
PROGRAMMING FOR PROBLEM SOLVING USING C (ES1101)					

COURSE OBJECTIVES:

The objectives of Programming for Problem Solving Using C are

1) To learn about the computer systems, computing environments, developing of a computer program and Structure of a C Program
2) To gain knowledge of the operators, selection, control statements and repetition in C
3) To learn about the design concepts of arrays, strings, enumerated structure and union types. To learn about their usage.
4) To assimilate about pointers, dynamic memory allocation and know the significance of Preprocessor.
5) To assimilate about File I/O and significance of functions

UNIT I

Introduction to Computers: Creating and running Programs, Computer Numbering System, Storing Integers, Storing Real Numbers

Introduction to the C Language: Background, C Programs, Identifiers, Types, Variable, Constants, Input/output, Programming Examples, Scope, Storage Classes and Type Qualifiers.

Structure of a C Program: Expressions Precedence and Associativity, Side Effects, Evaluating Expressions, Type Conversion Statements, Simple Programs, Command Line Arguments.

UNIT II

Bitwise Operators: Exact Size Integer Types, Logical Bitwise Operators, Shift Operators.

Selection & Making Decisions: Logical Data and Operators, Two Way Selection, Multiway Selection, More Standard Functions

Repetition: Concept of Loop, Pretest and Post-test Loops, Initialization and Updating, Event and Counter Controlled Loops, Loops in C, Other Statements Related to Looping, Looping Applications, Programming Examples

UNIT III

Arrays: Concepts, Using Array in C, Array Application, Two Dimensional Arrays, Multidimensional Arrays, Programming Example – Calculate Averages

Strings: String Concepts, C String, String Input / Output Functions, Arrays of Strings, String Manipulation Functions String/ Data Conversion, A Programming Example – Morse Code

Enumerated, Structure, and Union: The Type Definition (Type def), Enumerated Types, Structure, Unions, and Programming Application

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UNIT IV

Pointers: Introduction, Pointers to pointers, Compatibility, L value and R value
Pointer Applications: Arrays, and Pointers, Pointer Arithmetic and Arrays, Memory Allocation Function, Array of Pointers, Programming Application
Processor Commands: Processor Commands

UNIT V

Functions: Designing, Structured Programs, Function in C, User Defined Functions, Inter-Function Communication, Standard Functions, Passing Array to Functions, Passing Pointers to Functions, Recursion
Text Input / Output: Files, Streams, Standard Library Input / Output Functions, Formatting Input / Output Functions, Character Input / Output Functions
Binary Input / Output: Text versus Binary Streams, Standard Library, Functions for Files, Converting File Type.

TEXT BOOKS:

1. Programming for Problem Solving, Behrouz A. Forouzan, Richard F.Gilberg, CENGAGE
2. The C Programming Language, Brian W.Kernighan, Dennis M. Ritchie, 2e, Pearson

REFERENCES:

1. Computer Fundamentals and Programming, Sumithabha Das, Mc Graw Hill
2. Programming in C, Ashok N. Kamthane, Amit Kamthane, Pearson
3. Computer Fundamentals and Programming in C, Pradip Dey, Manas Ghosh, OXFORD

COURSE OUTCOMES:

Upon the completion of the course the student will learn

1) To write algorithms and to draw flowcharts for solving problems
2) To convert flowcharts/algorithms to C Programs, compile and debug programs
3) To use different operators, data types and write programs that use two-way/ multi-way selection
4) To select the best loop construct for a given problem
5) To design and implement programs to analyze the different pointer applications
6) To decompose a problem into functions and to develop modular reusable code
7) To apply File I/O operations

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I Year - I Semester		L	T	P	C
		3	0	0	3
ENGINEERING MECHANICS (ES1104)					

Objectives: The students completing this course are expected to understand the concepts of forces and its resolution in different planes, resultant of force system, Forces acting on a body, their free body diagrams using graphical methods. They are required to understand the concepts of centre of gravity and moments of inertia and their application, Analysis of frames and trusses, different types of motion, friction and application of work - energy method.

UNIT – I

Objectives: The students are to be exposed to the concepts of force and friction, direction and its application.

Introduction to Engg. Mechanics – Basic Concepts.

Systems of Forces: Coplanar Concurrent Forces – Components in Space – Resultant – Moment of Force and its Application – Couples and Resultant of Force Systems.

Friction: Introduction**,** limiting friction and impending motion, coulomb's laws of dry friction, coefficient of friction, cone of friction

UNIT II

Objectives: The students are to be exposed to application of free body diagrams. Solution to problems using graphical methods and law of triangle of forces.

Equilibrium of Systems of Forces: Free Body Diagrams, , Lami's Theorm, Equations of Equilibrium of Coplanar Systems, Graphical method for the equilibrium, Triangle law of forces, converse of the law of polygon of forces condition of equilibrium, Equations of Equilibrium for Spatial System of forces, Numerical examples on spatial system of forces using vector approach, Analysis of plane trusses.

UNIT – III

Objectives : The students are to be exposed to concepts of centre of gravity. The students are to be exposed to concepts of moment of inertia and polar moment of inertia including transfer methods and their applications.

Centroid: Centroids of simple figures (from basic principles) – Centroids of Composite Figures

Centre of Gravity: Centre of gravity of simple body (from basic principles), centre of gravity of composite bodies, Pappus theorems.

Area moments of Inertia: Definition – Polar Moment of Inertia, Transfer Theorem, Moments of Inertia of Composite Figures, Products of Inertia, Transfer Formula for Product of Inertia. **Mass Moment of Inertia:** Moment of Inertia of Masses, Transfer Formula for Mass Moments of Inertia, mass moment of inertia of composite bodies.

UNIT – IV

Objectives: The students are to be exposed to motion in straight line and in curvilinear paths, its velocity and acceleration computation and methods of representing plane motion.

Rectilinear and Curvilinear motion of a particle: Kinematics and Kinetics- Work Energy method and applications to particle motion- Impulse momentum method.

UNIT – V

Objectives: The students are to be exposed to rigid motion kinematics and kinetics

Rigid body Motion: Kinematics and kinetics of translation, Rotation about fixed axis and plane motion, Work Energy method and Impulse momentum method.

TEXT BOOK:

1. Engg. Mechanics - S.Timoshenko & D.H.Young., 4th Edn - , Mc Graw Hill publications.

Course outcomes:

1. The student should be able to draw free body diagrams for FBDs for particles and rigid bodies in plane and space and problems to solve the unknown forces, orientations and geometric parameters.
2. He should be able to determine centroid for lines, areas and center of gravity for volumes and their composites.
3. He should be able to determine area and mass movement of inertia for composite sections
4. He should be able to analyze motion of particles and rigid bodies and apply the principles of motion, work energy and impulse – momentum.

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I Year - I Semester		L	T	P	C
		0	0	2	1
ENGLISH LAB (HS1102)					

UNIT I:
Vowels, Consonants, Pronunciation, Phonetic Transcription

UNIT II:

Past tense markers, word stress-di-syllabic words, Poly-Syllabic words

UNIT III:

Rhythm & Intonation

UNIT IV:

Contrastive Stress (Homographs)

UNIT V:

Word Stress: Weak and Strong forms
Stress in compound words

References books:

1. Infotech English, Maruthi Publications. (with Compact Disc).
2. Exercises in Spoken English Part 1,2,3,4, OUP and CIEFL.
3. English Pronunciation in use- Mark Hancock, Cambridge University Press.
4. English Phonetics and Phonology-Peter Roach, Cambridge University Press.
5. English Pronunciation in use- Mark Hewings, Cambridge University Press.
6. English Pronunciation Dictionary- Daniel Jones, Cambridge University Press.
7. English Phonetics for Indian Students- P. Bala Subramanian, Mac Millan Publications.

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I Year - I Semester		L	T	P	C
		0	0	3	1.5
ENGINEERING CHEMISTRY LAB (BS1111)					

Introduction to Chemistry laboratory – Molarity, normality, primary, secondary standard solutions, volumetric titrations, quantitative analysis

1. Determination of HCl using standard Na_2CO_3 solution.
2. Determination of alkalinity of a sample containing Na_2CO_3 and NaOH.
3. Determination of Mn (II) using standard oxalic acid solution.
4. Determination of ferrous iron using standard $K_2Cr_2O_7$ solution.
5. Determination of copper (II) using standard hypo solution.
6. Determination of temporary and permanent hardness of water using standard EDTA solution.
7. Determination of iron (III) by a colorimetric method.
8. Determination of the concentration of acetic acid using sodium hydroxide (pH-metry method).
9. Determination of the concentration of strong acid vs strong base (by conductometric method).
10. Determination of strong acid vs strong base (by potentiometric method).
11. Determination of Mg^{+2} present in an antacid.
12. Determination of $CaCO_3$ present in an egg shell.
13. Estimation of Vitamin C.
14. Determination of phosphoric content in soft drinks.
15. Adsorption of acetic acid by charcoal.
16. Preparation of nylon-6, 6 and Bakelite (demonstration only).

Of the above experiments at-least 10 assessment experiments should be completed in a semester.

Outcomes: The students entering into the professional course have practically very little exposure to lab classes. The experiments introduce volumetric analysis; redox titrations with different indicators; EDTA titrations; then they are exposed to a few instrumental methods of chemical analysis. Thus at the end of the lab course, the student is exposed to different methods of chemical analysis and use of some commonly employed instruments. They thus acquire some experimental skills.

Reference Books

1. A Textbook of Quantitative Analysis, Arthur J. Vogel.

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DEPARTMENT OF AUTOMOBILE ENGINEERING

I Year - I Semester		L	T	P	C
		0	0	3	1.5
PROGRAMMING FOR PROBLEM SOLVING USING C LAB (ES1102)					

Course Objectives:

1) Apply the principles of C language in problem solving.
2) To design flowcharts, algorithms and knowing how to debug programs.
3) To design & develop of C programs using arrays, strings pointers & functions.
4) To review the file operations, preprocessor commands.

Exercise 1:

1. Write a C program to print a block F using hash (#), where the F has a height of six characters and width of five and four characters.
2. Write a C program to compute the perimeter and area of a rectangle with a height of 7 inches and width of 5 inches.
3. Write a C program to display multiple variables.

Exercise 2:

1. Write a C program to calculate the distance between the two points.
2. Write a C program that accepts 4 integers p, q, r, s from the user where r and s are positive and p is even. If q is greater than r and s is greater than p and if the sum of r and s is greater than the sum of p and q print "Correct values", otherwise print "Wrong values".

Exercise 3:

1. Write a C program to convert a string to a long integer.
2. Write a program in C which is a Menu-Driven Program to compute the area of the various geometrical shape.
3. Write a C program to calculate the factorial of a given number.

Exercise 4:

1. Write a program in C to display the n terms of even natural number and their sum.
2. Write a program in C to display the n terms of harmonic series and their sum. 1 + 1/2 + 1/3 + 1/4 + 1/5 ... 1/n terms.
3. Write a C program to check whether a given number is an Armstrong number or not.

Exercise 5:

1. Write a program in C to print all unique elements in an array.
2. Write a program in C to separate odd and even integers in separate arrays.
3. Write a program in C to sort elements of array in ascending order.

Exercise 6:

1. Write a program in C for multiplication of two square Matrices.
2. Write a program in C to find transpose of a given matrix.

Exercise 7:

1. Write a program in C to search an element in a row wise and column wise sorted matrix.
2. Write a program in C to print individual characters of string in reverse order.

Exercise 8:

1. Write a program in C to compare two strings without using string library functions.
2. Write a program in C to copy one string to another string.

Exercise 9:

1. Write a C Program to Store Information Using Structures with Dynamically Memory Allocation
2. Write a program in C to demonstrate how to handle the pointers in the program.

Exercise 10:

1. Write a program in C to demonstrate the use of & (address of) and *(value at address) operator.
2. Write a program in C to add two numbers using pointers.

Exercise 11:

1. Write a program in C to add numbers using call by reference.
2. Write a program in C to find the largest element using Dynamic Memory Allocation.

Exercise 12:

1. Write a program in C to swap elements using call by reference.
2. Write a program in C to count the number of vowels and consonants in a string using a pointer.

Exercise 13:

1. Write a program in C to show how a function returning pointer.
2. Write a C program to find sum of n elements entered by user. To perform this program, allocate memory dynamically using malloc( ) function.

Exercise 14:

1. Write a C program to find sum of n elements entered by user. To perform this program, allocate memory dynamically using calloc( ) function. Understand the difference between the above two programs
2. Write a program in C to convert decimal number to binary number using the function.

Exercise 15:

1. Write a program in C to check whether a number is a prime number or not using the function.
2. Write a program in C to get the largest element of an array using the function.

Exercise 16:

1. Write a program in C to append multiple lines at the end of a text file.
2. Write a program in C to copy a file in another name.
3. Write a program in C to remove a file from the disk.

Course Outcomes:

By the end of the Lab, the student

1) Gains Knowledge on various concepts of a C language.
2) Able to draw flowcharts and write algorithms.
3) Able design and development of C problem solving skills.
4) Able to design and develop modular programming skills.
5) Able to trace and debug a program

I Year - I Semester		**L**	**T**	**P**	**C**

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DEPARTMENT OF AUTOMOBILE ENGINEERING

		3	**0**	**0**	**0**
ENVIRONMENTAL SCIENCE (MC1101)					

Learning Objectives:
The objectives of the course are to impart:

- Overall understanding of the natural resources.
- Basic understanding of the ecosystem and its diversity.
- Acquaintance on various environmental challenges induced due to unplanned anthropogenic activities.
- An understanding of the environmental impact of developmental activities.
- Awareness on the social issues, environmental legislation and global treaties.

UNIT-I:
Multidisciplinary nature of Environmental Studies: Definition, Scope and Importance –Sustainability: Stockholm and Rio Summit–Global Environmental Challenges: Global warming and climate change, acid rains, ozone layer depletion, population growth and explosion, effects;. Role of information technology in environment and human health.
Ecosystems: Concept of an ecosystem. - Structure and function of an ecosystem; Producers, consumers and decomposers. - Energy flow in the ecosystem - Ecological succession. - Food chains, food webs and ecological pyramids; Introduction, types, characteristic features, structure and function of Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems.

UNIT-II:
Natural Resources: Natural resources and associated problems.
Forest resources: Use and over – exploitation, deforestation – Timber extraction – Mining, dams and other effects on forest and tribal people.
Water resources: Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems.
Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources.
Food resources: World food problems, changes caused by non-agriculture activities-effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity.
Energy resources: Growing energy needs, renewable and non-renewable energy sources use of alternate energy sources.
Land resources: Land as a resource, land degradation, Wasteland reclamation, man induced landslides, soil erosion and desertification; Role of an individual in conservation of natural resources; Equitable use of resources for sustainable lifestyles.

UNIT-III:
Biodiversity and its conservation: Definition: genetic, species and ecosystem diversity-classification - Value of biodiversity: consumptive use, productive use, social-Biodiversity at national and local levels. India as a mega-diversity nation - Hot-sports of biodiversity - Threats to biodiversity: habitat loss, man-wildlife conflicts. - Endangered and endemic species of India – Conservation of biodiversity: conservation of biodiversity.

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UNIT – IV Environmental Pollution: Definition, Cause, effects and control measures of Air pollution, Water pollution, Soil pollution, Noise pollution, Nuclear hazards. Role of an individual in prevention of pollution. - Pollution case studies, Sustainable Life Studies. Impact of Fire Crackers on Men and his well being.

Solid Waste Management: Sources, Classification, effects and control measures of urban and industrial solid wastes. Consumerism and waste products, Biomedical, Hazardous and e – waste management.

UNIT – V Social Issues and the Environment: Urban problems related to energy -Water conservation, rain water harvesting-Resettlement and rehabilitation of people; its problems and concerns. Environmental ethics: Issues and possible solutions. Environmental Protection Act -Air (Prevention and Control of Pollution) Act. –Water (Prevention and control of Pollution) Act -Wildlife Protection Act -Forest Conservation Act-Issues involved in enforcement of environmental legislation. -Public awareness.

Environmental Management: Impact Assessment and its significance various stages of EIA, preparation of EMP and EIS, Environmental audit. Ecotourism, Green Campus – Green business and Green politics.

The student should Visit an Industry / Ecosystem and submit a report individually on any issues related to Environmental Studies course and make a power point presentation.

Text Books:

1. Environmental Studies, K. V. S. G. Murali Krishna, VGS Publishers, Vijayawada
2. Environmental Studies, R. Rajagopalan, 2nd Edition, 2011, Oxford University Press.
3. Environmental Studies, P. N. Palanisamy, P. Manikandan, A. Geetha, and K. Manjula Rani; Pearson Education, Chennai

Reference:

1. Text Book of Environmental Studies, Deeshita Dave & P. Udaya Bhaskar, Cengage Learning.
2. A Textbook of Environmental Studies, Shaashi Chawla, TMH, New Delhi
3. Environmental Studies, Benny Joseph, Tata McGraw Hill Co, New Delhi
4. Perspectives in Environment Studies, Anubha Kaushik, C P Kaushik, New Age International Publishers, 2014

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I Year - II Semester		L	T	P	C
		3	0	0	3
ENGLISH (HS1201)					

Introduction

The course is designed to train students in receptive (listening and reading) as well as productive and interactive (speaking and writing) skills by incorporating a comprehensive, coherent and integrated approach that improves the learners' ability to effectively use English language in academic/ workplace contexts. The shift is from *learning about the language* to *using the language*. On successful completion of the compulsory English language course/s in B.Tech., learners would be confident of appearing for international language qualification/proficiency tests such as IELTS, TOEFL, or BEC, besides being able to express themselves clearly in speech and competently handle the writing tasks and verbal ability component of campus placement tests. Activity based teaching-learning methods would be adopted to ensure that learners would engage in actual use of language both in the classroom and laboratory sessions.

Course Objectives

- Facilitate effective listening skills for better comprehension of academic lectures and English spoken by native speakers
- Focus on appropriate reading strategies for comprehension of various academic texts and authentic materials
- Help improve speaking skills through participation in activities such as role plays, discussions and structured talks/oral presentations
- Impart effective strategies for good writing and demonstrate the same in summarizing, writing well organized essays, record and report useful information
- Provide knowledge of grammatical structures and vocabulary and encourage their appropriate use in speech and writing

Learning Outcomes

At the end of the module, the learners will be able to

- understand social or transactional dialogues spoken by native speakers of English and identify the context, topic, and pieces of specific information
- ask and answer general questions on familiar topics and introduce oneself/others
- employ suitable strategies for skimming and scanning to get the general idea of a text and locate specific information
- recognize paragraph structure and be able to match beginnings/endings/headings with paragraphs
- form sentences using proper grammatical structures and correct word forms

Unit 1:

Lesson-1: A Drawer full of happiness from "**Infotech English**", Maruthi Publications

Lesson-2: Deliverance by Premchand from "**The Individual Society",** Pearson Publications. (Non-detailed)

Listening: Listening to short audio texts and identifying the topic. Listening to short audio texts and identifying the context and specific pieces of information to answer a series of questions both in speaking and writing.

Speaking: Asking and answering general questions on familiar topics such as home, family, work, studies and interests. Self introductions and introducing others.

Reading: Skimming text to get the main idea. Scanning to look for specific pieces of information.

Reading for Writing: Paragraph writing (specific topics) using suitable cohesive devices; linkers, sign posts and transition signals; mechanics of writing - punctuation, capital letters.

Vocabulary: Technical vocabulary from across technical branches (20) GRE Vocabulary (20) (Antonyms and Synonyms, Word applications) Verbal reasoning and sequencing of words.

Grammar: Content words and function words; word forms: verbs, nouns, adjectives and adverbs; nouns: countables and uncountables; singular and plural basic sentence structures; simple question form - wh-questions; word order in sentences.
Pronunciation: Vowels, Consonants, Plural markers and their realizations

Unit 2:

Lesson-1: Nehru's letter to his daughter Indira on her birthday from "**Infotech English**", Maruthi Publications

Lesson-2: Bosom Friend by Hira Bansode from "**The Individual Society",** Pearson Publications. (Non-detailed)

Listening: Answering a series of questions about main idea and supporting ideas after listening to audio texts, both in speaking and writing.

Speaking: Discussion in pairs/ small groups on specific topics followed by short structured talks. Functional English: Greetings and leave takings.

Reading: Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together.

Reading for Writing: Summarizing - identifying main idea/s and rephrasing what is read; avoiding redundancies and repetitions.

Vocabulary: Technical vocabulary from across technical branches (20 words). GRE Vocabulary Analogies (20 words) (Antonyms and Synonyms, Word applications)

Grammar: Use of articles and zero article; prepositions.

Pronunciation: Past tense markers, word stress-di-syllabic words

Unit 3:

Lesson-1: Stephen Hawking-Positivity 'Benchmark' from "**Infotech English**", Maruthi Publications

Lesson-2: Shakespeare's Sister by Virginia Woolf from "**The Individual Society",** Pearson Publications. (Non-detailed**)**

Listening: Listening for global comprehension and summarizing what is listened to, both in speaking and writing.

Speaking: Discussing specific topics in pairs or small groups and reporting what is discussed. Functional English: Complaining and Apologizing.

Reading: Reading a text in detail by making basic inferences - recognizing and interpreting specific context clues; strategies to use text clues for comprehension. Critical reading.

Reading for Writing: Summarizing - identifying main idea/s and rephrasing what is read; avoiding redundancies and repetitions. Letter writing-types, format and principles of letter writing. E-mail etiquette, Writing CV's.

Vocabulary: Technical vocabulary from across technical branches (20 words). GRE Vocabulary (20 words) (Antonyms and Synonyms, Word applications) Association, sequencing of words

Grammar: Verbs - tenses; subject-verb agreement; direct and indirect speech, reporting verbs for academic purposes.

Pronunciation: word stress-poly-syllabic words

Unit 4:

Lesson-1: Liking a Tree, Unbowed: Wangari Maathai-biography from "**Infotech English**", Maruthi Publications

Lesson-2: Telephone Conversation-Wole Soyinka from "**The Individual Society",** Pearson Publications**.** (Non-detailed)

Listening: Making predictions while listening to conversations/ transactional dialogues without video (only audio); listening to audio-visual texts.

Speaking: Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions. Functional English: Permissions, Requesting, Inviting.

Reading: Studying the use of graphic elements in texts to convey information, reveal trends/patterns/relationships, communicative process or display complicated data.

Reading for Writing: Information transfer; describe, compare, contrast, identify significance/trends based on information provided in figures/charts/graphs/tables. Writing SOP, writing for media.

Vocabulary: Technical vocabulary from across technical branches (20 words) GRE Vocabulary (20 words) (Antonyms and Synonyms, Word applications) Cloze Encounters.

Grammar: Quantifying expressions - adjectives and adverbs; comparing and contrasting; degrees of comparison; use of antonyms

Pronunciation: Contrastive Stress

Unit 5:

Lesson-1: Stay Hungry-Stay foolish from "**Infotech English**", Maruthi Publications

Lesson-2: Still I Rise by Maya Angelou from "**The Individual Society",** Pearson Publications. (Non-detailed)

Listening: Identifying key terms, understanding concepts and interpreting the concepts both in speaking and writing.

Speaking: Formal oral presentations on topics from academic contexts - without the use of PPT slides. Functional English: Suggesting/Opinion giving.

Reading: Reading for comprehension. RAP Strategy Intensive reading and Extensive reading techniques.

Reading for Writing: Writing academic proposals- writing research articles: format and style.

Vocabulary: Technical vocabulary from across technical branches (20 words) GRE Vocabulary (20 words) (Antonyms and Synonyms, Word applications) Coherence, matching emotions.

Grammar: Editing short texts – identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject verb agreement)

Pronunciation: Stress in compound words

Prescribed text books for theory:

1. "**Infotech English**", Maruthi Publications. (Detailed)
2. "**The Individual Society",** Pearson Publications. (Non-detailed)

Reference books:

1. Bailey, Stephen. Academic writing: A handbook for international students. Routledge, 2014.
2. Chase, Becky Tarver. Pathways: Listening, Speaking and Critical Thinking. Heinley ELT; 2nd Edition, 2018.
3. Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.
4. Hewings, Martin. Cambridge Academic English (B2). CUP, 2012.

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DEPARTMENT OF AUTOMOBILE ENGINEERING

I Year - II Semester		L	T	P	C
		3	0	0	3
MATHEMATICS - III (BS1203) **(Common to all Branch's for I Year B. Tech)**					

Course Objectives:

- To familiarize the techniques in partial differential equations.
- To furnish the learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real world applications.

Course Objectives: At the end of the course, the student will be able to

- Interpret the physical meaning of different operators such as gradient, curl and divergence (L5)
- Estimate the work done against a field, circulation and flux using vector calculus (L5)
- Apply the Laplace transform for solving differential equations (L3).
- Find or compute the Fourier series of periodic signals (L3)
- Know and be able to apply integral expressions for the forwards and inverse Fourier transform to a range of non-periodic waveforms (L3)
- Identify solution methods for partial differential equations that model physical processes (L3)

UNIT I: Vector calculus: (10 hrs)

Vector Differentiation: Gradient — Directional derivative — Divergence — Curl — Scalar Potential.
Vector Integration: Line integral — Work done — Area — Surface and volume integrals — Vector integral theorems: Greens, Stokes and Gauss Divergence theorems (without proof).

UNIT II:Laplace Transforms: (10 hrs)

Laplace transforms of standard functions — Shifting theorems — Transforms of derivatives and integrals —

Unit step function — Dirac's delta function — Inverse Laplace transforms — Convolution theorem (without proof).
Applications: Solving ordinary differential equations (initial value problems) using Laplace transforms.

UNIT III:Fourier series and Fourier Transforms: (10 hrs)

Fourier Series: Introduction — Periodic functions — Fourier series of periodic function — Dirichlet's conditions — Even and odd functions — Change of interval — Half-range sine and cosine series.

Fourier Transforms: Fourier integral theorem (without proof) — Fourier sine and cosine integrals — Sine and cosine transforms — Properties — inverse transforms — Finite Fourier transforms.

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UNIT IV:PDE of first order: (8 hrs)

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions — Solutions of first order linear (Lagrange) equation and nonlinear (standard types) equations.

UNIT V: Second order PDE and Applications: (10 hrs)

Second order PDE: Solutions of linear partial differential equations with constant coefficients — RHS term of the type $e^{ax + by}$,sin(ax + by), cos(ax + by), $x^m y^n$

Applications of PDE: Method of separation of Variables — Solution of One dimensional Wave, Heat and two-dimensional Laplace equation.

Text Books:

1. **B.S. Grewal,** Higher Engineering Mathematics, 43rd Edition, Khanna Publishers.
2. **B. V. Ramana**, Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.

Reference Books:

1. **Erwin Kreyszig**, Advanced Engineering Mathematics, 10thEdition, Wiley-India.
2. **Dean. G. Duffy**, Advanced Engineering Mathematics with MATLAB, 3rd Edition, CRC Press.
3. **Peter O' Neil**, Advanced Engineering Mathematics, Cengage.
4. **Srimantha Pal, S C Bhunia,** Engineering Mathematics, Oxford University Press.

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DEPARTMENT OF AUTOMOBILE ENGINEERING

I Year - II Semester		L	T	P	C
		3	0	0	3
ENIGINEERING PHYSICS (BS1208)					

Course Objectives:

Physics curriculum which is re-oriented to the needs of non-circuital branches of graduate engineering courses offered by JNTUniversity:kakinada that serves as a transit to understand the branch specific advanced topics. The course is designed to:

- Impart concepts of mechanics required to identify forces and moments in mechanical systems by vector representation-extend Newton's second law for inertial and non-inertial frames of reference- study different types of harmonic oscillatory motions.
- Tap the Simple harmonic motion and its adaptability for improved acoustic quality of concert halls- impart concepts of flaw detection techniques using ultrasonics.
- Study the structure- property relationship exhibited by solid materials within the elastic limit.
- Impart knowledge in basic concepts of LASERs along with its Engineering applications- Familiarize types of sensors for various engineering applications
- Explore the knowledge of magnetic and dielectric materials and their utility in appliances.

UNIT-I **(10hrs)**

MECHANICS: Basic laws of vectors and scalars, rotational frames-conservative and non – conservative forces , F = - grad V, Newton's laws in inertial and linear accelerating non-inertial frames of reference, rotating frame of reference with constant angular velocity, Harmonic oscillator ; damped harmonic motion ; Forced oscillations and resonance.

Outcome:

The students will be able to

- Identify forces and moments in mechanical systems using scalar and vector techniques
- extend Newton's second law for inertial and non-inertial frame of reference
- explain simple harmonic motion and damped harmonic motions

UNIT-II **(10hrs)**

ACOUSTICS & ULTRASONICS: Introduction – Reverberation - Reverberation time - Sabine's formula (Derivation using growth and decay method)–absorption coefficient and its determination- factors affecting acoustics of buildings and their remedies.

Production of ultrasonics by Magnetostriction and piezoelectric methods – Detection of ultrasonics - acoustic grating - Non-Destructive Testing- pulse echo system through transmission and reflection modes - Applications.

Outcome:

The students will be able to

- explain how sound is propagated in buildings
- analyze acoustic properties of typically used materials in buildings

- recognize sound level disruptors and their use in architectural acoustics
- Use of ultrasonics in flaw detection using NDT technique

UNIT-III **(9hrs)**

ELASTICITY:, stress, strain, Hooke's law, stress-strain curve, generalized Hooke's law with and without thermal strains for isotropic materials, different types of moduli and their relations, bending of beams – Bending moment of a beam – Depression of cantilever.

Outcome:

The students will be able to

- Understand the elasticity and plasticity concepts
- Study different types of moduli and their relation
- Analyze the concepts of shearing force and moment of inertia

UNIT-IV **(9hrs)**

LASERS & SENSORS: Characteristics–Spontaneous and Stimulated emission of radiation – population inversion - Einstein's coefficients & Relation between them and their significance - Pumping Mechanisms - Ruby laser – Helium Neon laser – Applications.

SENSORS (qualitative description only): Different types of sensors and applications; Strain and Pressure sensors- Piezoelectric, magnetostrictive sensors, Temperature sensor - bimetallic strip, pyroelectric detectors.

Outcome:

The students will be able to

- **Understand** the basic concepts of LASER light Sources
- Study Different types of laser systems
- Identify different types of sensors and their working principles

UNIT-V **(10hrs)**

MAGNETISM & DIELECTRICS: Introduction – Magnetic dipole moment – Magnetization-Magnetic susceptibility and permeability – Origin of permanent magnetic moment – Bohr Magneton - Classification of magnetic materials (Dia, Para and Ferro) – Domain concept of Ferromagnetism - Hysteresis – soft and hard magnetic materials – Applications of Ferromagnetic materials.

Introduction - Dielectric polarization – Dielectric polarizability, Susceptibility and Dielectric constant-types of polarizations: Electronic and Ionic (Quantitative), Orientational polarizations (qualitative)-Lorentz internal field – Claussius_Mossoti equation- Frequency dependence of polarization - Applications of dielectrics.

Outcome:

The students will be able to

- **explain** the concept of dielectric constant and polarization in dielectric materials.
- **summarize** various types of polarization of dielectrics .
- **interpret** Lorentz field and Claussius_Mosotti relation in dielectrics.
- **classify** the magnetic materials based on susceptibility and their temperature dependence.
- **explain** the applications of dielectric and magnetic materials .
- **Apply** the concept of magnetism to magnetic devices.

Text Books:

1. "Engineering Mechanics" by Manoj K Harbola, Cengage Publications 2nd Eds.

2. "A text book of Engineering Physics" by P G Kshirsagar & M N Avadhanulu, S Chand & Company Ltd.
3. "Engineering Physics" by R K Gaur and S L Gupta, Dhanpat Rai Publications.
4. "Sensor and Transducers" by Ian R Sinclair, Elsevier (Newnes) 3rd Eds.

Reference Books:

1. "Engineering Physics" by M R Srinivasan, New Age International Publishers.
2. "Lectures on Physics" by Richard P Feynman, Pearson Publishers, New Millennium Eds.
3. "Lasers and Non-linear Optics" by B B Laud, New Age International Publishers (3rd Eds.).

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I Year - II Semester		L	T	P	C
		3	0	0	3
BASIC ELECTRICAL & ELECTRONICS ENGINEERING (ES1206)					

Preamble:
This course covers the topics related to analysis of various electrical circuits, operation of various electrical machines and electronic components to perform well in their respective fields.

Learning Objectives:
- To learn the basic principles of electrical circuital law's and analysis of networks.
- To understand principle of operation and construction details of DC machines.
- To understand principle of operation and construction details of transformers, alternator and 3-Phase induction motor.
- To study operation of PN junction diode, half wave, full wave rectifiers and OP-AMPs.
- To learn operation of PNP and NPN transistors and various amplifiers.

Unit - I
Electrical Circuits
Basic definitions – types of network elements – Ohm's Law – Kirchhoff's Laws – inductive networks – capacitive networks – series – parallel circuits – star-delta and delta-star transformations.-Numerical Problems.

Unit - II
DC Machines
Principle of operation of DC generator – EMF equation – types of DC machines – torque equation characteristics of DC motors – applications – three point starter – speed control methods of DC motor – Swinburne's Test-Brake test on DC shunt motor-Numerical problems.

Unit - III
AC Machines:
Transformers
Principle of operation and construction of single phase transformers – EMF equation – Losses – OC & SC tests – efficiency and regulation-Numerical Problems.
AC Rotating Machines
Principle of operation and construction of alternators – types of alternators Regulation of alternator by synchronous impedance method – principle of operation of synchronous motor – principle of operation of 3-Phase induction motor – slip-torque characteristics – efficiency – applications- Numerical Problems.

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Unit IV

Rectifiers & Linear ICs

PN junction diodes – diode applications (half wave and bridge rectifiers). Characteristics of operation amplifiers (OP-AMP) – application of OP-AMPs (inverting, non-inverting, integrator and differentiator)-Numerical Problems.

Unit V

Transistors

PNP and NPN junction transistor, transistor as an amplifier– frequency response of CE amplifier – Basic concepts of feedback amplifier-Numerical problems.

Learning Outcomes:

The student should be able to:

- Analyse various electrical networks.
- Understand operation of DC generators,3-point starter and DC machine testing by Swinburne's Test and Brake test.
- Analyse performance of single-phase transformer and acquire proper knowledge and working of 3-phase alternator and 3-phase induction motors.
- Analyse operation of half wave, full wave bridge rectifiers and OP-AMPs.
- Understanding operations of CE amplifier and basic concept of feedback amplifier.

Text Books:

1. Electrical Technology by Surinder Pal Bali, Pearson Publications.
2. Electronic Devices and Circuits by R.L. Boylestad and Louis Nashelsky, 9th edition, PEI/PHI 2006.

Reference Books:

1. Electrical Circuit Theory and Technology by John Bird, Routledge Taylor &Francis Group
2. Basic Electrical Engineering by M.S.Naidu and S.Kamakshiah, TMH Publications
3. Fundamentals of Electrical Engineering by Rajendra Prasad, PHI Publications,2nd edition
4. Basic Electrical Engineering by Nagsarkar, Sukhija, Oxford Publications,2nd edition
5. Industrial Electronics by G.K. Mittal, PHI

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DEPARTMENT OF AUTOMOBILE ENGINEERING

I Year - II Semester		L	T	P	C
		1	0	3	2.5
ENGINEERING DRAWING (ES1203)					

Course Objective: Engineering drawing being the principal method of communication for engineers, the objective is to introduce the students, the techniques of constructing the various types of polygons, curves and scales. The objective is also to visualize and represent the 3D objects in 2D planes with proper dimensioning, scaling etc.

Unit I
Objective: To introduce the students to use drawing instruments and to draw polygons, Engg. Curves.
Polygons: Constructing regular polygons by general methods, inscribing and describing polygons on circles.
Curves: Parabola, Ellipse and Hyperbola by general and special methods, cycloids, involutes, tangents & normals for the curves.
Scales: Plain scales, diagonal scales and vernier scales

Unit II
Objective: To introduce the students to use orthographic projections, projections of points & simple lines. To make the students draw the projections of the lines inclined to both the planes.
Orthographic Projections: Reference plane, importance of reference lines, projections of points in various quadrants, projections of lines, line parallel to both the planes, line parallel to one plane and inclined to other plane.
Projections of straight lines inclined to both the planes, determination of true lengths, angle of inclination and traces.

Unit III
Objective: The objective is to make the students draw the projections of the plane inclined to both the planes.
Projections of planes: regular planes perpendicular/parallel to one reference plane and inclined to the other reference plane; inclined to both the reference planes.

Unit IV
Objective: The objective is to make the students draw the projections of the various types of solids in different positions inclined to one of the planes.
Projections of Solids – Prisms, Pyramids, Cones and Cylinders with the axis inclined to both the planes.

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Unit V

Objective: The objective is to represent the object in 3D view through isometric views. The student will be able to represent and convert the isometric view to orthographic view and vice versa.

Conversion of isometric views to orthographic views; Conversion of orthographic views to isometric views.

Computer Aided Design, Drawing practice using Auto CAD, Creating 2D&3D drawings of objects using Auto CAD

Note: In the End Examination there will be no question from CAD.

TEXT BOOKS:

1. Engineering Drawing by N.D. Butt, Chariot Publications
2. Engineering Drawing by Agarwal & Agarwal, Tata McGraw Hill Publishers

REFERENCE BOOKS:

1. Engineering Drawing by K.L.Narayana & P. Kannaiah, Scitech Publishers
2. Engineering Graphics for Degree by K.C. John, PHI Publishers
3. Engineering Graphics by PI Varghese, McGrawHill Publishers
4. Engineering Drawing + AutoCad – K Venugopal, V. Prabhu Raja, New Age

Course Outcome: The student will learn how to visualize 2D & 3D objects.

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I Year - II Semester		L	T	P	C
		0	0	2	1
COMMUNICATION SKILLS LAB (HS1203)					

UNIT I:
Oral Activity: JAM, Hypothetical Situations, Self/Peer Profile
Common Errors in Pronunciation, Neutralising Accent

UNIT II:
Oral Activity: Telephonic Etiquette, Role Plays
Poster Presentations

UNIT III:
Oral Activity: Oral Presentation skills, Public speaking
Data Interpretation

UNIT IV:
Oral Activity: Group Discussions: Do's and Don'ts- Types, Modalities

UNIT V:
Oral Activity: Interview Skills: Preparatory Techniques, Frequently asked questions, Mock Interviews.
Pronunciation: Connected speech (Pausing, Tempo, Tone, Fluency etc.,)

References:

1. Infotech English, Maruthi Publications (with Compact Disc).
2. Exercises in Spoken English Part 1,2,3,4, OUP and CIEFL.
3. English Pronunciation in use- Mark Hancock, Cambridge University Press.
4. English Phonetics and Phonology-Peter Roach, Cambridge University Press.
5. English Pronunciation in use- Mark Hewings, Cambridge University Press.
6. English Pronunciation Dictionary- Daniel Jones, Cambridge University Press.
7. English Phonetics for Indian Students- P. Bala Subramanian, Mac Millan Publications.
8. Technical Communication- Meenakshi Raman, Sangeeta Sharma, Oxford University Press.
9. Technical Communication- Gajendrea Singh Chauhan, Smita Kashiramka, Cengage Publications.

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I Year - II Semester		L	T	P	C
		0	0	3	1.5
ENGINEERING PHYSICS LAB (BS1209)					

(Any 10 of the following listed 15 experiments)

LIST OF EXPERIMENTS:

1. Determination of Rigidity modulus of a material- Torsional Pendulum.
2. Determination of Young's modulus by method of single cantilever oscillations.
3. Determination of Acceleration due to Gravity and Radius of Gyration - Compound Pendulum.
4. Verification of laws of vibrations in stretched strings – Sonometer.
5. Determination of spring constant of springs using coupled oscillators.
6. Magnetic field along the axis of a current carrying coil – Stewart and Gee's apparatus
7. Study the variation of B versus H by magnetizing the magnetic material (B-H curve).
8. Measurement of magnetic susceptibility by Gouy's method.
9. Determination of ultrasonic velocity in liquid (Acoustic Grating)
10. Determination of dielectric constant by charging and discharging method
11. Determination of wavelength of Laser by diffraction grating
12. Determination of particle size using Laser.
13. Determeination of Pressure variation using strain Gauge sensor.
14. Determination of Moment of Inertia of a Fly Wheel.
15. Determination of Velocity of sound –Volume Resoantor.

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I Year - II Semester		L	T	P	C
		0	0	3	1.5
BASIC ELECTRICAL & ELECTRONICS ENGINEERING LAB (ES1208)					

Learning Objectives:

- To predetermine the efficiency of dc shunt machine using Swinburne's test.
- To predetermine the efficiency and regulation of 1-phase transformer with O.C and S.C tests.
- To obtain performance characteristics of DC shunt motor &3-phase induction motor.
- To find out regulation of an alternator with synchronous impedance method.
- To control speed of dc shunt motor using Armature voltage and Field flux control methods.
- To find out the characteristics of PN junction diode & transistor
- To determine the ripple factor of half wave & full wave rectifiers.

Section A: Electrical Engineering:

The following experiments are required to be conducted as compulsory experiments:

1. Swinburne's test on D.C. Shunt machine (predetermination of efficiency of a given D.C. shunt machine working as motor and generator).
2. OC and SC tests on single phase transformer (predetermination of efficiency and regulation at given power factors).
3. Brake test on 3-phase Induction motor (determination of performance characteristics)
4. Regulation of alternator by Synchronous impedance method.
5. Speed control of D.C. Shunt motor by
   a) Armature Voltage control b) Field flux control method
6. Brake test on D.C. Shunt Motor.

Section B: Electronics Engineering:

The following experiments are required to be conducted as compulsory experiments:

1.PN junction diode characteristics a) Forward bias b) Reverse bias (Cut in voltage and resistance calculations)
2. Transistor CE characteristics (input and output)
3. Half wave rectifier with and without filters.
4. Full wave rectifier with and without filters.
5. CE amplifiers.
6. OP- amp applications (inverting, non inverting, integrator and differentiator)

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Learning Outcomes:

The student should be able to:

- Compute the efficiency of DC shunt machine without actual loading of the machine.
- Estimate the efficiency and regulation at different load conditions and power factors for single phase transformer with OC and SC tests.
- Analyse the performance characteristics and to determine efficiency of DC shunt motor &3-Phase induction motor.
- Pre-determine the regulation of an alternator by synchronous impedance method.
- Control the speed of dc shunt motor using Armature voltage and Field flux control methods.
- Draw the characteristics of PN junction diode & transistor
- Determine the ripple factor of half wave & full wave rectifiers.

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I Year - II Semester		L	T	P	C
		0	0	2	1.5
ENGINEERING WORKSHOP & IT WORKSHOP (ES1220)					

Engg Workshop

Course Objective: To impart hands-on practice on basic engineering trades and skills.

Note: At least two exercises to be done from each trade.

Trade:

1.Carpentry	1. T-Lap Joint
	2. Cross Lap Joint
	3. Dovetail Joint
	4. Mortise and Tenon Joint
2.Fitting	1. Vee Fit
	2. Square Fit
	3. Half Round Fit
	4. Dovetail Fit
3.Black Smithy	1. Round rod to Square
	2. S-Hook
	3. Round Rod to Flat Ring
	4. Round Rod to Square headed bolt
4.House Wiring	1. Parallel / Series Connection of three bulbs
	2. Stair Case wiring
	3. Florescent Lamp Fitting
	4. Measurement of Earth Resistance
5.Tin Smithy	1. Taper Tray
	2. Square Box without lid
	3. Open Scoop
	4. Funnel
6.IT Workshop	1.Assembly & Disassembly of Computer IT Workshop

COURSE OBJECTIVES:

The objective of IT Workshop is to

1. Explain the internal parts of a computer, peripherals, I/O ports, connecting cables
2. Demonstrate basic command line interface commands on Linux
3. Teach the usage of Internet for productivity and self paced lifelong learning
4. Describe about Compression, Multimedia and Antivirus tools
5. Demonstrate Office Tools such as Word processors, Spreadsheets and Presentation tools

Computer Hardware:

Experiment 1: Identification of peripherals of a PC, Laptop, Server and Smart Phones: Prepare a report containing the block diagram along with the configuration of each component and its functionality, Input/ Output devices, I/O ports and interfaces, main memory, cache memory and secondary storage technologies, digital storage basics, networking components and speeds.

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Operating Systems:

Experiment 2: Internet Services:

- Web Browser usage and advanced settings like LAN, proxy, content, privacy, security, cookies, extensions/ plugins
- Antivirus installation, configuring a firewall, blocking pop-ups
- Email creation and usage, Creating a Digital Profile on LinkedIn
- Source control on Github, Hackerrank, Codechef, HackerEarth, etc
- Google hangout/ Skype/ gotomeeting video conferencing
- archive.org for accessing archived resources on the web

Productivity Tools:

Experiment 3: Demonstration and Practice on archival and compression tools

- scanning and image editing tools
- OCR and text extraction
- audio players, recording using Mic, editing, podcast preparation
- video players, recording using webcam/camcorder, editing
- podcast, screencast, vodcast, webcasting

Office Tools:

Experiment 4: Demonstration and Practice on Text Editors like Notepad++, Sublime Text, Atom, Brackets, Visual code, etc

Experiment 5: Demonstration and practice on Microsoft Word, Power Point

Experiment 6: Demonstration and practice on Microsoft Excel.

Experiment 7: Demonstration and practice on LaTeX and produce professional pdf documents.

Experiment 8: Cloud based productivity enhancement and collaboration tools:

- Store, sync, and share files with ease in the cloud using Google Drive
- Document creation and editing text documents in your web browser using Google docs
- Handle task lists, create project plans, analyze data with charts and filters using Google Sheets
- Create pitch decks, project presentations, training modules using Google Slides
- Manage event registrations, create quizzes, analyze responses using Google Forms
- Build public sites, internal project hubs using Google Sites
- Online collaboration through cross-platform support using Jamboard
- Keep track of important events, sharing one's schedule, and create multiple calendars using Google Calendar

TEXT BOOKS:

1. Computer Fundamentals, Anita Goel, Pearson Education, 2017
2. PC Hardware Trouble Shooting Made Easy, TMH

REFERENCES:

1. Essential Computer and IT Fundamentals for Engineering and Science Students, Dr.N.B.Vekateswarlu, S.Chand

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WEB RESOURCES:

1. https://explorersposts.grc.nasa.gov/post631/2006-2007/computer_basics/ComputerPorts.doc
2. https://explorersposts.grc.nasa.gov/post631/2006-2007/bitsnbyte/Digital_Storage_Basics.doc
3. https://www.thegeekstuff.com/2009/07/linux-ls-command-examples
4. https://www.pcsuggest.com/basic-linux-commands/
5. https://www.vmware.com/pdf/VMwarePlayerManual10.pdf
6. https://geek-university.com/vmware-player/manually-install-a-guest-operating-system/
7. https://gsuite.google.com/learning-center/products/#!/

COURSE OUTCOMES:

Students should be able to:

1. Assemble and disassemble components of a PC
2. Construct a fully functional virtual machine, Summarize various Linux operating system commands,
3. Secure a computer from cyber threats, Learn and practice programming skill in Github, Hackerrank, Codechef, HackerEarth etc.
4. Recognize characters & extract text from scanned images, Create audio files and podcasts
5. Create video tutorials and publishing, Use office tools for documentation, Build interactive presentations, Build websites, Create quizzes & analyze responses.

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I Year - II Semester		L	T	P	C
		0	0	3	1
ENGINEERING EXPLORATION PROJECT (PR1201)					

COURSE OBJECTIVES:

- Build mindsets & foundations essential for designers
- Learn about the Human-Centered Design methodology and understand their real-world applications
- Use Design Thinking for problem solving methodology for investigating illdefined problems.
- Undergo several design challenges and work towards the final design challenge

Apply Design Thinking on the following Streams to

- Project Stream 1: Electronics, Robotics, IOT and Sensors
- Project Stream 2: Computer Science and IT Applications
- Project Stream 3: Mechanical and Electrical tools
- Project Stream4: Eco-friendly solutions for waste management, infrastructure, safety, alternative energy sources, Agriculture, Environmental science and other fields of engineering.

HOW TO PURSUE THE PROJECT WORK?

- The first part will be learning-based-masking students to embrace the methodology by exploring all the phases of design thinking through the wallet/ bag challenge and podcasts.
- The second part will be more discussion-based and will focus on building some necessary skills as designers and learning about complementary material for human- centered design.
- The class will then divide into teams and they will be working with one another for about 2 – 3 weeks. These teams and design challenges will be the basis for the final project and final presentation to be presented.
- The teams start with **Design Challenge** and go through all the phases more in depth from coming up with the right question to empathizing to ideating to prototyping and to testing.
- Outside of class, students will also be gathering the requirements, identifying the challenges, usability, importance etc
- At the end, Students are required to submit the final reports, and will be evaluated by the faculty.

TASKS TO BE DONE:

Task 1: Everyone is a Designer

- Understand class objectives & harness the designer mindset

Task 2: The Wallet/Bag Challenge and Podcast

- Gain a quick introduction to the design thinking methodology
- Go through all stages of the methodology through a simple design challenge
- Podcast: Observe, Listen and Engage with the surrounding environment and identify a design challenge.

Task 3: Teams & Problems

- Start Design Challenge and learn about teams & problems through this
- Foster team collaboration, find inspiration from the environment and learn how to identify problems

Task 4: Empathizing

- Continue Design Challenge and learn empathy
- Learn techniques on how to empathize with users
- Go to the field and interview people in their environments
- Submit Activity Card

Task 5: Ideating

- Continue Design Challenge and learn how to brainstorm effectively
- Encourage exploration and foster spaces for brainstorming
- Submit Activity Card

Task 6: Prototyping

- Continue Design Challenge and learn how to create effective prototypes
- Build tangible models and use them as communication tools
- Start giving constructive feedback to classmates and teammates
- Submit Activity Card

Task 7: Testing

- Finish Design Challenge and iterate prototypes and ideas through user feedback
- Evolve ideas and prototypes through user feedback and constructive criticism
- Get peer feedback on individual and group performance
- Submit Activity Card

Task 8:

- Final Report Submission and Presentation

Note: The colleges may arrange for Guest Speakers from Various Design Fields: Graphic Design, Industrial Design, Architecture, Product Design, Organizational Design, etc to enrich the students with Design Thinking Concept.

REFERENCES:

1. Tom Kelly, *The Art of Innovation: Lessons in Creativity From IDEO, America's Leading Design Firm* (Profile Books, 2002)
2. Tim Brown, Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation (HarperBusiness, 2009)
3. Jeanne Liedtka, Randy Salzman, and Daisy Azer, Design Thinking for the Greater Good: Innovation in the Social Sector (Columbia Business School Publishing, 2017)

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OTHER USEFUL DESIGN THINKING FRAMEWORKS AND METHODOLOGIES:

- Human-Centered Design Toolkit (IDEO); https://www.ideo.com/post/design-kit
- Design Thinking Boot Camp Bootleg (Stanford D-School); https://dschool.stanford.edu/resources/the-bootcamp-bootleg
- Collective Action Toolkit (frogdesign); https://www.frogdesign.com/wpcontent/ uploads/2016/ 03/CAT_2.0_English.pdf
- Design Thinking for Educators (IDEO); https://designthinkingforeducators.com/

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II Year - I Semester		L	T	P	C
		3	0	0	3
METALLURGY & MATERIALS SCIENCE					

Course Objective: To understand the basic fundamentals of Material science and Physical metallurgy. The basic concepts to be taught will help for the improvement, proper selection and effective utilization of materials which is essential to satisfy the ever increasing demands of the society.

UNIT – I

Structure of Metals and Constitution of alloys: Bonds in Solids, Metallic bond, crystallization of metals, Packing Factor - SC, BCC, FCC& HCP-line density, plane density. Grain and grain boundaries, effect of grain boundaries on the Properties of metal / alloys – determination of grain size. Imperfections – point, line, surface and volume- Slip and Twinning.

Necessity of alloying, types of solid solutions, Hume Rotherys rules, intermediate alloy phases, and electron compounds

Equilibrium Diagrams : Experimental methods of construction of equilibrium diagrams, Isomorphous alloy systems, equilibrium cooling and heating of alloys, Lever rule, coring miscibility gaps, eutectic systems, congruent melting intermediate phases, peritectic reaction. Transformations in the solid state – allotropy, eutectoid, peritectoid reactions, phase rule, relationship between equilibrium diagrams and properties of alloys. Study of binary phase diagrams such as Cu-Ni and Fe-Fe_3C.

UNIT –II

Ferrous metals and alloys: Structure and properties of White Cast iron, Malleable Cast iron, grey cast iron, Spheriodal graphite cast iron, Alloy cast irons. Classification of steels, structure and properties of plain carbon steels, Low alloy steels, Hadfield manganese steels, tool and die steels.

Non-ferrous Metals and Alloys: Structure and properties of Copper and its alloys, Aluminium and its alloys, Titanium and its alloys, Magnesium and its alloys, Super alloys.

UNIT – III

Heat treatment of Alloys: Effect of alloying elements on Fe-Fe_3C system, Annealing, normalizing, hardening, TTT diagrams, tempering, hardenability, surface - hardening methods, Age hardening treatment, Cryogenic treatment of alloys.

UNIT – IV

Powder Metallurgy: Basic processes- Methods of producing metal powders- milling atomization-Granulation-Reduction-Electrolytic Deposition. Compacting methods – Sintering - Methods of manufacturing sintered parts. Sintering Secondary operations-Sizing, coining, machining -Factors determining the use of powder metallurgy-Application of this process.

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UNIT – V

Ceramic and composite materials: Crystalline ceramics, glasses, cermets, abrasive materials, Classification of composites, various methods of component manufacture of composites, particle – reinforced materials, fiber reinforced materials, metal ceramic mixtures, metal – matrix composites and C – C composites. Nanomaterials – definition, properties and applications.

TEXT BOOKS:

1. Introduction to Physical Metallurgy - Sidney H. Avener - McGrawHill
2. Essential of Materials science and engineering - Donald R.Askeland - Cengage.

REFERENCES :

1. Material Science and Metallurgy – Dr. V.D.kodgire- Everest Publishing House
2. Materials Science and engineering - Callister & Baalasubrahmanyam- Wiley Publications
3. Material Science for Engineering students – Fischer – Elsevier Publishers
4. Material science and Engineering - V. Rahghavan-PHI Publishers
5. Introduction to Material Science and Engineering – Yip-Wah Chung CRC Press
6. Material Science and Metallurgy – A V K Suryanarayana – B S Publications
7. Material Science and Metallurgy – U. C. Jindal – Pearson Publications

Course Outcomes:

CO1: Understand the crystalline structure of different metals and study the stability of phases in different alloy systems.
CO2: Study the behavior of ferrous and non ferrous metals and alloys and their application in different domains
CO3: Able to understand the effect of heat treatment, addition of alloying elements on properties of ferrous metals.
CO4: Grasp the methods of making of metal powders and applications of powder metallurgy
CO5: Comprehend the properties and applications of ceramic, composites and other advanced methods.

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II Year - I Semester		L	T	P	C
		3	0	0	3
MECHANICS OF SOLIDS					

Objective: The students completing this course are expected to understand the basic terms like stress, strain, poissons ratio…etc and different stresses and deflections induced in beams, thin cylinders, thick cylinders, and columns. Further, the student shall be able to understand the shear stresses due to torsion in circular shafts.

UNIT – I

SIMPLE STRESSES & STRAINS : Elasticity and plasticity – Types of stresses & strains–Hooke's law – stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio & volumetric strain – Bars of varying section – composite bars – Temperature stresses- Complex Stresses - Stresses on an inclined plane under different uniaxial and biaxial stress conditions - Principal planes and principal stresses - Mohr's circle - Relation between elastic constants, Strain energy – Resilience – Gradual, sudden, impact and shock loadings.

UNIT – II

SHEAR FORCE AND BENDING MOMENT : Definition of beam – Types of beams – Concept of shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, u.d.l, uniformly varying loads and combination of these loads – Point of contra flexure – Relation between S.F., B.M and rate of loading at a section of a beam.

UNIT – III

FLEXURAL STRESSES : Theory of simple bending – Assumptions – Derivation of bending equation: M/ I = f/y = E/R Neutral axis – Determination bending stresses – section modulus of rectangular and circular sections (Solid and Hollow), I,T, Angle and Channel sections – Design of simple beam sections.

SHEAR STRESSES: Derivation of formula – Shear stress distribution across various beams sections like rectangular, circular, triangular, I, T angle sections.

UNIT – IV

DEFLECTION OF BEAMS : Bending into a circular arc – slope, deflection and radius of curvature – Differential equation for the elastic line of a beam – Double integration and Macaulay's methods – Determination of slope and deflection for cantilever and simply supported beams subjected to point loads, - U.D.L uniformly varying load. Mohr's theorems – Moment area method – application to simple cases including overhanging beams, Statically indeterminate Beams and solution methods.

TORSION: Introduction-Derivation- Torsion of Circular shafts- Pure Shear-Transmission of power by circular shafts, Shafts in series, Shafts in parallel.

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UNIT – V

THIN AND THICK CYLINDERS: Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and Volumetric strains – changes in dia, and volume of thin cylinders – Riveted boiler shells – Thin spherical shells. Wire wound thin cylinders. Lame's equation – cylinders subjected to inside & outside pressures –compound cylinders.

COLUMNS:

Buckling and Stability, Columns with Pinned ends, Columns with other support Conditions, Limitations of Euler's Formula, Rankine's Formula,

TEXT BOOK:

1. Strength of materials /GH Ryder/ Mc Millan publishers India Ltd.
2. Strength of materials by B.C. Punmia-lakshmi publications pvt.Ltd, New Delhi.

REFERENCES :

1. Mechanics of Materials by Gere & Timeshenko
2. Strength of Materials -By Jindal, Umesh Publications.
3. Strength of Materials by S.Timshenko- D. VAN NOSTRAND Company- PHI Publishers
4. Strength of Materials by Andrew Pytel and Ferdinond L. Singer Longman- Harpercollins College Division
5. Solid Mechanics, by Popov-
6. Mechanics of Materials/Gere and Timoshenko, CBS Publishers

COURSE OUTCOMES:

On the completion of the course the student will able to

CO1: Model & Analyze the behavior of basic structural members subjected to various loading and support conditions based on principles of equilibrium.

CO2: Understand the apply the concept of stress and strain to analyze and design structural members and machine parts under axial, shear and bending loads, moment and torsional moment.

CO3: Students will learn all the methods to analyze beams, columns, frames for normal, shear, and torsion stresses and to solve deflection problems in preparation for the design of such structural components. Students are able to analyse beams and draw correct and complete shear and bending moment diagrams for beams.

CO4: Students attain a deeper understanding of the loads, stresses, and strains acting on a structure and their relations in the elastic behavior

CO5: Design and analysis of Industrial components like pressure vessels.

II Year - I Semester		**L**	**T**	**P**	**C**

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		3	**0**	**0**	**3**
THERMODYNAMICS					

Course Objectives:
To impart the knowledge of the thermodynamic laws and principles so as to enable the student to prepare an energy audit of any mechanical system that exchange heat and work with the surroundings**.**

UNIT – I
Introduction: Basic Concepts : System, boundary, Surrounding, Universe, control volume, Types of Systems, Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic Equilibrium, State, Property, Process - Reversible, Quasi static & Irreversible Processes, cycle, Causes of Irreversibility. Energy in State and in Transition - Types, Work and Heat, Point and Path function.
Zeroth Law of Thermodynamics – Concept of Temperature – Principles of Thermometry –Reference Points – Const. Volume gas Thermometer – Scales of Temperature.

UNIT – II
Joule's Experiments – First law of Thermodynamics – Corollaries – First law applied to a Process – applied to a flow system –Energy balance for closed systems-Specific heats- Internal energy, Enthalpy and Specific heats of Solids, liquids and Ideal gases, Some steady flow energy equation applied to Nozzle, Turbine, Compressor and heat exchanger devices, PMM-I.

UNIT III
Limitations of the First Law – Thermal Reservoir, Heat Engine, Heat pump, Parameters of performance, Second Law of Thermodynamics, Kelvin-Planck and Clausius Statements and their Equivalence, Corollaries, PMM of Second kind, Carnot cycle and its specialties, Carnot's theorem, Thermodynamic scale of Temperature.
Clausius Inequality, Entropy, Principle of Entropy Increase, Availability and Irreversibility (Basic definitions) – Thermodynamic Potentials, Gibbs and Helmholtz Functions, Maxwell Relations – Elementary Treatment of the Third Law of Thermodynamics.

UNIT IV
Pure Substances, P-V-T- surfaces, T-S and h-s diagrams, Mollier Charts, Phase Transformations – Triple point and critical point, properties during change of phase, Dryness Fraction – Clausius – Clapeyron Equation, Property tables. Various Thermodynamic processes and energy Transfer – Steam Calorimetry.

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UNIT – V

Ideal Gas equation of state- Compressibility factor- Van der Waals equation of state- Beattie-Bridgeman equation of state- Benedict-Webb-Rubin equation of state- Viral equation of state- compressibility charts – variable specific heats .

Mixtures of perfect Gases – Dalton's Law of partial pressure, Avogadro's Laws of additive volumes- Equivalent Gas constant and Molecular Internal Energy, Enthalpy, Specific Heat and Entropy of Mixture of Perfect Gases and Vapour.

Psychrometric Properties – Dry bulb Temperature, Wet Bulb Temperature, Dew point Temperature, Thermodynamic Wet Bulb Temperature, Specific Humidity, Relative Humidity, Saturated Air, Vapour pressure, Degree of saturation – Adiabatic Saturation , Carrier's Equation – Psychrometric chart.

TEXT BOOKS:

1. Engineering Thermodynamics, PK Nag 6th Edn , McGraw Hill.
2. Fundamentals of Thermodynamics – Sonntag, Borgnakke, Van Wylen, 6th Edn, Wiley

REFERENCES:

1. Thermodynamics by Prasanna Kumar, Pearson Publishers
2. Engineering Thermodynamics – Jones & Dugan PHI
3. Thermodynamics, an Engineering Approach, Yunus A Cenegel, Michael A Boles, 8th Edn in SI Units, McGraw Hill.
4. Thermodynamics – J.P.Holman , McGrawHill
5. An Introduction to Thermodynamics - Y.V.C.Rao – Universities press.
6. Thermodynamics – W.Z.Black & J.G.Hartley, 3rd Edn Pearson Publ.
7. Engineering Thermodynamics – D.P.Misra, Cengage Publ.
8. Engineering Thermodynamics – P.Chattopadhyay – Oxford Higher Edn Publ.

COURSE OUTCOMES:

After undergoing the course the student is expected to learn

CO1: Basic concepts of thermodynamics
CO2: Laws of thermodynamics
CO3: Concept of entropy
CO4: Property evaluation of vapors and their depiction in tables and charts
CO5: Evaluation of properties of perfect gas mixtures.

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DEPARTMENT OF AUTOMOBILE ENGINEERING

II Year - I Semester		L	T	P	C
		3	0	0	3
FLUID MECHANICS AND HYDRAULIC MACHINES.					

Course Objectives: The students completing this course are expected to understand the properties of fluids, its kinematic and dynamic behavior through various laws of fluids like continuity, Euler's, Bernoulli's equations, energy and momentum equations. Further, the student shall be able to understand the theory of boundary layer, working and performance characteristics of various hydraulic machines like pumps and turbines**.**

UNIT I

Objective*:* After studying this unit student will know the concept of fluid and its properties, manometry, hydrostatic forces acting on different surfaces and also problem solving techniques.

Fluid statics: Dimensions and units: physical properties of fluids - specific gravity, viscosity and its significance, surface tension, capillarity, vapor pressure. Atmospheric, gauge and vacuum pressure, Measurement of pressure – Manometers - Piezometer, U-tube, inverted and differential manometers. Pascal's & hydrostatic laws.

Buoyancy and floatation: Meta center, stability of floating body. Submerged bodies. Calculation of metacenter height. Stability analysis and applications.

UNIT II

Objective: In this unit student will be exposed to the basic laws of fluids, flow patterns, viscous flow through ducts and their corresponding problems.

Fluid kinematics: Introduction, flow types. Equation of continuity for one dimensional flow, circulation and vorticity, Stream line, path line and streak lines and stream tube. Stream function and velocity potential function, differences and relation between them. Condition for irrotational flow, flow net, source and sink, doublet and vortex flow.

Fluid dynamics: surface and body forces –Euler's and Bernoulli's equations for flow along a stream line, momentum equation and its applications, force on pipe bend.

Closed conduit flow: Reynold's experiment- Darcy Weisbach equation- Minor losses in pipes- pipes in series and pipes in parallel- total energy line-hydraulic gradient line.

UNIT III

Objective: At the end of this unit student will be aware of the concepts related to boundary layer theory, flow separation, basic concepts of velocity profiles, dimensionless numbers and dimensional analysis.

Boundary Layer Theory: Introduction, momentum integral equation, displacement, momentum and energy thickness, separation of boundary layer, control of flow separation, Stream lined body, Bluff body and its applications, basic concepts of velocity profiles.

Dimensional Analysis: Dimensions and Units, Dimensional Homogeneity, Non dimensionalization of equations, Method of repeating variables and Buckingham Pi Theorem.

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UNIT IV

Objective: In this unit student will know the hydrodynamic forces acting on vanes and performance evaluation of hydraulic turbines**.**

Basics of turbo machinery: hydrodynamic force of jets on stationary and moving flat, inclined, and curved vanes, jet striking centrally and at tip, velocity diagrams, work done and efficiency, flow over radial vanes.

Hydraulic Turbines: classification of turbines, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine-working proportions, work done, efficiencies, hydraulic design – draft tube- theory- functions and efficiency.

UNIT V

Objective: After studying this unit student will be in a position to understand the characteristic curves of hydraulic turbines and also evaluate the performance characteristics of hydraulic pumps**.**

Performance of hydraulic turbines: Geometric similarity, Unit and specific quantities, characteristic curves, governing of turbines, selection of type of turbine, cavitation, surge tank, water hammer. Hydraulic systems- hydraulic ram, hydraulic lift, hydraulic coupling. Fluidics – amplifiers, sensors and oscillators. Advantages, limitations and applications.

Centrifugal pumps: classification, working, work done – manometric head- losses and efficiencies- specific speed- pumps in series and parallel-performance characteristic curves, cavitation & NPSH.

Reciprocating pumps: Working, Discharge, slip, indicator diagrams.

TEXT BOOKS:

1. Fluid Mechanics- Fundementals and Applications by Y.A. Cengel, J.M.Cimbala, 6th Edn, McGrawHill
2. Fluid Mechanics - Dixon, 7th Edn, Elesvier

REFERENCE BOOKS:

1. Hydraulics, fluid mechanics and Hydraulic machinery- Modi and Seth
2. Fluid Mechanics and Hydraulic Machines - RK Bansal- Laxmi Publications (P) Ltd.
3. Fluid Mechanics and Hydraulic Machines - Rajput
4. Fluid Mechanics and Fluid Power Engineering - D.S. Kumar, Kotaria & Sons.
5. Fluid Mechanics and Machinery - D. Rama Durgaiah, New Age International.

COURSE OUTCOMES:

From this course the student is expected to learn

CO1: The basic concepts of fluid properties.
CO2: The mechanics of fluids in static and dynamic conditions.
CO3: Boundary layer theory, flow separation and dimensional analysis.
CO4: Hydrodynamic forces of jet on vanes in different positions.
CO5: Working Principles and performance evaluation of hydraulic pump and turbines.

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II Year - I Semester		L	T	P	C
		3	0	0	3
BASIC ELEMENTS OF AUTOMOBILE CHASSIS					

COURSE OBJECTIVES:

i. To understand the basic knowledge about various vehicle frames, front axles, steering systems and understand the conditions for true rolling motion of wheels during steering.
ii. To recognize the construction and working principle of drive line, final drive and differential systems
iii. To review the knowledge about the constructional feature of rear axle, wheels and tyres.
iv. To evaluate the working principles of both conventional and independent suspension system.
v. To demonstrate working principle of braking system used in automobile.

UNIT I
INTRODUCTION, FRAME, STEERING SYSTEM

Types of Chassis layout, with reference to Power Plant location and drive, various types of frames, Loads acting on vehicle frame, Constructional details and materials for frames, Testing of frames, Types of Front Axles and Stub Axles, Front Wheel Geometry, Condition for True Rolling Motion of Wheels during Steering, Ackerman's and Davis Steering Mechanisms, Steering Error Curve, Steering Linkages, Different Types of Steering Gears, Slip Angle, Over–Steer and Under–Steer, Reversible and Irreversible Steering, EPAS.

UNIT II :
PROPELLER SHAFT AND FINAL DRIVE

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

UNIT III .
AXLES AND TYRES

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

UNIT IV
SUSPENSION SYSTEM

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

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UNIT V
BRAKING SYSTEM

Theory of Automobile Braking, Stopping Distance Time and Braking Efficiency, Effect of Weight Transfer during Braking, Theory of Drum Brakes, Loading and Trailing Shoes, Braking Torque, Constructional Details of Drum Brake and its Activators, Disc Brake Theory, Types and Construction, Hydraulic Braking System, Mechanical Braking System, Pneumatic Braking System, Power–Assisted Braking System, Anti–Lock Braking System, Constructional Details.

TEXT BOOKS:

1. Kirpal Singh, Vol- I, Automobile Engineering, Standard Publisher, New Delhi , 2017
2. K.K.Ramalingam, "Automobile Engineering", scitech publication (India), 2011.
3. R.K. Rajput, A Text–Book of Automobile Engineering, Laxmi Publications Private Limited, 2015

REFERENCES:

1. Heinz Hazler, Modern Vehicle Technology, Butterworth, London, 2005.
2. Heldt P.M., Automotive Chassis, Chilton Co., New York, 1990
3. Newton Steeds and Garret, Motor Vehicles, 13th Edition, Butterworth, London, 2005.
4. N.K. Giri, Automotive Mechanics, Kanna Publishers, 2007
5. William. H. Crows – Work shop Manuel – 2005

COURSE OUTCOMES

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

i. Identify the different types of frame and chassis used in Automotive.
ii. Relate different types of drive lines and drives used in Automotive.
iii. Acquire knowledge about different types of front axle and rear axles used in motor vehicles.
iv. Examine the working principle of conventional and independent suspension systems.
v. Apply knowledge on working principles of brake and its subsystems.

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II Year - I Semester		L	T	P	C
		3	0	0	3
COMPUTER AIDED ENGINEERING PRACTICE					

Course Objective: To enhance the student's knowledge and skills in engineering drawing and to introduce drafting packages and commands for computer aided drawing and modeling.

UNIT-I

Objective: The knowledge of projections of solids is essential in 3D modeling and animation. The student will be able to draw projections of solids. The objective is to enhance the skills they already acquired in their earlier course in drawing of projection and sections of solids.

PROJECTIONS OF SOLIDS : Projections of Regular Solids inclined to both planes – Auxiliary Views. Sections and Sectional views of Right Regular Solids – Prism, Cylinder, Pyramid, Cone – Auxiliary views.

UNIT-II

Objective: The knowledge of development of surfaces of solids is required in designing and manufacturing of the objects. Whenever two or more solids combine, a definite curve is seen at their intersection. The intersection of solids also plays an important role in designing and manufacturing. The objective is to impart this knowledge through this topic.

DEVELOPMENT AND INTERPENETRATION OF SOLIDS: Development of Surfaces of Right Regular Solids – Prisms, Cylinder, Pyramid Cone and their parts.

Interpenetration of Right Regular Solids – Intersection of Cylinder Vs Cylinder, Cylinder Vs Prism, Cylinder Vs Cone.

UNIT-III

Objective: Isometric projections provide a pictorial view with a real appearance. Perspective views provides a realistic 3D View of an object. The objective is to make the students learn the methods of Iso and Perspective views.

ISOMETRIC PROJECTIONS : Principles of Isometric Projection – Isometric Scale – Isometric Views – Conventions – Isometric Views of Lines, Plane Figures, Simple and Compound Solids – Isometric Projection of objects having non- isometric lines. Isometric Projection of Spherical Parts. Transformation of Projections: Conversion of Isometric Views to Orthographic Views – Conventions.

PERSPECTIVE PROJECTIONS: Perspective View: Points, Lines, Plane Figures and Simple Solids, Vanishing Point Methods(General Method only).

In part B computer aided drafting is introduced.

UNIT IV

The objective is to introduce various commands in AutoCAD to draw the geometric entities and to create 2D and 3D wire frame models.

INTRODUCTION TO COMPUTER AIDED DRAFTING: Generation of points, lines, curves, polygons, dimensioning. Types of modeling : object selection commands – edit, zoom, cross hatching, pattern filling, utility commands, 2D wire frame modeling, 3D wire frame modeling,.

UNIT V:

By going through this topic the student will be able to understand the paper-space environment thoroughly.
VIEW POINTS AND VIEW PORTS: view point coordinates and view(s) displayed, examples to exercise different options like save, restore, delete ,joint , single option.

UNIT VI:
The objective is to make the students create geometrical model of simple solids and machine parts and display the same as an Isometric, Orthographic or Perspective projection.
COMPUTER AIDED SOLID MODELING: Isometric projections, orthographic projections of isometric projections ,Modeling of simple solids, Modeling of Machines & Machine Parts.

TEXT BOOKS:

1.Engineering Graphics, K.C. john, PHI Publications
2.Engineering drawing by N.D Bhatt , Charotar publications.

REFERENCES:

1. Mastering Auto CAD 2013 and Auto CAD LT 2013 – George Omura, Sybex
2. Auto CAD 2013 fundamentals- Elisemoss, SDC Publ.
3. Engineering Drawing and Graphics using Auto Cad – T Jeyapoovan, vikas
4. Engineering Drawing + AutoCAD – K Venugopal, V. Prabhu Raja, New Age
5. Engineering Drawing – RK Dhawan, S Chand
6. Engineering Drawing – MB Shaw, BC Rana, Pearson
7. Engineering Drawing – KL Narayana, P Kannaiah, Scitech
8. Engineering Drawing – Agarwal and Agarwal, Mc Graw Hill
9. Engineering Graphics – PI Varghese, Mc Graw Hill
10. Text book of Engineering Drawing with auto-CAD , K.venkata reddy/B.S . publications.
11. Engineering Drawing with Auto CAD/ James D Bethune/Pearson Publications
12. Engineering Graphics with Auto CAD/Kulkarni D.M, Rastogi A.P, Sarkar A.K/PHI Publications

End Semester examination shall be conducted for **Four** hours with the following pattern:

a) Two hours-Conventional drawing
b) Two hours – Computer Aided Drawing

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II Year - I Semester		L	T	P	C
		0	0	3	1.5
AUTOMOTIVE COMPONENTS LAB					

COURSE OBJECTIVES:

i. To assemble and disassemble the parts of an IC engine.
ii. To identify the various component of an IC engine.
iii. To identify the various components in transmission systems of an automobile.
iv. To assemble and disassemble the various components of transmission system.
v. To study all the functions of automobile components

LIST OF EXPERIMENTS

1. Assembly & Disassembly of Petrol engine.
2. Assembly & Disassembly of Diesel engine.
3. To study constructional and working principle of clutch.
4. Assembly & Disassembly of Gear Box.
5 Assembly & Disassembly of Transfer case.
6. Assembly & Disassembly of Differential & rear axle.
7. Assembly & Disassembly of Stub Axle Assembly.
8. To assemble and disassemble Transfer case
9. To assemble and disassemble Differential, Rear axle
10. To assemble and disassemble Front axle.
11. To Study different chassis layouts
12. To Study braking system
13. To Study Steering system
14. To Study Suspension system

COURSE OUTCOMES:

i. Dismantle and Assemble the automobile chassis and Engine components
ii. Identify & differentiate components of SI & CI engines
iii. Understand working of braking, steering, clutch, transmission, Suspension systems.
iv. Differentiate various subsystems of two, three & Four wheeler vehicles
v. Develop skills in Dismantling and assembling of chassis components.
vi. Correct minor repairs and trouble shoots the breakdowns

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II Year - I Semester		L	T	P	C
		0	0	3	1.5
MECHANICS OF SOLIDS AND METALLURGY LAB					

Course Objective: To impart practical exposure on the microstructures of various materials and their hardness evaluation. Also to impart practical knowledge on the evaluation of material properties through various destructive testing procedures.

NOTE: Any 6 experiments from each section A and B.

(A) MECHNICS OF SOLIDS LAB :

1. Direct tension test
2. Bending test on
   a) Simple supported
   b) Cantilever beam
3. Torsion test
4. Hardness test
   a) Brinells hardness test
   b) Rockwell hardness test
5. Test on springs
6. Compression test on cube
7. Impact test
8. Punch shear test

(B) METALLURGY LAB:

1. Preparation and study of the Micro Structure of pure metals like Iron, Cu and Al.
2. Preparation and study of the Microstructure of Mild steels, low carbon steels, high – C steels.
3. Study of the Micro Structures of Cast Irons.
4. Study of the Micro Structures of Non-Ferrous alloys.
5. Study of the Micro structures of Heat treated steels.
6. Hardeneability of steels by Jominy End Quench Test.
7. To find out the hardness of various treated and untreated steels.

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II Year - I Semester		L	T	P	C
		0	0	0	0
CONSTITUTION OF INDIA					

Course Objectives:

- To Enable the student to understand the importance of constitution
- To understand the structure of executive, legislature and judiciary
- To understand philosophy of fundamental rights and duties
- To understand the autonomous nature of constitutional bodies like Supreme Court and high court controller and auditor general of India and election commission of India.
- To understand the central and state relation financial and administrative.

UNIT-I

Introduction to Indian Constitution: Constitution meaning of the term, Indian Constitution - Sources and constitutional history, Features - Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy.

Learning outcomes:

After completion of this unit student will

- Understand the concept of Indian constitution
- Apply the knowledge on directive principle of state policy
- Analyze the History, features of Indian constitution
- Evaluate Preamble Fundamental Rights and Duties

UNIT-II

Union Government and its Administration Structure of the Indian Union: Federalism, Centre- State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, LokSabha, RajyaSabha, The Supreme Court and High Court: Powers and Functions;
Learning outcomes:-After completion of this unit student will

- Understand the structure of Indian government
- Differentiate between the state and central government
- Explain the role of President and Prime Minister
- Know the Structure of supreme court and High court

UNIT-III

State Government and its Administration Governor - Role and Position - CM and Council of ministers, State Secretariat: Organisation, Structure and Functions

Learning outcomes:-After completion of this unit student will

- Understand the structure of state government
- Analyze the role Governor and Chief Minister
- Explain the role of state Secretariat
- Differentiate between structure and functions of state secretariat

UNIT-IV

A.Local Administration - District's Administration Head - Role and Importance, Municipalities - Mayor and role of Elected Representative - CEO of Municipal Corporation PachayatiRaj: Functions PRI: ZilaPanchayat, Elected officials and their roles, CEO ZilaPanchayat: Block level Organizational Hierarchy - (Different departments), Village level - Role of Elected and Appointed officials - Importance of grass root democracy

Learning outcomes:-After completion of this unit student will

- Understand the local Administration
- Compare and contrast district administration role and importance
- Analyze the role of Myer and elected representatives of Municipalities
- Evaluate Zillapanchayat block level organisation

UNIT-V

Election Commission: Election Commission- Role of Chief Election Commissioner and Election Commissionerate State Election Commission:, Functions of Commissions for the welfare of SC/ST/OBC and women

Learning outcomes:-After completion of this unit student will

- Know the role of Election Commission apply knowledge
- Contrast and compare the role of Chief Election commissioner and Commissiononerate
- Analyze role of state election commission
- Evaluate various commissions of viz SC/ST/OBC and women

References:

1. Durga Das Basu, Introduction to the Constitution of India, Prentice – Hall of India Pvt. Ltd.. New Delhi
2. SubashKashyap, Indian Constitution, National Book Trust
3. J.A. Siwach, Dynamics of Indian Government & Politics
4. D.C. Gupta, Indian Government and Politics
5. H.M.Sreevai, Constitutional Law of India, 4th edition in 3 volumes (Universal Law Publication)
6. J.C. Johari, Indian Government andPolitics Hans

7. J. Raj IndianGovernment and Politics
8. M.V. Pylee, Indian Constitution Durga Das Basu, Human Rights in Constitutional Law, Prentice – Hall of India Pvt. Ltd.. New Delhi
9. Noorani, A.G., (South Asia Human Rights Documentation Centre), Challenges to Civil Right), Challenges to Civil Rights Guarantees in India, Oxford University Press 2012

resources:

1. nptel.ac.in/courses/109104074/8
2. nptel.ac.in/courses/109104045/
3. nptel.ac.in/courses/101104065/
4. www.hss.iitb.ac.in/en/lecture-details
5. www.iitb.ac.in/en/event/2nd-lecture-institute-lecture-series-indian-constitution

Course Outcomes:

At the end of the semester/course, the student will be able to have a clear knowledge on the following:

- Understand historical background of the constitution making and its importance for building a democratic India.
- Understand the functioning of three wings of the government ie., executive, legislative and judiciary.
- Understand the value of the fundamental rights and duties for becoming good citizen of India.
- Analyze the decentralization of power between central, state and local self-government.
- Apply the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy.
  1. Know the sources, features and principles of Indian Constitution.
  2. Learn about Union Government, State government and its administration.
  3. Get acquainted with Local administration and Pachayati Raj.
  4. Be aware of basic concepts and developments of Human Rights.
  5. Gain knowledge on roles and functioning of Election Commission

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II Year - II Semester		L	T	P	C
		3	0	0	3

KINEMATICS OF MACHINERY

Course objective: The students completing this course are expected to understand the nature and role of the kinematics of machinery, mechanisms and machines. The course includes velocity and acceleration diagrams,analysis of mechanisms joints, Cams and their applications. It exposes the students to various kinds of power transmission devices like belt,rope , chain and gear drives and their working principles and their merits and demerits.

UNIT – I

MECHANISMS : Elements or Links – Classification – Rigid Link, flexible and fluid link – Types of kinematic pairs – sliding, turning, rolling, screw and spherical pairs – lower and higher pairs – closed and open pairs – constrained motion – completely, partially or successfully constrained and incompletely constrained.

Grashoff's law , Degrees of freedom ,Kutzbach criterian for planar mechanisms, Mechanism and machines – classification of machines – kinematic chain – inversion of mechanism – inversions of quadric cycle chain – single and double slider crank chains.

UNIT – II

LOWER PAIR MECHANISM: Exact and approximate copiers and generated types – Peaucellier, Hart and Scott Russul – Grasshopper – Watt T. Chebicheff and Robert Mechanisms and straight line motion, Pantograph.

Conditions for correct steering – Davis Steering gear, Ackermans steering gear – velocity ratio; Hooke's Joint: Single and double – Universal coupling–application–problems.

UNIT – III

KINEMATICS: Velocity and acceleration – Motion of a link in machine – Determination of Velocity and acceleration diagrams – Graphical method – Application of relative velocity method four bar chain. Velocity and acceleration analysis of for a given mechanism, Klein's construction, determination of Coriolis component of acceleration.

PLANE MOTION OF BODY: Instantaneous center of rotation, centroids and axodes – relative motion between two bodies – Three centres in line theorem – Graphical determination of instantaneous centre, diagrams for simple mechanisms and determination of angular velocity of points and links.

UNIT – IV

CAMS: Definitions of cam and followers – their uses – Types of followers and cams – Terminology – Types of follower motion: Uniform velocity, Simple harmonic motion and uniform acceleration and retardation. Maximum velocity and maximum acceleration during outward and return strokes in the above 3 cases. Analysis of motion of followers: Roller follower – circular cam with straight, concave and convex flanks.

BELT DRIVES: Introduction, Belt and rope drives, selection of belt drive- types of belt drives,V-belts, materials used for belt and rope drives, velocity ratio of belt drives, slip of belt, creep of belt, tensions for flat belt drive, angle of contact, centrifugal tension, maximum tension of belt, Chains- length, angular speed ratio, classification of chains.

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UNIT – V

GEARS: Higher pairs, friction wheels and toothed gears–types – law of gearing, condition for constant velocity ratio for transmission of motion, Form of teeth: cycloidal and involute profiles. Velocity of sliding – phenomena of interferences – Methods of interference. Condition for minimum number of teeth to avoid interference, expressions for arc of contact and path of contact – Introduction to Helical, Bevel and worm gearing.

GEAR TRAINS : Introduction to gear Trains, Train value, Types – Simple and reverted wheel train – Epicyclic gear Train. Methods of finding train value or velocity ratio – Epicyclic gear trains. Selection of gear box-Differential gear for an automobile.

TEXT BOOKS:

1. Theory of Mechanisms & Machines by Jagadeesh lal, Metropolitan Pvt.Ltd.
2. Theory of Machines by Thomas Bevan/ CBS Publishers

REFERENCES:

1. Theory of Machines – S. S Rattan- TMH Publishers
2. Theory of machines and Machinery-Vickers - Oxford .
3. Theory of Mechanisms and machines – A.Ghosh & A.K.Malik – East West PresS Pvt. Ltd.
4. Kinematics and dynamics of Machinery- R.L Norton- TATA McGraw-Hill

Course outcomes:

The student should be able to

CO1: Contrive a mechanism for a given plane motion with single degree of freedom.
CO2: Suggest and analyze a mechanism for a given straight line motion and automobile steering motion.
CO3: Analyze the motion (velocity and acceleration) of a plane mechanism.
CO4: Suggest and analyze mechanisms for a prescribed intermittent motion like opening and closing of IC engine valves etc.
CO5: Select a power transmission system for a given application and analyze motion of different transmission systems

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II Year - II Semester		L	T	P	C
		3	0	0	3
APPLIED THERMODYNAMICS					

Course objectives:
This course is intended to study the thermodynamic analysis of major components of Rankine cycle, refrigeration cycles and compressible fluids and to analyze the energy transfers and transformations in these components including individual performance evaluation.

UNIT – I
VAPOUR POWER CYCLES: Carnot, Rankine cycle - schematic layout, thermodynamic analysis, concept of mean temperature of heat addition, methods to improve cycle performance – regeneration & reheating.

UNIT II
COMBUSTION: Fuels and combustion, concepts of heat of reaction, adiabatic flame temperature, Stoichiometry, flue gas analysis.
BOILERS : Classification – working principles of L.P & H.P boilers with sketches – mountings and accessories – working principles, boiler horse power, equivalent evaporation, efficiency and heat balance – Draught: classification – height of chimney for given draught and discharge, condition for maximum discharge, efficiency of chimney – artificial draught, induced and forced.

UNIT – III
STEAM NOZZLES: Function of a nozzle – applications - types, flow through nozzles, thermodynamic analysis – assumptions -velocity of fluid at nozzle exit-Ideal and actual expansion in a nozzle, velocity coefficient, condition for maximum discharge, critical pressure ratio, criteria to decide nozzle shape: Super saturated flow - its effects, degree of super saturation and degree of under cooling, Wilson line.
STEAM TURBINES: Classification – impulse turbine; mechanical details – velocity diagram – effect of friction – power developed, axial thrust, blade or diagram efficiency – condition for maximum efficiency. De-laval turbine - methods to reduce rotor speed-velocity compounding, pressure compounding and velocity & pressure compounding, velocity and pressure variation along the flow – combined velocity diagram for a velocity compounded impulse turbine, condition for maximum efficiency

UNIT IV
REACTION TURBINE: Mechanical details – principle of operation, thermodynamic analysis of a stage, degree of reaction –velocity diagram – Parson's reaction turbine – condition for maximum efficiency – calculation of blade height.
STEAM CONDENSERS: Requirements of steam condensing plant – classification of condensers – working principle of different types – vacuum efficiency and condenser efficiency – air leakage, sources and its affects, air pump, cooling water requirement.

UNIT – V
COMPRESSORS – Classification – fan, blower and compressor - positive displacement and non positive displacement type – reciprocating and rotory types.
Reciprocating: Principle of operation, work required, Isothermal efficiency, volumetric efficiency and effect of clearance, multi stage compression, saving of work, minimum work condition for two stage compression.
Rotary (Positive displacement type)

Roots Blower, vane sealed compressor, Lysholm compressor – mechanical details and principle of working – efficiency considerations.

Rotary (non positive displacement type)

Centrifugal compressors: Mechanical details and principle of operation – velocity and pressure variation. Energy transfer-impeller blade shape-losses, slip factor, power input factor, pressure coefficient and adiabatic coefficient – velocity diagrams – power.

TEXT BOOKS:

1. Heat Engineering (MKS and SI units), VP Vasandani, DS Kumar, Metropolitan books
2. Basics & Applied Thermodynamics- P.K.Nag – 4th edition- McGraw Hill

REFERENCES:

1. Thermal Engineering- Mahesh Rathore, TataMcGrawHill
2. Applied Thermodynamics by R Yadhav
3. Applied Thermodynamics by Eastop & McConkey, 5th Edn, Pearson
5. Fluid Mechanics Fundementals and Applications by Y.A.Cengel, J.M.Cimbala, McGrawHill
6. Thermal Engineering-M.L.Marthur & Mehta/Jain bros. Publishers
7. Thermal Engineering / RK Rajput/ Lakshmi Publications

Course outcomes:

CO1**:** Expected to learn the working of steam power cycles and also should be able to analyze and evaluate the performance of individual components

CO2: Student is able to learn the principles of combustion , stochiometry and flue gas analysis

CO3: Students will be able to design the components and calculate the losses and efficiency of the boilers, nozzles, turbines and condensers**.**

CO4: Student is able to learn various types of compressors, principles of working and their performance evaluation.

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DEPARTMENT OF AUTOMOBILE ENGINEERING

II Year - II Semester		L	T	P	C
		3	0	0	3
AUTOMOTIVE ENGINES					

COURSE OBJECTIVES:

i. To impart knowledge on basics of automotive SI and CI engines consisting of types, construction, working
ii. To Understand the actual engine working principle and its thermochemistry of fuel-air mixtures
iii. To learn the properties of gasoline and diesel fuel and combustion process involved in diesel engines
iv. To solve basic design problems of various operating parameters of the engine
v. To analyze the performance and pollution characteristics of SAI and CI engine and learn modern developments in IC engine

UNIT I
ENGINE FUNDAMENTALS

Engine types and their operation- classifications – Terminology- Four stroke and two stroke cycle- Engine components, working principle and materials - Engine operating parameters- Engine cycles- Air Standard cycles- Otto cycle- Fuel –air and actual cycle analysis – Engine emissions – Two stroke engine terminology – types – Merits and Demerits

UNIT II
INDUCTION AND IGNITION SYSTEM

Carburettors- requirements - working principles, types, different circuits – compensation and maximum power devices– Requirements and objective of injection system – types of injection - Jerk and distributor type pumps, Unit injector, common rail direct injection -. Electronic fuel injection – Study on injection pressure waves, Injection timing, Injection lag. Types of injection nozzle, Nozzle tests. Spray characteristics. Split and Multiple injection. Mechanical and pneumatic governors. Ignition system-function and types- Ignition control mechanism for speed and load- Electronic ignition system

UNIT III
FUEL PROPERTIES AND COMBUSTION OF FUELS

Hydrocarbon fuels- Gasoline and Diesel fuel properties. Ignition quality. Octane and cetane number. Laboratory tests for diesel fuel. Combustion stoichiometry - Combustion reactions- chemical equilibrium – Combustion in SI engine - Stages of combustion- Flame Propagation- Rate of pressure rise- Abnormal combustion- combustion chambers – design objectives and types Engine Knock Thermodynamic analysis of SI engine combustion- Burned and Unburned mixture states – combustion process characterization- Flame structure and Speed- Cyclic variations in combustion - CI Engine - Importance of air motion – Swirl, Squish and Tumble. Swirl ratio. Stages of combustion. Delay period – factors affecting delay period. Knock formation in CI engines. Comparison of knock in CI & SI engines. Direct and indirect injection combustion chambers for diesel combustion.

UNIT IV
ENGINE COOLING, LUBRICATING SYSTEMS AND SUPERCHARGING, TURBOCHARGING

Cooling system – Function- types - Frictional work- Definitions – Measuring methods – Engine friction components- Lubricating system- Function- types - Lubricant Requirements Necessity and limitation of supercharging. Thermodynamic cycle with super charging. Types of supercharger and turbocharger.

Intercooler. Matching of turbocharger. Modification of an engine for supercharging. Effect of supercharging on engine performance. Variable geometry and variable nozzle turbocharger. E-Turbocharger.

UNIT V

ENGINE HEAT TRANSFER, TESTING AND RECENT DEVELOPMENTS

Importance of heat transfer- Modes of heat transfer- heat transfer and engine energy balance- Convective and radiative heat transfer- Indicated and brake MEP, operating variables that affects SI engine performance, efficiency and emission – Factors that control combustion and performance – Automotive and stationary diesel engine testing and related standards – Engine power and efficiencies – Variables affecting engine performance – Heat balance – Methods to improve engine performance - Introduction to Stratified charge engine, LHR engines, HCCI and RCCI engines.

TEXT BOOKS

1. John B.Heywood , " Internal Combustion Engines", McGraw Hill Book Company.
2. M.L. Mathur and R.P.Sharma, Internal Combustion Engine, Dhanpath Rai Publications (P) Ltd, New Delhi 110002
3. V. Ganesan, Internal Combustion Engines, Tata-McGraw Hill Publishing Co., New Delhi, 2010.

REFERENCES

1. Heinz Hesiler, Advanced engine technology. Butterworth Heinmann publications
2. Heldt, P.M., High Speed Combustion Engines, Oxford IBH Publishing Co., Calcutta,
3. K. K. Ramalingm, internal Combustion Engines, Scitech publications, Chennai, 2003.
4. Maleev, V.M., Diesel Engine Operation and Maintenance, McGraw Hill, 1974.
5. Obert, E.F., Internal Combustion Engine analysis and Practice, International Text Book Co.,Scranton, Pennsylvania, 1988

COURSE OUTCOMES:

At the end of the course, Student can able to,

i. Define engine glossaries, identify various components of SI and CI engines and its sub-systems Ignition, cooling and lubrication
ii. Understand the actual engine working principle and its thermochemistry of fuel-air mixtures
iii. Understand basic knowledge on SI and CI engine combustion and its related parameters
iv. Student can able to apply their knowledge in analyzing the engine performance and pollution characteristics.
v. Exposed to gain knowledge on recent developments of prime sources

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DEPARTMENT OF AUTOMOBILE ENGINEERING

II Year - II Semester		L	T	P	C
		3	0	0	3
PRODUCTION TECHNOLOGY					

Course Objective:
To impart basic knowledge and understanding about the primary manufacturing processes such as casting, joining, bulk forming, sheet metal forming and powder metallurgy and their relevance in current manufacturing industry.

UNIT – I
CASTING : Steps involved in making a casting – Advantage of casting and its applications. Patterns and Pattern making – Types of patterns – Materials used for patterns, pattern allowances and their construction, Molding – molding methods - ingredients of molding sand –. Molding materials, Properties of molding sand, Testing of molding sand. Types of molding – Hand molding – Machine molding. Core – different types of cores – materials – properties of core sand – core manufacturing.

UNIT – II
Principles of Gating, Gating ratio and design of Gating systems. Risers – Types, function and design, casting design considerations. Methods of melting and types of furnaces - cupola, electric arc, resistance and induction furnace. Solidification of castings-Solidification of pure metals and alloys-Short & long freezing range alloys. Fettling. Casting defects. Basic principles and applications of special casting processes - Centrifugal casting – True, semi and centrifuging, Die casting, Investment casting and shell molding.

UNIT – III
Welding : Classification of welding processes, types of welded joints and their characteristics, Gas welding, Different types of flames and uses, Oxy – Acetylene Gas cutting. Basic principles of Arc welding, power characteristics, Manual metal arc welding, Submerged arc welding, TIG & MIG welding. Electro – slag welding.
Resistance welding, Friction welding, Friction stir welding, Forge welding, Explosive welding; Thermit welding, Plasma Arc welding, Laser welding, electron beam welding, Soldering & Brazing.

Heat affected zones in welding; pre & post heating, Weldability of metals, welding defects – causes and remedies – destructive and nondestructive testing of welds.

UNIT – IV
Plastic deformation in metals and alloys-recovery, recrystallization and grain growth. Hot working and Cold working-Strain hardening and Annealing. Bulk forming processes: Forging - Types of Forging, Smith forging, Drop Forging, Roll forging, Forging hammers, Rotary forging, forging defects; Rolling – fundamentals, types of rolling mills and products, Forces in rolling and power requirements. Extrusion and its characteristics. Types of extrusion, Impact extrusion, Hydrostatic extrusion; Wire drawing and Tube drawing.

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UNIT – V

Sheet metal forming - Blanking and piercing, Forces and power requirement in these operations, Deep drawing, Stretch forming, Bending, Spring back and its remedies, Coining, Spinning, Types of presses and press tools.

High energy rate forming processes: Principles of explosive forming, electromagnetic forming, Electro hydraulic forming, rubber pad forming, advantages and limitations.

TEXT BOOKS:

1. Manufacturing Processes for Engineering Materials – Kalpakjian S and Steven R Schmid- Pearson Publ , 5th Edn.
2. Manufacturing Technology -Vol I- P.N. Rao- TMH

REFERENCES :

1. Manufacturing Science – A.Ghosh & A.K.Malik – East West Press Pvt. Ltd
2. Process and materials of manufacture- Lindberg- PHI
3. Production Technology- R.K. Jain- Khanna
4. Production Technology-P C Sharma-S. Chand
5. Manufacturing Processes- H.S. Shaun- Pearson
6. Manufacturing Processes- J.P. Kaushish- PHI
7. Workshop Technology -WAJ Chapman/CBS Publishers&Distributors Pvt.Ltd.
8. Production Technology-HMT- Tata McGrawHill

Course Outcomes:

CO1: Able to design the patterns and core boxes for metal casting processes
CO2: Able to design the gating system for different metallic components
CO3: Know the different types of manufacturing processes
CO4: Be able to use forging, extrusion processes
CO5: Learn about the different types of welding processes used for special fabrication.

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		3	0	0	3
AUTOMOTIVE ELECTRICAL AND ELECTRONICS					

UNIT-I

Batteries and Accessories:

Principle and Construction of Lead Acid Battery, Characteristics of battery, rating capacity and Efficiency of Batteries, Various Tests on Batteries, Maintenance and Charging. Lighting System: Insulated and Earth Return System, Details of Head Light and Side Light, LED Lighting System, Head Light Dazzling and Preventive Methods – Horn, Wiper System and Trafficator.

UNIT-II

Starting System

Condition at Starting, Behavior of Starter during Starting, Series Motor and its Characteristics, Principle and Construction of Starter Motor, Working of Different Starter Drive Units, Care and Maintenances of Starter Motor, Starter Switches.

UNIT-III

Charging System

Generation of Direct Current, Shunt Generator Characteristics, Armature Reaction, Third Brush Regulation, Cutout. Voltage and Current Regulators, Compensated Voltage Regulator, Alternators Principle and Constructional Aspects and Bridge Rectifiers, New Developments.

UNIT-IV

Fundamentals of Automotive Electronics

Current Trends in Automotive Electronic Engine Management System, Electro Magnetic Interference Suppression, Electromagnetic Compatibility, Electronic Dashboard Instruments, Onboard Diagnostic System, Security and Warning System.

UNIT-V

Sensors & Actuators:

Types of Sensors: Sensor for Speed, Throttle Position, Exhaust Oxygen Level, knock, Manifold Pressure, Crankshaft Position, Coolant Temperature, Exhaust Temperature, Impact sensor, Air Mass Flow for Engine Application. Solenoids, Stepper Motors, Relay.

Text Books

1. Young A.P. & Griffiths. L. “Automotive Electrical Equipment”, ELBS & New Press-1999.
2. William B.Riddens “Understanding Automotive Electronics”, 5th edition - Butter worth Heinemann Woburn, 1998.

References

1. Bechhold “Understanding Automotive Electronics”, SAE, 1998.
2. Crouse, W.H “Automobile Electrical Equipment”, McGraw-Hill Book Co., Inc., New York, 3rd edition, 1986.
3. Judge A.W “Modern Electrical Equipment of Automobiles”, Chapman & Hall, London, 1992.
4. Kholi.P.L “Automotive Electrical Equipment”, Tata McGraw-Hill Co., Ltd., New Delhi, 1975.
5. Robert Bosch “Automotive Hand Book”, SAE (5th Edition), 2000.

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II Year - II Semester		L	T	P	C
		1	0	0	2

AUTOMOBILE ASSEMBLY DRAWING

Course Objective: The student will acquire a knowledge of fastening arrangements such as welding, riveting the different styles of attachment for shaft. The student also is enabled to prepare the assembly of various machine or engine components and miscellaneous machine components.

Machine Drawing Conventions :

Need for drawing conventions – introduction to IS conventions

a) Conventional representation of materials, common machine elements and parts such as screws, nuts, bolts, keys, gears, webs, ribs.
b) Types of sections – selection of section planes and drawing of sections and auxiliary sectional views. Parts not usually sectioned.
c) Methods of dimensioning, general rules for sizes and placement of dimensions for holes, centers, curved and tapered features.
d) Title boxes, their size, location and details - common abbreviations & their liberal usage
e) Types of Drawings – working drawings for machine parts.

I. Drawing of Machine Elements and simple parts

Objective: To provide basic understanding and drawing practice of various joint, simple mechanical parts Selection of Views, additional views for the following machine elements and parts with every drawing proportions.

a) Popular forms of Screw threads, bolts, nuts, stud bolts, tap bolts, set screws.
b) Keys, cottered joints and knuckle joint.
c) Rivetted joints for plates
d) Shaft coupling, spigot and socket pipe joint.
e) Journal, pivot and collar and foot step bearings, Cam profiles and Mechanisms.

II. Assembly Drawings:

Objective: The student will be able to draw the assembly from the individual part drawing.

Drawings of assembled views for the part drawings of the following using conventions and easy drawing proportions.

a) Engine parts –Gear pump, Fuel pump Petrol Engine connecting rod, piston assembly.
b) Other machine parts – stub axial assembly, steering gear box assembly, differential assembly and clutch assembly.
c) Valves : spring loaded safety valve, feed check valve and air cock, Control valves

NOTE : First angle projection to be adopted. The student should be able to provide working drawings of actual parts.

TEXT BOOKS:

1. Machine Drawing – N.Siddeswar, K.Kannaiah & V.V.S.Sastry - TMH
2. Machine Drawing –K.L.Narayana, P.Kannaiah & K. Venkata Reddy / New Age/ Publishers

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REFERENCES:

1. Machine Drawing – P.S.Gill,
2. Machine Drawing – Luzzader
3. Machine Drawing – Rajput
4. Machine Drawing – N.D. Junnarkar, Pearson
5. Machine Drawing – Ajeeth Singh, McGraw Hill
6. Machine Drawing – KC John, PHI
7. Machine Drawing – B Battacharya, Oxford
8. Machine Drawing – Gowtham and Gowtham, Pearson

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II Year - II Semester		**L**	**T**	**P**	**C**
		0	**0**	**3**	**1.5**

THERMAL ENGINEERING LAB

Course objective: To provide hands on experience in operating various types of internal combustion engines and understand their functioning and performance.

Note: The students have to perform minimum 10 Experiments.

1. I.C. Engines valve and port timing diagrams.
2. Testing of Fuels – Viscosity, flash point/fire point, carbon residue, calorific value.
3. I.C. Engine performance test and Exhaust emission measurements (4 -stroke diesel engine)
4. I.C. Engine performance test and Exhaust emission measurements (2-stroke petrol engine)
5. Evaluation of friction power by conducting Morse test on 4-stroke multi cylinder engine.
6. Determination of Friction Power by retardation or motoring test on IC engine.
7. I.C. Engine heat balance at different loads and show the heat distribution curve.
8. Economical speed test of an IC engine.
9. Performance test on variable compression ratio engines.
10. Performance test on reciprocating air compressor unit.
11. Dis-assembly / assembly of different parts of two wheelers. 3 wheelers & 4 wheelers. Tractor & Heavy duty engines covering 2-stroke and 4 stroke, SI and CI engines.
12. Study of boilers, mountings and accessories.

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		0	**0**	**3**	**1.5**

FLUID MECHANICS AND HYDRAULIC MACHINES LAB

Course Objective: To impart practical exposure on the performance evaluation methods of various flow measuring equipment and hydraulic turbines and pumps.

1. Impact of jets on Vanes.
2. Performance Test on Pelton Wheel.
3. Performance Test on Francis Turbine.
4. Performance Test on Kaplan Turbine.
5. Performance Test on Single Stage Centrifugal Pump.
6. Performance Test on Multi Stage Centrifugal Pump.
7. Performance Test on Reciprocating Pump.
8. Calibration of Venturimeter.
9. Calibration of Orifice meter.
10. Determination of friction factor for a given pipe line.
11. Determination of loss of head due to sudden contraction in a pipeline.
12. Turbine flow meter.

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II Year - II Semester		L	T	P	C
		3	0	0	0

ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE

Course Objectives:
To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the Importance of roots of knowledge system

- The course aim of the importing basic principle of third process reasoning and inference sustainability is at the course of Indian traditional knowledge system
- To understand the legal framework and traditional knowledge and biological diversity act 2002 and geographical indication act 2003
- The courses focus on traditional knowledge and intellectual property mechanism of traditional knowledge and protection
- To know the student traditional knowledge in different sector

Course Outcomes:
After completion of the course, students will be able to:

- Understand the concept of Traditional knowledge and its importance
- Know the need and importance of protecting traditional knowledge
- Know the various enactments related to the protection of traditional knowledge
- Understand the concepts of Intellectual property to protect the traditional knowledge

UNIT I
Introduction to traditional knowledge: Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, the physical and social contexts in which traditional knowledge develop, the historical impact of social change on traditional knowledge systems. Indigenous Knowledge (IK), characteristics, traditional knowledge vis-à-vis indigenous knowledge, traditional knowledge Vs western knowledge traditional knowledge vis-à-vis formal knowledge
Learning Outcomes:
At the end of the unit, the student will able to:

- Understand the traditional knowledge.
- Contrast and compare characteristics importance kinds of traditional knowledge.
- Analyze physical and social contexts of traditional knowledge.
- Evaluate social change on traditional knowledge.

UNIT II
Protection of traditional knowledge: the need for protecting traditional knowledge Significance of TK Protection, value of TK in global economy, Role of Government to harness TK.
Learning Outcomes:
At the end of the unit, the student will able to:

- Know the need of protecting traditional knowledge.
- Apply significance of tk protection.
- Analyze the value of tk in global economy.
- Evaluate role of government

UNIT III

Legal framework and TK: A: The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, Plant Varieties Protection and Farmers Rights Act, 2001 (PPVFR Act);B:The Biological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill, 2016. Geographical indications act 2003.

Learning Outcomes:

At the end of the unit the student will able to:

- Understand legal framework of TK.
- Contrast and compare the ST and other traditional forest dwellers
- Analyze plant variant protections
- Evaluate farmers right act

UNIT IV

Traditional knowledge and intellectual property: Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Certain non IPR mechanisms of traditional knowledge protection, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge, global legal FORA for increasing protection of Indian Traditional Knowledge.

Learning Outcomes:

At the end of the unit, the student will able to:

- Understand TK and IPR
- Apply systems of TK protection.
- Analyze legal concepts for the protection of TK.
- Evaluate strategies to increase the protection of TK.

UNIT V

Traditional knowledge in different sectors: Traditional knowledge and engineering, Traditional medicine system, TK and biotechnology, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Food security of the country and protection of TK.

Learning Outcomes:

At the end of the unit, the student will able to:

- Know TK in different sectors.
- Apply TK in engineering.
- Analyze TK in various sectors.
- Evaluate food security and protection of TK in the country.

Reference Books:

1) Traditional Knowledge System in India, by Amit Jha, 2009.
2) Traditional Knowledge System and Technology in India by Basanta Kumar Mohanta and Vipin Kumar Singh, PratibhaPrakashan 2012.
3) Traditional Knowledge System in India by Amit Jha Atlantic publishers, 2002
4) "Knowledge Traditions and Practices of India" Kapil Kapoor, Michel Danino

e-Resources:

1) https://www.youtube.com/watch?v=LZP1StpYEPM
2) http://nptel.ac.in/courses/121106003/

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III Year - I Semester		L	T	P	C
		3	0	0	3
DYNAMICS OF MACHINERY					

Course Objectives:

1. To analyze the forces in clutches, brakes and dynamometers involving friction.
2. understand the effect gyroscopic couple in motor cycles, aeroplanes and ships.
3. To understand the static and dynamic force analysis of four bar and slider crank mechanisms.
4. To study the turning moment diagrams of reciprocating engines and to learn design procedure of a flywheel
5. To learn analytical and graphical methods for calculating balancing of rotary and reciprocating masses
6. Understanding of vibrations and its significance on engineering design.

UNIT – I

FRICTION: Inclined plane, friction of screw and nuts, pivot and collar, uniform pressure, uniform wear, friction circle and friction axis: lubricated surfaces, boundary friction, film lubrication.

CLUTCHES: Friction clutches- single disc or plate clutch, multiple disc clutch, cone clutch, centrifugal clutch.

BRAKES AND DYNAMOMETERS: Simple block brakes, internal expanding brake, band brake of vehicle. General description and operation of dynamometers: Prony, Rope brake, Epicyclic, Bevis Gibson and belt transmission,

UNIT – II

STATIC AND DYNAMIC FORCE ANALYSIS: Dynamic force analysis of four bar mechanism and slider crank mechanism**,** inertia torque, angular velocity and acceleration of connecting rod, crank effort

TURNING MOMENT DIAGRAMS: Turning moment diagrams – fluctuation of energy – fly wheels and their design.

UNIT-III

PRECESSION: Gyroscopes, effect of precession motion on the stability of moving vehicles such as motor car, motor cycle, aero planes and ships.

GOVERNERS: Watt, porter and proell governors, spring loaded governors – Hartnell and Hartung with auxiliary springs. sensitiveness, isochronism and hunting.

UNIT – IV

BALANCING: Balancing of rotating masses single and multiple – single and different planes, use analytical and graphical methods. Primary, secondary, and higher balancing of reciprocating masses. analytical and graphical methods, unbalanced forces and couples – examination of "V" multi cylinder in line and radial engines for primary and secondary balancing, locomotive balancing, hammer blow, swaying couple, variation of tractive effort.

UNIT – V

VIBRATIONS: Free Vibration of spring mass system –Natural frequency-types of damping – damped free vibration, Simple problems on forced damped vibration, vibration isolation and transmissibility

transverse loads, vibrations of beams with concentrated and distributed loads. Dunkerly's methods, Raleigh's method, whirling of shafts, critical speeds, torsional vibrations, two and three rotor systems.

Text Books :

1. Theory of Machines -S.S Rattan - Mc. Graw Hill
2. Theory of Mechanisms and Machines -Dr.Jagadish Lal - Metropolitan Pvt.Ltd .

References :

1. Mechanism and machine theory - JS Rao & RV Dukkipati - New Age Publishers.
2. Theory of Machines - Shigley - McGrawHill Publishers
3. Theory of Machines - Thomas Bevan - Pearson Publishers

Course outcomes:

(1) To compute the frictional losses and transmission in clutches, brakes and dynamometers
(2) To determine the effect of gyroscopic couple in motor vehicles, ships and aeroplanes
(3) To analyze the forces in four bar and slider crank mechanisms and design a flywheel
(4) To determine the rotary unbalanced mass in reciprocating equipment
(5) To determine the unbalanced forces and couples in reciprocating and radial engines
(6) To determine the natural frequencies of discrete systems undergoing longitudinal, torsional and transverse vibrations.

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III Year - I Semester		L	T	P	C
		3	0	0	3
FUELS AND COMBUSTION					

Course Objectives: To impart the knowledge about the different kinds of fuels and principles of combustion, thermodynamics of combustion and flame propagation. The objective is to study and understand the combustion phenomena to increase combustion efficiency.

UNIT – I:
Objective: The objective is to introduce the use and the application of different fuel types and characteristics. The student will be able to understand various fuel handling and storage methods.
FUELS: Detailed classification – Conventional and Unconventional Solid, Liquid, gaseous fuels and nuclear fuels – Origin of Coal – Analysis of coal.
Coal – Carburisation, Gasification and liquification – Properties of coal, action of heat on coal, oxidation of coal, hydrogenation of coal, efficient use of solid fuels, manufactured fuels, agro fuels, solid fuel handling, properties related to combustion, handling and storage.

Unit-II
Objective: The objective is to expose the student about petroleum refining and conversion process in general and in India in particulars.
Origin and classification of Petroleum, refining and other conversion processes, composition of petroleum with respect to combustion, property and testing of petroleum products, various petroleum products, Nature of Indian Crudes & Petroleum refining in India, storage and handling of liquid fuels, liquid fuels combustion equipment.
Types of gaseous fuels, Natural gases, methane from coal mine, Producer gas, water gas, blast furnace gas, LPG.

UNIT – III
Objective: The objective is to make the students study and understand basic principles of combustion and chemical kinetics.
PRINCIPLES OF COMBUSTION: Chemical composition – Flue gas analysis – dew point of products – Stoichiometry Stoichiometry relations, theoretical air required for complete combustion, Chemical kinetics – Rate of reaction – Reaction order – Molecularity – Zeroth, first, second and third order reactions - complex reactions – chain reactions. Theories of reaction Kinetics – General oxidation behaviour of HC's.

UNIT – IV
Objective: The objective is to make the students study thermodynamics of combustion process and calculate adiabatic flame temperature.
THERMODYNAMICS OF COMBUSTION: Enthalpy of formation – Heating value of fuel –Heat of reaction-Heat of combustion$\mu_{rp,}$ μ_{hp} - determination of heating value of fuels(LCV,HCV)-Combustion reaction Temperature –chemical equilibrium, Equilibrium composition of gaseous mixtures. Combustion analysis- problems.

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UNIT – V

Objective: The objective is to study flame propagation, factors effecting the flame propagation of various kinds of fuels.

LAMINAR AND TURBULENT FLAMES PROPAGATION AND STRUCTURE: Flame stability – Burning velocity of fuels – Measurement of burning velocity – factors affecting the burning velocity.

Flame Propagation - Solid, Liquid & Gaseous Fuels Combustion - Flame Temperature - Theoretical, Adiabatic & Actual - Ignition Limits - Limits of Inflammability.

TEXT BOOKS :

1. Combustion Fundamentals / Roger A strehlow / Mc Graw Hill
2. Fuels and combustion / Sharma and Chander Mohan/ Tata Mc Graw Hill
3. Fuels & Combustion,/ Samir Sarkar,/2nd Edition/Orient Longman
4. Combustion Engineering and Fuel Technology / Shaha A.K./ Oxford and IBH.

REFERENCE BOOKS :

1. Principles of Combustion / Kanneth K.Kuo/ Wiley and Sons.
2. Combustion / Sarkar / Mc. Graw Hill.
3. An Introduction to Combustion / Stephen R. Turns/ Mc. Graw Hill International Edition.
4. Combustion Engineering / Gary L. Berman & Kenneth W. Ragland/ Mc. Graw Hill International Edition.

COURSE OUTCOMES:

The students completing the course will be able to understand the various kinds of fuels, their characteristics and origin. Further the student will be enriched with enough knowledge to understand the thermodynamics behind combustion, flame propagation and choice of combustion systems.

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III Year - I Semester		L	T	P	C
		3	0	0	3
AUTOMOTIVE COMPONENTS DESIGN					

UNIT –I Introduction

Introduction to Design Process: Basic fundamentals of strength of materials, Design Morphology. General Design Considerations, Design procedure, Standards in design, selection of materials, designation of materials manufacturing considerations in design.

Fundamentals of Machine Design: Stress concentration, FOS, consideration for the selection of FOS and application in design. S-N curve, endurance limit, fatigue, and its applications.

UNIT-II Design of Power Transmitting Elements

Design of Shafts as per ASME Code: Cause of failure in shafts, Materials for shaft, Stresses in shafts, Design of shafts subjected to twisting moment, bending moment and combined twisting and bending moments, Shafts subjected to fatigue loads, Design for rigidity, Design of Propeller Shafts for Automotive: Critical speed, Torque rating, Mechanics of Hotchkiss & Torque tube drive.

UNIT-III Design of Friction Clutches and Brakes

Friction Clutches **:** Classification and selection of friction clutches, torque transmitting capacities, design of single plate. Multi plate, cone and centrifugal clutches, types of friction materials, their advantages, limitations and selection criterion, concept of temperature rise in clutch operation.

Brakes :Energy absorbed by brake, design consideration in pivoted block brakes and long shoe, internal expanding shoe brakes, disk brake, temperature rise in brake operation.

UNIT-IV Design of Gears

Spur Gears: Introduction, Standard Proportions of Gear Systems, Gear Materials, various design considerations, Beam Strength of gear teeth- Lewis Equation, tangential loading, module Calculations, width calculations, Dynamic tooth loads, types of gear tooth failures, Spur Gear construction, Design of shaft for Spur Gears, Design of arms for Spur Gears.

Helical Gears: Introduction, Terms used in Helical Gears, Face width of Helical Gear Formative no. of teeth and minimum no. of teeth to avoid interference and undercutting, Proportion of the Helical Gears, Strength of Helical Gears, Design of Helical Gears.

UNIT- V Anti-Friction Bearing (Selection and Design)

Principle of operation and basic design. Hydro-static & Hydrodynamics bearing, Rolling Contact Bearings: Types, Static and Dynamic Load Capacity, Concept of equivalent load, Load life Relationship, Selection of bearing from Manufacturer’s Catalogue, Design for variable loads and Speeds, Introduction to journal bearing.

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Text Books

1. Design of machine elements V.B. Bhandari, TMH.
2. Machine Design by Dr. P.C. Sharma and Dr. D. K. Agrawal, S.K. Kataria and sons
3. Automobile Technology by Dr. N.K. Giri

References:

1. Handbook of gear design, GitimM.Maitra, TMH.
2. Fundamental of Gear Design, Remond J Drago, Butterworths, 1988
3. Automotive Chassis by JonsenReimpell, BH Pub

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III Year - I Semester		L	T	P	C
		3	0	0	3
MICRO PROCESSORS AND MICRO CONTROLLERS					

OBJECTIVES : The student will

- learn concepts of microprocessor, different addressing modes and programming of 8086.
- understand interfacing of 8086, with memory and other peripherals.
- learn concept of DMA, USART RS-232 and PIC controller.
- study the features of advanced processors and Pentium processors.
- study the features of 8051 Microcontroller, its instruction set and also other controllers.

UNIT-I: 8086/8088 MICROPROCESSORS
Register organization of 8086, Architecture, signal description of 8086, physical memory organization, general bus operation, I/O addressing capability, special purpose activities, Minimum mode, maximum mode of 8086 system and timings, the processor 8088, machine language instruction formats, addressing mode of 8086, instruction set off 8086,assembler directives and operators.

UNIT-II: PROGRAMMING WITH 8086 MICROPROCESSOR
Machine level programs, programming with an assembler, Assembly language programs, introduction to stack, stack structure of 8086/8088, interrupts and interrupt service routines, interrupt cycle of 8086, non-mask able interrupt and mask able interrupts, interrupt programming.

UNIT-III: BASIC AND SPECIAL PURPOSE PROGRAMMABLE PERIPHERALS AND THEIR INTERFACING WITH 8086/88
Semiconductor memory interfacing, dynamic RAM interfacing, interfacing i/o ports, PIO 8255 modes of operation of 8255,interfacing to D/A and A/D converters, stepper motor interfacing, control of high power devices using 8255.Programmable interrupt controller 8259A, the keyboard /display controller8279, programmable communication interface 8251 USART, DMA Controller 8257.

UNIT-IV: 8051 MICROCONTROLLER
Introduction to microcontrollers, 8051Microcontrollers, 8051pin description, connections, I/O ports and memory organization, MCS51addressing modes and instructions, assembly language programming tools.

UNIT-V: PIC MICROCONTROLLERS AND ARM 32-BIT MICROCONTROLLER
Overview and features, PIC16Cx/7X instructions, interrupts in PIC 16C61/71, PIC 16F8XX Flash controllers, I/O ports and timers. Introduction to 16/32 Bit processors, ARM architecture and organization, ARM / Thumb programming model, ARM / Thumb instruction set.

TEXT BOOKS:

1. A.K.Ray, K.M.Bhurchandi ,"Advanced Microprocessors and Peripherals", Tata McGraw Hill Publications,2000.
2. N.Sentil Kumar, M.Saravanan, S.Jeevananthan, "Microprocessors and Microcontrollers", Oxford University Press,2010.

REFERENCES:

1. Ajay V Deshmukh, ”Microcontrollers”, TATA McGraw Hill publications,2012.
2. Krishna Kant, “Microprocessors and Microcontrollers”, PHI Publications, 2010.

OUTCOMES

After going through this course the student will be able to

- develop programs for different addressing modes.
- perform 8086 interfacing with different peripherals and implement programs
- describe the key features of serial and parallel communication and able to
- Design a microcontroller for simple applications.

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III Year - I Semester		L	T	P	C
		3	0	0	3

MACHINE TOOLS AND METROLOGY

Course Objectives: The students completing this course are expected to understand the concept of various working principles of various machine tools and concepts of metal cutting. Further there are exposed to the importance of metrology.

UNIT – I

Objective: The fundamentals of metal cutting and forces involved will be given enough exposer to the student.

Elementary treatment of metal cutting theory – element of cutting process – geometry of single point tool angles, chip formation and types of chips – built up edge and its effects chip breakers, mechanics of orthogonal cutting –Merchant's force diagram, cutting forces, cutting speeds, feed, depth of cut, tool life, coolants, tool materials.

UNIT – II

Objective: the students are to be exposed the fundamental concepts of Engine Lathe and its various operations that can be performed.

Engine lathe – principle of working, specification of lathe – types of lathe – work holders tool holders – operations performed- box tools taper turning, thread turning – for lathes and attachments, turret and capstan lathes – collet chucks – other work holding – tool holding devices.

Principal features of automatic lathes – classification – single spindle and multi-spindle automatic lathes.

UNIT – III

Objective: the students are to be exposed the fundamental concepts of Drilling and boring machines and its various operations that can be performed. The students are to be exposed the fundamental concepts of grinding machines and its various operations that can be performed **Drilling & Boring machines:** Principles of working, specifications, types, operations performed – tool holding devices – twist drill – Boring Machines – jig boring machine, deep hole Drilling Machine.

Grinding: Theory of grinding – classification of grinding machines, different types of abrasives, bonds, specification and selection of a grinding wheel. Lapping, Honing & Broaching operations, comparison to grinding.

UNIT-IV

Objective: The students are to be exposed to the fundamental concepts and systems of limits and tolerances and measurement instruments**.**

SYSTEMS OF LIMITS AND FITS: Introduction, nominal size, tolerance, limits, deviations, fits and their types-unilateral and bilateral tolerance system, hole and shaft basis systems- interchangeability.

Linear measurement: Length standards, end standards, slip gauges- calibration of the slip gauges, dial indicators, micrometers.

Measurement of angles and tapers: Different methods – bevel protractor, angle slip gauges-clinometer

Limit gauges: Taylor's principle – design of go and no go gauges; plug, ring, snap, gap, taper, profile and position gauges.

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UNIT-V

Objective: The students are to be exposed the fundamental concepts of optical measuring instruments and surface measurement instruments.

Optical measurement instruments: Tools maker's microscope and uses - collimators, optical projector, optical flats and their uses.

Surface roughness measurement: Differences between surface roughness and surface waviness.

Comparators: Types - mechanical, optical, electrical and electronic, pneumatic comparators and their uses.

TEXT BOOKS:

1. Production Technology / R.K. Jain and S.C. Gupta/ Khanna Pub
2. Engineering Metrology / Mahajan / Dhanpat Rai Publishers

REFERENCES:

1. Production Engineering/K.C Jain & A.K Chitaley/PHI Publishers
2. Engineering Metrology / R.K.Jain / Khanna Publishers

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III Year - I Semester		L	T	P	C
		3	0	0	1.5
AUTOMOTIVE ENGINES AND FUELS LAB					

Course Objectives: To study the characteristics of the fuels and lubricants used in automobile and get practical knowledge in assembly & dismantling of engine components.

ENGINES LAB

LIST OF EXPERIMENTS

1. Dismantling study and Assembly of Single cylinder two stroke engines.
2. Dismantling study and Assembly of Single cylinder four stroke engines.
3. Dismantling study and Assembly of Power train transmission system of three wheelers.
4. Dismantling study and Assembly of Carburetor.
5. Dismantling study and Assembly of Fuel injection pump.
6. Dismantling study and Assembly of Multi cylinder engines (Advanced engine systems).
7. Dismantling study and Assembly of Lubrication system.
8. Dismantling study and Assembly of Cooling system. (Air cooling and Liquid cooling)

FUELS LAB

LIST OF EXPERIMENTS

1. ASTM distillation test of liquid fuels.
2. Calorific value of liquid and gaseous fuel.
3. Flash and Fire points of petrol and diesel. (closed and open type)
4. Temperature dependence of viscosity of lubricants & Fuels by Redwood Viscometer.
5. Viscosity index of lubricants & Fuels by Saybolt Viscometer.
6. Ash content and Carbon Residue Test.
7. Drop point of grease and mechanical penetration in grease.
8. Cloud and Pour point Test.

Course outcomes:

Attending the laboratory the students shall be able to :

1. The student after undergoing this course is expected to know the principles in assembly & dismantling of engine components
2. At the end of the lab learn characteristics of the fuels and lubricants used in automobile

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III Year - I Semester		L	T	P	C
		0	0	3	1

MICRO PROCESSORS AND MICRO CONTROLLERS LAB

The students are required to develop the necessary Algorithm, Flowchart and Assembly Language Program Source Code for executing the following functions using MASM/TASM software and to verify the results with necessary Hardware Kits.

PART-I: MICROPROCESSOR 8086

1. Introduction to MASM/TASM.
2. Arithmetic operation- Multi byte Addition and Subtraction, Multiplication and Division- Signedand unsigned Arithmetic operation, ASCII- Arithmetic operation.
3. Logic operations-Shift and rotate- Converting packed BCD to unpacked BCD, BCD to ASCII conversion.
4. By using string operation and Instruction prefix: Move Block, Reverse string, Sorting, Inserting, Deleting, Length of the string, String comparison.
5. DOS/BIOS programming: Reading keyboard (Buffered with and without echo)- Display characters, Strings.

PART-II: INTERFACING WITH MICROPROCESSOR

1. 8259 – Interrupt Controller-Generate an interrupt using 8259 timer.
2. 8279 – Keyboard Display- Write a program to display a string of characters.
3. 8255 – PPI-Write ALP to generate sinusoidal wave using PPI.
4. 8251 – USART-Write a program in ALP to establish Communication between two processors.

PART-III: MICROCONTROLLER 8051

1. Reading and Writing on a parallel port.
2. Timer in different modes.
3. Serial communication implementation.

PART-IV: INTERFACING WITH MICROCONTROLLER

Write C programs to interface 8051 chip to Interfacing modules to Develop single chip solutions.

1. Simple Calculator using 6 digit seven segment display and Hex Keyboard interface to 8051.
2. Alphanumeric LCD panel and Hex keypad input interface to 8051.
3. External ADC and Temperature control interface to 8051.
4. Generate different waveforms Sine, Square, Triangular, and Rampetc. using DAC interface to 8051; change the frequency and Amplitude.

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EQUIPMENT REQUIRED FOR LABORATORY

1. MASM/TASM software
2. 8086 Microprocessor Kits
3. 8051 Micro Controller kits
4. Interfaces/peripheral subsystems
   i) 8259 PIC
   ii) 8279-KB/Display
   iii) 8255 PPI
   iv) 8251 USART
5. A/D and D/AC Interface

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III Year - I Semester		L	T	P	C
		0	0	3	1
PRODUCTION TECHNOLOGY LAB					

Course Objective: To impart hands-on practical exposure on manufacturing processes and equipment.

1. Design and making of pattern
    i. Single piece pattern
    ii. Split pattern
2. Sand properties testing
    i. Sieve analysis (dry sand)
    ii. Clay content test
    iii. Moisture content test
    iv. Strength test (Compression test & Shear test)
    v. Permeability test
3. Mould preparation
    i. Straight pipe
    ii. Bent pipe
    iii. Dumble
    iv. Gear blank
4. Gas cutting and welding
5. Manual metal arc welding
    i. Lap joint
    ii. Butt joint
6. Injection Molding
7. Blow Molding
8. Simple models using sheet metal operations
9. Study of deep drawing and extrusion operations
10. Study of Basic powder compaction and sintering
11. Study of TIG/MIG Welding
12. Study of Resistance Spot Welding
13. Study of Brazing and soldering
14. Study of Plastic Moulding Process.

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III Year - I Semester		L	T	P	C
		3	0	0	0
IPR & PATENTS					

Course Objectives:

- To know the importance of Intellectual property rights, which plays a vital role in advanced Technical and Scientific disciplines
- Imparting IPR protections and regulations for further advancement, so that the students can familiarize with the latest developments

Course Outcomes:

- IPR Laws and patents pave the way for innovative ideas which are instrumental for inventions to seek Patents
- Student get an insight on Copyrights, Patents and Software patents which are instrumental for further advancements

UNIT I

Introduction to Intellectual Property Rights (IPR): Concept of Property - Introduction to IPR – International Instruments and IPR - WIPO - TRIPS – WTO -Laws Relating to IPR - IPR Tool Kit - Protection and Regulation - Copyrights and Neighboring Rights – Industrial Property – Patents - Agencies for IPR Registration – Traditional Knowledge –Emerging Areas of IPR - Layout Designs and Integrated Circuits – Use and Misuse of Intellectual Property Rights.

UNIT II

Copyrights and Neighboring Rights: Introduction to Copyrights – Principles of Copyright Protection – Law Relating to Copyrights - Subject Matters of Copyright – Copyright Ownership – Transfer and Duration – Right to Prepare Derivative Works –Rights of Distribution – Rights of Performers – Copyright Registration – Limitations – Infringement of Copyright – Relief and Remedy – Case Law - Semiconductor Chip Protection Act.

UNIT III

Patents: Introduction to Patents - Laws Relating to Patents in India – Patent Requirements – Product Patent and Process Patent - Patent Search - Patent Registration and Granting of Patent - Exclusive Rights – Limitations - Ownership and Transfer — Revocation of Patent – Patent Appellate Board - Infringement of Patent – Compulsory Licensing — Patent Cooperation Treaty – New developments in Patents – Software Protection and Computer related Innovations

UNIT IV

Trademarks: Introduction to Trademarks – Laws Relating to Trademarks – Functions of Trademark – Distinction between Trademark and Property Mark – Marks Covered under Trademark Law - Trade Mark Registration – Trade Mark Maintenance – Transfer of rights - Deceptive Similarities
Likelihood of Confusion - Dilution of Ownership – Trademarks Claims and Infringement – Remedies – Passing Off Action.

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UNIT V

Trade Secrets & Cyber Law and Cyber Crime: Introduction to Trade Secrets – General Principles - Laws Relating to Trade Secrets –

Maintaining Trade Secret – Physical Security – Employee Access Limitation – Employee Confidentiality Agreements – Breach of Contract –Law of Unfair Competition – Trade Secret Litigation – Applying State Law.

Cyber Law – Information Technology Act 2000 - Protection of Online and Computer Transactions –

E-commerce - Data Security – Authentication and Confidentiality - Privacy - Digital Signatures – Certifying Authorities - Cyber Crimes - Prevention and Punishment – Liability of Network Providers.

Text Books:

1) Intellectual Property Rights (Patents & Cyber Law), Dr. A. Srinivas. Oxford University Press, New Delhi.
2) Deborah E.Bouchoux: Intellectual Property, Cengage Learning, New Delhi.

References:

1) PrabhuddhaGanguli: Intellectual Property Rights, Tata Mc-Graw –Hill, New Delhi
2) Richard Stim: Intellectual Property, Cengage Learning, New Delhi.
3) Kompal Bansal &Parishit Bansal Fundamentals of IPR for Engineers, B. S. Publications (Press).
4) Cyber Law - Texts & Cases, South-Western's Special Topics Collections.
5) R.Radha Krishnan, S.Balasubramanian: Intellectual Property Rights, Excel Books. New Delhi.
6) M.Ashok Kumar and MohdIqbal Ali: Intellectual Property Rights, Serials Pub.

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III Year - I Semester		**L**	**T**	**P**	**C**
		0	**0**	**3**	**1**
SOCIALLY RELEVANT PROJECT					

Preamble:
There is lot of scientific and technological changes in the nation during last few decades in almost all the sectors. The state and central governments are introducing many schemes to all classes of people of the nation to increase the productivity in various sectors. India is a rural centric nation and the fruits of the scientific inventions and new technology shall be shared among all remote corners of the nation. With this aim, a socially relevant project is newly introduced in the curriculum with an objective of taking up the projects relevant to the societal needs.

Objectives:
(1) The student(s) shall explore the technological needs of society
(2) The student(s) shall understand the technological problems of society

General guidelines:

- A socially relevant project shall be a community service based project and it shall be innovative.
- A student has to pursue the socially relevant project to solve real life and pressing problems of society.
- The pursued socially relevant projects shall contribute to national development goals and priorities.
- Socially relevant project can be carried out by an individual student or by a team of maximum 5 of concerned department.
- The student(s) shall visit the society (Villages/Hospitals/Social Service Organizations etc) to identify the problem and conduct literature survey and provide a feasible solution.
- The socially relevant project selected shall be in the broad area of concerned discipline of course. Preference shall be given to rural societal problems.
- Each team shall work under the supervision of a faculty member of the concerned department.
- If the course is offered in II Year I Semester, the student or team of students shall complete this project during the vacation after I Year and so on.
- The duration of the project is about 15 to 20 hrs in total and students may split total duration into 2 to 3 hrs per day based convenience. The attendance shall be maintained by the supervisor.

Sample Projects (but not limited to):
(i) Energy Auditing in a rural village (ii) Smart starting and control of motors in agriculture and aqua fields (iii) TV Remote Operated Domestic Appliances Control (iv) Solar Powered Auto Irrigation System (v) Auto Intensity Control of Street Lights (vi) Hidden Active Cell Phone Detector (vii) Railway Track Security System (viii) Solar Power Charge Controller (ix) Home Automation System Using Digital Control (x) Intelligent Overhead Tank Water Level Indicator (xi) Pre Stampede Monitoring and Alarm System (xii) Detect Rash Driving Speed Checker System on Highways

Outcomes

(1) The student(s) are be able to provide a solutions the technological problems of society

(1) The student(s) is able suggest technological changes which suits current needs of society

(2) The student(s) are able to explain new technologies available for problems of the society.

Reference:

(1) Web Link: http://iitk.ac.in/new/socially-relevant-research
(2) https://csie.iitm.ac.in/SocialProjectsIITM.html
(3) http://www.iitkgp.ac.in/files/csr/csr_education.pdf

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III Year - II Semester		L	T	P	C
		3	0	0	3
HEAT TRANSFER (Heat transfer data book allowed)					

Course Objective: To understand different modes of heat transfer and apply these basics in the design of thermal systems

UNIT – I:

Introduction: Modes and mechanisms of heat transfer – Basic laws of heat transfer –General discussion about applications of heat transfer.

Conduction Heat Transfer: Fourier rate equation – General heat conduction equation in Cartesian, Cylindrical and Spherical coordinates – simplification and forms of the field equation – steady, unsteady and periodic heat transfer – Initial and boundary conditions

One Dimensional Steady State Conduction Heat Transfer: Homogeneous slabs, hollow cylinders and spheres- Composite systems– overall heat transfer coefficient – Electrical analogy – Critical radius of insulation

UNIT – II:

One Dimensional Steady State Conduction Heat Transfer: Variable Thermal conductivity – systems with heat sources or Heat generation-Extended surface (fins) Heat Transfer – Long Fin, Fin with insulated tip and Short Fin, Application to error measurement of Temperature

One Dimensional Transient Conduction Heat Transfer: Systems with negligible internal resistance – Significance of Biot and Fourier Numbers –Infinite bodies- Chart solutions of transient conduction systems- Concept of Semi infinite body.

UNIT – III:

Convective Heat Transfer: Classification of systems based on causation of flow, condition of flow, configuration of flow and medium of flow – Dimensional analysis as a tool for experimental investigation– Buckingham Π Theorem and method, application for developing semi – empirical non-dimensional correlation for convection heat transfer – Significance of non-dimensional numbers – Concepts of Continuity, Momentum and Energy Equations.

Forced convection: External Flows: Concepts about hydrodynamic and thermal boundary layer and use of empirical correlations for convective heat transfer -Flat plates and Cylinders.

Internal Flows: Concepts about Hydrodynamic and Thermal Entry Lengths – Division of internal flow based on this –Use of empirical relations for Horizontal Pipe Flow and annulus flow.

UNIT – IV:

Free Convection: Development of Hydrodynamic and thermal boundary layer along a vertical plate - Use of empirical relations for Vertical plates and pipes.

Heat Exchangers: Classification of heat exchangers – overall heat transfer Coefficient and fouling factor – Concepts of LMTD and NTU methods - Problems using LMTD and NTU methods.

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UNIT V:

Heat Transfer with Phase Change:

Boiling: – Pool boiling – Regimes – Calculations on Nucleate boiling, Critical Heat flux and Film boiling

Condensation: Film wise and drop wise condensation –Nusselt's Theory of Condensation on a vertical plate - Film condensation on vertical and horizontal cylinders using empirical correlations.

Radiation Heat Transfer : Emission characteristics and laws of black-body radiation – Irradiation – total and monochromatic quantities – laws of Planck, Wien, Kirchoff, Lambert, Stefan and Boltzmann– heat exchange between two black bodies – concepts of shape factor – Emissivity – heat exchange between grey bodies – radiation shields – electrical analogy for radiation networks.

TEXT BOOKS:

1. Heat Transfer by HOLMAN, Tata McgrawHill
2. Heat Transfer by P.K.Nag, TMH

REFERENCE BOOKS:

1.Fundamentals of Heat Transfer by Incropera & Dewitt, John wiley
2.Fundamentals of Engineering, Heat& Mass Transfer by R.C.Sachdeva, NewAge.
3. Heat& Mass Transfer by Amit Pal – Pearson Publishers
4. Heat Transfer by Ghoshdastidar, Oxford University press.
5. Heat Transfer by A Practical Approach, YunusCengel, Boles, TMH
6. Engineering Heat and Mass Transfer by Sarit K. Das, DhanpatRai Pub

Note: Heat and Mass transfer Data Book by C P Kothandaraman and Subrahmanyan is used to design and analyze various thermal processes and thermal equipment.

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

- Represent the physical problems of heat transfer in terms of governing equations or mathematical models
- Differentiate between different boundary conditions and apply the same for solving heat transfer problems
- Design thermal systems applying the concepts of heat transfer under steady state and well as unsteady state conditions
- Design, select and analyze the heat exchangers
- Apply the radiation concepts to the engineering devices.

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III Year - II Semester		L	T	P	C
		3	0	0	3
ELECTRICAL VEHICLES AND HYBRID TECHNOLOGY					

COURSE OBJECTIVES:

The course should enable the students to:

i. General aspects of Electric and Hybrid Vehicles (EHV), including architectures, modeling, sizing, sub system design and hybrid vehicle control.
ii. Understand about vehicle dynamics,
iii. Design the required energy storage devices,
iv. Select the suitable electric propulsion systems and
v. Understand of hybrid electric vehicles.

UNIT I
NEED FOR ALTERNATIVE SYSTEM

Need for hybrid and electric vehicles – main components and working principles of a hybrid and electric vehicles, Different configurations of hybrid and electric vehicles. Comparative study of diesel, petrol, hybrid and electric Vehicles. Advantages and Limitations of hybrid and electric Vehicles. Case study on specification of electric and hybrid vehicles.

UNIT II
DESIGN CONSIDERATIONS FOR ELECTRIC VEHICLES

Design requirement for electric vehicles- Range, maximum velocity, acceleration, power requirement, mass of the vehicle. Various Resistance- Transmission efficiency- Electric vehicle chassis and Body Design, Electric Vehicle Recharging and Refueling Systems.

UNIT III
ENERGY SOURCES

Battery Parameters- - Different types of batteries – Lead Acid- Nickel Metal Hydride - Lithium ion- Sodium based- Metal Air. Battery Modeling- Equivalent circuits, Battery charging- Quick Charging devices. Battery Management System.

Fuel Cell- Fuel cell Characteristics- Fuel cell types-Half reactions of fuel cell. Ultra capacitors., Hydrogen fuel cell- Connecting cell in series- water management in the PEM fuel cell- Thermal Management of the PEM fuel cell

UNIT IV
MOTORS

Types of Motors, Characteristic of DC motors, AC single phase and 3-phase motor, PM motors, Switched reluctance motors, Motor Drives and speed controllers, Torque Vectoring, Regenerative Braking. Rectifiers, Inverters, DC/AC converters.

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UNIT V

SUBSYSTEMS OF HYBRID AND ELECTRIC VEHICLES

Power Split devices for Hybrid Vehicles - Operation modes - Control Strategies for Hybrid Vehicle- Economy of hybrid Vehicles. Steering and Suspension system. Choice of Tires.

TEXT BOOKS:

1. Iqbal Husain, " Electric and Hybrid Vehicles-Design Fundamentals", CRC Press,2003
2. Mehrdad Ehsani, " Modern Electric, Hybrid Electric and Fuel Cell Vehicles", CRC Press,2005.

REFERENCES:

1. James Larminie and John Lowry, "Electric Vehicle Technology Explained " John Wiley & Sons,2003
2. Lino Guzzella, " Vehicle Propulsion System" Springer Publications,2005
3. Ron HodKinson, "Light Weight Electric/ Hybrid Vehicle Design", Butterworth Heinemann Publication,2005

COURSE OUTCOMES:

The students able to understand

i. Electric and hybrid vehicle operation and architectures
ii. Design of hybrid and electric vehicles.
iii. Energy requirement for vehicles.
iv. Vehicle characteristics, operating modes, and performance parameters of the vehicle
v. Different subsystems of hybrid and electric vehicles

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III Year - II Semester		L	T	P	C
		3	0	0	3
AUTOMOTIVE CHASSIS DESIGN					

UNIT I

Chassis and Vehicle Overall

Center of Gravity and handling properties –Body weight & Body center gravity – Mass Moment of Inertia. Vehicle Frame: Study of Loads –Moments and Stresses on Frame Members. Design of Frames for Passenger and Commercial Vehicle.

UNIT II

Steering Design:

Rack & Pinion: Advantages & Disadvantages, Configurations, Steering gear, manual with side tie rod take-off, Steering gear, manual with centre tie rod take-offRecirculating Ball type: Advantages & Disadvantages, Steering Gear, Power Steering Systems: Hydraulic, Electro-Hydraulic and Electrical systems and Steering Kinematics: Maximum displacement of Rack, Calculation of inner and outer wheel angles, Length of Tie rod.

UNIT III

Suspension System:

Wheel travel requirement, Sprung & Unsprung mass distribution, Calculation of Tyre rolling radius, checking of camber change & Toe Change, front view swing arm length, side view swing arm length, Calculation of Jacking force & its effects on suspension, Camber change rate, Wheel base and wheel track change, Anti Dive and Anti- squat considerations

UNIT IV

Gear Box Design:

In-line shaft arrangement, Internal gear arrangement, Face-dog selectors, Bearing arrangement, Crown wheel and pinion layout, Differential location and type, Transverse-shaft arrangement, Selector system, Selector interlock system, Lubrication method and Gearbox casing.

UNIT V

Continuous Variable Transmission (CVT):

Tuning of CVT: Speed & Power- Shift speed, engagement speed, power curves; Drive ratio & efficiency; Driven (secondary) clutch; Driving (primary) clutch; Pressure Spring; Fly weight System, Belt, and Gearing.

TEXT BOOKS:

1. Automotive Chassis by Jonsen Reimpell, Butterworth Heinemann Pub, 2001
2. Clutch Tuning Hand Book by Olav Aaeen, for serious racers and one who wants more performance from their variable ratio belt transmission.

REFERENCES:

1. Automotive Chassis Volume 1 by Giancarlo Genta & Lorenzo Morello, Springer, 2009
2. Manual Gear Box Design by Alec Stokes, SAE International, Butterworth Heinemann Pub, 1992.

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DEPARTMENT OF AUTOMOBILE ENGINEERING

III Year - II Semester		L	T	P	C
		3	0	0	3
AUTOMOTIVE POLLUTION AND CONTROL					

UNIT I
EMISSION FROM AUTOMOBILES
Sources of Pollution. Various emissions from Automobiles — Formation — Effects of pollutants on environment human beings. Emission control techniques – Emission standards.

UNIT II
EMISSION FROM SPARK IGNITION ENGINE AND ITS CONTROL
Emission formation in SI Engines- Carbon monoxide- Unburned hydrocarbon, NOx, Smoke —Effects of design and operating variables on emission formation – controlling of pollutants –Catalytic converters — Charcoal Canister — Positive Crank case ventilation system, Secondary air injection, thermal reactor, Laser Assisted Combustion.

UNIT III
EMISSION FROM COMPRESSION IGNITION ENGINE AND ITS CONTROL
Formation of White, Blue, and Black Smokes, NOx, soot, sulphur particulate and Intermediate Compounds – Physical and Chemical delay — Significance Effect of Operating variables on Emission formation — Fumigation, EGR, HCCI, Particulate Traps, SCR — Cetane number Effect.

UNIT IV
NOISE POLLUTION FROM AUTOMOBILES
Sources of Noise — Engine Noise, Transmission Noise, vehicle structural Noise, aerodynamics noise, Exhaust Noise. Noise reduction in Automobiles — Encapsulation technique for noise reduction — Silencer Design.

UNIT V
TEST PROCEDURES AND EMISSION MEASUREMENTS
Constant Volume Sampling I and 3 (CVSI &CVS3) Systems- Sampling Procedures — Chassis dyno- Seven mode and thirteen mode cycles for Emission Sampling — Sampling problems — Emissionanalysers —NDIR, FID, Chemiluminesecent, Smoke meters, Dilution Tunnel, SHED Test, Sound level meters.

TEXT BOOKS:

1. B.P Pundir , Engine Emissions, Narosa publications 2nd edition 2017
2. D.J.Patterson and N.A.Henin, ‘Emission from Combustion Engine and their control’, Anna Arbor Science Publication,1985.
3. G.P.Springer and D.J.Patterson, Engine Emissions, Pollutant formation, Plenum Press, New York, 1986.

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III Year - II Semester		L	T	P	C
		3	0	0	3
BASIC AUTOMOBILE ENGINEERING (OPEN ELECTIVE)					

Course Objectives:
The course imparts the principles of automobile systems and provides the salient features of safety, emission and service of automobiles.

UNIT – I
INTRODUCTION: Components of four wheeler automobile – chassis and body – power unit – power transmission – rear wheel drive, front wheel drive, 4 wheel drive – types of automobile engines, engine construction, turbo charging and super charging – engine lubrication, splash and pressure lubrication systems, oil filters, oil pumps – crank case ventilation – engine service, reboring, decarbonisation, Nitriding of crank shaft.

UNIT – II
TRANSMISSION SYSTEM: Clutches, principle, types, cone clutch, single plate clutch, multi plate clutch, magnetic and centrifugal clutches, fluid fly wheel – gear boxes, types, sliding mesh, construct mesh, synchro mesh gear boxes, epicyclic gear box, over drive torque converter. propeller shaft – Hotch – Kiss drive, Torque tube drive, universal joint, differential rear axles – types – wheels and tyres.

UNIT – III
STEERING SYSTEM: Steering geometry – camber, castor, king pin rake, combined angle toein, center point steering. types of steering mechanism – Ackerman steering mechanism, Davis steering mechanism, steering gears – types, steering linkages.

UNIT – IV
SUSPENSION SYSTEM: Objects of suspension systems – rigid axle suspension system, torsion bar, shock absorber, Independent suspension system.
BRAKING SYSTEM: Mechanical brake system, hydraulic brake system, master cylinder, wheel cylinder tandem master cylinder requirement of brake fluid, pneumatic and vacuum brakes.
ELECTRICAL SYSTEM: Charging circuit, generator, current – voltage regulator – starting system, bendix drive mechanism solenoid switch, lighting systems, horn, wiper, fuel gauge – oil pressure gauge, engine temperature indicator etc.

UNIT – V
ENGINE SPECIFICATION AND SAFETY SYSTEMS: Introduction- engine specifications with regard to power, speed, torque, no. of cylinders and arrangement, lubrication and cooling etc.
Safety: Introduction, safety systems - seat belt, air bags, bumper, anti lock brake system (ABS), wind shield, suspension sensors, traction control, mirrors, central locking and electric windows, speed control.

Note: Requested to adopt digital teaching methodology at least for two weeks during the semester.

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TEXT BOOKS:

1. Automotive Mechanics – Vol. 1 & Vol. 2 / Kirpal Singh/standard publishers
2. Automobile Engineering / William Crouse/TMH Distributors
3. Automobile Engineering/P.S Gill/S.K. Kataria & Sons/New Delhi.

REFERENCES:

1. Automotive Engines Theory and Servicing/James D. Halderman and Chase D. Mitchell Jr.,/ Pearson education inc.
2. Automotive Engineering / K Newton, W.Steeds & TK Garrett/SAE
3. Automotive Mechanics : Principles and Practices/ Joseph Heitner/Van Nostrand Reinhold
4. Automobile Engineering / C Srinivasan/McGrawHill.

Course Outcomes:

The student after undergoing the course, shall visualize the layout of an automobile and its systems like transmission, steering, suspension, braking, safety etc and should know the vehicle troubleshooting.

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III Year - II Semester		L	T	P	C
		3	0	0	3
AUTOMOTIVE MAINTENANCE AND SAFETY (OPEN ELECTIVE)					

UNIT I

INSPECTION SCHEDULE AND MAINTENANCE OF RECORDS

Need for maintenance, types of maintenance: preventive and breakdown maintenance,requirements of maintenance, preparation of check lists. Inspection schedule, maintenance ofrecords, log sheets and other forms, safety precautions in maintenance: general safety, toolsafety.

UNIT II

ENGINE MAINTENANCE

Tools used for engine disassembly, dismantling of engine components: cylinder head, valvetrain, cylinder block, connecting rod, piston and crankshaft assembly; cleaning and inspectionof engine components, reconditioning of components, servicing and maintenance of fuel system, engine tune-up, cooling system: water pump, radiator, thermostat. Lubrication system maintenance, anticorrosion and anti-freeze additives

UNIT III

CHASSIS MAINTENANCE

Servicing and maintenance of clutch, gear box, universal joints, propeller shaft, differentialsystem. Service and maintenance of brake – disc and drum brakes, steering wheel andsuspension systems, wheel alignment, vehicle body maintenance

ELECTRICAL SYSTEM MAINTENANCE

Servicing and maintenance of battery, starter motor, alternator and generator, ignition system,lighting system, electric horn, and wiper motor.

UNIT IV

SAFETY INTRODUCTION:

Active and passive safety, effects of deceleration inside passenger compartment, deceleration on impact with stationary and movable obstacle, concept of crumble zone and safety sandwich construction, optimization of vehicle structures for crash worthiness, types of crash / roll over tests, regulatory requirements for crash testing.

UNIT V

SAFETY CONCEPTS:

Active safety- driving safety, conditional safety, perceptibility safety, operating safety, passive safety: exterior safety, interior safety, deformation behavior of vehicle body, speed and acceleration characteristics of passenger compartment on impact, pedestrian safety - human impact tolerance-determination of injury thresholds, severity index, study of comparative tolerance, study of crash dummies

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Text Books:

1. Knott and Phil Knott, “An Introductory Guide to Motor Vehicle Maintenance: Light
2. Vehicles”, EMS publishing, 2010
3. Vehicle Maintenance and Garage Practice by Jigar A Doshi, PHI Pub, 2014.
4. Prasad, Priya and Belwafa Jamel, "Vehicles Crashworthiness and Occupant Protection”, American Iron and Steel Institute, USA
5. JullianHappian-Smith “An Introduction to Modern Vehicle Design” SAE, 2002

Reference Books:

1. William H. Crouse and Donald L. Anglin, “Automotive Mechanics”, 10th edition, 2007
2. Tim Giles, “Automotive service: Inspection, maintenance and repair”, 3rd edition, 2007
3. Jack Erjavec, “Automotive technology: A systems approach”, 5th edition, 2009
4. Recent development in Automotive Safety Technology”, SAE International Publication. Editor: Daniel J Helt,2013

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III Year - II Semester		L	T	P	C
		3	0	0	3
AUTOMOTIVE EMISSIONS AND EFFECTS (OPEN ELECTIVE)					

UNIT I

Laws and Regulation: Historical background, regulatory test procedures (European cycles). Exhaust gas pollutants (European rail road limits), particulate pollutants, European statutory values, inspection of vehicles in circulation (influence of actual traffic conditions and influence of vehicle maintenance) Analysis of pollutants: Carbon and Nitrogen compounds-(CO.CO2 Nox), Ammonia and Amines, Hydrocarbons. Volatile compounds, evaporative losses, analysis of particulates.

UNIT-II

SI engine emissions: Pollutants from SI engines, Mechanism & formation of Hc, Co and NOx in SI engines. Engines and operating variables affecting pollution in SI engines.
Pollution for CI engines, Mechanism & formation of Hc, Co and NOx , and root in CI engines. Factor affecting emissions in CI engines.

UNIT-III

CI engine emissions: Lean burns & stratified charge engines. Multipoint fuel injection and gasoline direct injection methods. Common rail fuel injection in diesel engines. Post combustion treatments: Introduction, exhaust gas recirculation, exhaust gas composition before treatment, catalytic convertors, oxidation and three way types thermal reactors, installation of catalysts in exhaust lines treatment in diesel engines, particulate traps for diesel engines, particulates trap regeneration.

UNIT-IV

Economic challenges: Introduction, cost of improvement to SI engines, cost of injection systems, cost of improvement in Diesel engines, economic consequences of introducing the catalyst, additional costs incurred by diesel traps, cost of periodic inspection of pollution control system and evaporative control system.

UNIT-V

Health effects: Health effects of HC, CO, NOx, Sox, O_3, CO_2 and PM emissions from SI and CI engine. Green house gases emitted by CI & SI engines. Effect on environment, Acid rain formation, climate change. Effect on building soil and water.

TEXT BOOKS:

1. Internal Combustion Engine Fundamentals/Heywood/Mc Graw Hill
2. Internal combustion engines and air pollution/ Edward Frederic Obert/ Intext Educ. Pub
3. Bosch – Gawline fuel injection /Bosch Publications
4. Bosch – Diesel fuel injection /Bosch Publications

REFERENCE BOOKS:

1. Automobiles and Pollution /PaulDegobert/ OPHRYS
2. SAE Surface Vehicle Emissions Standards Manual/ Society of Automotive Engineers
3. Automobile Pollution, Concerns, Priorities, and Challenges/ Shyam Kishor Agarwal/ APH Publishing
4. Diesel engine operation manual /V.L. Maleev/CBS Pub
5. Engine emission /Springer and Patterson/Plenum Press
6. Internal Combustion Engines /Heins Aeisth /SAE Publications.

Course outcome: The students completing this course will be in a position to derive various measures to be taken to reduce the exhaust gas pollutants coming out of automobiles to meet the laws and regulations in practice.

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III Year - II Semester		L	T	P	C
		0	0	3	1.5
AUTOMOTIVE ELECTRICAL AND ELECTRONICS LAB					

Note :Any 5 Experiments from each stream and rest can be considered as extra experiments

Automotive Electrical

1. Experiment on testing and study of different types of Batteries and constructions.
2. Testing, dismantling and assembling of starter motor used in automobile.
3. Testing, dismantling and assembling of alternator used in automobile.
4. Study of different colour code system used in automotive wiring system.
5. Demonstration and study of Battery Ignition System and their parts used in Automobile Vehicles.
6. Study of different Electrical Equipment's & Accessories (Speedometer, Warning lights, Electric Horn, Wind shield wipers system).
7. Study of different sensor used in modern automotive system.
8. Study of various electronics system (Electronic fuel injection system, Electronic ignition system, Air bag, ABS, Electronic fuel injector cleaner).
9. Demonstration and experiment on lighting system of two wheeler and Four Wheeler.
10. Demonstration, experiment and diagnosis on ignition system.

Automotive Electronics:

1. Verification of truth table of Logic Gates.
2. Verification of truth table of Adder, Subtractor & Flip-Flops.
3. Characteristics of rectifiers – Half wave & Full wave.
4. Timer – 555
5. Characteristics of SCR.
6. D/A and A/D converters.
7. Interfacing stepper motor control and CRT terminal
8. Assembly language programming exercise.
9. Interfacing A/D converter and simple data acquisition
10. Microcontroller Programming and Interfacing
11. EPROM Interfacing

Text Books:

Allan Bonnick, *"Automotive Computer Controlled Systems"*, 2011.

Tom Weather Jr and ClandC.Hunter, *"Automotive Computers and ControlSystem"*, Prentice Hall Inc., New Jersey.

Young A. P & Griffiths L, *"Automobile Electrical and Electronic Equipments"*, English Languages Book Society & New Press, 1990

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Reference Books:

Santini Al, *"Automotive Electricity and Electronics"*, Cengage Learning, 2012.

Tom Denton, *"Automotive Electrical and Electronic System"*, SAE International, 2004.

William B. Ribbens, *"Understanding Automotive Electronics"*, 6th Edition, Newnes, 2003.

BOSCH, *"Automotive Handbook"*, 8th Edition, BENTLEY ROBERT Incorporated, 2011.

Norm Chapman, *"Principles of Electricity and electronics for the Automotive Technician"*, Delmar Cengage Learning, 2008.

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

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III Year - II Semester		L	T	P	C
		0	0	3	1.5
METROLOGY AND MACHINE TOOLS LAB					

Note: minimum of 6 experiments from each section

Course Objective: This practical course covers the topics related to precession measuring instruments and the working and operations of various machine tools.

Section-I
METROLOGY LAB

1. Measurement of lengths, heights, diameters by vernier calipers, micrometers etc.
2. Measurement of bores by internal micrometers and dial bore indicators.
3. Use of gear tooth vernier calipers and checking the chordal thickness of spur gear.
4. Machine tool alignment test on the lathe.
5. Machine tool alignment test on milling machine.
6. Angle and taper measurements by bevel protractor, Sine bars, etc.
7. Use of spirit level in finding the straightness of a bed and flatness of a surface.
8. Thread measurement by two wire/ three wire method & tool makers microscope.
9. Surface roughness measurement by Talysurf.

Section-II
MACHINE TOOLS LAB

1. Introduction of general purpose machines -lathe, drilling machine, milling machine, shaper, planing machine, slotting machine, cylindrical grinder, surface grinder and tool and cutter grinder.
2. Step turning and taper turning on lathe machine
3. Thread cutting and knurling on -lathe machine.
4. Drilling and tapping
5. Shaping and planning
6. Slotting
7. Milling
8. Cylindrical surface grinding
9. Grinding of tool angles.

Course Outcome: After completing the course the student will be able to operate various precession measuring instruments and working and operations of various machines tools.

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III Year - II Semester		L	T	P	C
		0	0	3	1.5
AUTO SCANNING & VEHICLE TESTING LAB					

OBJECTIVE: To impart to the learner the skills to analyze engine and to study its performance, wheel balancing and alignment machines. Further to scan the automobile in all aspects for correct diagnosis.

1. Computerized engine analyzer study and practice.
2. Computerized wheel balancing machine study and practice.
3. Computerized wheel alignment machine study and practice.
4. Two wheeler chassis dynamometer study and practice
6. Study of wind tunnel -determining of coeff of drag for a given aerofoil .
7. Road worthiness test a) Acceleration b) Gradability c) Maximum speed d) Constant speed fuel consumption (High way drive) e) city drive fuel consumption tests.
8. Head light focusing test.
9. Visibility test .
10. Braking distance test .
11. Drawings of automobile bodies -light and heavy vehicles for different seating capacities .
12. Dimensional drawings of bus depots and service station workshop layouts.

Course outcomes: The students completing the course will be able to understand *automotive scan* tools and diagnostic equipment for fault diagnosis and troubleshooting any problem arises in automobile

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		L	T	P	C
III Year - II Semester		**0**	**0**	**60 hrs**	**1**
SUMMER INTERNSHIP/ SKILL DEVELOPMENT					

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III Year - II Semester		L	T	P	C
		0	3	0	0
PROFESSIONAL ETHICS AND HUMAN VALUES					

Course Objectives:

***To give basic insights and inputs to the student to inculcate Human values to grow as a responsible human beings with proper personality.**

***Professional Ethics instills the student to maintain ethical conduct and discharge their professional duties.**

UNIT I: Human Values:

Morals, Values and Ethics – Integrity –Trustworthiness - Work Ethics – Service Learning – Civic Virtue – Respect for others – Living Peacefully – Caring – Sharing – Honesty –Courage – Value Time – Co-operation – Commitment – Empathy – Self-confidence – Spirituality- Character.

UNIT: II: Principles for Harmony:

Truthfulness – Customs and Traditions -Value Education – Human Dignity – Human Rights – Fundamental Duties - Aspirations and Harmony (I, We & Nature) – Gender Bias - Emotional Intelligence – Salovey – Mayer Model – Emotional Competencies – Conscientiousness.

UNIT III: Engineering Ethics and Social Experimentation:

History of Ethics - Need of Engineering Ethics - Senses of Engineering Ethics- Profession and Professionalism —Self Interest - Moral Autonomy – Utilitarianism – Virtue Theory - Uses of Ethical Theories - Deontology- Types of Inquiry –Kohlberg's Theory - Gilligan's Argument –Heinz's Dilemma - Comparison with Standard Experiments — Learning from the Past –Engineers as Managers – Consultants and Leaders – Balanced Outlook on Law - Role of Codes – Codes and Experimental Nature of Engineering.

UNIT IV: Engineers' Responsibilities towards Safety and Risk:

Concept of Safety - Safety and Risk – Types of Risks – Voluntary v/sInvoluntary Risk – Consequences - Risk Assessment – Accountability – Liability - Reversible Effects - Threshold Levels of Risk - Delayed v/sImmediate Risk - Safety and the Engineer – Designing for Safety – Risk-Benefit Analysis-Accidents.

UNIT V: Engineers' Duties and Rights:

Concept of Duty - Professional Duties – Collegiality - Techniques for Achieving Collegiality – Senses of Loyalty - Consensus and Controversy - Professional and Individual Rights –Confidential and Proprietary Information - Conflict of Interest-Ethical egoism - Collective Bargaining – Confidentiality - Gifts and Bribes - Problem solving-Occupational Crimes- Industrial Espionage- Price Fixing-Whistle Blowing.

Global Issues:

Globalization and MNCs –Cross Culture Issues - Business Ethics – Media Ethics - Environmental Ethics – Endangering Lives - Bio Ethics - Computer Ethics - War Ethics – Research Ethics -Intellectual Property Rights.

- Related Cases Shall be dealt where ever necessary.

References:

1. Professional Ethics by R. Subramaniam – Oxford Publications, New Delhi.
2. Ethics in Engineering by Mike W. Martin and Roland Schinzinger - Tata McGraw-Hill – 2003.
3. Professional Ethics and Morals by Prof.A.R.Aryasri, DharanikotaSuyodhana - Maruthi Publications.
4. Engineering Ethics by Harris, Pritchard and Rabins, Cengage Learning, New Delhi.
5. Human Values & Professional Ethics by S. B. Gogate, Vikas Publishing House Pvt. Ltd., Noida.
6. Engineering Ethics & Human Values by M.Govindarajan, S.Natarajan and V.S.SenthilKumar-PHI Learning Pvt. Ltd – 2009.
7. Professional Ethics and Human Values by A. Alavudeen, R.Kalil Rahman and M. Jayakumaran – University Science Press.
8. Professional Ethics and Human Values by Prof.D.R.Kiran-Tata McGraw-Hill - 2013
9. Human Values And Professional Ethics by Jayshree Suresh and B. S. Raghavan, S.Chand Publications

Outcome:

***It gives a comprehensive understanding of a variety issues that are encountered by every professional in discharging professional duties.**

***It provides the student the sensitivity and global outlook in the contemporary world to fulfill the professional obligations effectively.**

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IV Year - I Semester		L	T	P	C
		3	0	0	0
INDUSTRIAL ENGINEERING AND MANAGEMENT					

Course Objectives:

1. To impart fundamental knowledge and skill sets required in the Industrial Management and Engineering profession, which include the ability to apply basic knowledge of mathematics, probability and statistics, and the domain knowledge of Industrial Management and Engineering
2. To produce graduates with the ability to adopt a system approach to design, develop, implement and innovate integrated systems that include people, materials, information, equipment and energy.
3. To enable students to understand the interactions between engineering, business, technological and environmental spheres in the modern society.
4. To enable students to understand their role as engineers and their impact to society at the national and global context.

Unit – I

INTRODUCTION: Definition of industrial engineering (I.E), development, applications, role of an industrial engineer, differences between production management and industrial engineering, quantitative tools of IE and productivity measurement. concepts of management, importance, functions of management, scientific management, Taylor's principles, theory X and theory Y, Fayol's principles of management.

Unit – II

PLANT LAYOUT: Factors governing plant location, types of production layouts, advantages and disadvantages of process layout and product layout, applications, quantitative techniques for optimal design of layouts, plant maintenance, preventive and breakdown maintenance.

Unit – III

OPERATIONS MANAGEMENT: Importance, types of production, applications, workstudy, method study and time study, work sampling, PMTS, micro-motion study, rating techniques, MTM, work factor system, principles of Ergonomics, flow process charts, string diagrams and Therbligs,

Unit – IV

STATISTICAL QUALITY CONTROL: Quality control, its importance, SQC, attribute sampling inspection with single and double sampling, Control charts – $\overline{X}$ and R – charts $\overline{X}$ AND *S* charts and their applications, numerical examples.

TOTAL QUALITY MANAGEMENT: zero defect concept, quality circles, implementation, applications, ISO quality systems. six sigma – definition, basic concepts

Unit – V

RESOURCE MANAGEMENT: Concept of human resource management, personnel management and industrial relations, functions of personnel management, Job-evaluation, its importance and types, merit rating, quantitative methods, wage incentive plans, types.

Unit - VI

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VALUE ANALYSIS: Value engineering, implementation procedure, enterprise resource planning and supply chain management.
PROJECT MANAGEMENT: PERT, CPM – differences & applications, critical path, determination of floats, importance, project crashing, smoothing and numerical examples.

TEXT BOOKS:

1. Industrial Engineering and management / O.P Khanna/Khanna Publishers.
2. Industrial Engineering and Production Management/Martand Telsang/S.Chand & Company Ltd. New Delhi

REFERENCE BOOKS:

1. Industrial Management / Bhattacharya DK/Vikas publishers
2. Operations Management / J.G Monks/McGrawHill Publishers.
3. Industrial Engineering and Management Science/ T. R. Banga, S. C. Sharma, N. K. Agarwal/Khanna Publishers
4. Principles of Management /Koontz O' Donnel/McGraw Hill Publishers.
5. Statistical Quality Control /Gupta/Khanna Publishers
6. Industrial Engineering and Management /NVS Raju/Cengage Publishers

COURSE OUTCOME:

Upon successful completion of this course you should be able to:

1. Design and conduct experiments, analyse, interpret data and synthesise valid conclusions
2. Design a system, component, or process, and synthesise solutions to achieve desired needs
3. Use the techniques, skills, and modern engineering tools necessary for engineering practice with appropriate considerations for public health and safety, cultural, societal, and environmental constraints
4. Function effectively within multi-disciplinary teams and understand the fundamental precepts of effective project management

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IV Year - I Semester		L	T	P	C
		3	0	0	3
VEHICLE DYNAMICS					

UNIT I

Introduction: Hypothetical vehicle control loop, Fundamental Approach, Vehicle coordinates, motion variables. Forces – Dynamic axle loads, Static loads on level ground, aerodynamic forces on body, hitch forces – problems

UNIT-II

Acceleration & Braking Performance – Power limited acceleration, Static loads on level ground, aerodynamic forces on body, Fundamental Expressions, Constant retardation, Wind Resistance, Power, Braking forces, Brakes: disc and drum, front, rear and four wheel braking,
Road friction rolling resistance, problems.

UNIT-III

Road Loads: Aerodynamic, Mechanics of pressure distribution – Aerodynamic forces: lift & drag, Spoilers, Lift force, side force and roll, pitch and yaw moments, Crosswind sensitivity. Rolling Resistance, Factors affecting pressure, velocity, slip temperature, etc – Total road loads – Fuel Economy Effects.

UNIT-IV

Ride: Excitation sources – road roughness, wheel assembly, driveline excitation, engine transmission. Vehicle response properties: Suspension isolation, suspension stiffness & damping Wheel Hop Resonance. Road-tyre friction – dynamic response of tires – Rigid body
bounce, pitch motion.Perception of ride and other vibration forms, Problems.

UNIT-V

Steady – State Cornering: Introduction, Low and high speed turning –Tire cornering forces,
governing expressions, understeer gradient, oversteer and nutral conditions. Characteristic speed, critical speed, yaw velocity gain, sideslip angle, static margin. Suspension effects on cornering: roll moment distribution – effect of tractive forces on cornering – Problems

TEXT BOOKS:

1. Thomas D.Gillespie, " Fundamentals of Vehicle dynamics." Society of Automotive engineers Inc, 2014
2. Wong H, Theory of Ground Vehicles, McGraw Hill, Second edition, 2006.

REFERENCES:

1. Hans B Pacejka, Tire and Vehicle Dynamics,3rd Edition, Elsevier Ltd., 2012.
2. Amitosh D, Vehicle Dynamics, Galgotia Book Ltd., 2010.
3. Rao V Dukkipati, Road Vehicle Dynamics,Springer 2008
4. Werner and Karl, Ground Vehicle Dynamics,Springer Berlin Heidelberg, 2008.

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COURSE OUTCOMES:

CO1 Understand the principles underlying the development and design of road vehicles under the influence of dynamic loads.
CO2 Analyze the performance and establish the design specifications for the acceleration and braking conditions.
CO3 Model, simulate and analyze the conventional road vehicles for better ride comfort.
CO4 Analyze the cornering forces and effects of tractive forces on cornering
CO5 Design suspension systems for better damping and comfort

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IV Year - I Semester		L	T	P	C
		3	0	0	3
VEHICLE BODY ENGINEERING					

Car Body Details
Types: Saloon, Convertibles, Limousine, Estate Car, Racing and Sports Car. Visibility: Regulations, Driver's Visibility, Tests for Visibility, Methods of Improving Visibility and Space in Cars. Safety: Safety Design, Safety Equipments for Cars. Car Body Construction; Design Criteria, Prototype Making, Initial Tests, Crash Tests on Full Scale Model, Dummies and Instrumentation

Vehicle Aerodynamics
Objectives. Vehicle Drag and Types; Various Types of Forces and Moments, Effects of Forces and Moments, Side Wind Effects on Forces and Moments, Various Body Optimization Techniques for Minimum Drag, Wind Tunnel Testing: Flow Visualization Techniques, Scale Model Testing, Component Balance to Measure Forces and Moments.

Bus Body Details
Types: Mini Bus, Single Decker, Double-Decker, Two Level and Articulated Bus. Bus Body Layout; Floor Height, Engine Location, Entrance and Exit Location, Seating Dimensions. Constructional Details: Frame Construction, Double Skin Construction, Types of Metal Sections used, Regulations, Conventional and Integral Type Construction.

Commercial Vehicle Details
Types of Body; Flat Platform, Drop Side, Fixed Side, Tipper Body, Tanker Body, Light Commercial Vehicle Body Types. Dimensions of Driver's Seat Relation to Controls. Drivers Cab Design.

Body Materials, Trim and Mechanisms
Steel Sheet, Timber, Plastic, Grp, Properties of Materials; Corrosion, Anticorrosion Methods. Selection of Paint and Painting Process. Body Trim Items. Body Mechanisms

Text Books

1. James E Duffy, "Modern Automotive Technology", Goodheart-Willcox; Seventh Edition, 2011
2. Jack Erjavec, "Automotive Techology – A systems approach", Cengage Learning, 2009,

Reference Books:

1. Geoff Davies, Materials for Automotive Bodies, Elsevier, Butterworth Heinemann, ISBN 0 7506 5692 1, 2003
2. Body Engineering , S. F. Page
3. Automotive Chassis – P.M. Heldt, Chilton & Co. 1952

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		3	0	0	3

ALTERNATIVE ENERGY SOURCES FOR AUTOMOBILES

Course Objectives: To impart the necessity of finding alternative energy sources for automobiles. To understand merits and demerits, performance characteristics of various sources of fuels and their comparison.

UNIT I
CONVENTIONAL FUELS FOR I.C. ENGINES

Petroleum based conventional fuels for SI and CI engine, Demand and Availability of crude oil – vehicle population increase – national and international standards for conventional and alternative fuels.
Desirable characteristics of SI Engine fuels – Petrol – Properties, Specification, chemical structure, Volatility characteristics, knock rating and additives. Desirable characteristics of CI Engine fuels – Diesel – Properties, Specification, chemical structure, Ignition quality, Cetane rating and additives.

UNIT II
ALCOHOLS AS FUELS

Availability of different alternative fuels for engines. Alcohols – Properties, Production methods and usage in engines. Blending, dual fuel operation, surface ignition, spark ignition and oxygenated additives. Performance, combustion and emission Characteristics in engines. Advantages and disadvantages of alcohol fuels

UNIT III
VEGETABLE OILS AND BIODIESEL AS FUELS

Properties of Vegetable oils and biodiesel- Methods of using vegetable oils – Blending, preheating, and emulsification – Preparation of biodiesel from non-edible, edible oil and Algae - Performance, combustion and emission Characteristics in diesel engines. Advantages and disadvantages of Vegetable oils and biodiesel

UNIT IV
HYDROGEN AS FUEL

Hydrogen – Properties, Production methods, storage and safety aspects. Issues & limitation in Hydrogen. Methods of using hydrogen in engines. Performance, combustion and emission Characteristics in engines. Advantages and disadvantages of Hydrogen fuel.

UNIT V
BIOGAS, CNG AND LPG AS FUELS

Biogas, Compressed Natural gas (CNG) and LPG – Properties and production methods. CO2 and H2S scrubbing in Biogas, Modifications required for use in Engines- Performance, combustion and emission Characteristics in engines. Advantages and disadvantages of Gaseous fuels. Working of LPG and CNG kits used in automotive engines.

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REFERENCES

1. Arumugam S. Ramadhas, "Alternative Fuels for Transportation" CRC Press, 2011.
2. Ayhan Demirbas and M. Fatih Demirbas, "Algae Energy-Algae as a New Source of Biodiesel", Springer-Verlag London Limited 2010.
3. Ayhan Demirbas, 'Biodiesel A Realistic Fuel Alternative for Diesel Engines', Springer-Verlag London Limited 2008
4. David M. Mousdale, "Introduction to Biofuels", CRC Press, 2015.
5. Ganesan.V., "Internal Combustion Engineering", Tata McGraw-Hill Publishing Co., New Delhi, 2003.
6. Gerhard Knothe, Jon Van Gerpen, Jargon Krahl, The Biodiesel Handbook, AOCS Press Champaign, Illinois 2005.
7. M. K. Gajendra Babu and K. A. Subramanian, "Alternative Transportation Fuels-Utilisation in Combustion Engines", CRC Press, 2013.
8. M.L. Mathur, R.P.Sharma "A course in internal combustion engines", Dhanpatrai publication, 2003.
9. Richard L Bechtold P.E., Alternative Fuels Guide book, Society of Automotive Engineers, 1997 ISBN 0-76-80-0052-1.

OUTCOMES:

By the end of this course, students will be able to

1. Student will possess a comprehensive understanding of available alternative fuels for IC engines. They will posses complete knowledge on producing different biofuels, modifying them and using them in IC engines
2. Students will acquire the skills in developing new technologies for alternative fuels efficiently in IC engines.
3. Students will demonstrate the importance of using alternative fuels for sustainable energy supply and for emission control in IC engines.

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		3	0	0	3
CAD/CAM (ELECTIVE –I)					

Course Objectives:

The general objectives of the course are to enable the students to

1. Understand the basic fundamentals of computer aided design and manufacturing.
2. To learn 2D & 3D transformations of the basic entities like line, circle, ellipse etc
3. To understand the different geometric modeling techniques like solid modeling, surface modeling, feature based modeling etc. and to visualize how the components look like before its manufacturing or fabrication
4. To learn the part programming, importance of group technology, computer aided process planning, computer aided quality control
5. To learn the overall configuration and elements of computer integrated manufacturing systems.

UNIT – I

Introduction to CAD/CAM, product cycle, CAD / CAM Hardware, basic structure.

COMPUTER GRAPHICS: Raster scan graphics coordinate system, database structure for graphics modeling, transformation of geometry, 2D and 3D transformations, mathematics of projections, clipping, hidden surface removal.

UNIT – II

GEOMETRIC MODELING: Requirements, geometric models, geometric construction models, curve representation methods,parametric representation of various curves:cubic spline, bezier curves. surface representation methods, Solid modelling.

UNIT – III

PART PROGRAMMING FOR NC MACHINES: NC, NC modes, NC elements, CNC machine tools, structure of CNC machine tools, features of Machining center, turning center, CNC Part Programming: fundamentals, manual part programming methods, Computer Aided Part Programming. Direct Numerical Control, Adaptive Control.

UNIT – IV

GROUP TECHNOLOGY: Part family, coding and classification, production flow analysis, types and advantages. Computer aided processes planning – importance, types. FMS-Introduction, Equipment, Tool management systems, Layouts, FMS Control

UNIT – V

COMPUTER INTEGRATED MANUFACTURING SYSTEMS: Types of manufacturing systems, machine tools and related equipment, material handling systems, material requirement planning, computer control systems, human labor in manufacturing systems, CIMS benefits.

COMPUTER AIDED QUALITY CONTROL: Terminology used in quality control, use of computers in Quality control. Inspection methods- contact and noncontact types, computer aided testing, integration of CAQC with CAD/CAM.

TEXT BOOKS:

1. CAD / CAM Principles and Applications/PN Rao / McGraw-Hill
2. Automation, Production systems & Computer integrated Manufacturing/ M.P. Groover/Pearson Education

REFERENCES:

1. Mastering CAD / CAM / Ibrahim Zeid / McGraw-Hill
2. Principles of Computer Aided Design and Manufacturing / Farid Amirouche / Pearson
3. Computer Numerical Control Concepts and programming / Warren S Seames / Thomson learning, Inc
4. Product manufacturing and cost estimation using CAD/CAE/ Kuang Hua Chang/Elsevier Publishers

Course Outcomes:

At the end of the course the students shall be able to:

1. Describe the mathematical basis in the technique of representation of geometric entities including points, lines, and parametric curves, surfaces and solid, and the technique of transformation of geometric entities using transformation matrix
2. Describe the use of GT and CAPP for the product development
3. Identify the various elements and their activities in the Computer Integrated Manufacturing Systems.

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		3	0	0	3
TWO AND THREE WHEELERS (ELECTIVE –I)					

OBJECTIVES:
The objective of this course is to make the students to know and understand the constructional details, operating characteristics and design aspects of Two and
Three wheelers.

UNIT I INTRODUCTION
Classifications- design considerations –weight and dimension limitations – requirements, stability problems, gyroscopic effect- pendulum effect of two and three wheelers.

UNIT II POWER UNITS, IGNITION SYSTEMS ELECTRICAL & BRAKING SYSTEMS
2 stoke and 4 stoke engines. Design criteria for engines – design of cylinders, cylinder head, cooling fins, crank case, connecting rod and crank shaft. Carburettor types and design. Wiring layout for two wheelers. Braking system in two wheelers.

UNIT III CLUTCHES AND TRANSMISSION
Types of clutches. Design of clutch system. Gears for two and three wheelers. Design of gear box and gear change mechanism. Belt, chain and shaft drive. Free wheeling devices, starting systems.

UNIT IV FRAMES, SUSPENSION, WHEELS AND TYRES
Types of frames. Wheel frames- construction design of frames for fatigue strength, torsional stiffness and lateral stability. Front and rear forks. Springs for suspension, Dampers, constructional details of wheel and tyres.

UNIT V THREE WHEELERS
Auto rickshaws, different types, Pick-Ups and delivery type vehicle, frames and transmission, wheel types, wheel mountings attachment, tyre types. Brake systems.

REFERENCES

1. 'Cycle Motor Manual', Templeton Press Ltd., London, 1992.
2. Irving P.E., "Motor Cycle Engineering", Temple Press Book, London, 1964
3. Johns.B.A., 'Motorcycles', Good Heartwill, 1984.
4. M.M.Griffin., 'Motor cycles from inside and outside', Prentice Hall Inc, New Jersey, 1978.
5. Marshal Cavandedish, 'Encyclopedia of Motor cycling', New York, 1989
6. Servicing Manuals- various motor cycles, Scooters, Mopeds and three wheelers.
7. Srinivasan.S., 'Motor cycle, Scooter, Mopeds', New century book house, 1988

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OUTCOMES:

To students will have the basic knowledge on various two wheelers and its technology along with its functions. At the end of the course the students will have through knowledge over different frames, suspension system and transmission unit used on various two and three wheeler vehicles

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		3	0	0	3
AUTOMOTIVE AERO DYNAMICS (ELECTIVE –I)					

Unit 1 – Fundamentals of Aerodynamics

Scope – Development trends – Flow phenomena related to vehicles – External and Internal flow problems – Performance of cars and light vans – Resistance to vehicle motion – Drag – Types of drag – Flow field around car – Aerodynamic development of cars – Optimization of car bodies for low drag

Unit 2 - Stability, Safety and Comfort

The origin of forces and moments – effects – vehicle dynamics under side wind – Force and Moment coefficients – Safety limit – dirt accumulation on vehicle – wind noise – Air flow around individual components – High performance vehicles – Very log drag cars – Design alternatives – High efficiency radiator arrangement – Development and simulation methods

Unit 3 - Wind Tunnels and Test Techniques

Principles of wind technology – Limitations of simulation – Scale models – Existing automobile wind tunnels – Climatic tunnels – Measuring equipment and transducers. Pressure measurement – velocity measurements – Flow visualization techniques – Road testing methods – Wind noise measurements

Unit 4 - Application of CFD

Methods to solve Navier–Stokes equation – Forces acting in a fluid element – Compressibility effects in a flow field – Inviscid flow – Governing equations – Irrotation flow field and consequences – Potential flows – Boundary layer methods – Numerical modeling of fluid flow around vehicle body

Unit 5 – Aerodynamic Design

Development and simulation methods –cars, buses, trucks

Text Book:

Yomi Obidi, 'Theory and Applications of Aerodynamics for Ground Vehicles', SAE Publications, 2014

References

1. W.H. Hucho, 'Aerodynamics of Road Vehicles', SAE Publications, 4th edition 1998.
2. R.McCallen, Browand, Ross, "The Aerodynamics of Heavy Vehicles", Springer, 2004
3. Smits, Lim, "Flow Visualization: Techniques and Examples", 2nd Edition, Imperial College, 2012
4. Schlichting, H, Kirsten K. 'Boundary Layer Theory', Springer, 2000.

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IV Year - I Semester		L	T	P	C
		3	0	0	3
FINITE ELEMENT METHODS (ELECTIVE –I)					

Course Objectives:

1. To learn basic principles of finite element analysis procedure
2. To learn the theory and characteristics of finite elements that represent engineering structures
3. To learn and apply finite element solutions to structural, thermal and dynamic problems.
4. Learn to model complex geometry problems and solution techniques.

UNIT-I

Introduction to finite element method, stress and equilibrium, strain – displacement relations, stress – strain relations, plane stress and plane strain conditions, variational and weighted residual methods, concept of potential energy, one dimensional problems.

Discretization of domain, element shapes, discretization procedures, assembly of stiffness matrix, band width, node numbering, mesh generation, interpolation functions, local and global coordinates, convergence requirements, treatment of boundary conditions.

UNIT – II

Analysis of Trusses: Finite element modeling, coordinates and shape functions, assembly of global stiffness matrix and load vector, finite element equations, treatment of boundary conditions, stress, strain and support reaction calculations.

Analysis of Beams: Element stiffness matrix for Hermite beam element, derivation of load vector for concentrated and UDL, simple problems on beams.

UNIT – III

Finite element modeling of two dimensional stress analysis with constant strain triangles and treatment of boundary conditions, formulation of axisymmetric problems.

UNIT-IV

Higher order and isoparametric elements: One dimensional quadratic and cubic elements in natural coordinates, two dimensional four noded isoparametric elements and numerical integration.

UNIT – V

Steady state heat transfer analysis : one dimensional analysis of a fin and two dimensional analysis of thin plate, analysis of a uniform shaft subjected to torsion. Dynamic Analysis: Formulation of finite element model, element consistent and lumped mass matrices, evaluation of eigen values and eigen vectors, free vibration analysis.

TEXT BOOKS:

1. The Finite Element Methods in Engineering / SS Rao / Pergamon.
2. Introduction to Finite Elements in Engineering/ Tirupathi R. Chandrupatla, Ashok D.Belegundu, Pearson Publishers.

References:

1. Finite Element Method with applications in Engineering / YM Desai, Eldho & Shah /Pearson publishers
2. An introduction to Finite Element Method / JN Reddy / McGraw Hill
3. The Finite Element Method for Engineers – Kenneth H. Huebner, Donald L. Dewhirst, Douglas E. Smith and Ted G. Byrom / John Wiley & sons (ASIA) Pte Ltd.

Course outcomes:

Upon successful completion of this course you should be able to:

1. Understand the concepts behind variational methods and weighted residual methods in FEM
2. Identify the application and characteristics of FEA elements such as bars, beams, plane and isoparametric elements, and 3-D element .
3. Develop element characteristic equation procedure and generate global equations.
4. Able to apply Suitable boundary conditions to global equations, and reduce it to a solvable form.
5. Able to apply the FE procedure to field problems like heat transfer.

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		3	0	0	3
VEHICLE INFOTRONICS (ELECTIVE –I)					

Overview of Infotronics:
Concept of Infotronics, Web-enabled Vs Web Based systems, Applications of Infotronics, Vehicle buses and protocols – LIN, CAN, MOST &Flexray.

Systems in vehicle:
Smart control of Vehicle[ESP] dynamics, drive Electronic Throttle control by wire, active suspensions/mounting system, Automated Guided Vehicles(AGV), Multi-disciplinary optimization in Vehicles (MDO) and advanced propulsion systems(APS), Radio Communication Technologies For Vehicle Information Systems, IEEE 802.11 and DSRC.

Telematics:
Global positioning systems, geographical information systems, navigation systems, automotive vision system, road recognition, driver assistance systems.

Intelligent vehicle Control
Active and Semi active suspensions/Mounts for NVH, Optimization and stability of Hydraulic Engine mounts and Bushing in Vehicle, Rollover control and Active stability control, combined control of ride comfort in passenger cars, Active Roll over control in hydraulically actuated articulated vehicles, intelligent drive by wire vehicles, Design and realization of seer and brake by wire. Electric and hybrid vehicle - Requirements, Introduction, characteristics, different types and Design.

Adaptive Control System
Conventional control schemes, system model for adaptive control, Design of self-tuning controllers, ACC overview, system based on ACC, Stop and Go, Anti- collision system, Impact of ACC on traffic and drivers, Adaptive noise control, automatic and adaptive control of highway traffic and moving vehicles. Power steering and power window: Requirements, Introduction, characteristics.

TEXT BOOKS:

1. Intelligent Vehicle Technology by L VlACIC, M PARENT, F HARA, Butterworth-Heinemann publication.
2. Navigation and Intelligent transportation systems By Ronald K. Jurgen, SAE.

REFERENCE BOOKS:

1. Robert Bosch, Automotive Hand Book by SAE
2. Understanding Automotive Electronics by Willam B. Ribbens, SAE
3. Understanding Automotive Electronics by Bechhold, SAE.

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		3	0	0	3
MECHATRONICS (ELECTIVE –II)					

Course Objective

The main objective of this course is to introduce the integrative nature of Mechatronics. To describe the different components and devices of mechatronics systems.

UNIT-I

Mechatronics systems – elements & levels of mechatronics system, Mechatronics design process, system, measurement systems, control systems, microprocessor-based controllers, advantages and disadvantages of mechatronics systems. Sensors and transducers, types, displacement, position, proximity, velocity, motion, force, acceleration, torque, fluid pressure, liquid flow, liquid level, temperature and light sensors.

UNIT-II

Hydraulic and pneumatic actuating systems - Fluid systems, Hydraulic systems, and pneumatic systems, components, control valves, electro-pneumatic, hydro-pneumatic, electro-hydraulic servo systems. Mechanical actuating systems and electrical actuating systems – basic principles and elements.

UNIT-III

Digital electronics and systems, digital logic control, micro processors and micro controllers, programming, process controllers, programmable logic controllers, PLCs versus computers, application of PLCs for control.

UNIT-IV

System and interfacing and data acquisition – Data Acquisition Systems, Analog to Digital and Digital to Analog conversions; Digital Signal Processing – data flow in DSPs, block diagrams, typical layouts, Interfacing motor drives.

UNIT-V

Dynamic models and analogies, System response. Process Controllers – Digital Controllers, Programmable Logic Controllers, Design of mechatronics systems & future trends.

TEXT BOOKS:

1. MECHATRONICS Integrated Mechanical Electronics Systems/KP Ramachandran, GK Vijaya Raghavan & MS Balasundaram/WILEY India Edition

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REFERENCES:

1. Mechatronics /Smaili A, Mrad F/ Oxford Higher Education, Oxford University Press
2. Mechatronics Source Book / Newton C Braga/Thomson Publications,Chennai.
3. Mechatronics – N. Shanmugam / Anuradha Agencies Publishers.
4. Mechatronics System Design / Devdas shetty/Richard/Thomson.
5. Mechatronics/M.D.Singh/J.G.Joshi/PHI.
6. Mechatronics – Electronic Control Systems in Mechanical and Electrical Engg. 4th Edition / W. Bolton/ Pearson, 2012
7. Mechatronics – Principles and Application / Godfrey C. Onwubolu/Elsevier, Indian print

COURSE OUTCOMES:

After completion of this course, the student shall be able to use the various mechatronics systems devices and components in the design of electro mechanical systems.

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		3	0	0	3
COMPUTATIONAL FLUID DYNAMICS (ELECTIVE –II)					

Course Objectives:
The course aims at providing required numerical and software techniques for solving various engineering problems involving fluid flow.

UNIT-I
Number system and errors, representation of integers, fractions, floating point arithmetic, loss of significance and error propagation, condition and instability, computational methods for error estimation, convergence of sequences.
Solution of a system of simultaneous linear algebraic equations, iterative schemes of matrix inversion, direct methods for matrix inversion, direct methods for banded matrices.

UNIT-II
conservation of mass, Newton's second law of motion, expanded forms of navier-stokes equations, conservation of energy principle, special forms of the Navier-stokes equations.
Steady flow, dimensionless form of momentum and energy equations, stokes equation, conservative body force fields, stream function - vorticity formulation.

UNIT-III
Finite difference applications in heat conduction and convention – heat conduction, steady heat conduction in a rectangular geometry, transient heat conduction, finite difference application in convective heat transfer, closure.
Finite differences, discretization, consistency, stability, and fundamentals of fluid flow modelling: introduction, elementary finite difference quotients, implementation aspects of finite-difference equations, consistency, explicit and implicit methods.

UNIT –IV
Introduction to first order wave equation, stability of hyperbolic and elliptic equations, fundamentals of fluid flow modelling, conservative property, the upwind scheme.

UNIT –V
FINITE VOLUME METHOD: Approximation of surface integrals, volume integrals, interpolation and differentiation practices, upwind interpolation, linear interpolation and quadratic interpolation.

TEXT BOOKS:
1. Numerical heat transfer and fluid flow / Suhas V. Patankar/Butter-worth Publishers
2. Computational fluid dynamics - Basics with applications /John. D. Anderson / Mc Graw Hill.

REFERENCES:

1. Computational Fluid Flow and Heat Transfer/ Niyogi/Pearson Publications
2. Fundamentals of Computational Fluid Dynamics /Tapan K. Sengupta / Universities Press.
3.Computational fluid dynamics: An introduction, 3rd edition/John.F Wendt/Springer publishers

COURSE OUTCOMES:

After undergoing the course the student shall be able to apply various numerical tools like finite volume, finite difference etc for solving the different fluid flow heat transfer problems.

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		3	0	0	3
CONDITION MONITORING (ELECTIVE –II)					

UNIT – I

Introduction to maintenance and condition based maintenance, Definition, system approach, objectives, responsibilities of maintenance department, maintenance strategies, principles of maintenance, concepts of maintainability, availability and reliability, implementation of CBM, comparison of CBM with other maintenance techniques and case studies (overview). Introduction to condition monitoring,Basic concept, techniques - visual monitoring, temperature monitoring, vibration monitoring, lubricant monitoring, crack monitoring, thickness monitoring, noise and sound monitoring.

UNIT – II

Basic signal processing techniques Probability distribution and density, Fourier analysis, Hilbert Transform, Cepstrum analysis, Digital filtering, Deterministic / random signal separation, Time-frequency analysis. WaveletTransform Introduction to Wavelets, Continuous Wavelet Transform (CWT), Discrete WaveletTransform (DWT), Wavelet Packet Transform (WPT),types of wavelets –Haarwavelets, Shannon wavelets, Meyer wavelets, Daubechies wavelets, Coifmann wavelets and applications of wavelets.

UNIT - III

Vibration Monitoring,Introduction, vibration data collection, techniques, instruments, transducers, selection, measurement location, time domain analysis, frequency domain analysis, time-frequencydomain analysis and commonly witnessed machinery faults diagnosed by vibration analysis.
Rotating and reciprocating machines, Vibration signals from rotating and reciprocating machines – signal classification, signals,generated by rotating machines, signals generated by reciprocating machines.

UNIT – IV

Mechanical fault diagnosis,Wear monitoring and lubricant analysis - sources of contamination, techniques, Spectrometric, Oil Analysis Procedure (SOAP) and ferrography. Nondestructive testing techniques,Measurement of surface and subsurface flaws – liquid penetrant inspection, eddy current inspection, radiographic inspection, ultrasonic inspection.

UNIT – V

Condition monitoring of rolling element bearings and gear, Introduction, construction, types of faults, rolling element bearing diagnostics and gear diagnostics. Tool wear monitoring, Introduction, techniques and case studies.

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TEXT BOOKS:

1. Robert Bond Randall – Vibration-Based Condition Monitoring – Industrial, Aerospace and Automotive applications, John Wiley & Sons Ltd., 2011
2. R.A.Collacot – Mechanical Fault Diagnosis – Chapman and Hall Ltd., 1977.
3. ISTE Course material on Condition Monitoring.
4. R.C.Mishra, K.Pathak – Maintenance Engineering and Management, Prentice Hall of India Pvt. Ltd., 2002.
5. K. P. Soman, K. I. Ramachandran, N. G. Resmi – Insight into wavelet from theory to practice, Third Edition, Prentice Hall of India,

REFERENCES BOOKS:

1. John S.Mitchell, Introduction to Machinery Analysis and Monitoring, Penn Well Books,1993.
2. Elsevier-“Hand book of Condition Monitoring” ELSEVIER SCIENCE
3. R.A.Collacott, “Vibration monitoring and diagnosis”, Wiley,1979.
4. RaoJ.S.,“VibratoryConditionMonitoringofMachines”,CRCPress,2000.
5. “ConditionMonitoringmanual”,NationalProductivityCouncil,NewDelhi.

Course Outcomes:

At the end of this course the student shall be able to:

1. Understand the types of maintenance used and its significance, role of condition based maintenance in industries, familiarize with different condition monitoring techniques and its advantages in industries.
2. Implement the basic signal processing techniques.
3. Understand the role of vibration monitoring, its methodology and its use in condition monitoring of rotating and reciprocating machines.
4. Understand the significance of mechanical fault diagnosis and non-destructive testing techniques in monitoring and maintenance.
5. Study condition monitoring of rolling element bearing, gears and tool condition monitoring techniques in machining.

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		3	0	0	3

MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS
(ELECTIVE –II)

Course Objectives:

- The Learning objectives of this paper are to understand the concept and nature of Managerial Economics and its relationship with other disciplines and also to understand the Concept of Demand and Demand forecasting.
- To familiarize about the Production function, Input Output relationship, Cost-Output relationship and Cost-Volume-Profit Analysis.
- To understand the nature of markets, Methods of Pricing in the different market structures and to know the different forms of Business organization and the concept of Business Cycles.
- To learn different Accounting Systems, preparation of Financial Statement and uses of different tools for performance evaluation.
- Finally, it is also to understand the concept of Capital, Capital Budgeting and the techniques used to evaluate Capital Budgeting proposals.

Unit-I

Introduction to Managerial Economics and demand Analysis:

Definition of Managerial Economics –Scope of Managerial Economics and its relationship with other subjects – Concept of Demand, Types of Demand, Determinants of Demand- Demand schedule, Demand curve, Law of Demand and its limitations- Elasticity of Demand, Types of Elasticity of Demand and Measurement- Demand forecasting and Methods of forecasting, Concept of Supply and Law of Supply.

Unit – II:

Theories of Production and Cost Analyses:

Theories of Production function- Law of Variable proportions-Isoquants and Isocosts and choice of least cost factor combination-Concepts of Returns to scale and Economies of scale-Different cost concepts: opportunity costs, explicit and implicit costs-Fixed costs, Variable Costs and Total costs –Cost –Volume-Profit analysis-Determination of Breakeven point(problems)-Managerial significance and limitations of Breakeven point.

Unit – III:

Introduction to Markets, Theories of the Firm & Pricing Policies:

Market Structures: Perfect Competition, Monopoly, Monopolistic competition and Oligopoly – Features – Price and Output Determination – Managerial Theories of firm: Marris and Williamson's models – other Methods of Pricing: Average cost pricing, Limit Pricing, Market Skimming Pricing, Internet Pricing: (Flat Rate Pricing, Usage sensitive pricing) and Priority Pricing, Business Cycles : Meaning and Features – Phases of a Business Cycle. Features and Evaluation of Sole Trader, Partnership, Joint Stock Company – State/Public Enterprises and their forms.

Unit – IV:

Introduction to Accounting & Financing Analysis:

Introduction to Double Entry System, Journal, Ledger, Trail Balance and Preparation of Final Accounts with adjustments – Preparation of Financial Statements-Analysis and Interpretation of Financial Statements-Ratio Analysis – Preparation of Funds flow and cash flow analysis (Problems)

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Unit – V:

Capital and Capital Budgeting: Capital Budgeting: Meaning of Capital-Capitalization-Meaning of Capital Budgeting-Time value of money- Methods of appraising Project profitability: Traditional Methods(pay back period, accounting rate of return) and modern methods(Discounted cash flow method, Net Present Value method, Internal Rate of Return Method and Profitability Index)

Course Outcomes:

- The Learner is equipped with the knowledge of estimating the Demand and demand elasticities for a product.
- The knowledge of understanding of the Input-Output-Cost relationships and estimation of the least cost combination of inputs.
- The pupil is also ready to understand the nature of different markets and Price Output determination under various market conditions and also to have the knowledge of different Business Units.
- The Learner is able to prepare Financial Statements and the usage of various Accounting tools for Analysis.
- The Learner can able to evaluate various investment project proposals with the help of capital budgeting techniques for decision making.

TEXT BOOKS:

A R Aryasri, Managerial Economics and Financial Analysis, The McGraw – Hill companies.

REFERENCES:

1. Varshney R.L, K.L Maheswari, Managerial Economics, S. Chand & Company Ltd,
2. JL Pappas and EF Brigham, Managerial Economics, Holt, R & W; New edition edition
3. N.P Srinivasn and M. SakthivelMurugan, Accounting for Management, S. Chand & Company Ltd,
4. MaheswariS.N,AnIntroduction to Accountancy, Vikas Publishing House Pvt Ltd
5. I.M Pandey, Financial Management , Vikas Publishing House Pvt Ltd
6. V. Maheswari, Managerial Economics, S. Chand & Company Ltd,

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IV Year - I Semester		L	T	P	C
		3	0	0	3
INTERNET OF THINGS (ELECTIVE –II)					

UNIT I - Introduction to IoT

Internet of Things - Physical Design- Logical Design- IoT Enabling Technologies - IoT Levels & Deployment Templates - Domain Specific IoTs - IoT and M2M - IoT System Management with NETCONF-YANG- IoT Platforms Design Methodology

UNIT II - IoT Architecture

M2M high-level ETSI architecture - IETF architecture for IoT - OGC architecture - IoT reference model - Domain model - information model - functional model - communication model - IoT reference architecture

UNIT III - IoT Protocols

Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Unified Data Standards – Protocols – IEEE 802.15.4 – BACNet Protocol – Modbus– Zigbee Architecture – Network layer – 6LowPAN - CoAP – Security

UNIT IV - Building IoT with Raspberry PI & Arduino

Building IOT with RASPERRY PI- IoT Systems - Logical Design using Python – IoT Physical Devices & Endpoints - IoT Device -Building blocks -Raspberry Pi -Board - Linux on Raspberry Pi - Raspberry Pi Interfaces -Programming Raspberry Pi with Python - Other IoT Platforms - Arduino.

UNIT V - Case Studies And Real-World Applications

Biometric Car Door opening system, Accident monitoring system, Engine oil and Coolant level monitoring system, Fleet and Driver Management system, Smart road communication system, Road Vehicle communication at hilly areas, real time car telematics tracking system.

Text Books:

1. Rajesh Singh, Anita Gehlot et.al., - Internet of Things in Automotive Industries and Road Safety: Electronic Circuits, program Coding and Cloud Servers , River publishers, ISBN- 978-87-7022-010-1.
2. Arshdeep Bahga, Vijay Madisetti, ―Internet of Things – A hands-on approach, Universities Press, 2015

References:

1. Arshdeep Bahga, Vijay Madisetti, ―Internet of Things – A hands-on approach‖, Universities Press, 2015
2. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), ―Architecting the Internet of Things‖, Springer, 2011.
3. Honbo Zhou, ―The Internet of Things in the Cloud: A Middleware Perspective‖, CRC Press, 2012.
4. Olivier Hersent, David Boswarthick, Omar Elloumi , ―The Internet of Things – Key applications and Protocols, Wiley, 2012

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IV Year - I Semester		L	T	P	C
		0	0	0	2
VEHICLE DESIGN AND SIMULATION LAB					

PART-A - SIMULATION

LIST OF CHASSIS DESIGN EXPERIMENTS

1. Design and modeling of frame.
2. Design and Modeling of clutch assembly
3. Design and Modeling of constant mesh gearbox.
4. Design and Modeling of sliding mesh gearbox.
5. Design and Modeling of Propeller shaft with universal joint.
6. Design and Modeling of rear axle.
7. Design and Modeling of stub axle assembly.

Note: Preferably using software CATIA/UNIGRAPHICS/PROE or Equivalent licensed software

PART-B - COMPUTATIONAL

LIST OF EXPERIMENTS

1. FEATURES OF MATLAB
2. USES OF MATLAB
3. MATHEMATICAL PROBLEMS IN MATLAB
4. FORMULATION OF IDEAL AND REAL GAS PROBLEMS IN MATLAB PROGRAM.
5. DYNAMICS AND VIBRATION ANALYSIS-I IN MATLAB PROGRAM
6. THERMAL STRESS ANALYSIS OF PISTON-I IN MATLAB PROGRAM.
7. ANALYIS OF KINEMATICS IN FOUR BAR MECHANISM IN MATLAB PROGRAM.

Note: Preferably using MAT LAB or other licensed software

PART-C – ANALYTICAL DESIGN

LIST OF EXPERIMENTS

1. Design and Analysis of steering system.
2. Design and Analysis of suspension system.
3. Design and Analysis of Frames.
4. Design and Analysis of Integration of subsystems to main system.
5. Behavioral Analysis of different road conditions on a green vehicle.
6. Design and simulation of Differential.
7. Design and simulation of Epicyclic (Gear box).

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Note: Preferably using software like ADAMS CAR / LOTUS / ABACUS / 3DX CATIA / NX or Equivalent licensed software

Course Objectives:

i. To familiarize the students to use modeling software for modeling engine components.
ii. To design chassis components with dimensions and strength requirements.
iii. To learn the use of standard practices in modeling of components.
iv. The use of modeling software to control the quality of the final engineered product.
v. To visualize the complete assembly of the various system.

Course Outcomes:

Students will be able to visualize the automotive components with the help of modeling software.

i. Make the modifications instantly if required at the initial stage itself.
ii. Demonstrate the knowledge on designing components to withstand the loads and deformations.
iii. Synthesize, analyze and document the design of the various components.
iv. Demonstrate the ability to use engineering techniques for developing vehicle components with industry standards.

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IV Year - II Semester		L	T	P	C
		3	0	0	3
NOISE, VIBRATIONS AND HARSHNESS					

OBJECTIVES:
knowledge in basic of vibration and noise
Understanding the effect of noise an human comfort and environment
Knowing the methods of vibration and noise measurement.

UNIT I
FUNDAMENTALS OF ACOUSTICS AND NOISE, VIBRATION
Theory of Sound—Predictions and Measurement, Sound Sources, Sound Propagation in the Atmosphere, Sound Radiation from Structures and Their Response to Sound, General Introduction to Vibration, Vibration of Simple Discrete and Continuous Systems, Random Vibration, Response of Systems to Shock, Passive Damping

UNIT II
EFFECTS OF NOISE, BLAST, VIBRATION, AND SHOCK ON PEOPLE
General Introduction to Noise and Vibration Effects on People and Hearing Conservation, Sleep Disturbance due to Transportation Noise Exposure, Noise-Induced Annoyance, Effects of Infrasound, Low-Frequency Noise, and Ultrasound on People, Auditory Hazards of Impulse and Impact Noise, Effects of Intense Noise on People and Hearing Loss, Effects of Vibration on People, Effects of Mechanical Shock on People, Rating Measures, Descriptors, Criteria, and Procedures for Determining Human Response to Noise.

UNIT III
TRANSPORTATION NOISE AND VIBRATION—SOURCES, PREDICTION, AND CONTROL
Introduction to Transportation Noise and Vibration Sources, Internal Combustion Engine Noise Prediction and Control—Diesel, Exhaust and Intake Noise and Acoustical Design of Mufflers, Tire/Road Noise—Generation, Measurement, and Abatement, Aerodynamic Sound Sources in Vehicles—Prediction and Control, Transmission and Gearbox Noise and Vibration Prediction and Control, Brake Noise Prediction and Control.

UNIT IV
INTERIOR TRANSPORTATION NOISE AND VIBRATION SOURCES - PREDICTION AND CONTROL
Introduction to Interior Transportation Noise and Vibration Sources, Automobile, Bus, and Truck Interior Noise and Vibration Prediction and Control, Noise and Vibration in Off-Road Vehicle Interiors-Prediction and Control,

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UNIT V
NOISE AND VIBRATION TRANSDUCERS, ANALYSIS EQUIPMENT, SIGNAL PROCESSING, AND MEASURING TECHNIQUES

General Introduction to Noise and Vibration Transducers, Measuring Equipment, Measurements, Signal Acquisition, and Processing, Acoustical Transducer Principles and Types of Microphones, Vibration Transducer Principles and Types of Vibration Transducers, Sound Level Meters, Noise Dosimeters, Analyzers and Signal Generators, Equipment for Data Acquisition, Noise and Vibration Measurements, Noise and Vibration Data Analysis, Calibration of Measurement Microphones, Calibration of Shock and Vibration Transducers, Metrology and Traceability of Vibration and Shock Measurements.

TEXT BOOKS:

1. Clarence W. de Silva , "Vibration Monitoring, Testing, and Instrumentation ",CRC Press, 2007
2. David A.Bies and Colin H.Hansen "Engineering Noise Control: Theory and Practice "Spon Press, London, 2009

REFERENCES:

1. Allan G. Piersol ,Thomas L. Paez "Harris' Shock and Vibration Handbook", McGraw-Hill , New Delhi, 2010
2. Colin H Hansen "Understanding Active Noise Cancellation" , Spon Press , London 2003
3. Matthew Harrison "Vehicle Refinement: Controlling Noise and Vibration in Road Vehicles ", Elsevier Butterworth-Heinemann, Burlington, 2004

OUTCOME:

At the end of the course, the student will understand the sources, effects, prediction, control techniques, measurement techniques of noise, vibration pertain to an automobile.

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IV Year - II Semester		L	T	P	C
		3	0	0	3
VEHICLE MAINTENANCE					

Course objectives: The students are exposed to maintain records and schedules, overhauling of engine components and various systems of a vehicle.

UNIT-I

Maintenance, Repair: Dismantling of engine components, cleaning methods, Visual inspection and dimensional check of various engine components, Identification of Recondition able & Discard able components, Reusable after minor repair.

Overhauling of engines: Minor and major tune up reconditioning, repairing methods of engine components, assembly procedure. Special tools used for maintenance, repair and overhauling.

UNIT-II

Maintenance, repair and servicing of cooling system, lubrication system:

Cooling system –Types of Cooling circuit, Types of water pumps, radiator,fans and thermostat valve, anti-corrosion and anti-freezing solutions, Coolant change intervals.

Lubricating system – Oil analysis, oil topping up, oil change intervals, Oil filters, Pressure relief valve, Bypass valve, Maintenance of air intake and exhaust system, Fuel System-Maintenance, Repair and servicing of fuel system-petrol, diesel fuel feed system components. Bleeding of air from fuel system.

UNIT-III

Maintenance, repair and servicing of electrical systems: Battery – testing methods. Starter motor. Charging system- DC generator, AC generator, Regulator, Ignition systems- coil ignition, transistor assisted ignition, capacitor discharge ignition. Electric horn, wiper, Flasher, electric fuel pump, gauges. Lighting system, head lights focussing. Wiring system.

UNIT-IV

Maintenance, repair and overhauling of chassis drive line components and suspensions systems: clutch – mechanical, automatic type gear box. Final reduction, Propeller shaft.

Suspension systems: front and rear suspension systems, Rigid and independent types, Brakes system – hydraulic, servo, servo assisted air braking, air bleeding. Steering system,

UNIT-V

Body repair tools, minor body panel beating, tinkering, soldering, polishing, painting. Door locks mechanism. Window glass actuating mechanism.

Wheel Alignment – Tyres: Maintence of tyres, tubes, flaps, valve caps, pressure in tyres, pattern of tyres-lug,semi lug, highway (Rib) and snow and mud pattern, Retreading of tyres. Rims classification, wheel balancing types.

TEXT BOOKS:

1. Fleet management/ John Doke/McGraw Hill Co, 1984.
2. An Introductory Guide to Motor Vehicle Maintenance: Light Vehicles /Phil Knott, Adam Roylance/EMS Publishing, London.

COURSE OUTCOME: The students completing this course are expected to maintain various records and scheduled and unscheduled maintenance. They are also expected to maintain, repair and service of various systems of a vehicle.

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IV Year - II Semester		L	T	P	C
		3	0	0	3

CERTIFICATION AND HOMOLOGATION

UNIT I

Introduction

Specification & Classification of Vehicles (including M, N and O layout), Regulations overview(ECE, EEC, FMVSS, AIS, CMVR, ADR), Type approval and Conformity of Production, Engine andVehicle specifications, Two Wheeler certification.

UNIT II

Vehicle Performance Testing:

Methods for evaluating vehicle performance- energy consumption in conventional automobiles, performance, emission and fuel economy, Operation of full load and part load conditions, effect of vehicle condition, tyre and road condition and traffic condition and driving habits on fuel economy, Gradability test, Turning circle diameter test, Steering Impact test, Steering effort test.

UNIT III

Road and Track Testing:

Initial inspection, PDI, engine running in and durability, intensive driving, maximum speed and acceleration, brake testing on the road, hill climbing, handling and ride characteristics, safety, mechanism of corrosion, three chamber corrosion testing, wind tunnel testing, road testing, test tracks.

UNIT IV

Active and Passive Safety Testing:

Wheel rim testing for cornering and radial fatigue, Fire resistance test, bumper test, crash test, side impact test, rollover test, safety belt test, Airbag test, Safety belt anchorages, Seat anchorages & head restraints, Occupant protection Impact test, Side door intrusion test.

UNIT V

Components Testing:

Size and Ply rating of tyres, Safety Glasses: Windscreen laminated safety glass, Side window / door glass, Back light / Rear toughened glass, Wind screen wiping system, Wiper Blade, Hydraulic brake hose, Hydraulic brake fluid, Rear view mirror specification (Exterior), Rear view mirror specification (Interior), Wheel rims, Wheel nut, Wheel discs & hub caps, Safety belt assemblies, Safety belt anchorages, Seat anchorages & head restraints, door locks & door retention.

overview and study of testing standards like; AIS testing standards, Euro Standards, SAE standards. ISO26262 standards for functional safety of electrical and/or electronic systems in automobiles.

TEXT BOOKS

1. Raymond M. Brach and R. Matthew Brach, "Vehicle Accident Analysis and ReconstructionMethods", SAE International, 2011
2. Automotive Industry Standards, AIS

REFERENCES

1. Ulrich Seiffert and Lothar Wech, “Automotive Safety Handbook”, SAE International, 2007
2. ISO Standards, ICS: 43.020, 43.040, 43.100

IV Year - II Semester		L	T	P	C

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		3	**0**	**0**	**3**

AUTOMOTIVE SAFETY
(ELECTIVE – III)

Course objective: To impart the knowledge of the safety concepts, comfort and convenience system, driver assistance system and other requirements of automotive safety**.**

UNIT-I
INTRODUTION:
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 crumble zone, safety sandwich construction.

UNIT-II
SAFETY AND FATIGUE ASPECTS
Design of body, forces in roll over, head on impact, plastics collapse and analysis, fatigue and vibration, test on box sections, structural vibration.

UNIT-III
SAFETY CONCEPT
Active safety: driving safety, conditional safety, perceptibility safety, operating safety- crash safety passive safety: exterior safety, interior, safety, deformation behaviour of vehicle body, speed and acceleration characteristics of passenger compartment on impact.
Safety equipment: Seat belt, regulations, automatic seat belt tightened system,Anti locking braking system(ABS), Speed limiting device(SLD),Fire detection and suppression system(FDSS), automatic traction control, automatic vehicle stability control, Collapsible steering system, tilt able steering system, air bags, electronic system for activating air bags, bumpers design for safety.

UNIT-IV
COLLISION WARNING AND AVOIDANCE
Collision warning system, causes of rear end collision, frontal object detection, rear vehicle object detection system object detection system with braking system interactions.

UNIT-V
COMFORT AND CONVENIENCE SYSTEM
Steering and mirror adjustment, central locking system, tyre pressure monitoring and control system, rain sensor system, automatic climate control systems, environment information system.

TEXT BOOKS:
1. Bosch /Automotive Handbook/5th edition /SAE publication
2. Junsz Pawlowski/Vehicle Body Engineering/Business book limited, 1989.
3. Ronald K Jurgen/Navigation and Intelligent Transportation Systems-Progress in Technology/ Automotive Electronics Series, SAE. USA,1998.

REFERENCE BOOKS:

1. Rudolf Limpert/Brake Design and Safety/ SAE International, Second Edition, 1999.
2. Ronald. K. Jurgen / "Automotive Electronics Handbook" – Second edition / Mc Graw – Hill

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DEPARTMENT OF AUTOMOBILE ENGINEERING

IV Year - II Semester		L	T	P	C
		3	0	0	3
AUTOMOTIVE HVAC (ELECTIVE – III)					

UNIT I
Refrigeration
Introduction - Methods of refrigeration ,Vapour compression refrigeration system - Vapour absorption refrigeration system, Commonly used refrigerants , Refrigerants used inautomobile air conditioning

UNIT II
Psychometry
Psychometric properties, tables, charts - Psychometric processes - Comfort charts – Factoraffecting comfort - Effective temperature - Ventilation requirements

UNIT III
Air Conditioning Systems and Load Analysis
Classification and layouts - Central / unitary air conditioning systems - Components like compressors, evaporators, condensers, expansion devices, fan blowers, heating systems etc.
Load Analysis: Outside & inside design consideration - Factors forming the load on refrigeration & air conditioning systems - Cooling & heating load calculations - Load calculations for automobiles - Effect of air conditioning load on engine performance.

UNIT IV
Air Distribution Systems
Distribution duct system, sizing, supply / return ducts - Types of grills, diffusers, ventilation, air noise level - Layout of duct systems for automobiles and their impact on load calculations.
Air Routine & Temperature Control: Objectives - evaporator care air flow - Through the dashre-circulating unit - Automatic temperature control - Controlling flow - Control of air handlingsystems.

UNIT V
Air Conditioning Service and Control
Air conditioner maintenance & service - servicing heater system - Removing & replacing components.
Air Conditioning Control: Common control such as thermostats- Humidity status - Control dampers - Pressure cutouts and relays

Text Books

1. Mark Schnubel, “Automotive Heating and Air Conditioning”, Today’s Technician, 5th edn,2013
2. C. P. Arora, Refrigeration & Air Conditioning

References

1. Steven Daly, “Automotive Air Conditioning and Climate Control Systems”, Butterworth - Heinemann; 1 edition (2006)
2. Norman C. Harris, “Modern Air-Conditioning Practice”, McGraw-Hill Education 1984
3. R.J. Dossat, “Principles of Refrigeration”, Prentice Hall, 5th ed, 2001.
4. Paul Lung, "Automotive Air Conditioning", C.B.S. Publisher & Distributor, (Delhi. 1991)

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IV Year - II Semester		L	T	P	C
		3	0	0	3
SPECIAL PURPOSE VEHICLES (ELECTIVE – III)					

COURSE OBJECTIVES:

i. To enhance the knowledge of the students about the various equipment's used in earth moving, applications.

ii. To understand the construction and working of the vehicle for constructional application

iii. To describe the working nature of farm equipment's based on their application.

iv. To discriminate the various industrial vehicles based on the purpose.

v. To acquire the knowledge on the functioning of military vehicle.

UNIT I
EARTH MOVING EQUIPMENTS

Construction layout, capacity and applications of dumpers, articulated haulers, front-end loaders, backhoe loaders, bulldozers, scrappers, motor graders, skid steer loaders ,excavator, hydraulic shovels, bucket conveyors , surface miners – highwall Miners. Selection criteria of prime mover for dumpers.

UNIT II
CONSTRUCTIONAL EQUIPMENTS

Construction layout, capacity and applications of cranes – types , Articulated Trucks ,concrete ready mixer, trenchers , Asphalt Pavers , road reclaimers , Compactors – types , draglines, drillers, borewell machine .

UNIT III
FARM EQUIPMEMTS

Classification of tractors – Main components of tractor. Working attachment of tractors – Auxiliary equipment –- Top lifting harvesters. General description, working, specification and functions paddy harvesting machines, Sugarcane harvesting, feller bunchers, forest machines.

UNIT IV
INDUSTRIAL VEHICLES

Constructional features, capacity and working of fork lifts, Utility vehicles, towing vehicles, man-lift chassis, scissor lift trucks, material handlers, reclaimers, Street sweepers.

UNIT V
MILITARY AND COMBAT VEHICLES

Special features and constructional details of Main Battle tank, gun carriers, transport vehicles, Armoured vehicle-launched bridge, amphibious bridging vehicle, communication vehicles.

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DEPARTMENT OF AUTOMOBILE ENGINEERING

TEXT BOOKS:

1. Abrosimov. K. Bran berg.A. andKatayer.K., " Road making Machinery ", MIR Publishers, Moscow, 1971.
2. Rodichev and G.Rodicheva, Tractor and Automobiles, MIR Publishers, 1987.
3. Wong.J.T., " Theory of Ground vehicles ", John Wiley & Sons, New York, 1987.

REFERENCES:

1. B. Geleman and M. Moskovin, Farm tractors, MIR publishers, Moscow.
2. Bart H Vanderveen, Tanks and Transport vehicles, Frederic Warne and Co ltd., London.
3. Kolchin,A., and V.Demidov, Design of Automotive Engines for Tractor, MIR Publishers, 1972.
4. Peurifoy R.L “Construction Planning, Equipment and Methods”, Tata McGraw-Hill, New Delhi, 2002.
5. Wong J “ Terramechanics and Off-Road Vehicle Engineering”, Butterworth-Heinemann, 2009

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IV Year - II Semester		L	T	P	C
		0	0	12	8
PROJECT II					

Objectives:
The aim of the course is to make the student perform a comprehensive project work that involves either or all of the following: optimum design of a mechanical component or an assembly, thermal analysis, computer aided design & analysis, cost effective manufacturing process, material selection, testing procedures or fabrication of components and prepare a detailed technical thesis report. The completed task should also take into account the significance of real time applications, energy management and the environmental affects.

Outcomes:
After completing the project work the student should learn the technical procedure of planning, scheduling and realizing an engineering product and further acquire the skills of technical report writing and data collection.

Course content:
The student should work in groups to achieve the aforementioned objectives and the outcomes.