JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF AUTOMOBILE ENGINEERING

COURSE STRUCTURE AND SYLLABUS

For UG – R20

B. TECH - AUTOMOBILE ENGINEERING

(Applicable for batches admitted from 2020-2021)

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DEPARTMENT OF AUTOMOBILE ENGINEERING

II YEAR I SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1	BSC-5	MATHEMATICS-III(Vector Calculus, Transforms and PDE)	3	--	--	3
2	PCC-1	Thermodynamics	3	--	--	3
3	PCC-2	Mechanics of Solids	3	--	--	3
4	PCC-3	Fluid Mechanics & Hydraulic Machines	3	--	--	3
5	PCC-4	Components of Automobile Chassis	3	--	--	3
6	PCC-L1	Mechanics of Solids & Metallurgy Lab	0	0	3	1.5
7	PCC-L2	Automobile Chassis lab	--	--	3	1.5
8	PCC-L3	Fluid Mechanics & Hydraulic Machines lab	--	--	3	1.5
9	SOC-1	Computer aided drafting and modelling lab	0	0	4	2
10	MC-3	Essence of Indian Traditional Knowledge	2	0	0	0
		Total Credits	**17**	--	**13**	**21.5**

II YEAR II SEMESTER

S. No	Course Code	Course Title	L	T	P	Credits
1	ESC-6	Applied Thermodynamics	3	--	--	3
2	BSC-6	Complex Variables and Statistical Methods	3	--	--	3
3	PCC-5	Automobile Engines	3	--	--	3
4	PCC-6	Automobile Electrical and Electronics	3	--	--	3
5	HSC-2	Operations Research	3	--	--	3
6	ESC-L4	Automobile Assembly Drawing	--	--	3	1.5
7	PCC-L6	Automobile Engines & Fuels Lab	0	--	3	1.5
8	PCC-L7	Automobile Electrical & Electronics Lab	0	--	3	1.5
9	SOC-2	Machine Tools and Metrology Lab	1	0	2	2
		Total Credits	**16**	--	**11**	**21.5**

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

MATHEMATICS-III
(VECTOR CALCULUS, TRANSFORMS AND PDE)

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 Outcomes: 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) and problems on above theorems.

UNIT –II: Laplace Transforms: (10 hrs)

Laplace transforms – Definition and Laplace transforms of some certain functions– Shifting theorems – Transforms of derivatives and integrals – Unit step function –Dirac's delta functionPeriodic function – Inverse Laplace transforms– Convolution theorem (with out 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 (article-22.5 in text book-1)– inverse transforms – Convolution theorem (without proof) – Finite Fourier transforms.

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.

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

Second order PDE: Solutions of linear partial differential equations with constant coefficients –Non-homogeneous 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, 44th 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. **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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II Year - I Semester		L	T	P	C
		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 Pathfunction.

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.

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.

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TEXT BOOKS:

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

REFERENCES:

1. Thermodynamics by Prasanna Kumar, PearsonPublishers
2. Engineering Thermodynamics – Jones & DuganPHI
3. Thermodynamics, an Engineering Approach, Yunus A Cenegel, Michael A Boles, 8thEdn inSI Units, McGrawHill.
4. Thermodynamics – J.P.Holman ,McGrawHill
5. An Introduction to Thermodynamics - Y.V.C.Rao – Universitiespress.
6. Thermodynamics – W.Z.Black& J.G.Hartley, 3rd Edn Pearson Publ.
7. Engineering Thermodynamics – D.P.Misra, CengagePubl.
8. Engineering Thermodynamics – P.Chattopadhyay – Oxford Higher EdnPubl.

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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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 shockloadings.

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 abeam.

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 pointloads,

- U.D.L uniformly varying load. Mohr's theorems – Moment area method – application to simple cases including overhanging beams, Statically indeterminate Beams and solutionmethods.

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 –compoundcylinders.

COLUMNS:

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

TEXT BOOK:

1. Strength of materials /GH Ryder/ Mc Millan publishers IndiaLtd.
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, UmeshPublications.
3. Strength of Materials by S.Timshenko- D. VAN NOSTRAND Company- PHIPublishers
4. Strength of Materials by Andrew Pytel and Ferdinond L. Singer Longman-HarpercollinsCollege Division
5. Solid Mechanics, byPopov-
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.

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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 solvingtechniques.

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 vortexflow.

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 radialvanes.

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 andefficiency.

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 andapplications.

Centrifugalpumps: 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, indicatordiagrams.

TEXT BOOKS:

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

REFERENCE BOOKS:

1. Hydraulics, fluid mechanics and Hydraulic machinery- Modi andSeth
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 AgeInternational.

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
COMPONENTS OF AUTOMOBILE CHASSIS					

COURSE OBJECTIVES:

i. To understand the basic knowledge about various vehicle frames, front axles, steering systemsand understand the conditions for true rolling motion of wheels duringsteering.
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 evaluatetheworkingprinciplesofbothconventionalandindependentsuspensionsystem.
iv. To demonstrate working principle of braking system used in automobile.

UNIT I

INTRODUCTION, FRAME, CLUTCHES & GEAR bOX

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. Importance of Clutch, types and Applications. Requirement of Gear Box, Manual types of Gear Boxes including Synchromesh and its Applications

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

STEERING & SUSPENSION SYSTEM

Steering System: 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.

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. HeldtP.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 inAutomotive.
ii. Relate different types of drive lines and drives used inAutomotive.
iii. Acquire knowledge about different types of front axle and rear axles used in motorvehicles.
iv. Examine the working principle of conventional and independent suspensionsystems.
v. Apply knowledge on working principles of brake and itssubsystems.

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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 tensiontest
2. Bending teston
   a) Simple supported
   b) Cantileverbeam
3. Torsiontest
4. Hardnesstest
   a) Brinells hardnesstest
   b) Rockwell hardnesstest
5. Test onsprings
6. Compression test oncube
7. Impacttest
8. Punch sheartest

(B) METALLURGYLAB:

1. Preparation and study of the Micro Structure of pure metals like Iron, Cu andAl.
2. Preparation and study of the Microstructure of Mild steels, low carbon steels, high – Csteels.
3. Study of the Micro Structures of CastIrons.
4. Study of the Micro Structures of Non-Ferrousalloys.
5. Study of the Micro structures of Heat treatedsteels.
6. Hardeneability of steels by Jominy End QuenchTest.

To find out the hardness of various treated and untreatedsteels.

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II Year - I Semester		L	T	P	C
		0	0	3	1.5
AUTOMOBILE CHASSIS LAB					

COURSE OBJECTIVES:

i. To assemble and disassemble the parts of an ICengine.
ii. To identify the various component of an ICengine.
iii. To identify the various components in transmission systems of anautomobile.
iv. To assemble and disassemble the various components of transmissionsystem.
v. To study all the functions of automobilecomponents

LIST OF EXPERIMENTS

1. To study constructional and working principle ofclutch.
2. Assembly & Disassembly of GearBox.
5 Assembly & Disassembly of Transfer case.
6. Assembly & Disassembly of Differential & rearaxle.
7. Assembly & Disassembly of Stub AxleAssembly.
8. To assemble and disassemble Transfercase
9. To assemble and disassemble Differential, Rearaxle
10. To assemble and disassemble Frontaxle.
11. To Study different chassislayouts
12. To Study brakingsystem
13. To Study Steeringsystem
14. To Study Suspensionsystem

COURSE OUTCOMES:

i. Understand working of braking, steering, clutch, transmission, Suspensionsystems.
ii. Differentiate various subsystems of two, three & Four wheelervehicles
iii. Develop skills in Dismantling and assembling of chassiscomponents.

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		L	T	P	C
II Year - I Semester		**0**	**0**	**3**	**1.5**
FLUID MECHANICS & HYDRAULIC MACHINERY 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 onVanes.
2. Performance Test on PeltonWheel.
3. Performance Test on FrancisTurbine.
4. Performance Test on KaplanTurbine.
5. Performance Test on Single Stage CentrifugalPump.
6. Performance Test on Multi Stage CentrifugalPump.
7. Performance Test on ReciprocatingPump.
8. Calibration ofVenturimeter.
9. Calibration of Orificemeter.
10. Determination of friction factor for a given pipeline.
11. Determination of loss of head due to sudden contraction in apipeline.
12. Turbine flowmeter.

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II Year - I Semester		L	T	P	C
		0	0	4	2
COMPUTER AIDED DRAFTING AND MODELLING LAB					

1. DRAFTING: Development of part drawings for various components in the form of orthographic and isometric. Representation of dimensioning and tolerances, Study of DXE, IGES files.
2. SURFACE MODELING - Generation of various Surfaces using surface modeling.

A) **DRAFTING:** Development of part drawings for various components in the form of orthographic and isometric. Representation of dimensioning and tolerances, Study of DXE, IGES files.

B) **SURFACE MODELING -** Generation of various Surfaces using surface modeling.

C) The following contents to be done by any 3D software package:

(i) **PART MODELING:** Generation of various 3D models through Pad, revolve, shell, sweep, parent child relation, Boolean operations and various standard translators.

(ii) **Assembly drawings:** (Any four of the following using solid model software) Generation of various Parts/assemblies: like Screw Jack, Oldham's Coupling, Foot step bearing, Couplings, knuckle and cotter joints, Crankshaft, Connecting Rod, Piston and Cylinder.

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II Year - I Semester		L	T	P	C
		2	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 knowledgesystem
- To understand the legal framework and traditional knowledge and biological diversity act 2002 and geographical indication act2003
- The courses focus on traditional knowledge and intellectual property mechanism of traditional knowledge andprotection
- To know the student traditional knowledge in differentsector

Course Outcomes:

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

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

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

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.

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.

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.

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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.

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, PratibhaPrakashan2012.
3) Traditional Knowledge System in India by Amit Jha Atlantic publishers,2002
4) "Knowledge Traditions and Practices of India" Kapil Kapoor, MichelDanino

e-Resources:

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

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DEPARTMENT OF AUTOMOBILE ENGINEERING

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 andforced.

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, Wilsonline.
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.

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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 – efficiencyconsiderations.

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, Metropolitanbooks
2. Basics & Applied Thermodynamics- P.K.Nag – 4th edition- McGrawHill

REFERENCES:

1. Thermal Engineering- Mahesh Rathore,TataMcGrawHill
2. Applied Thermodynamics by RYadhav
3. Applied Thermodynamics by Eastop&McConkey, 5thEdn,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/ LakshmiPublications

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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II Year - II Semester		L	T	P	C
		3	0	0	3
COMPLEX VARIABLES AND STATISTICAL METHODS					

Course Objectives:
- To familiarize the complex variables.
- To familiarize the students with the foundations of probability and statistical methods.
- To equip the students to solve application problems in their disciplines.

Course Outcomes: At the end of the course students will be able to
- apply Cauchy-Riemann equations to complex functions in order to determine whether a given continuous function is analytic (L3)
- find the differentiation and integration of complex functions used in engineering problems (L5)
- make use of the Cauchy residue theorem to evaluate certain integrals (L3)
- apply discrete and continuous probability distributions (L3)
- design the components of a classical hypothesis test (L6)
- infer the statistical inferential methods based on small and large sampling tests (L4)

UNIT – I: Functions of a complex variable and Complex integration: (10 hrs)
Introduction – Continuity – Differentiability – Analyticity –Cauchy-Riemann equations in Cartesian and polar coordinates –Harmonicand conjugate harmonic functions – Milne – Thompson method.
Complex integration: Line integral – Cauchy's integral theorem – Cauchy's integral formula – Generalized integral formula (all without proofs) and problems on above theorems.

UNIT – II: Series expansions and Residue Theorem: (10 hrs)
Radius of convergence – Expansion in Taylor's series, Maclaurin's series andLaurent series.
Types of Singularities: Isolated – Essential –Pole of order m– Residues – Residue theorem (without proof) – Evaluation of real integral of the types $\int_{-\infty}^{\infty} f(x)dx$ and $\int_{c}^{c+2\pi} f(\cos\theta, \sin\theta)d\theta$.

UNIT – III: Probability and Distributions: (10 hrs)
Review of probability and Baye's theorem – Random variables – Discrete and Continuous random variables – Distribution functions – Probability mass function, Probability density function and Cumulative distribution functions – Mathematical Expectation and Variance – Binomial, Poisson, Uniform and Normal distributions.

UNIT – IV: Sampling Theory: (8 hrs)
Introduction – Population and Samples – Sampling distribution of Means and Variance (definition only) – Central limit theorem (without proof) – Representation of the normal theory distributions – Introduction to t, χ^2 and F-distributions – Point and Interval estimations – Maximum error of estimate.

UNIT – V: Tests of Hypothesis: (10 hrs)
Introduction – Hypothesis – Null and Alternative Hypothesis – Type I and Type II errors – Level of significance – One tail and two-tail tests – Tests concerning one mean and two means (Large and Small samples) – Tests on proportions.

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Text Books:

1. **B. S. Grewal,** Higher Engineering Mathematics, 44th Edition, Khanna Publishers.
2. **Miller and Freund's,** Probability and Statistics for Engineers,7/e, Pearson, 2008.

Reference Books:

1. **J. W. Brown and R. V. Churchill**, Complex Variables and Applications, 9th edition, Mc-Graw Hill, 2013.
2. **S.C. Gupta and V.K. Kapoor**, Fundamentals of Mathematical Statistics, 11/e, Sultan Chand & Sons Publications, 2012.
3. **Jay l. Devore,** Probability and Statistics for Engineering and the Sciences, 8thEdition,Cengage.
4. **ShronL.Myers, Keying Ye, Ronald E Walpole,** Probability and Statistics Engineers and the Scientists,8th Edition, Pearson 2007.
5. **Sheldon, M. Ross**, Introduction to probability and statistics Engineers and the Scientists, 4thEdition, Academic Foundation,2011

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DEPARTMENT OF AUTOMOBILE ENGINEERING

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

UNIT-I:

Actual Cycles and Engine Construction: Introduction, Comparison of Air Standard and Actual Cycles, Time Loss Factor, Heat Loss Factor, Exhaust Blow down-Loss due to Gas exchange process, Volumetric Efficiency. Loss due to Rubbing Friction, Actual and Fuel-Air Cycles of CI Engines; Constructional Details of Four Stroke SI and CI Engines, Working Principle, Actual Indicator Diagram, Two Stroke Engine Construction and Operation, Comparison of Four Stroke and Two Stroke Engine Operation, Firing Order and Its Significance.

UNIT-II:

ENGINE TESTING & PERFORMANCE

Engine Performance Testing & Numerical- methods and Performance Characteristics; Testing and measurement equipment- dynamometers, Air & Fuel consumption, temperature, etc. Variables Affecting Engine Performance, Performance Maps. Lubrication and Cooling systems, Introduction to Supercharging and Turbocharging

UNIT-III:

SI ENGINE FUELING & COMBUSTION

Carburetor Working Principle, Requirements of an Automotive Carburetor, and types, Fuel Injection Systems; Pre-mixed charge combustion, SI Engine Combustion Conceptual models, Thermodynamic Analysis of Combustion, Cycle-to-Cycle Combustion variations and Knocking Combustion

UNIT-IV:

CI ENGINE FUELING & COMBUSTION

Fuel Injection and Spray Structure: Fuel Atomization and Droplet size distribution, Sauter Mean Diameter, Spray Penetration. Types of Combustion Chambers, CI Engine Combustion Conceptual Models: Conventional and Dec's Combustion Models. Diesel Combustion Process Characterization: Ignition Delay, Effect of Engine and Operational Parameters on Delay, Pre-mixed Combustion, Mixing Controlled Combustion. Thermodynamic Analysis. Multi Pulse Injections, Introduction to Low Temperature Combustion Like: Homogeneous Charge Compression Ignition(HCCI), Fuel Stratified Charge combustion/ Reactivity Controlled Compression Ignition (RCCI) Technologies, Pre-mixed Charge Compression (PCCI) and Dual fuel technologies

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UNIT-V:
FORMATION OF ENGINE EMISSIONS & CONTROL TECHNOLOGIES (SI & CI)

Emission Effects on Health & Environment: Sources of Engine emissions: Formation of CO, NO, UBHC, Soot and Particulate Matter. Diesel NOx-Particulate Trade off: Effect of SI Design and operating variables: Effect of Diesel Engine Design and operating Variables. SI Engine Emission Control Technology: Add-on systems for treatment of Emissions with in Engine, Exhaust After treatment. CI Engine Emission Control Technology: Application of EGR, Exhaust after treatment and new engine technologies for emission control.

Text Books:

1. IC Engines, M.L. Mathur & R.P. Sharma, DhanpathRai& Sons
2. Engine Emissions, Pollutant Formation and Advances in Control Technology, B.P. Pundir, Narosa Publishing House

Reference Books:

1. IC Engines Fundamentals, John B. Heywood, Mc Graw Hill Publications
2. Engineering Fundamentals of I C Engines, WiliardW.Pulkrabek, Prentice Hall Publications
3. Mixture Formation in Internal Combustion Engines, CarstenBaumgaten, Springer Pub
4. Thermal Engineering, PL Ballaney, Khanna Publishers, 25th Edition.

Web Links:

1. http://nptel.ac.in/courses/112105123/
2. http://nptel.ac.in/courses/112108148/
3. http://nptel.ac.in/courses/112104113/
4. http://nptel.ac.in/courses/112104033/

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DEPARTMENT OF AUTOMOBILE ENGINEERING

II Year - II Semester		L	T	P	C
		3	0	0	3
AUTOMOBILE 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 andTrafficator.

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 & NewPress-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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DEPARTMENT OF AUTOMOBILE ENGINEERING

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

Course Objectives:
The objective of the course is to understand the availability of resources and constraints in an industry and optimize them through the applications of appropriate resource management tools.

UNIT – I
Development – definition– characteristics and phases – operation research models – applications.
LINEAR PROGRAMMING: problem formulation – graphical solution – simplex method – artificial variables techniques -two–phase method, big-M method – dualityprinciple.

UNIT – II
TRANSPORTATION PROBLEM: Formulation – optimal solution, unbalanced transportation problem – degeneracy, assignment problem – formulation – optimal solution - variants of assignment problem- traveling salesman problem.
SEQUENCING – Introduction – flow –shop sequencing – *n* jobs through two machines – *n* jobs through three machines – job shop sequencing – two jobs through 'm' machines.

UNIT –III
REPLACEMENT: Introduction – replacement of items that deteriorate with time – when money value is not counted and counted – replacement of items that fail completely, group replacement.

UNIT –IV
THEORY OF GAMES: Introduction to decision theory – mini. max (max. mini) – criterion and optimal strategy – solution of games with saddle points – rectangular games without saddle points – 2 x 2 games – dominance principle – m x 2 & 2 x n games -graphical method.
WAITING LINES: Introduction to Kendallis notation–classification of queuing models, single channel – with infinite population and finite population models– multichannel – with infinite population.

UNIT – V
Network Analysis: Project planning, scheduling and controlling – tools for project management – critical path method – programme evaluation and review technique (PERT) – cost analysis and crashing – resource leveling – updating.

TEXT BOOKS:
1. Operations Research-An Introduction/Hamdy A Taha/Pearsonpublishers
2. Operations Research –Theory & publications / S.D.Sharma-Kedarnath/McMillan publishers India Ltd

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REFERENCES:

1. Introduction to O.R/Hiller &Libermann/TMH
2. Operations Research /A.M.Natarajan,P.Balasubramani,A. Tamilarasi/PearsonEducation.
3. Operations Research: Methods & Problems / Maurice Saseini, ArhurYaspan& Lawrence Friedman/Wiley
4. Operations Research / R.Pannerselvam/ PHI Publications.
5. Operations Research / Wagner/ PHIPublications.
6. Operation Research /J.K.Sharma/MacMilanPubl.
7. Operations Research/ Pai/ OxfordPublications
8. Operations Research/S Kalavathy / VikasPublishers
9. Operations Research / DS Cheema/University Science Press
10. Operations Research / Ravindran, Philips, Solberg / Wileypublishers

Course Outcomes:

After studying the course, the students are able to

1. Formulate the resource management problems and identify appropriate methods to solvethem
2. Apply LPP, transportation and assignment models to optimize the industrialresources
3. Solve decision theory problems through the application of gametheory
4. Apply the replacement and queuing models to increase the efficiency of thesystem
5. Model the project management problems through CPM andPERT

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DEPARTMENT OF AUTOMOBILE ENGINEERING

II Year - II Semester		L	T	P	C
		0	0	3	1.5
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.
(Production Drawing to be included)

Machine Drawing Conventions:

Need for drawing conventions – introduction to ISconventions

a) Conventional representation ofmaterials, 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 andauxiliary sectional views. Parts not usuallysectioned.
c) Methodsofdimensioning,generalrulesforsizesandplacementofdimensionsforholes, centers, curved and taperedfeatures.
d) Title boxes, their size, location and details - common abbreviations & their liberalusage
e) Types of Drawings – working drawings for machineparts.

I. Drawing of Machine Elements and simpleparts

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, setscrews.
b) Keys, cottered joints and knucklejoint.
c) Rivetted joints forplates
d) Shaft coupling, spigot and socket pipejoint.
e) Journal, pivot and collar and foot step bearings, Cam profiles andMechanisms.

II. AssemblyDrawings:

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, pistonassembly.
b) Other machine parts – stub axial assembly, steering gear box assembly, differentialassembly and clutchassembly.
c) Valves : spring loaded safety valve, feed check valve and air cock, Controlvalves

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, McGrawHill
6. Machine Drawing – KC John,PHI
7. Machine Drawing – B Battacharya,Oxford
8. Machine Drawing – Gowtham and Gowtham,Pearson

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DEPARTMENT OF AUTOMOBILE ENGINEERING

II Year - II Semester		L	T	P	C
		0	0	3	1.5
AUTOMOBILE 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. Draw the Valve and Port Timing Diagrams for 4S and 2S engines and compare with ideal cycle
2. Evaluate the Performance and Emissions from 4S Petrol Engine
3. Evaluate the Performance and Emissions from 4S Diesel Engine
4. Evalaution of Frictional Power from the Mores Test on a 4-Stroke Multi Cylinder Engine
5. Determination of Frictional Power by the retardation and Motoring Test on IC Engine
6. Draw the Heat Balance Sheet for a 4-Stroke Petrol or Diesel Engine
7. Analysis of Combustion Characteristics like ; P-θ, Differential Heat Release Rate, Integral Heat Release Rate and Ignition Delay of diesel engine
8. Calculation of Stiochiometric Air- Fuel mixtures of Conventional fuels through oxidation Equation and compare with Spectrometric analysis
9. Calculate the Volumetric Efficiency of a conventional fuel and compare with Gas based Dual Fuel Operation, when secondary fuel is inducted through inlet manifold
10. Dismantle and Assemble of Agriculture single Cylinder and Multi- Cylinder Automotive Engines

FUELS LAB

LIST OF EXPERIMENTS

1. ASTM distillation test of liquidfuels.
2. Gas Chromatograph with Mass Spectrometry
3. FTIR analysis
4. NMR Analysis C13/H1
5. HPLC Analysis
6. Calorific value of liquid and gaseousfuel.
7. Flash and Fire points of petrol and diesel. (closed and opentype)
8. Temperature dependence of viscosity of lubricants & Fuels by RedwoodViscometer.
9. Viscosity index of lubricants & Fuels by SayboltViscometer.
10. Ash content and Carbon ResidueTest.
11. Drop point of grease and mechanical penetration ingrease.
12. Cloud and Pour pointTest.

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 enginecomponents
2. At the end of the lab learn characteristics of the fuels and lubricants used inautomobile

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DEPARTMENT OF AUTOMOBILE ENGINEERING

II Year - II Semester		L	T	P	C
		0	0	3	1.5
AUTOMOBILE 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 andconstructions.
2. Testing, dismantling and assembling of starter motor used inautomobile.
3. Testing, dismantling and assembling of alternator used inautomobile.
4. Study of different colour code system used in automotive wiringsystem.
5. Demonstration and study of Battery Ignition System and their parts used in AutomobileVehicles.
6. Study of different Electrical Equipment's &Accessories(Speedometer,Warninglights,Electric Horn, Wind shield wiperssystem).
7. Study of different sensor used in modern automotivesystem.
8. Study of various electronics system(Electronicfuelinjectionsystem, Electronicignitionsystem,Air bag, ABS, Electronic fuel injectorcleaner).
9. Demonstration and experiment on lighting system of two wheeler and FourWheeler.
10. Demonstration, experiment and diagnosis on ignitionsystem.

Automotive Electronics:

1. Verification of truth table of LogicGates.
2. Verification of truth table of Adder, Subtractor &Flip-Flops.
3. Characteristics of rectifiers – Half wave & Fullwave.
4. Timer –555
5. Characteristics ofSCR.
6. D/A and A/Dconverters.
7. Interfacing stepper motor control and CRTterminal
8. Assembly language programmingexercise.
9. Interfacing A/D converter and simple dataacquisition
10. Microcontroller Programming andInterfacing
11. EPROM Interfacing

Text Books:

1. Allan Bonnick, *"Automotive Computer Controlled Systems"*, 2011.
2. Tom Weather Jr and ClandC.Hunter, *"Automotive Computers and ControlSystem"*, Prentice Hall Inc., New Jersey.
3. Young A. P & Griffiths L, *"Automobile Electrical and Electronic Equipments"*, English Languages Book Society & New Press, 1990

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Reference Books:

1. Santini Al, *"Automotive Electricity and Electronics"*, Cengage Learning, 2012.
2. Tom Denton, *"Automotive Electrical and Electronic System"*, SAE International, 2004.
3. William B. Ribbens, *"Understanding Automotive Electronics"*, 6th Edition, Newnes, 2003. BOSCH, *"Automotive Handbook"*, 8th Edition, BENTLEY ROBERT Incorporated, 2011.
4. Norm Chapman, *"Principles of Electricity and electronics for the Automotive Technician"*, Delmar Cengage Learning, 2008.
5. Judge A.W, *"Modern Electrical Equipment of Automobiles"*, Chapman & Hall, London, 1992.

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II Year - II Semester		L	T	P	C
		1	0	2	2
MACHINE TOOLS AND METROLOGY 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 machinetools.

Section-I
METROLOGY LAB

1. Measurement of lengths, heights, diameters by vernier calipers, micrometersetc.
2. Measurement of bores by internal micrometers and dial boreindicators.
3. Use of gear tooth vernier calipers and checking the chordal thickness of spurgear.
4. Machine tool alignment test on thelathe.
5. Machine tool alignment test on millingmachine.
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 asurface.
8. Thread measurement by two wire/ three wire method & tool makers microscope.
9. Surface roughness measurement byTalysurf.

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 cuttergrinder.
2. Step turning and taper turning on lathemachine
3. Thread cutting and knurling on -lathemachine.
4. Drilling andtapping
5. Shaping andplanning
6. Slotting
7. Milling
8. Cylindrical surfacegrinding
9. Grinding of toolangles.

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.