



SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY

(DEEMED TO BE UNIVERSITY)

Accredited A++ Grade by NAAC | 12B Status by UGC | Approved by AICTE

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School of Mechanical Engineering
Department of Automobile Engineering
1.1.3 Courses having focus on Employability / Entrepreneurship / Skill Development

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SAUA1302	AUTOMOTIVE PETROL ENGINES	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To learn the fundamental principles and operation of Engine.
- Understand SI engine fuel feed system.
- Understand the ignition system in SI Engine
- Gain knowledge on cooling and lubrication system in SI Engine
- Understand the combustion system in SI Engines.
- Understand the abnormal combustion in SI engine

UNIT 1 ENGINE CONSTRUCTION AND OPERATION

9 Hrs.

Constructional details of four stroke petrol engine, working principle, air standard Otto cycle, actual indicator diagram, fuel air analysis, two stroke engine construction and operation, comparison of four stroke and two stroke engines operation, firing order and its significance. Theoretical and actual Port Timing, Valve Timing of petrol engines.

UNIT 2 SI ENGINE FUEL SYSTEM

9 Hrs.

Carburetor working principle, requirements of an automotive carburetor, Solex, S.U, Carter carburetor. starting, idling, acceleration and normal circuits of carburetors. Compensation, maximum power devices, constant choke and constant vacuum carburetors, fuel feed systems; mechanical and electrical fuel feed pumps. Petrol injection, GDI, MPFI.

UNIT 3 IGNITION SYSTEM

9 Hrs.

Types and working of battery coil and magneto ignition systems, relative merits and demerits, centrifugal and vacuum advance mechanisms. Types and construction of spark plugs, electronic ignition systems- Transistorized coil ignition system Capacitive discharge ignition system.

UNIT 4 COOLING AND LUBRICATION SYSTEM

9 Hrs.

Need for cooling system, Types of cooling system: air cooling system, liquid cooling system, Comparison, forced circulation system, pressure cooling system. Lubrication system- Requirements, mist, wet sump lubrication system, properties of lubricants.

UNIT 5 COMBUSTION AND COMBUSTION CHAMBERS

9 Hrs.

Combustion in SI engine; stages of combustion, flame propagation, rate of pressure rises, abnormal combustion, detonation, effect of engine variables on knock, knock rating. Combustion chambers; different types, factors controlling combustion chamber design.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Understand the operational principle of two stroke & four stroke engine and recall the Otto cycle process in details
- CO2 - Explain the SI engine fuel feed system.
- CO3 - Explain the battery, magneto & electronic ignition system in SI engine.
- CO4 - Explain the principle of cooling & various lubrication system in SI engine.
- CO5 - Analyse the combustion phenomena in SI engine & explain types of SI engine combustion chamber.
- CO6 - Analyse the effect of engine variables on knocking in SI engine.

TEXT / REFERENCE BOOKS

1. Ganesan V, "Internal Combustion Engines", 4th Edition, Tata McGraw Hill Publication, 2017.
2. Rajput R. K, "A textbook of Internal Combustion Engines", 3rd Edition Laxmi Publications, 2016.
3. Mathur and Sharma "Internal Combustion Engines" "Dhanpat Rai and Sons Publication, 2012.
4. John B. Heywood, "Fundamentals of Internal Combustion Engine, 2nd Edition, McGraw Hill Education; 2018.
5. Heinz Heisler, "Advanced Engine Technology", 2nd Edition SAE Publication, 2010.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 2 Questions from each unit, each carrying 2 marks

20 Marks

PART B: 2 Questions from each unit with internal choice, each carrying 16 marks

80 Marks

SAUA1304	SOLID AND FLUID MECHANICS	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- To familiarize with the behaviour of structural components under different loading conditions
- To understand effect of component dimensions and shape on stresses and deformations.
- To understand fluid properties, flow characteristics and basic governing equations-mass, momentum, energy.
- To understand the analysis of rotor dynamic machines and Velocity Triangles.

UNIT 1 STRESS STRAIN AND DEFORMATION OF SOLIDS, STATES OF STRESS

9 Hrs.

Rigid bodies and deformable solids - stability, strength, stiffness - tension, compression and shear stresses - strain, elasticity, Hooke's law, limit of proportionately, modules of elasticity, stress-strain curve, lateral strain - temperature stresses deformation of simple and compound bars - shear modulus, bulk modulus, relationship between elastic constants - bi axial state of stress - stress at a point - stress on inclined plane - principal stresses and principal planes - Mohr's circle of stresses

UNIT 2 BENDING AND SHEAR STRESS DISTRIBUTION, TORSION AND BEAMS

9 Hrs.

Stresses in Beams - Simple bending theory - Composite Beams - Combined bending and Direct stress - Shear stress distribution for Rectangular and I section - Simple Torsion theory - Stresses and deformations in Solid and Hollow circular shafts- Double integration method - Macaulay's method - Moment area method - Conjugate method for simply supported and cantilever beams. (only point loads & Uniformly distributed loads.)

UNIT 3 SLOPE AND DEFLECTION OF BEAMS

9 Hrs.

Flow through orifices: Classification - Hydraulic co-efficient - Flow through rectangular orifice, Notches and weirs. Laminar and Turbulent flow: Reynolds experiment - Major and minor losses in pipes - Darcy Weisbach's equation, Chezy's formula - pipes in series and pipes in parallel - total energy line - hydraulic gradient line - Equivalent pipe

UNIT 4 FLUID PROPERTIES & EQUATIONS OF MOTION

9 Hrs.

Fluid Properties: Density - Specific Weight - Specific Gravity - Viscosity - Surface tension - Capillarity - compressibility. Fluid Statics: Hydrostatic Law - Pressure Variation in static fluid - Hydrostatic force on submerged plane-surfaces - Location of hydrostatic force. Manometers - Simple U tube and differential manometers - Buoyancy - Meta-centric height - determination of stability of floating bodies and submerged bodies- Basic equations of motion: Types of fluid flow - Continuity, momentum and energy equations - Euler's and Bernoulli's Equation and its applications. Flow Measurement: Orifice meter, Venturi meter, Piezometer, Pitot Tube.

UNIT 5 PUMPS & TURBINES

9 Hrs.

Centrifugal Pumps: Definition - Operations - Velocity Triangles - Performance curves - Cavitations - Multistaging, Reciprocating Pumps: Operation - Slip - indicator Diagram - Separation - Air vessels. Hydraulic Turbines: Classification of hydraulic turbines - Working principle of Pelton wheel, Francis and Kaplan turbines - velocity triangles - draft tube - hydraulic turbine characteristics. Dimensional Analysis: Buckingham's Theorem, Non-Dimension Numbers, Similarities of Flow- Model studies

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Analyze material strength using Stress-Strain relationships.
- CO2 - Acquire knowledge about principal stress and strain
- CO3 - Analyze Beam strength using Shear Force and Bending Moment Diagram.
- CO4 - Acquire knowledge on properties of fluids.
- CO5 - Understand the concept of kinematics and dynamics of fluids
- CO6 - Understand the concept of incompressible flow

TEXT / REFERENCE BOOKS

1. Cengel, Y.A., Fluid mechanics: fundamentals and applications, McGraw Hill Publishing, New Delhi, India, 2006.
2. Rajput, R.K. "Strength of Materials", 4th Edition, S.Chand & Co., New Delhi, 2002.
3. Khurmi, R.S., "Strength of Materials", 23rd Edition, S.Chand & Co, 2008.
4. Bansal, R.K., "Fluid Mechanics & Hydraulics Machines", 9th Edition, Laxmi Publications, 2005.
5. Kumar K. L., "Engineering Fluid Mechanics", 8th Edition, Eurasia Publication, 2009.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max Mark: 100

PART A: 10 Questions of 2 marks each- No choice

PART B: 2 Questions from each unit of internal choice, each carrying 16 marks

Exam Duration: 3 Hrs.

20 Marks

80 Marks

SMEA1402	MECHANICS OF MACHINES	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- Provide the insights of the fundamentals of knowledge Mechanisms and Cams.
- Provide basic of Flywheels and Balancing of Rotating and Reciprocating unbalance systems.
- Enhance knowledge in fundamentals of Single degree Free and Damped Vibrations.
- Provide the detailed overview of Forced Vibrations.
- Discuss the fundamentals of Gears, Gyroscopes and Governors.

UNIT 1 MECHANISMS AND CAMS

9 Hrs.

Mechanisms – Terminology and definitions – Kinematics inversions of 4 bars and slider crank chain – Kinematic analysis in simple mechanisms. Types of cams and followers - Terminology and definitions – Displacement diagrams – SHM, uniform velocity, uniform acceleration and retardation. Graphical constructions of cam profiles – Disc cam with knife edge follower, roller follower and flat-faced follower.

UNIT 2 FLY WHEELS AND BALANCING

9 Hrs.

Turning moment diagrams – Fluctuation of Energy and speed – Energy stored in Flywheel – Mass of Flywheel – Dimensions of Flywheel. Balancing – Static and Dynamic Balancing of Rotating Masses - Balancing of several masses rotating in same plane and in different planes- Partial Balancing of locomotives – Variation of tractive force, Hammer blow and swaying couple.

UNIT 3 FUNDAMENTALS OF VIBRATION

9 Hrs.

Basic features of vibratory systems - Lumped mass systems - Degrees of freedom - Free vibration of Longitudinal, Transverse and Torsional systems of Single degree of freedom - Equations of motion - Natural frequency – Whirling of shafts and critical speed - Dunkerley's Method – Torsional vibration of Two and Three rotor system. Damped free vibration - Types of Damping – Critical damping coefficient - Damping Factor – Logarithmic Decrement.

UNIT 4 FORCED VIBRATION

9 Hrs

Forced vibration of single degree freedom system with damping - Response to periodic forcing- Harmonic Forcing - Forcetransmissibility and amplitude transmissibility - Reciprocating and rotating unbalance - vibration isolation and transmissibility - Support motion - self excited vibration with examples.

UNIT 5 GEARS, GOVERNORS AND GYROSCOPES

9 Hrs.

Spur gear terminology – law of toothed gearing – Involute gearing – Path of contact, arc of contact and contact ratio. Interchangeable gears – Gear tooth action – interference and undercutting – Gear trains – Epicyclic gear train – tabular method of finding velocity ratio. Governors - Types - Centrifugal governors – Porter – Characteristics – Sensitivity – Stability – Hunting – Isochronisms – equilibrium speed - Controlling Force- Gyroscopes - Gyroscopic couple - Gyroscopic stabilization - Gyroscopic effects in Aeroplanes.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Understand the fundamentals of Mechanisms and Cams.
- CO2 - Understand the basic of Flywheels, balancing of Rotating and Reciprocating unbalance systems.
- CO3 - Conceive the fundamentals of Single degree Free and Damped Vibrations.
- CO4 - Conceive the fundamentals of Forced Vibrations.
- CO5 - Apply the fundamentals of Gears.
- CO6 - Apply the fundamentals of Gyroscopes, Governors.

TEXT / REFERENCE BOOKS

1. Khurmi R.S& Gupta J.S, "Theory of Machines", 16th Edition, S.Chand & Company, 2005, Reprint 2016.
2. Singh V.P, "Mechanical Vibrations", 3rd Edition, Dhanpatrai & Co., 2006.
3. Ghosh A. and Malik A.M, "Theory of Mechanism and Machines", 4th Edition, Affiliated East West Press (P) Ltd. 2009.
4. Ashok G. Ambekar, "Mechanism and Machine Theory", First Edition, PHI Learning Private limited, 2009.
5. Rattan S. S, Theory of Machines, 3rd Ed., Tata Mcgraw Hill, 2009.
6. Gordon R Pennock, Joseph E Shigley, "Theory of Machine and Mechanisms SI Edition, 4th Edition, Oxford University Press, 2014

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 2 Questions from each unit, each carrying 2 marks

20 Marks

PART B: 2 Questions from each unit with internal choice, each carrying 16 marks

80 Mark

SAUA1402	MANUFACTURING PROCESSES	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To learn the basic operation of various manufacturing process.
- This course is designed to provide students with an overview of a wide variety of manufacturing process.
- Introduce the student to processes and equipment utilized in the manufacturing environment.
- To learn the various methods and types of castings, welding, and Processing of plastics.
- To understand the basic concept of non-traditional machining process.
- To impart knowledge on selection of suitable manufacturing process for the typical component.

UNIT 1 CASTING, JOINING AND FORMING PROCESSES

9 Hrs.

Types of Moulding Methods - Gating Design. Special Casting processes, Defects in Castings-Inspection Methods. Principle and applications of submerged arc welding – Electro slag welding – TIG welding – MIG welding special welding processes -Plasma arc welding– Thermit welding – Friction welding – Diffusion welding – Welding defects Processing of plastics – Types, Applications, Advantages and Limitations - Injection Moulding, Blow moulding.

UNIT 2 MACHINE TOOLS

9 Hrs.

Working principle, Applications, Advantages and Limitations of Centre lathe, Capstan and turret lathes – automats – single spindle, Swiss type, automatic screw type, multi spindle - Turret Indexing mechanism, bar feed mechanism. shaper, planer, slotter, Milling, Gear cutting, forming, generation, shaping, hobbing.

UNIT 3 SURFACE FINISHING & MICRO-MANUFACTURING

9 Hrs.

Abrasive processes: grinding wheel – specifications and selection, types of grinding process – cylindrical grinding, Surface grinding, centreless grinding – honing, lapping, super finishing, polishing and buffing. Introduction and Scaling Laws for micro-manufacturing, Silicon Layer Processes, LIGA process Other Micro-fabrication Processes.

UNIT 4 NON TRADITIONAL MACHINING PROCESS

9 Hrs.

Non-Traditional machining: Working principle, Applications, Advantages and Limitations- AJM-WJM-USM-ECM-EDM- EBM-EDG- LBM-PAM.

UNIT 5 CNC MACHINE TOOLS AND FUNDAMENTALS OF CAD/CAM

9 Hrs.

Numerical control: Brief principles and description of numerical control application to M/c tools. DNC, CNC and adaptive control. Programming of CNC M/C tools, CNC programming based on CAD. Fundamentals of CAD/CAM, Computer integrated manufacturing, Compute Aided Process Planning, Computer Integrated, Production Planning system.

Max. 45 Hrs

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Recognize the different types of manufacturing process.
- CO2 - Learning various machine tools operations and applications.
- CO3 - Understanding the concept of Surface finishing operation and Micro manufacturing concepts.
- CO4 - Understand and Develop various Non Traditional Machining process.
- CO5 - Explain the operations and capabilities of CNC machines used in manufacturing.
- CO6 - Select the suitable manufacturing process in order to produce the various components.

TEXT / REFERENCE BOOKS

2. Ghosh, A., Mallik, A.K., Manufacturing Science, 2nd Edition, East West Press, 2010.
3. Hajra Choudhury, “Elements of Workshop Technology”, Vol. I and II, Media Promoters and Publishers Pvt.Ltd., Mumbai, 2005.
4. Jain R.K., Production Technology, Khanna Publishers, 2001.
5. Tata McGraw-Hill, Production Technology by HMT, 2002.
6. Kalpakjian .S and Schmid S R, Manufacturing Processes for Engineering Materials, Pearson Education, 2009.
7. Roy. A. Linberg, “Process and Materials of Manufacture”, PHI, 2000.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

PART A: 10 Questions of 2 marks each- No choice

PART B: 2 Questions from each unit with internal choice, each carrying 16 marks

Exam Duration: 3 Hrs.

20 Marks

80 Mark

SAUA1401	AUTOMOTIVE DIESEL ENGINES	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- Understand the diesel engine construction and its operation.
- Understand the fuel injection system in CI Engine.
- Gain knowledge on air motion & combustion phenomena in CI Engine.
- Understand turbo charging and engine management system in IC Engines.
- Understand CI engine performance.
- Understand the principle of modern engine technology.

UNIT 1 BASIC THEORY

9 Hrs.

Diesel engine construction and operation, two stroke and four stroke diesel dual cycle engines, diesel cycle, fuel-air and actual cycle analysis, diesel fuel, ignition quality, cetane number, laboratory tests for diesel fuels, standards and specifications.

UNIT 2 FUEL INJECTION SYSTEM

9 Hrs.

Requirements, air and solid injection, functions of components, jerk and distributor type pumps common rail system, PTFI system pressure waves, injection lag, unit injector, mechanical and pneumatic governors, fuel injector, types of injection nozzle, **nozzle tests, spray characteristics, injection timing, pump calibration**.

UNIT 3 AIR MOTION, COMBUSTION AND COMBUSTION CHAMBER

9 Hrs.

Importance of air motion, swirl, squish and turbulence, swirl ratio, fuel air mixing, stages of combustion, delay period, factors affecting delay period, knock in CI engines. Combustion chamber: design requirements, direct and indirect injection combustion chambers, M type combustion chamber.

UNIT 4 AUXILIARY SYSTEM

9 Hrs.

Necessity and limitations, types of supercharging and turbocharging, relative merits, matching of turbocharger, exhaust gas recirculation, charge cooling. Introduction to engine electronics, **Engine Management systems, Types of Sensors- piezoelectric, thermistor, hot wire, vortex, Exhaust oxygen, knocking sensor**

UNIT 5 PERFORMANCE TESTING AND MODERN ENGINE TECHNOLOGY

9 Hrs.

Necessity and limitations, charge cooling, basic performance parameters, performance characteristics, factors affecting performance characteristics, performance maps - CI engines, **heat balance test, Morse test, introduction to modern engine technologies** - lean burn engines, stratified charged engines, low heat rejection engines, homogeneously charged compression ignition engines engine management systems.

Max.45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Understand the operational principle of CI engine and recall the Diesel cycle & Dual cycle in detail.
- CO2 - Explain the working principle of fuel injection pump, governor in CI engine.
- CO3 - Analyse the combustion phenomena in CI engine & explain types of CI engine combustion chamber.
- CO4 - Explain the principle of turbocharging, Engine management systems.
- CO5 - Analyse the performance characteristic of IC engine.
- CO6 - Familiarize with modern engine technologies.

TEXT / REFERENCE BOOKS

1. Ganesan V, "Internal Combustion Engines" 4th edition, Tata McGraw Hill publication 2017.
2. Rajput R. K, "A textbook of Internal Combustion Engines", Third edition Laxmi Publications, 2016.
3. Mathur and Sharma "Internal Combustion Engines" "Dhanpat Rai and Sons Publication, 2012
4. John B. Heywood, "Fundamentals of Internal Combustion Engine, 2nd edition, McGraw-Hill Education; 2018.
5. Heinz Heisler "Advanced Engine Technology", 2nd edition SAE Publication, 2010.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 10 Questions of 2 marks each- No choice

20 Marks

PART B: 2 Questions from each unit with internal choice, each carrying 16 marks

80 Marks

SAUA1303	FUELS AND LUBRICANTS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand the refining process of petroleum.
- To develop understanding about various types of fuels, lubricants and their properties
- To understand the importance of Alternate fuels available.

UNIT 1 MANUFACTURE OF FUELS AND LUBRICANTS

9 Hrs.

Fuels, Classification, Structure of petroleum, refining process, thermal and catalytic cracking, products of refining process, manufacture of lubricating oil base stocks and finished automotive lubricants.

UNIT 2 FUELS FOR I.C. ENGINES

9 Hrs.

Types of Fuels, Liquid and gaseous fuels, heating value of fuels, higher and lower heating values, chemical structure of hydro-carbons SI Engine fuels, Volatility characteristics, desirable characteristics of SI Engine fuels, knock rating and additives, CI engine fuels, desirable characteristics, cetane rating and additives

UNIT 3 COMBUSTION OF FUELS

9 Hrs.

Stoichiometry - calculation of theoretically correct air required for combustion of liquid and Gaseous fuels, volumetric and gravimetric analysis of the dry products of combustion, mass of dry gas per kg of fuel burnt, mass of carbon in the exhaust gas, mass of carbon burnt to carbon monoxide per kg of fuel, heat loss due to incomplete combustion, exhaust gas analysis by Orsat apparatus.

UNIT 4 LUBRICANTS

9 Hrs.

Theory of Lubrication, Effect of engine variables on friction, Types of Lubrications- Hydrodynamic and Hydrostatic lubrication. Requirements for automotive lubricants and types, Viscosity index, oxidation deterioration and degradation of lubricants, additives of lubricants and synthetic lubricants, classification of lubricating oils, tests on lubricants. Grease, classification, properties, testing of grease.

UNIT 5 ALTERNATE FUELS

9 Hrs.

Alternate fuels for SI engines and CI engines, desirable characteristics, Octane and cetane rating. Introduction to electric, hybrid and fuel cell vehicles.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Recall the structure of petroleum and explain the petroleum refining process and manufacture of lubricants in detail.
- CO2 - Explain the properties of fuels and their effect on engine performance
- CO3 - Explain the qualities of fuels and various additives used to enhance performance of fuels and Derive theoretically correct air required for combustion of liquid and Gaseous fuels
- CO4 - Explain the theory of lubrication and effect of engine variables on friction
- CO5 - Explain the requirements and various properties of lubricants and compare different types of Lubricants.
- CO6 - Summarize the alternate fuels for SI and CI engines and alternate source vehicles

TEXT / REFERENCE BOOKS

- Ganesan V., "Internal Combustion Engines", Tata McGraw Hill Publishing Co., New Delhi, 2012.
- Mathur D.S., Sharma R.P. "A course in internal combustion engines", Dhanpatrai publication, 2014.
- Srivastava S.P., Jenő Hancsók "Fuels and Fuel-Additives" Wiley; 1st Edition, 2014.
- Srivastava S.P., "Developments in Lubricant Technology", Wiley Blackwell, 1 Edition, 2014.
- Gupta O.P., "Elements of Fuel & Combustion Technology", Khanna Book Publishing; 1st Edition, 2018.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 10 Questions of 2 marks each - No choice

20 Marks

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks

80 Marks

Employability

SAUA1403	AUTOMOTIVE CHASSIS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To gain in depth knowledge of fundamentals of chassis lay out with reference to power plant locations and drives.
- To discuss front wheel geometry and steering geometry.
- To understand drive line, suspension system and braking system

UNIT 1 INTRODUCTION

9 Hrs.

Types of chassis lay out with reference to power plant locations and drives, vehicle frames, various types of frames, passenger car frames, x member type frame, box section type frame, load acting on frames, constructional details, materials, sub frame, **testing of vehicle frames, checking of frame alignment.**

UNIT 2 FRONT AXLE AND STEERING SYSTEM

9 Hrs.

Types of front axles, construction details, materials, **front wheel geometry**; castor, camber, king pin inclination, toe-in and toe-out, condition for true rolling motion of wheels during steering, **steering geometry**, Ackermann and Davis steering system, constructional details of steering linkages, different types of steering gear boxes, slip angle, over-steer and under-steer, turning radius, wheel wobble, power assisted steering, steering ratio – power steering – centre point steering.

UNIT 3 DRIVE LINE

9 Hrs.

Effect of driving thrust and torque reactions, Hotchkiss drive, torque tube drive and radius rods, propeller shaft, universal joints, front wheel drive, different types of final drive, double reduction and twin speed final drives, differential principle, construction details of differential unit, non-slip differential locks, differential housings, construction of rear axles, types of loads acting on rear axle, fully floating, three quarter floating and semi floating rear axles, construction of different types of axle housings, final drive differential: worm and worm wheel, straight bevel gear, spiral bevel gear and hypoid gear final drives, fifth wheel coupling.

UNIT 4 SUSPENSION SYSTEM

9 Hrs.

Need of suspension system, type of suspension, suspension springs, constructional details and characteristics of leaf spring, variable rate leaf suspension, coil and torsion bar springs, anti-roll bar, front wheel & rear wheel independent suspension, rubber suspension, pneumatics suspensions, shock absorbers, torque reaction, air suspension system- electronically controlled, hydro-gas suspension.

UNIT 5 BRAKING SYSTEM

9 Hrs.

Classification of brakes, drum brakes and disc brakes, constructional details, theory of braking, determination of braking torque, concept of dual brake system, parking brake, material, hydraulic brake system, vacuum assisted system, air brake system- hydro mechanical, anti-lock braking, regenerative braking system, retarded engine brakes, eddy retarders, master cylinder, slave cylinder, servo action and self – energizing brakes.

Max.45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Understand the construction details of various types of automotive Frames and basic Chassis layouts
- CO2 - Understand the basic function steering system and steering components
- CO3 - Select the appropriate transmission system for various automobiles
- CO4 - Comprehend the final drive system of a vehicle.
- CO5 - Apply the knowledge for selection of suitable axles, wheels and tyres for a vehicle.
- CO6 - Distinguish various types of suspension system, brake system.

TEXT / REFERENCE BOOKS

1. Kirpal Singh, “Automobile Engineering Vol.I”, 12th Edition Standard Publishers, 2011.
2. Banga T.R. & Nathu Singh, “Automobile Engineering”, 3rd Edition Khanna Publications, 2012.
3. Rajput R.K., “A Text–Book of Automobile Engineering”, Laxmi Publications Private Limited, 2007.
4. Heldt.P.M. “Automotive Chassis”, 3rd edition Chilton Co. Publications, New York, 1990.
5. Heinz heisler “Advanced vehicle technology”, 2nd Editions Edward Arnold publication 2002.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

PART A: 10 Questions of 2 marks each - No choice

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks

Exam Duration: 3 Hrs.

20 Marks

80 Marks

SAUA1502	AUTOMOTIVE TRANSMISSION	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To know about the various transmission and drive line units of automobiles.
- To provide the basic knowledge, principle of operation and performance of various components and drives in an automotive transmission system.

UNIT 1 CLUTCH AND GEAR BOX

9 Hrs.

Transmission system – requirements of transmission system, clutches –types of clutches, functions, construction and working of friction clutches, **problems on clutches**, gear boxes – necessity and types of gear boxes, determination of gearbox ratios for different vehicle applications, speed synchronizing devices, gear materials, lubrication, and gear shifting mechanisms, **problems on gear boxes**, epicyclic gear transmission, transfer box.

UNIT 2 FLUID COUPLING AND TORQUE CONVERTORS

9 Hrs.

Principles, performance and limitations of fluid coupling, constructional details of a typical fluid coupling, torque capacity, slip in fluid coupling, torque convertor, reduction of drag torque, principle, construction and advantages of hydrodynamic torque converters, performance characteristics, converter couplings, multi-stage torque converter and poly phase torque converter, overdrive and over running clutches, comparison of fluid coupling and torque converters.

UNIT 3 AUTOMATIC TRANSMISSION

9 Hrs.

Automatic transmission: relative merits and demerits when compared to conventional transmission, hydrodynamic transmission. Ford – T model gear box, Wilson gear box- Cotal electromagnetic transmission – hydraulic control systems of automatic transmission.

UNIT 4 AUTOMATIC TRANSMISSION APPLICATION

9 Hrs.

Chevrolet turbo glide transmission, Toyota's automatic transmission with electronic control system, continuously variable transmission (CVT) – types – operations, Mercedes Benz automatic transmission, hydraulic actuation system for automatic transmission system.

UNIT 5 HYDROSTATIC DRIVE AND ELECTRIC DRIVE

9 Hrs.

Principle of hydrostatic drive systems, comparison of hydrostatic drive with hydrodynamic drive, construction and working of typical drives, Janney hydrostatic drive working - advantages and limitations, control of hydrostatic transmissions, **principle of electric drive, early and modified ward Leonard control systems, modern electric drive for buses and performance characteristics.**

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Understand the fundamentals, principle of operation and performance of various clutches and gear boxes. CO2 - Gain the knowledge about various hydrodynamic drives.
- CO3 - Learn various types of gear boxes used for automatic transmission.
- CO4 - Gain knowledge about application of automatic transmission.
- CO5 - Understand the principle of operation and performance of various hydrostatic drives.
- CO6 - Familiarize with various electric drives.

TEXT / REFERENCE BOOKS

1. Heinz Heisler, "Advanced Vehicle Technology", second edition, Butterworth – Heinemann, New York, 2002.
2. N. K. Giri, "Automobile Mechanics", Eleventh reprint, Khanna Publishers, Delhi, 2016
3. Design Practices, passenger Car Automotive Transmissions- 4th edition SAE Hand book- 2012.
4. Heldt P.M."Torque Converters", Chilton Book Co, reprinted 2016.
5. Kirpal Singh, "Automobile Engineering Vol"12th edition Standard Publishers, 2011.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

PART A: 10 Questions of 2 marks each - No choice

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks

Exam Duration: 3 Hrs.

20 Marks

80 Marks

Employability

SAUA1504	VEHICLE BODY ENGINEERING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- To develop knowledge in design of vehicle body to give maximum comfort for the passengers
- To develop skills in the areas of car body design, bus body design, active and passive safety.
- To understand different types of bodies and ergonomics of the vehicle

UNIT 1 CAR BODY DETAILS

9 Hrs.

Types of car bodies, visibility: regulations, driver's visibility, tests for visibility, methods of improving visibility and space incars safety: safety design, safety equipment for cars, car body construction - front assembly, roof assembly, under floor, bonnet; design criteria, prototype making, initial tests, crash tests on full scale model

UNIT 2 VEHICLE AERODYNAMICS

9 Hrs.

Objectives, vehicle drag and its 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, aerodynamic study for heavy vehicles, effects of different cabin to trailer body, pressure distribution, effects of a cab to trailer body roof height.

UNIT 3 BUS BODY AND COMMERCIAL VEHICLE DETAILS

9 Hrs.

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: types of body; flat platform, drop side, fixed side, tipper body, tanker body, light commercial vehicle body types, dimensions of driver's seatrelation to controls, drivers cab design.

UNIT 4 INTERIOR ERGONOMICS

9 Hrs.

Introduction, seating dimensions, interior ergonomics, seat comfort, driver seat design, dash board instruments, electronicdisplays, commercial vehicle cabin ergonomics, mechanical package layout, goods vehicle layout. Vehicle stability: Introduction, longitudinal, lateral stability, vehicle on a curvilinear path, critical speed for toppling and skidding, effect of operating factors on lateral stability, steering geometry and stabilization of steerable wheels, mass distribution and engine location on stability.

UNIT 5 BODY MATERIALS, TRIM AND MECHANISMS

9 Hrs.

Steel sheet, timber, plastic, glass, GRP, properties of materials; corrosion, anticorrosion methods, selection of paint and painting process, adhesives, insulation, body trim items, body mechanisms.

Max.45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Discuss the different types of car body design and its safety features.
- CO2 - Select a suitable body optimization techniques to minimize drag and able to describe the wind tunnel testing procedure.
- CO3 - Classify the various types of bus body construction and able to identify the body layout.
- CO4 - Describe the different types of commercial vehicles and its design.
- CO5 - Explain the various types of materials and painting techniques used in automobiles.
- CO6 - Acquire knowledge about the corrosion coating methods

TEXT / REFERENCE BOOKS

1. Powloski J, "Vehicle Body Engineering", Business Books Ltd., London 1989.
2. John Fenton, "Vehicle body layout and analysis", Mechanical Engg. Publication ltd, London, 1982.
3. Kohli P. L, "Automotive Chassis & Body", Papyrus Publishing House, New Delhi, 2010.
4. Wolf-Heinrich Hucho, "Aerodynamics of Road Vehicles" SAE International,USA,1998.
5. Robinson A.,Livesey W. A, "The Repair of Vehicle Bodies", Butterworth - Heinemann Ltd,1989
6. John Fenton, "Vehicle Body Layout & Analysis", Hutchinson, London, 1998

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

PART A: 10 Questions of 2 marks each – No choice

PART B: 2 Questions from each unit with internal choice, each carrying 12 marks

Exam Duration: 3 Hrs.

20 Marks

80 Marks

SMEA1304	MACHINE DRAWING	L	T	P	Credits	Total Marks
		1	0	4	3	100

COURSE OBJECTIVES

- To understand and apply national standards while drawing machine components based on BIS.
- To understand the conventions, abbreviations and symbols to be followed by Engineers for making assembly drawings.
- To make the students to understand sectioning and concept of limits, fits and tolerances used for component design.
- To understand surface texture, riveted joints, welded joints, keys.
- To know various thread forms and its engineering applications.
- To make the students learn to draw the assembly, orthographic and sectional views of various machine components and to interpret the assembly drawing.

DETAILED CONTENTS

1. Conventions, Abbreviations and Symbols

Conventional representation of shaft, hollow shaft, bar - Conventional representation of common machine elements such as threads, slotted head, bearings, straight and diamond knurling, holes on a linear and circular pitch, helical spring, leaf spring
 – Conventional representation of metals, glass, packing and insulating materials, liquids, concrete and wood – Conventional representation of screw, rivet and pin in section. Abbreviations for iron, carbon steel, alloy steel – Abbreviations for acrosscorners, across flats, assembly, bearing, center of gravity, counterbore, countersunk, insulation, left hand, right hand, nominal, pitch circle diameter, tolerance, undercut.

2. Sectional Views

Full section, half section, partial or local section, revolved or superimposed section, removed section, successive section, parts that are not sectioned.

3. Limits, Fits and Tolerances

Definitions: Limits, Fits and Tolerances – Upper limit, lower limit, tolerance, deviation, upper deviation, lower deviation, tolerance zone – Standard tolerance grades – Computation of IT tolerance using formulae and tables – Fundamental deviation – Computation of fundamental deviation – System of fits - Clearance fit – Interference fit – Transition fit – Problemson clearance and interference fit on shaft and hole basis system.

4. Surface Texture

Nominal surface – Roughness – Waviness – Lay – Sampling length – Indication of surface roughness by roughness values, roughness grade number, roughness symbols – Indication of surface roughness by surface texture symbol with all the characteristics.

5. Threaded Fasteners and Its Applications

Screw thread terminology – Basic forms of screw threads - Standard forms of V threads – Basic form of square threads – Modified forms of square threads – Basic knuckle thread – Standard form of knuckle thread - Conventional representation of internal V thread and external V thread – Square thread – Designation of threads – Empirical proportions of hexagon and square head bolt and nut.

6. Riveted Joints, Welded Joints and Keys

Application of riveted joints – Difference between a bolt and a rivet – Disadvantages of riveted joints – Types of riveted joints – Empirical proportions of riveted joints – Types of welded joints – Symbolic representation of weld – Elementary weld symbols – Keys – Application of keys.

7. Assembly Drawing (using mini-drafter) for the following with part drawings given

Preparation of assembled views from exploded views for the following components: Cotter joint with sleeve, screw jack, snug type pedestal bearing, swivel bearing, tail stock.

Max.45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Identify the national standards related to the machine drawing based on BIS and applying the standards. CO2 - Analyze limits and tolerances for assembly and evaluate to choose appropriate fits for the assembly.
- CO3 - Understand and apply surface finish and welding symbols.
- CO4 - Assemble machine components through drawings.
- CO5 - Interpret the machine components and conventions used in the drawing.
- CO6 - Interpret the components such as fasteners, riveted joints, welded joints and keys

TEXT/REFERENCE BOOKS

1. Engineering drawing practice for schools and colleges, SP 46 – 1988 (http://web.iitd.ac.in/~achawla/public_html/201/lectures/sp46.pdf).
2. Gopalakrishnan, K.R., Machine Drawing, Subhas Publications, 16th Edition, 2008.
3. Bhatt, N.D., Machine Drawing, Charotar Publishing House, 48th Edition, 2013.

4. Brian Griffiths, “Engineering Drawing for Manufacture”, Kogan Page Science, 2003.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Part A: Questions from sections 1 – 6 (Each section 10 marks)

Part B: One question from section 7 with no choice (Assembly Drawing)

Exam Duration: 3 Hrs.

60 Marks

40 Marks



Employability

SAIC4001	INDUSTRY 4.0	L	T	P	Credits	Total Marks
		2	-	2	2	100

UNIT 1 ADVANCED TECHNOLOGY AND ADVANCED MATERIALS

7 Hrs.

Advanced electro-optical sensing technology-active, passive multi-spectral and hyper spectral imaging; electronic beam steering; vacuum technology, surface and coating technology, health care technology, Nanotechnology- Nanomechanics,Nano optoelectronics; energy storage technology-next generation Li-based Batteries, Hydrogen storage, solar photovoltaic's, Flexible electronics. Intellectual Property Rights - case studies governing/pertaining to Materials/Technology.

UNIT 2 TRANSFORMING TECHNOLOGIES IN BIOENGINEERING

7 Hrs.

Establishment of smart biotechnology factory, Artificial intelligence in Bioprocess technology, Omics – Big data analysis through automation, 3D bio printing for tissue engineering, Simulation tools, RSM and Box model. Cyber physical systembased telemedicine, diagnosis and therapeutics through real time biosensors. Bionanotechnology. Intellectual Property rights (IPR): Case Studies.

UNIT 3 ADVANCEMENTS IN SUSTAINABLE BUILT ENVIRONMENT

7 Hrs.

Introduction – Technological developments in Architectural, Engineering and Construction (AEC) - Building Information Modelling (BIM) using Cloud computing technology and Internet of things (IoT) – Unmanned Aerial Vehicles, sensors – Additive manufacturing in construction – Concrete 3D printing - Materials used - Lightweight and functionally graded structures - Net Zero Energy buildings, Bioswales, Biofiltration pond, Ecosan systems- Recent developments in Waste water Management, Air pollution control, waste disposal - Integration of energy, water and environmental systems for a sustainable development- Emerging Technologies: Robot Highway- Vertical farming - Intellectual Property rights: Case studies.

UNIT 4 SMART MANUFACTURING

8 Hrs.

Smart factories and interconnection, Smart Manufacturing – automation systems, Additive Manufacturing, Smart grids, Micro Electro Mechanical Systems (MEMS), Stealth technology, Metal Finishing, Self propelled vehicles, e mobility, Green fuels, drones – unmanned aerial vehicles(UAVs), aerodynamics. Robotic Automation and Collaborative Robots – Augmented reality and haptics, engineering cybernetics and artificial intelligence (AI), Disruptive Technologies – Frugal Innovations – Emerging Technologies - Autonomous Robots, Swam Robot, Modular Robotics, Space craft, Intellectual Property Rights (IPR): Case Studies.

UNIT 5 SMART WORLD

8 Hrs.

Smart Sensors and IIOT, Smart grid, Hybrid renewable energy systems, Electronics in Smart city, Integration of Sensors in Robots and Artificial Intelligence, 5G Technology, Communication protocols, Human-Machine Interaction, Virtual Reality, Quantum Computing: Changing trends in transistor technology: Processor, Emerging Trends: Deep Space, Swarm Robots, Cyborg, Geofencing, Pervasive Computing, Intellectual Property Rights- Case Studies.

UNIT 6 CYBER PHYSICAL SYSTEMS

8 Hrs.

Introduction to Cyber Physical Systems (CPS), Architecture of CPS, Data science and technology for CPS, Prototypes ofCPS, Emerging applications in CPS including social space, crowd sourcing, healthcare and human computer interactions, Industrial Artificial Intelligence, Networking systems for CPS applications, Wearable cyber physical systems and applications, Domain applications of CPS: Agriculture, Infrastructure, Disaster management, Energy, Transportation, Intellectual Property Rights (IPR) : Case Studies.

Max.45 Hrs.

TEXT / REFERENCE BOOKS

1. William D. Callister, "Materials Science and Engineering, An Introduction, John Wiley and Sons Inc. Singapore, 2001.
2. V. Raghavan, "Physical Metallurgy: Principle and Practice,, Prentice Hall India Pvt Ltd, 2006.
3. Flavio Craveiro, Jose Pinto Duarte, Helena Bartolo and Paulo Jorge Bartolo, "Additive manufacturing as an enabling technology for digital construction: A perspective on Construction 4.0", Automation in Construction, Vol. 103,pp. 251-267, 2019.
4. Klaus Schwab, "Fourth Industrial Revolution", Random House USA Inc, New York, USA, 2017.
5. Oliver Grunow, "SMART FACTORY AND INDUSTRY 4.0. The current state of Application Technologies", Studylab Publications, 2016.
6. Alasdair Gilchrist, "INDUSTRY 4.0: Industrial Internet of Things", Apress, 2016.
7. Sang C. Suh, U. John Tanik, John N Carbone, Abdullah Eroglu, "Applied Cyber-Physical Systems", Springer Publications, New York, 2013.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

PART A: 11 Questions of 2 marks each-No choice

PART B: 2 Questions from each unit with internal choice, each carrying 13 marks

Exam Duration: 3 Hrs.

22 Marks

78 Marks

Employability

SAUA3008	TWO AND THREE WHEELED VEHICLES	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- Understand the various systems and subsystems of two and three wheeled vehicles
- understand the constructional details operating characteristics and vehicle design aspects
- Address the underlying concepts and methods behind two and three wheeler technology.
- Extant a problem oriented in depth knowledge of two and three wheeler technology.

UNIT 1 THE POWER UNIT

9 Hrs.

Two stroke and four stroke SI & CI engine construction and working, merits and demerits, symmetrical and unsymmetrical valve & port timing diagrams, scavenging process, scavenging efficiency, types of scavenging, uni flow and cross flow.

UNIT 2 FUEL AND IGNITION SYSTEM

9 Hrs.

Fuel system – different circuits in two wheeler fuel systems, fuel injection system, lubrication system, ignition systems - magneto coil and battery coil spark ignition system, electronic ignition system, starting system - kick starter system – self-starter system, recent technologies.

UNIT 3 CHASSIS AND SUB-SYSTEM

9 Hrs.

Main frame for two and three wheelers, its types, chassis and different drive systems for two wheelers, single, multiple plates and centrifugal clutches, gear box and its and various gear controls in two wheelers front and rear suspension systems shock absorbers, panel meters and controls on handle bar, freewheeling devices.

UNIT 4 BRAKES AND WHEELS

9 Hrs.

Drum brakes & disc brakes, construction and working and its types, front and rear brake links lay-outs, brake actuation mechanism, spoked wheel, cast wheel, disc wheel & its merits and demerits, tires and tubes, construction & its types, steering geometry.

UNIT 5 TWO AND THREE WHEELERS – CASE STUDIES

9 Hrs.

Case studies - sports bike, motor cycles, scooters and mopeds - auto rickshaws, pick up van, delivery van and trailer, servicing and maintenance, recent developments.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Gain knowledge about the Engines employed for two and three wheelers.
- CO2 - Understand about the Chassis and its sub-systems.
- CO3 - Distinguish about the functionality of Brakes and wheels.
- CO4 - Gain knowledge on specific Case studies of major Indian models.
- CO5 - Develop the information about Servicing, maintenance and trouble shooting of two and three wheelers.
- CO6 - Acquire knowledge about recent developments in two and three wheelers.

TEXT / REFERENCES BOOKS

1. Irving, P.E., Motor cycle Engineering, Temple Press Book, London, 1992.
2. The Cycle Motor Manual, Temple Press Ltd., London, 1990.
3. K. K. Ramalingam, Two Wheelers, Scitech publications, Chennai, 2005.
4. Encyclopedia of Motor cycling, 20 volumes, Marshall Cavendish, New York and London, 1989.
5. Bryant, R.V., Vespa Maintenance and Repair series.
6. Raymond Broad, Lambretta – A practical guide to maintenance and repair, 1987.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 10 Questions of 2 marks each - No choice

20 Marks

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks

80 Marks

SAUA3014	TRANSPORT MANAGEMENT	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- Understand the role of transport in economic development of a region.
- Appreciate the role of transport in fostering close contact and unity between traveling individuals and societies.
- Able to manage a transport fleet and their related activities for minimizing operational cost.

UNIT 1 INTRODUCTION

9 Hrs.

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

UNIT 2 TRANSPORT SYSTEMS

9 Hrs.

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

UNIT 3 SCHEDULING AND FARE STRUCTURE

9 Hrs.

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

UNIT 4 MOTOR VEHICLE ACT

9 Hrs.

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

UNIT 5 MAINTENANCE

9 Hrs.

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

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Demonstrate different theories in practice within companies and various supply chains.
- CO2 - Understand and take into consideration the importance of transportation management.
- CO3 - Evaluate knowledge/science within the area transportation management.
- CO4 - Describe the various transport systems and advantages of motor transport.
- CO5 - Apply the Motor Vehicle Act in fleet management and various maintenance activities to vehicles.
- CO6 - Assess the operating costs for transport vehicles and estimate the fare structure.

TEXT / REFERENCE BOOKS

1. John Duke, Fleet Management, McGraw-Hill Co, USA, 1984.
2. Kitchin.L.D., "Bus Operation", III edition, Illiff and Sons Co., London, 1992.
3. Government Motor Vehicle Act, Publication on latest act to be used as on date.
4. The motor vehicle Act 1939 - Ejaz Ahemad, Ashok law house, India – 1989.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 10 Questions of 2 marks each - No choice

20 Marks

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks

80 Marks

Entrepreneurship

SAUA1702	VEHICLE MAINTENANCE	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To know about the various methods of maintaining vehicles and their subsystems.
- To impart knowledge on engine maintenance – repair and overhauling.
- To understand step by step procedure for maintain the various automotive sub systems.

UNIT 1 MAINTENANCE, WORKSHOP PRACTICES, SAFETY AND TOOLS

9 Hrs.

Maintenance – need, importance, primary and secondary functions, policies - classification of maintenance work - vehicle insurance - basic problem diagnosis, automotive service procedures – workshop operations – workshop manual .safety – personnel, machines and equipment, vehicles, fire safety - first aid, basic tools – special service tools – measuring instruments – condition checking of seals, gaskets and sealants, scheduled maintenance unscheduled maintenance services – service intervals - towing and recovering, reports, log sheets, trip sheets and other forms.

UNIT 2 ENGINE AND ENGINE SUBSYSTEM MAINTENANCE

9 Hrs.

General engine service- dismantling of engine components- engine repair- working on the underside, front, top, ancillaries- service of basic engine parts, cooling and lubricating system, fuel system, intake and exhaust system, electrical system - electronic fuel injection and engine management service - fault diagnosis- servicing emission controls.

UNIT 3 TRANSMISSION AND DRIVELINE MAINTENANCE

9 Hrs.

Clutch- general checks, adjustment and service- dismantling, identifying, checking and reassembling transmission, transaxle- road testing- removing and replacing propeller shaft, servicing of cross and yoke joint and constant velocity joints- rear axle service points removing axle shaft and bearings- servicing differential assemblies- fault diagnosis.

UNIT 4 STEERING, BRAKE, SUSPENSION, WHEEL MAINTENANCE

9 Hrs.

Inspection, maintenance and service of hydraulic brake, drum brake, disc brake, parking brake, bleeding of brakes. inspection, maintenance and service of mc person strut, coil spring, leaf spring, shock absorbers, dismantling and assembly procedures, wheel alignment and balance, removing and fitting of tyres, tyre wear and tyre rotation, inspection, maintenance and service of steering linkage, steering column, rack and pinion steering, recirculating ball steering service- worm type steering, power steering system.

UNIT 5 AUTO ELECTRICAL AND AIR CONDITIONING MAINTENANCE

9 Hrs.

Maintenance of batteries, starting system, charging system and body electrical -fault diagnosis using scan tools, maintenance of air conditioning parts like compressor, condenser, expansion valve, evaporator - replacement of hoses- leak detection- AC charging- fault diagnosis, vehicle body repair like panel beating, tinkering, soldering, polishing, painting.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Gain knowledge about vehicle operation and maintenance, service schedules etc.
- CO2 - Apply the concepts of scheduling.
- CO3 - Understand Maintenance of engine sub system and Repair
- CO4 - Understand maintenance procedures like repairing, overhauling
- CO5 - Describe the basic concepts of steering, brake, suspension and wheel maintenance.
- CO6 - Analyze the testing methods for checking battery, starter motor, charging systems, ignitions system.

TEXT / REFERENCE BOOKS

1. Ed May, “Automotive Mechanics”, Volume 1 and 2, 8th edition, McGraw Hill Publications, 2009.
2. Vehicle Service Manuals of reputed manufacturers.
3. Bosch Automotive Handbook, Tenth Edition, 2017.
4. Automotive Mechanics W.H. crouse.2010.
5. James D Halderman, “Advanced Engine Performance Diagnosis” 6 edition, Pearson, 2015

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 10 questions of 2 marks each - No choice

20 Marks

PART B: 2 questions from each unit of internal choice; each carrying 16 marks

80 Marks

SAUA3010	STYLING AND MODELLING OF VEHICLES	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- To understand the basics and familiarize with the concepts on the styling of automobiles.
- To design the structure and surfaces of vehicles.
- To visualize the interior and exterior of vehicles.

UNIT 1 INTRODUCTION

9 Hrs.

Introduction to product design, drawing by hand, drawing using CAD softwares, geometric versus naturalistic drawing, modernist design. Basic drawing skills - Perspectives, metric projections, spherical projections, orthographic projections, sections and scrap views. Tools and materials. Car Design., Automotive Sketching, Styling process, Car proportions, Aerodynamics, Crashworthiness and its influence on body design, Designing of Interior

UNIT 2 FORM STUDIES

9 Hrs.

Technical production documentation, the general arrangement drawing, drafting standards, computer aided drafting, geometric constructions, controlling curves, Form studies, Speed Forms, Clay Modeling, 2D systems, 3D systems, parametric design. CAD data - Exchange standards and all change in the CAD market. From watercolor washes to markers, painting by numbers, the art of design, visual tricks, making marker drawing, 2D computer programs: paint and vector, 3D computer aided styling (CAS), creating virtual reality, shading a computer model, ray tracing and radiosity, adding texture, fractals and commercial modelers.

UNIT 3 COMPUTER SYSTEMS

9 Hrs.

The computer processor, system software, the central processing unit, memory, frame buffers, display, input devices, hardcopy output, 3D output devices, networking, healthy and safety. Concept design - Satisfying the client, sketch, schematic, evaluating the design, 3D modeling concepts, hybrid approach, commercial computer solutions, drawing in space, creating organic forms. Art of technical illustration, techniques of technical illustration, thick and thin lines, sections, cutaways and ghosting, photo-tracing, annotation and labeling, computer aided illustration, interactive technical illustration and commercial solutions.

UNIT 4 VEHICLE ERGONOMICS

9 Hrs.

Dimension Determination, Anthropometry – Need, Data collection methodology, Different postural considerations, Measuring Procedures Subject and Sampling size selection, Measurement of Hands/Feet/Full posture, Applying Anthropometry data, Application of percentile curves. Passenger Compartment, Floor Pan, Technical requirements, Dash board equipments arrangement, Positioning of operational controls, Force Analysis, Seating and position(ECE Regulations), Human Factors, Navigation systems, pedal positioning

UNIT 5 VEHICLE PACKAGING

9 Hrs.

R-Point, AHP, Manikin positioning of 2-D pattern, car entry/exit, Sight – All round visibility, View of Instruments, Mirror design, Logical formation of cockpit, Boot lid packaging, Loading/Unloading analysis.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Familiarize on sketching in various automotive exterior parts
- CO2 - Acquire the knowledge on design and styling of cars.
- CO3 - Acquire the concepts of benchmarking for quality improvement
- CO4 - Gain knowledge on the systematic methods of creative designing.
- CO5 - Expertise in the various steps involved in automotive product design
- CO6 - Expertise in the various processes involved in automotive product development

TEXT / REFERENCE BOOKS

- Vivek D Bhise, "Ergonomics in the Automotive Design Process", 2013, ISBN- 10: 1439842108
- Tony Lewin, "How to Draw Cars like a Pro", Motorbooks International, 2003.
- Thom Taylor, Lisa Hallett, "How to Draw Cars like a Pro", Motorbooks International; 2Rev Ed edition, 2006.
- Julian Happian-Smith, "An introduction to modern vehicle design", Butterworth Heinmann, 2001.
- Fenton John, "Handbook of automotive body and system design", Wiley-Blackwell, 1998.
- J. Brian Peacock, Waldemar Karwowski, "Automotive ergonomics", Taylor & Francis ltd, 1993.
- Alan Pipes, "Drawing for Designers", Laurence King Publishing, 2007.
- Erik Olofsson, Klara Sjöln, "Design Sketching", Keeos Design Books AB, 2005.
- Stuart Macey, Geoff Wardle, Ralph Gilles, Freeman Thomas, Gordon Murray , "H-Point: The Fundamentals of Car Design & Packaging", Design Studio Press, 2009.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

PART A: 10 Questions of 2 marks each - No choice

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks

Exam Duration: 3 Hrs.

20 Marks

80 Marks

SAUA3002	AUTOMOTIVE POLLUTION CONTROL	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- Understand the sources of Automobile Emissions and their effects on environment.
- Gain knowledge about the formation of Emissions from SI Engines.
- Gain knowledge about the formation of Emissions from CI Engines.
- Understand Emission and control Techniques in SI and CI Engines.
- Understand measuring techniques of Emission and test procedure.

UNIT 1 INTRODUCTION

9 Hrs.

History back ground, exhaust gas pollutants, vehicle population assessment in metropolitan cities and contribution to pollution, effect on human health and environment, global warming, acid rain, type of emission-exhaust & non-exhaust emission, transient operational effect on pollution

UNIT 2 POLLUTANT FORMATION IN S.I ENGINES

9 Hrs.

Pollutant formation in SI engines, mechanism of HC and CO formation in four stroke and two stroke SI engines, NO_x formation in SI engine, effects of design and operating variables on emission formation, control of evaporative emission, modern evaporative emission control device, charcoal canister, two stroke engine pollution.

UNIT 3 POLLUTANT FORMATION IN C.I ENGINES

9 Hrs.

Pollutant formation in CI engines, smoke and particulate emissions in CI engines, effects of design and operating variables on CI engines emissions, NO_x formation and control, noise pollution from automobiles, vehicle body noise, measurement standards, smoke & smoke measurements, particulate emission and control, diesel pollution control methods – CO – UBHC – low heat rejection engine.

UNIT 4 CONTROL OF EMISSION FROM SI AND CI ENGINES

9 Hrs.

Design of engine, optimum selection of operating variables for control of emissions, EGR, thermal reactors, secondary air injection, catalytic converters, catalyst, fuel modifications, post combustion treatments, fuel cells, two stroke engine pollution controls, supply of fuel – establishment of national test centres, construction of road networks, estimation of petroleum reserve – need for alternate fuels – merits & demerits and uses of CNG, LPG, alcohols, hydrogen, bio-fuels, electric energy, solar energy, noise control, noise control devices and noise proof materials & vibration control – muffler.

UNIT 5 MEASUREMENT TECHNIQUES, EMISSION STANDARDS AND TEST PROCEDURE

9 Hrs.

NDIR, FID, chemiluminescent analysers, gas chromatograph, smoke meters, emission standards, driving cycles – USA, JAPAN, EURO and INDIA, test procedures – ECE, FTP tests. SHED test – chassis dynamometers, dilution tunnels, measurements of invisible emissions – ORSAT sat apparatus, evaluation of emission standards – mandatory tests for emission measurement type approval & production conformity tests – driving cycles, Bharat stages & Euro emission standards.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Understand the sources of formation of engine emissions and its effect on human health and environment.
- CO2 - Explain the effects of design and operating variables on emission formation and working principle of modern evaporative emission control device.
- CO3 - Explain the effects of design and operating variables on CI engines emissions and various sources of noise pollution from automobiles
- CO4 - Understand various emission control technique for both SI and CI engines.
- CO5 - Understand the importance of various alternative fuels for reducing emission.
- CO6 - Explain the test procedure of different emission measurement technique and recall various emission standards.

TEXT / REFERENCE BOOKS

1. Pundir.B. P, “Engine Emissions: Pollutant Formation and Advances in Control Technology”, 2nd edition, Narosa publication, 2012.
2. Ganesan V, “Internal Combustion Engines” 4th edition, Tata McGraw Hill publication 2017.
3. Rajput R. K, “A textbook of Internal Combustion Engines”, Third edition Laxmi Publications, 2016.
4. John B. Heywood, “Fundamentals of Internal Combustion Engine, Second edition, McGraw-Hill Education; 2018
5. Mathur and Sharma “Internal Combustion Engines” “Dhanpat Rai and Sons Publication, 2012.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

PART A: 10 Questions of 2 marks each - No choice

PART B: 2 Questions from each unit with internal choice, each carrying 16 marks

Exam Duration: 3 Hrs.

20 Marks

80 Marks

SAUA3011	COMPUTER SIMULATION OF IC ENGINES	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- Understand simulation of IC engine combustion processes.
- Apply the simulation techniques for modification of combustion chamber.
- Apply the simulation techniques to develop new engines.

UNIT 1 SIMULATION PRINCIPLES

9 Hrs.

Simulation principles-First and second laws of thermodynamics – Estimation of properties of gas mixtures - Structure of engine models – Open and closed cycle models - Cycle studies, Chemical Reactions, First law application to combustion, Heat of combustion – Adiabatic flame temperature, Chemical Equilibrium and calculation of equilibrium composition - – Heat transfer in engines – Heat transfer models for engines.

UNIT 2 SIMULATION OF COMBUSTION IN SI ENGINES

9 Hrs.

Simulation in SI engine - Combustion in SI engines, Flame propagation and velocity, Single zone models – Multi zone models – Mass burning rate, Turbulence models – One dimensional models – Chemical kinetics modelling – Multidimensional models, Flow chart preparation.

UNIT 3 SIMULATION OF COMBUSTION IN CI ENGINES

9 Hrs.

Main difference between SI and CI engine simulation, differences between ideal and actual cycles, Combustion in CI engines Single zone models – Premixed-Diffusive models – Wiebe’ model –Whitehouse way model, Two zone models - Multizone models- Meguerdichian and Watson’s model, Hiroyasu’s model, Lyn’s model – Introduction to Multidimensional and spray modeling, Flow chart preparation.

UNIT 4 SIMULATION OF TWO STROKE ENGINES

9 Hrs.

Thermodynamics of the gas exchange process - Flows in engine manifolds – One dimensional and multidimensional models, determination of the pressure-crank angle variation, and computation of performance parameters. Flow around valves and throughports Models for scavenging in two stroke engines – Isothermal and Non-isothermal models, Heat Transfer and Friction. Simulation for pollution estimation.

UNIT 5 SIMULATION OF GAS TURBINE COMBUSTORS

9 Hrs.

Gas Turbine Power plants – Flame stability, Combustion models for Steady Flow Simulation –Emission Models. Flow chart preparation.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Understand first and second laws of thermodynamics.
- CO2 - Understand the basic Heat transfer models for engines.
- CO3 - Apply the simulation techniques for modification of combustion chamber
- CO4 - Apply the simulation techniques to develop new engines
- CO5 - Apply the simulation techniques Combustion in SI engines.
- CO6 - Apply the simulation techniques Combustion in CI engines

TEXT / REFERENCE BOOKS

1. Ashley S. Campbell, Thermodynamic Analysis of Combustion Engines, Krieger publication co.
2. Ganesan V., Computer Simulation of Spark Ignition Engine Processes, Universities Press, 2000.
3. Ganesan V., Computer Simulation of C.I. Engine Processes, Universities Press, 2000.
4. Cohen H. Rogers GEC. – Gas Turbine Theory – Pearson Education India Fifth edition, 2001.
5. Bordon P. Blair, The Basic Design of two-Stroke engines, SAE Publications.
6. Ramos J.I, Internal Combustion Engine Modeling, Butterworth – Heinemann Ltd.
7. Mattavi J.N and C.A.Amann, Combustion Modeling in Reciprocating Engines, Plenum Press.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

PART A: 10 Questions of 2 marks each - No choice

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks

Exam Duration: 3 Hrs.

20 Marks

80 Marks



Skill Development

SMEA1503	FINITE ELEMENT ANALYSIS	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- To introduce the concepts of Mathematical Modeling of Engineering Problems.
- To appreciate the use of FEM to a range of Engineering Problems.
- Learn how to implement the finite element method efficiently in order to solve a particular equation for simple problems.
- Solve simple and complicated 2D structural problems for stress analysis under impact loads from general engineering aspects.

UNIT 1 INTRODUCTION

9 Hrs.

Historical Background– Basic Concepts of FEM – Mathematical Modeling of field problems in Engineering – Governing Equations – Discrete and continuous models – Boundary, Initial and Eigen Value problems–Residual Methods- Variational Formulation of Boundary Value Problems – Ritz Method.

UNIT 2 ONE-DIMENSIONAL PROBLEMS

9 Hrs.

One Dimensional Second Order Equations – Discretization – Element types- Linear and Higher order Elements – Derivation of Shape functions and Stiffness matrices and force vectors- Assembly of Matrices- **Solution of problems from solid mechanics and heat transfer- Bar, Beam Elements – Applications to Heat Transfer.**

UNIT 3 TWO DIMENSIONAL PROBLEMS

9 Hrs.

Basic Boundary Value Problems in Two Dimensions – Triangular, quadrilateral, higher order elements – Triangular elements – Shape functions and element matrices and vectors. **Application to Field Problems - Thermal problems – Torsion of Noncircular shafts –Quadrilateral elements – Higher Order Elements.**

UNIT 4 SOLUTION TO PLANE ELASTICITY PROBLEMS

9 Hrs.

Introduction to Theory of Elasticity – Plane Stress – Plane Strain and Axisymmetric Formulation – Body forces and temperature effects **Stress calculations - Plate and shell elements.**

UNIT 5 ISO PARAMETRIC FORMULATION

9 Hrs.

Natural Co-ordinate System – Lagrangian Interpolation Polynomials – Iso-parametric Elements – Formulation –Numerical Intergration – 1D -2D Triangular elements – rectangular elements – **Introduction to Analysis Software-- h & p elements- Errors and Types.**

Max.45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Understand the basics of matrix manipulations required for Finite Element Analysis
- CO2 - Apply finite element formulations to solve one dimensional Problems.
- CO3 - Apply finite element formulations to solve two dimensional scalar Problems.
- CO4 - Apply finite element method to solve two dimensional Vector problems.
- CO5 - Apply finite element method to solve problems on iso parametric element
- CO6 - Appreciate the importance of ethical issues pertaining to the effective utilization of FEA in Mechanical engineering.

TEXT / REFERENCE BOOKS

1. Reddy, J.N., “An Introduction to the Finite Element Method”, 3rd Edition, Tata McGraw-Hill, 2010.
2. Seshu, P, “Text Book of Finite Element Analysis”, Prentice-Hall of India Pvt. Ltd., New Delhi, 2007.
3. Chandrupatla & Belagundu, “Introduction to Finite Elements in Engineering”, 4th Edition, Prentice Hall College Div,1997.
4. Rao, S.S., “The Finite Element Method in Engineering”,4th Edition, Butterworth Heinemann, 2005.
5. Robert D. Cook, David S. Malkus, Michael E. Plesha, Robert J. Witt, “Concepts and Applications of Finite Element Analysis”, 4th Edition, Wiley Student Edition, 2002.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 10 Questions of 2 marks each - No choice

20 Marks

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks

80 Marks

Skill Development

SMEA3005	NON DESTRUCTIVE TESTING AND TECHNIQUES	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To enable the student to understand the modern NDT techniques.
- To present the underlying principles and alternatives for destructive testing procedures.
- To provide the student with the opportunity for hands-on experience for diverse domains of application.

UNIT 1 INTRODUCTION AND VISUAL INSPECTION METHODS

9 Hrs.

Scope and advantages of NDT. Comparison of NDT with DT. Some common NDT methods used since ages, Terminology. Flaws and Defects, Visual inspection-Unaided, Equipment used for visual inspection. Ringing test chalk test (oil whitening test). Attractive uses of above tests in detecting surface cracks, bond strength & surface defects.

UNIT 2 LIQUID PENETRANT TESTING AND MAGNETIC PARTICLE TESTING

9 Hrs.

Die penetrate test (liquid penetrate inspection), Principle, scope. Equipment & techniques, Tests stations, Advantages, types of penetrant and developers. Illustrative examples – Heavy castings of large size, frame of jet engine, porosity testing of nickel alloys, leak testing. Magnetic particle Inspection – Scope, principle, Ferro Magnetic and Non-ferro magnetic materials, equipment & testing. Advantages, limitations Interpretation of results. DC & AC magnetization, Skin Effect, use of dye & wet powders for magna glow testing, different methods to generate magnetic fields, Applications and demonstration.

UNIT 3 RADIOGRAPHIC METHODS

9 Hrs.

X-ray radiography principle, equipment & methodology. Applicability, types of radiations limitations. Interpretation of Radiographs, limitations of gamma-ray radiography –principle, equipment. Attenuation of electromagnetic radiations, source of radioactive materials & technique. Photo electric effect, Rayleigh's scattering (coherent scattering), Compton's scattering (Incoherent scattering). Pair production, Beam geometry, scattering factor. Precautions against radiation hazards. Xero- Radiography, Digital Radiography, Gamma ray Radiography, Safety in X- ray and Gamma ray radiography. Advantages of gamma ray radiography over X-ray radiography.

UNIT 4 ULTRASONIC TESTING AND ACOUSTIC EMISSION TESTING

9 Hrs.

Introduction, Principle of operation, Piezoelectricity. Ultrasonic probes, CRO techniques, advantages, Limitation & typical applications. Applications in inspection of castings, forgings, Extruded steel parts, bars, pipes, rails and dimensions measurements. Acoustic Emission Technique – Introduction, Types of AE signal, AE wave propagation, Source location, Kaiser effect, AE transducers, Principle, AE parameters, AE instrumentation, Advantages & Limitations, Applications and demonstration.

UNIT 5 EDDY CURRENT TESTING AND THERMOGRAPHY

9 Hrs.

Eddy current Testing – Principle, properties of eddy currents, Eddy current sensing elements, probes, Instrumentation, Types of arrangement, Advantages & Limitations & applications. Thermography – Introduction, Principle, Contact & Non- Contact inspection methods, Active & Passive methods, Liquid Crystal – Concept, example, advantages & limitations. Electromagnetic spectrum, infrared thermography- approaches, IR detectors, Applications and demonstration.

Max.45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Describe the basic concepts of NDT.
- CO2 - Interpret the quality of the components.
- CO3 - Design the precautions against the radiation hazards.
- CO4 - Knowledge on Interpretation of results.
- CO5 - Analyze products as production team member.
- CO6 -

TEXT / REFERENCE BOOKS

1. ASM Metals Handbook, "Non-Destructive Evaluation and Quality Control", American Society of Metals, Metals Park, Ohio, USA, 200, Volume-17.
2. Research Techniques in NDT Vol.3, R.S. Shah, Academic 2002.
3. Paul E Mix, "Introduction to non destructive testing: a training guide", Wiley, 2nd edition New Jersey, 2005.
4. Ravi Prakash, "Non-Destructive Testing Techniques", New Age International Publishers, 1st revised edition, 2010.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 10 Questions of 2 marks each - No choice

20 Marks

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks

80 Marks

SAUA1701	HYBRID AND ELECTRIC VEHICLES	L	T	P	Credits	Total Marks
		3	0	4	2	100

COURSE OBJECTIVES

- To introduce the fundamentals concepts, principles of hybrid, electric and fuel cells
- To understand the analysis and design of hybrid, electric and fuel cells
- To understand the basics of battery and its types

UNIT 1 INTRODUCTION TO ELECTRIC VEHICLE

9 Hrs.

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

UNIT 2 HYBRID VEHICLES

9 Hrs.

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

UNIT 3 ELECTRIC PROPULSION SYSTEMS

9 Hrs.

DC motors, AC motors, permanent magnet motors, brushless DC and reluctance motors, Characteristics, regenerative braking. DC generators, AC generators, voltage and frequency regulations. Control system principles, speed and torque control – DC motors and AC motors.

UNIT 4 ENERGY STORAGEES

9 Hrs.

Electrochemical batteries – types of batteries – lead acid batteries, nickel based batteries, and lithium based batteries, electrochemical reactions, thermodynamic voltage, specific energy, specific power energy efficiency. Ultra capacitors.

UNIT 5 FUEL CELLS AND SOLAR CARS

9 Hrs.

Fuel cell, construction, working equations, possible fuel sources, fuel reformer, design of solar cars – photovoltaic cells, tracking efficiency and cost comparisons.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Understand the working of different configuration of electric vehicles.
- CO2 - Understand the hybrid vehicle configuration.
- CO3 - Differentiate electric and hybrid vehicles.
- CO4 - Understand the properties of batteries and its types.
- CO5 - Understand the electric vehicle drive systems and hybrid electric vehicles.
- CO6 - Design of solar cell and fuel cell.

TEXT / REFERENCE BOOKS

2. Iqbal Hussain, "Electric and Hybrid vehicles Design fundamentals", CRC press, second edition 2013.
3. James Larminie, John Lowry, "Electric vehicle technology explained" second edition, John & Wiley sons 2012.
4. Mehrdad Ehsani, Yimin Gao, Ali Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals", CRC press, 2010.
5. Sandeep Dhameja, "Electric Vehicle Battery Systems", Butterworth – Heinemann, 2002.
6. Ronald K Jurgen. "Electric and Hybrid Vehicle – Electric Vehicles", SAE, 2011.
7. Ron Hodkinson and John Fenton, "Light Weight Electric/Hybrid Vehicle Design", Butterworth-Heinemann, 1st Edition 2001.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

PART A: 10 Questions of 2 marks each - No choice

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks

Exam Duration: 3 Hrs.

20 Marks

80 Marks

Skill Development

SMEA1203	FUNDAMENTALS OF MECHANICAL ENGINEERING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To provide design concepts and product development stages.
- To provide the fundamentals of the machining processes and machine tools.
- To provide the working principles of power plant, IC engines and the related components.

UNIT I CONCEPTS OF DESIGN

9 Hrs.

Introduction to engineering design, Need for design, Product life cycle, Product development process, Types of product development process, Idea generation methods, Design process.

UNIT II FOUNDRY, FORMING AND JOINING PROCESSES

9 Hrs.

Concepts of manufacturing, Foundry: tools, patterns and allowances - green and dry sand moulding, furnaces. Casting principles. Metal forming: Concepts and principles, forging, rolling, extrusion and drawing, Metal joining processes: Arc welding and Gas welding, brazing and soldering. Sheet metal operations: Shearing, piercing, blanking, bending, forming and spinning.

UNIT III MACHINING PROCESSES

9 Hrs.

Machining Concepts, Tool and work holding devices. Machine tools and operations: lathe, drilling machine, boring machine, milling machine, shaper, planer, broaching machine and grinder. Introduction to digital manufacturing: NC, DNC and CNC.

UNIT IV I.C. ENGINES

9 Hrs.

Engine classification - Working principle of S.I. and C.I. engines - four stroke and two stroke cycles - comparison of four stroke and two stroke engines. Components of I.C. engines - function of piston, piston rings, cylinder, connecting rod and crankshaft. Ignition systems - single jet carburettor - spark plug - cooling systems - lubrication systems - fuel pump and fuel injector.

UNIT V POWER GENERATION

9 Hrs.

Energy demand, Non-renewable energy, Renewable energy. Power plants: Thermal, Gas turbine, diesel, hydro, wind, solar, nuclear, geothermal power plants. Boilers: Classification and types of Boilers, Modern high pressure boilers, Turbines: Classification, construction and working principle of impulse and reaction turbines.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Understand the fundamentals of product design and development.
- CO2 - Understand the basics of the manufacturing processes.
- CO3 - Understand the basics of machine tools and operations.
- CO4 - Understand the working principles of four stroke and two stroke engines and components.
- CO5 - Understand various sources of energy and their significance.
- CO6 - Understand the working principles of various power plants and accessories

TEXT / REFERENCE BOOKS

1. Karl T Ulrich, Steven D Eppinger, Product Design & Development. Tata McGraw Hill New Delhi, 2003.
2. Kevin Otto & Kristin Wood Product Design: "Techniques in Reverse Engineering and new Product Development", 1st Edition, Pearson Education New Delhi, 2004.
3. Hajra Choudhury. S.K, Hajra Choudhury. A.K, Nirjhar Roy, "Elements of Workshop Technology", Vol. 1, MediaPromoters, 2009.
4. Serop Kalpakjian, Steven R. Schmid, Manufacturing Engineering & Technology, 7th Edition, Pearson Publications, 2014.
5. Mikell P Groover, "Automation, Production Systems, And Computer-Integrated Manufacturing", 4th Edition, Pearson Education, 2014.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 10 Questions from each unit, each carrying 2 marks

20 Marks

PART B: 2 Questions from each unit with internal choice, each carrying 16 marks

80 Marks



Skill Development

SMEA1202	ENGINEERING MECHANICS (For Aero, Auto, Mech and Mechatronics)	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- To understand the concept of Statics.
- To appreciate the concept of Equilibrium.
- To recognise properties of surfaces and solids.
- To learn the theory of Friction.
- To acquire the concept of Dynamics.

UNIT 1 BASICS & STATICS OF PARTICLES

9 Hrs.

Introduction-Units and Dimensions-Laws of Mechanics-Vectors-Vectorial representation of forces and moments - Vector operations-resolution and composition of forces - equilibrium of a particle - Free body diagram - forces in space-equilibrium of a particle in space-equivalent systems of forces-principle of transmissibility-Resultant and Equilibrant.

UNIT 2 EQUILIBRIUM OF RIGID BODIES

9 Hrs.

Types of supports and their reactions - requirements of stable equilibrium – Moments and Couples- Varignon's theorem- Equilibrium of Rigid bodies in two dimensions- Equilibrium of Rigid bodies in three dimensions.

UNIT 3 PROPERTIES OF SURFACES AND SOLIDS

9 Hrs.

Determination of Areas - First moment of Area and the centroid - simple problems involving composite figures. Second moment of plane area-Parallel axis theorem and perpendicular axis theorem-Polar moment of Inertia – Principal moments of Inertia of plane areas – Principle axes of inertia – relation to area moments of Inertia. Second moment of plane area of simple sections like C,I,T,Z etc. - Basic Concept of Mass moment of Inertia.

UNIT 4 FRICTION

9 Hrs.

Frictional Force - Laws of Coulomb friction - Cone of friction-Angle of repose-relation between cone of friction and angle of repose- limiting friction-Rolling resistance- Simple contact friction - Screw - Wedge- Ladder- Belt friction.

UNIT 5 KINETICS OF RIGID BODIES AND DYNAMICS OF PARTICLES

9 Hrs.

Dynamics- Classification- Kinematics- Kinetics- Types of energy-Displacement, Velocity and acceleration their relation- Relative motion - Curvilinear motion - Newton's Law - D'Alembert's Principle, Work Energy Equation- Impulse and Momentum- Impact of elastic bodies- General plane motion.

Max.45 Hrs

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Understand the fundamentals of Statics.
- CO2 - Apply the concept of Equilibrium.
- CO3 - Evaluate the Centroid and Area Moment of Inertia.
- CO4 - Analyze the Friction in different applications.
- CO5 - Understand the fundamentals of Dynamics.
- CO6 - Analyze overall Rigid body system of Kinematics and Kinetics.

TEXT / REFERENCEBOOKS

1. Bhavikatti S.S., Engineering Mechanics, 1st Edition, New Age International publishers, 2017.
2. Bansal R.K., A Textbook of Engineering Mechanics, 4th Edition, Laxmi Publications, 2002.
3. Bedi D.S., Engineering Mechanics, 1st Edition, Khanna Publishing Co. (P) Ltd., 2013.
4. Khurmi R.S. and Khurmi N, Engineering Mechanics, S.Chand Publishing, 2018.
5. Beer & Johnston, "Vector Mechanics for engineers", Vol I & II, 9th Edition, Tata McGraw Hill, 2010.
6. Sharma, D.P., Engineering Mechanics, Pearson, 2010.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 10 Questions from each unit, each carrying 2 marks

20 Marks

PART B: 2 Questions from each unit with internal choice, each carrying 16 marks

80 Marks

SAUA1301	APPLIED THERMODYNAMICS	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- To understand the basic concepts of thermodynamics
- To understand the air standard cycles and working principles of four stroke and stroke engines
- To familiarize with the types of air compressors and their working principle
- To understand the working principles of refrigeration and air conditioning systems

UNIT 1 FIRST LAW OF THERMODYNAMICS

9 Hrs.

Concepts - concept of continuum, macroscopic approach, thermodynamic systems - closed, open and isolated. Property, state, path and process, quasi-static process, work, modes of work, Zeroth law of thermodynamics - concept of temperature and heat. Concept of ideal gas. First law of thermodynamics - application to closed and open systems, internal energy, specific heat capacities, enthalpy, steady flow process with reference to various thermal equipments.

UNIT 2 SECOND LAW OF THERMODYNAMICS

9 Hrs.

Second law of thermodynamics - Kelvin's and Clausius statements of second law. Reversibility and irreversibility. Carnot theorem, Carnot cycle, reversed Carnot cycle, efficiency, COP, Clausius inequality, concept of entropy, change of property of ideal gas, principle of increase of entropy.

UNIT 3 GAS POWER CYCLES AND INTERNAL COMBUSTION ENGINES

9 Hrs.

Air standard cycles - Otto, Diesel and Dual cycles. Derivation of expression for air standard efficiency and mean effective pressure. I.C Engines- Introduction-Classification, Comparison between four stroke and two stroke, petrol & diesel engines **Performance testing on internal combustion engines, Performance curves.**

UNIT 4 AIR COMPRESSORS

9 Hrs.

Positive displacement compressor - reciprocating air compressor, work done, volumetric efficiency, Effect of clearance volume- for qualitative treatment- rotary compressors - vane type, roots blower-centrifugal compressor

UNIT 5 REFRIGERATION AND AIR CONDITIONING

9 Hrs.

Simple vapour compression refrigeration cycle, cycle with superheat & subcooling, Performance calculations, Working principle of basic vapour absorption system (Qualitative treatment only). Psychrometry and psychrometric properties, Psychrometric processes, Air conditioning systems- winter and summer. (Qualitative treatment only).

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Understand the thermodynamic systems and thermodynamic properties.
- CO2 - Apply first law of thermodynamics in engineering applications.
- CO3 - Understand the second law of thermodynamics and concept of entropy.
- CO4 - Analyze gas power cycles and develop understanding of I.C engines.
- CO5 - Analyze the performance of reciprocating and rotary compressors.
- CO6 - Understand the concepts of refrigeration cycles and air conditioning systems.

TEXT / REFERENCE BOOKS

2. Nag P.K., "Engineering Thermodynamics", Tata McGraw Hill Education, 2009.
3. Yunus A. Cengel, Michael A. Boles, "Thermodynamics: An Engineering Approach", McGraw Hill Education, 2014.
4. Rajput R.K., "Thermal Engineering", Laxmi Publications, 2010.
5. Khurmi R.S., Gupta J.K., "Thermal Engineering", S Chand, 2006.
6. P.L. Ballaney, "Thermal Engineering", Khanna Publisher, 2005.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

PART A: 10 Questions of 2 marks each - No choice

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks

Exam Duration: 3 Hrs.

20 Marks

80 Marks



Skill Development

SAUA1501	AUTOMOTIVE ENGINE COMPONENTS DESIGN	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To familiarize the various steps involved in the Design Process.
- To understand the principles involved in evaluating the shape and dimensions of a component to satisfy functional and strength requirements.
- To learn to use standard practices and standard data.
- To learn to use catalogues and standard machine component.

UNIT 1 INTRODUCTION

9 Hrs.

Engineering material and their physical properties applied to design, selection of materials. Stress and strain, theory of failures, factor of safety, endurance limit, notch sensitivity, stress concentration, Limits, Fits and Tolerances, design considerations for interference fits, surface finish, surface roughness, Rankine's formula - Tetmajer's formula - Johnson formula- design of pushrods.

UNIT 2 CYLINDER AND PISTON – MATERIALS AND DESIGN

9 Hrs.

Choice of materials of cylindrical piston, piston friction, piston slap, design of piston, piston pin (Gudgeon pin), piston ring, piston failures, lubrication and piston assembly. Design of cylinder. Ceramic coating – Engine performance, Emission.

UNIT 3 DESIGN OF CONNECTING ROD, CRANKSHAFT

9 Hrs.

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

UNIT 3 DESIGN OF VALVES, VALVE TRAIN AND FLYWHEEL

9 Hrs.

Design aspects of intake and exhaust manifolds, inlet and Exhaust valves, valve springs, tappets, valve train. Design of cam & camshaft, Design of rocker arm, Cam profile generation. Materials and design of flywheel.

UNIT 5 DESIGN OF TRANSMISSION SHAFTS, BEARINGS AND SPRINGS

9 Hrs.

Design of transmission shafts, materials used for bearings, classification of bearings. Viscosity of lubricants, theory of hydrostatic and hydrodynamic lubrication, design of sliding contact bearings and design of helical springs

Max.45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Understand and implement Engineering Design process.
- CO2 - Apply engineering principles and analytical techniques in the design process.
- CO3 - Develop knowledge on design procedure of various engine components.
- CO4 - Design the Machine Components like Shafts and Springs Gear, Design Flywheels and Bearings.
- CO5 - Acquire knowledge on geometrical dimensioning.
- CO6 - Acquire the knowledge about the lubrication.

TEXT / REFERENCE BOOKS

1. Jain.R.K, "Machine Design", Khanna Publishers, New Delhi, 1997.
2. "Design Data Book", PSG College of Technology, Coimbatore, 2012.
3. Heldt.P.M "High Speed Combustion Engines", Oxford-IBH Publishing Co., Calcutta, 1965.
4. Kolchin.A and Demidov.V, "Design of Automotive Engines", MIR Publishers, Moscow, 1984.
5. Sundararaja Murthy T.V "Machine Design", Khanna Publishers, New Delhi, 1991.
6. John L Lumley, "Engine – An Introduction", Cambridge University Press, 1999.
7. Giri.N.K, "Automobile Mechanics", Khanna Publishers, New Delhi, 2007

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 10 Questions of 2 marks each - No choice

20 Marks

PART B: 2 Questions from each unit with internal choice, each carrying 12 marks

80 Marks



Skill Development

SAUA1503	HEAT TRANSFER APPLIED TO I.C ENGINES	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- Impart the knowledge of fundamentals of heat transfer
- Deep understanding on the governing equations for convection heat transfer and the dimensionless parameters
- Understand the temperature distribution and heat transfer rate in engine components
- Familiarize with cooling system and measurement of heat transfer rate in IC engines

UNIT1 CONDUCTION

9 Hrs.

Fourier law of conduction, general equation in Cartesian, cylindrical, spherical co-ordinates – 1 Dimensional steady state conduction in solids across plane wall - composite wall - composite cylinder - composite sphere with convection boundaries, overall heat transfer co-efficient, critical thickness of insulation, conduction with generation, thermal contact resistance, variable conductivity.

UNIT 2 CONVECTION

9 Hrs.

Forced convection - external flow over a plate; cylinder, sphere & non circular ducts- internal flow through pipes- annular spaces & non circular conducts. Natural convection from vertical inclined & horizontal surfaces.

UNIT 3 RADIATION

9 Hrs.

Electromagnetic spectrum, black body emission, emissive power, laws of radiation, radiation shape factor, electrical analogy, radiation shields gas radiation.

UNIT 4 HEAT TRANSFER AND COOLING IN IC ENGINES

9 Hrs.

Temperature distribution in cylinder, piston – engine heat transfer and energy balance – parameters- Extended Surfaces- Fins-Heat Exchanger Types - Overall Heat Transfer Coefficient - Fouling Factors - Analysis - LMTD method, - NTU method - Classification -cooling system-need for cooling system-power required to cool the engine-characteristics of efficient cooling system-types of cooling system.

UNIT 5 MEASUREMENT OF HEAT TRANSFER RATES IN IC ENGINES

9 Hrs.

Measurement methods-SI engine measurement-CI engine measurement –evaluation of heat transfer correlations-boundary layer behavior-components temperature distribution - effect of engine variables-temperature measurement.

Max.45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Understand the basic modes of heat transfer
- CO2 - Compute temperature distribution in steady-state heat conduction.
- CO3 - Understand principles of forced and free convection heat transfer processes.
- CO4 - Understand the principles of radiation heat transfer.
- CO5 - Understand the cooling systems in IC engines.
- CO6 - Estimate the temperature distribution and heat transfer rate in IC engine.

TEXT / REFERENCE BOOK

2. Heywood J.B “Internal Combustion Engine Fundamentals”, McGraw-Hill Book CO., USA - 1995.
3. Rajput.R.K, Heat and Mass transfer – S.Chand& Co, 2016.
4. Kothandaraman C.P. Fundamentals of Heat and Mass Transfer - New Age International (P) Ltd., 1998.
5. Sachdeva R.C. Fundamentals of Heat and Mass Transfer - New Age International (P) Ltd.
6. Ozisik N.M., Heat Transfer - McGraw Hill Book Company, 1988.
7. Holman J.P. Heat Transfer – McGraw Hill Book Company, 1989.
8. Incropera and Dewite, Heat Transfer - John Wiley.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 10 Questions of 2 marks each – No choice

20 Marks

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks

80 Marks



Skill Development

SAUA3004	VEHICLE DESIGN CHARACTERISTICS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand the concepts of designing the vehicle and various resistances.
- To acquire basic knowledge of the preliminary design concepts involved in designing of a vehicle.
- To impart knowledge on calculation of vehicle gear ratios.

UNIT 1 INTRODUCTION

9 Hrs.

Assumptions to be made in designing a vehicle, range of values for gross vehicle weight, frontal area, maximum speed, and maximum acceleration, gradability in different gears, basics of automobile design, vehicle design considerations, and drive arrangement.

UNIT 2 PERFORMANCE CURVES

9 Hrs.

Resistance, power and torque curve, driving force against vehicle speed – acceleration and gradability in different gears for a typical car or truck plotted from specifications, calculation of engine cubic capacity, bore and stroke length, calculation, tabulation and plotting of torque and mechanical efficiency for different vehicle speeds.

UNIT 3 RESISTANCE TO VEHICLE MOTION

9 Hrs.

Calculation and plotting the curves of air, rolling and gradient resistances, driving force – engine power, speed, rear axle ratio, torque and mechanical efficiency at different vehicle speeds, calculation and plotting of driving force, power requirement for different loads and acceleration, maximum power calculation.

UNIT 4 ENGINE DESIGN

9 Hrs.

Pressure volume diagram, frictional mean effective pressure, engine capacity, velocity and acceleration, gas force, inertia and resultant force at various crank angles – side thrust on cylinder walls, calculation of the displacement- velocity- acceleration of piston and connecting rod.

UNIT 5 GEAR RATIOS

9 Hrs.

Determination of gear ratios- four speed constant mesh gear box- sliding mesh gear box, acceleration and gradability - typical problems on vehicle performance of four wheeler, alternate methods for obtaining gear ratios, algebraic method, tabular method, compound epicycle gear train.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Describe the concepts and assumptions to be made in designing a vehicle.
- CO2 - Formulate the engine performance parameters and draw the performance curves
- CO3 - Identify the various resistances to vehicle motion and plot the graphs.
- CO4 - Evaluate the various forces and moments and plot the graphs
- CO5 - Evaluate the vehicle performance parameters and draw the performance curves.
- CO6 - Demonstrate the calculation of various gear ratios for vehicle.

TEXT / REFERENCE BOOKS

1. N. K. Giri, "Automobile Mechanics", Eleventh reprint, Khanna Publishers, Delhi, 2016
2. William H.Crouse, William Harry Crouse "Automobile Mechanics" Tata McGraw-Hill Education, 2006.
3. Josep Heitner "Automobile Mechanics principles and practice " CBS publishers, 2004
4. Srinivasan.S "Automobile Mechanics" Second edition, Tata McGraw-Hill Education, 2017
5. Gupta. R.B., "Automobile Engineering", Sathya Prakashan, 8 ed., 2013.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 10 Questions of 2 marks each - No choice

20 Marks

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks

80 Marks



Skill Development

SMEA1702	INDUSTRIAL MECHATRONICS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To enable the student to understand the modern mechatronics components.
- To present the underlying principles and alternatives for mechatronics systems design.
- To provide the student with the opportunity for hands-on experience with the related components of the technology for diverse domains of application.

UNIT 1 MECHATRONICS, SENSORS AND TRANSDUCERS

10 Hrs.

Introduction to Mechatronics Systems – Key elements, Information systems, Real time interfacing, Elements of data acquisition system - sequential controllers-Block diagram of Washing Machine-Sensors and Transducers – Performance Terminology – Sensors for Displacement, Position and Proximity; Velocity, Motion, Force, Fluid Pressure, Liquid Flow, Liquid Level, Temperature, Range sensors, Light Sensors, Humidity, Vibration. Special transducers - Piezoelectric transducer - Magnetostrictive transducer - Shape memory alloy (SMA) transducer. – Selection of Sensors.

UNIT 2 SIGNAL CONDITIONING&8085 MICROPROCESSOR

8 Hrs.

Signal Conditioning – Analogue to Digital Convertor – Digital to Analogue Convertor- Multiplexer – De multiplexer – Interfacing Concepts – Temperature Control - Architecture of 8085 micro processor – pin configuration – addressing modes – instruction sets – timing diagram - block diagrams.

UNIT 3 SYSTEM MODELS AND CONTROLLERS

10 Hrs.

Building blocks of Mechanical, Electrical, Fluid and Thermal Systems. Rotational – Translational Systems, Electromechanical Systems – Hydraulic – Mechanical Systems. Continuous and discrete process Controllers – Control Mode – Two Step mode – Proportional Mode – Derivative Mode – Integral Mode – PID Controllers – Digital Controllers – Velocity Control – Adaptive Control.

UNIT 4 PROGRAMMING LOGIC CONTROLLERS

9 Hrs.

PLC: Introduction to the design and mode of operation of programmable logic control (PLC) – Basic Structure – Input / Output Processing – Programming –Ladder programming-Cylinder sequencing problems- sequence charts- Mnemonics – Timers, Internal relays and counters – Shift Registers – Master and Jump Controls – Data Handling – Analog Input / Output – Selection of a PLC.

UNIT 5 DESIGN OF MECHATRONICS SYSTEM

8 Hrs.

Introduction to MEMS, Micro sensors in mechatronics, Sensors for condition monitoring, Artificial intelligence in mechatronics, Stages in designing Mechatronics Systems – Traditional and Mechatronic Design Possible Design Solutions. Case studies of Mechatronics systems- Pick and place Robot- piece counting system, Autonomous mobile robot-Wireless surveillance balloon- Engine Management system- Automatic car park barrier.

Max.45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Describe the basic concepts of Mechatronic system and sensors
- CO2 - Implement interfacing concepts using 8085 microprocessors and Signal Conditioning.
- CO3 - Analyze and design System models and controllers.
- CO4 - Design Ladder programming and PLC interfacing
- CO5 - Understand the Mechatronics design stages and possible design solutions
- CO6 - Design the Mechatronics systems through case studies

TEXT / REFERENCE BOOKS

1. Bolton, “Mechatronics”, Pearson education, 2nd Edition, 5th Indian Reprint, 2003
2. Smaili.A and Mrad.F, "Mechatronics integrated technologies for intelligent machines", Oxford university press, 2008
3. Rajput. R.K, A textbook of mechatronics, S. Chand & Co, 2007
4. Michael B. Histan and David G. Alciatore, “Introduction to Mechatronics and Measurement Systems”, McGraw-Hill International Editions, 2000.
5. Bradley D.A., Dawson D., Buru N.C. and. Loader A.J, “Mechatronics”, Chapman and Hall, 1993.
6. Dan Neculescu, “Mechatronics”, Pearson Education Asia, 2002 (Indian Reprint).
7. HMT, Mechatronics, Tata McGraw-Hill Publishing Company Ltd., New Delhi 2004.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 2 Questions from each unit, each carrying 2 marks

20 Marks

PART B: 2 Questions from each unit with internal choice, each carrying 16 marks

80 Marks

Skill Development

SAUA3003	AUTOMOTIVE AERODYNAMICS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To apply basic principles of aerodynamics for the design of vehicle body.
- To become familiar with modern engineering tools and analyze the problems within the domains of Automobile Engineering as members of multidisciplinary teams.
- To demonstrate the ability to use the techniques, skills and modern engineering tools necessary for engineering practice in the field of Automobile Engineering.

UNIT 1 INTRODUCTION

9 Hrs.

Scope, historical developments, fundamentals of fluid mechanics, flow phenomenon related to vehicles, external and internal flow problem, resistance to vehicle motion, performance, fuel consumption and performance potential of vehicle aerodynamics.

UNIT 2 AERODYNAMIC DRAG OF CARS

9 Hrs.

Cars as a bluff body, flow field around car, drag force, types of drag force, analysis of aerodynamic drag, drag coefficient of cars, strategies for aerodynamic development, low drag profiles.

UNIT 3 SHAPE OPTIMIZATION OF CARS

9 Hrs.

Front end modification, front and rear windshield angle, boat tailing, hatchback, fastback and square back, dust flow patterns at the rear, effects of gap configuration, effect of fasteners. **Case studies on modern vehicles.**

UNIT 4 WIND TUNNELS FOR AUTOMOTIVE AERODYNAMICS

9 Hrs.

Introduction, principle of wind tunnel technology, limitation of simulation, stress with scale models, full-scale **wind tunnels, measurement techniques, equipment and transducers, road testing methods, numerical methods. CFD analysis.**

UNIT 5 VEHICLE HANDLING

9 Hrs.

The origin of forces and moments on a vehicle, lateral stability problems, **methods to calculate forces and moments – vehicle dynamics underside winds, the effects of forces and moments, characteristics of forces and moments, dirt accumulation on the vehicle, wind noise, drag reduction in commercial vehicles and racing cars.**

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, students will be able to

- CO1 - Acquire strong basics in motion of the vehicle in all aspects of the constraints.
- CO2 - Understand the fundamentals of aerodynamics, vehicle body optimization, measuring aerodynamics forces.
- CO3 - Predict component or process to meet the desired needs within realistic constraints such as comfort, environmental and safety,
- CO4 - Analyze, interpret data and simulate the structures in automobiles.
- CO5 - Choose the appropriate characteristics of forces and moments in vehicle for multi-disciplinary areas.
- CO6 - Design, formulate and optimistically solve problems related to Automobile Engineering.

TEXTBOOK / REFERENCES

1. Hucho .W.H., “Aerodynamic of Road Vehicles”, SAE International, 2015.
2. A. Pope, “Wind Tunnel Testing”, 5th Edition, John Wiley & Sons New York, 2015.
3. “Automotive Aerodynamic”, ISBN:978-1-119-18572-7, Wiley, 2016.
4. Thomas Schwartz, “Aerodynamics of Road Vehicles”, R-430, Society of Automotive Engineers Inc, 2015.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 10 Questions of 2 marks each - No choice

20 Marks

PART B: 2 Questions from each unit with internal choice, each carrying 16 mark

80 Marks

Skill Development

SAUA3001	AUTOMOTIVE AIRCONDITIONING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- Identify various components of Vehicle Air conditioning and heating system
- Understand the principle of maintenance and service procedure of Air conditioner
- Study the working of Air conditioning system and its components
- Understand the working of various types of refrigerants and their properties.

UNIT 1 AIRCONDITIONING FUNDAMENTALS

9 Hrs.

Basic air conditioning system - location components, layout of air conditioning system, Components - compressor, condenser and high pressure service valve, thermostatic expansion valve, evaporator, controlling evaporator temperature

UNIT 2 AIR CONDITIONER – HEATING SYSTEM

9 Hrs.

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

UNIT 3 REFRIGERANT

9 Hrs.

Classification of refrigerants – Coding of Refrigerants - Desirable properties of refrigerants-Substitute for CFC refrigerants - Containers - Handling refrigerants, air conditioning lubricants. Thermodynamic Cycle of Air conditioner-Vapour Compression cycle, Coefficient of Performance.

UNIT 4 AUTOMATIC TEMPERATURE CONTROL

9 Hrs.

Different Types Of Sensors And Actuators Used In Automatic Temperature Control- Fixed And Variable Displacement Temperature Control- Semi Automatic- Controller Design For Fixed And Variable Displacement Type Air Conditioning System

UNIT 5 AIR CONDITIONING SERVICE

9 hrs.

Air conditioner maintenance and service, inspection using manifold gauge, servicing heater system, removing and replacing components, evacuation and refilling of refrigerant, trouble shooting of air controlling system, servicing of compressor

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Understand various types of refrigerants and their properties
- CO2 - Diagnose various faults in air conditioning system by using suitable tools and instruments.
- CO3 - Explain the thermodynamic cycle of refrigeration, Compute C.O.P and classify refrigerants.
- CO4 - Distinguish manually controlled and automatic controlled air conditioner.
- CO5 - Justify evacuation and refilling of refrigerants. Carryout servicing of components in refrigeration system.
- CO6 - Follow safety rules while servicing of Air conditioning and heating system.

TEXT / REFERENCE BOOKS

1. William H. Crouse and Donald I. Anglin - "Automotive Air conditioning" – McGraw Hill Inc. - 1990.
2. Boyce H.D Wiggins - "Automotive Air Conditioning" - Delmar – 2002
3. Mitchell information Services, Inc - "Mitchell Automatic Heating and Air Conditioning Systems" - Prentice Hall Ind.-1989.
4. Paul Weiser - "Automotive Air Conditioning" - Reston Publishing Co., Inc., - 1990.
5. MacDonald, K.I., - "Automotive Air Conditioning" - Theodore Audel series – 1978.
6. Goings.L.F. – "Automotive Air Conditioning" - American Technical services -1974.
7. Warren Farnell And James D.Halderman, "Automotive Heating, Ventilation, And Air Conditioning Systems", Classroom Manual, Pearson Prentice Hall, 2004.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

PART A: 10 Questions of 2 marks each - No choice

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks

Exam Duration: 3 Hrs.

20 Marks

80 Marks

Skill Development

SAUA3012	FUEL CELL AND APPLICATIONS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand the fundamentals of fuel cell technologies
- To understand the thermodynamics and kinetics of fuel cell To study the working of various types of fuel cell
- To learn the various types of fueling methods
- To analyze the cost effectiveness and eco-friendliness of Fuel Cells

UNIT 1 INTRODUCTION AND OVERVIEW OF FUEL CELLS

9 Hrs.

Overview of fuel cells – Need of fuel cell, History, Principle and overview of fuel cell, Basic electrochemistry for all the fuel cells, Low and high temperature fuel cells; Fuel cell thermodynamics - heat, work potentials, prediction of reversible voltage, Nernst equation; Effect of temperature, pressure, concentration on Nernst potential fuel cell efficiency, Concept of electrochemical potential.

UNIT 2 FUEL CELL TYPES

9 Hrs.

Types of fuel cells – Alkaline Fuel Cell, Phosphoric Acid Fuel Cell, Solid Oxide fuel cell, Molten Carbonate fuel cell, Direct Methanol Fuel Cell, Proton Exchange Membrane Fuel Cell – relative merits and demerits, comparison on battery Vs fuel cell.

UNIT 3 FUEL CELL COMPONENTS AND PERFORMANCE

9 Hrs.

Fuel cell performance characteristics – current/voltage, voltage efficiency and power density, ohmic resistance, Butler- Volmer equation; Tafel equation, kinetic performance, mass transfer effects – membrane electrode assembly components, fuel cell stack, bipolar plate, humidifiers and cooling plates.

UNIT 4 FUELING

9 Hrs.

Hydrogen storage technology – pressure cylinders, liquid hydrogen, metal hydrides, carbon fibers – reformer technology –steam reforming, partial oxidation, auto thermal reforming – CO removal, fuel cell technology based on bio-mass.

UNIT 5 APPLICATION OF FUEL CELL AND ECONOMICS

9 Hrs.

Fuel cell usage for domestic power systems, large scale power generation, Automobile, Space, Economic and environmental analysis on usage of Hydrogen and Fuel cell. Future trends in fuel cells.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Understand the fundamentals of fuel cells.
- CO2 - Compare different types of fuel cells with their merits and demerits.
- CO3 - Understand the performance characteristics of fuel cell.
- CO4 - Understand various fueling technology.
- CO5 - Know about the applications of fuel cell in various fields.
- CO6 - Analyze the cost effectiveness and eco-friendliness of Fuel Cells.

TEXT / REFERENCE BOOKS

1. J. Larminie and A. Dicks, Fuel Cell Systems Explained, 2nd Edition, Wiley, 2003.
2. Xianguo Li, Principles of Fuel Cells, Taylor and Francis, 2005.
3. S. Srinivasan, Fuel Cells: From Fundamentals to Applications, Springer, 2006.
4. Hayre, R. P., S. Cha, W. Colella, F. B. Prinz, Fuel Cell Fundamentals, Wiley, NY, 2006.
5. Basu, S. (Ed) Fuel Cell Science and Technology, Springer, N.Y, 2007.
6. Fuel Cells for automotive applications, Professional Engineering Publishing UK. ISBN 1-86058-4233, 2004.
7. Fuel Cell Technology Handbook SAE International Gregor Hoogers CRC Press ISBN 0-8493-0877-1-2003.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 10 Questions of 2 marks each - No choice

20 Marks

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks

80 Marks

Skill Development

SAUA3007	MODERN AUTOMOBILE ACCESSORIES	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To gain in depth knowledge of fundamentals of various Automobile parts.
- To discuss location and importance of each Automobile parts.
- To learn the functioning of the Engine and its accessories, gear box, clutch, brakes Steering, axles and wheels.
- To gain depth knowledge of suspension, frame, springs and other connections.

UNIT 1 ENGINE MANAGEMENT SYSTEMS

9 Hrs.

Electronically controlled unit, Engine Management system – Gasoline and Diesel engine, Electronically controlled SI and CI engine fuel injection systems, related hardware and software; Open and Closed loop ignition system, Engine cooling and lubrication system, Catalytic converters and particulate traps.

UNIT 2 CHASSIS SYSTEM

9 Hrs.

Introduction and Basic parts of suspension system, Active suspension control, Pneumatic suspensions, Power train monitoring, safety views – Modern development in Chassis management of vehicles.

UNIT 3 HEATING AND AIR CONDITIONING

9 Hrs.

Principles of Vehicle air conditioning and heating – Automatic Climate control system – Modern trends in thermal management of vehicles – Influence of Electronics in thermal management of vehicles.

UNIT 4 COMFORT AND CONVENIENCE

9 Hrs.

Adaptive cruise control, car entertainment, power windows, navigation systems, adaptive noise control, electric seats, driver information system. Power windows and power steering.

UNIT 5 SAFETY AND SECURITY SYSTEMS

9 Hrs.

Airbags, seat belt tightening system, collapsible and tilt able steering column, Anti theft system, Anti lock braking system, electronically stability control system/ traction control system, roll over protection system.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Understand the Engine & Chassis Management system.
- CO2 - Understand the Heating and Air-Conditioning system.
- CO3 - Understand the Comfort, Convenience, Safety & Security systems. CO4 - Understand the environmental hazards from automobile emissions. CO5 - Design Modern chassis frame.
- CO6 - Develop and analyze for the future developments in the automobile industry.

TEXT / REFERENCE BOOKS

2. Tom Denton, "Automobile Electrical and Electronic Systems" –Edward Arnold, London, 5th Edition -2017
3. Eric Chowanietz – "Automotive Electronics Electron" –SAE International, USA – 1995
4. Bosch Automotive Hand Book – 10th edition – SAE publications, USA – 2018
5. James E.Duffy, "Modern Automotive Technology" 10th Edition 2015
6. Giri.N.K, "Automobile Technology" Khanna Publishers, New Delhi, 2nd Edition, 2009

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 10 Questions of 2 marks each - No choice

20 Marks

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks

80 Marks



Skill Development

SAUA3009	VIBRATION AND NOISE CONTROL IN AUTOMOBILES	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To gain in depth knowledge of fundamentals of vibration and noise in automobiles.
- To discuss the various sources of vibrations and noise in automobiles.
- To understand techniques to measure and control noise.

UNIT 1 BASICS OF VIBRATION

9 Hrs.

Introduction, classification of vibration: free and forced vibration, undamped and damped vibration, linear and nonlinear vibration, response of damped and undamped systems under harmonic force, analysis of single degree and two degree of freedom systems, torsion vibration, determination of natural frequencies. Introduction, elements of vibration, source of vibration, types of vibration, measurement of vibration- FFT analyzer, quarter car model analysis. **Methods of vibration control – passive, active, semi active control, vibration isolation, engine and drive train vibrations**

UNIT 2 BASICS OF NOISE

9 Hrs.

Introduction, amplitude, frequency, wavelength and sound pressure level, addition, subtraction and averaging decibel levels, noise dose level, legislation, measurement and analysis of noise, measurement environment, equipment, frequency analysis, tracking analysis, sound quality analysis. 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 3 AUTOMOTIVE NOISE SOURCES AND MEASURING TECHNIQUES

9 Hrs.

Noise characteristics of engines, engine overall noise levels, assessment of combustion noise, assessment of mechanical noise, engine radiated noise, intake and exhaust noise, engine accessory contributed noise, transmission noise, aerodynamic noise, tire noise, brake noise. 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, Determination Of Sound Power Level And Emission Sound Pressure Level, Sound Intensity Measurements, Noise And Vibration Data Analysis, Calibration Of Measurement Microphones, Calibration Of Shock And Vibration Transducers, **Metrology And Traceability Of Vibration And Shock Measurements**

UNIT 4 CONTROL TECHNIQUES

9 Hrs.

Vibration isolation, tuned absorbers, untuned viscous dampers, damping treatments, application dynamic forces generated by IC engines, engine isolation, crank shaft damping, modal analysis of the mass elastic model shock absorbers, estimation of noise source and acoustics of walls- enclosure barrier, sound absorbing materials, duct noise and mufflers.

UNIT 5 SOURCE OF NOISE AND CONTROL

9 Hrs.

Introduction to sound, methods for control of engine noise, combustion noise, mechanical noise, predictive analysis, palliative treatments and enclosures, automotive noise control principles, sound in enclosures, sound energy absorption, sound transmission through barriers, Source ranking, noise path analysis, modal analysis, design of experiments, optimisation of dynamic characteristics, vibration absorbers and Helmholtz resonators, active control techniques. **Noise measurements control of air borne and structure borne noise**- use of absorber, criteria for the selection of materials. Engine noise and control, Brake noise and control, tyre noise and control, gear noise and control, clutch noise and control, transmission noise, resonators, mufflers, anechoic chamber.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Study the concepts of vibration and noise in automobiles.
- CO2 - Identify the sources of noise in automobiles.
- CO3 - Measure the levels of noise in vehicle components.
- CO4 - Study the techniques to control vibrations.
- CO5 -Understand the various sound absorbing materials.
- CO6 -Familiarise with the modern techniques in noise and harshness measurement and control.

TEXT / REFERENCE BOOKS

1. Singiresu S.Rao - "Mechanical Vibrations" - Pearson Education, ISBN –81-297-0179-0 - 2004.
2. Kewal Pujara "Vibrations and Noise for Engineers, Dhanpat Rai & Sons, 1992.
3. Julian Happian-Smith - "An Introduction to Modern Vehicle Design"- Butterworth-Heinemann, 2004.
4. Ramamurti V., "Mechanical Vibration Practice and Noise Control", Narosa Publishing House, 2012.
5. Sujatha C., "Vibration and Acoustics – Measurement and Signal Analysis", Tata McGraw Hill Education Private Ltd, 2009.
6. Pundir B P, "Engine Emissions: Pollutant Formation and Advances in Control Technology", Narosa Publishing House Pvt. Ltd., Delhi, 2007.

7. Matthew Harrison, Butterworth-Heinemann, Burlington, Vehicle Refinement: Controlling Noise and Vibration in Road Vehicles, 2011.
8. Gang Sheng, "Vehicle Noise, vibration and Sound quality", SAE International 2012.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 10 Questions of 2 marks each - No choice

20 Marks

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks

80 Marks



Skill Development