

SYLLABUS FOR V SEMESTER (III YEAR)
B. Tech. (Automobile Engineering)

5AE1A: HEAT TRANSFER

3L+1T

MM: 100 Ex.Hrs. : 3

Same as 5ME1A

5AE2A: DYNAMICS OF MACHINES

3L+1T

MM: 100 Ex. Hrs: 3

Same as 5ME2A

5AE3A: AUTOMOTIVE SYSTEMS

B. Tech (Automobile) 5th Semester
3L

Max. Marks : 80
Exam Hours : 3

UNIT	CONTENTS	CONTACT HOURS
I	Automotive frame and chassis: Frames – types, materials, chassis – two wheeler chassis, four wheeler chassis and multi axle chassis and their components, power plant location – front wheel drive, Rear wheel drive and all wheel drive (4WD).	4
	Vehicle body – types – saloon, sedan, hatchback, limousine, sports car, convertible, vehicle body nomenclature of car, bus and trucks.	4
II	Transmission system: Need of clutch, types of clutch, dual clutch system, fluid coupling and torque convertor, Fault and remedies, Need of gear box, gear ratio, gear train, type of gear boxes – sliding mesh, constant mesh and synchromesh gearbox, epicyclic gear train, transfer gear box	4
	Differential – principle, working, construction, types of front axle and rear axle. Propeller shaft, universal joints – Hotchkiss drive and torque tube drive, hook's type, C.V. joints, divided propeller shaft, rubber universal couplings and slip joint.	4
III	Suspension system – objectives of suspension system, type and construction of front and rear suspension systems, Independent suspension system, leaf springs, shock absorbers, stabilizer bar, torsion bars.	4
	Steering system – Objectives, layout of steering system and components, steering geometry – caster, camber, toe-in, toe-out, king-pin inclination, scrub radius, Ackermann and davis steering principles, types of steering gear box, power steering.	4
IV	Brakes – classification of brakes, components of brake system, types of brakes – mechanical brake, hydraulic brake, air assisted hydraulic brake, vaccum assisted hydraulic brake, Disc brake and Anti-lock brake system, self energizing brakes, brake shoes, callipers, brake linings and materials.	4
	Wheel and tyre: type of wheels – spoke wheel, alloy wheel , rim construction and types, split wheel, tyre construction, types of tyres – cross ply tyres and radial tyres, tread pattern, tyre retreading – cold and hot retreading process, tyre specifications.	4
V	Windshield wipers, electric horns, fuel feed system – gravity feed and pressure feed system and their components, speedometer, headlights, wiring diagram of two wheeler and four wheelers.	4
	Modern developments in automotive systems - Limited slip differential, Traction control systems, Drive-by-wire, Security restrain systems – Air bag and seat belt, Night vision systems, global positioning system, Speed governors, electric vehicle, hybrid vehicle.	4
	TOTAL	40

Text Book

Automobile Engineering, Vol I & II, Dr, Kirpal Singh

Reference Books:

- 1.) A text book of Automobile Engineering, R.K.Rajput, Laxmi Publication
- 2.) Automotive Engineering, David A.Crolla, BH publication

5AE4A: COMPUTER APPLICATION IN AUTOMOBILE ENGGB. Tech (Automobile) 5th Semester
3LMax. Marks : 80
Exam Hours : 3

UNIT	CONTENTS	CONTACT HOURS
I	Fundamentals of 2-D drafting (Output primitives): Role of computers in design. Advantages and disadvantages of CAD. Simple algorithms for drawing Lines, Circles, ellipses.	4
	Pixel addressing and object geometry, Screen grid coordinates maintaining geometric proportion of displayed objects. Scan line polygon fill algorithm, inside and outside test, Flood fill algorithm, Character generation.	4
II	Attributes of Output primitives: (only Explanation no algorithm) Line attributes (line type, line width, line color), Area-Fill Attributes (Fill style, Pattern fill, and soft fill) Text attributes (Text height, marker attributes, Dimension attributes)	4
	Two dimensional Geometric transformations: Derive functions for these transformations -translation, Rotation, Scaling, Mirror Composite transformation.	4
III	Solid modeling as per the parametric software's: explanation of commands like extrude, revolve, sweep, blend, round, chamfer, holes, array.	4
	Surface modeling: extrude, revolve, sweep, Helix, blend. Surface editing: Merge, trimming, fill surface, solidify surface. Thicken surface. Graphic standards and data exchange formats.	4
IV	FINITE ELEMENT APPROACH for analysis of models: Basic Concept of the Finite Element Method, Comparison between traditional and FEM approach, Advantages of Finite Element Analysis.	4
	Basic mathematical preliminaries: Shape function and derivation of Stiffness matrix: Linear element, Quadratic element, Cubic element. Natural coordinates, constant strain triangle (1D and 2D elements only)	4
V	Assembly of elements, global stiffness matrix and its properties, Node numbering, Displacement and force Boundary conditions, Transformations matrix Finite element approach to find displacement, strain, Strain energy:	4
	Numerical solution of equilibrium problem by Gaussian elimination: Simple problems with 1 dimensional & 2 dimensional problem: Bar Problems with axial loading, 2 d simple truss problems, limited to procedure to find stiffness matrix, displacement, strain, Strain energy.	4
	TOTAL	40

Text Book

- 1 Zeid and Sivasubramanian, CAD/CAM: Theory and Practice, Tata McGrawHill
- 2 Rogers and Adams, Mathematical Elements for Computer Graphics, TataMcGraw Hill

Reference Books:

- 1 Rao P.N., CAD / CAM Principles and Applications, McGraw Hill.
- 2 Pao Y.C., Elements of Computer Aided Design and Manufacturing, John Wiley and Sons.
- 3 Alavala C.R., CAD/CAM: Concepts and Applications, Prentice Hall of India.
- 4 Xiang and Plastock, Computer Graphics, Schaum's Outlines, TataMcGraw Hill.

Same as 5ME5A

5AE6A: MECHANICAL MEASUREMENT AND CONTROL

B. Tech (Automobile) 5th Semester

Max. Marks : 80

3L

Exam Hours : 3

UNIT	CONTENTS	CONTACT HOURS
I	System configuration, basic characteristic, calibration, classification and performance characteristics of a instrumentation system, Specification and testing of dynamic response,	3
	Strain Measurement, electric strain gauges types, selection and installation, strain gauge circuits, temperature compensation and calibration, use of strain gauges on rotating shafts, load cells, Mechanical and Optical Strain Gauges.	5
II	Various Mechanical, Electro-Mechanical and Photoelectrical Sensors for sensing of displacement, velocity, acceleration, torque, force, temperature from low to high range,.	5
	flow, level of fluid , pressure, angular speed, voltage, frequency and current	3
III	Introduction to Multi-Channel Data-Acquisition System, measurement pods, Interface Hardware, data analysis software, interfacing,	3
	Concepts and examples of automatic control systems, systems by differential equations, transfer function, block diagram, open and feed back control systems, signal flow graphs and its constructions, control system components, error sensing devices and servo motors.	5
IV	Control for mechanical systems and processes, speed control system for steam/gas turbines, constant tension, reeling system, electro-mechanical systems, thermal systems, pneumatic systems,	4
	mathematical models of physical systems, feedback characteristics of control systems, time response analysis, transient response analysis, time response specifications, steady state-error.	4
V	Concepts of stability, Routh-Hurwitz stability criterion, relative stability, root locus technique, use of construction rules without any derivation,.	4
	frequency response analysis, polar plots, stability in frequency domain, bode logarithmic plots, Nyquist stability criterion	4
	TOTAL	40

Text book

1. Control System, Gopal M., Tata McGraw Hill New Delhi.
2. Mechanical Measurement and Instrumentation, Rajput R.K., S.K.Kataria and Sons.

Reference Books:

1. Mechanical Measurement, Beckwith, Pearson Education.
2. Experimental Methods for Engineers, Holman, McGraw Hill Publication.
3. Mechanical Engineering Measurement, Sahwney A.R., Dhanpat Rai and Sons.
4. Modern Control Engineering, Ogata, Pearson Education India.

5AE7A: HEAT TRANSFER LAB
LAB 3 Periods

Same as 5ME7A

5AE8A: DYNAMICS OF MACHINES LAB
2 Periods

Same as 5ME8A

5AE9A: MECHANICAL MEASUREMENTS AND CONTROL LAB.
2 Periods

INSTRUMENTATION LAB SESSIONAL

- 1) Displacement Measurement using Capacitive Pick-up System.
- 2) Displacement Measurement Using Inductive Pick-up System.
- 3) Displacement Measurement Using Light Dependent Register Set up.
 - a. Displacement v/s Resistance at Constant Voltage.
 - b. Voltage v/s Resistance at Constant Displacement.
- 4) Study of Speed Measurement System.
 - a. Magnetic Pick-up.
 - b. Strobometer.
- 5) Study of Load Measurement System Load Cell + Load Indicator.
- 6) Calibration of Thermocouple Wire.

CONTROL LAB. SESSIONAL

- 7) Problems on
 - i. Block diagram reduction technique
 - ii. Block diagram formation for Control Systems.
 - iii. Root Locus Plot
 - iv. Bode Plot
 - v. Polar plot and Nyquist Stability Criterion
- 8) Experiments on
 - i. Hydraulic System
 - ii. Control System

5AE10A: PROFESSIONAL ETHICS AND DISASTER MANAGEMENT
LAB 2 Periods

Same as 5ME10A

5AE11A: COMPUTER APPLICATION IN AUTOMOBILE ENGG LAB
2 Periods

1. Parametric modeling of mechanical parts
2. Generation of Drawing of modeled parts
3. Analysis of Simply supported beam with different type of loading, torsion bending.
4. Two dimensional frames analysis.
5. Analysis of three dimensional solids.

Detail problems for experiment with different software can be included

SYLLABUS FOR VI SEMESTER (III YEAR)
B. Tech. (Automobile Engineering)

6AE1A: DESIGN OF MACHINE ELEMENTS- II

3L+ 1T

MM 100 Ex. Hrs: 3

Same as 6ME1A

6AE2A: ADVANCED I.C.ENGINE

B. Tech (Automobile) 6th Semester
3L

Max. Marks : 80
Exam Hours : 3

UNIT	CONTENTS	CONTACT HOURS
I	Charge Motion in Cylinder: Intake jet flow, Mean velocities and turbulence characteristics: definitions and application of engine velocity data,	3
	Swirl: swirl measurement, swirl generation during induction, swirl modification within the cylinder, Squish, Pre-chamber engine flow, Crevice flows and blowby, Flows generated by piston-cylinder wall interaction	5
II	Combustion in Spark Ignition engine – Thermodynamic analysis of SI engine combustion, Burned mass fraction, analysis of cylinder pressure data,	4
	combustion process characterization, flame structure and speed, cycle to cycle variation – causes and effects, Measurement and control	4
III	Combustion in CI engine – Types of diesel combustion systems, direct combustion system, in-direct injection system; their comparison,	4
	Fuel Injection – Fuel spray behaviour, Overall spray structure, Atomization, droplet size distribution, sauter mean diameter, spray penetration, wall wetting and its effects.	4
IV	Modeling Real flow and combustion process: Purpose and classification of models, Governing equations for open thermodynamics system, Intake and exhaust flow models,	4
	Thermodynamic based in cylinder model, Fluid Mechanics based multidimensional models	4
V	Modern development in Engine: Electronic Injection system, Distributor system, CRDI, Fuel Injection System; Unit Injections, Rate shaping. Trends in nozzle designs, SAC volume, VCO nozzles, Gasoline Direct Injection, Gasoline port injection, HCII engines	4
	Special developments – Variable valve timing (VVT), Variable Swirl concepts, Variable geometry turbochargers, Four Valve technology, Multiple injection system	4
	TOTAL	40

Text book

- 1) Internal combustion engine fundamentals, John B. Heywood, TMH
- 2) Course in Internal combustion engine, M.L. Mathur, R.P. Sharma, Dhanpat Rail Publication

Reference Books:

- 1 The Internal-combustion engine in theory and practice, C.F. Taylor, Vol I & II, MIT Press
- 2 Internal combustion engine, V.Ganeshan, TMH
- 3 Internal combustion engine, H.N.Gupta, PHI
- 4 Internal Combustion Engine, S.S. Thipse, Jaico Publishing House, 2010

6AE3A: AUTO EMISSION AND POLLUTION CONTROLB. Tech (Automobile) 6th Semester
3LMax. Marks : 80
Exam Hours : 3

UNIT	CONTENTS	CONTACT HOURS
I	Engine emissions and air pollution: Constituents of engine exhaust responsible for air pollution and their effect on human health, ozone layer depletion and global warming, Photochemical smog, greenhouse gases, Kyoto protocol and carbon trading.	3
	Formation of Pollutants: Combustion generated and other pollutants, general mechanisms and kinetics of formation of carbon-monoxide, unburnt hydrocarbon, oxides of nitrogen and particulate matter due to combustion, effect of air-fuel ratio on emissions, Zeldovitch mechanism for formation of NO _x , soot and smoke formation. NO _x particulate trade-off.	5
II	Emissions from Spark ignition engines: Types of emission form spark ignition engines, importance of mixture formation, lean and rich mixture, study of various mechanism of formation of unburnt hydrocarbon, effect of various design and operating variables on formation of CO, UBHC and NO _x .	4
	Discussion on different technologies used for reducing engine out emissions from a spark ignition engine, gasoline port injection and gasoline direct injection, Evaporative emissions and their control.	4
III	Emissions from Compression Ignition engines: Types of emissions from compression ignition engine, effect of various design and operating variables on formation of NO _x , smoke and particulate matter.	4
	Discussion of various technologies for reducing engine out emissions from a compression ignition engine such as turbo charging, inter-cooling, fuel injection pressure, injection timing retard, exhaust gas recirculation.	4
IV	Exhaust After treatment: Need for exhaust after treatment, fundamentals of catalytic converters, three-way catalyst, diesel oxidation catalyst, diesel particulate filter, effect of fuel sulphur on after treatment devices.	4
	Emission Test Procedures: Test cycles for emission testing of two-three wheelers, passenger cars, utility vehicles, light and heavy duty commercial vehicles used in India and Europe. Test procedures for various types of evaporative emissions.	4
V	Study of emission standards: Two-three wheelers, passenger cars, utility vehicles, light and heavy duty commercial vehicles used in India and Europe.	4
	Equipment for Emission Measurements: NDIR analyzers, Flame ionization detector, chemiluminescence analyzer, constant volume sampling, measurement of smoke and particulate matter.	4
	TOTAL	40

TextBook

- 1.) Engine Emissions: Pollution formations and advances in control technology, B. P. Pundir Narosa Book Distributors Pvt Ltd
- 2.) Internal combustion engine fundamentals, John B. Heywood, TMH
- 3.) Course in Internal combustion engine, M.L. Mathur, R.P. Sharma, Dhanpat Rail Publication

Reference Books:

- 1 Combustion and emission in SI engines, SAE, 1996
- 2 New Combustion Systems in SI & Diesel Engines, and Combustion & Emission Formation Processes in Diesel Engines, SAE, 2004

6AE4A: AUTO CHASSIS AUTO SYSTEM DESIGN

B. Tech (Automobile) 6th Semester
3L

Max. Marks : 80
Exam Hours : 3

UNIT	CONTENTS	CONTACT HOURS
I	Introduction of Auto System Design: Principle of automotive design, design considerations, classification of design, basic requirements of design, quality of design engineer.	2
	Automotive chassis and chassis frame: general considerations related to chassis layout, chassis components, classification according to engine location, load and weight distribution, types of frame, frame materials, different type of frame sections for heavy and light vehicles, construction details, engine mountings, testing of frames in bending and torsion	6
II	Design of cylinder pipe and tubes: General considerations of engine design, design of cylinder head and cover plates– Flat head, circular flat plate, elliptical cover, dished head, standard ellipsoidal cover, hemispherical cover integral and welded, conical cover – integral and welded, bolted and welded head,	5
	design of cylinder subjected to internal pressure and cylinder liner and materials, Vessel subjected to external pressure, design of pipes and tubes	3
III	Design of engine Parts: Design of piston, piston pin, piston rings and their materials, design of connecting rod and its material. Design of crank shaft, crankshaft materials,	5
	Design considerations of valve design, intake and exhaust valve design. Design of rocker arm	3
IV	Design of gearbox, housing and Brakes: Design of gear box: structural diagram, design of sliding mesh gear box, design of housing, sealing and gaskets	4
	General brake design considerations, Pascal law, design of internal expanding brakes, materials, design of disc brakes, calculation of mean lining pressure and heat generation during brake operation	4
V	Design of driveline components and suspension: Materials and design of propeller shaft, Design of universal Joint, Design of spline joint	4
	General consideration regarding design of suspension system, Materials for the automotive suspension system, design of coil and leaf springs	4
	TOTAL	40

Text Book

- 1.) An Introduction to Modern Vehicle Design, edited by Julian Happian-Smith, BH Publication
- 2.) Machine Design, Dr. P.C. Sharma et.al, katson publication

Reference Books:

- 1 Mechanical Engineering Design, J.E. Shigley et. Al., TMH
- 2 Design of machine elements, IIIrd edition, V.B. Bhandari, TMH
- 3 Automobile Mechanics, Dr. N.K. Giri, Khanna publishers

6AE5A: VEHICLE BODY AND AERODYNAMICS

B. Tech (Automobile) 6th Semester
3L

Max. Marks : 80
Exam Hours : 3

UNIT	CONTENTS	CONTACT HOURS
I	Introduction: Vehicle design in modern automobile industries, criteria for vehicle body design, types of frame, construction details. Body Details: Types of different vehicle bodies – car, bus and trucks, nomenclature of car and truck bodies, seat layout, seat dimension.	4
	Construction details- frame construction, double skin construction, types of metal section used, conventional and integral type construction, light commercial vehicle body types – dimension of driver seat in relation, driver cabin design criteria.	4
II	Materials of body's different components- Steel sheet, timber, plastic, GRP, FRP for automotive body properties of materials, body trims, Corrosion resistant materials, Selection of paints and painting process of body, different body-shop tools used in denting process, Body mechanism- door lock mechanism, window glass actuating mechanism.	4
	Different types of metal joining process used in vehicle body construction - riveting method, welding method. Visibility- driver's visibility, regulation, visibility test, method of improving visibility and space in cars	4
III	Aerodynamic fundamental Introduction , Aerodynamics forces and terms – streamlines, attached and separated flow, velocity distribution, Laminar and turbulent flow, skin friction coefficient, transition and laminar bubble,	4
	pressure distribution on automobile shape, wakes, Drag, lift and side forces and their coefficients for various road vehicles, source of drag and lift, Drag reduction techniques	4
IV	Aerofoils and wings – lift coefficient of an aerofoil, effect of Reynolds number, desirable pressure distribution, wing aspect ratio and taper ratio, lift coefficient of a finite wing, Induced drag	4
	Aerodynamics and vehicle performance – tire performance, tire adhesion, effect of aerodynamics on performance – maximum speed, straight line braking, maximum turning speed, Vehicle drag and down force, effect of side winds, lateral stability, suspension and pitch sensitivity, multi vehicle interaction,	4
V	Aerodynamics of complete vehicle: Basic vehicle body concept, aerodynamics of complete vehicle, flow over wheels, sliding seals and skirts, under body channels, simple add-ons: spoiler, strakes and wickers, internal flow, race car wings.	4
	Wind tunnel testing – type and process, model size and test section blockage, methods of mounting the models on test sections, Computational methods – Fluid dynamic equations	4
TOTAL		40

Text Book

- 1 Race car aerodynamics – design for speed, Joseph katz, Bentley publishers.
- 2 The Automotive body, Vol – II, Lorenzo Morello et. al., Springer
- 3 Materials for automobile bodies, II edition, Geoff Davies, BH publication

Reference Books:

- 1) Race car vehicle dynamics – Miliken, SAE International
- 2) Vehicle body engineering, Janusz pawlowski, business books
- 3) The Automotive body manufacturing systems and process, Mhd. A Omar, Wiley.

6AE6A: AUTO ELECTRICAL AND ELECTRONICS

B. Tech (Automobile) 6th Semester
3L

Max. Marks : 80
Exam Hours : 3

UNIT	CONTENTS	CONTACT HOURS
I	Vehicle Electrical Systems: Requirement and power supply, Voltage regulation in vehicle electrical system, Electrical system structures, Electrical system parameters: state of charge, state of health, State of function, Electrical energy management: purpose and functions of EEM,	4
	Storage Batteries: Requirements, construction charging and discharging of battery, battery characteristics, battery capacity, efficiency, rating and performance of lead acid battery Battery types: Maintenance free battery, AGM battery, Deep cycle resistant battery, Vibration proof battery, Battery maintenance, Electrolyte, Battery tests, Battery charging equipment and methods. Battery malfunctions.	4
II	Starter and charging system: Requirements of starter, design factors, classification, operation of starter, triggering the starter, characteristics of starter motor, type of starting, motor drive mechanisms, starter switch, starter system fault	4
	D.C. generator & A.C. alternators, Magneto, Armature reaction, Cut out relay, Voltage and Current regulator system for generator and alternators. Electrodynamics and electromagnetic principle, Piezo-actuators, fluid mechanical actuators	4
III	Auxiliary systems: Symbols used in circuit diagrams, Lighting equipments: low beam and high beam head lamp (Reflection headlamps, facet-type reflector, PES headlamps, Xenon headlamps, Bi-Litronic), tail lamps, fog lamps, brake light, side indicator, parking and other indicating lights. Principle of automotive illumination, dash board lights, indicators and meters, speedometers, electric horn, windshield wiper, heaters & defrosters, electric horn and relay devices, Different types of gauges and indicators. Electrical fuel pump.	6
	Ignition system: Contact less electronic ignition system, electronic spark timing and its control.	2
IV	Automotive electronics: Automotive networking, Bus system, Advantages of bus systems, requirements of buses, Buses in motor vehicle:	4
	CAN, FlexRay, LIN, Ethernet, IP, CAN, MOST bus and optical fibers/wave guides, Architectures of electronic system	4
V	Automotive sensors: Basic principle, Main requirements, Micromechanics, Position sensors, Speed and RPM sensors, Acceleration and vibration sensors, Pressure sensors, Flowmeters, Gas sensors, concentration sensors,	4
	temperature sensors, Force sensors, Optoelectronics sensors, Sensors for driver assistance systems: Ultrasonic technology, Radar technology, LIDAR sensors	4
TOTAL		40

Text Book

1 Automotive electrical equipments, P.L. Kohli, TMH.

Reference Books:

- 1.) Automotive electricity and electronics, II edition, Al Santini, ASE program certification
- 2.) Fundamental of automotive electronics, II edition, V.A.W. Hillier, Nelson Thrones
- 3.) Automobile electrical and electronics systems, III ed, Tom Denton, Elsevier BH

6AE7A: MACHINE DESIGN SESSIONALS– II

2 Periods

Same as 6ME7A

6AE8A: AUTO ELECTRICALS AND ELECTRONICS LAB

2P

- 1) Study of different type of Batteries and constructions and different battery tests.
- 2) Study of different automotive electrical system (Starting system, Ignition system, lighting system, wiring harness.)
- 3) Assembling and dismantling of starter motor used in automobile.
- 4) Assembling and dismantling of alternator used in automobile.
- 5) Trouble shooting with ignition system.
- 6) Study of different colour code system used in automotive wiring system.
- 7) Study of different Electrical Equipments & Accessories (Speedometer, Warning lights , Electric Horn , Wind shield wipers system)
- 8) Study of different sensor used in modern automotive system.
- 9) Study of various electronics system (Electronic fuel injection system, Electronic ignition system , Air bag , ABS , Electronic fuel injector cleaner).

6AE9A: VEHICLE BODY ENGINEERING LAB

2P

- 1) Perform the visibility test on the vehicle.
- 2) Study of different types of tool used in body shop
- 3) Perform the various joining processes (welding, riveting) in the body material.
- 4) Assembling and dismantling of various body mechanisms like door lock mechanism, window winding machine mechanism, passenger seat mechanism.
- 5) Perform the dent beating process on the metal sheet.
- 6) Study and perform the various painting process on the car.
- 7) Make the different scale model like Bus body model, mini truck model and car models.
- 8) To study and perform the wind tunnel test on the models like aerofoil, sphere and cylinder.
- 9) To Study the different vehicle crash analysis process

6AE10A: IC ENGINES LAB-II

2P

- 1) To perform the load test on variable compression ratio engine to determine the following: engine brake power (KW), engine brake torque (N-m), Brake specific fuel consumption (kg/kWh), and brake mean effective pressure (kPa).
- 2) To perform the Morse test on three/four cylinder petrol engine to determine the IP of the engine.
- 3) To study and perform computerized engine control systems including sensor testing, onboard diagnosis, scan tool use and fuel injector testing, cleaning and preventive maintenance.
- 4) Study of electronic fuel injection system.
- 5) Study of Common rail direct injections engine.
- 6) To perform laboratory course covering the basics of automotive electric and electronic.
- 7) Study of various sensor and electronic control module used in automobile.
- 8) Study of Electronic fuel pump.
- 9) Study of circuit construction emphasizing meter usage, including analog, digital and oscilloscopes.
- 10) Study of alternative fuels for I.C. Engines.

6AE11A: AUTOMOTIVE EMISSION AND POLLUTION LAB

2P

- 1) To study the factors affecting the S.I. engine emission.
- 2) To study the factors affecting the C.I. engine emission.
- 3) Study of NDIR Gas analyzer.
- 4) Study of Flame ionization detector.
- 5) Study of Chemi-luminescence NO_x analyzer.
- 6) To Measure HC, CO, CO₂, NO_x using exhaust gas analyzer for single cylinder four stroke engine.
- 7) To study the diesel smoke measurement methods.
- 8) To study the Indian and European standard emission norms: Bharat Stage Norms and Euro Norms

SYLLABUS FOR VII SEMESTER (IV YEAR)**B. Tech. (Automobile Engineering)****7AE1A: VEHICLE DYNAMICS**

B. Tech (Automobile) 7th Semester
3L + 1T

Max. Marks : 80
Exam Hours : 3

UNIT	CONTENTS	CONTACT HOURS
I	Introduction to vehicle dynamics: lumped mass, vehicle fixed coordinate system, motion variables, earth fixed coordinate system, Euler angles, force system acting on a rigid vehicle,	4
	Newton's second law application in dynamics, Dynamics axle loads: static loads on level ground, low speed acceleration, loads on grades, rigid body translation and rotational dynamics.	4
II	Tires: construction, size and load rating, terminology and load rating, mechanism of force generation, tractive properties, cornering properties, camber thrust, aligning moment,	4
	combined braking and cornering, conicity and ply steer, durability forces, performance of tires on wet surfaces.	4
III	Suspension geometry: degree of freedom and motion path, instant centre, solid axles, anti squat and anti pitch geometry,	4
	anti dive suspension geometry, roll centre geometry, active suspension, castor theory	4
IV	Steering geometry: steady state handling, characteristics of a two-axle vehicle, steady state response, directional stability	4
	Stability of vehicle: introduction, stability and dynamics of an elementary automobile model, Stability analysis using inertial coordinates, dynamics stability in a steady turn, Stability of vehicle at banked roads and curved path	4
V	Two wheeler stability: basic geometry considerations, body force components of a two wheeler, two wheel rigid vehicle dynamics,	4
	steering control of banking vehicles, steering control of lean angles, Counter steering or reverse action	4
TOTAL		40

Text Book

- 1) Fundamentals of vehicle dynamics: Thomas D Gillespe, SAE International publication
- 2) Vehicle dynamics theory and applications: Raza N Nazar

Reference Books:

- 1) Vehicle stability: dean karnhoop
- 2) Race car dynamics: william F. Milliken, SAE international publication
- 3) Theory of ground vehicles: J Y Wong, Jonh Willey & sons Inc.

7AE2A: INDUSTRIAL ROBOTICS AND AUTOMATION

B. Tech (Automobile) 7th Semester
3L

Max. Marks : 80
Exam Hours : 3

UNIT	CONTENTS	CONTACT HOURS
I	MICROCONTROLLER Introduction, 8051 Microcontroller hardware, Input/output Pins, Input/output Ports, External Memory, Counters and Timers, Serial Data;	4
	Introduction about Arduino Microcontroller, Programming and Circuit Concepts, Pin diagram.	4
II	ROBOTIC DEVICES Sensors and their types (IR, Sonar, Laser, Vision, parametric sensor, Bluetooth serial master for Microcontroller); Motor and their types (DC gear type Motor, Servo Motor, Stepper Motor, Synchronous Motor);	4
	Micro USD Power Supply, Switching Regulator (Step up and Step down Regulator); Color LEDs, Thermister, Diode, Zener Diode, Resistor, Capacitor, Inductor and Transistor.	4
III	PROGRAMMING THE ROBOT Brief Introduction of C++, Android Library Revision 19, Arduino Libraries and Raspbion OS and its Libraries; Programming the Arduino Microcontroller for blinking Multiple LEDS using Arduino Library;	4
	Programming the Ultrasonic Distance Sensor; Programming to Control DC motors Using Motor Controller Shield and Arduino Library; Remote Control of Robot over Bluetooth; Programming a Motor Shield Driver, Distance Sensor Driver and Remote Control Driver.	4
IV	POSITION AND FORCE CONTROL OF MANIPULATORS Introduction, Feedback Control of a Single-link Manipulator, PID Control of a Multi-link Manipulator, Non-linear Control of Manipulators, Simulation and Experimental Results, Non-linear control of constrained and Parallel Manipulators, Cartesian Control of Manipulators, Force Control of Manipulators,.	5
	Hybrid Position/Force Controller, Stability Analysis of Non-linear Control Schemes, Advanced Topics in Non-linear Control of Manipulators	3
V	MODELLING AND CONTROL OF FLEXIBLE MANIPULATORS Introduction, Modelling of a Flexible Joint, Euler—Bernoulli Beam Model, Kinematic Modelling of Multi-link Flexible Manipulators, Discretization Methods,	4
	Equations of Motion of Multi-link Flexible Manipulators Control of Flexible Link Manipulators, Other Topics in Flexible Manipulators.	4
TOTAL		40

Text book

- 1 Robotics, Fu K S, McGraw Hill.
- 2 An Introduction to Robot Technology, P. Coiffet and M. Chaironze, Kogam Page Ltd

Reference Books:

- 1 Robotic Engineering, Richard D. Klafter, Prentice Hall
- 2 Robot Analysis and Intelligence, Asada and Slow time, Wiley Inter-Science.
- 3 Introduction to Robotics, John J Craig, Pearson Edu.
- 4 Robot Dynamics & Control – Mark W. Spong and M. Vidyasagar, John Wiley & Sons
 - [www. Raspbian.org](http://www.Raspbian.org)
 - developer.android.com/tools/support_library
 - Arduino.cc/en/Reference/Libraries

7AE3A: MECHANICAL VIBRATION AND NOISE CONTROL

B. Tech (Automobile) 7th Semester
3L+1T

Max. Marks : 80
Exam Hours : 3

UNIT	CONTENTS	CONTACT HOURS
I	Undamped free vibration: Introduction, single degree of freedom system, undamped free vibration, Natural frequency of free vibration. Raleigh method stiffness of spring elements, effect of spring mass. Damped free vibration: introduction, single degree of freedom system, different type of damping..	5
	Concept of critical damping and its importances, response study of viscous damped system for case of under damping. Critical damping and over damping logarithmic decrement	3
II	Forced vibrations: Single degree of freedom system, steady state solution with viscous damping due to harmonic force. Solution by complex algebra, concept of response reciprocating and rotating unbalance vibration isolation, Transmissibility ration, energy is dissipated by damping, equivalent viscous damping, structural damping, sharpness of resonance, base excitation..	5
	Vibration measuring instruments, accelerometer and vibrometer, whirling of shafts with and without damping, discussion of speeds above and below critical speeds	3
III	System with two degree of freedom system: introduction, principle modes and normal modes coordinates coupling, generalized and principle coordinates. Free vibrations in terms of initial conditions, geared systems. Forced oscillations harmonic excitation..	5
	Applications- vehicle suspension. Dynamic vibration absorber, dynamic of reciprocating engines	3
IV	Continuous systems: Introduction, vibration of spring, longitudinal vibration of rods, torsional vibrations of rods..	5
	Euler equations for beams, simple problems	3
V	Noise and noise control: sound, noise decibel scale, pressure and density level, addition of levels, overall noise from different frequency ranges, sound level meters, perceived noise level, traffic noise index, NC curves, Building Acoustics,.	5
	effect of noise on people, noise reduction, noise due to industrial equipments, important I.S codes related to noise	3
TOTAL		40

Text Book

- 1 Mechanical Vibration Singh , V.P. Dhanpat Rai publication.
2. Mechanical Vibration. Rao , J.S ,New Age

Reference Books:.

1. Vibration & Noise Control , Pujara, Dhanpat rai publication
2. Mechanical Vibration , Den Hartog, Dover Reprint 1984.

7AE4A: AUTOMOTIVE TRANSMISSION

B. Tech (Automobile) 7th Semester
3L

Max. Marks : 80
Exam Hours : 3

UNIT	CONTENTS	CONTACT HOURS
I	Introduction and basics of transmission: Requirements of gear box, sliding mesh gear box, constant mesh gear box, synchromesh gear box, epicyclic gear box,	4
	velocity ratio and gear ratio for vehicle, performance characteristics in different speed , overdrive.	4
II	Hydrodynamic drive: Fluid Coupling : Principle of operation, constructional details, torque capacity and performance curve.	4
	Torque converter : Principle of operation, constructional details, torque capacity and performance curve. Multistage torque converter, converter fluid.	4
III	Hydrostatic drive: Various types of hydrostatic system, working principle of hydrostatic system, advantage and limitations,	4
	Jenny hydrostatic drive, comparison of hydrostatic and hydrodynamic drive.	4
IV	Electric drive: Principle of electric drive, Early ward Leonard control system, Modify Leonard control system,	5
	advantage of electric drive, limitation of electric drive.	3
V	Automatic Transmission: Need for automatic Transmission, Chevrolet turbo glide transmission system, torque flite,.	4
	Automatic transmission fluid, effect of automatic transmission on vehicle performance and fuel economy	4
	TOTAL	40

Text Book

- 1 The motor vehicle, 13 edition, Garrett, Newton, Steeds, BH publication
- 2 Power Transmission, Anil Chikara, Satya Publication.

Reference Books:

1. Automotive transmissions, II ed, Harald naunheimer, springer
2. Automotive Mechanics, William . H. Couse , Tata McGraw-Hill Publication
3. Automobile Engineering, Kripal Singh, Standard Publication.
4. Automobile Engineering,Gupta K.M , Umesh Publication

7AE5A: AUTOMOTIVE REFRIGERATION AND AIRCONDITIONING

B. Tech (Automobile) 7th Semester
3L

Max. Marks : 80
Exam Hours : 3

UNIT	CONTENTS	CONTACT HOURS
I	Introduction of air conditioning & Refrigerant – Second law of thermodynamics, Refrigeration effect, Types of refrigerant and their properties, Cycles - vapour compression refrigeration cycle, Vapour absorption cycle, Alternative cycles – CO ₂ (R744)based refrigeration cycle, absorption refrigeration, gas refrigeration,	5
	Evaporative cooling – thermo-electric cooling, air-conditioning system activation, expansion valve system, fixed orifice valve system (cycling clutch orifice tube).	3
II	Psychometric: Psychometric properties, relations, charts, and processes, cooling coils, By-pass factor and air washers.	4
	Human Comfort: Mechanism of body heat losses, factors affecting human comfort, effective temperature, comfort chart.	4
III	Automotive air conditioning fundamentals - Air conditioning fundamentals –Basic theory of cooling – car heating system, heat control, Air distribution through the interior of vehicle,	4
	Air filtration – pollen filter, carbon filter and germicidal lamp, photo-catalytic filter, Air diffuser system, Booster heating system – PTC heaters, diesel fuel booster system,	4
IV	Automotive air conditioning components – Compressor – operation and types – reciprocating (crank and axial piston type), rotary (vane type) and oscillating (scroll type - helix), Condenser – tube and plate type, parallel flow type, Dual condenser, receiver – drier/accumulator operation,	4
	expansion valve/fixed orifice valve – equalised expansion valve, Box or H-valve type, fixed orifice valve, variable orifice valve, evaporator, anti-frosting device, basic control switches	4
V	Air conditioning electrical and electronics – electrical principles, sensors and actuators, testing sensors – temperature (NTC and PTC), Sun load sensors, pressure sensors, position sensors, speed sensors, humidity sensor (capacitive), air quality sensor (metal oxide semiconductor),	4
	actuators – solenoids (relays and coolant valves), motor (permanent magnet type), stepper motor, multiplex wiring system, wiring diagrams, Automotive A/C manual control system, automotive A/C auto temperature control system, Automotive climate control system	4
	TOTAL	40

Text Book

- 1 Refrigeration and air-conditioning, C.P. Arora, TMH
- 2 Automotive air conditioning and climate control system – Steven Daly – BH Publication

Reference Books:

- 1) Automotive air conditioning, Crouse and Anglin, Mcgraw Hill, 1983
- 2) Automotive air conditioning, L.F. Goings, ATS
- 3) Refrigeration and air conditioning technology, Whitman et.al, Cengage learning

7AE6.1A: FUEL CELL, ELECTRIC AND HYBRID VEHICLE (ELECTIVE I)B. Tech (Automobile) 7th Semester
3LMax. Marks : 80
Exam Hours : 3

UNIT	CONTENTS	CONTACT HOURS
I	Introduction and types of Fuel cell: Introduction : the rational behind fuel cell development, basic principle of fuel cell, operational of fuel cell, efficiency of fuel cell, co generation of heat and power, important reaction such as hydrogen oxidation, methonal oxidation etc,	4
	Types of fuel cell: DMFC (direct methanol fuel cell),PAFC (phosphoric acid fuel cells), MCFC (molten carbonate fuel cells), SOFC (solid oxide fuel cells)	4
II	Fuel processing and application of fuel cells: Fuel processing- general, producing hydrogen from alcohol, producing hydrogen from hydrocarbon, hydrogen from other sources, Gas cleanup, reformer system, hydrogen storage system Engineering:	4
	fuel cell engineering, vehicle cell design, stack engineering fuel processing system application: stationary power, propulsion of vehicle, portable application	4
III	Electric Vehicle: Introduction, working. Electric car motors, electric car batteries,	4
	charging system of electric car, magna charge system. conversion system for transmission.	4
IV	Hybrid vehicle: Introduction, working. Power split devices. Hybrid car performance, gasoline hybrid structure. Gasoline Vs electric power.	4
	Transmission components of hybrid vehicle. Advantage and limitation. Different types of hybrid vehicle.	4
V	Solar Vehicles: Introduction and working, photovoltaic cell, solar cell. Energy lose in solar cell..	4
	Solar powering house. Solar cost, anatomy of solar cells	4
TOTAL		40

Text Book

- 1 Non Conventional Energy, Rai G.D. Khanna Publication
- 2 Fuel cell technology, N. Sammes, Springer
- 3 **Electric and Hybrid Vehicles: Design Fundamentals, Second Edition, By Iqbal Husain, CRC press**

Reference Books:

1. Microbial Fuel Cell, Bruce E. Logan , Willey publication.
2. Principle of Fuel Cell, Xiangeo Li, CRC Press.
3. Hydrogen fuel cells for road vehicles, corbo et.al, springers
4. Electrical vehicle technology, James Iaraminie, Wiley

7AE6.2A: QUALITY CONTROL (ELECTIVE II)B. Tech (Automobile) 7th Semester
3LMax. Marks : 80
Exam Hours : 3

UNIT	CONTENTS	CONTACT HOURS
I	Quality Concept And Management: Evolution of quality control, Quality characteristics, need of control , quality objective and quality policy, quality cost, quality of design, conformance, Objective and application of Statistical quality control,	5
	process capability analysis. Quality assurance, Concept of TQM, ISO 9000 and ISO 14000 system	3
II	Control Chart : General theory of control chart, control chart for variable and attributes,	4
	Group Control chart, moving average and moving range charts, acceptance control chart, CUSUM chart, difference control charts	4
III	Sampling Plans: Fundamental Concepts of acceptance sampling, multiple and sequential sampling plans, acceptance sampling by variables,	4
	sampling plans using different criteria. comparison of various types of sampling plans.	4
IV	Life testing and Reliability: Models of probability of equipment failure, Exponential failure, density, MTTF, Weibull failure	4
	,concept of reliability, designing for reliability, Maintainability, Reliability measurement and test	4
V	Quality Management: Philosophies of Deming , Juran, Ishikawa and Philip Crosby, Seven Quality tools, Quality circle, Kaizen	4
	, Concept of poka yoke,5 S campaign, Six sigma, Quality function deployment, Benchmarking	4
	TOTAL	40

Text Book

- 1 Quality Planning & Analysis, Juran J.M. & Gryna F.M. Tata McGraw Hill.
- 2 Statistical Quality Control, Grant E.L and Leavenworth Richard S., Tata McGraw-Hill,2000

Reference Books:

1. Quality Control, Dale H. Besterfield, 8th Edition, Pearson/Prentice Hall, 2008
2. Introduction to Statistical Quality Control, Douglas C. Montgomery, 2nd Edition, Wiley India
3. Fundamentals of Quality Control and Improvement, Mitra, Amitava 2nd Edition,Prentice Hall
4. Reliability Engineering, Srinath, L.S., Affiliated East West Press

7AE6.3A: CAM (ELECTIVE III)B. Tech (Automobile) 7th Semester
3LMax. Marks : 80
Exam Hours : 3

UNIT	CONTENTS	CONTACT HOURS
I	Introduction: Basic principle of Mechanization, Automation and Automatic Controls, Open and Close Loop systems, Adaptive control, Hydraulic, Pneumatic and Electro-mechanical actuating systems.	4
	Product cycle in conventional and computerized manufacturing environment. Introduction to CAM. Advantages and disadvantages of CAM	4
II	N C Systems: Numerical Control in CAM: Definition , Historical Background, basic components of NC system, Classification ,NC Procedure, Coordinate system, motion control systems, Advantages of NC systems .Economic of NC.	4
	Principle of operation of CNC, Features of CNC, Development in CNC systems, Direct Numerical Control (DNC)	4
III	Part Programming: Numerical control part programming: punched tape, tape coding & format. Manual part programming,	4
	Computer Assisted part programming : Automatically programmed tools programming (APT).	4
IV	CIM and Group technology: Introduction to Computer integrated manufacturing Systems and FMS, Computer aided process planning, Introduction to AGV.	4
	Introduction to GT, GT cell and flow lines, different part coding systems, Part print analysis, optiz's and multi class coding.	4
V	Robot Technology: Introduction, Industrial Robots, Robot physical Configuration, Basic Robot motions, Technical features such as work volume, precision of movement speed of movement, weight carrying capacity, type of drive systems,	4
	Introduction to Robot Languages, End Erectors, work cell control and interlocks, Robotic sensors, Robot applications & economics, Intelligent robots, interfacing of a vision system with a Robot	4
	TOTAL	40

Text Book

1 CAD/CAM , Groover , Tata MCGraw-Hill Publication.

Reference Books:

1. CAD/CAM , Ibrahim Zied, Tata McGraw-Hill Publication.
2. CAD/CAM/CIM, Radhakrishnan. New Age. Publication .

7AE7A: MECHANICAL VIBRATIONS AND VEHICLE DYNAMICS LAB

2P

1. To verify the relation of simple pendulum.
2. To determine the radius of gyration of compound pendulum.
3. To determine the radius of gyration of given bar by using Bi-filer suspension .
4. To determine the natural frequency of a spring mass system.
5. To determine the natural frequency of free torsional vibrations of single rotor system.
6. To verify the Dunkerley's rule.
7. To study the longitudinal vibratipn of helical spring and to determine the frequency and time period oscillation theoretically and actually by experiment.
8. To study the forced vibration of equivalent spring mass system.
9. To perform the wheel balancing test.
10. Study the various parameters at the time of application of brakes (Braking efficiency, stopping distance, reaction time etc.).
11. Study of antilock braking system.
12. Study of different steering system used in automobile.
13. Study of ride comfort in vehicle.

7AE8A: AUTO TRANSMISSION LAB

2P

1. To study the different type of gears used in automotive mechanisms.
2. To dismantle and assemble of clutch assembly.
3. To dismantle and assemble of gearbox.
4. To dismantle and assemble of propeller shaft.
5. To dismantle and assemble of steering system.
6. To inspect for wear and tear, crack breakdown, servicing and cleaning and necessary adjustment in the transmission components
7. To calculate the gear ratio of the gear box.
8. Technical specification of two and four wheeled vehicle and troubleshooting chart of all the transmission components.
9. To study and practice of the gear selector mechanism.
10. To study the two wheel drive and four wheel drive mechanism.

7AE9: INDUSTRIAL ROBOTICS AND AUTOMATION LAB

1. Practical Study of Some Robot Components:

- (a) Microcontroller
 - (b) Motor Controller Shield
 - (c) DC Gear motors
 - (d) Servo Motor
 - (e) Stepper Motor
 - (f) Breadboard
 - (g) Breadboard jumper wires
 - (h) Color LEDs
 - (i) Ceramic Capacitors
 - (j) Electrolytic Capacitors
 - (k) Resistors
 - (l) Tilt switches
 - (m) Thermistor
 - (n) Photo resistor
 - (o) Diode
 - (p) Relay
 - (q) Potentiometer
 - (r) Piezo Element
 - (s) Transistor
 - (t) Various types of Sensors including IR, Ultrasonic, Laser, Parametric and Vision sensors.
2. Driving Multiple LEDs
 3. Reading a Photo Resistor
 4. Driving a Servo Motor
 5. Hardware Components of a Working Prototype Robot including
 - a) A Microcontroller
 - b) A Motor Controller Shield
 - c) DC Gear Motors with Chassis
 - d) Ultrasonic Distance Sensors
 - e) Bluetooth slave for remote control
 - f) Prototyping board and cables
 - g) USB cable and Power Supply
 6. Programming the Ultrasonic Distance Sensor
 7. Programming to Control DC motors Using Motor Controller Shield and Arduino Library
 8. Program for Remote Control of Robot over Bluetooth
 9. Assembling the Robot
 10. Programming a Motor Shield Driver;
 11. Programming a Distance Control Driver
 12. Programming a Remote Control Driver

Case Study on: TRAJECTORY PLANNING AND GENERATION-Introduction, Joint Space Schemes, Joint Space Schemes With Via Points, Cartesian Space Schemes, Some Additional Issues in Trajectory Planning.

7AETR: Practical Training and Industrial Visit

7AEPR: Project Stage- I

SYLLABUS FOR VIII SEMESTER (IV YEAR)

B.Tech. (Automobile Engineering)

8AE1A: ALTERNATIVE FUELS AND ENGINE TRIBOLOGY

B. Tech (Automobile) 8th Semester
3L

Max. Marks : 80
Exam Hours : 3

UNIT	CONTENTS	CONTACT HOURS
I	Introduction: Estimation of petroleum reserves, need for alternative fuels, availability and properties of alternative fuels. Merits and demerits of alternative fuels..	4
	Alcohols: properties of alcohol as SI engine fuel, ethanol and methanol, ethanol- gasoline blends, methanol -gasoline blend, combustion characteristics in the fuel engines, performance and emission characteristics	4
II	Compressed natural gas, LPG and biogas: availability of CNG properties, modification required to use in engine- performance and emission characteristics of CNG vehicles SI and CI Engines. Use of LPG in SI engine: performance and emission for LPG.	5
	Biogas generation, properties, performance and emission characteristics, storage, handling and safety aspects,	3
III	Bio-diesel: Different sources of vegetable oils use of straight vegetable oils in engine, Trans- etherification, bio-diesel, bio-diesel properties and standards, biodiesel blends. Engine performance and emission characteristics with use of biodiesel and its blends, worldwide trends in use of bio diesel.	4
	Hydrogen: hydrogen as SI engine fuel, properties combustion characteristics, port injection, timed injection, direct injection of hydrogen in engines, backfire arrest, performance and emission characteristics, production, storage and handling, safety aspects.	4
IV	Engine Tribology of Fundamentals: Function of engine lubrication, fundamental of lubrication regimes of lubrication-hydrodynamic, mixed and boundary lubrication, elasto hydrodynamic lubrication,	4
	Description of engine components working of each of these regimes.	4
V	Engine Lubrication System: Engine lubrication system and their components, bearing lubrication, lubrication of piston, ring and liners, mechanisms of lubricating oil consumption, method of measuring engine oil consumption, positive crank case ventilation. Cylinder liner and its fitment, characterization and measurement of cylinder liner surface finish, oil filters- full flow and bypass filters, importance of air filter, wet and dry air filtration.	4
	Wear of different engine parts. Lubricating Oils: classification and service rating of lubricating oils, detailed study of different properties of lubricating oils, oil additives, oil drain intervals and used oil analysis, oil coolers.	4
	TOTAL	40

Text Book

- 1 Alternative Fuels Guide Book , Becfold L., SAE International
- 2 Fundamental of Tribology Basu , S.K. , PHI

Reference Books:

1. Energy today and tomorrow , Maheswar Dayal , I& B publication India
2. Lubrication of Bearing , Redzimoyskay, SAE International.
3. Alternative fuels for road vehicles, Mark L Poulton, CM publications

8AE2A: AUTO MAINTENANCE AND MANAGEMENT

B. Tech (Automobile) 8th Semester
3L

Max. Marks : 80
Exam Hours : 3

UNIT	CONTENTS	CONTACT HOURS
I	Introduction: Importance of maintenance, Types of maintenance – preventive, predictive, periodic and breakdown maintenance. Differences b/w service, repair and replace, maintenance schedule, analysis of breakdown, preventive measures, preparation of check lists, chassis lubrication schedule, component retrieval, estimating repair cost, maintenance record, warranty period, inspection forms, log books, trip sheets, other maintenance record forms.	5
	Garage Practice: types of service station/garage, layout of garage, factor affecting layout, tools & equipments, transport service undertakings, layout for different garages	3
II	Engine Maintenance: Engine components inspection, cleaning methods, dimensional check of various engine components, minor and major tune up, reconditioning and repairing methods of engine components. Assembling procedure, special tools used for engine	4
	maintenance, repair and overhauling, cooling systems - Anti corrosion and antifreeze solutions, radiator, and thermostat. Lubrication oil topping up, oil change, oil relief valve; fuel feed systems, FIP adjustment and testing, testing of injectors.	4
III	Chassis and drive line maintenance: Gear box inspection and check- manual and automatic types, repair and overhaul of gear box..	3
	Flaw detection in frames, Shaft and axle inspection - propeller shaft, front and rear suspension systems, brake system routine inspection - hydraulic, servo, air bleeding, steering system maintenance – axles, pump and steering gear inspection and repair, wheel alignment- tires	5
IV	Electric system maintenance: Battery testing method, testing of starter motor, charging system- DC generator, AC alternator, regulator, ignition system check - coil ignition, transistor assisted ignition, capacitor discharge ignition.	4
	Maintenance of electric horn, wiper motor, flasher, electric fuel pump, gauges. wiring system inspection and repair, head lights focusing	4
V	Body repair: minor body panel beating, shouldering, painting: Introduction of automotive paints , types of paints, corrosion and anticorrosion method, rubbing polishing,	4
	Working of paint booth ,door lock mechanism, window glass actuation mechanism.	4
TOTAL		40

Text Book

1 Automotive maintenance and troubleshooting, [Ernest A. Venk](#), [Edward Dale Spicer](#), [Irving Augustus Frazee](#), ATS

Reference Books:

1. Automotive Service, maintenance, repair, IV ed, Tim Gilies

8AE3A: TRACTOR AND EARTH MOVING MACHINERIES

B. Tech (Automobile) 8th Semester
3L +1T

Max. Marks : 80

Exam Hours : 3

UNIT	CONTENTS	CONTACT HOURS
I	Tractor Classification of tractors, Components of tractors, transmission system, braking system, Steering geometry and steering of crawler system,.	4
	Hydraulic lift, drawbar, valve mechanism, final drive, wheel and tires of tractor	4
II	Farm equipment – Construction and working of Planting equipments, Fertilizer equipments, Spraying and dusting equipments,	4
	Hay making machines, Hitching of Implements, Harvesting machine	4
III	Earthmovers:- Crawler drive system – construction and materials, Crane – classifications, construction, working, load carrying capacity, working of winch, Bulldozer and loader– cable and hydraulic dozer, wheeled and crawler,	4
	Working, construction, hydraulic operation of dozer, shovel operating capacity, power and capacity of earth moving machineries,	4
IV	Special Earthmovers:- Excavator – type, working - trench making and digging, construction of excavators, operating capacity,	3
	Special earthmovers – working and construction of Scraper or grader, Tree dozer, bush cutter, stampers, rippers, dumper truck, articulated vehicles, tipper, drag lines, ditchers	5
V	Earth moving equipments maintenance and management- Type of maintenance schedules, purpose and advantages, Method of selection of equipments selection of machine, basic rules of matching machine,	4
	selection of equipment including the nature of operation, selection based on type of soil, based on haul distance, based on weather condition	4
TOTAL		40

Text Book

1. Tractor and farm equipment, CP Nakara, Dhanpat rai publication 2003
2. Abrosimov. K. Bran berg.A. and Katayer.K., Road making Machinery, MIR Publishers, Moscow

Reference Books

- 1 Wang.J.T., Theory of Grand vehicles, John Wiley & Sons, New York, 1987.
- 2 Off the road wheeled and combined traction devices - Ashgate Publishing Co. Ltd. 1998
- 3 R.L. Peurifoy, Construction Planning Equipment and Methods, McGraw Hill Publishers, 1956
- 4 Mahesh Varma, Construction Equipment and its Planning and Applications, Metropolitan Books Co., Delhi, 2004

8AE4.1A: INDUSTRIAL ENGINEERING (ELECTIVE I)

B. Tech (Automobile) 8th Semester
3L

Max. Marks : 80
Exam Hours : 3

UNIT	CONTENTS	CONTACT HOURS
I	Introduction: Work of F.W. Taylor, Frank and Lillian Gilbreth and others; Productivity definition, Means of increasing productivity work study, Motion Study; Definition, aims; Procedure for method study: selection of jobs; Recording Techniques:	4
	Micro motion study: Therbligs; Cychography and Chronocycle graph: Principles of motion economy. design of work place layout: Analysis in the form of a chart; operation chart; flow process chart; flow diagrams; string diagram; Man Machine chart; Two hand chart; Simon chart.	4
II	Work Measurement (Time Study): Definition; uses; procedure; time study equipment; performance rating; allowances, number of cycles to be studied. Determination of standard time: Predetermined Motion Time Systems.	5
	Job Evaluation: Objective of job evaluation; Methods of Job evaluation; Non-quantitative and quantitative.	3
III	Production Planning and Control: Types of production; function of production planning and control; planning Preplanning, sales forecasting; routing; Scheduling; dispatching and control with other departments..	4
	Wages and incentives: Characteristics of a Good wage for incentive system. Methods of wage payment Concept of wage incentive schemes, financial and non financial Holsely premium plan. Merric's Multiple piece rate system	4
IV	Facility Design: Facility location factors and evaluation of alternate location, types of plant layout and their evaluation.	4
	Line Balancing: Need, Heuristic approach for the line balancing Computerized Layout	4
V	Project planning and Control: Network Control, CPM, PERT, control cost consideration and optimization.	4
	Resource allocation and leveling. Aggregate Production planning model	4
TOTAL		40

Text Book

- 1 Motion & Time Study & Measurement of Work, Ralph, M Barnes , John Wiley & Sons Operation
- 2 Management: The Management of Productive System, Buffa E.S., John Willey & Sons.
- 3 Introduction to Work Study, George Kanawaty, International Labour Office, International Labour Organization, 1983

Reference Books

1. PERT & CPM: Principles and Applications, Srinath, L.S., Affiliated East West Press.
2. Production & Operations Management ; Charry S.N., Tata McGraw Hill
3. Operations Management, Taylor Russel, Pearson Education

8AE4.2A: VEHICLE TRANSPORT MANAGEMENT (ELECTIVE II)

B. Tech (Automobile) 8th Semester
3L

Max. Marks : 80
Exam Hours : 3

UNIT	CONTENTS	CONTACT HOURS
I	The Infrastructure: Road, Approach Road, National, state Highways. Traffic condition, Bus-stop, shelters, bus station. Garages layout of premises, equipment, use of machinery.	4
	Conveyance of staff. Facilities for passengers. Maintenance-preventive, breakdown, overhauling-major, minor.	4
II	Organization and Management: Forms of ownership, principle of transport management. Internal organization, centralized condition, decentralized condition (Engineering, Traffic and administration),	4
	Staff administration industrial relation, administration, requirement and training, welfare, health and safety.	4
III	Public relation division: Dissemination of information, maintaining goodwill, handling complaints, traffic advisory committees, Local contractor co-operation with the press.	4
	Facilities for the visitors, forms of publicity, Importance of quality, advertisements, signs notices and directions, specialized publicity.	4
IV	Prevention of accidents: Emphasis of safe driving, annual awards bonus encouragement vehicle design, platforms layout, location of steps, scheduled route, records. Route planning: Sourcing of traffic, town planning, turning points, stopping places, shelters, survey of route, preliminary schedule test runs, elimination of hazards factors affecting frequency, possibility single verses double deck.	5
	Timing, bus working and schedules: Time table layout uses of flat graph method of presentation preparation of vehicle, numbering determination of vehicle efficiency checking, efficiency of crew.	3
V	The fare structure: Basis of fare, historical background, effect of competition. Calculating average zone, system straight and tapered scale, fares concession system. Fare collection system.	4
	Operating Cost and types of vehicles: Classification, average speed running costs, supplementary costs, life of vehicles, factor affecting cost per vehicles km traveled. Indian Motor vehicle Act.	4
	TOTAL	40

Text Book

- 1 Bus and Coach Operation , Rex w. Faulks , Butterwirth version
- 2 Automobile Engineering. Gupta , R.B, Satya publication

Reference Books

1. Bus Operation , Kitchen L D., Liffle & Sones London.
2. Automobile Engineering , Gupta K.M. , Umesh publication.

8AE4.3A: MECHATRONICS (ELECTIVE-III)B. Tech (Automobile) 8th Semester
3LMax. Marks : 80
Exam Hours : 3

UNIT	CONTENTS	CONTACT HOURS
I	INTRODUCTION: Definition and an overview of mechatronics, design of mechatronics system. Objectives,	3
	Advantage and disadvantage of mechatronics. Microprocessor based controllers. System and design – mechatronics approach, modeling, and simulation, man – machine interface.	5
II	SENSORS AND SIGNAL CONDITIONING: Classification of transducers, development in transducers technology, (no detailed discussion on different type of transducers), classification of sensors, principle of working and application of light	4
	Sensors, proximity sensors and hall effect sensors. Concept, necessity op-amps protection, filtering, and wheat stone bridge-Digital- Multiplexer. Data acquisition.	4
III	MICROPROCESSOR: Introduction, 8085 A processor architecture and terminology – such as, CPU, memory and address, ALU, assembler, data, register, fetch cycle, write cycle, state bus, interrupts.	4
	8085 pin diagram. Micro controller. Difference between microprocessor and micro controller.	4
IV	ELECTRICAL ACTUATOR: Classification of actuator system with examples, mechanical switches. Concept of bouncing method of preventing bouncing of mechanical switches. Solenoid relays.	4
	Solid state switches- diode thyristor, triacs, transistors, and Darlington pair. Electrical actuator, stepper motor, permanent magnet motor servo motor, servo system, derives circuit, open and closed loop control.	4
V	HYDRAULIC ACTUATOR: Valves – classification, pressure control valves, pressure relief valves, pressure regulating valves, pressure sequence valve. Direction control valves – sliding spool valve, solenoid operated. Symbol of hydraulic element. Hydraulic cylinder – constructional features, classification and application.	4
	Hydraulic motor - types vane motors and piston motors, application. EXAMPLE OF MECHATRONIC SYSTEM: Robotics, manufacturing, machine – diagnostic, road vehicles	4
	TOTAL	40

Text Book

- 1 Mechatronics: Principles, Concepts and applications, Mahalik N.P., Tata McGraw Hill
- 2 Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering, Bolton, W., Pearson Education

Reference Books

1. Mechatronics, HMT Hand Book, Tata McGraw Hill.
2. Mechatronics, Singh and Joshi, Prentice Hall of India
3. Mechatronics: Integrated Technologies for Intelligent Machines, Smaili and Mrad, Oxford Publication.
4. Introduction to Mechatronics and Measurement Systems, Alciatore and Histan, Tata McGraw Hill
5. Mechatronics: Integrated Mechanical Electronic Systems, Ramachandran, Vijayaraghavan and Balasundaram, Wiley India Publication .
6. Mechatronics , Bradley D. A., Chapman & Hall Publication .

8AE5A: AUTO MAINTENANCE AND RECONDITIONING LAB

2P

1. To study and practice on garage equipment and servicing of the vehicle.
2. To study about the fault in different electrical systems of the vehicle like wiper systems, lighting system, horn, starter, charging system and wiring system.
3. To adjust the play in clutch pedal, brake pedal, hand brake lever and steering wheel.
4. Hand on practice of the air bleeding from brakes and tightening and adjustment of wheel bearing.
5. Assembling and dismantling of differential and adjusting the backlash.
6. To study and practice of wheel alignment (Mechanical and computerized) and wheel balancing.
7. To study and practice of engine analyzer.
8. Perform head light focusing test and visibility test.
9. To study the tire retreading and vulcanizing.
10. Study and practice on the fuel injection calibration equipment and nozzle tester machine.
11. Testing of vehicle models on the wind tunnel machine.

12. Trouble shooting in cooling system of an automotive vehicle
13. Trouble shooting in the ignition system, setting of contact breaker points and spark plug gap

8AE6A: ADVANCED AUTOMOBILE ENGINEERING LAB

2P

Any 10 experiments

1. To find out the performance characteristics of variable compression ratio engine.
2. To study the design aspects of off road vehicles.
3. To study the frame design of the any car.
4. To study the solar operated vehicles.
5. To study the hybrid vehicle.
6. To study the special vehicles like sagway, offroad bike, quad bikes, hovercraft etc.
7. To study the effect on emissions after preheating the intake air.
8. To study the performance characteristics and emission of single cylinder S.I. engine blend with any alternative fuel in the four stroke engine.
9. To study the performance characteristics of two stroke engine.
10. To study the use of waste exhaust gases to drive the auxiliary units like alternator/compressor.
11. To study the electromagnetic clutch controlled gear box.
12. To study the compressed air engine technology.
13. To study the fuel level measurement in digital display.
14. To study the various ECM controlled mechanisms like Quattro systems, Traction control, Drive by wire technology and automatic gear boxes etc.
15. To study the role of ergonomics in the automotives.
16. To study the fleet management in the workshop.
17. To study the single cylinder engine simulation software (any software).

8AESM: Seminar

8AEPR: Project Stage -II