# Shri Rawatpura Sarkar University, Raipur

Examination Scheme & Syllabus

for
M.Tech.(Automobile Engineering)
Semester-I

(Effective from the session: 2022-23)

# SHRI RAWATPURA SARKAR UNIVERSITY, RAIPUR, CHHATTISGARH
# FACULTY OF ENGINEERING

Two Years M.Tech. Programmme
## Scheme of Teaching and Examination
## M.Tech. First Semester Automobile Engineering
## Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
## (Effective from the session: 2022-23)

| S.N | Course Code | Course Title | Hours per week | | | Credit | Examination Scheme | | | Sem End Exam Duration (Hrs) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | | Continuous Evaluation | Sem End Exam | Total | |
| 1. | MENAE101T | Advanced Computational Methodology | 3 | 1 | - | 4 | 30 | 70 | 100 | 3 |
| 2. | MENAE101P | Computational Laboratory | - | - | 4 | 2 | 15 | 35 | 50 | - |
| 3. | MENAE102T | Automotive Engines and Emission control | 3 | 1 | - | 4 | 30 | 70 | 100 | 3 |
| 4. | MENAE103T | Automotive Chassis | 3 | 1 | - | 4 | 30 | 70 | 100 | 3 |
| 5. | MENAE104T | Elective-I | 3 | 1 | - | 4 | 30 | 70 | 100 | 3 |
| 6. | MENAE105T | Automotive Electrical and Electronics | 3 | 1 | - | 4 | 30 | 70 | 100 | 3 |
| 7. | MENAE106P | Automotive System Components Laboratory | - | - | 4 | 2 | 15 | 35 | 50 | - |
| | | | | | | 24 | | | 600 | |

L- LECTURE T- TUTORIAL P- PRACTICAL

## ELECTIVE-I

| I | Automotive Transmission | MENAE104A |
|---|---|---|
| II | Electronic Engine Management System | MENAE104B |
| III | Automotive Safety | MENAE104C |

| Course Title | ADVANCED COMPUTATIONAL METHODOLOGY | | | |
|---|---|---|---|---|
| Course Code | MSCCP101T | | | |
| **Course Credits** | L | T | P | TC |
| | 3 | 1 | - | 4 |
| Prerequisites | Engineering mathematics –I, II, III | | | |
| **Course Objectives** | **This course will enable students to:**<br>• Represent the problems mathematically.<br>• Optimize the solutions.<br>• Analyze the result numerically and linguistically by fuzzy theory.<br>• Emphasize the meaning and purpose of these techniques and their use in solving Engineering Problems. | | | |
| **Course Contents** | **UNIT – I**<br>**Graph theory and its application**<br>Basic Terminology, Simple graph, Multi graph, Types of graph, Path Cycles Eulerian and Hamiltonian graph Shortest path problem Representation of graph Trees and their properties Spanning, Tree Binary Tree, Tree traversal.<br><br>**UNIT - II**<br>**Fuzzy Set  and its Applications**<br>Fuzzy sets-Basic definitions, α-level sets. Convex fuzzy sets. Basic operations on fuzzy sets. Types of fuzzy sets. Cartesian products, Algebraic products. Bounded sum and difference, t-norms and t-conorms. The Extension Principle- The Zadeh's extension principle. Image and inverse image of fuzzy sets. Fuzzy numbers. Elements of fuzzy arithmetic.<br><br>**UNIT - III**<br>**Cryptography  and its application**<br>Introduction to the Concepts of Security:  The need for security, Security Approaches, Principles of Security, Types of Attacks. Cryptographic Techniques: Plain Text and Cipher Text, Substitution Techniques, Transposition Techniques, Encryption and Decryption, Symmetric and Asymmetric Key Cryptography, Steganography, Key Range and Key Size, Possible Types of Attacks. DES, RSA, Digital Signature.<br><br>**UNIT - IV**<br>**Statistical Analysis**<br>Expectation and variance of random variable. Sampling Distribution. Testing | | | |

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|  | a Hypothesis. Level of significance. Confidence limits. Test of significance for large sample. Central limit theorem. Test of significance for means of two large samples. Sampling Variables-small samples. Student t-distribution, Chi-square test.<br><br>**UNIT - V**<br><br>**Optimization Techniques**<br><br>Dynamic Programming-Deterministic and Probabilistic Dynamic programming. Inventory- Basic characteristics of an inventory system. The Economic order quantity. Deterministic models. Network analysis (PERT/ CPM). |
| **Course outcomes** | **After the completion of course:**<br><br>1. This is the foundation of research and development in the computational domain of engineering and technology.<br>2. As the prerequisite, this will be traced the thought and ideas to design the behavioral tools over the engineering range.<br>3. This is a transformation from theory to application through measuring theory of natural problems and its applications |
| **Text Books** | 1. Calculus of Variations with Applications, Gupta, A.S. Prentice Hall of India(P) Ltd., N e w Delhi, 6th print,2006.<br><br>2. Introduction to Partial Differential Equations, Sankar Rao, .K Prentice Hall of India(P) Ltd., New Delhi, 5th print, 2004.<br><br>3. Advanced Engineering Mathematics, Jain.R.K, Iyengar.S.R.K. Narosa publications 2nd Edition, 2006.<br><br>4. Numerical Methods in Science and Engineering, Grewal, B.S - Kanna Publications, New Delhi.<br><br>5. Numerical Methods, Kandasamy.P , Thilagavathy. K and Gunavathy, S Chand and Co., Ltd., New Delhi, 5th Edition, 2007.<br><br>6. Theory and problems of Complex Variables with an Introduction to Conformal Mapping and Its applications, Schaum's outline series, Spiegel, M. R - Mc Graw Hill Book Co., 1987. |
| **Reference Books** | 1. Multi - Objective Optimization Using Evolutionary Algorithms, K. Deb(2003)John Wiley.<br>2. Applied Statistics & Probability for Engineers: Montgomery, Douglas C. & Runger, George C. (2007), 3/e,Wiley India.<br>3. Parallel distributed processing Vol.1 (1986) Rumelhart, D.E and McClelland, J.L., M I T Press, 1986.<br>4. Fuzzy logic implementation and applications (1996), Patyra, M.J. and Mlynek Wiley. |

Board of Studies

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| Course Title | AUTOMOTIVE ENGINES AND EMISSION CONTROL | | | |
|---|---|---|---|---|
| Course Code | MENAE102T | | | |
| Course Credits | **L** | **T** | **P** | **TC** |
| | 3 | 1 | - | 4 |
| prerequisites | internal combustion engine auto mobile engineering | | | |
| Course objectives | **This course will enable students: -** <br><br> • Penetrate deep into engine classification, construction and operation of IC engines with latest technologies. <br><br> • Grasp the importance SI and CI engine application in automobiles. <br><br> • Understand the performance parameters and testing methodologies. <br><br> • Understand effect of vehicle population and emitted pollutants on human health and environment and various types of emissions. <br><br> • Impart knowledge in development of engine technologies. | | | |
| Course Contents | **UNIT- I** <br><br> **Construction And Operation** <br><br> Constructional details of spark ignition (SI) and compression ignition (CI) engines. Working principles. Two stroke SI and CI engines. Comparison of SI and CI engines and four stroke and two stroke engines. Engine classification, firing order. Otto, diesel and dual cycles, Miller cycle. Introduction to Lean burn engine technologies, charge stratification. <br><br> **UNIT- II** <br> **SI Engines** <br><br> Air fuel ratio requirements - Carburetion - Throttle body injection, Sequential injection. Function of Components Spark plug, Ignition System - battery coil, magneto coil, Electronic. Combustion in SI Engines - Combustion Chambers, Stages of Combustion - factors affecting flame propagation, Knock in SI engines, variables affecting knocking. Pollution from SI engines. <br><br> **UNIT- III** <br> **CI Engines** <br><br> Diesel fuel injection system, Function of Components, Jerk type pump, Distributor pump, Mechanical and pneumatic Governor, Fuel Injector, Types of nozzle, importance of Swirl, Squish, Turbulence air motion, Combustion in CI Engines - Combustion Chambers, Stages of Combustion, Factors affecting Ignition Delay, Knock in CI engines. Pollution from CI engines | | | |

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| | **UNIT- IV**<br><br>**Emission Control Techniques**<br><br>Design of engine, optimum selection of operating variables for control of emissions, EGR, charge stratification, SCR, DPF, Lean NOX catalyst technology. Thermal reactors, secondary air injection, catalytic converters, catalysts, fuel modifications, fuel cells, Two stroke engine pollution control.<br><br>**UNIT- V**<br><br>**Measurement Techniques Emission Standards And Test Procedures**<br><br>NDIR, FID, Chemiluminescent analyzers, Gas Chromatograph, smoke meters, emission standards, driving cycles - USA, Japan, Euro and India. Test procedures - ECE, FTP Tests. SHED Test - Chassis dynamometers, dilution tunnels. |
| **Course outcomes** | **At the end of this course students will be able to:-**<br><br>• Discern SI and CI engine systems application in automobiles and grasp the basic engine terminologies<br><br>• Understand the necessity of Ignition system SI engines<br><br>• Differentiate the fuel dynamics for SI and CI engines<br><br>• Define the key terms such as carburetion, stoichiometric ratio, Lean burn, stratified, HCCI etc.<br><br>• Understand the combustion process for both SI and CI engines on liquid and gaseous fuels. |
| **Text Books** | 1. Internal Combustion Engines by V. Ganesan, 2007, Tata Mc Graw Hill<br><br>2. Ramalingam K.K., "Internal Combustion Engines", Sci-Tech Publications, 2005.<br><br>3. Paul Degobert - Automobiles and Pollution - SAE International ISBN-1-56091-563-3, 1991. |
| **Reference Books** | 1. Advanced Engine Technology by Heisler, SAE Publication.<br><br>2. Edward F. Obert Internal Combustion Engines.<br><br>3. H.N. Gupta Fundamentals of Internal Combustion Engines by, PHI.<br><br>4. Mathur and Sharma Internal Combustion Engines Dhanpat Rai and Sons 2002. |

Board of Studies

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| Course Title | **AUTOMOTIVE CHASSIS** | | | |
|---|---|---|---|---|
| Course Code | **MENAE103T** | | | |
| **Course Credits** | **L** | **T** | **P** | **TC** |
| | **3** | **1** | **-** | **4** |
| Prerequisites | **automobile engineering** | | | |
| Course objectives | **This course will enable students: -** <br><br> • Understand various types of layout of vehicles and features and applications. <br><br> • Understand the construction, materials and various types of frames with knowledge on loads acting on frames and testing of frames. <br><br> • Know about the construction, materials and types of front axles. Conceive the significance of front wheel and steering geometry and study steering layouts, steering gear boxes and steering systems. <br><br> • Understand the construction and working of drive line system, final drives, differentials, rear axles, wheels and tires, suspension and brake systems. | | | |
| Course Contents | **UNIT-I** <br> **Introduction** <br><br> Types of chassis layout with reference to drives, vehicle frames, various types of frames, Monocoque structure, constructional details, materials, testing of vehicle frames, unitized frame body construction. <br><br> **UNIT- II** <br> **Steering System** <br><br> Types of front axles, construction details, materials, front wheel geometry: castor, camber, king pin inclination, toe-in. conditions for true rolling motion of wheels during steering, steering geometry, Ackermann steering system, constructional details of steering linkages, slip angle, cornering force, different types of steering gear boxes, steering linkages and layouts, turning radius, wheel wobble, power assisted steering, steering of crawler tractors and Electronic Steering System. <br><br> **UNIT- III** <br> **Drive Line** <br><br> 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, differential locks, differential housings, construction of rear axles, types of loads acting on rear axles, fully floating, three quarter floating and semi floating rear axles, rear axle | | | |

housing, construction of different types of axle housings, multi axle vehicles, Differential for Tandem drive.

### UNIT- IV

**Suspension System**

Need of suspension system, types of suspension, suspension springs, constructional details and characteristics of leaf, coil and torsion bar springs, independent suspension, rubber suspension, pneumatic suspension, shock absorbers, semi-active and active suspension system. Compensated suspension system, hydro-gas suspension system, wheels and tires.

### UNIT- V

**Braking System**

Braking Efficiency and stopping distance, Reaction time, Braking time, Classification of brakes, drum brakes and disc brakes, constructional details, theory of braking, concept of dual brake system, parking brake, material, hydraulic system, vacuum assisted system, air brake system, antilock braking, retarded engine brakes, eddy retarders and electronic braking system.

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| **Course outcomes** | **At the end of this course students will be able to:-**<br><br>• Differentiate various layouts, analyze the merits and limitations and apply in real time, Analyze frames for rea time applications, Dismantle, study, perform corrections and assemble front axles.<br><br>• Be familiar with various types of rear axles, brake systems, final drives, ABS and differential', Create virtual and real vehicle models and perform testing.<br><br>• Analyze and solve problems in steering mechanism, propeller shaft, and braking and suspension system and suggest design solutions.<br><br>• Describe the operation of steering system of crawler tractors and electronic steering system. |
| **Text Books** | 1. Heldt.P.M.- "Automotive chassis"- chilton co., New york- 1990<br><br>2. Steed W - "Mechanics of road vehicles"- Illiffe books Ltd., london- 1960. |
| **Reference Books** | 1. Newton Steeds and Garrot- "Motor Vehicles"- Butterworth's, London- 2000.<br><br>2. Judge A.W- "Mechanism of the Car"- Chapman and Halls Ltd., London- 1986<br><br>3. Giles.J.G- "Steering, Suspension and tyres"- Iiiffe Book Co., London- 1988.<br><br>4. Crouse W.H- "Automotive Chassis and Body"- McGraw-Hill, New York-1971.<br><br>5. K.K.Ramalingam - "Automobile Engineering" - Scitech Publication, Chennai – 2001. |

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| Course Title | **AUTOMOTIVE ELECTRICAL AND ELECTRONICS** | | | |
|---|---|---|---|---|
| Course Code | **MENAE105T** | | | |
| **Course Credits** | **L** | **T** | **P** | **TC** |
| | **3** | **1** | | **4** |
| Prerequisites | **automobile engineering** | | | |
| Course objectives | **This course will enable students: -** <br><br> • Understand construction and working of batteries and accessories. <br><br> • Understand the working of starting system. <br><br> • Understand the working of charging system <br><br> • Understand the fundamentals of automotive electronics. | | | |
| Course Contents | **UNIT- I** <br><br> **Batteries And Accessories** <br><br> Principle and construction of lead acid battery, characteristics of battery, rating capacity and efficiency of batteries, various tests on batteries, maintenance and charging. Lighting system: insulated and earth return system, details of head light and side light, LED lighting system, head light dazzling and preventive methods - Horn, wiper system and trafficator. <br><br> **UNIT- II** <br><br> **Starting System** <br><br> Condition at starting, behavior of starter during starting, series motor and its characteristics, principle and construction of starter motor, start stop system, working of different starter drive units, care and maintenances of starter motor, starter switches. <br><br> **UNIT- III** <br><br> **Charging System** <br><br> Generation of direct current, shunt generator characteristics, armature reaction, third brush regulation, cutout. Voltage and current regulators, compensated voltage regulator, alternators principle and constructional aspects and bridge rectifiers, new developments, wiring requirements, insulated and earth return systems. <br><br> **UNIT- IV** <br><br> **Fundamentals of Automotive Electronics** <br><br> Current trends in automotive electronic engine management system, electromagnetic interference suppression, electromagnetic compatibility, | | | |

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| | electronic dashboard instruments, onboard diagnostic system, OBD I,II, security and warning system. Electronic ignition and injection systems.<br><br>**UNIT-V**<br><br>**Sensors and Actuators**<br><br>Types of sensors: sensor for speed, throttle position, exhaust oxygen level, manifold pressure, crankshaft position, coolant temperature, exhaust temperature, air mass flow for engine application, rail pressure, cam position. Solenoids, stepper motors, relay. Sensors for intelligent transport systems. Lighting, wipers, climate control and electronic displays. Sensors for occupant safety. The digital vehicle. Intelligent vehicle systems |
| **Course outcomes** | The students should be able to:<br><br>• Describe the working of lead acid battery. The operation of lighting system, Horn and Wiper system.<br><br>• Describe the condition at starting and behavior of starter during starting and the working and maintenances of starter motor.<br><br>• Describe the working of different starter drive units and the working of onboard diagnostic system, security and warning system.<br><br>• Describe the shunt generator characteristics, working of alternators and bridge rectifiers. Aware of current trends in automotive electronics engine management system. |
| **Text Books** | 1. Young A.P. & Griffiths. L. "Automotive Electrical Equipment", ELBS & New Press- 1999.<br><br>2. William B.Riddens "Understanding Automotive Electronics", 5th edition - Butter worth Heinemann Woburn, 1998.<br><br>3. Crouse, W.H "Automobile Electrical Equipment", McGraw-Hill Book Co., Inc., New York, 3rd edition, 1986. |
| **Reference Books** | 1. Bechhold "Understanding Automotive Electronics", SAE, 1998.<br><br>2. Judge A.W "Modern Electrical Equipment of Automobiles", Chapman & Hall, London, 1992.<br><br>3. Kholi.P.L "Automotive Electrical Equipment", Tata McGraw-Hill Co., Ltd., New Delhi, 1975.<br><br>4. Robert Bosch "Automotive Hand Book", SAE (5th Edition), 2000.<br><br>**5.** Ganesan.V. "Internal Combustion Engines", Tata McGraw-Hill Publishing Co., New Delhi, 2003. |

Board of Studies

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| Course Title | **AUTOMOTIVE SYSTEM COMPONENTS LABORATORY** | | | |
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| Course Code | **MENAE106P** | | | |
| **Course Credits** | **L** | **T** | **P** | **TC** |
| | **-** | **-** | **4** | **2** |
| Prerequisites | **Vehicle Frames, Axles, Gear Box** | | | |
| **Course objectives** | **This course will enable students: -**<br><br>• Experience the skill of dismantling and assembling of engines.<br><br>• Experience the skill of dismantling and assembling of Axles, differential, gear box and transfer case<br><br>• Experience the skill of measuring the heavy-duty vehicle frames and light duty vehicle frames.<br><br>• Understand battery testing and maintenance<br><br>• Understand the testing of starting<br><br>• Understand the study of rectifiers and filters. | | | |
| **Course Contents** | **LIST OF EXPERIMENTS**<br>**Engine System**<br>1. Dismantling and Assembling of 4 cylinder petrol engine.<br>2. Dismantling and Assembling of 6 cylinder diesel engine.<br>3. Study of Engine Auxiliaries.<br>4. Ovality and taper measurement of cylinder bore and engine crank shaft.<br>**Electrical System**<br>1. Testing of batteries and battery maintenance<br>2. Testing of starting motors and generators<br>3. Testing of regulators and cut – outs<br>4. Diagnosis of ignition system faults<br>5. Study of automobile electrical wiring<br>**Chassis System**<br>**Study of:** Heavy duty vehicle frame, Steering System, Braking System, Gear box and Transfer case.<br>**Electronic System**<br>**Study of** : Rectifiers and filters, logic gates, adder and flip-flops, SCR and IC timer<br>Interfacing A/D converter and simple data acquisition, Micro controller programming and interfacing | | | |
| **Course outcomes** | **This course will enable students:-** | | | |

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| | • Completely dismantle and assemble the engines |
| | • Calculate the Engine displacement by measuring the Stroke length, bore. |
| | • Locate the components with the engine for accurate operations |
| | • Dismantle and assemble axles, differential, gear box and transfer case. |
| | • Understand the necessity of transfer case mechanism for all wheel drive and differentiate gear box and transfer box |
| | • Describe the working of starter motor, regulators, cut-outs relay, ignition system. |
| **List of Equipment's** | **ENGINES** <br> 1. Four cylinder petrol engine <br> 2. Six cylinder diesel engine <br> 3. Fuel filter, fuel injection pump, injector, carburetor, MPFI component <br> 4. Ignition coil, magneto, electronic ignition system components <br> 5. Water pump, thermostat, radiator, temperature gauge <br> 6. Lub oil pump, pressure relief valve, filter, oil pressure gauge <br> 7. Internal micrometer, external micrometer, dial gauges <br><br> **CHASSIS** <br> 1. Heavy duty vehicle chassis frame <br> 2. Light duty vehicle chassis frame <br> 3. Steering system <br> 4. Steering gear box (Rack and pinion, recirculating ball type) <br> 5. Hydraulic brake system <br> 6. Air brake system <br> 7. Transfer case <br> 8. Gear box (light duty, heavy duty) <br><br> **ELECTRICAL AND ELECTRONICS** <br> 1. Battery, hydrometer, voltage tester <br> 2. Starter motor, regulator, cutout <br> 3. Distributor, ignition coil, spark plug <br> 4. Auto electrical wiring system <br> 5. Rectifiers, filters <br> 6. Amplifier <br> 7. IC timer |

| | 8. Data logger |
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| Course Title | **COMPUTATIONAL LABORATORY** |
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| **Course Code** | **MENAE107P** |

| **Course Credits** | **L** | **T** | **P** | **TC** | |
|---|---|---|---|---|---|
| | **-** | **-** | **4** | **2** | |

| **Prerequisites** | **Cad/Cam, Lines, Circles, Ellipses, Parabolas, Hyperbolas** |
|---|---|
| **Course objectives** | **This course will enable students: -**<br>• Practice on various design as well as programming software.<br>• Get knowledge about MATLAB.<br>• Hands on practice on MATLAB/Pro-E.<br>• Practices on various curves modeling and other tools. |
| **Course Contents** | **LIST OF EXPERIMENTS**<br><br>**Performed Minimum ten experiments**<br>1. Introduction and Installation of CAD/CAM/CAE Software's.<br>2. Introduction to Solid Modelling & Pro/E Package<br>3. Working with sketch mode of Pro/E<br>4. Introduction to MATLAB Programming<br>5. Working with creating features (Extrude & Revolve)<br>6. Working Datum Planes<br>7. Working with the tools like Hole, Round, Chamfer and Rib<br>8. Working with the tools like Pattern, Copy, Rotate, Move and Mirror<br>9. Working with advanced modeling tools (Sweep, Blend & Swept Blend)<br>10.     Assembly modelling in Pro/E<br>11.     Generating, editing and modifying drawings in Pro/E<br>12.     Exercises on Analytic Curves (Lines, Circles, Ellipses, Parabolas, Hyperbolas, Conics) using MATLAB Programming<br>13.     Exercises on Synthetic Curves (Cubic Splines, Bezier Curves, B-Spline Curves) using MATLAB Programming<br>14.     Working with CAD Data Exchange formats: IGES,ACIS, DXF and STL |
| **Course outcomes** | The students will be able to:<br>• Draw complex geometries of machine components in sketcher mode.<br>• Write programs to generate analytical and synthetic curves used in engineering practice.<br>• Generate freeform shapes in part mode to visualize components.<br>• Create complex engineering assemblies using appropriate assembly constraints.<br>• Develop G and M codes for turning and milling components. |

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| | • Practice on CAD data exchange formats used in design and fabrication of engineering components. |
| **Software required** | 1. MATLAB Programming for Engineers, Stephen J. Chapman, Fifth Edition.<br>2. CAD/CAM/CIM by P.RadhaKrishnan, S.Subramanyan, V.Raju. |

## Elective –I

| Course Title | **AUTOMOTIVE TRANSMISSION** | | | |
|---|---|---|---|---|
| Course Code | **MENAE104A** | | | |
| **Course Credits** | **L** | **T** | **P** | **TC** |
| | **3** | **1** | **-** | **4** |
| Prerequisites | **Theory of Machine, Dynamics of Machine & Automobile Engineering** | | | |
| **Course Objectives** | **This course will enable students: -**<br><br>• Understand various types of Gear Box, its principle and applications.<br><br>• Understand the construction, principle and the concept of Fluid Coupling & Torque Convertor.<br><br>• Know about the concept of epicycles gear system and its types, overdrives.<br><br>• Gain knowledge about the concepts of hydrostatic drive, its merits & demerits and the electric drive commonly used in buses<br><br>• Understand the construction and working of the most commonly used automatic transmission systems and its advantage over the conventional transmissions. | | | |
| **Course Contents** | **UNIT- I**<br><br>**Clutch And Gear Box**<br><br>Clutch: Different types of clutches, working principles and constructions, torque capacity and design of Clutch plate.<br><br>Gear Box: Performance of vehicle, total resistance to motion, traction and tractive effort, acceleration, calculation of gear ratio, design of three speed gear box, design of four speed gear boxes<br><br>**UNIT- II**<br><br>**Automotive Transmission**<br><br>All spur and internal gear type planetary gearboxes, Ford T-model, Octal and Wilson Gear box, determination of gear ratios, automatic overdrives.<br><br>**UNIT- III**<br><br>**Hydrodynamic Drive**<br><br>Fluid coupling: advantages and limitations, construction details, torque capacity, slip in fluid coupling, performance characteristics. Means used to reduce drag torque in fluid coupling. Principal of torque conversion, single, multi stage and polyphase torque converters, performance characteristics, constructional and | | | |

| | operational details of typical hydraulic transmission drives.<br><br>**UNIT- IV**<br><br>**Hydrostatic Drive And Electric Drive**<br><br>Hydrostatic drives: advantages and disadvantages, principles of hydrostatic drive systems, construction and working of typical hydrostatic drives, Janney Hydrostatic drive. Electrical drives: advantages and limitations, principles of Ward Leonard system of control Modern electric drive for buses and performance characteristics.<br><br>**UNIT- V**<br><br>**Automatic Transmission Applications**<br><br>Automatic transmission: relative merits and demerits when compared to conventional transmission, automatic control of gears, study of typical automatic transmissions, Ford and Chevrolet drive, and automatic control of gear box. Electronically Controlled Transmission and CVT Case Studies: GM's tap shift Technology, Porsche Tiptronic Technology |
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| **Course outcomes** | • The students should be able to:<br>• Differentiate various types of gearbox, its working, its advantages & its limitations,<br>• Analyze gear ratios for various types of gear boxes for real time applications; Be familiar with epicyclic gear trains, its types, operations, merits & demerits.<br>• Describe and analyze the operation of Fluid Coupling & Torque convertor. Realize the performance & output of the Fluid Coupling & Torque convertor under various parameters.<br>• Describe the need, working, construction and the principle of overdrives. Describe the concept of hydrostatic drive |
| **Text Books** | 1. Heldt P.M - Torque converters- Chilton Book Co.-1992<br>2. Newton and Steeds - Motor Vehicle- Illiffee Publisher- 2000 |
| **Reference Books** | 1. Design Practices, passenger Car Automotive Transmissions- SAE Hand book- 1994. |

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**Elective-I**

| Course Title | ELECTRONIC ENGINE MANAGEMENT SYSTEM | | | |
|---|---|---|---|---|
| Course Code | MENAE104B | | | |
| Course Credits | L | T | P | TC |
| | 3 | 1 | - | 4 |
| Prerequisites | Sensors, Ignition System, Detonation | | | |
| Course Objectives | **This course will enable students: -** <br><br> • Understand the automotive instruments and sensors. <br><br> • Understand the measurement of engine parameter by using sensor. <br><br> • Understand the working Electronic Ignition System. <br><br> • Understand the Principles of Digital Control systems. <br><br> • Understand the application of on board diagnosis. | | | |
| Course Contents | **UNIT- I** <br><br> **Sensors** <br><br> Types - Air flow, Pressure, Temperature, Speed Oxygen, Detonation, Position - Principle of operation, Arrangement and material. <br><br> **UNIT- II** <br><br> **Gasoline Injection System** <br><br> Open loop and closed loop systems, Mono point, Multi point and Direct injection systems - Principles and Features, Bosch injection systems. <br><br> **UNIT- III** <br><br> **Diesel Injection System** <br><br> Inline injection pump, Rotary pump and injector - Construction and principle of operation, Common rail and unit injector system - Construction and principle of operation. <br><br> **UNIT- IV** <br><br> **Ignition Systems** <br><br> Ignition fundamentals, Types of solid state ignition systems, High energy ignition distributors, Electronic spark timing and control. <br><br> **UNIT- V** <br><br> **Engine Mapping** <br><br> Combined ignition and fuel management systems. Digital control techniques - Dwell angle calculation, Ignition timing calculation and Injection duration | | | |

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| | calculation. Hybrid vehicles and fuel cells. |
| **Course outcomes** | The students should be able to:<br><br>• Describe the sensor classification and sensor product selection guide and measurements of automotive sensors.<br><br>• Describe the working of Pressure, position, flow, temperature, humidity, speed, acceleration, oxygen, torque, light, distance and level.<br><br>• Differentiate the electronic fuel injection system in SI and CI engines and Describe the advantages of using direct fuel injection over the indirect fuel injection system.<br><br>• Describe the advantages of electronic ignition system over the conventional ignition system.<br><br>• Describe the algorithms for digital controllers. |
| **Text Books** | 1. Bosch Technical Instruction Booklets.<br><br>2. Tom Denton, Automotive Electrical and Electronic Systems, Edward Amold,1995. |
| **Reference Books** | 1. Robert N.Brady, Automotive Computers and Digital Instrumentation, Prentice Hall, 1988.Duffy Smith, Auto Fuel Systems,<br><br>2. The god Heart Willcox Company Inc., Publishers, 1987. Heinz Heisler, Advanced Engine Technology. SAE Publications, 1995 |

Dr. AJAY KUMAR GUPTA                                              Mr. RAJ KUMAR BHARTI

## Elective-I

| Course Title | **AUTOMOTIVE SAFETY** | | | |
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| **Course Code** | **MENAE104C** | | | |
| **Course Credits** | **L** | **T** | **P** | **TC** |
| | **3** | **1** | **-** | **4** |
| **Prerequisites** | **Automobile Engineering & Environment Engineering** | | | |
| **Course Objectives** | • Understand various types of Gear Box, its principle and applications.<br><br>• Understand the construction, principle and the concept of Fluid Coupling & Torque Convertor.<br><br>• Know about the concept of epicycles gear system and its types, overdrives.<br><br>• Gain knowledge about the concepts of hydrostatic drive, its merits & demerits and the electric drive commonly used in buses.<br><br>• Understand the construction and working of the most commonly used automatic transmission systems and its advantage over the conventional transmissions. | | | |
| **Course Contents** | **UNIT- I**<br><br>**Introduction**<br><br>Design of the body for safety, Energy equation, Engine location, Deceleration of vehicle inside passenger compartment, Deceleration on impact with stationary and movable obstacle, Concept of crumble zone, Safety sandwich construction.<br><br>**UNIT- II**<br><br>**Safety Concepts**<br><br>Active safety: Driving safety, Conditional safety, Perceptibility safety, and Operating safety- Passive safety: Exterior safety, Interior safety, Deformation behavior of vehicle body, and Speed and acceleration characteristics of passenger compartment on impact.<br><br>**UNIT- III**<br><br>**Safety Equipments**<br><br>Seat belt, Regulations, Automatic seat belt lightener system, Collapsible steering column, tillable steering wheel, Air bags, Electronic system for activating air bags, Bumper design for safety, Antiskid braking system, Regenerative Braking System, Cruise Control, Adaptive Cruise Control Devices.<br><br>**UNIT- IV** | | | |

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**Collision Warning and Avoidance**

Collision warning system, Causes of rear end collision, Frontal object detection, ear vehicle object detection system, Object detection system with braking system interactions, Driver Fitness Detection.

**UNIT- V**

**Comfort and Convenience System**

Steering and mirror adjustment, Central locking system, Garage door opening system, Tyre pressure control system, Rain sensor system, and Environment information system, Manual and Automated Wiper System, GPS.

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**Course outcomes**

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The students should be able to:

- Know about the design of the bumper for safety.
- Know about the concept of crumble zone, and also the effect of acceleration and deceleration of the vehicle in the compartment of the vehicle.
- Know the various types of safety aspects such as active and passive safety.
- Know the active safety components, passive safety components such as air bags, seat belts.

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**Text Books**

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

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**Reference Books**

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1. J.Powloski - "Vehicle Body Engineering" - Business books limited, London - 1969.
2. Ronald.K.Jurgen - "Automotive Electronics Handbook" - Second edition- McGraw-Hill Inc., - 1999.

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