# Shri Rawatpura Sarkar University, Raipur

# Examination Scheme & Syllabus

# for

# M.Tech.(Automobile Engineering)

# Semester-III

(Effective from the session: 2022-23)

SHRI RAWATPURA SARKAR UNIVERSITY, RAIPUR, CHHATTISGARH
FACULTY OF ENGINEERING

# Faculty of Engineering,
# Shri Rawatpura Sarkar University, Raipur

## M.Tech.(Automobile Engineering)
## Semester-III
## Examination Scheme
## (Effective from the session: 2022-23)

| S. N | Course Code | Th /Pr | Subject | Type of Course | Teaching hours per week | | | TC | Examination Scheme | | | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | L | T | P | | Theory | | Practical | | |
| | | | | | | | | | EX | IN | EX | IN | |
| 1 | MENAE301T | Th | COMBUSTION ENGINEERING | Core | 3 | 1 | - | 4 | 70 | 30 | - | - | 100 |
| 2 | MENAE302A | Th | Elective-III | Core | 3 | 1 | - | 4 | 70 | 30 | - | - | 100 |
| 3 | MENAE303P | - | Technical Paper Writing and Seminar | - | - | - | 4 | 2 | - | - | 70 | 35 | 100 |
| 4 | MENAE304P | - | Predissertation (Literature Review/ Problem Formulation/ Synopsis | - | - | - | 28 | 14 | - | - | 140 | 60 | 200 |
| | **Total Contact hr per week: 28** | | | **Total Credit: 24** | | | | | **Grand Total Marks:** | | | | **500** |

L: Lecture T: Tutorial P: Practical

**Elective-III**

| S.NO. | Subject Name | Subject Code |
|---|---|---|
| 1 | Automotive Materials | MENAE302A |
| 2 | Fluid Drives and Control | MENAE302B |
| 3 | Vehicle Design | MENAE302C |

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| **Course Title** | **COMBUSTION ENGINEERING** | | | | |
| **Course Code** | **MENAE301T** | | | | |
| **Course Credits** | **L** | **T** | **P** | **TC** | |
| | **3** | **1** | **-** | **4** | |
| **Prerequisites** | **Internal Combustion Engine** | | | | |
| **Course Objectives** | **This course will enable students to:**<br>• Identify the mixing of fuel<br>• Identify the type fins.<br>• Design the combustion chamber | | | | |
| **Course Contents** | **UNIT-I**<br>Scope and history of combustion, Fuels, Thermodynamics of combustion, Chemical kinetics of combustion, rate of reactions, chain reactions, opposing reactions, consecutive reactions, competitive reactions, Conservation equation for multi component reacting systems,<br>**UNIT-II**<br>Combustion Processes: Combustion in premixed and diffusion flames. Combustion process in I.C. Engines and Gas Turbines. Combustion of gaseous & vaporized fuels, gas –fired furnace combustion.<br>**UNIT-III**<br>Premixed charge engine combustion, Detonation of gaseous mixture Premixed laminar flames, Gaseous diffusion flames & combustion of a single liquid fuel droplet, Turbulent flames, combustion in two – phase flame systems, Chemically reacting boundary layer flows, Ignition.<br>**UNIT-IV**<br>Heat of Reaction and Adiabatic Flame Temperature: Importance of heat of reaction. Constant pressure, constant volume combustion heat of reaction. Heat of reaction measurement.<br>**UNIT-V**<br>Combustion of liquid fuels, spray formation & droplet behavior, Oil – fired furnace combustion, gas turbine spray combustion, direct injection engine combustion, detonation of liquid – gaseous mixture, combustion of solid fuels, | | | | |
| **Course Outcomes** | **After the completion of course:**<br>• demonstrate knowledge of the operating characteristics of common IC engines<br>• the generation of undesirable exhaust emissions and methods used to reduce them | | | | |

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| | • demonstrate an understanding of the various heat transfer mechanisms in the engine |
| **Text Books** | 1. S. P. Sharma &Chander Mohan -Fuels & Combustion, Tata McGraw Hill.<br>2. Samir Sarkar- Fuels & Combustion, Orient Longman, 3rd Edition. |
| **Reference Books** | 1. Gary L. Borman, Kenneth W. Ragland - Combustion Engineering, McGraw Hill<br>2. Kenneth K. Kuo-Principles of Combustion, John Wiley & Sons |

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| **Course Title** | **AUTOMOTIVE MATERIALS** | | | | |
| **Course Code** | **MENAE302A** | | | | |
| **Course Credits** | **L** | **T** | **P** | **TC** | |
| | **3** | **1** | **-** | **4** | |
| **Prerequisites** | **Material Engineering** | | | | |
| **Course Objectives** | **This course will enable students to:**<br>• present a problem oriented in depth knowledge of automotive materials and manufacturing.<br>• address the underlying concepts and methods behind automobile materials and manufacturing including the surface treatment of the material. | | | | |
| **Course Contents** | **UNIT-I**<br>**Advance Metallic Material**<br>Micro-alloy steel (DP, TRIP, IF), classification, application and development Composite Material: classification, properties, fabrication process, stress-strain relationship, failure analysis, application and modern development<br>**UNIT-II**<br>**Ceramic Material**<br>Crystal Structures, Silicate Ceramics, Carbon, Imperfections in Ceramics, Diffusion in Ionic Materials, Ceramic Phase Diagrams, Brittle Fracture of Ceramics, Stress–Strain Behavior Mechanisms of Plastic, Deformation,Ceramics, Clay Products, Refractories, Abrasives, Cements, Advanced Ceramics fabrication and Processing of Glass sand Glass–Ceramics, Fabrication and Processing<br>**UNIT-III**<br>**Polymer Material**<br>Classification, properties, processing and synthesis, mechanical behaviour and application.<br>**UNIT-IV**<br>**Energy material**<br>Fossil fuel, solar cell, semiconductor materials, Lithium battery, nuclear material etc.<br>**UNIT-V**<br>**Nano-material**<br>Introduction to phase transformations and microstructural control on the nanometer scale, Production techniques for inorganic nanoparticles and nanomaterials. Microstructural stability in nanomaterials. Chemical and mechanical properties of inorganic nanomaterials and microstructure-property | | | | |

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| | relationships. Case studies in controlled synthesis |
| **Course Outcomes** | **After the completion of course:**<br>• The students can identify different areas of automobile materials and manufacturing.<br>• The students can find the applications of all the areas in day to day life |
| **Text Books** | 1. William F. Smith- Fundamentals of Materials science & Engineering, McGraw Hill (1999).<br>2. Eds. R W Kelsall, I W Hamley and M Geoghegan- Nanoscale Science and Technology, published Wiley, 2005 |
| **Reference Books** | 1. William F. Smith-Principles of Materials science & Engineering, McGraw Hill (1999)<br>2. L.H. van Vlack- Elements of Materials science & Engineering, Addison-Wesley<br>3. W. A. Goddard, D. W. Brenner, S. E. Lyshevski, G. J. Iafrate- Handbook of Nanoscience, Engineering and Technology, CRC Press, New York 2003.<br>4. H. S. Nalwa- Nanostructured Materials and Nanotechnology (concise edition), Academic Press, New York 2002. |

<table>
<tr><td>Course Title</td><td colspan="5">FLUID DRIVES AND CONTROL</td></tr>
<tr><td>Course Code</td><td colspan="5">MENAE302B</td></tr>
<tr><td rowspan="2">Course Credits</td><td>L</td><td>T</td><td>P</td><td>TC</td><td></td></tr>
<tr><td>3</td><td>1</td><td>-</td><td>4</td><td></td></tr>
<tr><td>Prerequisites</td><td colspan="5">Fluid Mechanics, fluid machinery & fluid & dynamics etc</td></tr>
<tr><td>Course Objectives</td><td colspan="5">This course will enable students to:<br>• analyze the fluid flow in automobile.<br>• learn about the application of mass and momentum conservation laws for fluid flows<br>• obtain the velocity and pressure variations in various types of simple flows</td></tr>
<tr><td>Course Contents</td><td colspan="5">UNIT-I<br>Energy and power in Hydraulic Systems<br>Application of Pascal’s law, Conservation of energy, the continuity equation, hydraulic horse power, Bernonll’s equation, energy, power and flow rate in the SI Metric System.<br>UNIT-II<br>The source of hydraulic power<br>Pumps, Pumping theory, pump classification – Gear, vane, piston, pump performance, pump noise, pump selection.Linear Actuator ( Hydraulic Cylinder) : Overall operating features, cylinder mountings and mechanical linkages, cylinder force, velocity and power, cylinder cushions, mechanics of hydraulic cylinder loadings, telescopic cylinder, design aspects.<br>Rotary Actuator (Hydraulic Motor) : Classification: Gear, Vane, Piston; hydraulic motor theoretical torque, power and flow rate, hydraulic motor performance.<br>Valves and other control components in hydraulic systems : Direction control valves, pressure control valves, flow control valves, cartridge valves, pressure and temperature switches, hydraulic accumulators, pressure intensifiers, servo valves.<br>UNIT-III<br>Hydraulic Conductors and Fittings<br>Conductor sizing, pressure ratings of conductors, steel pipes, steel tubing, plastic tubing, flexible hoses,quick disconnect couplings, metric size tubing.<br>Hydraulic Circuit Design and Analysis : Control of a single acting hydraulic cylinder, control of a double acting hydraulic cylinder, regenerative circuit, pump unloading circuit, pressure intensifier circuit, sequencing circuit, cylinder</td></tr>
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| | synchronization circuit, fail-safe circuit, speed control of hydraulic cylinder and hydraulic motor, hydrostatic transmission systems, analysis of hydraulic system with fictional losses, accumulator circuits.<br>**UNIT-IV**<br>**Components of Pneumatic Systems**<br>Properties of air, the perfect gas laws, compressors, fluid conditioners, air control valves, pneumatic actuators. Pneumatics: Circuit and Applications: Pneumatic circuit design considerations, air pressure losses in pipelines, simple multicylinder circuits, emergency stop circuits, emergency stop circuits, fail-safe circuits, two-handed control, cascade circuits, cascade circuit design procedure, group selection and stepper circuits.<br>**UNIT-V**<br>**Electrical Controls for Fluid Power Circuits**<br>Electrical components, limit switches, solenoids, control of a cylinder using a single limit switch, reciprocation of a cylinder using pressure or limit<br>switches, dual cylinder sequencing circuits, electrical control of a regenerative circuit, electro hydraulic servo system, application of Programmable Logic Controller (PLCs) in fluid power circuits.<br>Introduction to Fluidics : Principles of fluids logic control, basic fluidic devices, fluid sensors, fluidic control of fluid power systems. |
| **Course Outcomes** | **After the completion of course:**<br>• Upon completion of this course, students will be able to mathematically analyze simple flow situations<br>• They will be able to evaluate the performance of pumps and turbines |
| **Text Books** | 1. S.R. Majumdar- Pneumatic System: Principles and Maintenance, Tata Mc Graw Hill<br>2. Authony Esposito- Fluid power with applications, Prentice Hall International, Inc |
| **Reference Books** | 1. A.B.Goodwin- Power Hydraulics, B.I. Publications 6. Chris Stacey- Practical Pneumatics, Arnold Publication<br>2. D.D. Banks, D.S.Banks- Industrial Hydraulics, Prentice Hall |

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| **Course Title** | **VEHICLE DESIGN** | | | | |
| **Course Code** | **MENAE302C** | | | | |
| **Course Credits** | **L** | **T** | **P** | **TC** | |
| | **3** | **1** | **-** | **4** | |
| **Prerequisites** | **Machine Design** | | | | |
| **Course Objectives** | **This course will enable students to:**<br>• automotive vehicle dynamics and safety | | | | |
| **Course Contents** | **UNIT-I**<br>**Selection of materials**<br>Materials for various pattern of duty and factor of safety as per specification of SAE.<br>**UNIT-II**<br>**Gear box**<br>Gear train, input, output and lay shaft. Gear body, bearings with heat dissipation, gear casing.<br>**UNIT-III**<br>**Steering**<br>Collapse able and other type, steering wheel, steering column, rack & pinion, sector gear, tie rod.<br>**UNIT-IV**<br>**Clutch**<br>Clutch plate, cushion spring, torsion spring, clutch paddle, liver. Suspension: Spring design, shock absorber and other components.<br>**UNIT-V**<br>**Differential**<br>Sun gear, planet gear, ring gear arm. | | | | |
| **Course Outcomes** | **After the completion of course:**<br>• Be familiar with the terminology of road vehicle dynamics, stability and handling.<br>• Understand the techniques used to engineer safety in to vehicles.<br>• Understand the evaluation of vehicle safety using crash data | | | | |

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| **Text Books** | 1. Patil S.P.- Mechanical System Design<br>2. MadhabanK,and Reddy K.V. - Design data handbook, CBS Publication |
| **Reference Books** | 1. De.A.- Automobile Engineering, Galgotia Publication<br>2. J. G. Giles -Steering, Suspension &Tyres, Illefe Books Ltd., London<br>3. P. M. Heldt- Automotive Chassis, Chilton Co. NK |

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# Semester-III
# 2022-23

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| **Course Title** | **Technical Paper Writing and Seminar** | | | | |
| **Course Code** | **MENAE303P** | | | | |
| **Course Credits** | **L** | **T** | **P** | **TC** | |
| | **-** | **-** | **8** | **4** | |
| **Prerequisites** | **Projects seminar, Project writing paper writing etc** | | | | |
| **Course Objectives** | **This course will enable students to:**<br>• Describe the research process.<br>• Select a research topic of importance to the profession.<br>• Effectively work with their academic advisor and graduate committee.<br>• Develop and follow an appropriate timeline for completion of the thesis/dissertation.<br>• Identify an appropriate theory base for their research.<br>• Develop a conceptual model relevant to their research. | | | | |
| **Course Contents** | 1. Each student will select a topic in the area of geo-tech engineering and related area in the state of art area & technical development.<br>2. The topic will be decided by the Student, Guide and Departmental research committee.<br>3. Each student will make seminar presentation with audio/video aids, for the duration of 45 minutes and seminar work shall be in form of report to be submitted by the students at the end of the semester.<br>4. This report copies must be duly signed by guide and Head of Department. Attendance of all students for all seminars is compulsory.<br>5. Define the statement of research problem<br>6. Literature survey, familiarity with research journals<br>7. Technical writing skills<br>8. Presentation skills | | | | |
| **Course Outcomes** | **After the completion of course:**<br>• Acceptable with minor or no revisions (no further approval required)<br>• Acceptable with major revisions in content or format not acceptable | | | | |
| **Reference Books** | 1. Student will learn to survey the relevant literature such as books, national/international referred journals and contact resource persons for the selected topic of research. | | | | |

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| **Course Title** | **Predissertation (Literature Review/ Problem Formulation/ Synopsis)** | | | | |
| **Course Code** | **MENAE304P** | | | | |
| **Course Credits** | **L** | **T** | **P** | **TC** | |
| | **-** | **-** | **12** | **6** | |
| **Prerequisites** | **Minor Project & major project** | | | | |
| **Course Objectives** | **This course will enable students to:**<br>• Demonstrate the skills for good presentation and technical report writing skills.<br>• Apply engineering and management principles while executing the project. | | | | |
| **Course Contents** | 1. Each student will select a topic in the area of geo-tech engineering and related area in the state of art area & technical development.<br>2. Every student will carry out dissertation under the supervision of a Supervisor.<br>3. The topic shall be approved by a committee constituted by the Head of the concerned department.<br>4. Every student will be required to present two seminar talks, First at the beginning of the Dissertation (Phase-I)to present the scope of the work and to finalize the topic, and second towards the end of the semester, presenting the work carried out by him/her in the semester.<br>5. The committee constituted will screen both the presentations and work.<br>6. Define the statement of research problem<br>7. Literature survey, familiarity with research journals<br>8. Broad knowledge off the available techniques to solve the problems<br>9. Technical writing skills<br>10. Presentation skills | | | | |
| **Course Outcomes** | **After the completion of course:**<br>1. Student will learn to survey the relevant literature such as books, national/international referred journals and contact resource persons for the selected topic of research.<br>2. Students will be able to use different experimental techniques.<br>3. Students will be able to use different software/computational/analytical tools.<br>4. Students will be able to design and develop an experimental set up/equipment/test rig.<br>5. Students will be able to conduct tests on existing set ups/equipments and draw logical conclusions from the results after analyzing them. | | | | |

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| | 6. Students will be able to either work in a research environment or in an industrial environment. |
| **Reference Books** | 1. Student will learn to survey the relevant literature such as books, national/international referred journals and contact resource persons for the selected topic of research. |