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# B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

## January / February 2025 Semester End Main Examinations

Programme: B.E.         Semester: VII

Branch: Mechanical Engineering         Duration: 3 hrs.

Course Code: 22ME7PEAUE         Max Marks: 100

Course: Automotive Engineering

**Instructions**: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

<div style="writing-mode: vertical">**Important Note:** Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.</div>

| | | | | CO | PO | Marks |
|---|---|---|---|---|---|---|
| | | | **UNIT - I** | | | |
| 1 | a) | | Describe with a neat sketch the working of Turbocharger. Mention the effect of Turbocharger on the performance of IC Engines. | CO1 | PO1 | **10** |
| | b) | | Explain the working principle of dry sump lubrication system with a simple sketch. Also mention the advantages. | CO1 | PO1 | **10** |
| | | | **OR** | | | |
| 2 | a) | | Explain with a neat sketch the working principle of Exhaust Gas Recirculation (EGR) System | CO1 | PO1 | **10** |
| | b) | | With a block diagram discuss the operational features of Engine management system | CO1 | PO1 | **10** |
| | | | **UNIT - II** | | | |
| 3 | a) | | Explain with a graph Road speed vs power available at wheels and Road speed vs tractive effort. | CO2 | PO1 | **10** |
| | b) | | For a vehicle with mass = 1500 kg, $Af \cdot c_d = 0.7m^2$, $c_r = 0.012$, a vehicle speed v = 120 km/h and an acceleration a = 0.027 g, calculate the traction torque required at the wheels and the corresponding rotational speed level (tires 195/65/15T). Calculate the road slope that is equivalent to that acceleration. Assume $\rho_a = 1.20 kg/m^3$, $g = 9.81 m/s^2$. | CO2 | PO2 | **10** |
| | | | **OR** | | | |
| 4 | a) | | How the following parameter affect the performance of the vehicles explain with performance curves and equations in brief   a. Acceleration      b. Gradability | CO2 | PO1 | **10** |
| | b) | | Compute Forces due to drag, rolling resistance and gradient for the following vehicles assuming ρ = 1.2 (kg/m3) and θ = 8°. For | CO2 | PO2 | **10** |

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|---|---|---|---|---|---|
| | | the vehicle given in the table, find Aerodynamic drag at velocity v1 and v2; also find rolling resistance at two velocities.<br><br>| Vehicle | GVW (kg) | CD | Area (m2) | µ | V1 (km/h) | V2 (km/h) | Tyre Radius (m) |<br>|---|---|---|---|---|---|---|---|<br>| **4-wheeler** | 1500 | 0.3 | 2.5 | 0.015 | 30 | 80 | 0.3 | | | | |

### UNIT - III

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|---|---|---|---|---|---|
| 5 | a) | What are the stages of combustion in CI engines Explain briefly with graph, what is the effect of improper combustion. | *CO3* | *PO1* | **10** |
| | b) | What is double de-clutching. Explain the working of sliding mesh type gear box. | | | **10** |

### OR

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|---|---|---|---|---|---|
| 6 | a) | Explain the construction and working of fluid flywheel . enumerate the advantages of fluid flywheel over the other types of clutches | *CO3* | *PO1* | **10** |
| | b) | Describe various requirements of automotive clutch. Discuss in detail the construction and working of a centrifugal clutch | *CO3* | *PO1* | **10** |

### UNIT - IV

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|---|---|---|---|---|---|
| 7 | a) | Sketch and explain the purpose and working of<br>    i) Final drive unit<br>    ii) Differential gear system<br>By arrow marks indicate the direction of rotation of each gear when the vehicle is turning to the right | *CO4* | *PO1* | **10** |
| | b) | Mention the basic requirements of wheels. With a neat sketch explain the construction of disc type wheel. | *CO4* | *PO1* | **10** |

### OR

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|---|---|---|---|---|---|
| 8 | a) | Define Camber, caster, kingpin inclination, scrub radius, and their significance in steering geometry with sketches. | | | **10** |
| | b) | With a relevant diagram derive an expression for the distribution of forces on front wheels and rear wheels of four wheelers when brakes applied to front and rear wheels separately. | | | **10** |

### UNIT - V

| | | | | | |
|---|---|---|---|---|---|
| 9 | a) | With a diagram explain the application of starting system in an automobile. | | | **10** |
| | b) | Sketch and discuss EV powertrain architectures –Fuel cell electric vehicle (FCEV) | | | **10** |

### OR

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|---|---|---|---|---|---|
| 10 | a) | With the help of block diagram explain general EV configuration | | | **10** |
| | b) | With the help of block diagram explain the working of Series and parallel hybrid vehicles | | | **10** |

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