AUTOMOBILE ENGINEERING
(MECH 4144)

Time Allotted : 2½ hrs **Full Marks : 60**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 4 (four) from Group B to E, taking one from each group.

Candidates are required to give answer in their own words as far as practicable.

Group – A

1. Answer any twelve: **12 × 1 = 12**

Choose the correct alternative for the following

(i) In air cooled engines, fins are attached on the outer surface of the cylinder and cylinder heads to
(a) Increase the heat transfer coefficients
(b) Increase the contact area for better radiation of heat
(c) Provide aesthetic look
(d) Provide more strength to the engine structure

(ii) Which one of the following material is used for brake lining?
(a) Cast iron (b) Aluminium
(c) Asbestos (d) Copper alloy.

(iii) The ball joints are used on the tie rod ends to
(a) Reduce amount of noise generated
(b) Reduce amount of sliding resistance
(c) Compensate for the movement of the suspension vertically and in other direction
(d) Improve the force transmission speed

(iv) The clutch is installed between the transmission and the
(a) Engine (b) Rear axle
(c) Propeller shaft (d) Differential

(v) The term ply rating in a tyre refers to
(a) Actual number of plies (b) Recommended inflation pressure
(c) Aspect ratio (d) Index of strength

(vi) Which the following tyre of spring is most commonly used for suspension is heavy vehicles?
(a) Coil spring (b) Semi elliptic leaf spring
(c) Quarter elliptic leaf spring (d) Plastic spring.

(vii) The type of rear axle on trucks is
(a) Semi floating (b) Fully floating
(c) Three quarter floating (d) Floating

(viii) When the vehicle is moving at a uniform speed, then the tractive effort becomes
(a) More than the vehicle resistance (b) Less than the vehicle resistance
(c) Equal to the vehicle resistance (d) None of these

(ix) The following vehicle can be driven both by battery and fuel for long distance
(a) Hybrid electric vehicle (b) Battery electric vehicle
(c) Plug in hybrid electric vehicle (d) both (b) and (c)

(x) Which of the following resistance applied on a moving vehicle, depends on velocity
(a) Air resistance (b) Rolling resistance
(c) Mechanical resistance (d) Gradient resistance.

Fill in the blanks with the correct word

(xi) The _____ allows smooth coupling and uncoupling of the engine and drive train.

(xii) The central part of a typical universal joint is called _____ .

(xiii) _____ is a speed and torque changing device between the engine and driving wheels.

(xiv) Hydrogen fuel cells work by combining hydrogen and _____ to generate electricity.

(xv) _____ brakes clamp a flat disk between two parts.

Group - B

2. (a) Draw a schematic layout of the MPFI system in a SI engine and describe its operation. Why is it preferable to a carburettor? *[(CO1)(Apply/IOCQ)]*

(b) Describe the basic principle of operation of a starting mechanism. *[(CO2)(Remember/LOCQ)]*

8 + 4 = 12

3. (a) Explain the working principle of "Disk brake" with suitable figure. *[(CO2) (Understand/LOCQ)]*

(b) A motor truck running at 80 km/h stops in a distance of 20 m. Find out the value of coefficient of friction between the wheel and road surface. How this stopping distance would be affected if the friction coefficient is reduced to 0.2 by rain? *[(CO2) (Evaluate/HOCQ)]*

6 + 6 = 12

Group - C

4. (a) Derive the equation for perfect steering for front wheel steered 4 wheel vehicle. *[(CO3)(Analyse/HOCQ)]*

(b) Through suitable sketch indicate the following angles in the front wheels and explain its Necessity (i) Camber angle (ii) Steering Angle Inclination (iii) Caster Angle. *[(CO3)(Remember/LOCQ)]*

6 + 6 = 12

5. (a) Describe the working of a synchromesh transmission with the help of a neat sketch. *[(CO3)(Analyse/IOCQ)]*

(b) Discuss the basic necessity of providing a gear box on the vehicle? *[(CO3)(Remember/LOCQ)]*

8 + 4 = 12

Group - D

6. (a) Give brief description of torsion bar and stabilizer bar. *[(CO4)(Analyse/HOCQ)]*

(b) Describe, with a neat sketch, the construction and functioning of a Mac Pherson strut suspension. *[(CO4)(Remember/LOCQ)]*

6 + 6 = 12

7. (a) Describe with a neat sketch the construction and working of a differential. *[(CO4)(Analyse/IOCQ)]*

(b) Describe different tread patterns in tyres. *[(CO4)(Remember/LOCQ)]*

8 + 4 = 12

Group - E

8. (a) A car has a weight of 10 KN, including 4 passengers and luggage. The engine is running in top gear at 5000 rpm. The frontal area of the vehicle is 2.2 m2, wheel radius is 0.5 m, air density is 1.2 Kg/m3, drag coefficient (Cd) is 0.9 and co efficient of rolling (μ) is 0.012. The overall gear ratio is 4.3 and transmission efficiency is 80%. Find the break power of the vehicle. *[(CO5)(Evaluate/HOCQ)]*

(b) Explain aerodynamic resistance of a moving vehicle. How does it change with vehicle speed explain with an example? *[(CO5)(Understand/LOCQ)]*

8 + 4 = 12

9. (a) Explain the architecture of electric vehicle drive train. *[(CO6)(Understand/LOCQ)]*

(b) Differentiate between HEV and Plug in HEVs. *[(CO6)(Analyse/HOCQ)]*

6 + 6 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	41.67	25	33.33