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
<u>any 4 (four)</u> from Group B to E, taking <u>one</u> from each group.*

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

Group – A
(Multiple Choice Type Questions)

1. Answer any twelve: **12 × 1 = 12**

Choose the correct alternative for the following

(i) What is the angle between the vertical when the top of the wheel slants outward?
(a) Negative camber   (b) Negative castor
(c) Positive camber   (d) Positive castor.

(ii) Where is the differential located?
(a) Between transmission and rear axle
(b) Between engine and transmission
(c) Between two propeller shaft
(d) Between steering wheel and steering column.

(iii) At idling, the engine requires
(a) Lean fuel-air mixture   (b) Rich fuel-air mixture
(c) Stoichiometric mixture   (d) No fuel in the air.

(iv) Which of the following is not part of automatic transmission?
(a) Epicyclic gearbox   (b) Torque convertor
(c) Multi-plate clutch   (d) Sliding mesh gearbox.

(v) The transmission system transmits _____ from engine to wheels?
(a) Speed   (b) Power   (c) Current   (d) Current

(vi) The front axle of a car has pivot centers 1.3 m apart. The angle of inside lock is 40°C and the angle of the outside lock is 35°C What is the wheelbase of the car?
(a) 5.5 m   (b) 3.5 m   (c) 4.5 m   (d) 6.5 m

(vii) Which types of joints are used, when the shafts are inclined?
(a) Universal joint   (b) Hinge joint
(c) Ball and socket joint   (d) Pivot joint.

(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 (a), (b) & (c).

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

(x) Air resistance does not depend on which of the following
(a) Slope of the land   (b) Frontal area
(c) Velocity of vehicle   (d) Air density.

Fill in the blanks with the correct word

(xi) The friction disc of a clutch is sandwiched between the pressure plate and the _____.

(xii) The _____ axles are those axles which contains differential and through which rotary motion is transmitted to the wheels.

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

(xiv) The extreme positions of the piston in the cylinder of an IC engine are called _____.

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

Group - B

2. (a) Explain the working principle of "Disk brake" with suitable figure.
[(CO2)(Understand/LOCQ)]
   (b) A car travelling at 80 km/hr stops in a distance of 30 m. when the brakes are applied to it under standard road conditions (μ=0.92). Calculate the deceleration produced and the efficiency of the braking system.   *[(CO2)(Analyse/IOCQ)]*
   6 + 6 = 12

3. (a) What is valve timing diagram? Draw the typical valve timing diagram of a four stroke petrol engine. Give the reasons for early opening of the exhaust valve and late closing of the inlet valve.   *[(CO1)(Remember/LOCQ)]*
   (b) Draw schematic diagram of MPFI system in a SI engine and explain why it is preferred over carburetor.   *[(CO1)(Remember/LOCQ)]*
   6 + 6 = 12

Group - C

4. (a) Show with a neat sketch, how the steering is arranged so that the wheels will roll freely when the car is moving in a curve path.   *[(CO3)(Apply/IOCQ)]*
   (b) What is toe-in and toe-out? How much toe-in is initially provided and why?
   [(CO3)(Apply/IOCQ)]
   6 + 6 = 12

5. (a) Draw a neat diagram of a constant mesh gear box and explain its working principle. *[(CO3)(Create/HOCQ)]*
   (b) Sketch and explain the torque converter. *[(CO3) (Remember/LOCQ)]*

8 + 4 = 12

Group - D

6. (a) Sketch and label the different types of stub axle. *[(CO4) (Remember/LOCQ)]*
   (b) What is meant by semi-floating, three-quarter floating, and fully- floating axles. Illustrate your answer with suitable sketch. *[(CO4) (Apply/IOCQ)]*

6 + 6 = 12

7. (a) Define the following term in the context of automobile tyres:
   (i) Aspect ratio (ii) Ply rating (iii) Tyre tread. *[(CO4)(Remember/LOCQ)]*
   (b) Give a brief description of torsion bar and stabilizer bar. *[(CO4)(Remember/LOCQ)]*

7 + 5 = 12

Group - E

8. (a) Explain aerodynamic resistance of a moving vehicle. How does it change with vehicle speed explain with an example? *[(CO5)(Analyse/IOCQ)]*
   (b) A car has a weight of 10000 N including passengers. It is moving with the velocity of 110 Km/hr. The wheel tyre diameter is 0.5 m. The frontal area of car is 2.2 m^2. Co-efficient of rolling friction and air resistance are 0.012 and 0.007 respectively. Find out the wheel torque. *[(CO5)(Create/HOCQ)]*

6 + 6 = 12

9. (a) Explain drive train of an electric vehicle with suitable diagram.
   [(CO6)(Understand/LOCQ)]
   (b) Write a short note on hydrogen fuel. *[(CO6)(Understand/LOCQ)]*

6 + 6 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	54.27	31.25	14.57

Course Outcome (CO):

After the completion of the course students will be able to
1. Articulate the different types of automobiles, explain the engine components, functioning of IC engines and classify the fuel supply system for S.I and C.I engines.
2. Differentiate the types of lubrication system; identify different lubrication and cooling systems used in vehicles. Classify ignition system and braking system
3. Review the salient features of different steering mechanisms, describe the methods of wheel alignment and wheel balancing, describe the features and importance of different transmission systems used in an automobile
4. Explain the salient features of different differential gear boxes, axles and suspension systems used in an automobile
5. Calculate the power requirement of a vehicle
6. Trace the evolution of ICE automobiles into hybrid and electric vehicles and explain their salient features.

*LOCQ: Lower Order Cognitive Question; IOCQ: Intermediate Order Cognitive Question; HOCQ: Higher Order Cognitive Question.