Ref. No. : Ex/PG/AuE/PE/T/121A/2025

M.E. AUTOMOBILE ENGINEERING FIRST YEAR SECOND SEMESTER EXAM 2025

VEHICLE DESIGN

Time : 3 Hrs | Full Marks : 100

Answer any 5 from the following

1. (a) **Multiple choice questions** 10×1=10

(i) Which of the following is a major advantage of monocoque vehicle construction?

A) Easy engine removal

B) Better crash energy absorption

C) Increased ground clearance

D) Easier to repair

(ii) Which engine component transfers motion from the piston to the crankshaft?

A) Camshaft

B) Connecting rod

C) Timing chain

D) Push rod

(iii) What is the primary function of a clutch in a vehicle?

A) Increase engine speed

B) Transfer torque to the battery

C) Engage and disengage power from the engine to the transmission

D) Control steering wheel movement

(iv) Which of the following is NOT a component of the transmission system?

A) Gearbox

B) Propeller shaft

C) Differential

D) Carburetor

(v) The MacPherson strut is commonly used in which part of the vehicle?

A) Rear axle

B) Front suspension

C) Steering column

D) Transmission system

(vi) Which of the following braking systems provides better heat dissipation?

A) Drum brake

B) Disc brake

C) Air brake

D) Mechanical brake

(vii) Which type of axle is typically used in rear-wheel-drive vehicles?

A) Dead axle

B) Floating axle

C) Live axle

D) Tandem axle

(viii) Ackermann steering geometry is designed to:

A) Improve acceleration

B) Minimize fuel consumption

C) Prevent wheel slip while turning

D) Improve aerodynamics

(ix) Which of the following vehicle types requires a stiffer suspension for stability?

A) City sedan

B) Luxury car

C) Sports car

D) Compact hatchback

(x) For off-road vehicles, which transmission type is most suitable?

A) CVT

B) Manual transmission with 4WD

C) Single-speed automatic

D) Semi-automatic without clutch

(b) **Short type questions. Answer any 5 from following** 5×2=10

(i) How is power developed in automobiles?

(ii) Name the various materials used in manufacturing of tyres.

(iii) Classify air suspension system.

(iv) What is the function of gear box?

(v) What are the stresses to which the frame members are subjected to?

(vi) What is the function of pressure plate in a clutch?

(vii) Distinguish between disc brake with drum brake.

(viii) What is the advantage of self-expanding shoe brake?

2. (i) What are the different types of wheels? Discuss their relative merits.
(ii) Explain the rack and pinion steering system of an automobile.
(iii) Explain the operation of a telescopic type shock absorber with a sketch.
(iv) Explain the working of Disc brake system. 4×5=10

3. (a) Prove that the energy dissipated during clutching operation is independent of the torque and directly proportional to the square of relative velocity of the driving and driven shafts. 10

(b) Calculate the frictional force acting on the brake in a block brake with a long shoe. 10

4. (a) Calculate the torque transmission capacity of a centrifugal clutch and explain two specific applications where it is commonly used. 8+2

(b) Find the actuating force by the cam on the leading and trailing shoe in case of internal expanding brake. 10

5. (a) Explain the major types of vehicle chassis with their structural advantages. Which type of frame is preferred in modern passenger cars and why? 8+4

(b) Describe the primary components of an internal combustion engine with a neat sketch. 8

6. (a) Explain the working of a manual transmission system with a labeled diagram. What are the key differences between manual and automatic transmissions? 8+4

(b) Describe the function of a differential. Why is it necessary in the transmission system? 8

7. (a) Discuss the design considerations for front and rear axles in a passenger car. What are the types of axles and their applications? 5+5=10

(b) Explain the Ackermann steering geometry with the help of a sketch. What are the factors affecting steering stability and response? 5+5=10