Name: **Enrolment No:**	

UPES

End Semester Examination, May 2025

Course: Automotive Subsystem Design **Semester : VI**

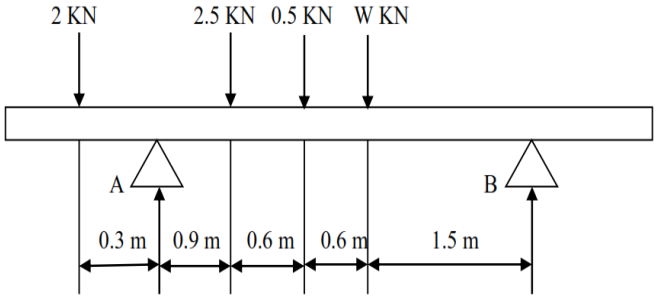
Program: B.Tech ADE **Time : 03 hrs.**

Course Code: MEAD3033 **Max. Marks: 100**

Instructions: Assume data wherever necessary.

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	Differentiate between torsional stiffness and bending stiffness with respect to vehicle structures.	**4**	**CO1**
Q 2	A closed coiled helical spring is to carry a load of 500 N. Its mean coil diameter is to be 10 times that of the wire diameter. Calculate these diameters if the maximum shear stress in the material of the spring is to be 80 MPa.	**4**	**CO2**
Q 3	Differentiate between sprung mass and unsprung mass.	**4**	**CO1**
Q 4	What is the purpose of a universal joint in a propeller shaft?	**4**	**CO2**
Q 5	What are the differences between leaf springs and coil springs?	**4**	**CO2**
SECTION B **(4Qx10M= 40 Marks)**			
Q 6	Explain static longitudinal, Asymmetric loading, combined bending torsion loading case and side loading case for the vehicle.	**10**	**CO3**
Q 7	Derive the expression for deflection and maximum shear stress developed in the material of a closed-coiled helical spring subjected to a weight W.	**10**	**CO2**
Q 8	Discuss how steering geometry (Ackermann principle, toe angle, caster, and camber) influences vehicle handling and cornering stability. **OR** A torsion-bar suspension is to be designed to support a maximum static load of 3433.5 N at the end of the lever arm 250 mm long. The deflection of the lever above the horizontal is to be 30^0 with a total angle of deflection of 90^0. Assuming a safe allowable stress of 784800 kPa, calculate (a) the diameter of the torsion bar (b) the effective length and (c) the load rate.	**10**	**CO3**

Q 9	Illustrate the following with appropriate figures: (a) Effects and Comparisons of Payload on spring frequency for various types of spring media. (b) Effect of static load on spring height. (c) Effect of static payload on spring air pressure for various spring static heights.	**10**	**CO3**
SECTION-C (2Qx20M=40 Marks)			
Q 10	A bus chassis, 5.4 m long, consists of two side members and a number of cross members. Each side member can be considered as a beam, simply supported at two points A&B, 3.6m apart, A being positioned 0.9 m from the front end of the frame and subjected to the following concentrated loads. Engine support (front) 2 kN, engine support(rear) 2.5 kN gear box support 0.5 kN, and body W kN. The distance of these loads from the front end of the frame are respectively 0 m, 1.8 m, 2.4 m and 3 m. If the frame are respectively 0.6m,1.8 m, 2.4 m and 3m. If the reaction at A is 8.5kN, determine: a) The magnitude of the load 'W'due to vehicle body, b) The magnitude of the support reaction at B.  	**20**	**CO4**
Q 11	Derive the expression for torque capacity and total axial force of a cone clutch using Uniform Pressure Theory. Explain the thermal considerations of heat transmission during clutch operation. **OR** Design a propeller shaft for a commercial vehicle transmitting 150 Nm torque at 3000 RPM. Include universal joint design and material considerations.	**20**	**CO4**