Name:

Enrolment No:

UPES

End Semester Examination, May 2023

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

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

Course Code: MEAD 3011 **Max. Marks: 100**

Instructions: Assume data wherever necessary.

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	Distinguish between laminated and coiled springs with appropriate figures.	**4**	**CO1**
Q 2	Explain the Ackermann steering mechanism stating the conditions of understeer and oversteering.	**4**	**CO1**
Q 3	Illustrate with figure the complete cycle of automotive body design normally employed in automotive industries.	**4**	**CO2**
Q 4	Differentiate between dependent and independent suspension system with appropriate examples.	**4**	**CO2**
Q 5	Classify and explain in brief, the various resistances that a vehicle faces during acceleration and deceleration.	**4**	**CO2**
	SECTION B **(4Qx10M= 40 Marks)**		
Q 6	Derive the expressions for reactions forces acting at front and rear wheel of a typical passenger car subjected to longitudinal and axisymmetric loading with appropriate figures.	**10**	**CO2**
Q 7	The coefficient of rolling resistance of the truck weighing 62293.5 N is 0.018 and the coefficient of air resistance is 0.0276 in the formula $R = KW + K_a AV^2$, N, Where A is in m^2 and V the speed in kmph. The transmission efficiency in top gear of 6.2:1 is 90% and that in the second gear of 15:1 is 80%. The frontal area is 5.574 m^2. If the truck has to have a maximum speed of 88 km/h in top gear, Calculate: (a) The engine BP required. (b) The engine speed if the driving wheels have an effective diameter of 0.8125m. (c) The maximum grade the truck can negotiate at the above engine speed in second gear.	**10**	**CO4**
Q 8	Explain the difference between bending stiffness and torsional stiffness of the chassis. Draw a diagram showing the typical static pressure coefficient distribution starting from front to the rear end of the vehicle.	**10**	**CO1**

Q 9	Derive the expression for energy dissipated during clutching operation using energy criteria. **OR** A closely coiled helical spring is to carry a max 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.	**10** **10**	**CO3** **CO3**
SECTION-C **(2Qx20M=40 Marks)**			
Q 10	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.	**20**	**CO3**
Q 11	Derive the torque transmitting capacity of a frictional clutch using uniform pressure theory and uniform wear theory. A plate clutch consists of one pair of contacting surfaces and transmits 20 kW power at 750 rpm. The ratio of outer diameter to inner diameter is 2. The coefficient of friction is 0.2 and the permissible intensity of pressure is 1 N/mm^2. Assuming uniform wear theory, calculate the inner and outer diameters. **OR** 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, 3.6 m 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 0.6 m, 1.8 m, 2.4 m and 3 m. If the reaction at A is 8.5 kN, Calculate: (a) The magnitude of the load W due to the vehicle body, (b) The magnitude of the support reaction at B.	**20** **20**	**CO4** **CO4**