

Name:

Enrolment No:



UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2022

Course: Automotive Sub-System Design

Program: B.Tech – ADE

Course Code: MEAD3011

No. of Pages: 04

Note: USE of design data handbook is allowed during the examination.

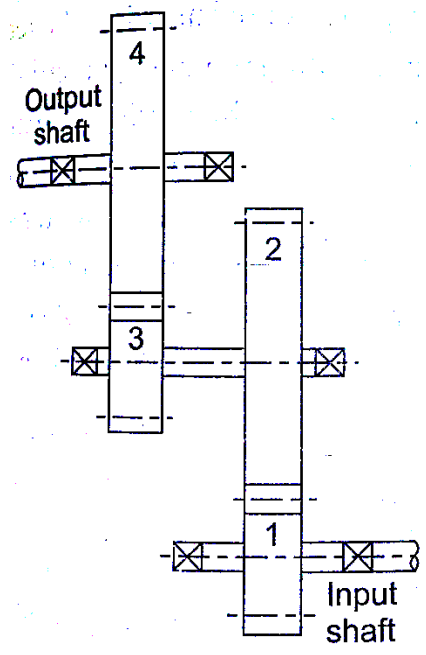
Assume any suitable data if missing.

Semester: VI

Time: 3 hours

Max. Marks: 100

SECTION A
(5Qx4M=20Marks)

Q No	Attempt all questions.	Marks	CO
Q 1	Explain working of Wishbone Link Suspension.	4	CO1
Q 2	Differentiate between static & Dynamic Balancing.	4	CO1
Q 3	Draw the diagram to explain vehicle anatomy and enlist the chassis components.	4	CO1
Q 4	Explain gear ratio. For a gear train shown in figure determine the speed ratio of output shaft to input shaft. 	4	CO2
Q 5	Explain the role of Telescopic suspension used in two wheeler with diagram.	4	CO3

SECTION B
(4Qx10M= 40 Marks)

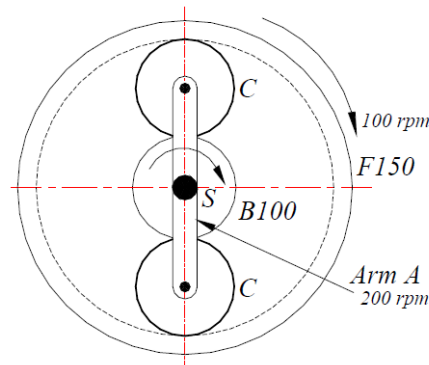
There is internal choice in Q.No. 9.

Q 6	Explain the working of working of Power steering system with of suitable diagram.	10	CO2															
Q 7	<p>The following data is given for a caliper disk brake (see diagram), with circular pad, for the lightweight two-wheeler,</p> <p>torque capacity = 1500 N-m outer radius of pad = 1160 mm inner radius of pad = 120 mm coefficient of friction = 0.30 average pressure on pad = 2 MPa number of pads = 2</p> <p>Calculate the angular dimension of the pad.</p> <div style="text-align: center; margin-top: 20px;"> </div>	10	CO4															
Q 8	<p>Wheel balancing is very important for four wheeler car. Justify the statement with reasons.</p> <p>Consider the following data for static balancing find the counter mass required for balancing.</p> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th style="text-align: left;">Mass (kg)</th> <th style="text-align: left;">Radius (r)</th> <th style="text-align: left;">Angular Position</th> </tr> </thead> <tbody> <tr> <td>m1= 10 gm</td> <td>150 mm</td> <td>0</td> </tr> <tr> <td>m2= 12 gm</td> <td>160 mm</td> <td>45⁰</td> </tr> <tr> <td>m3= 16 gm</td> <td>180 mm</td> <td>135⁰</td> </tr> <tr> <td>m4= 15 gm</td> <td>140 mm</td> <td>270⁰</td> </tr> </tbody> </table> <p>Assume suitable radius of counter mass.</p>	Mass (kg)	Radius (r)	Angular Position	m1= 10 gm	150 mm	0	m2= 12 gm	160 mm	45 ⁰	m3= 16 gm	180 mm	135 ⁰	m4= 15 gm	140 mm	270 ⁰	10	CO2
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Q 9	<p>(i) Draw the constructional details of radial tyres. Also enlist the advantages as compared to biased tyres.</p> <p>(ii) Explain the Disc and wire type wheel.</p>	10	CO3															

SECTION-C (2Qx20M=40 Marks)

There is internal choice in Q No 11.

- Q 10 (i) Construct the ray Diagram and kinematic diagram to design the 8 speed gear box for maximum speed of 2000 rpm and minimum speed of 480 rpm. Consider input power 20 kW at 1600 rpm. (12)
- (ii) In an epicyclic gear train shown in figure, the arm A is fixed to the shaft S. The wheel B having 100 teeth rotates freely on the shaft S. The wheel F having 150 teeth driven separately. If the arm rotates at 200 rpm and wheel F at 100 rpm in the same direction; find (a) number of teeth on the gear C and (b) speed of wheel B. (8)



20

CO3
CO4

- Q 11 A motor vehicle single plate clutch is to have both sides of plate effective. It is to transmit power of 20 kW power at speed 3000 rpm with 10% overloading. The pressure intensity on friction surface is not to exceed by 0.09 N/mm^2 . The surface speed at the mean radius is limited to 40 m/s. The coefficient of friction is 0.25. The outside radius is 1.3 times the inside radius. The axial thrust is to be provided by 4 springs of about 30 mm mean coil diameter. Maximum permissible stress in shear is not to exceed by 400 N/mm^2 . Take modulus of rigidity $0.83 \times 10^5 \text{ N/mm}^2$. Design the spring completely.

20

CO4

OR

In an automotive plate clutch, six helical compression springs arranged in parallel, provide the axial thrust of 1500 N. The springs are compressed by 10 mm to provide this thrust force. The springs are identical and the spring index is 6. The springs are made of cold-drawn steel wires with ultimate tensile strength of 1200 N/mm^2 . The permissible shear stress for the spring wire can be taken as 50% of the ultimate tensile strength ($G = 81370 \text{ N/mm}^2$). Design the springs and determine:

- (i) Wire diameter
- (ii) Mean coil diameter
- (iii) Number of active coils
- (iv) Total number of coils
- (v) Solid length
- (vi) Free length
- (vii) Required spring rate
- (viii) Actual spring rate