

7. (a) In a belt transmission dynamometer the distance between the centre of driving pulley and the dead weights is one metre. Find the value of dead weights required to keep the lever in horizontal position if power transmitted is 7.5KW and the diameter of each of the driving as well as the intermediate pulleys is equal to 400mm. The driving pulley runs at 400 rpm. 10
- (b) Describe the construction and operation of a torsion dynamometer. 10

**SECTION - D**

8. The wheel of a motor cycle have a total moment of inertia of  $2.5 \text{ kg-m}^2$  and the engine parts have a moment of inertia of  $0.14 \text{ kg-m}^2$ . The gear ratio is 5 to 1 and the axis of rotation of the engine crank shaft is parallel to that of rear wheel, which have a diameter of 65 cm. Determine the magnitude and direction of the gyroscopic couple when motor cycle rounds a curve of 25 m radius at a speed of 50 km/hr. Total mass of the system is 180 kg and  $h = 0.6\text{m}$ . 20
9. A four-wheeled trolley car of total mass 2000 kg running on rails of 1.6 m gauge, rounds a curve of 30 m radius at 54 km/h. The track is banked at  $8^\circ$ . The wheels have an external diameter of 0.7 m and each pair with axle has a mass of 200 kg. The radius of gyration for each pair is 0.3 m. The height of centre of gravity of the car above the wheel base is 1 m. Determine allowing for centrifugal force and gyroscopic couple actions, the pressure on each rail. 20

Roll No. \_\_\_\_\_

**24257**

**B, Tech, 5th Semester (ME)  
Examination – February, 2022**

**DYNAMICS OF MACHINES**

Paper : ME-301-P

Time : Three Hours ]

[ Maximum Marks : 100

*Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No candidate in this regard, will be entertained after examination.*

Note : Attempt five questions in all, selecting one question from each Section. Question No. 1 is compulsory. All questions carry equal marks.

1. Explain the followings : 5 × 4 = 20
- (a) Gyroscopic couple, applied torque and reaction torque
  - (b) Working of Hartung governor
  - (c) Equivalent offset inertia force
  - (d) Rope brake dynamometer

## SECTION - A

2. (a) Determine the required input torque on the crank of a slider-crank mechanism for the crank equilibrium when the applied piston load is 1000 Kg. The lengths of the crank and the connecting rod are 40 mm and 100 mm respectively and the crank has turned through  $45^\circ$  from the inner-dead centre. 10
- (b) Define and explain the superposition theorem as applicable to a system of forces acting on a mechanism. 10
3. A vertical double acting steam engine has a cylinder 300 mm diameter and 450 mm stroke and runs at 200 rpm. The reciprocating parts has a mass of 225 kg and the piston rod is 50 mm diameter. The connecting rod is 1.2 m long. When the crank has turned through  $125^\circ$  from the top dead centre, the steam pressure above the piston is  $30 \text{ kN/m}^2$  and below the piston is  $1.5 \text{ kN/m}^2$ . Calculate the effective turning moment on the crank shaft. 20

## SECTION - B

4. A shaft carries four masses A, B, C and D of magnitude 200kg, 300kg, 400kg and 200kg respectively and revolving at radii 80 mm, 70 mm, 60 mm and 80 mm in planes measured from A at 300 mm, 400 mm, and 700 mm. The angles between the cranks measured anticlockwise are A to B  $45^\circ$ , B to C  $70^\circ$  and C to D  $120^\circ$ . The balancing masses are to be placed in planes X

and Y. The distance between the planes A and X is 100 mm, between X and Y is 400 mm and between Y and D is 200 mm. If the balancing masses revolve at a radius of 100 mm, find their magnitudes and angular positions. 20

5. The cranks and connecting rods of a 4-cylinder in-line engine running at 1500 rpm are 60 mm and 240 mm each respectively and the cylinders are spaced 150 mm apart. If the cylinders are numbered 1 to 4 in sequence from one end, the cranks appear at intervals of  $90^\circ$  in an end view in the order 1-4-2-3. The reciprocating mass corresponding to each cylinder is 15kg. Determine : 1. Unbalanced primary and secondary forces, if any, and 2. Unbalanced primary and secondary couples with reference to central plane of the engine. 20

## SECTION - C

6. The lengths of the upper and lower arms of a porter governor are 20 cm and 25 cm respectively. Both the arms are pivoted on the axis of rotation. The central load is 150 N, the weight of each ball is 20 N and the friction of the sleeve together with the resistance of the operating gear is equivalent to a force of 30 N at the sleeve. If the limiting inclinations of the upper arms to the vertical are  $30^\circ$  and  $40^\circ$ , determine the range of the speed of the governor. 20