

Dec.-22-0247

ME-606 (Dynamics of Machinery)

B.Tech. 6th (CBCS)

Time : 3 Hours

Max. Marks : 60

*The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.*

**Note :** Attempt five Questions in all. One question from each unit.  
Question no. 9 is compulsory.

### UNIT - I

1. (a) Discuss the equilibrium of two and three force members. (4)
- (b) In a four link mechanism the dimensions of the links are given below. Fixed link AD=60 mm, driving link AB = 50 mm, coupler BC = 100mm, driven link DC 80 mm, and DE= 40 mm. The driving link is making an angle  $120^\circ$  with AD. The driven link is acted upon by a force of 1.5 kN on link DC at E. Determine the input torque T on the link AB. (6)
2. (a) Define balancing and state its benefits. (4)
- (b) A shaft carries four masses A, B, C and D of 12, 20, 30 and 16 kg respectively spaced 18 cm apart. Measuring angle anti clockwise from A, B is  $240^\circ$ , C is  $135^\circ$  and D is  $270^\circ$ . The radii are 15 cm, 12 cm, 6 cm and 18 cm and the speed of the shaft is 120 rpm. Find the magnitude and direction relative to A of the resultant moment at a plane midway between A and B. (6)

### UNIT - II

3. (a) Explain the balancing of the radial engine. (4)

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- (b) The length of the connecting rod is 500 mm and its centre of gravity lies at 165 mm from the crank pin centre. The rod has a mass of 80 kg and a radius of gyration of 182 mm about an axis through the centre of mass. The stroke of the piston is 225 mm and the crank speed is 300 rpm. Determine the inertia force on the crankshaft when the crank has turned (i)  $30^\circ$  and (ii)  $135^\circ$  from inner dead centre. (6)
4. (a) What do you understand by indicator diagram? (4)
- (b) The ratio of the connecting rod length to crank length for a vertical petrol engine is 4:1. The bore / stroke is 80/100 mm and mass of the reciprocating parts is 1 kg. The gas pressure on the piston is  $0.7\text{N/mm}^2$  when it has moved 10 mm from T.D.C. on its power stroke. Determine the net load on the gudgeon pin. The engine runs at 1800 r.p.m. At what engine speed will this load be zero? (6)

### UNIT - III

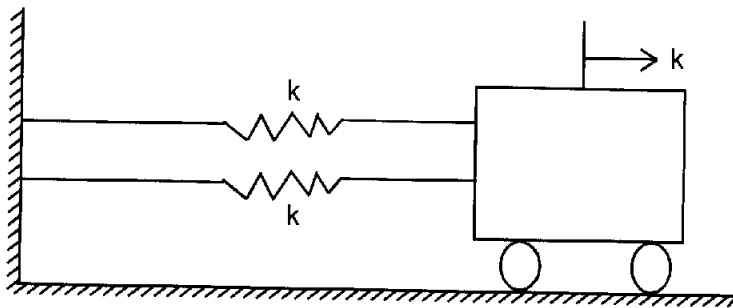
5. (a) What is dynamometer? Explain Prony brake, rope brake and band brake dynamometers. (4)
- (b) A horizontal cross compound steam engine develops 300 kW at 90 r.p.m. The coefficient of fluctuation of energy as found from the turning moment diagram is to be 0.1 and the fluctuation of speed is to be kept within  $\pm 0.5\%$  of the mean speed. Find the weight of the flywheel required, if the radius of gyration is 2 metres. (6)
6. (a) What is governor? Write types of Governor. (4)
- (b) All the arms of a Porter governor are 178 mm long and are hinged at a distance of 38 mm from the axis of rotation. The mass of each ball is 1.15 kg and mass of the sleeve

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is 20 kg. The governor sleeve begins to rise at 280 r.p.m. when the links are at an angle of  $30^\circ$  to the vertical. Assuming the friction force to be constant, determine the minimum and maximum speed of rotation when the inclination of the arms to the vertical is  $45^\circ$ . (6)

#### UNIT - IV

7. (a) Define Gyroscopic effect and its application. (4)
- (b) Determine the angle of inclination with respect to the vertical for a two-wheeler having the following details while negotiating a curve of radius 50 m. Combined mass of vehicle with rider = 260 kg, C.G with rider in vertical position = 0.6 m, Moment of inertia of each road wheel =  $1 \text{ kg.m}^2$ , Moment of inertia of flywheel =  $0.3 \text{ kg.m}^2$ , Speed of the vehicle = 90 km/hr, Diameter of wheel = 0.6 m, Speed of engine is 5 times that of road wheels and in the same direction. (6)
8. (a) What is Spring-mass damper system? Explain with neat sketch. (4)
- (b) A mass of 1 kg is attached to two identical springs each with stiffness  $k = 20 \text{ kN/m}$  as shown in the figure. Under frictionless condition, the natural frequency of the system in Hz close to. (6)



#### (Compulsory)

9. (a) Define and explain the terms: Inertia force and inertia torque.
- (b) What is free body diagram?
- (c) Define and explain the term 'Balancing of Rotating Masses'.
- (d) Define the terms Primary and secondary disturbing forces in reciprocating masses engine.
- (e) Explain sensitivity and stability of governor.
- (f) What is principle of dynamometer?
- (g) Define the term spin and precession.
- (h) What is meaning of vibration?
- (i) Write the purpose of flywheel.
- (j) Find the height of watt governor, if mean rpm of running the governor is 400. (10×2=20)