Code No: 155BA

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year I Semester Examinations, January/February - 2023
DYNAMICS OF MACHINERY
(Common to ME, MCT)

Time: 3 Hours **Max. Marks: 75**

Note: i) Question paper consists of Part A, Part B.
ii) Part A is compulsory, which carries 25 marks. In Part A, Answer all questions.
iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART – A

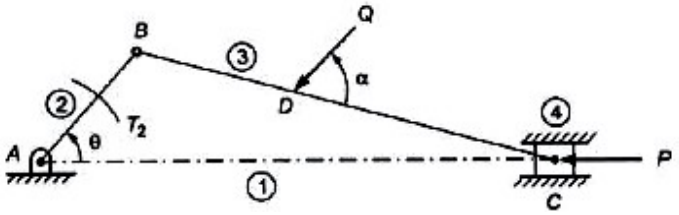
(25 Marks)

1.a) What is D'Alembert's principle and describe its significance. [2]
b) What is gyroscope and how it works? [3]
c) What is a turning moment diagram? What are its advantages? [2]
d) How is the connecting rod's inertia taken into consideration in a reciprocating engine? [3]
e) A differential band brake under certain conditions can provide self-locking. Where this facility finds applications? [2]
f) What do you mean by film friction? State its laws. [3]
g) What is the hunting of a governor? [2]
h) Why the reciprocating masses cannot be balanced completely? [3]
i) What do you understand by whirling of a shaft? [2]
j) What are free, damped and forced vibrations? Explain. [3]

PART – B

(50 Marks)

2. A four-bar mechanism shown in Figure is acted upon by a force P = 100 $\angle 120^0$ N on link CD. The dimensions of the various links are:
AB = 40 mm, BC = 60 mm, CD = 50 mm, AD = 30 mm, DE = 20 mm
Determine the input torque on link AB for the static equilibrium of the mechanism. [10]



OR

3. A two wheeler of 350 mm wheel radius is negotiating a turn of radius 80 m at a speed of 100 km/h. The combines mass of vehicle with its rider is 250 kg. The C.G. of rider is 0.6 m above the ground level. The mass moment of inertia of engine flywheel is 0.3 kg-m^2 and moment of inertia of each road wheel is 1.0 kg - m^2. If the speed of the engine is 5 times the speed of the wheel and in the same direction, find angle of heel of vehicle. [10]

4. Describe the graphical and analytical method of finding the inertia torque on the crankshaft of a horizontal reciprocating engine. [10]

OR

5. A vertical petrol engine 100 mm diameter and 120 mm stroke has a connecting rod 250 mm long. The mass of the piston is 1.1 kg. The speed is 2000 r.p.m. On the expansion stroke with a crank 20^0 from top dead centre, the gas pressure is 700 kN/m^2. Determine: a) Net force on the piston, b) Resultant load on the gudgeon pin, c) Thrust on the cylinder walls, and d) Speed above which, other things remaining same, the gudgeon pin load would be reversed in direction. [10]

6. An engine developing 50 kW at 1200 rpm is fitted with a cone clutch. The cone angle is 12^0 and a maximum mean diameter of 500 mm. The coefficient of friction is 0.25. The normal pressure on the clutch face is not to exceed 0.1 MPa. Determine (a) the axial spring force to engage the clutch, and (b) the face width required. [5+5]

OR

7. What are uniform pressure and uniform wear theories? Deduce expressions for the friction torque considering both the theories for a flat collar. [10]

8 In a Hartnell type governor, the two masses are 5 kg each and the load on the sleeve is 45 kg. With the mass arms vertical, the path radius is 80 mm and the equilibrium speed, neglecting friction, is 450 rpm. Determine (a) the corresponding compressive force in the spring, and (b) the friction force at the sleeve, which can be overcome in this position for an increase in speed of 1%. [10]

OR

9. Explain analytical and graphical methods of balancing several masses rotating in same plane. [10]

10. A 60 kg compressor rotor is mounted on a shaft of stiffness 15 MN/m. Determine the critical speed of the rotor assuming the bearings to be rigid. If the rotor has an eccentricity of 2 mm and its operating speed is 6500 rpm, determine the unbalance response. The damping factor in the system can be taken as 0.06. If the compressor is started from rest, what will be the maximum whirl amplitude of the rotor before it reaches its full operational speed? [10]

OR

11. A shaft of 40 mm diameter and 2.5 m length has a mass of 15 kg per meter length. It is simply supported at the ends and carries three masses of 90 kg, 140 kg and 60 kg at 0.8 m, 1.5 m, and 2 m respectively from the left support. Take E = 200 GN/m^2, find the frequency of the transverse vibrations. [10]

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