R18

Code No: 155BA

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech III Year I Semester Examinations, March - 2024

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)	Define inertia force.	[2]
b)	With a neat sketch show plane of spinning, plane of precession, plane of gyroscope couple and define them.	[3]
c)	Define piston effort and crank effort.	[2]
d)	When and why is the correction couple applied while considering the inertia of the connecting rod of a reciprocating engine	[3]
e)	What do you mean by film friction?	[2]
f)	Differentiate absorption and transmission dynamometers.	[3]
g)	What are primary and secondary unbalance forces?	[2]
h)	What are centrifugal governors? How do they differ from inertia governors?	[3]
i)	Define logarithmic decrement.	[2]
j)	Briefly explain Dunkerly's method.	[3]

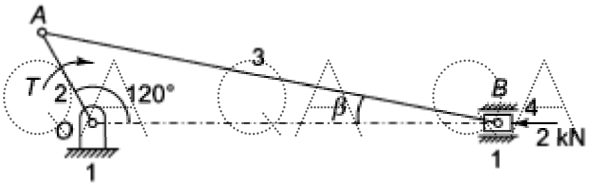
PART – B

(50 Marks)

2. Explain the gyroscopic effect on four-wheeled vehicles. [10]

OR

3. A slider crank mechanism with the following dimensions is acted upon by a force $F = 2$ kN at B as shown in Figure. Determine the input torque T on the link OA for the static equilibrium of the mechanism for the given configuration. OA = 100 mm AB = 450 mm. [10]



4. The torque exerted on the crank shaft of a two stroke engine is given by the equation:

$$T \text{ (N-m)} = 14500 + 2300 \sin 2\theta - 1900 \cos 2\theta$$

Where θ is the crank angle displacement from the inner dead center. Assuming the resisting torque to be constant, determine: a) The power of the engine when the speed is 150 r.p.m.; b) The moment of inertia of the flywheel if the speed variation is not to exceed ± 0.5% of the mean speed; and c) The angular acceleration of the flywheel when the crank has turned through 30° from the inner dead center. [10]

OR

5. A single cylinder four-stroke petrol engine develops 18.4 kW power at a mean speed of 300 rpm. The work done during suction and exhaust strokes can be neglected. The work done by the gases during explosion strokes is three times the work done on the gases during the compression strokes and they can be represented by the triangles. Determine the mass of the flywheel to prevent a fluctuation of speed greater than 2 per cent from the mean speed. The flywheel diameter may be taken as 1.5 m. [10]

6. A leather faced conical clutch has a cone angle of 30º. If the intensity of pressure between the contact surfaces is limited to 0.35 N/mm^2 and the breadth of the conical surface is not to exceed one-third of the mean radius, find the dimensions of the contact surfaces to transmit 22.5 kW at 2000 r.p.m. Assume uniform rate of wear and take coefficient of friction as 0.15. [10]

OR

7. Describe with the help of a neat sketch the principles of operation of an internal expanding shoe brake. Derive the expression for the braking torque. [10]

8. Explain the following:
a) Hammer blow
b) Swaying couple
c) Variation of tractive effort. [3+3+4]

OR

9. A Porter governor has equal arms each 250 mm long and pivoted on the axis of rotation. Each ball has a mass of 5 kg and the mass of the central load on the sleeve is 25 kg. The radius of rotation of the ball is 150 mm when the governor begins to lift and 200 mm when the governor is at maximum speed. Find the range of speed, sleeve lift, governor effort and power of the governor in the following cases:
a) When the friction at the sleeve is neglected, and
b) When the friction at the sleeve is equivalent to 10 N. [5+5]

10. The mass of a single degree damped vibrating system is 7.5 kg and makes 24 free oscillations in 14 seconds when disturbed from its equilibrium position. The amplitude of vibration reduces to 0.25 of its initial value after five oscillations. Determine:
a) stiffness of the spring, b) logarithmic decrement, and c) damping factor, i.e. the ratio of the system damping to critical damping. [10]

OR

11. Explain the free torsional vibrations of a three rotor system. [10]

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