R16

Code No: 134AU

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech II Year II Semester Examinations, February - 2024

DYNAMICS OF MACHINERY

(Mechanical Engineering)

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)	State the applications of the gyroscope.	[2]
b)	State the conditions for the equilibrium of a rigid body when it is acted by two forces and a torque.	[3]
c)	Specify the uses of turning moment diagram of reciprocating engines.	[2]
d)	Explain the working of flywheel.	[3]
e)	Explain the terms: friction circle and friction axis.	[2]
f)	What is the use of Dynamometers? Name different types of dynamometers.	[3]
g)	Define effort and power of a governor.	[2]
h)	What is the function of a governor? How does it differ from that of a flywheel?	[3]
i)	Sketch the longitudinal, transverse and torsional free vibrations.	[2]
j)	What do you understand by whirling of a shaft?	[3]

PART – B

(50 Marks)

2.a) An aeroplane makes a complete half circle of 50 metres radius, towards left, when flying at 200 km/hr. The rotary engine and the propeller of the plane has a mass of 500 kg and a radius of gyration of 0.3 m. The engine rotates at 2500 rpm clockwise when viewed from the rear. Find the gyroscopic couple on the aircraft and state its effect on it.

b) Explain the effect of the gyroscopic couple on the reaction of the four wheels of a vehicle negotiating a curve. Also find the total reactions on the four wheels considering the weight and the centrifugal effects. [4+6]

OR

3. A slider-crank mechanism shown in figure 1 is subjected to piston load of 1 kN, AB = 250 mm, BC = 600 mm. Determine the input torque to link AB for the static equilibrium of the mechanism. Use analytical method. [10]

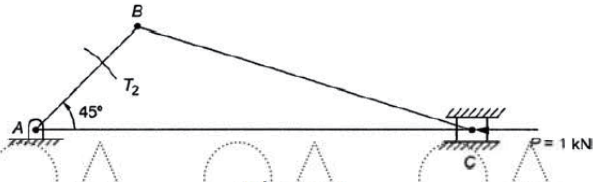

Figure 1

4. A single cylinder vertical engine has a bore of 300 mm, a stroke of 350 mm and a connecting rod of length 700 mm. The weight of the reciprocating parts is 125 kg. When the piston is at quarter-stroke from TDC and is moving downwards, the net pressure on it is 0.5 MPa. If the speed of the engine is 250 rpm, calculate the turning moment on the crankshaft. [10]

OR

5. A three cylinder single acting engine has its cranks set equally at 120° and it runs at 600 rpm. The torque-crank angle diagram for each cycle is a triangle for the power stroke with a maximum torque of 100 N-m at 60° from dead centre of corresponding crank. The torque on the return stroke is zero. The mass of the flywheel is 10 kg and has a radius of gyration of 100 mm. Determine the power developed, coefficient of fluctuation of speed, coefficient of fluctuation of energy and maximum angular acceleration of the flywheel. [10]

6.a) Describe with a neat sketch the working of a multi-plate friction clutch.

b) Draw the schematic diagram of a flat pivot bearing. Derive the expression for total frictional torque on the bearing for uniform pressure and for uniform wear. [4+6]

OR

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

b) Explain with a neat sketch the functioning of a belt transmission dynamometer. [6+4]

8. A Hartnell governor having a central sleeve spring and two right-angled bell crank levers moves between 290 rpm and 310 rpm for a sleeve lift of 15mm. The sleeve arms and the ball arms are 80 mm and 120 mm respectively. The levers are pivoted at 120 mm from the governor axis and mass of each ball is 2.5 kg. The ball arms are parallel to the governor axis at the lowest equilibrium speed. Determine loads on the spring at the lowest and the highest equilibrium speeds and stiffness of the spring. [10]

OR

9.a) Explain why only a part of the unbalanced force due to reciprocating masses is balanced by revolving mass.

b) Four masses A, B, C and D revolve at equal radii and are equally spaced along a shaft. The mass B is 7 kg and the radii of C and D make angles of 90° and 240° respectively with the radius of B. Find the magnitude of the masses A, C and D and the angular position of A so that the system may be completely balanced. [3+7]

10.a) A cantilever shaft 50 mm diameter and 300 mm long has a disc of mass 100 kg at its free end. The Young's modulus for the shaft material is 200 GPa. Determine the frequency of longitudinal and transverse vibrations of the shaft.

b) Explain the Dunkerley's method to find the fundamental frequency of a shaft carrying several loads. [5+5]

OR

11. Determine the natural frequency and position of the node for the free torsional vibrations of the stepped shaft shown in figure 2. Take shear modulus, G = 80 GPa.[10]

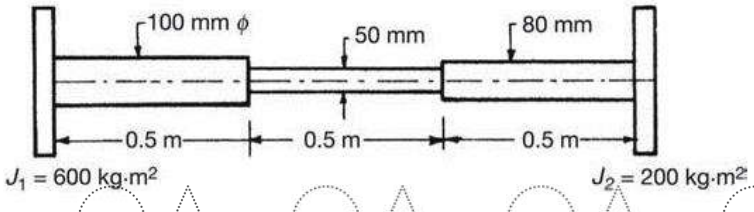

Figure 2

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