Code No: R1931031 **R19** **SET - 1**

III B. Tech I Semester Supplementary Examinations, June/July-2022

DYNAMICS OF MACHINERY

(**Common to** Mechanical Engineering, Automobile Engineering)

Time: 3 hours Max. Marks: 75

Answer any **FIVE** Questions **ONE** Question from **Each unit**

All Questions Carry Equal Marks

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UNIT-I

1. a) Derive an expression for the effort required to raise a load with a screw jack taking friction into consideration. [7M]

   b) The contact surfaces in a cone clutch have an effective diameter of 75 mm. The semi-angle of the cone is 150. The coefficient of friction is 0.3. Find the torque required to produce slipping of the clutch if an axial force applied is 180 N. This clutch is employed to connect an electric motor running uniformly at 1000 r.p.m. with a flywheel which is initially stationary. The flywheel has a mass of 13.5 kg and its radius of gyration is 150 mm. Calculate the time required for the flywheel to attain full speed and also the energy lost in the slipping of the clutch. [8M]

(OR)

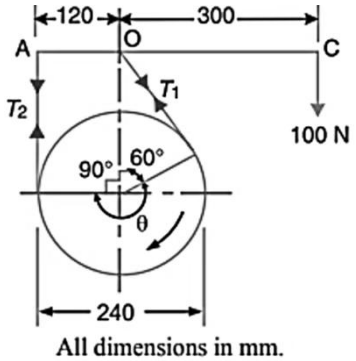
2. a) Describe the construction and operation of a prony brake dynamometer. [7M]

   b) The simple band brake, as shown in Fig.1 is applied to a shaft carrying a flywheel of mass 400 kg. The radius of gyration of the flywheel is 450 mm and runs at 300 r.p.m. If the coefficient of friction is 0.2 and the brake drum diameter is 240 mm, find: [8M]

   (i) The torque applied due to a hand load of 100 N,

   (ii) The number of turns of the wheel before it is brought to rest

   (iii) The time required to bring it to rest, from the moment of the application of the brake.



All dimensions in mm. Fig.1

UNIT-II

3. a) Discuss the method of finding the crank effort in a reciprocating single acting, single cylinder petrol engine. [7M]

b) A vertical engine running at 1200 r. p.m. with a stroke of 110 mm, has a connecting rod 250 mm between centers and mass 1.25 kg. The mass centre of the connecting rod is 75 mm from the big end centre and when suspended as a pendulum from the gudgeon pin axis makes 21 complete oscillations in 20 seconds. Calculate the radius of gyration of the connecting rod about an axis through its mass centre. [8M]

(OR)

4. The turning moment diagram for a petrol engine is drawn to the following scales: Turning moment, 1 mm = 5 N-m; crank angle, 1 mm = 1°. The turning moment diagram repeats itself at every half revolution of the engine and the areas above and below the mean turning moment line taken in order are 295, 685, 40, 340, 960, 270 mm^2. The rotating parts are equivalent to a mass of 36 kg at a radius of gyration of 150 mm. Determine the coefficient of fluctuation of speed when the engine runs at 1800 r.p.m. [15M]

UNIT-III

5. a) Explain the effect of the gyroscopic couple on the reaction of the four wheels of a vehicle negotiating a curve. [7M]

b) The rotor of a turbine installed in a boat with its axis along the longitudinal axis of the boat makes 1500 r.p.m. clockwise when viewed from the stern. The rotor has a mass of 750 kg and a radius of gyration of 300 mm. If at an instant, the boat pitches in the longitudinal vertical plane so that the bow rises from the horizontal plane with an angular velocity of 1 rad /s, determine the torque acting on the boat and the direction in which it tends to turn the boat at the instant. [8M]

(OR)

6. a) Explain the term height of the governor. Derive an expression for the height in the case of a Watt governor. What are the limitations of a Watt governor? [7M]

b) A Porter governor has arms 250 mm each and four rotating fly balls of mass 0.8 kg each. The sleeve movement is restricted to ± 20 mm from the height when the mean speed is 100 r.p.m. Calculate the central dead load and sensitivity of the governor neglecting friction when the fly ball exerts a centrifugal force of 9.81 N. Determine also the effort and power of the governor for 1 percent speed change. [8M]

UNIT-IV

7. The three cylinders of an air compressor have their axes 120° to one another and their connecting rods are coupled to a single crank. The stroke is 100 mm and the length of each connecting rod is 150 mm. The mass of the reciprocating parts per cylinder is 1.5 kg. Find the maximum primary and secondary forces acting on the frame of the compressor when running at 3000 r.p.m. [15M]

(OR)

8. A shaft carries four masses in parallel planes A, B, C and D in this order along its length. The masses at B and C are 18 kg and 12.5 kg respectively, and each has an eccentricity of 60 mm. The masses at A and D have an eccentricity of 80 mm. The angle between the masses at B and C is 100° and that between the masses at B and A is 190°, both being measured in the same direction. The axial distance between the planes A and B is 100 mm and that between B and C is 200 mm. If the shaft is in complete dynamic balance, determine: [15M]
   (i) The magnitude of the masses at A and D ;
   (ii) The distance between planes A and D ; and
   (iii) The angular position of the mass at D.

UNIT-V

9. a) Discuss about the advantages and disadvantages of vibrations. [5M]
   b) A 75 kg machine is mounted on the springs of stiffness $k = 11.76 \times 10^5$ N/m with an assumed damping factor of 0.20. A 2 kg piston within the machine has a reciprocating motion with a stroke of 0.08 m and a speed of 300 rpm. Assuming the motion of piston to be harmonic, calculate the amplitude of vibration of the machine and the vibratory force transmitted to the foundation. [10M]

(OR)

10. a) Define and derive the expression for the Logarithmic decrement? [8M]
    b) A shaft of 100 mm diameter and 1 m long is fixed at one end, and the other end carries a flywheel of mass 1 tonne. The radius of gyration of the flywheel is 0.5 m. Find the frequency of torsional vibrations, if the modulus of rigidity of the shaft material is 80 GN/m^2. [7M]

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