



**B.Tech II Year II Semester Supplementary Examinations, July 2021**  
**Dynamics of Machinery**  
(Mechanical Engineering)

**Maximum Marks: 70**

Date: 18.07.2021 Duration: 3 hours

- Note:**
1. This question paper contains two parts A and B.
  2. Part A is compulsory which carries 20 marks. Answer all questions in Part A.
  3. Part B consists of 5 Units. Answer any one full question from each unit.
  4. Each question carries 10 marks and may have a, b, c, d as sub questions.

Part-A

**All the following questions carry equal marks** **(10x2M=20 Marks)**

- 1 Discuss Precessional angular motion
- 2 Define right hand screw rule
- 3 Define the clutch
- 4 What is the difference between brake and Dynamometer?
- 5 What is meant by fluctuation of Energy?
- 6 Classify governors
- 7 What do you mean by coupled locomotives and uncoupled locomotives?
- 8 What is Tractive force?
- 9 What are different types of Vibrations?
- 10 What is meant by Whirling of shafts?

Part-B

Answer All the following questions. **(10M X 5=50Marks)**

- 11 The mass of flywheel of an engine is 6.5 tonnes and the radius of gyration is 1.8 meters, It is found from the turning moment diagram that the fluctuation of energy is 56 kN-m. If the mean speed of the engine is 120 r.p.m., find the maximum and minimum speeds. [10]  
OR
- 12 Describe, in detail, the complete static force analysis of the system of a reciprocating engine mechanism. [10]
- 13 A single plate clutch (both sides effective) is required to transmit 26.5 kW at 1600 rpm. The outer diameter of the plate is limited to 300 mm, and the intensity of pressure between the plates is not to exceed 68.5 kN/m<sup>2</sup>. Assuming uniform wear and a coefficient of friction of 0.3, show that the inner diameter of the plate is approximately 90 mm. [10]

OR

- 14 A band brake acts on the 3/4th of circumference of a drum of 450 mm diameter which is keyed to the shaft. The band brake provided a braking torque of 225 N-m. One end of the band is attached to a fulcrum pin of the lever and the other end to a pin 100 mm from the fulcrum. If the operating force is applied at 500 mm from the fulcrum and the coefficient of friction is 0.25, calculate the operating force when the drum rotates in (a) anticlockwise, and (b) clockwise direction [10]

- 15 (a) What are the differences between Porter and Proell Governors? [5]  
(b) The arms of a Hartnell governor are of equal length. At the mid position of the sleeve, the ball arm is vertical and the radius at which the ball rotates is 83mm when the equilibrium speed, neglecting friction, is 350 rpm. On changing the speed by 3 the magnitude of the rotating masses the spring stiffness the initial compression of the spring. [5]

OR

- 16 The Flywheel of a steam engine has a radius of gyration of 1 m and a mass of 2500 kg. The starting torque of the steam engine is 1500 N-m and may be assumed constant. Determine the i. Angular acceleration of the Fly wheel, and ii. The kinetic energy of the wheel after 10 seconds from the start. [10]

- 17 A rotating shaft carries four unbalanced masses 18 kg, 14 kg, 16 kg and 12 kg at radii 50 mm, 60 mm, 70 mm and 60 mm respectively. The 2nd, 3rd and 4th masses revolve in planes 80 mm, 160mm and 280 mm respectively measured from the plane of the first mass and are angularly located at  $60^\circ$ ,  $135^\circ$  and  $270^\circ$  respectively measured clockwise from the first mass looking from this mass end of the shaft. The shaft is dynamically balanced by two masses, both located at 50 mm radii and revolving in planes mid-way between those of 1st and 2nd masses and midway between those of 3rd and 4th masses. Determine, graphically or otherwise, the magnitudes of the masses and their respective angular positions. [10]

OR

- 18 A single cylinder engine runs at 250 r.p.m. and has a stroke of 180 mm. The reciprocating parts has a mass of 120 kg and the revolving parts are equivalent to a mass of 70 kg at a radius of 90 mm. A mass is placed opposite to the crank at a radius of 150 mm to balance the whole of the revolving mass and two-thirds of the reciprocating mass. Determine the magnitude of the balancing mass and the resultant residual unbalance force when the crank has turned  $30^\circ$  from the inner dead centre, neglect the obliquity of the connecting rod. [10]

- 19 A beam of length 10 m carries two loads of mass 200 kg at distances of 3 m from each end together with a central load of mass 1000 kg. Calculate the frequency of transverse vibrations. Neglect the mass of the beam and take  $I = 109 \text{ mm}^4$  and  $E = 205 \times 10^3 \text{ N/mm}^2$ . [10]

OR

- 20 Derive an expression for the frequency of free torsional vibrations for a shaft fixed at one end and carrying a load on the free end. [10]