

**INDIAN MARITIME UNIVERSITY**  
(A Central University, Govt. of India)  
**End Semester Examinations –June-July 2019**  
**B. Tech (Marine Engineering)**  
**Semester-II**  
**ENGINEERING MECHANICS II (UG11T2206)**

---

**Date: 06.07.2019**  
**Time: 03 Hrs.**

**Max Marks: 100**  
**Pass Marks: 50**

---

**PART A**  
**Compulsory Questions (3\*10 = 30 MARKS )**

1.
  - a) Explain angle of repose and impending motion?
  - b) Explain the phenomenon of "Slip" in a belt drive .
  - c) State the difference between work done by a force and work done by torque.
  - d) A body of weight 500N is lying on a rough horizontal surface having a coefficient of friction 0.3. If it is subjected to a force P , applied at  $20^{\circ}$  with horizontal, determine the frictional force F developed in the surface
  - e) Define maximum and minimum equilibrium speeds of a governor
  - f) Explain the terms: Amplitude and Periodic Time as applied to SHM
  - g) Explain "Creep" in a belt drive.
  - h) A flywheel 1 m in diameter accelerates uniformly from rest to 1000 rpm in 20 sec. what is its angular acceleration?
  - i) Define centrifugal tension in a belt ? When it is considered in calculations and when not?
  - j) Define "Hunting " of a "Governor"

**PART B (Answer any five questions)**

2. An force of 2250N is required to just move a certain body up an inclined plane of angle of  $12^{\circ}$ , force acting parallel to the plane. If the angle of inclination is increased to  $15^{\circ}$ , then the force required is 2580N. Find the weight of the body and co-efficient of friction [14 Marks]

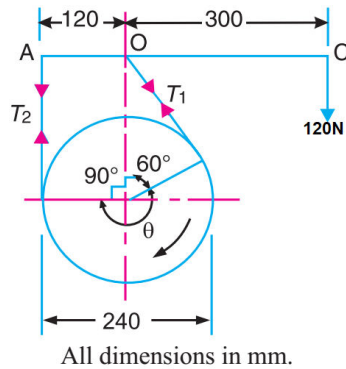
3 (a) The total mass of a flywheel and shaft is 2540 Kgs ; the radius of gyration is 686 mm and it is running at 150 rpm. The torque required to overcome friction at the bearings is 27 Nm. Find (i) the kinetic energy stored in wheel and shaft (ii) energy lost per revolution due to friction (iii) the number of revolutions made in coming to rest when uncoupled from the driving motor and (iv) the time to come to rest.

(b) A point on the rim of a rotating wheel originally has a tangential velocity of 12 m/s and a centripetal acceleration of  $96 \text{ m/s}^2$ . The angular speed of the wheel subsequently is uniformly retarded to 5 rad/s in 4s. For the wheel , estimate (i) the diameter (ii) the original angular speed (iii) the subsequent angular retardation (iv) the tangential acceleration of the point on the rim.  
[7+7=14 Marks]

4. A connecting rod AB makes 40 small oscillations per minute about a knife edge through the hole at the end A. The distance of c.g G from A is 0.45m. Find the radius of gyration of the rod about an axis through G parallel to the knife edge. Also find the number of oscillations per minute which the rod will make if supported on a knife edge through the hole at B if AB= 1.5 metre [14 Marks]

5. A pulley 500 mm diameter is driven at 375 rpm by a belt 200 mm wide by 12mm thick. The tension in the tight side of the belt is three times the tension in the slack side. Calculate the maximum power that can be transmitted if the stress in the belt not to exceed  $400 \text{ kN/m}^2$ , neglecting the stress set up in the belt due to centrifugal force. [14 Marks]

6. The simple band brake ,as shown , is applied to a shaft carrying a wheel of mass 400 kg. The radius of gyration of the wheel is 450mm and runs at 300rpm. If  $\mu = 0.2$  and the brake drum diameter is 240mm , find:



- (i) the torque applied due to hand load of 120 N
- (ii) the number of turns of the wheel before it is brought to rest

[7+7 =14 Marks]

7. a) Derive the equation of the watt governor “ $N^2 = 895/h$ ”
- b) A watt governor has four links each 250mm long, two revolving masses each of 3 kg and a negligible central mass. All the links are hinged to respective sleeves at radial distances 40mm from the axis of rotation. The masses revolve at a radius of 150 mm at minimum speed and at a radius of 200 mm at maximum speed. Determine (i) the range of speed (ii) Sensitiveness of the governor (iii) whether the governor is isochronous?

[6+8 =14 Marks]

8. A conical pivot supports a load of 20kN, the cone angle is  $120^\circ$  and the intensity of normal pressure is not to exceed  $0.3 \text{ N/mm}^2$ . The external diameter is twice the internal diameter. Find the outer and inner radii of bearing surface. If the shaft rotates at 200 rpm and  $\mu = 0.1$ , find the power absorbed in friction. Assume uniform pressure. [14 Marks]

\*\*\*\*\*