

GUJARAT TECHNOLOGICAL UNIVERSITY**PDDC - SEMESTER-V • EXAMINATION – WINTER 2013****Subject Code: X 51901****Date: 04-12-2013****Subject Name: Theory of Machine****Time: 10.30 AM - 01.00 PM****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1** (a) A porter governor has two balls each of mass 3 kg and central load of mass 15 kg. The arms are all 200 mm long, pivoted on axis. If the maximum and minimum radii of rotation of the balls are 160mm and 120mm respectively, find the range of speed. **07**
- (b) A simple band brake is operated by a lever of length 500mm. the brake drum has a diameter of 500mm and the brake band embraces $\frac{5}{8}$ of the circumference. One end of the band is attached to the fulcrum of the lever while the other end is attached to a pin on the lever 100 mm from the fulcrum. If the effort applied to the end of the lever is 2 KN and the co-efficient of friction is 0.25, find the maximum braking torque on the drum. **07**
- Q.2** (a) A single cylinder double acting steam engine delivers 185 kw at 100 rpm. The maximum fluctuation of energy per revolution is 15% of the energy developed per revolution. The speed variation is limited to 1% either way from the mean. The mean diameter of the rim is 2.4m. Find the mass and cross sectional dimensions of the flywheel rim when width of rim is twice the thickness. The density of flywheel material is 7200 kg/m^3 . **07**
- (b) The rotor of a turbine installed in a boat with its axis along the longitudinal axis of the boat makes 1500 rpm clockwise when viewed from the stem. the rotor has a mass of 750kg 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/sec, determine the torque acting on the boat and the direction in which it tends to turn the boat at the instant. **07**
- OR**
- (b) The crank pin circle radius of a horizontal engine is 300 mm. the mass of the reciprocating parts is 250kg. When the crank has travelled 60° from I.D.C., the difference between the driving and the back pressure is 0.35 N/mm^2 . The connecting rod length between centers is 1.2 m and the cylinder bore is 0.5m. If the engine runs at 250 r.p.m. and the effect of piston rod diameter is neglected, calculate 1. Pressure on slide bars, 2. Thrust in the connecting rod, 3. Tangential force on the crank-pin and 4. Turning moment on the crank shaft. **07**
- Q.3** (a) Prove that the maximum fluctuation of energy = $2EC_s$ **07**
- (b) Derive the equation of height in case of porter governor. **07**
- OR**
- Q.3** (a) Define and explain 1. Stability. 2. sensitiveness 3. Isochronisms and 4. Hunting relating to the governor. **07**
- (b) Explain 1. fluctuation of energy 2. Fluctuation of speed 3. Co-efficient of fluctuation of energy 4. Co-efficient of fluctuation of speed **07**
- Q.4** (a) Explain rope brake dynamometer and epicyclic train dynamometer. **07**
- (b) Explain effect of gyroscopic couple on a naval ship during pitching **07**

OR

- Q.4** (a) Derive equation of braking torque on the drum of band and block brake. **07**
(b) Explain effect of the gyroscopic couple on an aeroplane. **07**
- Q.5** (a) Describe the analytical method of finding the inertia torque on the crankshaft of a horizontal reciprocating engine. **07**
(b) Describe classification of synthesis problem **07**
- OR**
- Q.5** (a) Deduce an expression for the inertia force in the reciprocating parts, neglecting the weight of the connecting rod. **07**
(b) Explain graphical synthesis of four bar mechanism. **07**
