

GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER-V • EXAMINATION – WINTER 2013

Subject Code: 151902**Date: 29-11-2013****Subject Name: Theory of Machines****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) Differentiate between Governor and Flywheel. **07**
 (b) Explain stability of a two-wheeled vehicle. **07**

- Q.2** (a) Explain the term height of governor. Derive an expression for height in case of Watt governor. What are the limitations of Watt governor? **07**
 (b) Synthesis a 4-bar mechanism to generate a function $y = \log_{10} x$ in the interval of $1 \leq x \leq 10$. The input crank length is to be 50 mm. The input crank is to be rotate from 45° to 105° while output crank moves from 135° to 225° . Use 3 precession points with Chebyshev spacing's. **07**

OR

- (b) Explain Bloch's Synthesis Method for synthesizing a 4 bar mechanism. **07**
- Q.3** (a) An open belt drive connects two pulleys 120 cm and 50 cm diameter, on parallel shafts 4 meters apart. The mass of the belt is 0.9 Kg per meter length and the maximum tension is not to exceed 2000 N. The coefficient of friction is 0.3. The 120 cm diameter pulley, which is driver, runs at 200 rpm. Due to belt slip on one of the pulleys, the velocity of the driven shaft is only 450 rpm. Calculate the torque on each of the shafts, the power transmitted and power lost in friction. What is the efficiency of the drive? **07**
 (b) Explain inertia force analysis of a reciprocating engine using Klen's construction. **07**

OR

- Q.3** (a) The crank-pin circle radius of a horizontal engine is 300 mm. The mass of the reciprocating parts is 250 Kg. 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 500 mm. If the engine runs at 250 rpm and if the effect of piston rod diameter is neglected, calculate; (1) pressure on slide bars, (2) thrust in the connecting rod, (3) turning moment on the crank shaft. **07**
 (b) Prove that the ratio of the driving tensions on the two sides of a pulley is $T_1/T_2 = e^{\mu\theta}$ **07**

Where, T_1 = Tension in the tight side of the belt,

T_2 = Tension in the slack side of the belt

θ = Angle of contact in radians

μ = coefficient of friction between the belt and pulley

- Q.4 (a)** Explain the effect of gyroscopic couple on four wheel drive. **07**
(b) In a spring loaded Hartnell type governor, the extreme radii of rotation of the balls are 80 mm and 120 mm. The ball arm and the sleeve arm of the bell crank lever are equal in length. Mass of each ball is 2 Kg. If the speeds at the two extreme positions are 400 and 420 rpm, find (i) the initial compression of the central spring and (ii) the spring constant. **07**

OR

- Q.4 (a)** A horizontal cross compound steam engine develops 294240 Watts at 90 rpm. The coefficient of fluctuation of energy, found from turning moment diagram is 0.1 and speed is to be within 0.5 % of the mean speed. Find the weight of the flywheel required if radius of gyration is 2 meters. **07**
Q.4 (b) What is the function of dynamometer? Classify the dynamometers. Explain with neat sketch any one dynamometer. **07**

- Q.5 (a)** Explain with neat sketch Pickering governor. List the applications of Pickering governor. **07**
(b) The torque exerted on the crank shaft of a two stroke engine is given by $T = 15000 + 2000 \sin 2\theta - 1800 \cos 2\theta$ N-m. Assuming the resistance torque to be constant, determine **07**
(i) The power of the engine when running at 150 rpm
(ii) The moment of inertia of flywheel if the speed variation from the mean speed of 150 rpm is not to exceed $\pm 0.5\%$

OR

- Q.5 (a)** What is turning moment diagrams? What information can be avail from them? **07**
(b) The turbine rotor of a ship is of mass 3500 Kg. It has a radius of gyration of 0.45 meters and speed of 3000 rpm clockwise when looking from stern. Determine the gyroscopic couple and its effect upon the ship; **07**
(i) When the ship is steering to the left on a curve of 100 meter radius at a speed of 36 km/hrs.
(ii) When the ship is pitching in a SHM, the bow falling with its maximum velocity. The period of pitching is 40 seconds and the total angular displacement between the two extreme positions of pitching is 12 degrees.
