GUJARAT TECHNOLOGICAL UNIVERSITY BE - SEMESTER-V EXAMINATION – WINTER 2015

Subject Code: 151902 Subject Name: Theory of Machines Time: 10:30am to 1:00pm Instructions:

- 1. Attempt all questions.
- 2. Make suitable assumptions wherever necessary.
- 3. Figures to the right indicate full marks.
- Q.1 (a) With the help of a neat sketch explain the working of a single block or shoe brake. 07
 - (b) The arms of a porter governor are each 25 cm long and pivoted on the governor axis. Mass of each ball is 5 kg and mass of the central sleeve is 30 kg. The radius of rotation of the balls is 15 cm when the sleeve begins to rise and reaches a value of 20 cm for maximum speed. Determine the range of the governor.
- **Q.2** (a) Describe the construction and operation of a brake rope dynamometer.
 - (b) In a spring loaded Hartnell type governor, the extreme radii of rotation of the balls 07 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.
 - OR
 - (b) A porter governor has equal arms each 200 mm in length and pivoted on the axis of 07 rotation. The mass of each ball is 5 kg and the mass of sleeve is 25 kg. The radius of governor is 100 mm when governor begins to lift. If the frictional increase of speed is 1%, then determine the governor effort and power.
- Q.3 (a) Explain the operation of flywheel in a punching machine
 - (b) The turbine rotor of a ship has a mass of 2.2 tones and rotates at 1800 r.p.m. 07 clockwise when viewed from the left. The radius of gyration of the rotor is 320mm. Determine the gyroscopic couple and its effect when (1) Ship turns right at a radius of 250m. with a speed of 25 km/hr.(2) Ship pitches with the bow rising at an angular velocity of 0.8 rad/sec. (3)Ship rolls at an angular velocity of 0.1 rad/sec.

OR

- Q.3 (a) Define the flywheel and state its importance. Explain the types of flywheels. 07
 (b) The turbine rotor of a ship has a mass of 3500 kg. It has a radius of gyration of 0.45 07 m and a speed of 3000 rpm clockwise when looking from stern. Determine the gyroscopic couple and its effect upon the ship:
 1. When the ship is steering to left on a curve of 100 m radius at a speed of 36 km/h
 2. When the ship is pitching in a simple harmonic motion, 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.
- Q.4 (a) Draw and explain Klein's construction for determining the velocity of the 07 piston of a Reciprocating engine
 - (b) A connecting rod is suspended from the point 25 mm above the small end centre and 07 650 mm above its C.G. it takes 35 seconds for 20 oscillations. Find dynamically equivalent system of two masses when the mass is located at small end centre. Mass of the connecting rod is 40 Kg.

Total Marks: 70

Date:15/12/2015

07

07

Q.4	(a)	What is meant by dynamically equivalent system? State and prove conditions	07
		for it.	
	(b)	In I.C .Engine Mechanism the Crank radius is 400mm and Connecting rod is 950 mm long. The diameter of piston is 100mm and net gas pressure acting on the piston is 15 MPa. Find (1) Thrust in connecting road (2) Piston side exhaust (3) Torque acting on Crankshaft (4) Radial force or load on main bearings when crank has made 45° from TDC. Mass is 200kg and rpm is 400	07
Q.5	(a)	Explain Freudenstein's method for a four bar mechanism	07
•	(b)	Explain Bloch's synthesis method.	07
		OR	
Q.5	(a)	Explain Chebyshev Method to find precession points for the function.	07
	(b)	Explain three position synthesis of slider crank mechanism	07
