Student Exam No._____

GANPAT UNIVERSITY

B. Tech. Semester: IV (Mechanical Engineering)

CBCS Regular Examination May – June 2014

2ME404 Dynamics of Machines

Time: 3 Hours **Total Marks:** 70

Instruction: 1. Assume suitable data if necessary.
2. Answer to the two sections must be written in separate answer books.
3. Figures to the right indicate full marks of the questions.

Section - I

Que. 1 **Answer the following question.**

(A) Derive the equation for minimum number of teeth on the pinion in order to avoid interference. **[05]**

(B) The turbine rotor of a ship has a mass of 200 kg rotates at 2000 rpm clockwise when viewed from the stern (aft). The rotor has radius of gyration of 0.30 m. Determine the gyroscopic couple and its effect when, **[06]**

(i) The ship turns left at a radius of 300 m radius at a speed of 30 km/hr,

(ii) The ship pitches with the blow rising at an angular velocity of 1 rad/sec, and

(iii) The ship rolls at an angular velocity is 0.1 rad/sec.

OR

Que. 1 **Answer the following question.**

(A) Explain the gyroscopic effect on Naval ship. **[05]**

(B) A pair of involute spur gear with 16° pressure angle and pitch of module 6 mm is in mesh. The number of teeth on pinion is 16 and its rotational speed is 240 RPM when the gear ratio is 1.75, find in order that the interference is just avoided: (1) the addenda on pinion and gear wheel, (2) the length of path of contact, and (3) the maximum velocity of sliding of teeth on either side of the pitch point. **[06]**

Que. 2 **Answer the following question.**

(A) Enlist the term which are used in governor and define its. **[05]**

(B) In a spring-controlled governor of the Hartung type, the length of the ball and sleeve arms are 70 mm and 100 mm respectively. The total travel of the sleeve is 30 mm. In the mid-position, each spring is compressed by 45 mm and the radius of rotation of the mass centre is 120 mm. Each ball has a mass of 4 kg and spring has a stiffness of 20 kN/m of compression. The equivalent mass of the governor gear at the sleeve is 20 kg. Neglecting the moment due to the revolving masses. When the arms are inclined, determine the ratio of the range of speed to the mean speed of the governor. Find also, the speed in the mid-position. **[07]**

OR

Que. 2 **Answer the following question.**

(A) Classify the governor & derive the equation for porter governor by instantaneous centre method. **[05]**

(B) A loaded governor of the porter type has equal arms and links each 250 mm long. The mass of each ball is 2 kg and the central mass is 12 kg. When the ball radius is 150 mm, the valve is fully open and when the radius is 185 mm, the valve is closed. Find the maximum speed and the range of speed. If the maximum speed is to be increased 20% by an addition of mass to be central load, find what additional mass is required. **[07]**

Que. 3 **Atteempt Any Three.**

(A) Define the following terms with appropriate example for governor:-
(i) Sensitiveness, (ii) Stability.

(B) Explain various axis and plane referred to gyroscope.

(C) Explain the law of gearing with suitable sketch.

(D) Explain the Oldham coupling with neat sketch.

Section - II

Que. 4 **Answer the following question.**

(A) Derive an expression of velocity and acceleration of piston in a slider crank mechanism. [04]

(B) Synthesis a four bar mechanism using Freudenstein's equation to satisfy in one of its positions. The specification of position θ, velocity ω and acceleration α are as follow: [08]

$\theta = 60°$; $\omega_2 = 6$ rad/sec; $\alpha_2 = 3$ rad/sec^2
$\emptyset = 90°$; $\omega_4 = 3$ rad/sec; $\alpha_4 = 6$ rad/sec^2

OR

Que. 4 **Answer the following question.**

(A) Derive Freudenstein's equation for 4- bar mechanism. [04]

(B) In a horizontal engine, the mass of the reciprocating parts is 260 kg. The crank-pin circle radius is 320 mm. When the crank has travelled 60° from IDC, the difference between the driving and the back pressure is 0.36 N/mm2. The length of connecting rod is 1.4 m. The bore of the cylinder is 520 mm. The engine runs at 260 rpm and if the effect of piston rod diameter is neglected, calculate (i) Pressure on side bars (ii) Thrust in the connecting rods (iii) Tangential force on the crank-pin and (iv) Turning moment on the crank shaft. [08]

Que. 5 **Answer the following question.**

(A) Synthesis a four bar mechanism to generate the function $y = \log_{10} x$ in the interval of $1 \leq x \leq 10$. The input crank is to rotate from 45° to 105° while output link moves from 135° to 225°. Use three accuracy points with Chebyshev's spacing. The input crank length is 60 mm. [07]

(B) What is the need of static force analysis? Explain the principal of superposition. [04]

OR

Que. 5 **Answer the following question.**

(A) A 4 bar mechanism with the following dimensions is acted upon by a force 80 N at 150° on the link DC (Refer Fig. 1) Take AD = 500 mm, AB = 400 mm, BC = 1000 mm, DC= 750 mm, DE= 350 mm. Determine the input torque T on the link AB for the static equilibrium of the mechanism for the given configuration. [07]

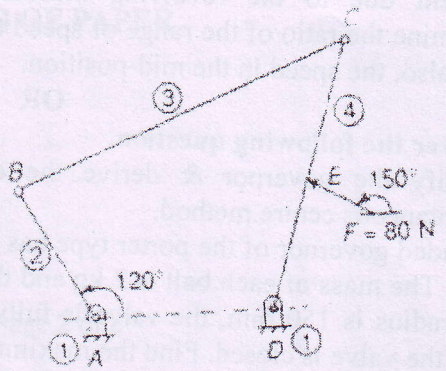

Fig. 1

(B) What is synthesis? How it is differ from analysis. [04]

Que. 6 **Attempt any three.** [12]

(A) State and explain the D' Alembert's principle.

(B) Derive an expression of turning moment on crank shaft of a horizontal reciprocating engine neglecting the effect of the mass of the connecting rod.

(C) Classify synthesis problems and explain in detail.

(D) Explain fluid coupling with neat sketch.

********** END OF PAPER **********