Mechanical
Date : 20/05/2015

Student Exam No. _____

GANPAT UNIVERSITY

B. Tech. Semester: 4th MechatronicsEngineering

CBCS Regular Examination April - June 2015

2MC404 - Dynamics of Machines

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

Instruction:

(1) All questions are compulsory.
(2) Assume suitable data if necessary.
(3) Right Figure indicates full marks.

Section - I

Que.1 Attempt the following questions.

(A) Explain the terms "Static Balancing" and "Dynamic Balancing". State the necessary condition to achieve them. **[05]**

(B) The turbine rotor of a ship has a mass of 3500 kg. It has a radius of gyration of 0.45 m and speed of 3000 rpm clock-wise 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 m radius at a speed of 36 km/hr,

(ii) When the ship is pitching in a simple harmonic motion, the bow falling with its maximum velocity. The period of pitching is 40 sec and the total angular displacement between the two extreme positions of pitching is 12 degrees.

OR

Que.1 Attempt the following questions.

(A) Describe the Gyroscopic effect on sea going vessels. **[05]**

(B) A rotating shaft carries four unbalanced masses 18 kg, 14 kg, 16 kg and 12 kg at radii 5 cm, 6 cm, 7 cm and 6 cm respectively. The 2nd, 3rd and 4th masses revolve in planes 8 cm, 16 cm and 28 cm respectively measured from the plane of the first mass and are angularly located at 60°, 135° and 270° respectively measured anti-clockwise from the first mass looking from this mass end of the shaft. The shaft is dynamically balanced by two masses, both located at 5 cm radii and revolving in plane mid way between those of 1st and 2nd masses and midway between those of 3rd and 4th masses. **[07]**

Determine graphically, the magnitude of the masses and their respective angular positions.

Que.2 Attempt the following questions.

(A) What is stability of governor? Sketch the controlling force v/s radius diagram for a stable, unstable and isochronous governor. Derive the condition for stability. **[05]**

(B) A spring loaded governor of the Hartnell type has arms of equal length. The masses rotate in circle of 130 mm diameter when the sleeve is in the mid-position and the ball arms are vertical. The equilibrium speed for this position is 450 rpm neglecting friction. The maximum sleeve movement is to be 25 mm and the maximum variation of speed taking in account the friction to be five percent of the mid position speed. The mass of the sleeve is 4 kg and the friction force may be considering equivalent to 30 N at the sleeve. The power of the governor must be sufficient to overcome the friction by one percent change of speed either way at mid-position. Determine, neglecting obliquity effect of arms: (i) The value of each rotating mass, (ii) The spring stiffness in N/mm, and (iii) The initial compression of spring. [06]

OR

Que.2 Attempt the following questions.

(A) Explain the working of a Hartung Governor with a neat sketch. [05]

(B) Each arm of a porter governor is 200 mm long and is pivoted on the axis of the governor. The radii of rotation of the balls at the minimum and the maximum speeds are 120 mm and 160 mm respectively. The mass of the sleeve is 24 kg and each ball is 4 kg. [06]

Find the range of speed of the governor. Also determine the range of speed if the friction at the sleeve is 18 N.

Que.3 Attempt Any Three. [12]

(A) Define and explain the following terms relating to Governor.
(i) Sensitiveness, (ii) Isochronisms, (iii) Hunting, (iv) Stability.

(B) Why is Balancing of rotating parts necessary for high speed engine? Give examples and explain its.

(C) Discuss the effect of Gyroscopic Couple on a two wheel vehicle when taking a turn.

(D) Explain the terms Height of a Governor. Derive an expression for the height in the case of Watt Governor. What are the limitations of a Watt Governor?

Section – II

Que.4 Attempt the following questions.

(A) Explain following: [06]
1) Critical damping coefficient
2) Damping factor
3) Damping ratio.

(B) **Figure - 1**shows a semicircular disc placed on flat surface. Find the equation of motion when it is displaced from the mean position. [06]

OR

Que.4 Attempt the following questions

(A) Derive the equation of motion for simple spring mass system using free body diagram method with neat sketch. [06]

(B) For the spring mass system as shown in **Figure - 2**. Following data is given [06]

$k_1 = 2800\ N/m$; $k_3 = 1900\ N/m$;

$k_2 = 1400\ N/m$; $k_4 = k_5 = 2800\ N/m$;

$m = 0.5\ Kg$

Find out the natural frequency of the system.

Que.5 Attempt the following questions

(A) Derive the freudensein's equation for displacement analysis. [05]

(B) A pinion with 20 teeth is in mesh with a gear with 60 teeth. The pressure angle is 20° and addendum of 7 mm. The pitch line velocity is 1.4 m/sec. Determine: [06]

1) The number of pairs of teeth in contact and the angle of rotation of the larger wheel for one pair of teeth in contact,
2) Sliding velocity at
   a) Commencement of engagement,
   b) Termination of the engagement and
   c) At pitch point.

OR

Que.5 Attempt the following questions

(A) Explain Path of Contact and Arc of Contact of two meshing gear. [05]

(B) Synthesize a four bar function generation to solve the equation $y = \sin x$ in the region $0 \leq x \leq \frac{\pi}{2}$. Use 3 precision point and chebychev spacing. [06]

$\theta_0 = 30°, \varphi_0 = 60°$ *and* $\Delta\theta = 60° \& \Delta\varphi = 90°$. Draw configuration.

Que.6 Write Any THREE questions. [12]

(A) State and Explain the law of gearing.

(B) Explain the polydyne cam.

(C) Explain Jump Phenomena with neat sketch.

(D) Define following terms:

1) Resonance, 2) Amplitude, 3) Frequency, 4) Damped vibration

Figures

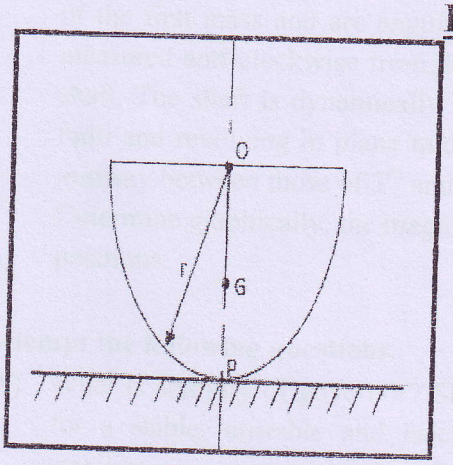

Figure -1

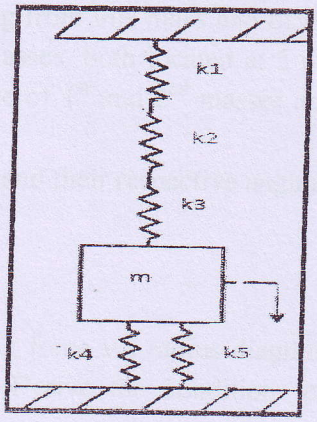

Figure -2

END OF PAPER