Code No: **R31033** **R10** **Set No. 1**

III B.Tech I Semester Supplementary Examinations, October/November - 2017

DYNAMICS OF MACHINERY

(Common to Mechanical Engineering and Auto Mobile Engineering)

Time: 3 hours **Max. Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks

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1 a) What is the effect of gyroscopic couple on rolling of a ship? Why? [5M]

b) The rotor of a turbine yatch rotates at 1200 rpm clockwise when viewed from stern. The rotor has a mass of 750 kg and radius of gyration of 250 mm. Find the maximum gyroscopic couple transmitted to the hull when yatch pitches with a maximum angular velocity of 1 rad/s. What is the effect of this couple? [10M]

2 a) What is friction? Is it a blessing or curse? Justify your answer giving examples? [4M]

b) A flat foot step bearing 300 mm in diameter supports a load of 8 kN. If the coefficient of friction is 0.1, and the speed of the shaft is 80 rpm, find the power lost in friction, assuming uniform wear. [11M]

3 A band and block brake having 12 blocks, each of which subtends an angle of 16^0 at the centre, is applied to a rotating drum of diameter 600 mm, the blocks are 75 mm thick. The drum and the flywheel mounted on the same shaft have a mass of 1800 kg and have a combined radius of gyration of 600 mm, the two ends of the band are attached to pins on the opposite sides of the brake fulcrum at distance of 40 mm and 150 mm from the fulcrum. If a force of 250 N is applied at a distance of 900 mm from the fulcrum, find (i) the maximum braking torque (ii) the angular retardation of the drum (iii) the time taken by the system to be stationary from the rated speed of 300 rpm. Take coefficient of friction between the blocks and the drum as 0.3. [15M]

4 The turning moment diagram for a four stroke gas engine may be assumed for simplicity to be represented by four triangles, the areas of which from the line of zero pressure are as follows: Expansion stroke = 3550 mm^2; Exhaust stroke = 500 mm^2 ; Suction stroke = 350 mm^2 ; and compression stroke = 1400 mm^2, each mm^2 represents 3 N-m. Assuming the resisting moment to be uniform, find the mass of the rim of a fly wheel required to keep the mean speed 200 rpm within +2% and -2%. The mean radium of the rim may be taken as 0.75 m. Also determine the crank positions for the maximum and minimum speeds. [15M]

5 a) (i) Compare the functions of a flywheel and a governor. [4+3M]
(ii) How are governors classified?

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b) For a spring controlled Hartnell type governor, following data is provided: mass of the governor ball is 2 kg, length of the vertical arm of bell crank lever is 800 mm, and length of the other arm of bell crank lever is 90 mm. The speeds corresponding to radii of rotations 120 mm and 130 mm are 300 rpm respectively. Determine the stiffness of spring. [8M]

6 a) (i) Why rotating masses are to be dynamically balanced? [3+4M]
(ii) Describe reasons for partial balancing of reciprocating masses.

b) Four masses A,B,C and D revolves at equal radii and equally spaced along a shaft. The mass B is 7 kg and the radii of C and D make angle of 90^0 and 240^0 respectively with the radius of B. Find the magnitude of masses A,C and D and angular position of A, so that the system may be completely balanced. [8M]

7 Four masses m_1, m_2, m_3 and m_4 having 100, 175, 200 and 25 kg fixed to cranks of 20 cm radius and revolve in places 1,2,3 and 4. The angular position of the cranks in planes 2,3 and 4 with respect to the crank in plane 1 are 75^0 same sense. The distances of planes 2,3 and 4 from plane 1 are 60 cm, 186 cm and 240 cm respectively. Determine the position and magnitude of the balance mass at a radius of 60 cm in plane L and M located at the middle of the plane 1 and 2 and the middle of the planes 3 and 4 respectively. [15M]

8 a) Discuss the effect of inertia of the shaft in longitudinal and transverse vibrations. [5M]

b) A shaft 40 mm diameter and 2.5 m long has a mass of 15 kg/m length. It is simply supported at the ends and carries three masses 90 kg, 140 kg and 60 kg at 0.8 m, 1.5 m and 2 m respectively from the left support. Taking E= 200 GPa. Find the frequency of transverse vibrations. [10M]

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