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Code No: 135SB

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year I Semester Examinations, February - 2022
DYNAMICS OF MACHINERY
(Mechanical Engineering)

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

Answer any five questions
All questions carry equal marks
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1.a) Explain the concept of precessional angular motor.
b) An aeroplane runs at 600 km / h. The rotor of the engine weighs 4000 N with radius of gyration of 1 meter. The speed of rotor is 3000 r.p.m. in anticlockwise direction when seen from rear side of the aeroplane. If the plane takes a loop upwards in a curve of 100 metres radius, find: (i) gyroscopic couple developed; and (ii) effect of reaction gyroscopic couple developed on the body of aeroplane. [7+8]

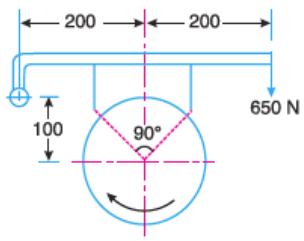
2.a) Explain the Effect of Gyroscopic Couple on a Naval Ship during Steering.
b) The turbine rotor of a ship has a mass of 8 tonnes and a radius of gyration 0.6 m. It rotates at 1800 r.p.m. clockwise, when looking from the stern. Determine the gyroscopic couple, if the ship travels at 100 km/hr and steer to the left in a curve of 75 m radius. [7+8]

3. In a turning moment diagram, the areas above and below the mean torque line taken in order are 4400, 1150, 1300 and 4550 mm^2 respectively. The scales of the turning moment diagram are: Turning moment, 1 mm = 100 N-m; Crank angle, 1 mm = 1^0. Find the mass of the flywheel required to keep the speed between 297 rpm and 303 rpm., if the radius of gyration is 0.525 m. [15]

4. A single cylinder, single acting, four stroke cycle gas engine develops 20 kW at 250 r.p.m. The work done by the gases during the expansion stroke is 3 times the work done on the gases during the compression stroke. The work done on the suction and exhaust strokes may be neglected. If the flywheel has a mass of 1.5 tonnes and has a radius of gyration of 0.6m, find the cyclic fluctuation of energy and the coefficient of fluctuation of speed. [15]

5. A flat foot step bearing 225 mm in diameter supports a load of 7.5 kN. If the coefficient of friction is 0.09 and r.p.m is 60, find the power lost in friction, assuming a) Uniform pressure, and b) Uniform wear. [15]

6. A single block brake, as shown in figure (All dimensions in mm) has the drum diameter 250 mm. The angle of contact is 90^0 and the coefficient of friction between the drum and the lining is 0.35. If the operating force of 650 N is applied at the end of the lever, determine the torque that may be transmitted by the block brake. [15]



7. A Porter governor has equal arms each 250 mm long and pivoted on the axis of rotation. Each ball has a mass of 5 kg and the mass of the central load on the sleeve is 25 kg. The radius of rotation of the ball is 150 mm when the governor begins to lift and 200 mm when the governor is at maximum speed. Find the minimum and maximum speeds and range of speed of the governor. [15]

8. A shaft of diameter 10 mm carries at its centre a mass of 12 kg. It is supported by two short bearings, the centre distance of which is 400 mm. Find the whirling speed: (a) neglecting the mass of the shaft, and (b) taking the mass of the shaft also into consideration. The density of shaft material is 7500 kg/m^3. [15]

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