Code No: 155BA

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year I Semester Examinations, August - 2022
DYNAMICS OF MACHINERY
(Common to ME, MCT)

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

Answer any five questions
All questions carry equal marks
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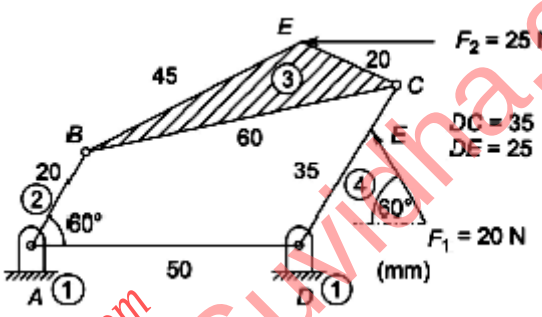
1.a) What are the gyroscopic effects on an aero-plane?
b) Express the total angular acceleration of a rotor spinning about the horizontal axis. [5+10]

2. For the mechanism shown in figure, using any one method to determine the torque on the link AB for the static equilibrium of the mechanism. [15]



3. The turning moment diagram for an IC engine is drawn to the following scales: For Turning moment, 1 mm = 1000 N-m, and for crank angle, 1 mm = 6 ^{0}. The areas above and below the mean turning moment line taken in order are: 530, 330, 380, 470, 180, 360, 350, 280 mm ^{2}. The mean speed of the engine is 150 rpm and the total fluctuation of speed must not exceed 3.5% of mean speed. Determine the diameter and mass of the flywheel rim, assuming that total energy of the flywheel is to be 15/14 that of rim. The peripheral velocity of the flywheel is 15 m/s. Find also the suitable cross-sectional area of the rim of the flywheel. Take density of the rim material as 7200 kg/m^3. [15]

4.a) Derive the expression for the energy stored in flywheel.
b) The connecting rod of a gasoline engine is 300 mm long between its centers. It has a mass of 15 kg and mass moment of inertia of 7000 kg-mm ^{2}. Its center of gravity is at 200 mm from its small end center. Determine the dynamical equivalent two-mass system of the connecting rod if one of the masses is located at the small end center. [7+8]

5. A single plate clutch is required to transmit 8 kW at 1000 rpm. The axial pressure is limited to 70 kN/m ^{2}. The mean radius of the late is 4.5 times the radial width of the friction surface. If both the sides of the plate are effective and the coefficient of friction is 0.25, find the
a) Inner and outer radii of the plate and the mean radius.
b) Width of the friction lining. [7+8]

6.a) A truncated conical pivot of cone angle φ rotating at speed N supports a load W. The smallest and largest diameter of pivot over the contact area 'd' and '*D*' respectively. Assuming uniform wear, derive the expression for frictional torque.

b) A torsion dynamometer is fitted on a turbine shaft to measure the angle of twist. It is observed that the shaft twists 2^0 in a length of 5 m at 600 rpm. The shaft is solid and has a diameter of 250 mm. If the modulus of rigidity is 84 GPa, find the power transmitted by the turbine. [8+7]

7. The cranks 2 to 9 of a nine-cylinder engine running at 1000 rpm make 240, 120, 160, 280, 40, 80, 320 and 200 degrees respectively with crank 1, when measured in a counter-clockwise direction. The rotating masses for each cylinder are estimated to be 20 kg at 0.5 m radius. The distance between center lines of cranks is 0.4 m. It is proposed to balance this engine by two masses, one in the damper at a distance of 0.6 m from cylinder one and the other located in the fly wheel at a distance of 0.6 m from cylinder nine. Determine the magnitudes and the locations of the balancing masses. [15]

8. A shaft, 1.5 m long, supported by flexible bearings at the ends carries two wheels each of 50 kg mass. One wheel is situated at the center of the shaft and the other at a distance of 375 mm from the center towards left. The shaft is hollow of external diameter 75 mm and internal diameter 40 mm. The density of the shaft material is 7700 kg/m^3 and its modulus of elasticity is 200 GN/m^2. Find the lowest whirling speed of the shaft, taking into account the mass of the shaft. [15]

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