CBCS SCHEME

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17AU52

Fifth Semester B.E. Degree Examination, Feb./Mar.2022
Dynamics of Machines

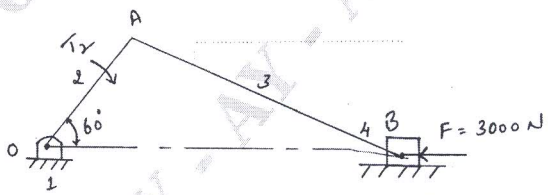
Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. Define the following:
(i) Two force member (ii) Three force member (iii) Members with two forces and a torque. **(06 Marks)**

b. The following Fig. Q1(b) shows a slider-crank mechanism. A force of F = 3000 N is applied on the slider. Determine various forces on each member and also the driving torque T_2 on the crank. **(14 Marks)**



OA = 100 mm, AB = 300 mm
Fig. Q1(b)

OR

2 a. State and explain D'Alemberts principle. **(04 Marks)**

b. The following data relate to a horizontal engine:
Mass of reciprocating parts = 120 kg ; Crank length = 90 mm
Engine speed = 600 rpm ; Connecting rod mass = 90 kg
Length between centres = 450 mm;
Distance of centre of mass from big end centre = 180 mm
Radius of gyration about an axis through the centre of mass = 150 mm.
Find the magnitude and the direction of the inertia torque on the crank shaft when the crank has turned 30° from the inner dead centre. **(16 Marks)**

Module-2

3 a. Explain static balancing and dynamic balancing. **(04 Marks)**

b. A shaft carries four rotating masses A, B, C and D in this order along its axis. The mass A may be assumed concentrated at a radius of 120 mm, B at 150 mm, C at 140 mm and D at 180 mm. The masses of A, C and D are 15 kg, 10 kg and 8 kg respectively. The planes of revolution of A and B are 150 mm apart and of B and C are 180 mm apart. The angle between A and C is 90°. If the shaft is in complete dynamic balance, determine (i) The angles between the radii of A, B and D. (ii) The distance between the planes of revolution of C and D (iii) The mass B. **(16 Marks)**

OR

4 The cranks and connecting rod of a 4 cylinder in line engine running at 1800 rpm are 50 mm, 250 mm each respectively and the cylinders are spaced 150 mm apart. If the cylinders are numbered 1 to 4 in sequence from one end and the crank appears at intervals of 90° in an end view in the order 1-4-2-3. The reciprocating mass corresponding to each cylinder is 1.5 kg. Determine (i) Unbalanced primary and secondary forces if any (ii) Unbalanced primary and secondary couples with reference to central plane of engine. **(20 Marks)**

Module-3

5 a. Define the following:
(i) Maximum fluctuation of speed.
(ii) Co-efficient of fluctuation of energy. **(04 Marks)**

b. Turning moment curve for one revolution of a multi-cylinder engine above and below line of mean resisting torque are given by -0.32, +4.06, -2.71, +3.29, -3.16, +2.32, -3.74, +2.71 and −2.45 sq.cm. The vertical and horizontal scales are 1 cm = 60000 kg cm and 1 cm = 24° respectively. The fluctuation of speed is limited to ±1.5% of mean speed which is 250 rpm. The hoop stress in rim material is limited to 56 kg/cm^2. Neglecting effect of boss and arms determine suitable diameter and cross section of flywheel rim. Density of rim material is 0.0072 kg/cm^3. Assume width of rim equal to 4 times its thickness. **(16 Marks)**

OR

6 a. Define the following:
(i) Sensitiveness (ii) Hunting (iii) Stability (iv) Controlling force **(08 Marks)**

b. The Porter governor having the upper and lower arms are 200 mm and 250 mm respectively and are pivoted on the axis of rotation. The mass of sleeve is 15 kg, the mass of each ball is 2 kg and friction of the sleeve together with the resistance of operating gear is equal to a load of 25 N at the sleeve. If the limiting inclinations of the upper arms to the vertical arc 30° and 40°, find the range of speed of governor taking friction into account. **(12 Marks)**

Module-4

7 a. Derive an equation for frictional torque developed in a flat pivot bearing. **(10 Marks)**

b. A shaft has a number of collars integral with it. The external diameter of the collar is 400 mm and the shaft diameter is 250 mm. If the intensity of pressure is 0.35 N/mm^2 and the co-efficient of friction is 0.05, estimate the power absorbed when the shaft runs at 105 rpm carrying a load of 150 kN and number of collars required. **(10 Marks)**

OR

8 a. Derive an equation for ratio of belt tensions in the flat belt. **(08 Marks)**

b. A pulley is driven by a flat belt, the angle of lap being 120°. The belt is 100 mm wide by 6 mm thick and density 1000 kg/m^3. If co-efficient of friction is 0.3 and maximum stress in the belt is not to exceed 2 MPa, find the greatest power which the belt can transmit and the corresponding speed of the belt. **(12 Marks)**

Module-5

9 a. Explain the effect of gyroscope on aeroplane. **(10 Marks)**

b. Find the angle of heel with respect to the vertical of a two wheeler taking a turn. Given combined mass of vehicle with its radii 250 kg, moment of inertia of the engine flywheel 0.3 kgm^2, moment of inertia of each road wheel 1 kgm^2, speed of engine fly wheel 5 times that of road wheels and in the same direction, height of c.g of rider with vehicle 0.6 m, 2 wheeler speed 90 kmph, wheel radius 300 mm, radius of turn 50 m. **(10 Marks)**

OR

10 The following particulars relate to a symmetrical circular cam operating a flat faced follower:
Least radius = 16 mm ; Nose radius = 3.2 mm ;
Distance between cam shaft centre and nose centre equals 25 mm.
Angle of action of cam = 150° ; Cam shaft speed = 600 rpm
Assuming that there is no dwell between ascent and descent, determine the lift of the valve, the flank radius and the acceleration and retardation of the follower at a point where circular nose merges into circular flank. **(20 Marks)**

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