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10AE53

Fifth Semester B.E. Degree Examination, July/August 2021
Dynamics of Machinery

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions.***

1 a. What are conditions for a body to be in equilibrium under the action of two forces, three forces and two forces and a torque? **(06 Marks)**

b. In a four bar mechanism shown in Fig.Q.1(b). Calculate the required value of T_2 and various forces on links for the equilibrium of the system. **(14 Marks)**

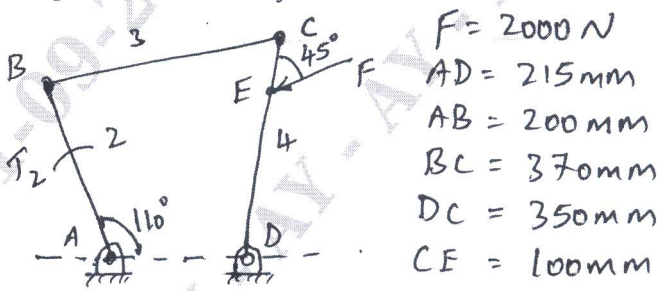

Fig.Q.1(b)

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

b. Prove that the maximum fluctuations of energy 'C' is given by C = 0.02qE for a flywheel, where E = mean K.E and q = Total percentage fluctuation of speed. **(06 Marks)**

c. A gas engine working on otto cycle develops 22.08kW at 300rpm. The coefficient of fluctuation of energy is 1.85. The fly wheel mass is 1000kg and its radius of gyration is 0.9m. What is the cyclic speed variation from the mean? **(10 Marks)**

3 a. Derive an expression for the belt tension. **(08 Marks)**

b. An open belt drive is required to transmit 10kW from a motor running at 600rpm. The belt is 12mm thick and has a mass density of 0.001gm/mm^3. Safe stress in the belt is not to exceed 2.5N/mm^2. Effective diameter of the driving pulley is 250mm where as the speed of driven pulley is 220rpm. The two shaft are 1.25m apart. If the coefficient of friction is 0.25, determine the width of the belt. **(12 Marks)**

4 a. Why is balancing of rotating parts necessary for high speed engines? Explain static and dynamic balancing. **(06 Marks)**

b. A shaft carries four masses A, B, C and D placed in parallel planes perpendicular to the shaft axis and in this order along the shaft. The masses B and C are 40kg and 28kg and both are at 160mm radius. While the masses in planes A and D are at 200mm radius. Angle between B and C is 100°, B and A is 190°, both angles being measured in the same sense. Plane A and B are 250mm apart, B and C are 500mm apart. If the shaft is to be in complete balance, determine: i) Masses in planes A and D ii) Distance between planes C and D iii) Angular position of mass D. **(14 Marks)**

5 a. The following data relate to a single cylinder reciprocating engine:
Mass of reciprocating parts = 40kg
Mass of revolving parts = 30kg at 180mm radius
Speed = 150rpm
Stroke = 350mm
If 60% of the reciprocating parts and all the revolving parts are to be balanced, determine:
i) The balance mass required at a radius of 320mm.
ii) The unbalanced force when the crank has turned 45° from the top dead centre. **(04 Marks)**

b. Prove that the resultant unbalanced force is minimum when half of the reciprocating masses are balanced by rotating masses i.e. when C = 1/2. **(10 Marks)**

c. What are In-line engines and state how they are balanced. **(06 Marks)**

6 a. Define the terms:
i) Sensitiveness
ii) Stability
iii) Isochron
iv) Effort
v) Power **(05 Marks)**

b. The arms of a porter governor are each 30cm long and are pivoted on the governor axis. Mass of each ball is 2kg. At the mean speed of 150rpm, the arm makes 30° with the vertical. Determine the central load and the sensitivity of the governor, if the sleeve movement is ± 2.5cm. **(15 Marks)**

7 a. Explain the following:
i) Gyroscopic effect
ii) Linear momentum
iii) Angular momentum
iv) Spin
v) Precession. **(10 Marks)**

b. Each road wheel of a motor cycle has a moment of inertia of 2kg m^2. The rotating parts of the engine of the motor cycle has a moment of inertia of 0.2kg m^2. The speed of the engine is 5 times the speed of the wheel and is in the same sense. The mass of the motor cycle with rider is 200kg and its C.G is 500mm above ground level. The diameter of the wheel is 500mm. The motor cycle is travelling at 15m/s on a curve of 30m radius. Determine:
i) Gyro couple, centrifugal couple, over turning couple and balancing couple in terms of angle of heel.
ii) Angle of heel. **(10 Marks)**

8 The following data relate to a symmetrical circular cam operating on a flat faced follower. Least radius = 25mm, nose radius = 8mm, lift of the valve = 10mm, angle of action of cam = 120°, cam shaft speed = 1000rpm, determine:
i) Flank radius
ii) Maximum velocity
iii) Maximum acceleration
iv) Maximum retardation.
If the mass of the follower and valve with which it is in contact is 4kg, find the minimum force exerted by the spring to over come the inertia of the moving parts. **(20 Marks)**

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