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10AU54

Fifth Semester B.E. Degree Examination, Jan./Feb. 2021
Dynamics of Machines

Time: 3 hrs.   Max. Marks:100

Note: *Answer any FIVE full questions, selecting at least TWO questions from each part.*

PART – A

1 a. Explain Equilibrium with respect to two force and three force members. **(06 Marks)**
   b. A four bar mechanism shown in Fig. Q1(b). The dimensions of various links are AB = 200mm, BC = 370mm, CD = 350mm, AD = 215mm, CE = 100mm. Determine the required value of "T_2" and various forces on links for the equilibrium of the system.
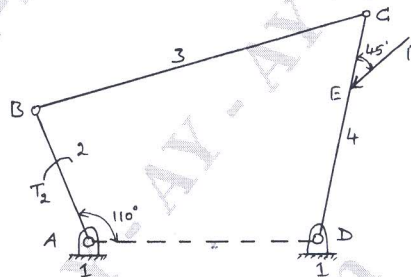

Fig Q1(b)   **(14 Marks)**

2 a. Explain the following terms with respect to I.C. engine:
      i)   Piston effort
      ii) Force acting along the connecting rod
      iii) Crank pin effort
      iv) Crank effort. **(08 Marks)**
   b. A vertical double acting steam engine has a cylinder 300mm diameter and 450mm stroke and runs at 200rpm. The reciprocating parts has a mass of 225kg and the piston rod is 50mm diameter. The connecting rod is 1.2m long. When the crank has turned through 125° from the top dead centre, the steam pressure above the piston is $30kN/m^2$ and below the Piston is $1.5 \ kN/m^2$. Calculate the effective turning moment on the crank shaft. **(12 Marks)**

3 a. Derive an expression for maximum fluctuation of energy in a multi-cylinder engine. **(08 Marks)**
   b. A single cylinder, single acting four stroke gas engine develops 20 KW at 300 rpm. The work done by the gases during the expansion stroke is three times work done on the gases during the compression stroke, the work done during the suction and exhaust strokes being negligible. If the total fluctuation of speed is not to exceed ±2% of the mean speed and the turning moment diagram during compression and expansion is assumed to be triangular in shape, determine the moment of inertia of the flywheel. **(12 Marks)**

4 a. Derive an expression for displacement, velocity and Acceleration for a Tangent cam operating on a radial translating roller follower, when the roller has contact with straight Flank. **(12 Marks)**
   b. Derive an expression for Displacement and velocity for a circulation arc cam operating a Flat – Faced follower, when the contact is on the circular Flank. **(08 Marks)**

PART – B

5 a. Explain briefly static balance and dynamic balance as applied to revolving masses in different planes. **(04 Marks)**

   b. Four masses of magnitude 5, 6 M and 8kg revolve in planes A, B, C and D respectively. The planes B, C, D are placed at a distance 0.3m, 1.2m and 2.0m respectively from A. The masses are at same radii of 0.3m. Find the magnitude of M and relative angular position of all masses for complete balance. **(16 Marks)**

6 a. Derive an expression for residual unbalanced force in case of partial primary balance of single cylinder engine. **(08 Marks)**

   b. A five cylinder in line engine running at 750 rpm has successive cranks 144° degree apart, the distance between cylinder centre lines being 375 mm. the piston stroke is 225 mm and the ratio of connecting rod length to the crank radius is 4. Examine the engine for balance of primary forces and couples. The reciprocating mass per cylinder is 15 kg. **(12 Marks)**

7 a. Define the following terms relating to Governor:
      i) Sensitiveness
      ii) Stability
      iii) Isochronism
      iv) Effort and power. **(08 Marks)**

   b. The Arms of a porter governor are each 250mm long and pivoted on the governor axis. The mass of each ball is 5kg and the mass of the central sleeve is 30kg. The radius of rotation of the balls is 150mm when the sleeve begins to rise and reaches a value of 200mm for maximum speed. Determine the speed range of governor. If the Friction at the sleeve is equivalent of 20N of load at the sleeve, Determine how the speed range is modified. **(12 Marks)**

8 a. Describe the effect of the gyroscopic couple on an aero plane for the following cases, with vector diagram: **(12 Marks)**

Case no.	Viewing from	Direction of rotation of propeller	Turn of the aero plane towards
1	Nose	Clock wise	Left
2	Nose	Counter clock wise	Left
3	Nose	Clock wise	Right
4	Nose	Counter clockwise	Right

   b. Each road wheel of a motor cycle has a moment of inertia of $2 kgm^2$. The rotating parts of the engine of the motor cycle has a moment of inertia of $0.2 kgm^2$. 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 CG is 500mm above ground level. The diameter of the wheel is 50mm. The motor cycle is travelling at 15m/sec. on a curve of 30m radius. Determine: i) Gyro couple, centrifugal couple, overturning and balancing couple in terms of angle of heel and ii) Angle of heel. **(08 Marks)**

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