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B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

June / July 2024 Semester End Main Examinations

Programme: B.E. **Semester: V**
Branch: Mechanical Engineering **Duration: 3 hrs.**
Course Code: 20ME5DCDOM / 16ME5DCDOM **Max Marks: 100**
Course: Dynamics of Machines

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may suitably be assumed.

UNIT - I

1 a) Explain how static force analysis is done on a slider crank mechanism. **06**

b) Determine T_2 for the static equilibrium of the mechanism shown in Fig (1). **14**
Given: AD = 800 mm, AB = 300 mm, BC = 700 mm and CD = 400 mm.

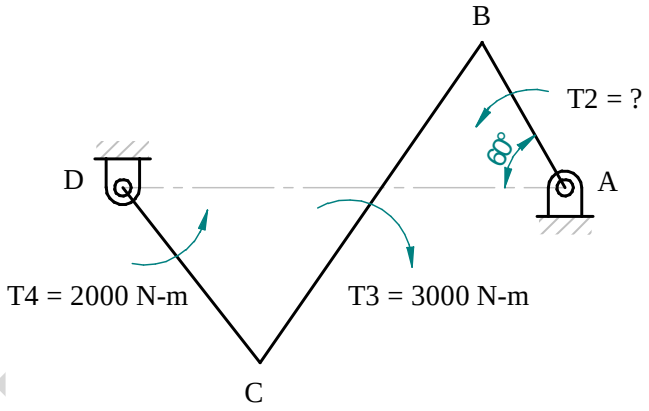

Fig (1)

OR

2 a) Show that $e_{max} = K_s I \omega^2/100$ and hence prove $e_{max} = 0.02 K_s E$, where e_{max} is Maximum fluctuation of energy, K_s is total fluctuation of speed and E is mean kinetic energy. **06**

b) The turning moment diagram for a four-stroke gas engine may be assumed for simplicity to be represented by four triangles, the areas of which from the line of zero pressure are as follows: **14**
Suction stroke = 0.45×10^{-3} m^2; Compression stroke = 1.7×10^{-3} m^2; Expansion stroke = 6.8×10^{-3} m^2; Exhaust stroke = 0.65×10^{-3} m^2. Each m^2 of area represents 3 MN-m of energy.
Assuming the resisting torque to be uniform, find the mass of the rim of a flywheel required to keep the speed between 202 and 198 rpm. The mean radius of the rim is 1.2 m.

UNIT - II

3 a) Derive an equation for max. Power transmitted by belt drive and show $\mathbf{v = \sqrt{\frac{T}{3m}}}$. **06**

b) A leather belt is required to transmit 15KW from a pulley of 1200mm effective diameter running at 300rpm. The angle of contact is spread over 5/12 of circumference and co-efficient of friction between belt and pulley is 0.3. If the safe working stress is 1.5MPa, mass of leather is 1gm/cc and thickness of belt is 10mm, determine the width of the belt taking centrifugal tension in to account. **14**

OR

4 a) Considering a circular arc cam with flat faced follower, derive the expressions for displacement velocity and acceleration of the follower when the flat face of the follower has contact on the circular flank. **08**

b) In a symmetrical tangent cam operating a roller follower, the least radius of the cam is 30 mm and roller radius is 17.5 mm. The angle of ascent is 75° and the total lift is 17.5 mm. The speed of cam shaft is 600 rpm. Assume that there is no dwell between ascent and descent. Calculate: **12**
(i) The principal dimensions of the cam
(ii) The accelerations of the cam at the beginning of the lift, where straight flank merges into the circular nose and at the apex of the circular nose.

UNIT - III

5 a) With the help of sketches, distinguish Static and Dynamic balancing. **08**

b) A shaft carries four masses A, B, C and D of magnitude 200 kg, 300 kg, 400 kg and 200 kg respectively and revolving at radii 80 mm, 70 mm, 60 mm and 80 mm in planes measured from A at 300 mm, 400 mm and 700 mm. The angles between the cranks measured anticlockwise are A to B 45°, B to C 70° and C to D 120°. The balancing masses are to be placed in planes X and Y. The distance between the planes A and X is 100 mm, between X and Y is 400 mm and between Y and D is 200 mm. If the balancing masses revolve at a radius of 100 mm, find their magnitudes and angular positions. **12**

UNIT - IV

6 a) The firing order in a 6-cylinder 4-stroke inline engine is 1-4-2-6-3-5. The stroke is 100 mm, connecting rod length is 200 mm, the pitch distance between the cylinder centre lines are 100 mm, 100 mm, 150 mm, 100 mm and 100 mm. Determine the out of balance primary and secondary forces and couples on this engine taking the mid plane between cylinders 3&4 as reference plane. The reciprocating mass per cylinder is 2 kg and the engine runs at 1500 rpm. **14**

b) How do the concept of direct and reverse cranks is made use of in estimating the unbalanced primary and secondary forces of an engine mechanism? **06**

UNIT - V

7 a) Discuss the stability of a Four-Wheeler taking Right Turn. The engine and wheel axle are parallel and rotate in the same sense. **10**

b) Each road wheel of a motor cycle has a moment of inertia of 1.5 kg-m^2. The rotating parts of the engine have a moment of inertia of 0.25 kg-m^2. The speed of the engine is six times the speed of the wheels and in the same sense. The mass of the vehicle along with the rider is 250 kg and its CG is 600 mm above the ground level. Find the angle of heel if the motor cycle is travelling at 60 KMPH and taking a turn of 30 m radius considering the wheel diameter as 600 mm. **10**

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