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Question Paper Code : 70166

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2021.

Third / Fourth Semester

Automobile Engineering

AT 6302 – MECHANICS OF MACHINES

(Common to Aeronautical Engineering, Industrial Engineering, Industrial Engineering and Managements and Manufacturing Engineering)

(Regulation 2013)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Differentiate the terms lower and higher pairs.

2. List out the different types of motion with which a follower can move.

3. State the law of Gearing.

4. Define contact ratio.

5. Explain why coefficient of friction as low in rolling friction.

6. List out the limitations of v-belt drive.

7. State the static equilibrium conditions.

8. What is use of D'Alembert's principle?

9. Why single cylinder engine can not be completely balanced.

10. Define critical speed of the shaft.

PART B — (5 × 13 = 65 marks)

11. (a) Explain the all four inversions of four bar mechanism.

Or

(b) (i) Discuss the nomenclature of cam and follower with neat sketch. (8)

(ii) Suggest a suitable cam profile for high speed application of cam. (5)

12. (a) (i) Derive an expression for the minimum number of teeth required on the pinion in order to avoid interference in involute gear teeth. (8)

(ii) Discuss atleast 5 methods to avoid interference. (5)

Or

(b) An epicyclic gear consists of three gears ring gear A, planet B and sun gear C. The gear A has 72 internal teeth and gear C has 32 external teeth. The gear B meshes with both A and C and is carried on an arm EF which rotates about the center of A at 18 rpm. If the gear A is fixed, determine the speed of gears B & C. (13)

13. (a) A single dry plate clutch transmits 7.5KW at 900 rpm. The axial pressure is limited to 0.07 N/mm^2. If the co-efficient of friction is 0.25, find (i) Mean radius and face width of the friction lining assuming the ratio of the mean radius to the face width as 4, and (ii) Outer and inner radii of the clutch plate. (13)

Or

(b) A shaft rotating at 200 rpm drives another shaft at 300 rpm and transmits 6 KW through a belt. The belt is 100mm wide and 10mm thick. The distance between the shafts is 4 m. the smaller pulley is 0.5 m in diameter. Calculate the stress in the belt, if it is (i) an open belt drive, and (ii) a cross belt drive. Take $\mu = 0.3$. (13)

14. (a) (i) The following forces are acting at a point: (i) 20 N inclined at 30° towards north of East. (ii) 25 N towards North, (iii) 30 N towards North West, and (iv) 35N inclined at 40° towards South of West. Find the magnitude and direction of the resultant of force. (7)

(ii) A hammer of mass 400 kg, falls through a height of 3 m on a pile of negligible mass. If it drives the pile 1 m into the ground, determine the average resistance of the ground per penetration. (6)

Or

(b) The single cylinder engine has following specification :

(i) Mass of piston is 1.5 kg.

(ii) Crank radius = 100 mm.

(iii) Length of connecting rod = 500 mm.

(iv) rpm of crank = 1000 rpm.

When θ =(Crank angle) is 60° find the Intertia free and inertial torque on Crank shaft. (13)

15. (a) A shaft carries 4 masses A, B, C and D of magnitude 200, 300. 400 and 200 kg respectively and revolving at radii 80, 70,60 and 80 mm in planes measured from A at 300, 400 and 700 mm. The angles between the cranks measured in anti-clock wise direction are A-B 45°, B-C 70°, and C-D 120°. The balancing masses are to be placed in planes X and Y located 100 and 500mm from A. if the balancing masses revolve at a radius of 100mm, find their magnitudes and angular positions. (13)

Or

(b) A horizontal shaft of 5 mm diameter is 200 mm long and is supported in long bearings at its ends. A disc of mass 50 kg is attached to the centre of the shaft. Neglecting any increase in stiffness due to the attachment of the disc to the shaft, find the critical speed of rotation and the maximum bending stress when the shaft is rotating at 75% of the critical speed. The center of the disc is 0.25 mm from the geometric axis of the shaft. $E = 200\ GN/m^2$. (13)

PART C — (1 × 15 = 15 marks)

16. (a) The crank of a slider mechanism rotates clockwise at a constant speed of 300 rpm. The crank is 150mm and the connecting rod is 600 mm long. Determine (i) Linear velocity and acceleration at the mid-point of connecting rod. (ii) Angular velocity and angular acceleration of connecting rod at a crank angle of 45° from inner dead centre position. (15)

Or

(b) A four bar mechanism ABCD has the link AB as crank, BC as coupler, CD as the output link and AD as fixed link. The X and Y coordinates of the points are: A (0,0), B (0,50), C (50,50) and D (100,0). AB rotates at a constant angular velocity of 10 rad/s (cw). Determine the angular acceleration of BC and DC. (15)

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