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Question Paper Code : 20146

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2018.

Third / Fourth Semester

Automobile Engineering

AT 6302 — MECHANICS OF MACHINES

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

(Regulations 2013)

Time : Three hours Maximum : 100 marks

(Drawing sheets may be permitted)

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Differentiate mechanism and structure with examples.
2. List the important applications of a single slider crank mechanism.
3. Differentiate between speed ratio and train value in gear trains.
4. Classify gears according to its axis position and the arrangement of teeth.
5. Write the expression of torque required to lower the load in a screw jack.
6. State the purpose of cross belt drives in industrial applications.
7. State the conditions for static equilibrium and dynamic equilibrium of machine parts.
8. Explain the meaning of superposition principle of mechanisms.
9. State the conditions of dynamic balancing of rotating systems.
10. Differentiate between free vibrations and damped vibrations.

PART B — (5 × 13 = 65 marks)

11. (a) In a slider crank mechanism, the length of the crank and connecting rod are 150 mm and 600 mm respectively. The crank position is 60° from inner dead centre. The crank shaft speed is 250 r.p.m. (anticlockwise). Using analytical method, determine : (i) Velocity and acceleration of the slider, and (ii) Angular velocity and angular acceleration of the connecting rod.

Or

(b) Sketch and explain any three inversions of double slider crank chain mechanism.

12. (a) The following data refers to two mating involute gears of 20° pressure angle. The number of teeth on pinion is 25. Gear ratio = 3, speed of pinion is 250 rpm, module =12 mm. The addendum on each wheel is equal to one module. Calculate (i) the path of approach (ii) the path of recess (iii) length of path of contact (iv) length of arc of Contact; and (v) contact ratio.

Or

(b) Draw and explain the different types of gear trains.

13. (a) (i) A single plate clutch, both sides are effective, is required to transmit 35 kW at 200 rpm, the pressure being applied axially by means of springs and limited to 150 N/cm^2. If the outer diameter of the plate is to be 300 mm, find the required inner diameter of the clutch ring and the total force exerted by the springs. Assume the wear to be uniform and a co-efficient of friction of 0.3. (7)

(ii) The mean diameter of a square threaded screw jack is 50 mm. The pitch of the thread is 10 mm. The coefficient of friction is 0.15. What force must be applied at the end of a 0.7 m long lever, which is perpendicular to the longitudinal axis of the screw to raise a load of 20 kN and to lower it? (6)

Or

(b) A compressor, requiring 90 kW is to run at about 250 r.p.m. The drive is by V belts from an electric motor running at 750 r.p.m. The diameter of the pulley on the compressor shaft must not be greater than 1 metre while the centre distance between the pulleys is limited to 1.75 metre. The belt speed should not exceed 1600 m/min. Determine the number of V-belts required to transmit the power if each belt has a cross sectional area of 375 mm^2, density 1000 kg/m^3 and an allowable tensile stress of 2.5 MPa. The groove angle of the pulley is 35°. The coefficient friction between the belt and the pulley is 0.25.

14. (a) Figure Q.14 (a) shows a slider crank mechanism in which the resultant gas pressure 8×10^4 N/m^2 acts on the piston of cross sectional area 0.1 m^2. The system is kept in equilibrium as a result of the couple applied to the crank 2, through the shaft at O_2. Determine forces acting on all the links (including the pins) and the couple on 2. OA = 100 mm, AB = 450 mm.

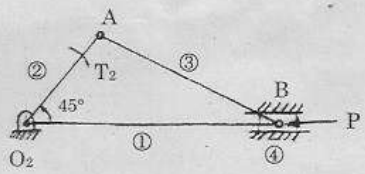

Fig Q. 14 (a)

Or

(b) A four-link mechanism with the following dimensions is acted upto by a force 80 N at angle 150° on link DC in Fig. 14 (b) : AD = 50 mm, AB = 40 mm, BC = 100 mm, DC = 75 mm, DE = 35 mm. Determine the input torque T on the link AB for the static equilibrium of the mechanism for the given configuration.

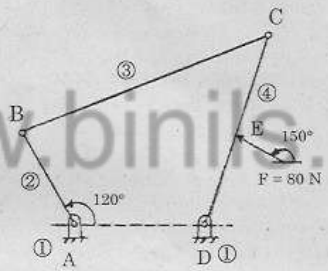

Fig Q. 14 (b)

15. (a) A, B, C, and D are four masses carried by a rotating shaft at radii 100, 125, 200, and 150 mm respectively. The planes in which the masses revolve are spaced 600 mm apart and the masses of B, C and D are 10 kg, 5 kg and 4 kg respectively. Find the required mass A and the relative angular settings of the four masses so that the shaft shall be in complete balance.

Or

(b) A shaft of length 1.25 m is 75 mm in diameter for the first 275 mm of its length, 125mm in diameter for the next 500 mm length, 87.5 mm in diameter for the next 375 mm length and 175 mm in diameter for the remaining 100 mm of its length. The shaft carries two rotors at two ends. The mass moment of inertia of the first rotor is 75 kgm^2 where as of the second rotor is 50 kgm^2. Find the frequency of natural torsional vibrations of the system. The modulus of the rigidity of the shaft material may be taken as 80 GN/m^2.

PART C — (1 × 15 = 15 marks)

16. (a) A cam rotates clockwise at a uniform speed of 1500 rpm. It is required to give a roller follower with the following motion defined below :

(i) Follower to move outwards through 50 mm during 130° of cam rotation.

(ii) Follower to dwell for next 60° of cam rotation.

(iii) Follower to return to its starting position during next 130° of cam rotation.

(iv) Follower to dwell for the rest of the cam rotation.

The minimum radius of the cam is 35 mm and the diameter of the roller is 15 mm. The line of the stroke of the follower is off-set by 20 mm from the axis of the cam shaft. The displacement of the follower takes place with equal acceleration and retardation. Draw the cam profile for the given conditions.

Or

(b) An epicyclic gear consists of three gears A, B and C as shown in Fig Q. 16 (b). 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 centre of A at 18 rpm. If the gear A is fixed, determine the speed of gears B and C.

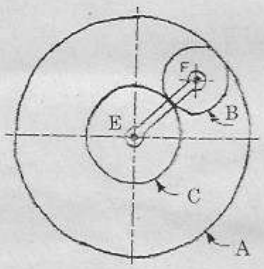

Fig Q. 16 (b)