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Question Paper Code : P 1012

SPATER

B.E/B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2009.

Fourth Semester

Aeronautical Engineering

AE 1253/AT 1252/PR 1252 — MECHANICS OF MACHINES

(Common to Automobile Engineering and Production Engineering)

(Regulation 2004)

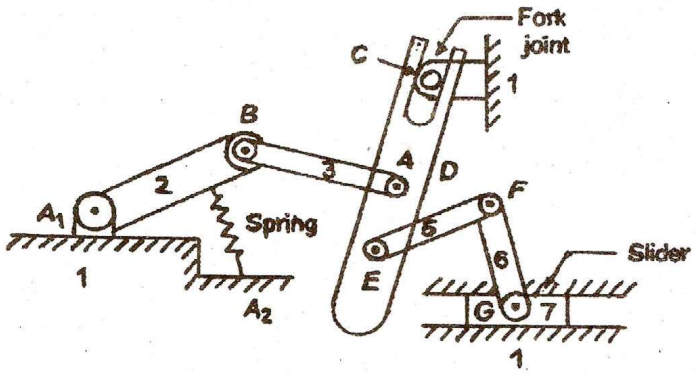
Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. State the difference between a planar mechanism and spatial mechanism.

2. Determine the number of degrees of freedom of the mechanism shown below :



3. Define limiting angle of friction and angle of repose.

4. Why is the pulley face given a convex curvature and is never kept flat?

5. List a comparison between involute and cycloidal tooth profile for the following characteristics; pressure angle, ease to manufacture, centre distance and interference.

6. What is meant by a reverted gear train and state atleast 2 applications of the same?

7. What is the difference between a discrete and a continuous system? Is it possible to solve any vibration problem as a discrete one?

8. Define static balancing and dynamic balancing. State the necessary condition to achieve them.

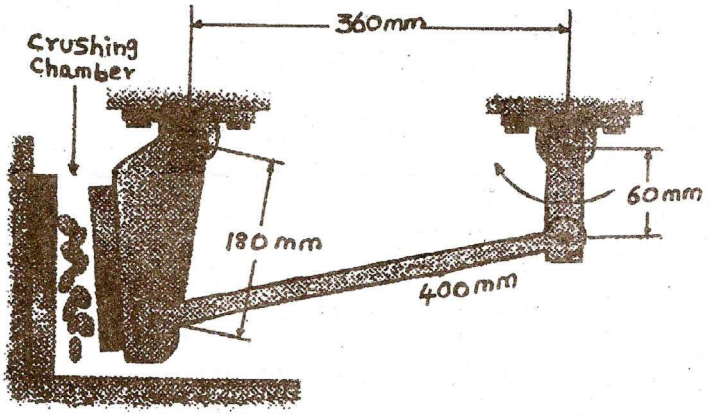
9. What is meant by whirling speed?

10. Explain why only a part of the unbalanced force due to reciprocating masses is balanced by revolving mass.

PART B — (5 × 16 = 80 marks)

11. (a) (i) What is meant by kinematic inversion and state the applications of the various inversions of a four bar kinematic chain. (6)

(ii) The figure below shows a rock crushing mechanism. Determine the rotational velocity of the crushing ram, in the shown configuration, as the 60 mm cranks rotates at 120 rpm, clockwise. (10)



Or

(b) In a slider crank mechanism the crank radius is 10 cm and the connecting rod 40 cm long. The crank rotates in anticlockwise direction at a constant speed of 600 rpm. Find the acceleration of the slider and angular acceleration of connecting rod at an instant when the crank is past the inner dead centre by 45 degrees.

12. (a) A single plate clutch, with both sides effective, has inner and outer diameters of friction surface to be 250 mm and 350 mm respectively. The maximum intensity of pressure is not to exceed 0.15 MPa. The coefficient of friction is 0.3. Determine the power transmitted by the clutch at a speed of 2400 rpm for (i) uniform wear, and for (ii) uniform pressure

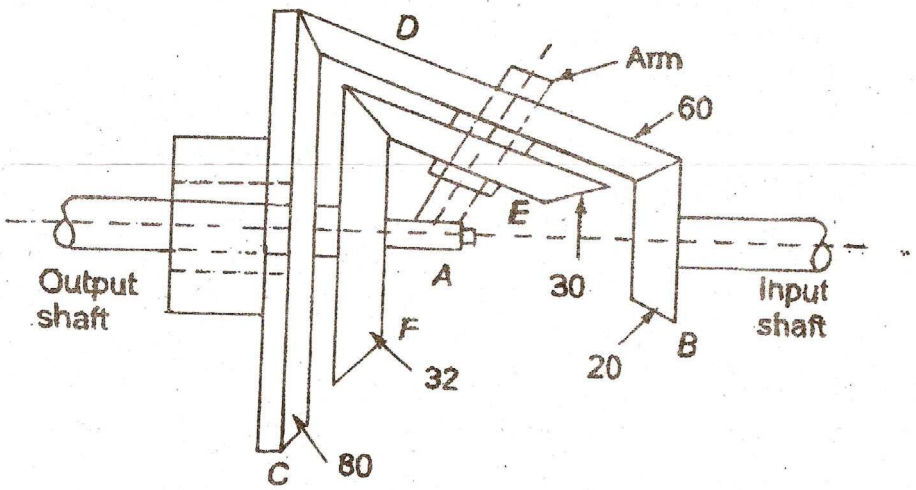
Or

(b) An open belt drive is used to connect two parallel shafts 4 m apart. The diameter of bigger pulley is 1.5 m and that of the smaller pulley is 0.5 m. The mass of the belt is 1 kg/m length. The maximum tension is not to exceed 1500 N. The coefficient of friction is 0.25. The bigger pulley, which is the driver, runs at 250 rpm. Due to slip, the speed of the driven pulley is 725 rpm. Calculate the power transmitted, power lost in friction and efficiency of the drive.

13. (a) Two 20 degree involute gears in mesh have a gear ratio of 2 and 20 teeth on the pinion. The module is 5 mm and the pitch line speed is 1.5. m/s. Assuming addendum to be equal to one module, find the angle turned through by pinion when one pair of teeth is in mesh and maximum velocity of sliding.

Or

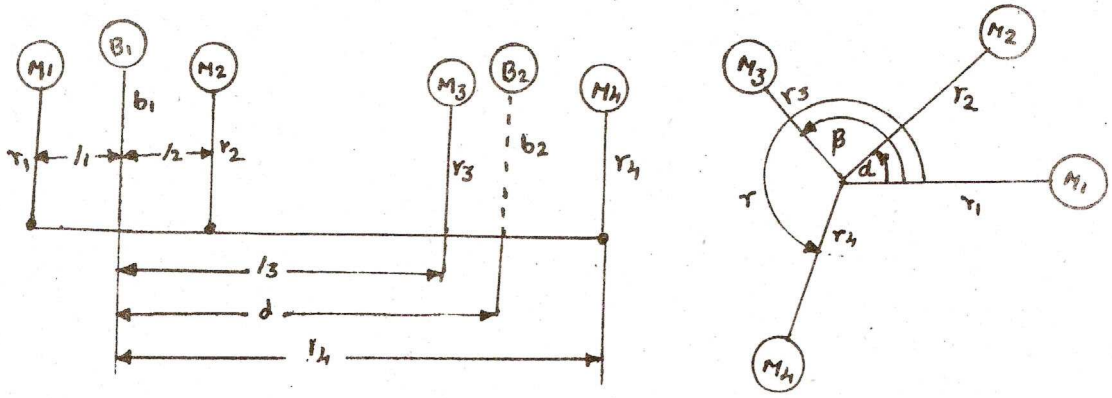
(b) In a gear train, shown below, the gear B is connected to the input shaft. The arm A carrying the compound wheels D and E, turns freely on the output shaft. If the input speed is 1200 rpm anti clockwise, when seen from the right, determine the speed of the output shaft under the following conditions (i) when the gear C is fixed, and (ii) when gear C rotates at 10 rpm counter clockwise direction.



14. (a) A twin cylinder uncoupled locomotive has its cylinders 60 cm apart and balanced masses are 60° apart, the planes being symmetrically placed about the centre line. For each cylinder, the revolving masses are 300 kg at crank pin radius of 32 cm and reciprocating parts 285 kg. All the revolving and 2/3rd of the reciprocating masses are balanced. The driving wheels are 1.8 m diameter. When the engine runs at 60 KMPH, find (i) the swaying couple, (ii) the variation in tractive effort and (iii) the hammer blow. The distance between centre line of wheels is 1.5 m.

Or

(b) A shaft carries four rotating masses as shown in the figure. The balancing masses are to be placed in planes L and M. If the balancing masses revolve at a radius of 100 mm, find their magnitude and angular positions.



15. (a) A vibrating system is defined by the following parameters :

m = 2 kg, k = 100 N/m C = 3 N-sec/m

Determine (i) the damping factor, (ii) the natural frequency of damped vibration (iii) Logarithmic decrement (iv) the ratio of two consecutive amplitudes and (v) the number of cycles after which the original amplitude is reduced to 10 percent.

Or

(b) Two equal masses of weight 400 kg each and radius of gyration 40 cm are keyed to the opposite ends of a shaft 60 cm long. The shaft is 7.5 cm diameter for the first 25 cm of its length, 12.5 cm diameter for the next 10 cm and 8.5 cm diameter for the remaining of its length. Find the frequency of free torsional vibrations of the system and the position of node.
