Reg. No. : ☐☐☐☐☐☐☐☐☐☐☐☐

Question Paper Code : 21200

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2022.

Fourth Semester

Production Engineering

PR 8451 – MECHANICS OF MACHINES

(Common to : Aeronautical Engineering/Aerospace Engineering/Automobile Engineering/Industrial Engineering/Manufacturing Engineering/Mechanical and Automation Engineering)

(Regulations 2017)

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Mention any two differences between Machine and Structure.

2. What is a Mechanism?

3. Define Module of a gear.

4. What are the general methods to avoid tooth interference?

5. List the advantages of belt drive.

6. What is the function of the clutch?

7. Define the static and dynamic balancing.

8. What happens when a system is unbalanced?

9. Define resonance.

10. Why critical damping is important? Give examples.

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Notes   *Available @*

Syllabus
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PART B — (5 × 13 = 65 marks)

11. (a) In Fig. 1, the angular velocity of the crank OA is 600 r.p.m. Determine the linear velocity of the slider D and the angular velocity of the link BD, when the crank is inclined at an angle of 75° to the vertical. The dimensions of various links are OA = 28mm; AB = 44 mm; BC = 49mm ; and BD 46 mm The centre distance between the centres of rotation O and C is 65mm. The path of travel of the slider is 11 mm below the fixed-point C. The slider moves along a horizontal path and OC is vertical.
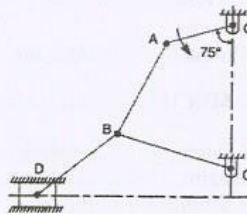

Fig. 1

Or

(b) Draw the profile of a cam operating a knife-edge follower having a lift of 30 mm. The cam raises the follower with SHM for 150° of the rotation followed by a period of dwell for 60°. The follower descends for the next 100° rotation of the cam with uniform velocity, again followed by a dwell period.

The cam rotates at a uniform velocity of 120 rpm and has a least radius of 20 mm. What will be the maximum velocity and acceleration of the follower during the lift and the return?

12. (a) Explain the condition for a constant velocity ratio of toothed wheels with neat sketch. State the advantages of involute gears.

Or

(b) Calculate the train value for the following (Fig.2 and Fig.3) gear trains in terms of 'T' and 'N'. Also comment about the results. What is the function of gear box?
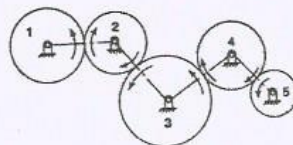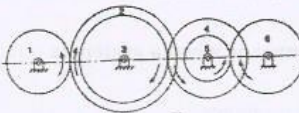

Fig. 2   Fig. 3

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13. (a) Derive the condition for maximum efficiency of square threaded screw-jack and comment about (i) over hauling (ii) self-locking.

Or

(b) Derive the relation for the ratio of tensions in the flat belt drives and state the condition for the maximum power transmission.

14. (a) Four masses m_1, m_2, m_3 and m_4 are 200 kg, 300 kg, 240 kg and 260 kg respectively. The corresponding radii of rotation are 0.2 m, 0.15 m, 0.25 m and 0.3 m respectively and the angles between successive masses are 45°, 75° and 135°. Find the position and magnitude of the balance mass required, if its radius of rotation is 0.2 m.

Or

(b) A Porter governor has equal arms each 250mm long and pivoted on the axis of rotation. Each ball has a mass of 5kg and the mass of the central load on the sleeve is 25kg. The radius of rotation of the ball is 150 mm when the governor begins to lift (Fig.4) and 200 mm when the governor is at maximum speed. Find the minimum and maximum speeds and range of speed of the governor.
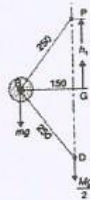

Fig. 4

15. (a) In a single-degree damped vibrating system, a suspended mass of 8kg makes 30 oscillations in 18 seconds. The amplitude decreases to 0.25 of the initial value after 5 oscillations. Determine the (i) stiffness of the spring (ii) logarithmic decrement (iii) damping factor and (iv) damping coefficient

Or

(b) Determine the frequency of torsional vibrations of the disc shown in Fig.5 if both the ends of the shaft are fixed and the diameter of the shaft is 40mm. The disc has a mass of 96 kg and a radius of gyration of 0.4 m. Take modulus of rigidity for the shaft material as 85 GN/m². = I_1 m and I_1 = 0.8m.

Fig. 5

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PART C — (1 × 15 = 15 marks)

16. (a) What are inversions in mechanism? Draw schematic sketches of any two inversions of a four-bar chain. Is cycling forms the four-bar chain with rider? Draw the schematic sketch and show the fixed, rotating and oscillating links in it.

Or

(b) Draw the block-diagram for the location and links between the governor, clutch and gear box in an engine. Briefly discuss its functions.

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