Reg. No. : ☐☐☐☐☐☐☐☐☐☐☐☐

Question Paper Code : 71097

M.E. DEGREE EXAMINATION, JUNE/JULY 2013.

Second Semester

CAD/CAM

CD 9221/CD 921/ UCD 9121/10222 ED 103 – INTEGRATED MECHANICAL DESIGN

(Common to M.E. Computer Aided Design and M.E. Engineering Design)

(Regulation 2009/2010)

Time : Three hours   Maximum : 100 marks

Answer ALL questions. All questions carry equal marks.

Design data book permitted

PART A — (10 × 2 = 20 marks)

1.   Define standardisation.

2.   What is meant by group tolerances?

3.   Define maximum shear stress.

4.   Write briefly about BIS standards.

5.   What is meant by gear correction?

6.   List gear tooth failure modes.

7.   Mention types of brakes.

8.   What are the thermal consideration in brake design?

9.   What is the need for an integrated design?

10. Mention the problems in integrated design.

PART B — [(2 × 16 = 32) + (1 × 48)]

11. (a)   A mild steel shaft transmits 23kW at 200 r.p.m. It carries a central load of 900 N and is simply supported between the bearings 2.5 meters apart. Determine the size of the shaft, if the allowable shear stress is 42 MPa and the maximum tensile or compressive stress is not exceed 56MPa. What size of the shaft will be required, if it is subjected to gradually applied loads?   (16)

Or

(b) A pair of cast iron bevel gears connects two shafts at right angles. The pitch diameters of the pinion and gear are 80 mm and 100 mm respectively. The tooth profiles of the gear are of 141/2°composite form. The allowable static stress for both the gears is 55 Mpa. If the pinion transmits 2.75kW at 1100 r.p.m., find the module and number of teeth on each gear from the standpoint of strength and check the design from the standpoint of wear. Take surface endurance limit as 630 MPa and modulus of elasticity for cast iron 84kN/mm². (16)

12. (a) A rope drum of an elevator having 650 mm diameter is fitted with a brake drum of 1 m diameter. The brake drum is provided with four cast iron brake shoes each subtending an angle of 45°. The mass of the elevator when loaded is 2000 kg and moves with a speed of 2.5 m/s. The brake has a sufficient capacity to stop the elevator in 2.75 m. Assuming the co-efficient of friction between the brake drum and shoes as 0.2, find : 1. width of the shoe, if the allowable pressure on the brake shoe is limited to 0.3N/mm²; and 2. heat generated in stopping the elevator. (16)

Or

(b) A single band brake operators on a drum of 600 mm in diameter that is running at 200 r.p.m. The coefficient of friction is 0.25. The brake band has a contact of 270°, one end is fastened to a fixed pin and the other end to the brake arm 125 mm from the fixed pin. The straight brake arm is 750 mm long and placed perpendicular to the diameter that bisects the angle of contact.

   (i) What is the pull necessary on the end of the brake arm to stop the wheel if 35kW is being absorbed? What is the direction for this minimum pull? (8)

   (ii) What width of steel band of 2.5 mm thick is required for this brake if the maximum tensile stress is not to exceed 50 MPa? (8)

13. (a) The Back gear mechanism of a lathe is to have a speed reduction from cone pulley to the spindle of 8:1 with a centre distance 200 mm approximately. The gears used are of 20° full-depth involute spur gears. The drive is obtained from a 25 cm diameter pulley fixed into a 3 hp motor running at 480 rpm. The pulley drives another pulley 45 cm diameter on cross-section which carries a 3-stepped cone pulley of 35 cm, 25 cm and 15 cm diameter. The safe working stress for shaft and key material is 42 MPa in shear. The safe tension per cm width of the belt is 200N. Ratio of tensions T1/T2 = 3. Safe stress in the arm of pulley is 35 MPa. Other data if needed may be assumed. Design the following.

   (i) Main hollow spindle

   (ii) Belt

   (iii) Gears

   (iv) Intermediate shaft (lay shaft)

   (v) Bearing. (48)

Or

(b) Design and draw a hand operated screw press for 2 ton capacity to the following details.

  (i) Frame (made of cast iron)

  (ii) Screw rod(select suitable carbon steel material).

  (iii) Bush(bronze).

  (iv) Pressure plate(high grade cast iron).

  (v) Foundation bolts (select suitable carbon steel materials).

Selection of screw frame is I – section.
Safe working stresses shall be based on standards. Unsupported length of a screw is 600 mm. (48)

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