G 6067

M.E. DEGREE EXAMINATION, MAY/JUNE 2007.

First Semester

Computer Aided Design

CD 1603 — INTEGRATED MECHANICAL DESIGN

(Common to M.E. CAD/CAM)

(Regulation 2005)

Time : Three hours Maximum : 100 mar

Use of approved design data book is permitted.

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Mention the surface finish and tolerances obtained by processes (a) Milling ar (b) Grinding.

2. Define modular construction and cite an example.

3. What is critical speed of a shaft?

4. What are the details provided in the production drawing of a shaft?

5. What are the common gear failure modes?

6. State the criteria for determination of minimum centre distance of gears.

7. Why is uniform rate of wear assumed for design of clutches?

8. How are number of plates and effective number of surfaces related in clutch?

9. Define self energizing brake.

10. State the advantage of self locking brakes?

PART B — (5 × 16 = 80 marks)

11. (a) Discuss the various distinct design related tasks of conventional design process. Explain how are these better performed by CAD.

Or

(b) (i) Explain with an example the various factors that influence the design for assembly.

(ii) Explain the significance of integration of various steps in design.

12. (a) The shaft an air compressor is subjected to a maximum twisting moment of 1500 N-m and a maximum bending moment of 3000 N-m. Neglecting the axial load on the shaft determine the diameter of the shaft, if the allowable shear stress is 50 N/mm^2. Assume K_b = 1.5 and K_t = 1.2. If the shaft is to be a hollow one with d_i/d_o = 0.3, subjected to the same loading and made of the same material as the solid shaft, compare the torsional stiffness of the two shafts.

Or

(b) A shaft is supported in bearings, separated by a distance of 1 metre. It carries a pulley of weight 100 N in the center and transmits power with tensions in the belt on the tight and slack sides as 600 N and 200 N respectively. Determine the diameter of the shaft by using C40 material with factor of safety 2.

13. (a) Design a pair of helical gears to transmit 60 kW between a 3000 rpm electrical motor and a 750 rpm load that is essentially free of shock. 40 hour/week operation is anticipated. State a satisfactory combination of module, numbers of teeth, helix angle, pressure angle, face width, manufacturing accuracy and material and hardness.

Or

(b) A worm is driven by a 300 rpm motor delivering 3 kW. The worm is hardened steel and the wheel chill-cast bronze. It has a right-hand triple-threaded worm, 16 : 1 velocity ratio. Design the drive and estimate the heat generation rate and the heat dissipation capacity assuming suitable data.

14. (a) (i) Describe the working principle of over running clutch with a neat sketch. (6)

(ii) A plate clutch has a pair of mating friction surfaces with 330 mm outside diameter and 220 mm inside diameter. The co-efficient of friction is 0.3 and the permissible pressure is 850 kPa. Find the torque that can be transmitted using the uniform-wear assumption. (10)

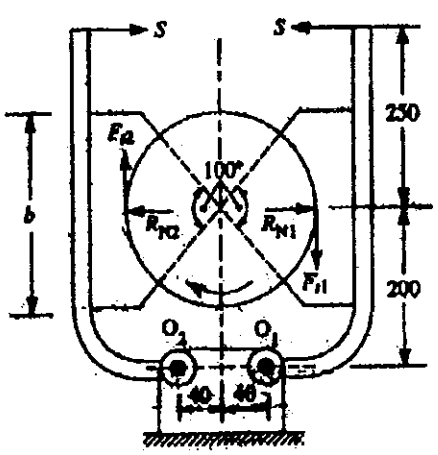
Or

(b) A multiple plate clutch has 3 discs on the driving shaft and 2 discs on th driven shaft. The outside diameter of the contact surface is 250 mm an inside diameter 130 mm. Assuming uniform pressure and $\mu = 0.3$, fin the total spring load exerted on the plates together to transmit 25 kW a 1600 rpm. If there are 6 springs each of stiffness 15 kN/m, find th maximum power that can be transmitted, assuming uniform wear.

15. (a) A rope supports a load and is wound round a barrel 500 mm diameter. differential band brake acts on a drum 750 mm diameter which is keye to the same shaft on the barrel. The two ends of the bands are attache to pins on opposite sides of the fulcrum of the brake level and at distanc of 25 mm and 100 mm from fulcrum. The angle of lap of the brake band i 250° and the coefficient of friction is 0.25. What is the maximum load which can be supported by the brake when a force of 75 N is applied t the lever at a distance of 3000 mm from the fulcrum?

Or

(b) A double shoe brake, as shown in figure 15 (b) is capable of absorbing torque of 1400 N-m. The diameter of the brake drum is 350 mm and th angle of contact for each side is 100°. If the coefficient of friction betwee the brake drum and lining is 0.4, find : (i) the spring force necessary t set the brake and (ii) the width of the brake shoes, if the bearing pressu on the lining material is not to exceed 0.3 N/mm².



ALL DIMENSIONS ARE IN 'mm'

Figure 15 (b)