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Question Paper Code : 81166

M.E. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2013.

Computer Aided Design

Second Semester

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

(Common to M.E. CAD/CAM and M.E. Engineering Design)
(Regulation 2009/2010)

Time : Three hours

Maximum : 100 marks

Use of approved Design data book is permitted.

Assumptions and assumed data have to be stated clearly.

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is the difference between ductile and brittle materials?
2. Write briefly about BIS standards.
3. What is contact ratio?
4. What is cyclic stress?
5. What is equivalent spur gear?
6. What do you mean by a self— energizing and self-locking in brakes?
7. Mention the types of stresses that are induced in shafts.
8. What types of stresses are produced in a belt used for power transmission?
9. Differentiate between speed reducer and gear box.
10. List the gear tooth failure modes.

PART B — (80 marks)

(2 × 16 = 32) + (1 × 48)

11. (a) A shaft is required to transmit 25kW at 400rpm. It is supported on two bearings 600mm apart and two gears are keyed on it. A 20 teeth, 14.5° involute, 5mm module pinion is located at 125mm to the right of the right bearing and delivers power to a gear directly below the shaft. A 75 teeth, 14.5° involute, 8mm module gear is located at 250mm to the right of the left bearing and receives power from a pinion, directly above it. Determine the diameter if permissible normal stress is 85MPa. (16)

Or

(b) The spindle of a drill is to run at 12 different speeds in the range of 100rpm to 355rpm. The drive is from an electric motor of 5kW at 360rpm. Design a gear box with a standard step ratio. Design should include the following.

(i) Kinematic arrangement

(ii) Speed diagram

(iii) Spur gear design (16)

12. (a) In a turbine drive 300kW power is transmitted using a pair of double helical gear. The pinion speed is 2950 rpm and that of the gear is about 816.5 rpm. There are no space constraints on the gear drive. Selecting suitable materials, design the pinion and the gear to last for 108 cycles. Design the gearbox completely. (16)

Or

(b) A single band brake operates on a drum of 600 mm in diameter that is running at 200 rpm. 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?

(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? (16)

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 250mm approximately. The gears used are of 20° full depth involute spur gears. The drive is obtained from a 300mm diameter pulley fixed into a 3.5hp motor running at 550 rpm. The pulley drives another pulley 550mm diameter on cross section which carries a 3 stepped cone pulley of 400mm, 300mm and 200mm diameter. The safe tension per cm width of the belt is 200N. Ratio of tension $T_1/T_2 = 3$ Safe stress in the arm of the pulley is 40MPa. Other data if needed may be assumed. Design the following

(i) Main hollow spindle

(ii) Belt

(iii) Gears

(iv) Lay shaft

(v) Bearing. (48)

Or

(b) Design a belt bucket elevator for the given data.

Service use - Raise crushed product from mill outlet to storage silo.

Material chemical name- Aluminum Sulphate.

Bulk density - 1700 kg/m^3 .

Maximum duty - $5,000 \text{ kg/hr}$

Maximum lump size - 3 mm max.

Average size - 2 mm

Percentage of lumps in total — Nil.

Height product is to be raised and angle of inclined : 5.5 m including length of discharge chute into 4 m high storage silo.

Temperature of product — Ambient`

Angle of repose : 30°

Service required : Intermittent. Up to 12 hours per day 6 days a week.

Open or closed boot design - Open boot bottom, elevator will sit on a Concrete floor. (48)