

PSG POLYTECHNIC COLLEGE, COIMBATORE - 641 004

DIPLOMA ODD SEMESTER EXAMINATIONS – OCT / NOV 2014

M12404 / D12404 DESIGN OF MACHINE ELEMENTS

Time: 3 Hours

Max. Marks: 100

Instructions:

1. Answer any **TEN** questions in **Group A**.
2. Answer any **THREE** questions in **Group B**.
3. Answer any **ONE** question in **Group C**.
4. **Group B** contains design problems in flat belt, v-belt, chain drives, spur gear, helical gear and bearings. **Group C** contains shaft and gear box design problems only.
5. PSG Design Data book is permitted to use.

Group - A

Marks: 10 x 3 = 30

1. Write short notes on theories of failure.
2. Define: Slip & Factor of Safety.
3. What is meant by crowning of pulleys?
4. List any three advantages of V-belt drive over flat belt drive.
5. List the important points to be considered during the installation of chain drives?
6. Define: Module, Addendum & Dedendum
7. List out the different types of gear used.
8. What are the advantages of worm gears?
9. With an example, explain the standards used for bearing specification.
10. Compare Sliding contact and Rolling contact bearings.
11. What is meant by Dynamic load carrying capacity of a bearing?
12. List out the forces acting on a shaft drive.
13. What are the different types of transmission shafts?
14. List out the different types of gear boxes used in an automobile.
15. What is the importance of a speed diagram in a gear box design?

Group - B

Marks: 3 x 16 = 48

16. Select a **Flat belt** from the manufacturers catalog to transmit 8 kW of power at 960 rpm. The speed of the driven pulley is 750 rpm. The approximate center distance is 2.5m. The drive is used for machine tool application.
17. Design a **V-belt** drive to transmit 20 kW at 700 rpm to an aluminium rolling machine. The speed ratio is 2.5. The maximum distance between the pulleys is 3m. The driving unit is high torque ac motor.

18. Select a **Roller chain** from the manufacturers catalog to transmit the power of 20kW motor to a reciprocating pump. The pump is to operate 24 Hrs per day continuously at constant load. The speed of the motor is 600 rpm and that of the pump is 200 rpm. Check the selected chain breaking load for its power transmitting capacity. Also determine the sprocket dimensions.
19. Design a pair of **Spur gears** to transmit a power of 6kW at 1440 rpm. The gear ratio is kept at 2.5 and the material for pinion is 15Ni2Cr1Mo15 and for the gear it is C45. Check the design for its bending and contact compressive strength only.
20. Select a deep groove **Ball bearing** to carry a radial load of 300 kgf and an axial load of 220 kgf. The bearing is to run for 8 hrs a day for 3 years at 450 rpm. The bearing is used for applications having continuous and steady load.

Group - C

Marks: 1 x 22 = 22

21. A **Shaft** is supported on bearings A and B, 900mm apart. The shaft carries a 20^o straight tooth spur gear located 250mm to the right of the left end bearing A and a pulley is 200 mm to the left of right end bearing B. The diameter of the gear and pulley are 250mm and 350mm respectively. The drive for the pulley is vertically downwards and for the gear is at an angle of 60^o to the horizontal at right top. The gear rotates in counter clockwise direction as seen from the left side. The pulley receives power from a motor and the gear supplies power to some external sources. The belt tension ratio is kept at 2.5. The shaft has to transmit the power of 7.5 kW and it rotates at a speed of 650 rpm. Design the shaft by assuming $K_b = 2$ and $K_t = 1.5$ and the allowable shear stress is 40 N/mm².
22. Design and sketch the arrangement of a **9 Speed Gear box** for the following specification:
- | | |
|---------------------------|------------|
| Maximum speed | : 900 rpm |
| Minimum speed | : 150 rpm |
| Input from electric motor | : 10 kW |
| Motor speed | : 1440 rpm |
- Also fix the number of teeth in all gears based on standard speed ratios.

/END/

Note: Group **B** & Group **C** questions are having design problems of more than 10 to 15 steps of answers which will give the detailed design procedure of flat belt, v-belt, chain drives, spur gear, helical gear, bearings, shaft and gear box.