

Code: MEMD1T6B

I M.Tech - I Semester - Regular Examinations – April, 2015

**GEAR ENGINEERING
(MACHINE DESIGN)**

Duration: 3 hours

Marks: 5x14=70

Answer any FIVE questions. All questions carry equal marks

1. a) What are the desirable properties of a gear material? 4 M
- b) Discuss the gear manufacturing processes. 6 M
- c) Explain the selection of right kind of gears for a given application. 4 M
2. A 15kW and 1200 r.p.m. motor drives a compressor at 300 r.p.m. through a pair of spur gears having 20° stub teeth. The centre distance between the shafts is 400 mm. The motor pinion is made of forged steel having an allowable static stress as 210 MPa, while the gear is made of cast steel having allowable static stress as 140 MPa. Assuming that the drive operates 8 to 10 hours per day under light shock conditions, find from the standpoint of strength:
a) Module b) Face width and c) Number of teeth and pitch circle diameter of each gear. Check the gear thus designed from the consideration of wear. The surface endurance limit may be taken as 700 MPa. 14 M

3. Pair of helical gears are to transmit 15 kW. The teeth are 20° stub in diametral plane and have a helix angle of 45° . The pinion runs at 10,000 rpm and has 80 mm pitch diameter. The gear has 320 mm pitch diameter. If the gears are made of cast steel having allowable static strength of 100 Mpa. Determine the suitable module and face width from static strength considerations and check the gears for dynamic and wear loads. Given $\sigma_{cs} = 618$ MPa. 14 M

4. A pair of bevel gears to connect two shafts at right angles and transmit 9 kW. The allowable static stress for pinion and gear materials may be taken respectively as 85 MPa and 55 MPa and brinall hardness of 200 and 160. The speed may be assumed as 1200/420 rpm and number of teeth may be assumed as 21 for pinion and 60 for gear. Tooth profile may be taken as 20° full depth involute. Check the design for dynamic and wear loads. 14 M

5. The following data refer to a worm and worm gear drive:
 - i) centre distance=200mm
 - ii) pitch circle diameter of the worm is 80mm
 - iii) Number of starts 4
 - iv) Axial module =8 mm
 - v) transmission ratio = 20
 - vi) the worm gear is made of phosphor bronze with an allowable bending stress=55 MPa
 - vii) the worm is made of hardened and ground steel

viii) tooth form is 20° full depth involute.

Determine

i) number of teeth on the worm gear

ii) lead angle

iii) face width of worm gear to 15 kW of power at 1750 rpm of the worm based on beam strength of the worm gear.

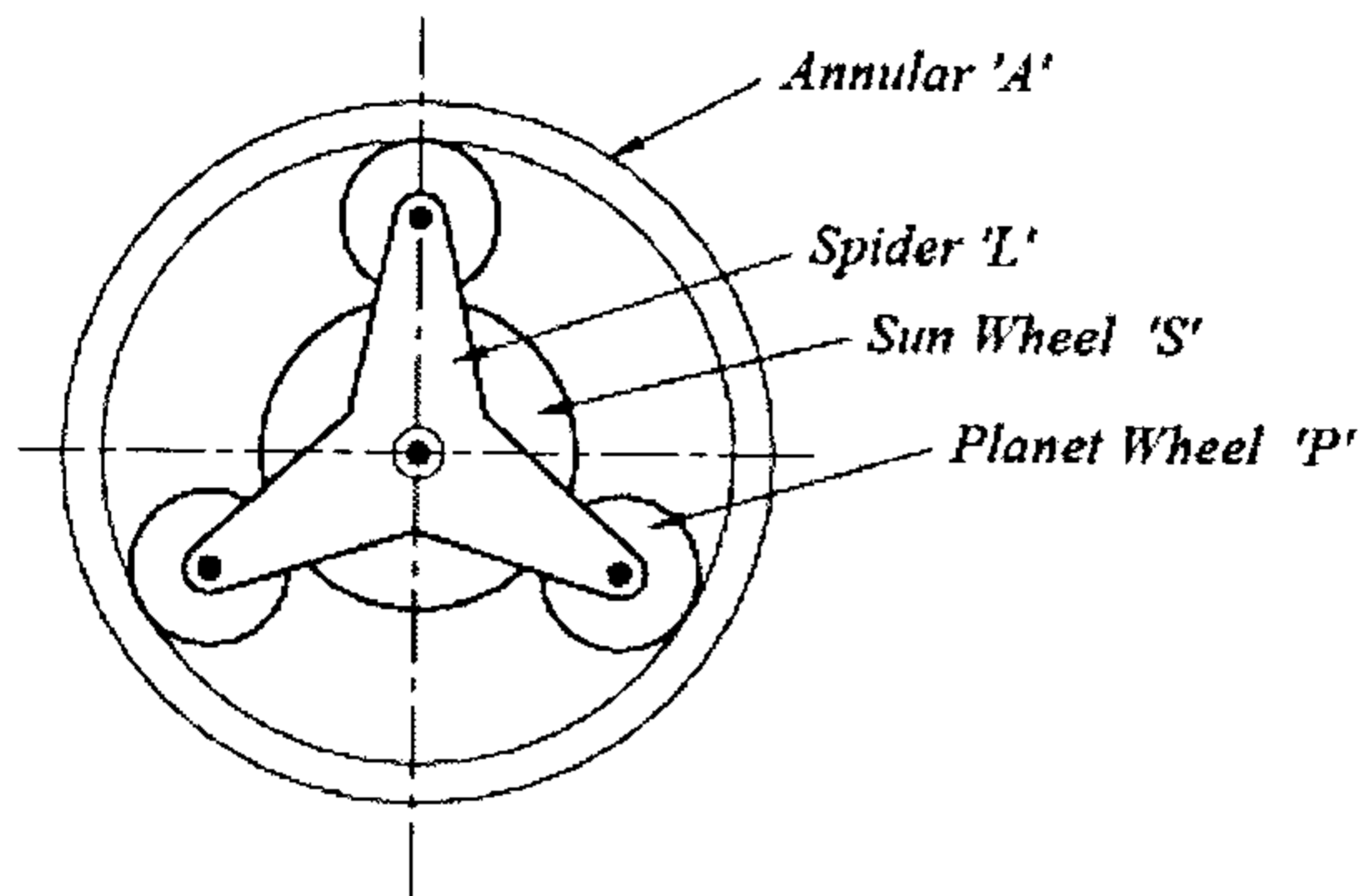
14 M

6. a) Explain the overloading and Gear casing problems in gear train. 6 M

b) Explain the following terms: 8 M

i) Pitting ii) Plastic flow iii) Scuffing.

7. In an epicyclic gear of sun and planet type shown in Figure, the pitch circle diameter of the annular wheel A is to be nearly 216mm and module 4mm. When the annular ring is stationary, the spider that carries three planet wheels P of equal size to make one revolution for every five revolution of the driving spindle carrying the sun wheel. Determine the number of teeth for all the wheels and the exact pitch circle diameter of the annular wheel. If an input torque of 20 N-m is applied to the spindle carrying the sun wheel, determine the fixed torque on the annular wheel. 14 M



Figure

8. a) What are the applications of traditional and nontraditional optimization techniques? 7 M
- b) Formulate the Gear train problem in which number of teeth's of gear is assumed to be known and face width of gears are assumed as decision variables. Take minimization of total weight of gear train as objective. 7 M