

PARUL UNIVERSITY
FACULTY OF ENGINEERING & TECHNOLOGY
B.Tech. Winter 2022 - 23 Examination

Semester: 7
Subject Code: 03109401
Subject Name: Machine Design-II

Date: 03/10/2022
Time: 10:30am to 1:00pm
Total Marks: 60

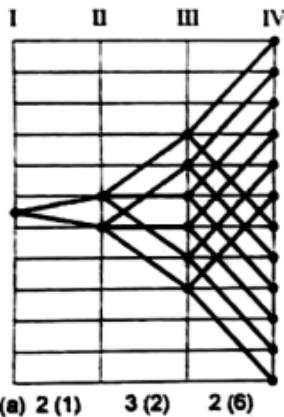
Instructions:

1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Make suitable assumptions wherever necessary.
4. Start new question on new page.
5. Design data book is not allowed.

Q.1 Objective Type Questions - (Fill in the blanks, one word answer, (All are compulsory) (15)

(Each of one mark)

1. Pitch Angle of the Internal Bevel Gear
 - (a) Less than 90°
 - (b) Equal to 90°
 - (c) Greater than 90°
 - (d) Equal to 180°
2. Which of the following have zero axial thrust
 - (a) Herring Bone Gears
 - (b) Bevel Gears
 - (c) Worm Gear
 - (d) Helical Gear
3. In which of the gearbox all gears are always in contact?
 - (a) Sliding mesh gearbox
 - (b) Synchromesh gearbox
 - (c) Constant-mesh gearbox
 - (d) Epicyclical gearbox
4. Length of the Cylinder(L) is Correlated with Length of the stroke(l) as
 - (a) $L=l$
 - (b) $L=1.15l$
 - (c) $L=2l$
 - (d) $L=1.5l$
5. Connecting rod in buckling above XX axis is ----- times strong in compare with YY axis
 - (a) 4
 - (b) 2
 - (c) 1
 - (d) 3
6. The number of starts on worm for a velocity ratio of 40 is _____
7. In this structure diagram, how many numbers of speeds are available at outer spindle-----



8. The angle at which the teeth of the gear are inclined to the axis of a gear is called as-----
9. Flat belts are made up of -----
10. Crane Hook is designed in ----- shape to with stand higher loads.
11. State the Law of Gearing.
12. Define Circular Pitch of the Gear.
13. What are whipping stresses in connecting rod ?
14. What do you mean by Bearing Crush?
15. Explain the classification of Mechanical Drives.

Q.2 Answer the following questions. (Attempt any three) (15)

- A) A pair of spur gears consists of a 20 teeth pinion meshing with a 120 teeth gear. The module is 4 mm. Calculate (i) the Centre distance (ii) the pitch circle diameters of the pinion and the gear (iii) the addendum and dedendum (iv) the tooth thickness (v) the bottom clearance and (vi) the gear ratio
- B) Explain about the Thermal Considerations in the Worm and Worm wheel.

C) Write a short note on Cylinder and Cylinder Liners?

D) The cylinder of a four-stroke diesel engine has the following specifications: Brake power = 3.75kw, Speed = 1000 rpm Indicated mean effective pressure = 0.35 MPa Mechanical efficiency = 80% Determine the bore and length of the cylinder liner

Q.3 A) A pair of straight bevel gears is mounted on shafts, which are intersecting at right angles. The number of teeth on the pinion and gear are 21 and 28 respectively. The pressure angle is 20° . The pinion shaft is connected to an electric motor developing 5 kW rated power at 1440 rpm. The service factor can be taken as 1.5. The pinion and the gear are made of steel ($S_{ut} = 750 \text{ N/mm}^2$) and heat-treated to a surface hardness of 380 BHN. The gears are machined by a manufacturing process, which limits the error between the meshing teeth to 10 mm. The module and face width are 4 mm and 20 mm respectively. Determine the factor of safety against pitting failure. **(07)**

B) A pair of parallel helical gears consists of a 20 teeth pinion meshing with a 100 teeth gear. The pinion rotates at 720 rpm. The normal pressure angle is 20° , while the helix angle is 25° . The face width is 40 mm and the normal module is 4 mm. The pinion as well as the gear is made of steel 40C8 ($S_{ut} = 600 \text{ N/mm}^2$) and heat treated to a surface hardness of 300 BHN. The service factor and the factor of safety are 1.5 and 2 respectively. Assume that the velocity factor accounts for the dynamic load and calculate the power transmitting capacity of gears.? **(08)**

OR

B) A pair of spur gears with 20° full-depth involute teeth consists of a 20 teeth pinion meshing with a 41 teeth gear. The module is 3 mm while the face width is 40 mm. The material for pinion as well as gear is steel with an ultimate tensile strength of 600 N/mm^2 . The gears are heat treated to a surface hardness of 400 BHN. The pinion rotates at 1450 rpm and the service factor for the application is 1.75. Assume that velocity factor accounts for the dynamic load and the factor of safety is 1.5. Determine the rated power that the gears can transmit.? **(08)**

Q.4 A) The following data is given for a four-stroke diesel engine: Cylinder bore = 250 mm, Length of stroke = 300 mm, Speed = 600 rpm Indicated mean effective pressure = 0.6 MPa Mechanical efficiency = 80% Maximum gas pressure = 4 MPa Fuel consumption = 0.25 kg per BP per h Higher calorific value of fuel = 44 000 kJ/kg Assume that 5% of the total heat developed in the cylinder is transmitted by the piston. The piston is made of grey cast iron FG 200 ($S_{ut} = 200 \text{ N/mm}^2$ and $k = 46.6 \text{ W/m}^\circ\text{C}$) and the factor of safety is 5. The temperature difference between the centre and the edge of the piston head is 220°C . (i) Calculate the thickness of piston head by strength consideration. (ii) Calculate the thickness of piston head by thermal consideration. (iii) Which criterion decides the thickness of piston head? (iv) State whether the ribs are required. (v) If so, calculate the number and thickness of piston ribs. (vi) State whether a cup is required in the top of the piston head. (vii) If so, calculate the radius of the cup **(07)**

OR

A) The following data is given for the piston of a four-stroke diesel engine: Cylinder bore = 250 mm Material of piston rings = Grey cast iron Allowable tensile stress = 100 N/mm^2 Allowable radial pressure on cylinder wall = 0.03 MPa Thickness of piston head = 42 mm Number of piston rings = 4 Calculate: (i) radial width of the piston rings; (ii) axial thickness of the piston rings; (iii) gap between the free ends of the piston ring before assembly; (iv) gap between the free ends of the piston ring after assembly; (v) width of the top land; (vi) width of the ring grooves; (vii) thickness of the piston barrel; and (viii) thickness of the barrel at open end. **(07)**

B) Prove that Economical Cutting Speed Loss is constant in the Geometrical Progression. **(08)**

Consider the below table for Lewi's form factor

Number of Teeth	Lewis form Factor
20	0.32
21	0.326
22	0.330
23	0.333
24	0.337
25	0.340
26	0.344
27	0.348