GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–VIII (old) - EXAMINATION – SUMMER 2018

Subject Code:181902   **Date:30/04/2018**

Subject Name:Machine Design II

Time:10:30 AM to 01:00 PM   **Total Marks: 70**

Instructions:
1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Use of PSG Design Data book is permitted.**

Q.1 **(a)** Explain following terminology of spur gear.   **07**

   1. Tooth space
   2. Center distance
   3. Base circle
   4. Circular pitch
   5. Diametral pitch
   6.Contact ratio
   7. Pressure angle

(b) It is required to design a pair of spur gears with 20^0 full-depth involute teeth   **07**
based on lewis equation. The velocity factor is to be used to account for dynamic
load. The pinion shaft is connected to 10 kW, 1440 rpm motor. The starting
torque of the motor is 150% of the rated torque. The speed reduction is 4:1. The
pinion as well as gear is made of plain carbon steel 40C8 (σ_{ut} =600 N/mm^2).
The factor of safety can be taken as 1.5. Design the gears, specify their
dimensions and suggest suitable surface hardness for the gears.

Q.2 **(a)** A pair of parallel helical gears consists of 20 teeth pinion meshing with a 100   **07**
teeth gear. The pinion rotates at 720 rpm. The normal pressure angle is 20^0,
while the helix angle is 25^0. The face width is 40 mm and normal module is
4mm. the pinion as well as the gear is made of steel 40C8 (σ_{ut} = 600 MPa) 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 dynamic load and calculate power transmitting capacity of gears

(b) Draw the structure diagram for the following structural formulae and identify   **07**
the optimum structural formula out of them. Draw the gearing diagram for the
optimum structural formula.

   1. *2(1) 3(2)*   **2.** *2(3) 3(1)*   **3.** *3(2) 2(1)*   **4.** *3(1) 2(3)*

OR

(b) Explain the procedure of designing multi speed gear box.   **07**

1

Q.3 **(a)** For a bevel gear explain following terms with figure.   **07**

       1. Crown gear
       2. Miter gear
       3. Pitch cone
       4. Face angle
       5. Back cone

    (b) A pair of straight bevel gear is mounted on shaft, which are intersecting at right   **07**
angles. The number of teeth on the pinion and gear are 21 & 28 respectively.
The pressure angle is 20^0. 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 ($\sigma_{ut} = 750$ N/mm^2) and heat treated
to a surface hardness of 380 BHN. The gear are machined by manufacturing
process, that limits the error between meshing teeth to 10 μm. the module and
face width are 4 mm and 20 mm respectively.
Determine the factor of safety for bending as well as for pitting.

OR

Q.3 **(a)** What is worm gear? List out the advantages and limitation of worm gear drives.   **07**

    (b) A triple threaded worm, rotating at 1200 rpm, drives a worm gear having 36   **07**
teeth and transmits 15 KW power. The teeth are of 20^0 full depth involute
profiles. The axial pitch of the worm is 31.41 mm and pitch diameter is 60 mm.
if the co-efficient of friction is 0.03, calculate

       1. The helix angle of worm
       2. The speed ratio
       3. The center distance between two shafts
       4. The apparent stress in the worm gear and
       5. Efficiency of drive.

Q.4 **(a)** Explain the procedure for design of I.C engine cylinder   **07**

    (b) The cylinder of a four –stroke diesel engine has the following specifications: **07**

       Cylinder bore =150 mm
       The reboring allowances for 150 mm diameter, C = 4 mm
       Maximum gas pressure =3.5 MPa
       Cylinder material = Grey cast iron FG 200 ($\sigma_{ut} = 200$ N/mm^2)
       Factor of safety = 5
       Poisson's ratio = 0.25

       Determine the thickness of the cylinder wall. Also, calculate the apparent and
       net circumferential and longitudinal stresses in the cylinder wall.

Q.4 **(a)** What are the different types of piston rings? State their functions. Why is more number of thin piston rings preferred over small number of thick rings? **07**

(b) Determine the dimensions of cross section of the connecting road for a diesel engine with the following data: **07**

Cylinder bore = 100 mm
Length of connecting road =350 mm
Maximum gas pressure = 4 MPa
Factor of safety = 6.

Q.5 **(a)** Explain with neat sketches, different types of hoisting equipment used for material handling. State example of each. **07**

(b) Design a crane hook for lifting capacity of 5 tones. It is made from forged steel and has a triangular section. Take permissible tensile stress as 80 N/mm^2. Use design data book to standardize the dimension of hook. **07**

OR

Q.5 **(a)** What do you understand by 6 X 37wire ropes? Explain with neat sketch, different wire rope section? **07**

(b) Design a wire rope for a lift using following data. **07**

1. Number of ropes = 2
2. Maximum load on ropes including cabin weight = 8 kN
3. Tensile strength of 6 X 19 wire rope = 43.5 d^2 kN, where 'd' is rope diameter in cm
4. Factor of safety = 12

Assume necessary additional data.

****