

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-VIII (Old) EXAMINATION – WINTER 2019

Subject Code: 181902

Date: 21/11/2019

Subject Name: Machine Design -II

Time: 02:30 PM TO 05:00 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 Design Data book is permitted in exam.

- Q.1 (a)** Explain different modes of gear teeth failures, stating their reasons and remedies. **07**
- (b)** A pair of spur gear with 20° full depth involutes teeth needs to be designed. Input shaft rotates at 800 rpm and receives 6 kW power. Speed reductions of output shaft by 5 times. Pinion and gear are made of steel with $\sigma_{ut} = 450 \text{ N/mm}^2$ service factor is 1.3. The gears are machined to accuracy of grade 10. Assume a pitch line velocity of 3.6 m/s and FOS is 2. Estimate the module of the gear teeth. Determine static and dynamic load from Spott's equation. Specify the surface hardness of gear teeth assuming that strength in bending is the same as strength in wear. **07**
- Q.2 (a)** Explain the importance of thermal considerations in worm and worm gear design **07**
- (b)** A 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 r.p.m. 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 a suitable module and face width from static strength considerations and check the gears for wear, given $\sigma_{es} = 618 \text{ MPa}$. **07**
- OR**
- (b)** A 35 kW motor running at 1200 r.p.m. drives a compressor at 780 r.p.m. through a 90° bevel gearing arrangement. The pinion has 30 teeth. The pressure angle of teeth is 14½°. **07**
- The wheels are capable of withstanding a dynamic stress, $\sigma_w = 140 \left(\frac{280}{280 + v} \right) \text{ MPa}$,
 where v is the pitch line speed in m / min. The form factor for teeth may be taken as $(0.124 - 0.686/T_E)$, where T_E is the number of teeth equivalent of a spur gear. The face width may be taken as ¼ th of the slant height of pitch cone. Determine for the pinion, the module pitch, face width, addendum, dedendum, outside diameter and slant height.
- Q.3 (a)** Explain the effect of helix angle on power transmission capacity of helical gear. Also suggest the values of helix angle for helical gear. **07**
- (b)** The following particulars of a single reduction spur gear are given : Gear ratio = 10 : 1; Distance between centres = 660 mm approximately; Pinion transmits 500kW at 1800 r.p.m.; Involute teeth of standard proportions (addendum = m) with pressure angle of 22.5°; Permissible normal pressure between teeth = 175 N per mm of width. Find : **07**
1. The nearest standard module if no interference is to occur;
 2. The number of teeth on each wheel;
 3. The necessary width of the pinion; and
 4. The load on the bearings of the wheels due to power transmitted.
- OR**
- Q.3 (a)** Derive the Levi's equation of beam strength for a spur gear. **07**
- (b)** A triple threaded worm has teeth of 6 mm module and pitch circle diameter of 50 mm. If the worm gear has 30 teeth of 14½° and the coefficient of friction of the worm gearing is 0.05, find 1. the lead angle of the worm, 2. Velocity ratio, 3. centre distance, and 4. Efficiency of the worm gearing. **07**
- Q.4 (a)** Explain the design procedure of I C Engine cylinder. **07**
- (b)** Design a cast iron piston head, radial ribs, piston rings & piston barrel for a single acting four stroke engine for the following data: Cylinder bore = 100 mm ; Stroke = 125 mm ; Maximum gas pressure = 5 N/mm² ; Indicated mean effective pressure = 0.75 N/mm²; **07**

Mechanical efficiency = 80% ; Fuel consumption = 0.15 kg per brake power per hour;
Higher calorific value of fuel = 42×10^3 kJ/kg ; Speed = 2000 r.p.m. Any other data
required for the design may be assumed.

OR

- Q.4 (a)** Explain the design procedure of connecting rod. **07**
(b) A four stroke diesel engine has the following specifications: Brake power = 5 kW; Speed = 1200 r.p.m.; Indicated mean effective pressure = 0.35 N/mm^2 ; Mechanical efficiency = 80 %. Determine: 1. bore and length of the cylinder; 2. thickness of the cylinder head; and 3. size of studs for the cylinder head. **07**

- Q.5 (a)** What are the basic principles in selecting the type of material handling equipment? **07**
(b) Explain the design procedure of crane hook. **07**

OR

- Q.5 (a)** Explain the different types of ropes used in material handling equipments. **07**
(b) Explain the design procedure of a belt conveyor. **07**

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