

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER- V (New) EXAMINATION – WINTER 2019

Subject Code: 2154104

Date: 02/12/2019

Subject Name: Design of Machine Elements and Transmission System

Time: 10:30 AM TO 01:00 PM

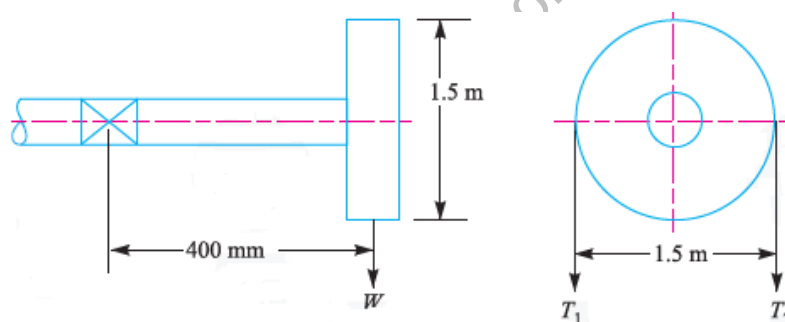
Total Marks: 70

Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- | | Marks |
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| Q.1 (a) Write short note on interchangeability | 03 |
| (b) Define stress concentration factor and Explain stress concentration | 04 |
| (c) Explain following limit system.
(1) Hole basis system (2) Shaft basis system | 07 |

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| Q.2 (a) Discuss the advantages offered by the threaded joints. | 03 |
| (b) Discuss the various type of shafts and the standard size of transmission shaft. | 04 |
| (c) A line shaft is driven by means of a motor placed vertically below it. The pulley on the line shaft is 1.5 metre in diameter and has belt tensions 5.4 kN and 1.8 kN on the tight side and slack side of the belt respectively. Both these tensions may be assumed to be vertical. If the pulley be overhang from the shaft, the distance of the centre line of the pulley from the centre line of the bearing being 400 mm, find the diameter of the shaft. Assuming maximum allowable shear stress of 42 MPa. | 07 |



OR

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| (c) Define equivalent torsional stress moment and equivalent bending moment. State when these two terms are used in the design of shafts. | 07 |
| Q.3 (a) What is Kennedy key? Give its application | 03 |
| (b) Discuss the function of a coupling. Give at least three practical application of coupling. | 04 |
| (c) Sketch a protective type flange coupling and indicate there on its leading dimension for shaft size of 'd'. | 07 |

OR

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| Q.3 (a) What are keys? State its function. | 03 |
| (b) How do you differentiate between a coupling and a clutch. | 04 |
| (c) Design and make a neat dimensioned sketch of a muff coupling which is used to connect two steel shafts transmitting 40 kW at 350 r.p.m. The material for the shafts and key is plain carbon steel for which allowable shear and crushing stresses may be taken as 40 MPa and 80 MPa | 07 |

respectively. The material for the muff is cast iron for which the allowable shear stress may be assumed as 15 MPa.

- Q.4** (a) Explain type of belt drive. **03**
 (b) Write advantages and disadvantages of V-Belt drive over the flat belt drive. **04**
 (c) A leather belt 9 mm × 250 mm is used to drive a cast iron pulley 900 mm in diameter at 336 r.p.m. If the active arc on the smaller pulley is 120° and the stress in tight side is 2 MPa, find the power capacity of the belt. The density of leather may be taken as 980 kg/m³, and the coefficient of friction of leather on cast iron is 0.35. **07**

OR

- Q.4** (a) Explain following terms used in helical gear:
 (1) Helix angle (2) Normal pitch (3) Axial pitch **03**
 (b) Write classification of gear. **04**
 (c) A reciprocating compressor is to be connected to an electric motor with the help of spur gears. The distance between the shafts is to be 500 mm. The speed of the electric motor is 900 r.p.m. and the speed of the compressor shaft is desired to be 200 r.p.m. The torque, to be transmitted is 5000 N-m. Taking starting torque as 25% more than the normal torque, determine : **07**
 1. Module and face width of the gears using 20 degrees stub teeth, and
 2. Number of teeth and pitch circle diameter of each gear.
 Assume suitable values of velocity factor and Lewis factor.
- Q.5** (a) Discuss the materials and practical applications for the various types of springs. **03**
 (b) Explain the following term with respect to spring.
 (a) Free length. (b) Solid length (c) Spring index (d) Spring stiffness. **04**
 (c) A truck spring has 12 number of leaves, two of which are full length leaves. The spring supports are 1.05 m apart and the central band is 85 mm wide. The central load is to be 5.4 kN with a permissible stress of 280 MPa. Determine the thickness and width of the steel spring leaves. The ratio of the total depth to the width of the spring is 3. Also determine the deflection of the spring. **07**

OR

- Q.5** (a) State commonly used bearing materials. **03**
 (b) State the disadvantages of trust ball bearing. **04**
 (c) The following particulars of a single reduction spur gear are given :
 Gear ratio = 10 : 1; Distance between centers = 660 mm approximately;
 Pinion transmits 500 kW 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.
