GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-V (OLD) - EXAMINATION - SUMMER 2017 Subject Code: 151905 Date: 12 Subject Name: Machine Design-I Time: 02:30 PM to 05:00 PM Total M

Date: 12/05/2017

Total Marks: 70

Instructions:

- 1. Attempt all questions.
- 2. Make suitable assumptions wherever necessary.
- **3.** Figures to the right indicate full marks.
- 4. Illustrate your answer with neat sketches wherever required.

Q.1	(a)	What is standardization? Give its applications in mechanical engineering. State the benefits of standardization.	07			
	(b)	What is the importance of wear considerations in design? Explain the measures to minimize the wear	07			
Q.2	(a)	Explain the following terms. 1) Spring index 2) Spring rate 3) Free length 4) Wahl's factor	07			
	(b)	Calculate the dimensions of the helical spring for a ramsbottom safety valve for the following data. valve diameter = 65 mm, Maximum blows off pressure = 0.8 N/mm^2 , valve lift for pressure rise from 0.75 to 0.80 N/mm ² = 3.5 mm Maximum allowable stress = 550 N/mm^2 Spring index = 6, Modulus of rigidity = $8.3 \times 10^4 \text{ N/mm}^2$				
		OR				
0.2	(a)	Explain following terms for Journal Bearing	07			

- (a) Explain following terms for Journal Bearing
 (i) Bearing Characteristic Number (ii) Viscosity Index (iii) Somerfied Number,
 (iv) Bearing Modulus
 - (b) It is required to select a ball bearing suitable for a 50 mm diameter shaft rotating at 1500 rpm. The radial and thrust loads at the bearing are 4500 N and 1600 N respectively. The value of X and Y factors are 0.56 and 1.4 respectively. Select a proper ball bearing from the following table for the rating life of 22500 hr. the inner ring rotates and the service factor is 1.

Bearing No.	6010	6210	6310	6410	T)
C(N)	21600	35100	61800	87100	

(i) Explain the different types of stresses induced in a belt with neat sketch. Q.3 **(a)** 07 (ii) Write a note on belt materials The following data refers to flat belt drive 07 **(b)** Power to be transmitted = 15 kWMotor speed = 1440 r.p.m. Speed of driven pulley = 480 r.p.m.Density of belt material = 950 Kg/m^3 Centre distance between two pulleys = Twice diameter of bigger pulley belt speed = 20 m/secModulus of elasticity for belt material = 100 MPa Coefficient of friction=0.35 Permissible stress for belt material = 2.25 Mpa Belt thickness = 5 mmCalculate (i) pulley diameters (ii) length and width of the belt

- Q.3 (a) (i) Explain the step by step procedure used for chain drive selection. (ii) State the different belt tension adjustment devices and explain one of them in detail with neat sketch.
 (b) V-belt drive has the following specification: 07
 - (b) V-belt drive has the following specification: Power to be transmitted = 30 kW Motor speed = 1440 r.p.m. Machine pulley speed =480 r.p.m. Centre distance between two pulleys = 1 m Approximate Allowable belt speed = 20 m/sec Coefficient of friction=0.20 Density of belt material = 1000 Kg/ m³ Cross sectional area of V belt = 700 mm² Find the no. of v-belts required and pulley diameters neglecting the slip of the belt.
- Q.4 (a) (i) Explain the design of pipes.(ii) State the different equations used for thick cylinder design with their conditions and limitations.
 - (b) The piston rod of a hydraulic cylinder exerts an operating force of 10 kN. The 07 friction due to piston packing & stuffing box is equivalent to 10% of the operating force. The pressure in the cylinder is 10 MPa. The cylinder is made of Cast Iron FG 200 and the factor of safety is 5. Determine the diameter and the thickness of the cylinder

07

07

07

OR

- Q.4 (a) (i) Explain the friction materials used in friction clutches.(ii) Explain the difference between single plate and multiplate clutch.
 - (b) A simple band brake is applied on a drum of 560 mm diameter which is rotating 07 at 240 rpm. The band having an angle of contact on the drum of 270⁰. One end of the band is fitted to a fixed pin while the other end is fitted to the lever 140 mm from the fixed pin. The lever is 800 mm long and is perpendicular to the diameter that bisects the angle of contact. If the coefficient of friction is 0.3, what will be the necessary pull at the end of the lever to stop the drum when the power absorbed is 40 kW. Also calculate the width of the band if its thickness is 3 mm and the maximum tensile stress is limited to 40 N/mm².
- Q.5 (a) (i) State and explain the factors affecting selection of antifriction bearing.
 07 (ii) Explain the bearing materials in detail.
 - (b) The following specification refers to a centrifugal clutch: Power to be transmitted = 15 kW No. of shoes = 4 Angle subtended by the shoe at centre = 60^0 Inner radius of drum = 150 mm Distance of C.G. of shoe from the centre of the spider =120 mm Coefficient of friction the shoe and drum = 0.25 Running Speed = 900 r.p.m. Shoe engagement starts at Speed = ³/₄ th of the Running Speed Permissible pressure intensity = 0.10 MPa Find (i) capacity of the clutch Mass of each shoe and (ii) size of each shoe.

OR

- Q.5 (a) Explain the Soderberg diagram and Goodman's diagram with neat sketch
 - (b) A machine component is subjected to fluctuating stress that varies from 40 to 100 MPa. The corrected endurance limit stress for the machine component is 270 MPa. The ultimate tensile strength and yield strength of material are 600 and 450 MPa respectively. Calculate the factor of safety using 1. Gerber theory 2. Soderberg line and 3. Goodman line.