

Enrollment No: _____

Exam Seat No: _____

C.U.SHAH UNIVERSITY

Winter Examination-2019

Subject Name: Machine Design-I

Subject Code: 4TE06MDE1

Branch: B.Tech (Mechanical)

Semester: 6

Date : 16/09/2019

Time : 10:30 To 01:30

Marks : 70

Instructions:

- (1) Use of Programmable calculator & any other electronic instrument is prohibited.
- (2) Instructions written on main answer book are strictly to be obeyed.
- (3) Draw neat diagrams and figures (if necessary) at right places.
- (4) Assume suitable data if needed.

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- Q-1 Attempt the following questions: (14)**
- a) Define: "Design synthesis" **01**
 - b) What is the final outcome of a machine design process? **01**
 - c) What do you mean by creep? **01**
 - d) What is the pressure vessel? **01**
 - e) Write a cause of failure of antifriction bearing. **01**
 - f) Explain the term regarding wire rope used in hoisting machinery: "Fatigue life of rope" **01**
 - g) Explain role of preferred numbers in standardization? **01**
 - h) Write the different types of stresses induced in a belt. **01**
 - i) Write the effects of the L/D ratio on the performance of journal bearing. **01**
 - j) What is Hertz contact stresses? **01**
 - k) What do you mean by a 6 x 9 rope? **01**
 - l) How a wire rope is most likely to fail? **01**
 - m) When a brake becomes self-locking? **01**
 - n) What is buckling in spring? **01**
- Attempt any four questions from Q-2 to Q-8**
- Q-2 Attempt all questions (14)**
- a) What do you mean by ergonomics? **02**
 - b) What is endurance limit? Explain design criteria with solderberg's line. **05**
 - c) A machine component is subjected to fluctuating stress that varies from 40 to 100 N/mm². The corrected endurance limit stress for the machine component is 270 N/mm². The ultimate tensile strength and yield strength of the material are 600 and 450 N/mm² respectively. Find the factor of safety using
 - (i) Gerber theory
 - (ii) Soderberg line
 - (iii) Goodman line, also find the factor of safety against static failure.
- Q-3 Attempt all questions (14)**
- a) Find out the numbers of R20/4 (100,....., 1000) derived series. **04**
 - b) What are the principles of Design for Manufacturing and Assemblies (DFMA)? **04**
 - c) Explain the performance of a hydrodynamic bearing with the curve of μ versus $Z.N / p$. **06**



- Q-4 Attempt all questions (14)**
- a) (i) Explain Lubricant and properties of lubricants for sliding contact bearing. **07**
(ii) Explain hydrodynamic bearing & bearing modulus with neat sketch.
- b) A 75 mm diameter full journal bearing runs at 400 rpm. It is 75 mm long and is subjected to a radial load of 2500 N. The bearing is lubricated with SAE 30 oil with the viscosity 16.5×10^{-3} kg/ms flows into the bearing at a temperature of 75 °C. The radial clearance is 0.03mm. Determine: **07**
1) Sommerfeld number 2) Minimum film thickness 3) Attitude 4) Power loss in friction 5) Heat loss 6) Side flow & Total flow of lubricants 7) Temperature rise

- Q-5 Attempt all questions (14)**
- a) Design a V belt drive from the following data. **07**
Motor Power = 3.75 kw Belt width = 17 mm
Speed of Motor = 1440 rpm Belt thickness = 11 mm
Speed reduction = 4 Belt area = 140 mm²
Density of belt = 1.5×10^5 N/mm³, Endurance limit for belt is 10 N/mm².
- b) (i) Write step by step procedure for the design of chain drive giving all governing equation. **07**
(ii) Discuss the different types of belts and their material used for power transmission.

- Q-6 Attempt all questions (14)**
- a) Explain the terms related to helical spring: **04**
(1) Spring rate (2) Free length (3) Spring index (4) Stress factor
- b) What is nipping in a leaf spring? Discuss its role. List the materials commonly used for the manufacture of the leaf springs. **04**
- c) A helical spring is made from a wire of 6 mm diameter and has outside diameter of 75 mm. If the permissible shear stress is 350 MPa and modulus of rigidity 84 kN/mm², find the axial load which the spring can carry and the deflection per active turn. **06**

- Q-7 Attempt all questions (14)**
- a) A hydraulic control for a straight line motion, as shown in fig.1, utilizes a spherical pressure tank 'A' connected to a working cylinder B. The pump maintains a pressure of 3 N/mm² in the tank. **08**

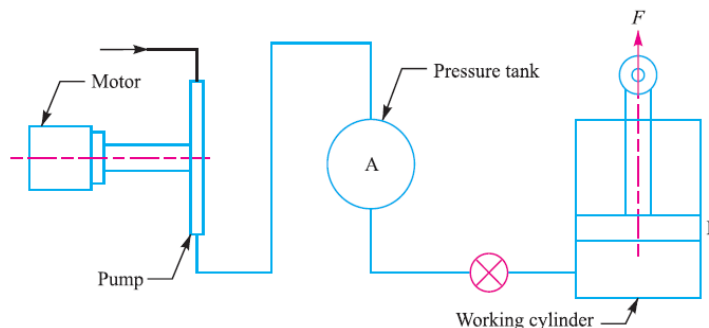


Fig.1

- (i) If the diameter of pressure tank is 800 mm, determine its thickness for 100% efficiency of the joint. Assume the allowable tensile stress as 50 MPa.
(ii) Determine the diameter of a cast iron cylinder and its thickness to produce =25 kN. Assume an operating force $F=25$ kN. Assume (i) an allowance of 10 per cent of operating force F for friction in the cylinder and packing, and (ii) a



pressure drop of 0.2 N/mm^2 between the tank and cylinder. Take safe stress for cast iron as 30 MPa.

(iii) Determine the power output of the cylinder, if the stroke of the piston is 450 mm and the time required for the working stroke is 5 seconds.

(iv) Find the power of the motor, if the working cycle repeats after every 30 seconds and the efficiency of the hydraulic control is 80 percent and that of pump 60 percent.

b) Sketch and explain the different types of ends used for pressure vessels. **06**

Q-8 **Attempt all questions** **(14)**

a) Describe with the help of neat sketch the principle of operation of an internal expanding shoe brake. **07**

b) The semi-cone angle in cone clutches is usually 12.5° . Justify the statement giving reasons. **04**

c) What do you mean by a self-energizing brake and a self-locking brake? **03**

