Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- Vth SEMESTER–EXAMINATION – MAY/JUNE - 2012

Subject code: 151905 **Date: 06/06/2012**

Subject Name: Machine Design-I

Time: 02:30 pm – 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.**

Q.1 **(a)** (i) Explain the importance of Wahl's stress factor in spring design. **07**
(ii) State and explain the factors affecting selection of spring materials.

(b) Design a helical compression spring from the following data: **07**
Minimum load = 100 N
Maximum load = 225.6 N
Compression of spring = 10 mm
Permissible shear stress for spring material = 440 Mpa
Spring end – square and ground ends
Modulus of rigidity for spring material = 0.80 x 10^5 MPa

Q.2 **(a)** (i) Explain the friction materials used in friction clutches. **07**
(ii) Explain the difference between single plate and multiplate clutch.

(b) The following specification refers to a centrifugal clutch: **07**
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 = ¾ 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

(b) Design a single plate clutch considering uniform wear criterion and effective **07**
one pair of contacting surfaces from the following specification:
Power to be transmitted = 18.5 kW
Speed = 750 r.p.m.
Outer diameter = 2 times internal diameter
Permissible pressure for the lining = 1 MPa
Coefficient of friction = 0.20
Permissible stress for shaft material = 45 MPa

Q.3 **(a)** (i) Explain the different types of stresses induced in a belt with neat sketch. **07**
(ii) Write a note on belt materials.

(b) The following data refers to flat belt drive **07**
Power to be transmitted = 15 kW
Motor 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 = 810 mm
belt speed = 20 m/sec
Modulus of elasticity for belt material = 100 MPa
Coefficient of friction=0.35
Permissible stress for belt material = 2.25 Mpa
Belt thickness = 5 mm
Calculate (i) pulley diameters (ii) length and width of the belt

OR

Q.3 **(a)** (i) Explain the step by step procedure used for chain drive selection. **07**
(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**
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/ m^3
Cross sectional area of V belt = 700 mm^2
Find the no. of v-belts required and pulley diameters neglecting the slip of the belt.

Q.4 **(a)** State the different equations used for thick cylinder design with their conditions and limitations. **07**

(b) Design a journal bearing from the following data: **07**
Radial load = 20 kN
diameter of journal =100 mm
Speed of journal =900 r.p.m.
oil SAE 10 with viscosity at 55^0 C = 0.017 kg/m-sec
ambient temperature =15.5^0 C
maximum bearing pressure = 1.5 Mpa
permissible rise in oil temperature = 10^0 C
heat dissipation coefficient = 1232 $W/m^2/^0C$
L/D ratio = 1.6
Design parameter ZN/p = 28
clearance ratio = 0.0013
specific heat of oil = 1900 $J/kg/^0C$

OR

Q.4 **(a)** (i) State and Explain the factors affecting the selection of a suitable antifriction bearing. **07**
(ii) Explain the effects of the L/D ratio and C/D ratio parameters on the performance of journal bearing.

Q.4 **(b)** A hydraulic press has the following specifications: **07**
Capacity = 80 kN
Fluid pressure = 16 MPa
Stroke = 80 mm
Permissible tensile stress for pillar and ram = 75 MPa
Permissible stress for C.I. cylinder = 30 MPa
Distance between the center line of pillars = 800 mm
Distance between top supporting platform and

bottom of top plate when the ram is in the down most position = 800mm
Design the ram, cylinder and pillars.

Q.5 **(a)** Explain Goodman's and Soderberg's diagram with neat sketches. **07**

(b) Answer the following (any TWO) **07**

(i) Explain the wear considerations in design.

(ii) Explain the important considerations to be considered in casting design.

(iii)Explain Hertz contact stresses in detail.

OR

Q.5 **(a)** (i) What do you meant by standardization? Explain the use of standardization in design. **07**

(ii) Explain the assembly considerations in machine design.

(b) The following data refers to a transmission shaft : **07**

[torsional moment that varies from = -100 Nm to + 600 Nm.
ultimate tensile strength = 630 Mpa
yield strength = 360 MPa, stress
load correction factor = 0.6
size correction factor = 0.85
Surface finish factor = 0.8.
reliability factor = 0.897
factor of safety = 2
Calculate the shaft diameter using distortion energy theory of failure.

****