

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 = 0.80×10^5 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°
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 = $\frac{3}{4}$ 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

- (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 $55^\circ \text{C} = 0.017 \text{ kg/m-sec}$
 ambient temperature = 15.5°C
 maximum bearing pressure = 1.5 Mpa
 permissible rise in oil temperature = 10°C
 heat dissipation coefficient = $1232 \text{ W/m}^2/^\circ\text{C}$
 L/D ratio = 1.6
 Design parameter $ZN/p = 28$
 clearance ratio = 0.0013
 specific heat of oil = $1900 \text{ J/kg}^\circ\text{C}$

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.
- (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 mean 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.
