Seat No.: _____ **Enrolment No._____**

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V- EXAMINATION – SUMMER 2016

Subject Code: 151905 **Date: 21/05/2016**

Subject Name: Machine Design-I

Time: 02:30 PM to 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.**
4. **Draw neat sketches wherever required to justify the answer.**

Q.1 **(a)** Explain the selection procedure of the chain drive in detail. **05**

(b) A flat leather belt with open belt arrangement is used to transmit 15 kW power from electric motor running at 1440 r.p.m. to a machine pulley at 480 r.p.m. the center distance between this two pulleys is twice the diameter of the bigger pulley. The belt should operate at the velocity of 20 m/sec. The permissible stress for belt material is 2.25 MPa. The density of leather is 0.95 gm/cc and coefficient of friction is 0.35. The thickness of the belt is 5mm. Find (i) the Diameter of pulleys (ii) the length and width of belt (iii) the belt tensions. **09**

Q.2 **(a)** Explain the different types of stresses induced in steel wire ropes with neat sketches. **05**

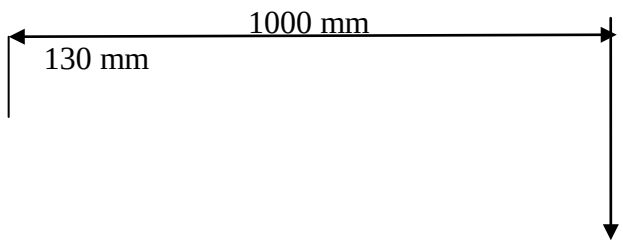
(b) Design a single plate clutch to transmit 15 kW power at 1500 r.p.m. (uniform wear criteria) from the following data : **09**

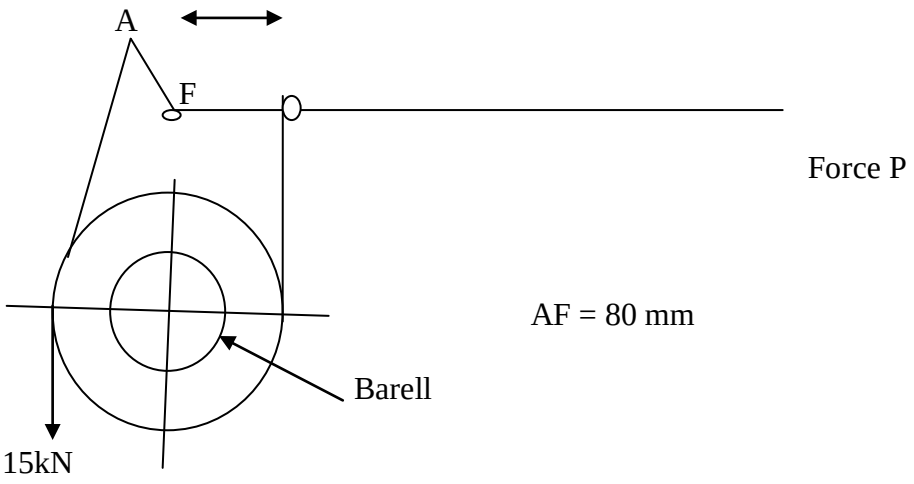
Consider 25% overload for the design and Friction lining on both sides of clutch effective.

Coefficient of friction = 0.25, ratio of mean radius to radial width of friction faces = 4.5, permissible pressure intensity between friction faces = 0.07 MPa, number of springs = 6, design shear stress for spring material = 400 MPa, modulus of rigidity = 0.8×10^5 MPa .

OR

(b) A differential band brake supporting a load of 15 kN is attached to a barrel of 400 mm diameter and a drum of 800 mm diameter is keyed to the shaft. The two end of the band are attached to the brake lever on the opposites of the fulcrum at 80 mm and 130 mm respectively. The angle of contact of the band is 240^0.The operating force is applied at a distance of 1000 mm from the fulcrum. Design (i) band (length and thickness) if the design stresses for band in tension, shear and crushing are 75 MPa, 60 MPa and 150 MPa respectively (ii) lever cross section if h = 2.5 b taking design bending stress for lever is 75 MPa. **09**





Q.3	**(a)**	Explain the Soderberg diagram and Goodman's diagram with neat sketch.	**05**
Q.3	**(b)**	Explain the design for manufacturing and design for assembly.	**09**

OR

Q.3	**(a)**	What do you mean by design for standardization? Explain it in detail.	**05**
	(b)	A transmission shaft made of cold drawn steel 45C8 is subjected to a fluctuating torque which varies from 600 N-m clockwise to 100 N-m anticlockwise. Using the distortion energy theory, find the diameter of shaft. Surface finish factor = 0.8 Size factor = 0.85 Reliability factor = 0.897 Factor of safety = 2 Ultimate tensile strength = 630 MPa Yield tensile strength = 360 MPa	**09**
Q.4	**(a)**	Explain the basic design consideration to be considered in pressure vessel design.	**05**
	(b)	A semi-elliptical leaf spring of an automobile suspension has a span of 1.1 m and width of central band is 100 mm. There are two extra full length leaves and eight graduated leaves including master leaf. The central load on spring is 35 kN. The design bending stress for spring is 750 MPa and E is 2.07 x 10^5 MPa. If the ratio of width to the thickness of leaf is 10, calculate i) Width and thickness of the leaf ii) Maximum deflection of the spring iii) Camber and radius of curvature.	**09**

OR

Q.4	**(a)**	Explain the factors to be considered while selecting spring material.	**05**
	(b)	Design a hydraulic press from the following data : Working pressure of the fluid operating the press = 15 N/mm^2 Maximum press capacity = 150 kN Friction factor = 1.2 Clearance between cylinder wall and ram = 15 mm Design and draw the following parts of the press: 1) Design of ram [hollow ram with R_i / R_o = 0.8366] 2) Pillars and 3) cylinder. The design stresses are as below: Ram (Mild steel) :- σ_t = 100 Mpa Cylinder (Cast iron):- σ_t = 80 Mpa Pillars:- σ_t = 80 Mpa	**09**
Q.5	**(a)**	Design a journal bearing from the following data for centrifugal pump: Speed of the journal = 900 r.p.m. Load on journal = 20 KN	**07**

Type of oil used is SAE10 Ambient temperature 15.5^0C
Maximum bearing pressure for pump = 0.5 MPa
Operating temperature = 55^0C Length of bearing to diameter ratio = 1.6
Absolute viscosity of lubricant = 0.017Kg/m-s Temperature rise = 10^0C
Heat dissipation coefficient = 1232W/m^2/ ^{0}C

(b) Explain the following: **07**

1. Static load capacity, dynamic load capacity and equivalent dynamic load.
2. Difference between sliding contact bearing and rolling contact bearing.

OR

Q.5 **(a)** Calculate the dynamic load bearing capacity of single row deep groove ball bearing from the following data : **07**

Radial load = 4000 N Axial load = 5000 N
Operating speed = 1600 r.p.m. Uniform and steady load condition
Average life of the bearing = 5 years at 10 hrs/day
Values of X and Y are 0.56 and 1.6 respectively.

(b) Answer the following: **07**

1. Explain the importance of thermal consideration in journal bearing design.
2. Explain the factors affecting selection of journal bearing materials.

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