## C.U.SHAH UNIVERSITY Summer Examination-2018

#### Subject Name: Machine Design - I Subject Code: 4TE06MDE1 Semester: 6 Date: 27/04/2018

#### Branch: B.Tech (Mechanical) Time: 02:30 To 05:30 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.

Q-1		Attempt the following questions:	(14)
C	a)	When do you use Birnie's equation for cylinder wall thickness?	01
	<b>b</b> )	What is R5 series? Develop R5 series from 1 to 10.	01
	<b>c</b> )	Why are fasteners avoided in assemblies?	01
	d)	'In case of thin cylinder subjected to internal pressure, the tendency to burst lengthwise is twice as great as at tranverse section.' Why?	01
	e)	Which one of the following drives is used for a constant velocity ratio, positive drive with large centre distance between the driver and driven shafts?	01
	f)	State the relationship between active, inactive and total number of coils in the helical compression spring	01
	<b>g</b> )	What is surge in spring?	01
	h)	What are the two theories applied for friction clutch	01
	i)	Give practical applications of multi-plate clutch?	01
	j)	What is differential band brake?	01
	k)	What is the effect of centrifugal tension on power transmitted by a belt drive?	01
	<b>l</b> )	What are the materials by which pulleys of flat belts are made?	01
	m)	Define rating life of bearing	01
	n)	Name any two solid lubricants	01
Attempt	any f	our questions from Q-2 to Q-8	

# Q-2Attempt all questions(14)a)Prove that the ratio of driving tension on the two sides of a pulley is06

$$\frac{T_1}{T_2} = e^{\mu.\theta}$$

Where  $T_1$  = Tension in the tight side of the belt,

- $T_2$  = Tension in the slack side of the belt,
- $\boldsymbol{\mu} = Coefficient$  of friction between the belt and pulley, and
- v = Angle of contact in radians.
- b) Determine the number V-Belts required to transmit 30 kW at 1440 rpm from the following data:

Diameter of driving pulley = 250 mm

Diameter of driven pulley = 900 mm



Centre diameter between two shafts = 1.25 m Groove angle of pulley =  $40^{\circ}$  $\mu = 025$ Mass density of belt =  $1100 \text{ kg/m}^3$ Allowable tension per belt = 850 NWidth of belt at the top = 22 mmDepth of belt = 14 mm

Cross-section area of belt =  $230 \text{ mm}^2$ .

If the difference between pitch length and inside length for the belt is 56 mm, select the belt length using the following table, and find the exact distance between two shafts. Ignore belt length correction factor.

Belt length correction factor

Nominal	А	В	С	D	Е
Inside					
Length					
(mm)					
4013	-	1.13	1.02	0.92	-
4115	-	1.14	1.03	0.92	-
4394	-	1.15	1.04	0.93	-
4572	-	1.16	1.05	0.94	-

Q-3		Attempt all questions	(14)
	a)	Explain generalized guidelines for assembly with neat sketch	05
	<b>b</b> )	Write the important characteristics of Brake lining material	05
	c)	State merits & demerits of Chain Drive over Rope drive	04
Q-4		Attempt all questions	(14)
-	a)	Define contact stress. Explain spherical and cylindrical contact stress in detail	07
	b)	A forged steel bar, 50 mm in diameter, is subjected to reversed bending stress of 250 N/ mm <sup>2</sup> . The bar is made of steel 40C8 ultimate tensile stress 600 N/mm <sup>2</sup> .Calucate the life of the bar for a reliability of 90%.	07

#### Q-5 Attempt all questions

- a) What is fatigue? Explain the significance of fatigue stress concentration factor
  05 and the notch sensitivity
- b) A pulley is keyed to a shaft midway between two bearings. The shaft is made of cold drawn steel for which the ultimate strength is 550 MPa and the yield strength is 400 MPa. The bending moment at the pulley varies from -150 N-m to + 400 N-m as the torque on the shaft varies from -50 N-m to + 150 N-m. Obtain the diameter of the shaft for an indefinite life. The stress concentration factors for the keyway at the pulley in bending and in torsion are 1.6 and 1.3 respectively. take the following values: Factor of safety = 1.5

Load Correction factor = 1.0 in bending, and 0.6 in torsion size effect factor = 0.85surface effect factor = 0.33



(14)

#### Q-6 Attempt all questions

a) An hydraulic control for a straight line motion, as shown in Fig.1.1 Utilises a spherical pressure tank 'A' connected to a working cylinder B. The pump maintains a pressure of 3 N/mm2 in the tank.

1. 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.

2. Determine the diameter of a cast iron cylinder and its thickness to produce 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/mm2 between the tank and cylinder. Take safe stress for cast iron as 30 MPa.

3. 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.

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

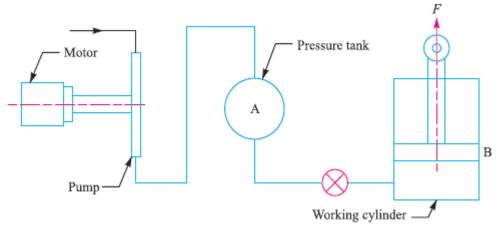


fig. 1.1

b) What is "Autofrettage"? Write methods of pre-stressing the cylinder

Q-7

#### Attempt all questions

- a) A conical clutch with semi-cone angle of  $12.5^{\circ}$ , and have face width  $1/3^{rd}$  of mean radius is used to transmit power from an electric motor running at 1000 rpm, to a stationary machine. The machine is equivalent to rotor of mass 200 kg and radius of gyration as 200 mm. the machine is brought in the full speed of 1000 rpm from stationary condition in 35 seconds. If  $\mu = 0.2$  and intensity of pressure is not to exceed 0.09 MPa, find,
  - (i) Face Width of conical surfaces
  - (ii) Inner and outer radii. of conical surfaces
  - (iii) Force required to engage the clutch.
  - (iv) Amount of heat generated during each engagement.
  - (v) Capacity of electric motor.
- **b**) Explain the important parameters affecting the design of journal bearing

### Q-8 Attempt all questions

- a) What are the basic principles to be followed in bearing mounting? Explain the 07 methods of bearing mounting
- b) Explain Wear and Thermal consideration for designing IC Engine Component 07



04 (14)

10

04

(14)