

Fine Menoufi University Faculty of Engineering Shebin El Kom *First Semester Examination* Academic Year:2014-2015 Dep.of Production Eng.&Mech. Design Year:3 rd Subject/ Code:Mechanical Design PRE311 Time: 4 Hours Date:20-1-2015 Total marks 140

Allowed Table (None) <u>This Exam measures ILOS no(a1,a13,b2,b6,b17,c1,c3 )</u> Answer all the following Question's <u>Question(1)</u>

Note, assume any missing data you need in its convenient range.

- 1- Design control circuit for single acting cylinder to push a pin with slow movement without damaging the pin(circular key), the Speed of pushing must be calibrated with speed control, under 50 kg pushing force.
- 2- Design and draw piston, cylinder, rod and cover( choose pressure and explain why)?

3-Design controlled open loop circuit.

4- Explain and draw circuit diagram for the figures below.

5- Sketch ball seat valve.

6- Design and construct an external gear pump, used in fluid power system developing pressure up to( 3000 psi) with constant discharge at a given speed shaft (1500 rpm), calculate volume create between the gear and housing.Given drive gear teeth=11 teeth, with 50 mm with module 3mm and height of tooth=75mm.



## **QUESTION NO. 2**

a) Explain with neat sketches the bushed pin flexible coupling.

b) <u>Design with construction</u> a cast iron flange coupling to transmit 15KW at 900 r.p.m from an electric motor to a compressor. The service factor may be assumed as 1.35. The following permissible stresses may be used:

The shear stress for shaft, key and bolt=40 MPa.

The crushing stress for key and bolt=80 MPa.

The shear stress for cast iron=8 MPa.

#### **QUESTION NO. 3**

a-Explain briefly with neat sketches the main types of mechanical (friction) clutches. What are the characteristic of the material used for lining of friction surfaces of a clutch?

b- Show with neat sketch only the single disk friction clutch in engaging and disengaging positions. c-A plate clutch having a single drive plate with contact surfaces on each side is requires transmitting 110 KW at 1250 r.p.m. The outer diameter of the contact surfaces is to be 300 mm and the coefficient of friction as 0.4. a) Assuming a uniform pressure of 0.17 N/mm<sup>2</sup>, determine the inner diameter of the friction surfaces. b) Assuming the same dimensions and the same total axial thrust, determine the maximum torque that can be transmitted and the maximum intensity of the pressure when uniform wear condition have been reached.

## 04:-Design Shafts On The Basis of Lateral Rigidity:-

- A) What types of stresses are induced in shafts (solid and hollow) at different theories of failure? (10Mc
- B) The layout of an intermediate shaft of a gear box supporting two spur gears B and C is shown in Fig.2. The shaft is mounted on two bearings A and D. The pitch circle diameters of gears B and Care 900 and 600 mm respectively. The material of the shaft is steel FeE 580 ( $S_{ut} = 770$  and  $S_{yt} = 580N/mm^2$ ). Assume that the gears are connected to the shaft by means of keys. The maximum permissible radial deflection at any gear is limited to 1 mm. The modulus of elasticity of the shaft diameter material is 207000 N/mm<sup>2</sup>. Determine the shaft diameter on the basis of lateral rigidity. (20 Marks)

Answer only one of the following questions

# **<u>O5:-Sliding Contact Bearings</u>:-**

- A) Explain the following terms as applied to journal bearings: a-Bearing characteristic number, b-Bearing modulus? (5 Marks)
- B) The load on the journal bearing is 150kN due to turbine shaft of 300 mm diameter running at 1800 r.p.m. Determine the following: 1- Length of the bearing if the allowable bearing pressure is 1.6 N/mm<sup>2</sup>, and 2- Amount of heat to be removed by the lubricant per minute if the bearing temperature is 60°C and viscosity of oil at 60°C is 0.02 kg/m-s and the bearing clearance is 0.25mm. (15 Markov)

### **<u>Q6:-</u>** Rolling contact Bearings:-

# [20 Marks]

- A) Write short note on classifications and different types of antifriction bearings. Draw neat sketches of these bearings. (5Marks)
- B) A single row angular contact ball bearing number 310 is used for an axial flow compressor, the values of r idial factor (X) and thrust factor (Y) are X = 1 and Y = 0 and the basic dynamic capacity, C = 53 kN. The bearing is to carry a radial load of 2500 N and an axial or thrust load of 1500 N. Since the rotational factor (V) for most of the bearing is 1. Assuming light shock load with (K<sub>s</sub>) is 1.5, determine the rating life of the bearing. (15 Marks)



(20 Mark)

(20 Mark)

[20 Marks]

[30Mark]