Kadi Sarva Vishwavidyalaya

B.E. Sem IV (Mechanical Engineering)

Subject: Industrial Drafting and Machine Design (ME-404)

Date: 28/10/2015 Time: 3 Hrs Max. Marks: 70

Instructions:

(1) Answer each section in separate Answer sheet.
(2) Use of Scientific calculator is permitted.
(3) All questions are compulsory.
(4) Indicate clearly, the options you attempt along with its respective question number.
(5) Assume suitable data if necessary.
(6) Use the last page of main supplementary of rough work.

Section – I

Q.1

[A] Differentiate between Crushing stress and Compressive stress. [2]

[B] Why taper is in cotter? What is the purpose of clearance in Cotter Joints? [2]

[C] Define following terminology [2]
(i) Ductility (ii) Hardness (iii) Resilience (iv) Plasticity

[D] What is preferred number? How will denote basic series? [2]

[E] Identify the following materials & give at least one application of each. [2]
(i) FG 300 (ii) 45C8

[F] Determine the smallest hole that can be punched in 5 mm thick M.S. plate having an ultimate shear stress of 300 N/mm^2. If permissible compressive strength of punch is 360 N/mm^2, calculate induced shear stress for punch. [5]

OR

[F] The crankpin of I.C. engine sustains a maximum load of 30 kN. If the allowable bearing pressure is 12 N/mm^2, and length to diameter ratio is 1.25, find the size of the crank pin. [5]

Q.2 [A] Design a cotter joint to connect two mild steel rods for a pull of 30 KN. The maximum permissible stresses are 55 MPa in tension, 40 MPa in shear and 70 MPa in crushing. Draw a neat sketch of the joint designed. [7]

[B] Differentiate between cotter and key. [3]

OR

Q.2 [A] Design a knuckle joint used to connect two rods subjected to a maximum load of 25 kN. The rod is having circular cross-section. The permissible stresses, for rod and pin materials are 80 MPa, 55 MPa and 130 MPa in tension. Shear and crushing respectively. Consider 10 % overload for the design of joint. [7]

[B] Differentiate clearly between knuckle joint and cotter joint. State their Applications. [3]

Q.3 [A] Explain the important terminology of riveted joints and find the efficiency of the double riveted lap joints with zig-zag riveting is to be designed for 13 mm thick plates. Assume 80 MPa, 60 MPa and 120 MPa in tension, Shear and crushing respectively. Also calculate pitch of rivets. [7]

[B] Draw with neat sketch Double riveted (zigzag) equal cover butt joint. [3]

OR

Q.3 [A] Design a closed coiled helical spring to absorb a blow of 200 N weight which falls through a vertical height of 500 mm. The deflection of spring is 100 mm. The allowable shear stress is 420 N/mm^2. Take, C = 6 and G = 80 GPa [7]

[B] Explain the importance of Wahl's stress factor in spring design. [3]

Section – II

Q.4 [A] What is ASME (American Society of Mechanical Engineers) code for shaft Design? [2]

[B] What is compound lever? Why a bush is used in a lever? [2]

[C] What is self-locking screw? And discuss the condition of self locking. [2]

[D] Give symbol for straightness, flatness, perpendicularity and cylindricity. [4]

[E] Explain three basic types of levers with practical examples. [5]

OR

[E] The cross section of a key is 20 mm X 15 mm for a shaft of 80 mm diameter. The key is required to transmit a torque of 750 Nm from the shaft to the hub. The key is made of 7C4 steel having σ_{ut} = 320 MPa. Determine the length of key if factor of safety is 3.5. [5]

Q.5 Two pulleys M and N are supported on a line shaft as shown in figure 3. The pulleys are keyed to the shaft. Power is supplied to the shaft by means of a vertical belt on pulley M, which is then transmitted to pulley N carrying a horizontal belt. The pulley belt on pulley M is subjected to tight side and slack side tension of 3000 N and 1000 N respectively. The ratio of belt tensions on tight and slack sides is 3:1 for both pulley belt. The shaft is made of 40NiCr 1Mo15 having ultimate tensile strength and yield point tensile strength 780 MPa and 580 MPa respectively. Taking the values of Kb = 1.5 and Kt = 1.2, determine the shaft diameter according to A.S.M.E. code. [10]

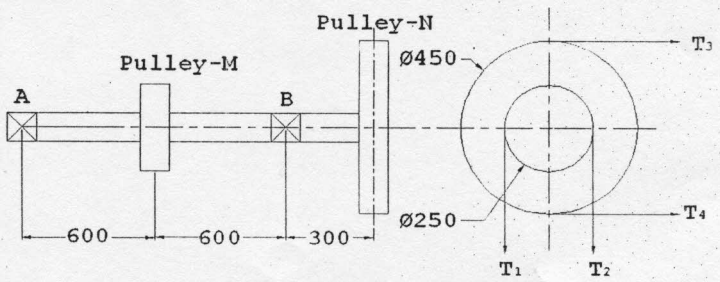

Fig.3

OR

Q.5 A bell-crank lever is subjected to a load of 8 kN at 18 short arm end. The arms lengths are 150 mm and 450 mm. The cross-section of the lever is rectangular with the ratio Depth to the width of lever (b/h) as 2.5. The ratio of length to diameter for pin is 1.3.The design stresses for pin and lever material is 85 MPa and 50 MPa in tension and Shear respectively. The permissible bearing pressure is 12 MPa. Design the lever and fulcrum pin [10]

Q.6 [A] A power screw having double start square threads of 26 mm nominal diameter and 21 mm core diameter and 5 mm pitch is acted upon by an axial load of 10 kN. The outer diameter of the swivel head is 50 mm and inner diameter is 20 mm. the co-efficient of friction is 0.2 for both the screw and swivel head. The screw rotates at 12 rpm. Calculate: [5]

1) Torque required to rotate the screw
2) Power required to drive it

[B] List any five modified command of AutoCAD. [5]

OR

Q.6 [A] Design a bush-pin type flexible flange coupling from the following data to connect two shafts: Power to be transmitted = 20 *kW*, Speed = 400 *rpm*, Design shear stress for shaft material = 85 *MPa.* , No. of pins = 6, Permissible bearing pressure for rubber bus hand pin = 0.45 *MPa*, Permissible shear stress and bending stress for pin material = 70 *MPa* and 160*MPa*, Draw neat sketch of the coupling designed. [7]

[B] Why a thin brass sleeve is mounted over the enlarged end of the bolt? [3]

*******BEST OF LUCK*******

Kadi Sarva Vishwavidyalaya

B.E. Sem IV (Mechanical Engineering)

Subject: Industrial Drafting and Machine Design (ME-404)

Date: 14/05/2014 Time: 3 Hrs Max. Marks: 70

Instructions:

(1) Answer each section in separate Answer sheet.
(2) Use of Scientific calculator is permitted.
(3) All questions are compulsory.
(4) Indicate clearly, the options you attempt along with its respective question number.
(5) Assume suitable data if necessary.
(6) Use the last page of main supplementary of rough work.

Section – I

Q.1

[A] Differentiate between (a) Shear stress and Tensile stress (b) Static and Live Load. [2]

[B] Why taper is in cotter? What is the purpose of clearance in Cotter Joints? [2]

[C] Define following terminology [2]
(i) Yield Strength (ii) Creep (iii) Resilience (iv) Plasticity

[D] What is preferred number? How will denote basic series? [2]

[E] Identify the following materials & give at least one application of each. [2]
(i) FG 300 (ii) 45C8

[F] Determine the smallest hole that can be punched in 12 mm thick M.S. plate having an ultimate shear stress of 390 N/mm^2. If permissible crushing stress for punch material is 2.4 KN/mm^2. [5]

OR

[F] An offset link subjected to load of 25 KN as shown in fig.1. it is made of FG300. Factor of safety has considered 3. Determine dimensions of link. [5]

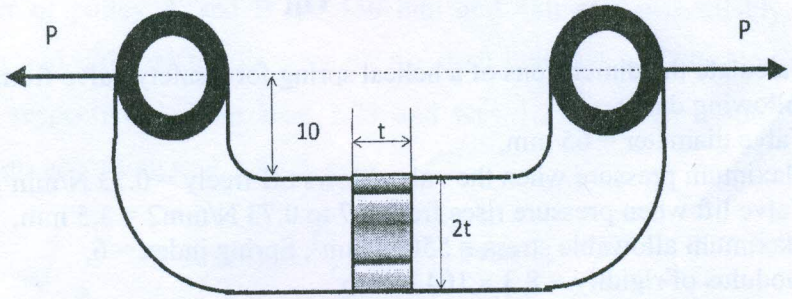

Fig.1

Q.2

[A] Design a cotter joint to connect two mild steel rods for a pull of 30 KN. The maximum permissible stresses are 55 MPa in tension, 40 MPa in shear and 70 MPa in crushing. Draw a neat sketch of the joint designed. [7]

[B] Differentiate between cotter and key. [3]

OR

Q.2

[A] Design a knuckle joint used to connect two rods subjected to a maximum load of 25 kN. The rod is having circular cross-section. The permissible stresses, for rod and pin materials are 80 MPa, 55 MPa and 130 MPa in tension. Shear and crushing respectively. Consider 10 % overload for the design of joint. [7]

[B] Differentiate clearly between knuckle joint and cotter joint. State their Applications. [3]

Q.3

[A] A bracket is attached to a steel channel by means of nine identical rivets as shown in fig.2. Determine the diameter of rivets, if the permissible shear stress is 60 N/mm2. [7]

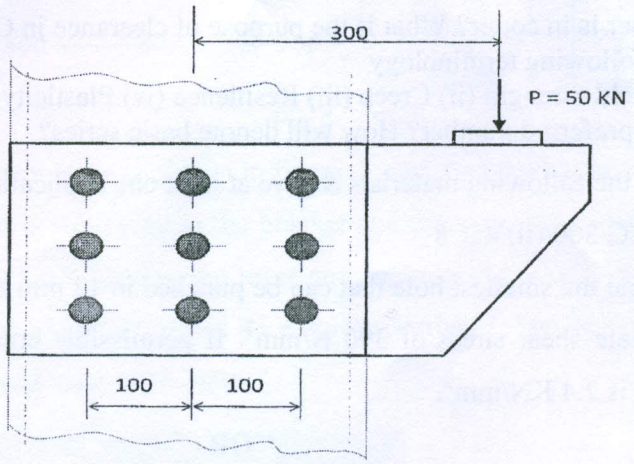

Fig.2

[B] Draw with neat sketch Double riveted (zigzag) unequal cover butt joint. [3]

OR

Q.3

[A] Calculate the dimensions of a helical spring for a safety valve from the following data : [7]
Valve diameter = 65 mm,
Maximum pressure when the valve blows off freely = 0.73 N/mm^2,
Valve lift when pressure rises from 0.7 to 0.73 N/mm2 = 3.5 mm,
Maximum allowable stress = 550 N/mm^2, Spring index = 6,
Modulus of rigidity = 8.3 × 104 N/mm^2.

[B] Explain the importance of Wahl's stress factor in spring design. [3]

Section – II

Q.4

[A] What is ASME (American Society of Mechanical Engineers) code for shaft design? [2]

[B] What is compound lever? Why a bush is used in a lever? [2]

[C] What is self-locking screw? And discuss the condition of self locking. [2]

[D] List any four modified command of AutoCAD. [2]

[E] Why a thin brass sleeve is mounted over the enlarged end of the bolt? [2]

[F] The cross section of a key is 20 mm X 15 mm for a shaft of 80 mm diameter. The key is required to transmit a torque of 750 Nm from the shaft to the hub. The key is made of 7C4 steel having σ_{ut} = 320 MPa. Determine the length of key if factor of safety is 3.5. [5]

OR

[F] A power screw having double start square threads of 26 mm nominal diameter and 21 mm core diameter of the swivel head is 50 mm and inner diameter is 20 mm. the co-efficient of friction is 0.2 for both the screw and swivel head. The screw rotates at 12 rpm. [5]

1) Torque required to rotate the screw
2) Power required to drive it

Q.5 The line shaft shown in figure 3 is driven by a pulley B from an electrical motor. Another belt drive from pulley A is running a compressor. Belt tensions from pulley are 1500 N and 600 N. The ratio of belt tension for pulley B is 3.5 the diameter of pulley A and B are 150 mm and 480 mm respectively. The yield strength and ultimate tensile strength for shaft material are 380 N/mm^2 and 720 N/mm^2 respectively. Take Kb= 1.75 and Kt= 1.25. Design a solid shaft with circular as according to A.S.M.E. code. [10]

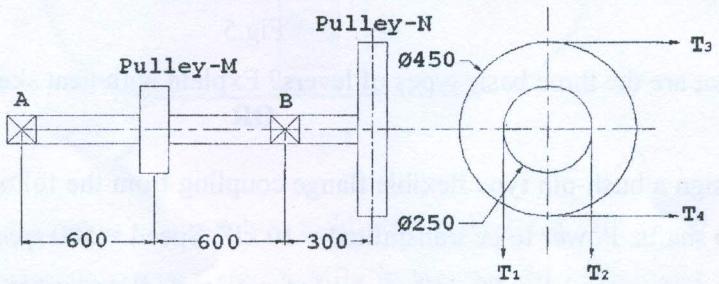

Fig.3

OR

Q.5 A shaft supported on two bearings carries two pulleys as shown in figure 4. The shaft transmits 10 *kW* power at 300 *rpm* from pulley A to pulley B. The pulley A has a diameter of 300 *mm* and mass of 15 *kg*, while pulley B has a diameter of 600 [10]

Kadi Sarva Vishwavidyalaya

B.E. Sem IV (Mechanical Engineering)

Subject: Industrial Drafting and Machine Design (ME-404)

Date: 07/11/2014 Time: 3 Hrs Max. Marks: 70

Instructions:

(1) Answer each section in separate Answer sheet.
(2) Use of Scientific calculator is permitted.
(3) All questions are compulsory.
(4) Indicate clearly, the options you attempt along with its respective question number.
(5) Assume suitable data if necessary.
(6) Use the last page of main supplementary of rough work.

Section – I

Q.1

[A] Differentiate between Crushing stress and Compressive stress. [2]

[B] What do you understand by the term double shear? Explain with neat sketch. [2]

[C] Define following terminology [2]
(i) Yield Strength (ii) Creep (iii) Ductility (iv) Hardness

[D] What is preferred number? How will denote derive series? [2]

[E] Identify the following materials & give at least one application of each. [2]
(i) FG 350 (ii) 40C6

[F] The crankpin of I.C. engine sustains a maximum load of 30 kN. If the allowable bearing pressure is 12 N/mm^2, and length to diameter ratio is 1.25, find the size of the crank pin. [5]

OR

[F] Determine the smallest hole that can be punched in 5 mm thick M.S. plate having an ultimate shear stress of 300 N/mm^2. If permissible compressive strength of punch is 360 N/mm^2, calculate induced shear stress for punch. [5]

Q.2

[A] Design a cotter joint to connect two mild steel rods for a pull of 30 KN. The maximum permissible stresses are 55 MPa in tension, 40 MPa in shear and 70 MPa in crushing. Draw a neat sketch of the joint designed. [7]

[B] Why taper is provided in a cotter? What is the purpose of clearance in Cotter Joints? [3]

OR

Q.2

[A] Design a knuckle joint used to connect two rods subjected to a maximum load of 35 kN. The rod is having circular cross-section. The permissible stresses, for rod and pin materials are 90 MPa, 60 MPa and 120 MPa in tension. Shear and crushing respectively. [7]

[B] Differentiate clearly between knuckle joint and cotter joint. State their Applications. [3]

Q.3

[A] A double riveted equal covers butt joint is to be designed to join two plates 12 mm thick. The allowable stresses are: σ_t= 100 N/mm^2, τ = 75 N/mm^2 and σ_{cr} = 160 N/mm^2. ZigZag riveting is to be used. Find rivet diameter, pitch of rivet, transverse pitch and efficiency of joint. [7]

[B] Explain with neat sketch caulking and Fullering. [3]

OR

Q.3

[A] Design a closed coiled helical spring to absorb a blow of 200 N weight which falls through a vertical height of 500 mm. The deflection of spring is 100 mm. The allowable shear stress is 420 N/mm^2. Take, C = 6 and G = 80 GPa [7]

[B] Explain the surging in spring. [3]

Section – II

Q.4

[A] What is ASME (American Society of Mechanical Engineers) code for shaft design? [2]

[B] State difference between shaft and axle? [2]

[C] What is self-locking screw? And discuss the condition of self locking. [2]

[D] Explain a bell crank lever? [2]

[E] Why a thin brass sleeve is mounted over the enlarged end of the bolt? [2]

[F] The cross section of a key is 25 mm X 20 mm for a shaft of 100 mm diameter. The key is required to transmit a torque of 750 Nm from the shaft to the hub. The key is made of 7C4 steel having σ_{ut} = 350 MPa. Determine the length of key if factor of safety is 3. [5]

OR

[F] A double-threaded power screw, with ISO metric trapezoidal thread is used to raise a load of 300 kN. The nominal diameter is 100 mm and pitch is 12 mm. The co-efficient of friction is 0.15. neglecting collar friction, calculate: [5]

1) Torque required to raise the load.
2) Efficiency of the screw

Q.5 [A] Compare the weight, strength and rigidity of a hollow shaft of same external diameter as that of solid shafts. Both the shafts are made of same material. Assume that diameter ratio for the hollow shaft is 0.6. [5]

[B] Which theories of failure are applicable for shaft design? Why? [5]

OR

Q.5 A line shaft carries two pulleys A and B as shown in fig.1. the diameter of pulley (A) is 360 mm and pulley (B) is 500 mm. The maximum tension in either belt is 2.5 kN and the ratio of tensions for both pulleys belt drive is 2.5:1. The shaft is made of 45C8 steel having σ_{ut}= 630 N/mm^2 and σ_y= 380 N/mm^2. The pulleys are keyed to the shaft. If shock and fatigue factors are k_t = 1 and k_m = 1.5, find the diameter of the shaft, using maximum shear stress theory. [10]

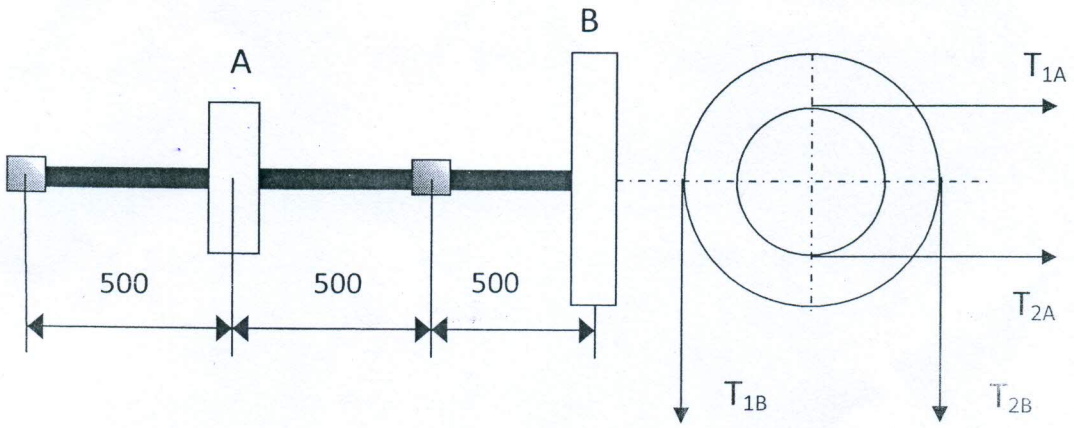

Fig.1

Q.6 A right angled bell crank lever is used to a raise a load of 10 kN at the end of shorter arm, which is 150 mm long. The mechanical advantage of the lever is 1.8. if the allowable stress for lever and pin are σ_t= 100 N/mm^2 and τ= 50 N/mm^2, P_b= 20 N/mm^2 for pin, design the lever completely showing the arrangement for application of load and effort. [10]

OR

Q.6

[A] Design a bush-pin type flexible flange coupling from the following data to connect two shafts: Power to be transmitted = 10 *kW*, Speed = 500 *rpm*, Design shear stress for shaft material = 80 *MPa.* , No. of pins = 6, Permissible bearing pressure for rubber bus hand pin = 0.35 *MPa*, Permissible shear stress and bending stress for pin material = 60 *MPa* and 150*MPa*, Draw neat sketch of the coupling designed. [7]

[B] State the difference between protected and unprotected rigid flange coupling with neat sketch. [3]

*******BEST OF LUCK*******

Kadi Sarva Vishwavidyalaya

B.E. Sem IV (Mechanical Engineering)

Subject: Industrial Drafting and Machine Design (ME-404/AE-404)

Date: May 2015 Time: 3 Hrs Max. Marks: 70

5-5-15

Instructions:

(1) Answer each section in separate Answer sheet.
(2) Use of Scientific calculator is permitted.
(3) All questions are compulsory.
(4) Indicate clearly, the options you attempt along with its respective question number.
(5) Assume suitable data if necessary.
(6) Use the last page of main supplementary of rough work.

Section – I

Q.1

[A] List and explain the factors affecting selection of suitable materials. [2]

[B] Define cotter. Why taper is usually given to cotter? [2]

[C] Define following stress with neat sketch [2]
(i) Compressive stress (ii) Shear stress

[D] What is factor of safety? State the considerations on which it depends. [2]

[E] Identify the following materials & give at least one application of each. [2]
(i) FG 350 (ii) 40C8

[F] Determine the minimum size of a circular hole that can be punched in a M.S. plate, 5 mm thick and having ultimate shear strength of 300 MPa. Take compressive strength of punch as 360 MPa. [5]

OR

[F] Square key is stronger against crushing than rectangular key. Justify [5]

Q.2 [A] Explain the important terminology of riveted joints and find the efficiency of the double riveted lap joints with zig-zag riveting is to be designed for 13 mm thick plates. Assume 80 MPa, 60 MPa and 120 MPa in tension, Shear and crushing respectively. Also calculate pitch of rivets. [7]

[B] What are the advantages and disadvantages of bushed pin type coupling? [3]

OR

Q.2 [A] It is required to design a cotter joint to connect two steel rods of equal diameter. The permissible stresses for the rods, spigot end and socket end are σ_t =96 N/mm2, σ_c = 134 N/mm2 & τ = 45 N/mm2. For cotter, σ_t =80 N/mm2, τ = 40 N/mm2. Each rod is subjected to an axial Tensile force of 80 KN. Calculate following dimensions: 1. Diameter of spigot 2. Width & thickness of cotter 3. Thickness of socket collar. [8]

[B] Differentiate clearly between knuckle joint and cotter joint. [2]

Q.3 [A] Design a bush-pin type flexible flange coupling from the following data to connect two shafts: Power to be transmitted = 10 kW, Speed = 500 rpm, Design shear stress for shaft material = 80 MPa , No. of pins = 6, Permissible bearing pressure for rubber bus hand pin = 0.35 MPa, Permissible shear stress and bending stress for pin material = 60 MPa and 150MPa, explain with neat sketch of coupling. [7]

[B] Draw with neat sketch Double riveted (zigzag) unequal cover butt joint. [3]

OR

Q.3 [A] Calculate the dimensions of a helical spring for a safety valve from the following data : [6]
Valve diameter = 65 mm,
Maximum pressure when the valve blows off freely = 0.73 N/mm^2,
Valve lift when pressure rises from 0.7 to 0.73 N/mm2 = 3.5 mm,
Maximum allowable stress = 550 N/mm^2, Spring index = 6,
Modulus of rigidity = 8.3 × 104 N/mm^2.

[B] Explain the following terms. [4]
1) Spring index 2) Free length 3) Spring rate 4) Wahls factor

Section – II

Q.4

[A] What is ASME (American Society of Mechanical Engineers) code for shaft design? [2]

[B] What is nipping in case of leaf spring? [2]

[C] State the difference between shaft, axle and spindle. [2]

[D] Give symbol for straightness, flatness, perpendicularity and cylindricity. [4]

[E] Explain three basic types of levers with practical examples. [5]

OR

[E] A power screw having double start square threads of 26 mm nominal diameter and 21 mm core diameter of the swivel head is 50 mm and inner diameter is 20 mm. the co-efficient of friction is 0.2 for both the screw and swivel head. The screw rotates at 12 rpm. [5]

1) Torque required to rotate the screw
2) Power required to drive it

Q.5 A line shaft supporting two pulleys P and Q as shown in figure 1. Power is supplied to the Shaft by means of a vertical belt on pulley P, which is then transmitted to pulley Q carrying belt as shown. The ratio of belt tensions on tight side and loose side 3:1. The maximum tension in either belt is limited to 2700 N. The permissible stress for 40C8 shaft material is 85.5 N/mm^2.Take the values for K =1.5. Design the shaft According to A.S.M.E code. [10]

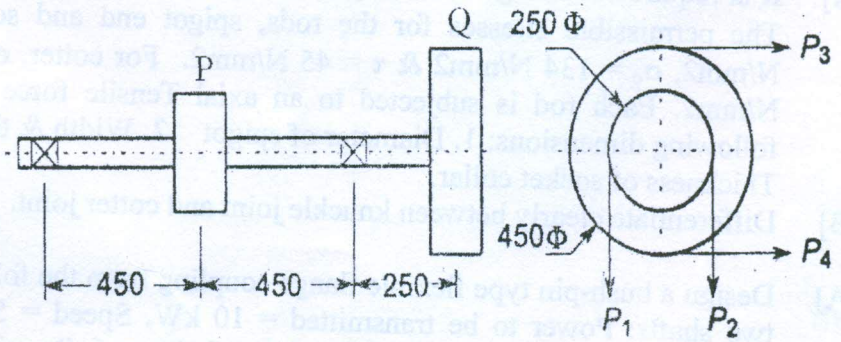

Fig.1

OR

Q.5 Design a square thread screw for a C-clamp (figure 2) for 12 kN capacity from the following data : [10]

Coefficient of friction for screw thread = .13
Coefficient of friction for thrust pad = 0.08
Design stress for screw material (tension) = 55 MPa
Permissible bearing pressure = 10 MPa
Mean diameter of thrust pad = 30 mm (Design screw and nut only)
Standard size for square threads:

Major diameter (mm)	Minor diameter (mm)	Pitch (mm)
16 mm	13 mm	3 mm
18 mm	15 mm	3 mm
20 mm	17 mm	3 mm
22 mm	19 mm	3 mm

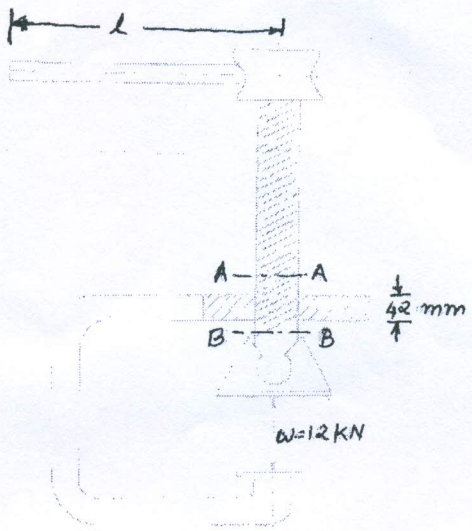

Fig.2

Q.6 [A] A bell crank lever is to be designed to raise a load of 15 kN at the short arm end. The arm lengths are 150 mm and 500 mm. The permissible stresses for lever and pin materials in shear and tension are 60 MPa and 90 MPa respectively. The bearing pressure on the pin is to be limited to 12 MPa. Assume the lever cross section as t x 4t and fulcrum pin length as 1.25 times pin diameter. [7]

OR

[B] Explain self locking and over hauling of power screw? [3]

OR

Q.6

[A] A solid shaft and a hollow shaft having same length are equally strong in torsion. The outside diameter of the hollow shaft is 20% more then the diameter of solid shaft. If both the shafts are made from same material and assume diameter ratio for hollow shaft is 0.6. find the ratio of weight of hollow shaft to the solid shaft. [5]

[B] Explain following Autocad command with example. [5]
1) copy 2) Trim 3) Polyline 4) Mirror 5) Extend

*******BEST OF LUCK*******