ALPHA COLLEGE OF ENGINEERING & TECHNOLOGY

ODD SEM 2018

ASSIGNMENT 1

SUB : DME (2151907) 5^{TH} ME A

Chapter 1 – Introduction

NO	QUESTION	YEAR	MARKS
1	State and illustrate various principal design rules as per Casting Design with sketches.	DEC-15 MAY-16 MAY-17	7 5 7
2	State and illustrate various principle design rules used in design for forging.	DEC-15	7
3	Discuss the importance of selection of materials in machine design.	MAY-16 MAY-17	4 7
4	What are the principles of design for manufacture and assemblies (DFMA)?	NOV-16	7
5	What are preferred numbers? The maximum & minimum load carrying capacities of dumpers in a manufacturing unit are 630 KN and 40 KN respectively. The company is interested in developing seven models in this range. Specify their load carrying capacities.	MAY-16	5
6	Name the various alloying elements in ‘alloy’ steels.	NOV-16	3
7	What do you mean by standardization? Explain role of preferred numbers in standardization? Standardize six speeds between 250 to 1400 rpm and State the series of torque for 0.5kw drive.	-	7
8	Explain aesthetic considerations in design.	-	4
9	What is significance of ergonomic considerations in design? Explain in detail.	-	4
10	Explain the different types of mechanical properties.	-	7
11	Explain the design considerations for Welding.	-	7
12	Explain the effect of heat treatment on properties of steel.	-	4
13	Find out series R 20/4 for 100 rpm to 1000 rpm.	-	4
14	The maximum & minimum load carrying capacities of dumpers in a manufacturing unit are 630 KN and 40 KN respectively. The company is interested in developing seven models in this range. Specify their load carrying capacities.	-	4
15	Explain the following: (i) Assembly considerations in machine design (ii) Design of components for casting (iii) Design of components for forging (iv) Design for creep (v) Design for wear (vi) Contact stresses (or Hertz contact stresses)	-	7

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ASSIGNMENT 2

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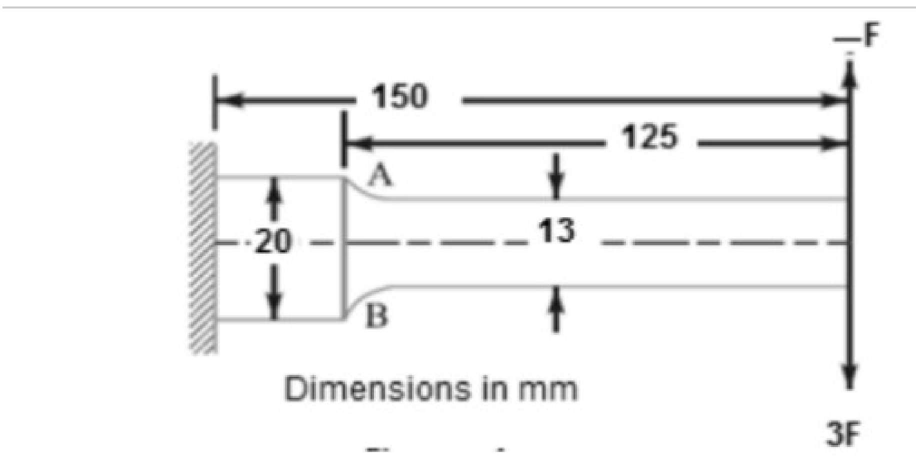
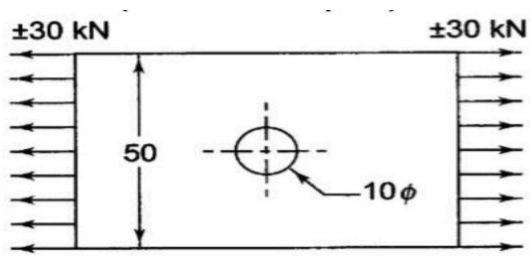
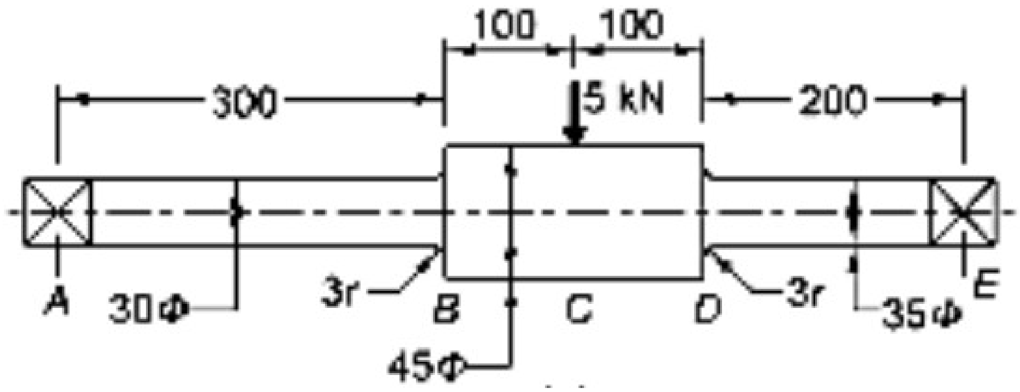
Chapter 2 – DESIGN AGAINST FLUCTUATING LOADS

NO	QUESTION	YEAR	MARKS
1	Derive Soderberg's equation and state its application to different types of loadings.	DEC-15 MAY-17	7 7
2	What is endurance strength? Discuss the factors affecting endurance strength of the materials.	DEC-15 MAY-16 MAY-17	4 7 3
3	What are the Goodman and the Soderberg line?	NOV-16	3
4	State the methods of reducing stress concentration.	NOV-16	4
5	The following data refers to a transmission shaft: Torsional moment that varies from - 100 Nm to + 600 Nm. The 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.	DEC-15	7
6	A machine component is subjected to fluctuating stress that varies from 40 to 100 MPa. The corrected endurance limit stress for the machine component is 270 MPa. The ultimate tensile strength and yield strength of material are 600 and 450 MPa respectively. Calculate the factor of safety using 1. Gerber theory, 2. Soderberg line and 3. Goodman line.	DEC-15	7
7	A cantilever beam made of carbon steel of circular cross-section as shown in figure, is subjected to a load which varies from –F to 3F. Determine the maximum load that the beam can sustain for an indefinite life. Factor of safety = 2, Stress concentration factor =1.42, Notch sensitivity = 0.9 Ultimate stress = 550 Mpa, Yield stress = 470 MPa, Endurance limit = 275 MPa, Size factor = 0.85, Surface finish factor = 0.89 .  	MAY-16	7

8	A simply supported beam has a concentrated load at the centre which fluctuates from a value of 'P' to '4P'. The span of the beam is 500 mm and its cross-section is circular with a diameter of 60 mm. Taking for the beam material an ultimate stress of 700 MPa, a yield stress of 500 MPa, endurance limit of 330 MPa for reversed bending, and a factor of safety of 1.3, Calculate value of load 'P' based on Goodman's formula. Take a size factor of 0.85 and a surface finish factor of 0.9.	NOV-16	7
9	A hot rolled steel shaft is subjected to a torsional moment that varies from 330 Nm to –110 Nm and an applied bending moment at a critical section varies from 440 Nm to –220 Nm. The shaft is of uniform cross-section and no keyway is present at the critical section. Determine the required shaft diameter. The material has an ultimate strength of 550 MPa and yield strength of 410 MPa. Take the endurance limit as half the ultimate strength, factor of safety of 2, size factor of 0.85 and a surface finish factor of 0.62.	MAY-16	7
10	A Forged steel bar 60 mm in diameter is subjected to a reversed bending stress of 200 N/ mm2 .The bar is made of 40C8 (ultimate stress is 600 MPa) . Calculate the life of bar for a reliability of 90 % Take surface finish factor = 0.44, Size factor = 0.85, Reliability factor = 0.897.	-	7
11	A plate made of steel 20C8 (S_{ut} = 440 N/mm ^{2}) in hot rolled and normalized condition is shown in figure below. It is subjected to a completely reversed load of 30 kN. The notch sensitivity factor q can be taken as 0.8 and the expected reliability is 90%. The size factor is 0.85. The factor of safety is 2. Determine the plate thickness for infinite life. 	-	7
12	A rotating shaft subjected to a non-rotating force of 5 kN and simply supported between two bearings A and E as shown in figure. The shaft is machined from plain carbon steel 30C8 (S_{ut} = 500 N/mm ^{2}) and the expected reliability is 90 %. The equivalent notch radius at the fillet section can be taken as 3 mm. What is the life of the shaft? Bending moment at section B is 642.9 kN.mm; surface finish factor =0.79; size factor = 0.85; reliability factor = 0.897; stress concentration factor = 1.72; notch sensitivity = 0.78.	MAY-15	7

			
13	A transmission shaft of cold drawn steel 27Mn2 (S_{ut} = 500 N/mm 2 and S_{yt} = 300 N/mm 2) is subjected to a fluctuating torque which varies from - 100 N-m to + 400 N-m. The factor of safety is 2 and the expected reliability is 90%. Neglecting the effect of stress concentration, determine the diameter of the shaft. Assume the distortion energy theory of failure.	-	7
14	A circular bar 500 mm length is supported freely and its two ends. It is acted upon by a central concentrated cyclic load having a minimum value of 20 kN and a maximum value of 50 kN. Determine the diameter of bar by taking factor of safety 1.5; size effect of 0.85; surface finish factor of 0.9; The material properties of bars are given by: ultimate strength of 650 MPa, yield strength of 500 MPa and endurance strength of 350 MPa	MAY-13 DEC-14 MAY-15	7 7 7
15	Define stress concentration factor. Explain methods for reducing stress concentration.	-	7

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ASSIGNMENT 3

SUB : DME (2151907) 5^{TH} ME A

Chapter 3 – DESIGN OF SPRINGS

NO	QUESTION	YEAR	MARKS
1	Explain the terminology used in Helical Compression Spring.	DEC-11 JUNE-11 DEC-13	7 7 7
2	Explain buckling of spring in detail.	DEC-15	4
3	What is nipping in a leaf spring? Discuss its role.	MAY-16 NOV-16 MAY-17	4
4	What is shot peening?	NOV-16	3
5	What is the function of a spring? In which type of springs the behavior is non-linear?	MAY-17	3
6	The extension springs are in considerably less use than the compression springs, why?	MAY-17	3
7	Design a helical compression spring from the following data: 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 x 10^5 Mpa.	DEC-15	7
8	A semi-elliptic leaf spring consists of two extra full length leaves and eight graduated length leaves, including the master leaf. The center to center distance between the two eyes of the spring is 1 m. The maximum force acting on the spring is 10 kN and the width of the leaf is 50 mm. The spring is initially preloaded in such a way that when the load is maximum, the stresses induced in all the leaves are equal to 350 N/mm^2 . The modulus of elasticity of the leaf material is 2.07 x 10 5 N/mm^2. Determine: (i) The thickness of leaves. (ii) The deflection of the spring at maximum load.	DEC-15	7
9	A helical compression spring made of oil tempered carbon steel is subjected to a fluctuating load from 400 N to 1000 N. The spring index is 6 and the design factor of safety is 1.25. If the yield stress in shear is 770 MPa and endurance stress in shear is 350 MPa, Find: 1. Size of the spring wire , 2. Diameters of the spring, 3. Number of turns of the spring, and 4. Free length of the spring. The compression of the spring at the maximum load is 30 mm. For spring material, the modulus of rigidity is 80 KN/mm^2 . Spring ends are square and ground.	MAY-16	7
10	A semi-elliptical laminated vehicle spring to carry a load of 6000 N is to consist of seven leaves 65 mm wide, two of the leaves extending the full length of the spring. The spring is to be 1.1 m in length and attached to the axle by two U-bolts 80 mm apart. The bolts hold the central portion of the spring so rigidly that they may be considered equivalent to a band having a width equal to the distance between the bolts.Assume a design stress for spring material as 350 N/mm^2 . Determine: 1. Thickness of leaves 2. Deflection of spring 3. Diameter of eye 4. Length of leaves Take E = 210 KN/mm^2, Bearing pressure = 8 N/mm^2 .	MAY-16	7
11	The valve of an aircraft engine is operated by a cluster of two concentric springs made of same material. The maximum load on the spring is 6500 N. The permissible shear stress for the spring material is 625 N/mm^2 . Assuming spring index for both springs as 6 and the deflection under the load should not exceed 30 mm. Calculate the main	NOV-16	7

	dimensions of the springs. $G = 8 \times 10^4$ N/mm^2 . Use standard coil clearance.		
12	A semi-elliptical spring has ten leaves in all, with the two full length leaves extending 625 mm. It is 62.5 mm wide and is made of strips 6 mm thick. The leaves are pre-stressed so as to equalize stresses in all leaves. Design a helical spring, with spring index of 6, which will have approximately the same values of induced stress and deflection for any load. Take, $E = 2.1 \times 10^5$ MPa and $G = 8.4 \times 10^4$ MPa.	NOV-16	7
13	Design a helical compression spring for a maximum load of 1000 N for a deflection of 25 mm using the value of spring index as 5. The maximum permissible stress for spring wire is 420 N/mm^2 , and modulus of rigidity is 84 KN/ mm^2 .	MAY-17	7
14	Design a leaf spring for following specification: Total load = 14 tonnes Numbers of springs supporting the load = 4 Maximum number of leaves = 10 Span of the spring = 1000 mm Permissible deflection = 80 mm Take Young Modulus = 0.2×10^6 N/mm^2 , Allowable stress in spring material = 600 N/mm^2	MAY-17	7
15	What is A.M. Wahl's factor in spring? Explain the importance of Wahl's stress factor in spring design.	-	4
16	Classify and explain springs according to their shapes with neat sketches.	MAY-18	4
17	Define spring. Explain important functions and applications of springs.	-	4
18	Design a closed coil helical (neglecting the effect of stress concentration) spring from the following data: Maximum load = 2750 N Minimum load = 2250 N Axial deflection = 6 mm Spring index = 5 Permissible shear stress = 420 MPa Modulus of rigidity = 84 kN / mm^2	-	7

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ASSIGNMENT 4

SUB : DME (2151907) 5^{TH} ME A

Chapter 4 – BELT & CHAIN DRIVES

NO	QUESTION	YEAR	MARKS
1	Derive the expression of a ratio of driving tensions for the flat belt drive. Explain the effect of centrifugal tension on ratio of driving tensions in brief.	DEC-15 MAY-17	7 7
2	Derive an expression for the ratio of driving tensions of a V-belt drive.	MAY-16 NOV-16	7 7
3	What is crowning of the pulley? State the objectives of providing crowning.	MAY-16	3
4	Explain the step by step procedure used for design of chain drive system.	MAY-16 MAY-18	7 4
5	Why is the cross-section of the pulley an elliptical arm? Why is major axis of the cross-section in the plane of rotation?	NOV-16	3
6	State the advantage and disadvantage of the chain drive over belt and rope drive.	NOV-16	4
7	Sketch the cross section of a V-belt and label its important parts.	MAY-17	3
8	Explain any two type of chain with neat sketches. Explain the polygon action of chain.	DEC-15	7
9	A leather belt 9 mm x 250 mm is used to drive cast iron pulley 900 mm in diameter at 336 r.p.m. If the active arc on smaller pulley is 1200 and the stress in the tight side is 2 N/mm^2 , Find the power capacity of the belt. The density of leather may be taken as 980 kg/m^3 , and $\mu = 0.35$.	MAY-17	7
10	Two parallel shafts whose center lines are 4.8 m apart, are connected by an open belt drive. The diameter of the larger pulley 1.5 m and that of smaller pulley 1.05 m. The initial tension in the belt when stationery is 3 KN. The mass of the belt is 1.5 kg/m length. The co-efficient of friction between the belt and the pulley is 0.3 Taking centrifugal tension in to account, calculate the horse power transmitted, when smaller pulley rotates at 400 r.p.m.	MAY-17	7
11	A fan is driven by open belt from a motor runs at 880 rpm. A leather belt 8 mm thick and 250 mm wide is used. The diameter of motor pulley and driven pulley are 350 mm and 1370 mm respectively. The centre distance is 1370 mm and both pulleys are made of cast iron. The coefficient of friction of leather on cast iron is 0.35. The allowable stress for the belt is 2.5 MPa, which allows for factor of safety. The belt mass is 975 kg/m^3 . Determine the power capacity of belt drive.	NOV-16	7
12	A cast iron pulley transmits 20 kW at 300 rpm. The diameter of pulley is 550 mm and has four straight arms of elliptical cross-section in which the major axis is twice the minor axis. Find the dimensions of the arm if the allowable bending stress is 15 MPa.	NOV-16	4
13	A compressor, requiring 90 KW, is to run at about 250 R.P.M. The drive is by V-belts from an electric motor running at 750 R.P.M. The diameter of pulley on compressor shaft must not be greater than 1 metre while the centre distance between the pulleys is limited to 1.75 metre. The belt speed should not exceed 1600 meters/min. Determine the number of V-belts required to transmit the power if each belt has a cross-sectional area of 375 mm^2 , density 1000 kg / m^3 and an allowable tensile stress of 2.5 MPa. The groove angle of the pulleys is 35^0 . The coefficient of friction between the belt and the pulley is 0.25. Calculate also the length required of each belt.	MAY-16	7
14	Explain with the help of neat sketches, the types of flat belt drives.	-	4

15	Two V Belts of section B are transmitting power on grooved pulleys. Angle of Groove is 35^0 . Belt angle is 40^0 . The driver pulley of 300 mm runs at 1500 rpm and driven pulley is 600 mm diameter. The coefficient of friction between belt and pulley is 0.3. If the power transmitted is 150 kW, determine (i) Centrifugal tension (ii) maximum tension, (iii) length of the belt for open drive. (iv) designation of the belt, (v) the speed at which maximum power can be transmitted The mass of the belt is 0.193 kg per m length For Section B Belt. Assume centre distance between pulleys is 900 mm.	Dec-15	7
16	Design a 10 mm thick rubber belt to drive a dynamo generating 20 KW at 2250 R.P.M. and fitted with a pulley 200 mm diameter. The dynamo efficiency to be 85%. Allowable stress for belt = 2.1 MPa, Density of rubber = 1000 kg/m^3 , Angle of contact for dynamo pulley = 1650, μ = 0.3.	MAY-16	7
17	What is a condition for maximum power transmission in the belt drive? Derive it for maximum power.	-	7
18	Two parallel shaft 6m apart are to be connected by a belt running over a pulley of diameter 600 mm and 400 mm respectively. Find lengths of belt when belt is open and when belt is crossed.	-	4
19	An open belt drive connects two pulleys 1.2 m and 0.5 m diameter, on parallel shafts 3.6 m apart. The mass of the belt is 1 kg/m length and the maximum tension is not to exceed 2000 N. The coefficient of friction is 0.3. The 1.2 m pulley, which is the driver, runs at 200 rpm. Due to slip on one of the pulleys, the velocity of the driven shaft is only 450 rpm. Calculate (1) The torque on each of the two shafts, (2) The power transmitted, and (3) Power lost in friction.	-	7
20	Discuss the different types of belts and their material used for power transmission.	JUNE-11 JUNE-12	4 4
21	Explain Slip & Creep of belt. Also explain initial tension in belt.	-	7
22	Derive the equation for the length of belt for open belt drive. Also derive the equation for the arc of contact on smaller pulley.	-	7
23	Derive the equation for the length of belt for cross belt drive.	-	7

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ASSIGNMENT 5

SUB : DME (2151907) 5TH ME A

Chapter 5 – PRESSURE VESSELS

NO	QUESTION	YEAR	MARKS
1	Explain Clavarino's and Birnie's equation in detail.	DEC-15	7
2	Explain autofrettage for cylinders (or What is pre-stressing the cylinder? What are the various methods used for it?).	DEC-15 MAY-16 NOV-16	3 3 4
3	State the different equations used for the design of thick cylinder subjected to internal pressure based on materials and end conditions.	MAY-16	7
4	Explain various types of ends used for pressure vessels giving practical applications of each.	MAY-16 MAY-17 MAY-18	7 4 4
5	Drive the Lame's equation for thick cylinders.	NOV-16	4
6	Distinguish between circumferential stress and longitudinal stress in a cylindrical shell, when subjected to internal pressure.	MAY-17	4
7	Compare the stress distribution in thin and thick walled pressure vessels.	MAY-17	3
8	A shrink fit assembly formed by shrinking one tube over another, is subjected to an internal pressure of 60 N/mm^2 . Before the fluid is admitted, the internal and the external diameters of the assembly are 120 mm and 200 mm and the diameter of the junction is 160 mm. If after shrinking on, the contact pressure at the junction is 8 N/mm^2 , Determine using Lame's equations, stresses at the inner, mating and outer surfaces of the assembly after the fluid has been admitted.	MAY-17	7
9	A thick cylinder having 120 mm external diameter and 60 mm internal diameter is subjected to an internal fluid pressure of 15 MPa and external fluid pressure of 6 MPa. Determine the resultant hoop and radial stresses at inner and outer surface of cylinder. Also sketch curves showing the stresses distribution.	NOV-16	7
10	A high pressure cylinder consists of steel tube with 20 mm and 40 mm as inner and outer diameter respectively. It is jacketed by outer steel tube with 60 mm outer diameter. The tubes are assembled by shrinking process in such a way that the maximum principal tensile stress in any tube is restricted to 100 N/mm^2 . Find the shrinkage pressure and original dimension of the tube. Take E = 207 KN/mm^2 .	MAY-16 NOV-16	7 7
11	A cast iron pipe of internal diameter 200 mm and thickness of 50 mm carries water under a pressure of 5	DEC-15	7

	N/mm^2 . Calculate the tangential and radial stresses at Radiuses (r) =100 mm; 110 mm; 130 mm; 140 mm and 150 mm. Sketch the stress distribution curves.		
12	The piston rod of a hydraulic cylinder exerts pressure of 10 MPa. The internal diameter of the cylinder is 350 mm. The C.I. cover plate of thickness 15 mm is fixed to the cylinder by means of 8 bolts with a nominal diameter of 16 mm and zinc gasket of 5 mm thickness. The bolts are made of steel FeE350 (σ_y = 350 N/mm^2). The flange thickness is 15 mm. Each bolt is initially tightened with a pre-load of 18 kN. Determine factor of safety of the bolts considering the effect of the gasket. Assume E for steel= 207 GPa; E for cast iron =100 GPa; E for Zinc=90 GPa.	DEC-15	7
13	What is compounding of cylinder? Why it is required?	-	4
14	Explain area compensations for nozzles.	-	4
15	What are the important points to be considered while designing the pressure vessels?	-	4
16	The piston rod of a hydraulic cylinder exerts an operating force of 10 kN. The friction due to piston packing and stuffing box is 10 % of the operating force. The pressure in the cylinder is 10 N/mm 2 . The cylinder is made of C.I. having allowing tensile stress of 40 N/mm 2 . Determine the diameter and thickness of the cylinder.	-	7
17	The inner diameter of a cylinder tank for liquefied gas is 250 mm. The gas pressure is limited to 15 MPa. The tank is made of plain carbon steel 10C4 (S ut = 340 N/mm^2 and μ = 0.27) and the factor of safety is 5. Calculate the cylinder wall thickness.	-	7
18	A steel tank for shipping gas is to have an inside diameter of 200 mm and a length of 1000 mm. The gas pressure is 10.5 N/mm^2 . The permissible stress is to be 56 Mpa. (a) Determine the required wall thickness, using the thin cylinder equation. (b) Determine the thickness using Clavarino's equation.	-	7
19	An accumulator is required to store 150 liters of water at a pressure 20 MPa. Assuming the length of stroke to be 3 meter, determine: (a) The diameter of the ram. (b) The internal diameter of the cylinder, assuming a clearance of 40 mm. (c) The thickness of the cylinder, if the permissible stress of the cylinder is 60 N/mm^2 .	-	7
20	A high pressure cylinder consists of a steel tube with 20 mm and 35 mm as inner and outer diameters respectively. It is jacketed by outer steel tube with 50 mm outer diameter. The tubes are assembled by shrinking process in such a way that the maximum tensile stress induced in any tube is limited to 100 N/mm 2 . Calculate the	-	7

	shrinking pressure and original dimensions of the tubes. $E = 2.0 \times 10^5$ N/mm^2 .		

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