NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF INDUSTRIAL TECHNOLOGY

INDUSTRIAL AND MANUFACTURING ENGINEERING DEPARTMENT

Bachelor of Engineering Honours Degree Industrial and Manufacturing Engineering

2nd Semester Main Examination

COURSE : SOLID MECHANICS II

CODE : TIE 2203

DATE : MAY 2014

DURATION : 3 HOURS

INSTRUCTIONS AND INFORMATION TO CANDIDATE

1. Answer any **five** questions of the **seven** questions.
2. Each question carries **20 marks.**
3. This paper contains six **(7)** questions.
4. There are five **(4)** printed pages.

REQUIREMENTS

1. Scientific Calculator

QUESTION 1

A material is subjected to two mutually perpendicular direct stresses of 120 MN/m^2 tensile and 80 MN/m^2 compressive, together with a shear stress of 46 MN/m^2. The shear couple acting on planes carrying the 120 MN/m^2 stress is clockwise in effect. Calculate

a) The magnitude of the principal stresses, **[8]**
b) The direction of the planes on which these stresses act, **[6]**
c) The magnitude of the maximum shear stress, **[3]**
d) The normal stress. **[3]**

QUESTION 2

A compound cylinder is formed by shrinking a tube 300 mm external diameter with a wall thickness of 30 mm onto another cylinder of internal diameter 300 mm, also 30 mm thick, both being made from the same material. The stress set up due to shrinkage is $20MN/m^2$. The compound cylinder is now subjected to an internal pressure of $80MN/m^2$.

a) Calculate the hoop stress on the inner and outer surfaces of the outer tube. **[10]**
b) Determine the hoop stress on the inner and outer surfaces of the inner tube. **[10]**

QUESTION 3

A diameter 120 mm solid shaft transmits 0,75 MW at 300 revolutions per minute and is also subjected to a bending moment of 10 KNm as well as a tensile load. If the maximum principal stress is limited to 80 MN/m^2 , determine,

a) The permissible end thrust **[10]**
b) The other principal stress **[4]**
c) The planes on which these stresses act **[6]**

QUESTION 4

A diameter 80 mm shaft is pressed into a steel ring of outside diameter 100 mm, 200 mm long such that under an applied toque of 10 kNm, relative slip is just avoided. Assuming diameter 80 mm to be common for both the shaft and ring, calculate

a) The interference fit, **[10]**

b) The circumferential stress in the hub. **[10]**

QUESTION 5

A thin walled member 1,5 metres long has a cross section shown below in Figure QU5, the Truncheon. Further details for use, if required, are shown in Table QU5.

a) Determine the maximum torque that can be carried by this shaft if the angle of twist is not to exceed 12^o **[10]**

b) What will be the maximum shear stress when this maximum torque is applied. **[10]**

Take G for the material as 90 GN/m^2

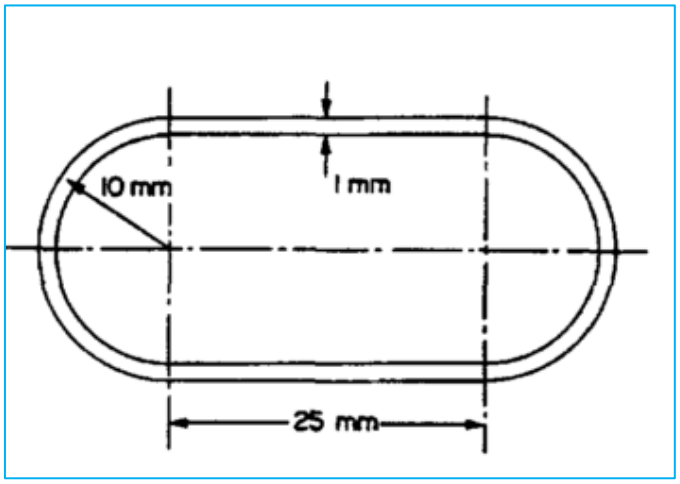

Figure QU5 Truncheon

Table QU5

d/b	1.0	1.5	1.75	2.0	2.5	3.0	4.0	6.0	8.0	10.0	∞
k_1	0.208	0.231	0.239	0.246	0.258	0.267	0.282	0.299	0.307	0.313	0.333
k_2	0.141	0.196	0.214	0.229	0.249	0.263	0.281	0.299	0.307	0.313	0.333

QUESTION 6

An I- section girder is rigidly built in at one end and loaded at the other end with a load with a magnitude of 2 kN, inclined at 30^o to the web. The load passes through the centroid section of the girder. The dimensions are: flange 100 mm x 200 mm: web, 200mm x 12 mm.

a) Determine the stress set up in the cross section. **[10]**

b) Calculate the maximum stress set up when the load is acting vertically. **[10]**

QUESTION 7

A hollow circular steel strut with its ends fixed in position has a length of 2 metres, an outside diameter of 120 mm and an inside diameter of 90 mm. Assuming that before loading, there is an initial sinusoidal curvature of the strut with a deflection of 5 mm, determine the maximum stress set up due to a compressive end load of 240 kN. Take E to be equal to 220 GN/m^2 **[20]**

.....End of the examination.....