University of Technology
Mechanical Engineering Department
Final Term Examination 2015/2016

Subject: CAE
Division: Aircraft Engineering
Examiner(s): CAE group

Year: 4th year classes
Time: 3 Hrs.
Date: 31 /5 / 2016

Note: 1. Answer (one) question only. 2. Assume any missing data.

Q1. For the surface shown in figure bellow simulate:

A) Free vibration to determine:

1- (10) Mode shapes. And 2- Natural frequencies.

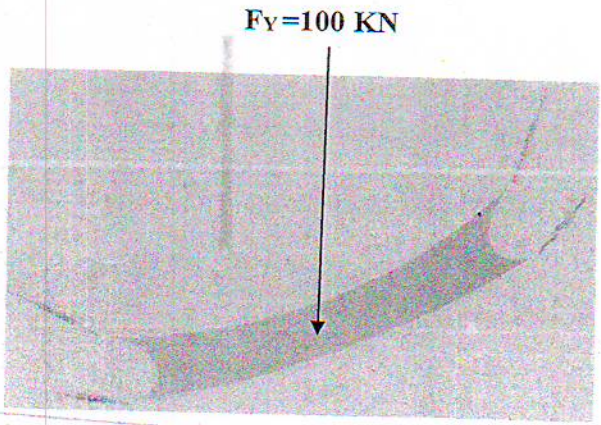
B) Harmonic vibration at each 0.1 Hertz (0.1 Hz) to determine:

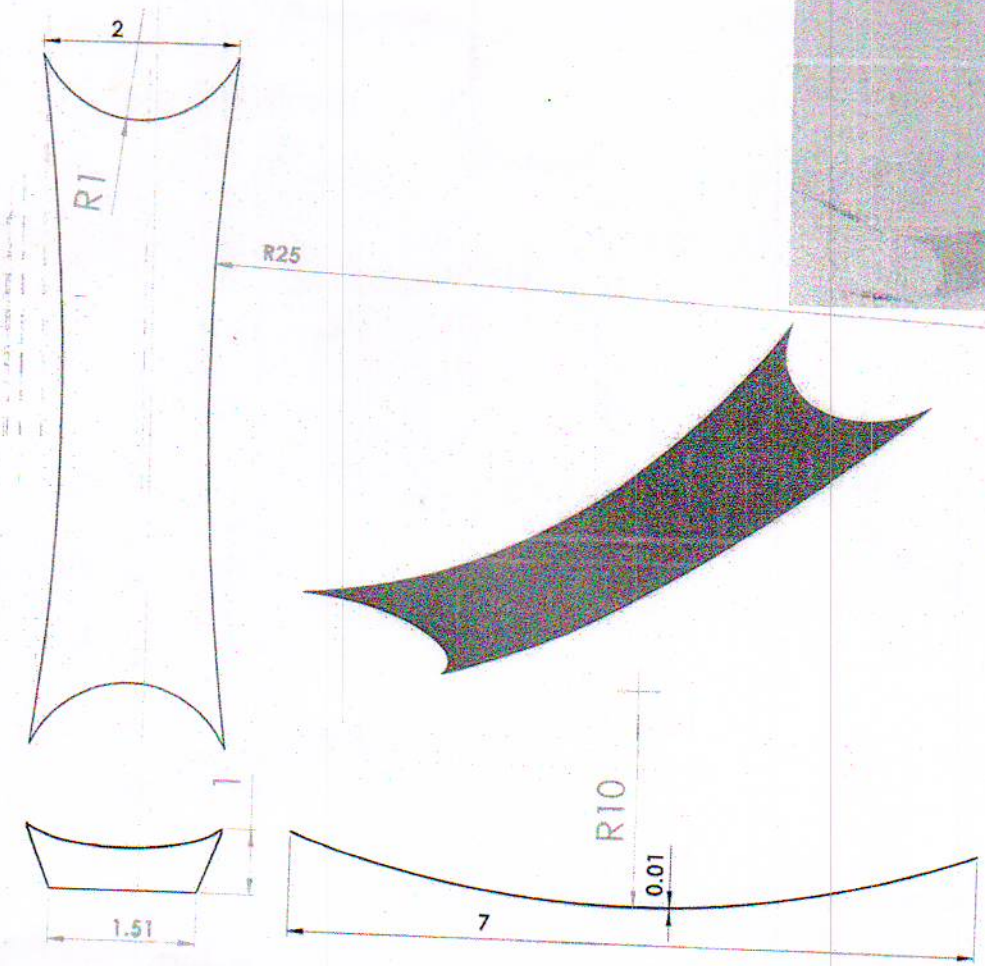
1- Deformation response of geometry at load direction.

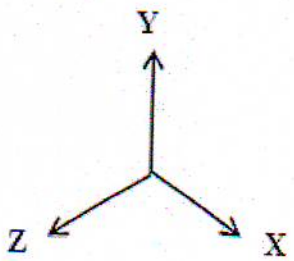
2- Stress and strain at maximum peak frequency.

C) Buckling analysis to determine load multiplier.

Assumption:
Apply excitation within the range of the natural frequency of geometry
Material: copper
Elastic deformation
Spring stiffness=100 N/m
The ground is far away from the surface corners by (0.5 m) in X direction and (1 m) in Y & Z directions
Dimensions in meters







50 marks

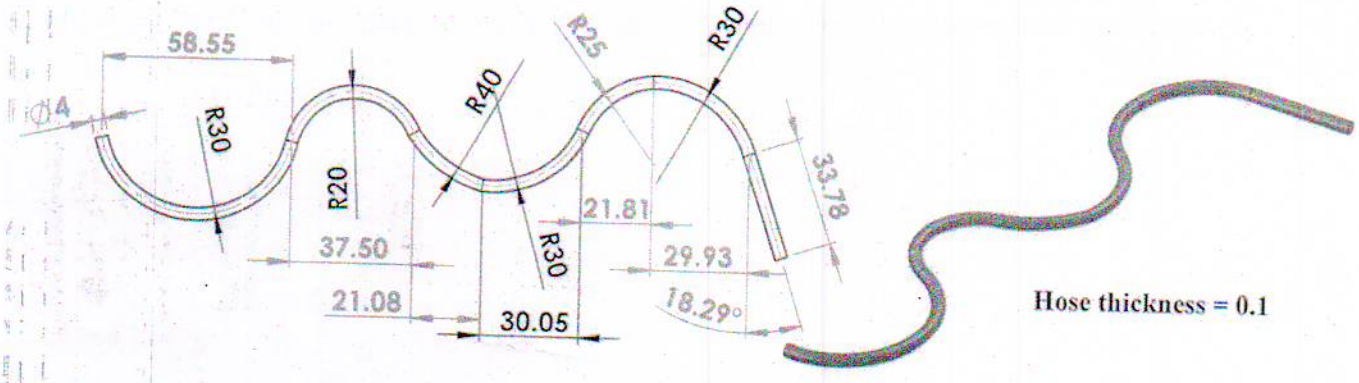
University of Technology
Mechanical Engineering Department
Final Term Examination 2015/2016

Subject: CAE
Division: Aircraft Engineering
Examiner(s): CAE group

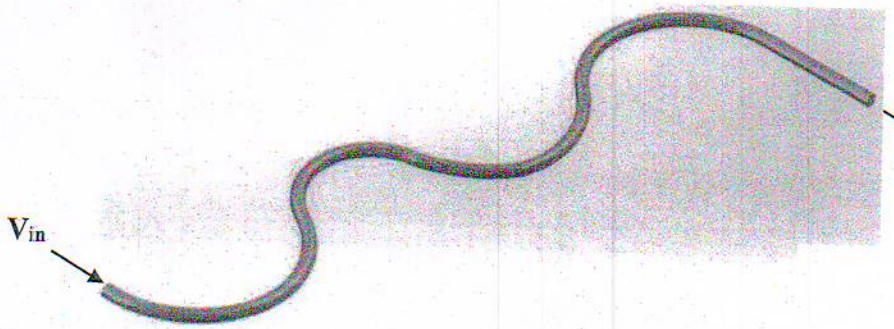
Year: 4th year classes
Time: 3 Hrs.
Date: 31 /5 / 2016

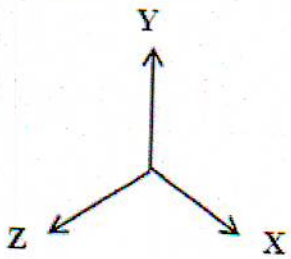
Q2. Simulate fluid structure interaction to determine the stress and deformation in hose (flexible pipe) due to fluid flow and heat flux for the geometry shown in the figure below:

Assumption:
Steady state
Working fluid: water , Turbulent flow
V_{in}=4 m/s, T_{in}=10 °C, P_{out}=1 atm. and constant heat flux at fluid wall=10 KW/m^2
Dimension in centimeter
Hose is fixed at ends surfaces
Hose material: polyethylene



Hose thickness = 0.1





Minimum iterations = 100

Determine the following:
Contour of pressure in (XZ-plane), at mid-plane
Vector of velocity in (XZ-plane), at mid-plane
Contour of temperature in (XZ-plane), at mid-plane

50 marks

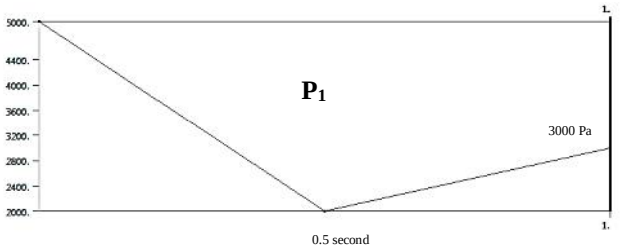
University of Technology
Mechanical Engineering Department
Final Year Examination 2014/2015

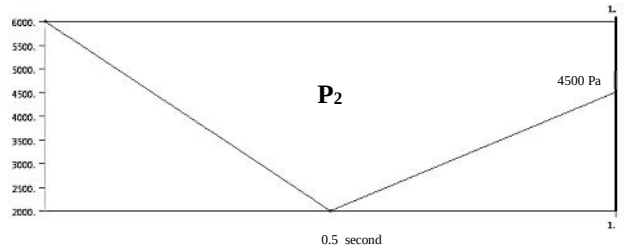
Subject: CAE **Year:4th year**
Division: All Divisions **Exam Time: 3 Hrs.**
Examiner(s): CAE Group **Date: 20 / 10 / 2015**

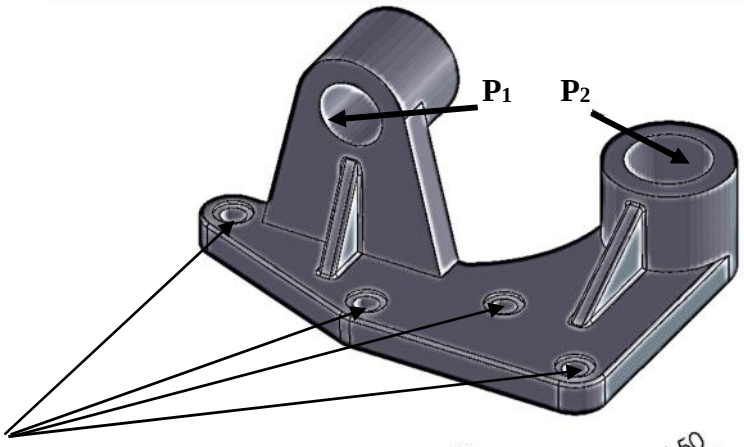
Notes: 1. Answer (one) question only. 2. Assume any missing data. 3. All dimensions in millimeters.

Q1. For the geometry shown in figure bellow, simulate transient structure analysis to determine deformation, stress and strain.

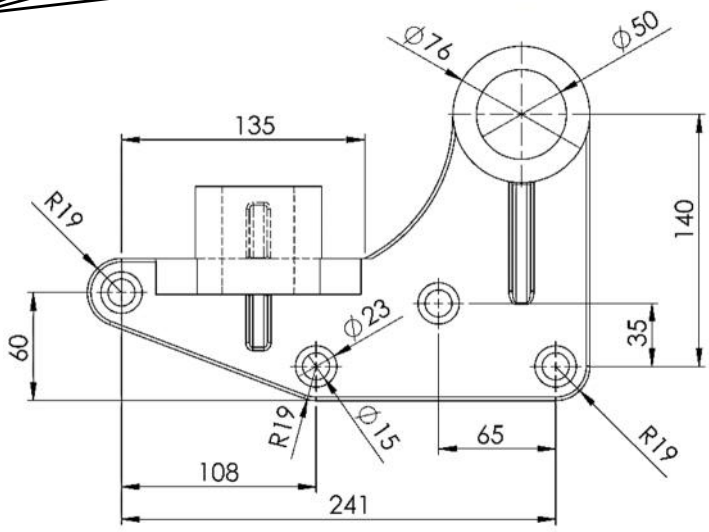
Assumption:
Material: steel
Elastic deformation

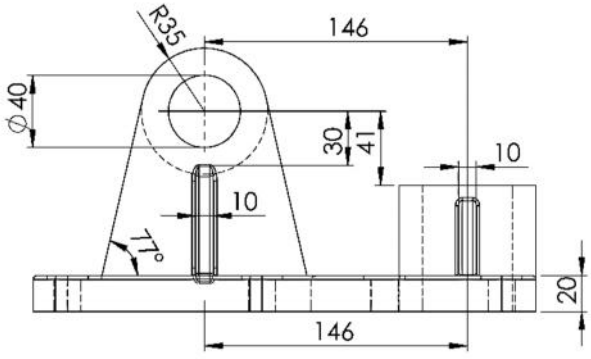


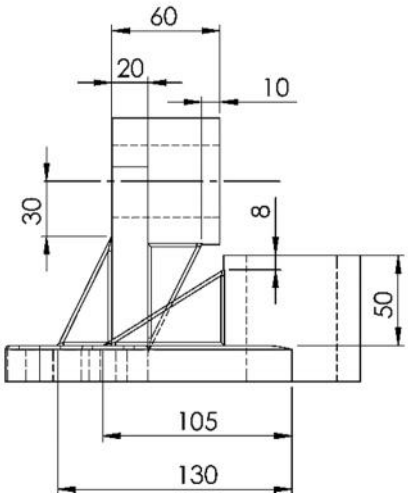




Fixed







50 marks

Q2. Simulate thermal and structure interaction in heat sink shown in the figure bellow to determine temperature distribution, deformation, stress, and strain:

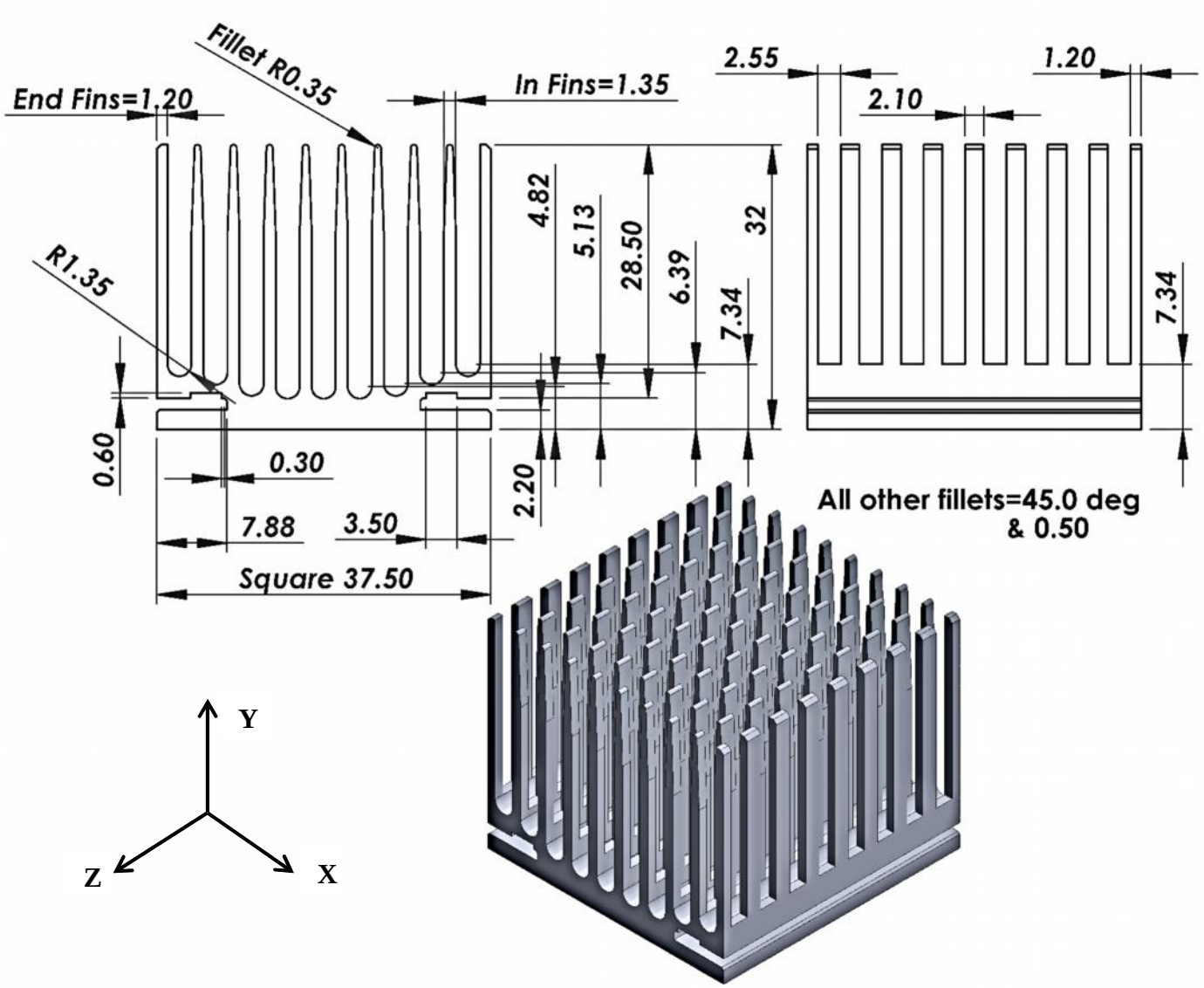
Assumption

Steady state

Lower face is fixed and subjected to constant temperature, T = 90 ºC

All other faces are subjected to convection heat transfer, $T_\infty = 30\,℃ \;\; and \;\; h = 4\,\frac{W}{m^2\,℃}$

Material: Copper



50 marks

University of Technology
Mechanical Engineering Department
Final Year Examination 2014/2015

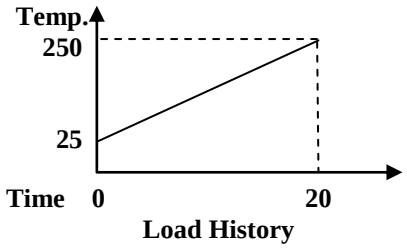
Subject: CAE
Division: All Divisions
Examiner(s): CAE group

Year: 4th year classes
Time: 3 Hrs.
Date: 16 / 9 / 2014

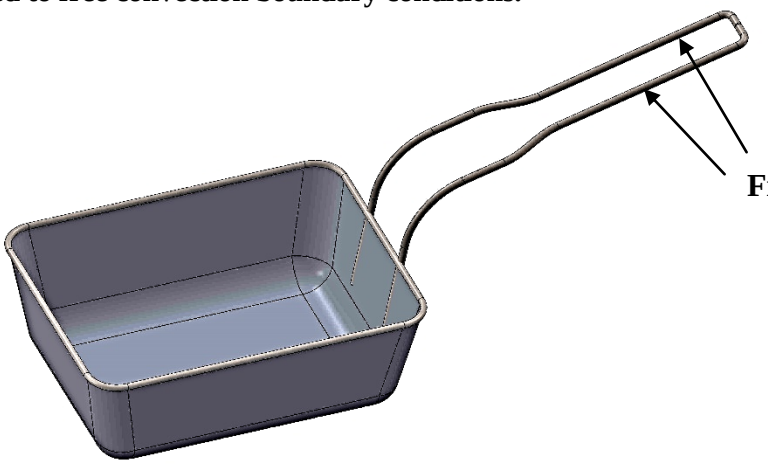
Note: 1. Answer (one) question only. 2. Assume any missing data.

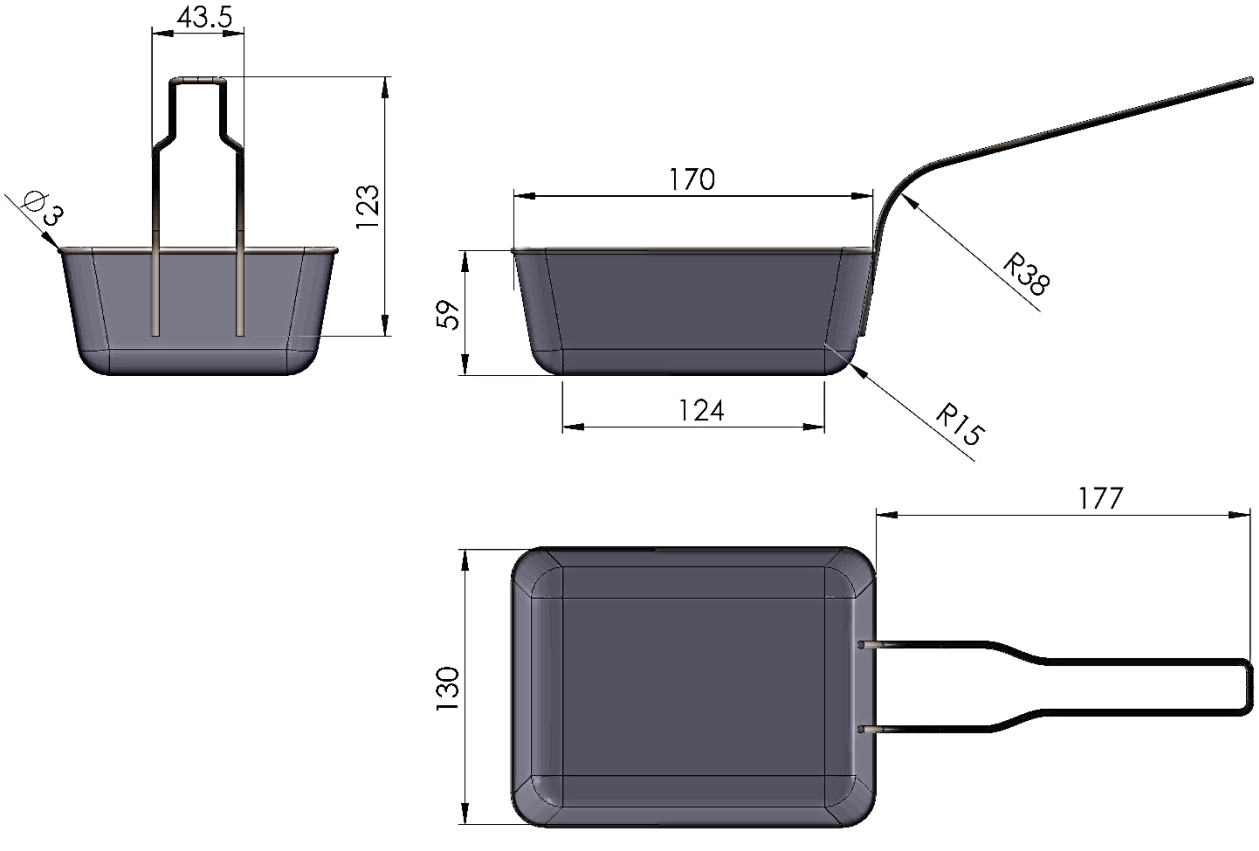
Q1. For the frying pan shown in figure bellow, determine:

A) Temperature distribution after 20 sec. due to thermal load showing in load history.
B) Steady state thermal induced stress due to thermal load.



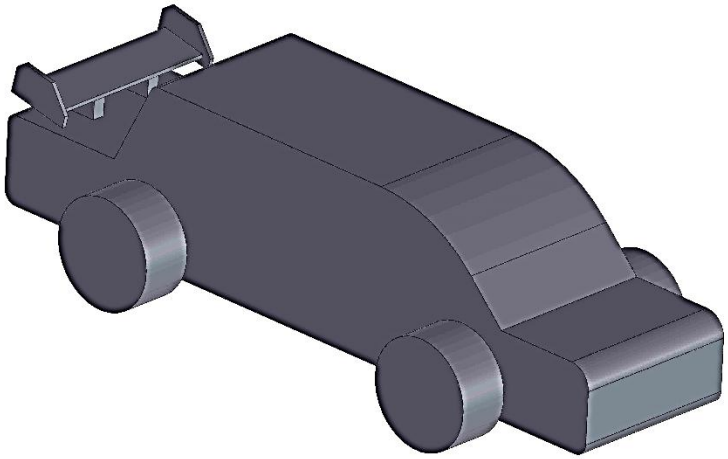
Assumption:
$T_{initial}$ = 25 °C , T_∞ = 20 °C , h_∞ = 5 W/m^2.°C
Material: steel
Dimension in mm and thickness of the frying pan = 4 mm
Lower surface is subjected to the temperature showing in load history.
All other surfaces are subjected to free convection boundary conditions.



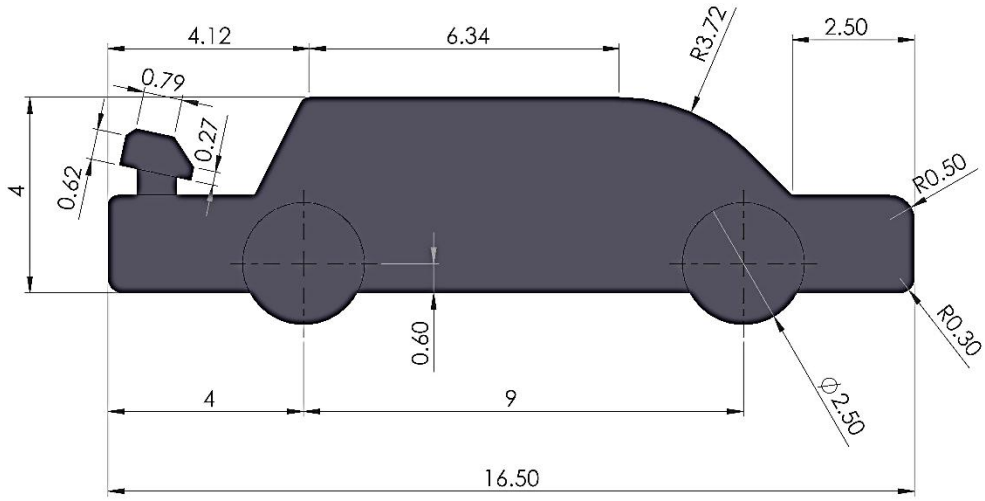


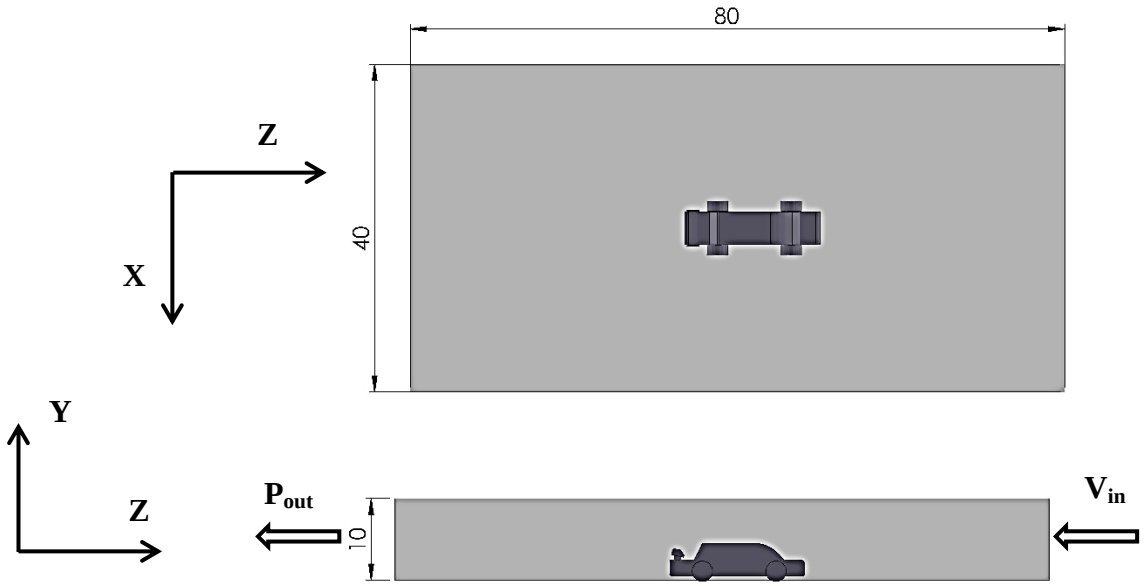
50 marks

Q2. Simulate fluid structure interaction to determine the stress and deformation in car model shown in the figure below:



Assumption:
Steady state
Working fluid: air
Turbulent flow
V_{in}=10 m/s
P_{out}=1 atm.
Dimension in cm





Determine the following:
Contour of pressure in (YZ-plane), at channel mid-plane
Vector of velocity in (YZ-plane), at channel mid-plane
Contour of velocity in (XZ-plane), at channel mid-plane

50 marks

University of Technology
Mechanical Engineering Department
Final Year Examination 2014/2015

Subject: CAE
Division: Air Conditioning and Refrigeration Engineering
Examiner(s): CAE group

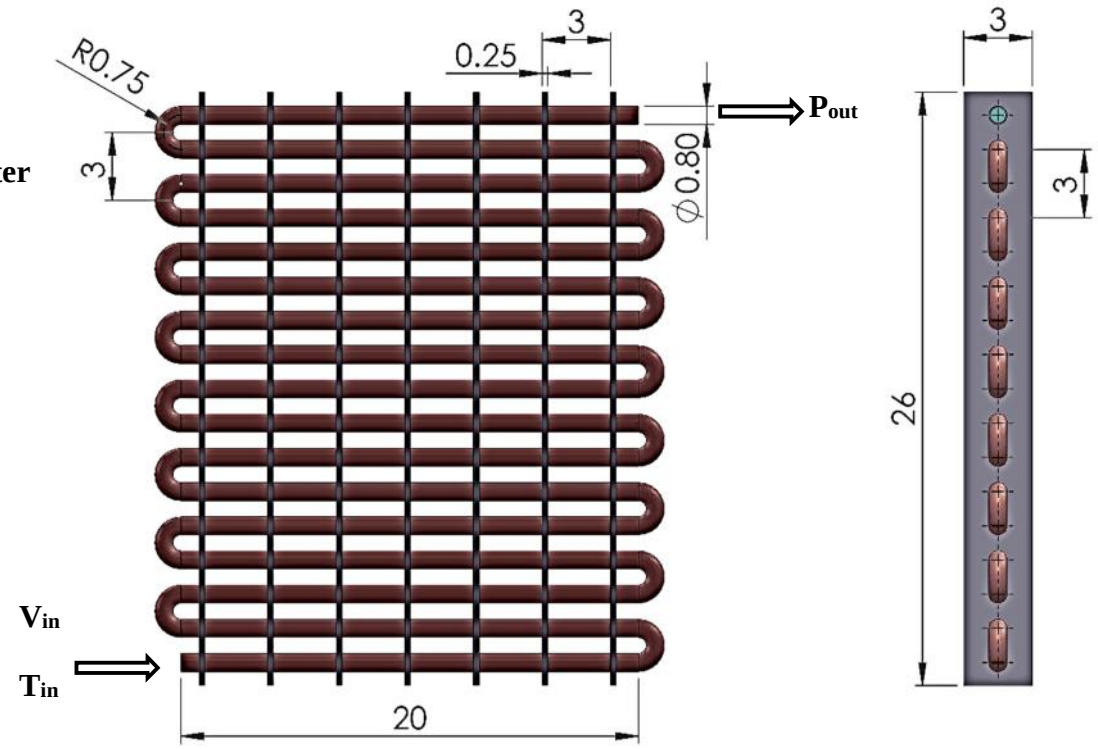
Year: 4th year classes
Time: 3 Hrs.
Date: 1 / 6 / 2015

Note: 1. Answer (one) question only. 2. Assume all missing data.

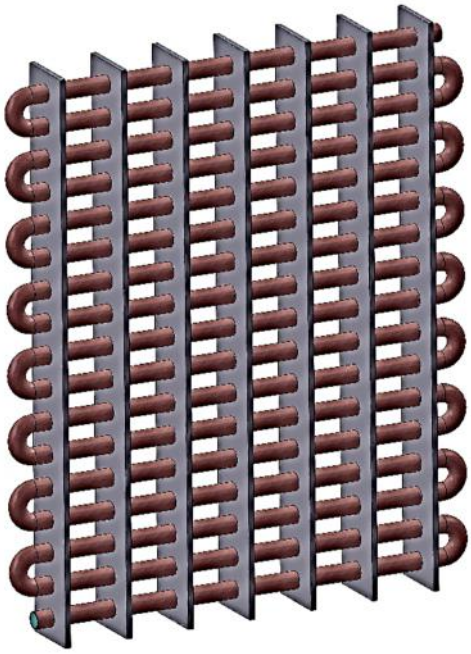
Q1. Simulate fluid structure interaction to determine the stress and deformation in the condenser shown in figure below due to fluid flow and thermal load.

Assumption:

Steady state
Working fluid: water
Turbulent flow
V_{in} = 1 m/s
T_{in} = 60 ºC
P_{out} = 1 atm
Dimension in mm

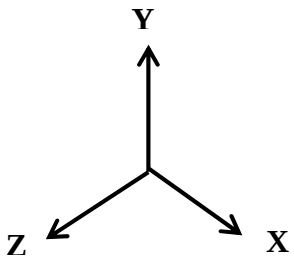


Pipe thickness 1mm



All surfaces are subjected to convection

$$T_{\infty} = 25\,℃ \quad and \quad h = 2.5\ \frac{W}{m^2\,℃}$$



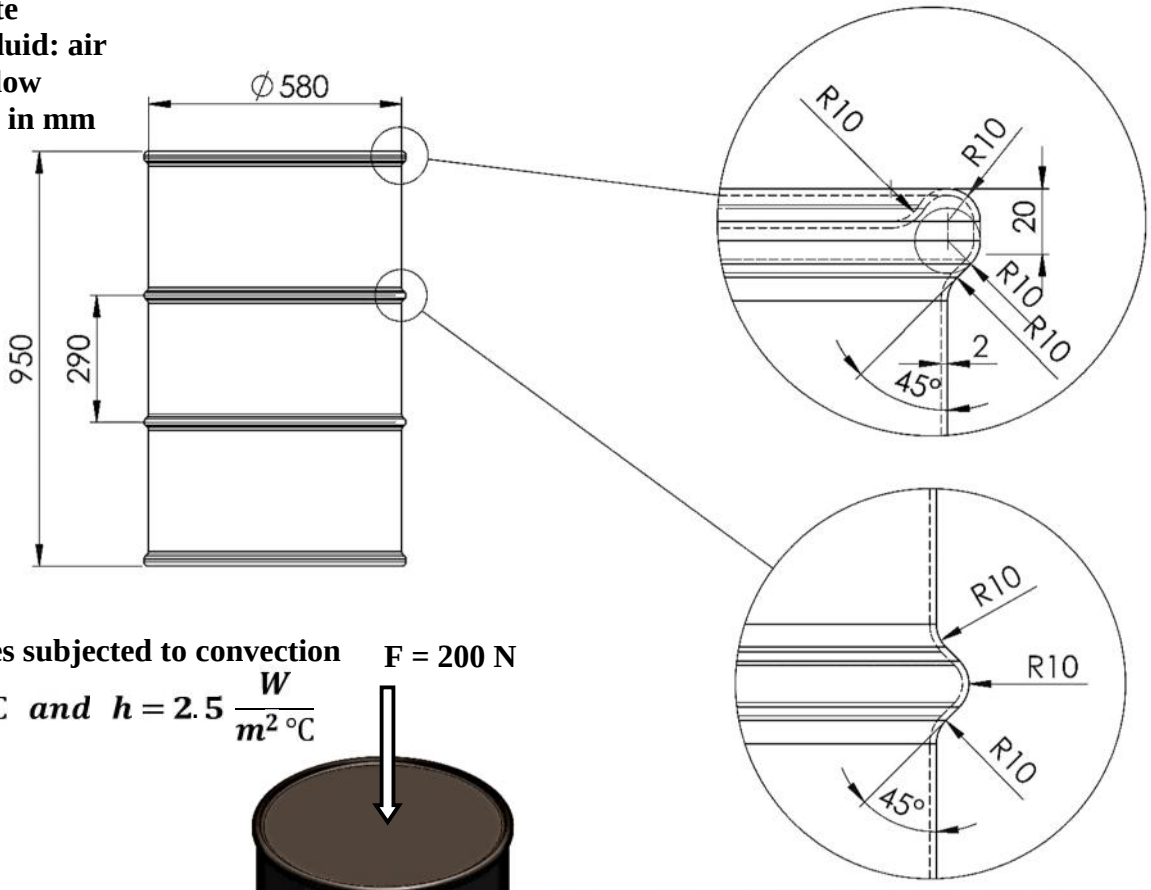
Determine the following:
Contour of pressure in (YZ-plane), at mid-plane
Vector of velocity in (YZ-plane), at mid-plane
Contour of velocity in (XZ-plane), at mid-plane

50 marks

Q2. (a) Simulate steady state convection in geometry shown in figure below,
(b) Simulate fluid structure interaction to determine maximum stress and strain due to pressure load and thermal load shown in figure below.

Assumption:

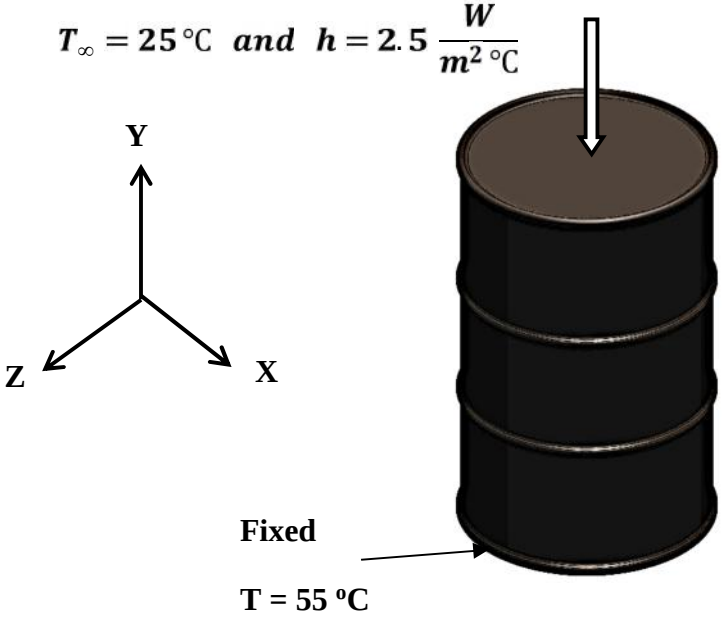
Steady state
Working fluid: air
Laminar flow
Dimension in mm



All surfaces subjected to convection

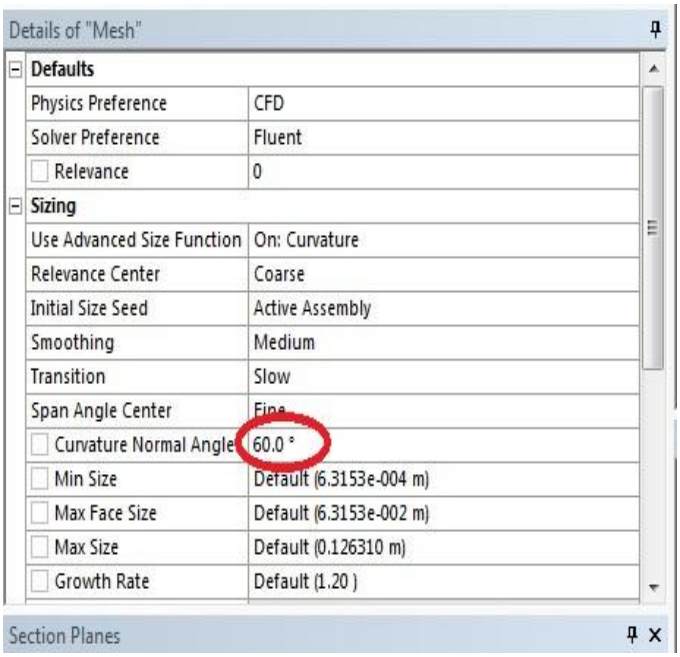
$T_\infty = 25\,°C \;\; and \;\; h = 2.5\ \frac{W}{m^2\,°C}$

F = 200 N



T = 55 °C

Hint: For the fluid part, generate mesh using curvature normal angle 60°



Determine the following:
Contour of pressure in (YZ-plane), at mid-plane
Vector of velocity in (YZ-plane), at mid-plane
Contour of velocity in (XZ-plane), at mid-plane

50 marks

University of Technology
Mechanical Engineering Department
Final Year Examination 2014/2015

Subject: CAE
Division: General Mechanical Engineering
Examiner(s): CAE group

Year: 4th year classes
Time: 3 Hrs.
Date: 28 / 5 / 2015

Note: 1. Answer (one) question only. 2. Assume all missing data.

Q1. For the Hand Crunch shown in figure bellow simulate:

A) Free vibration to determine:

1- Mode shape. And 2- Natural frequencies.

B) Harmonic vibration to determine:

1- Deformation response of geometry at load direction.

2- Stress and strain at maximum peak frequency.

C) Buckling analysis to determine buckling load

D) Transient structure analysis to determine deformation and stress at t=0.5 s., t=1 s.

Time step =0.2 s.

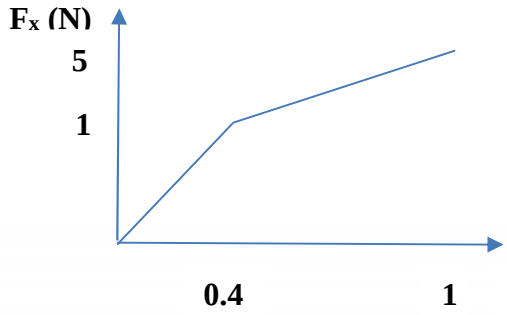
Total time =1 s.

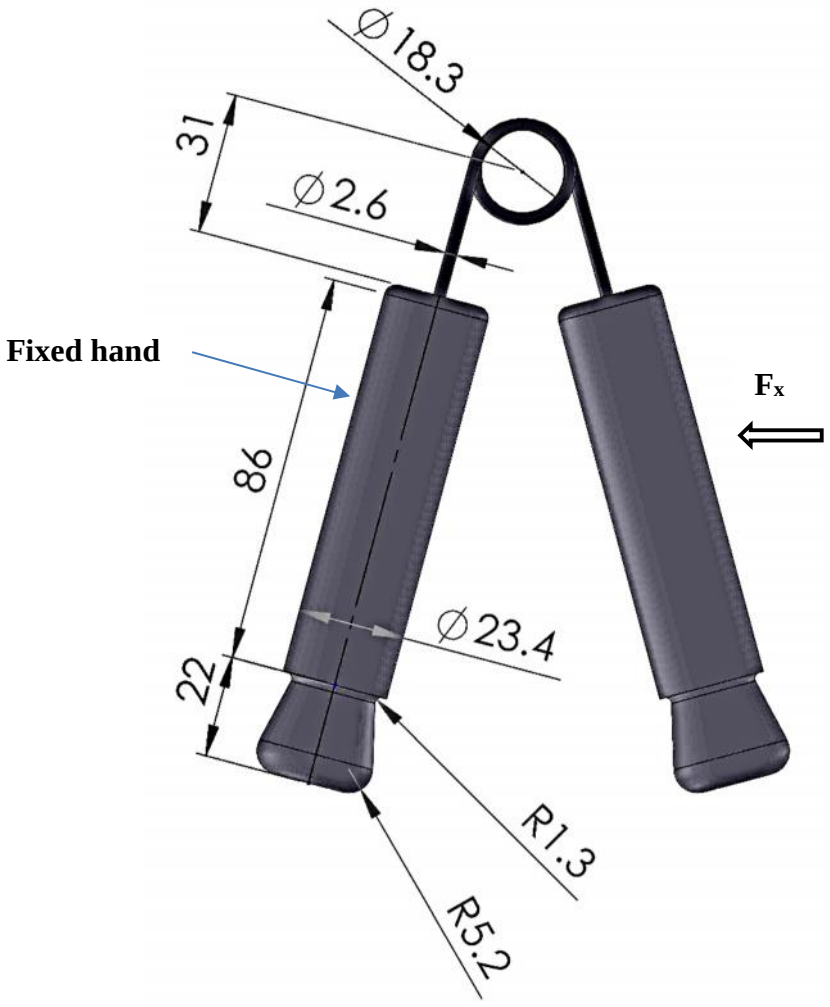
Assumption:

Apply excitation frequencies within the range of the natural frequencies of the geometry

Material: steel

Elastic deformation

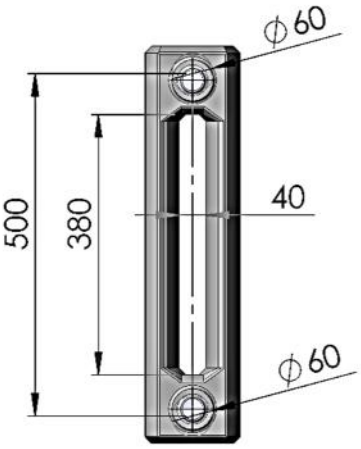


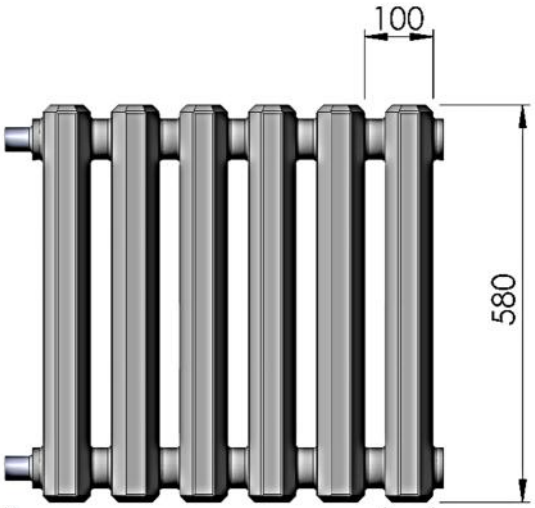


Q2. Simulate fluid structure interaction to determine the stress and deformation in Heat exchanger due to fluid flow and thermal load for the geometry shown in figure below:

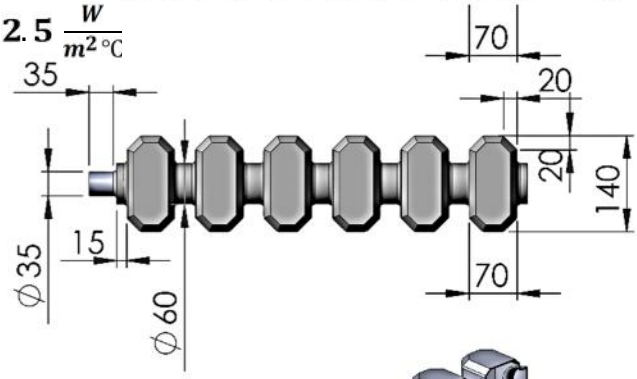
Assumption:

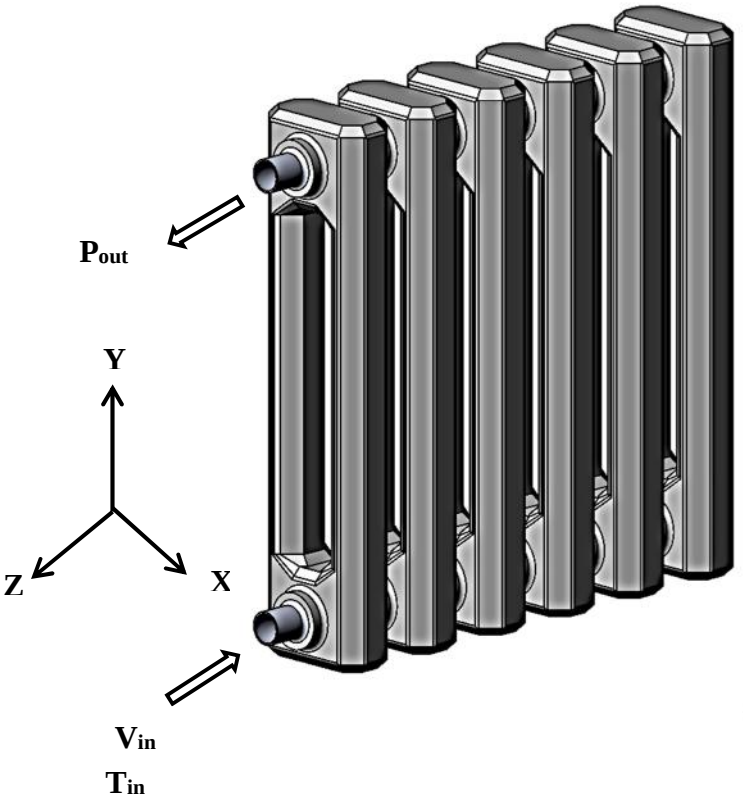
Steady state
Working fluid: water
Turbulent flow
V_{in}= 0.5 m/s
T_{in}= 50 ºC
P_{out}= 1 atm
Dimension in mm





All surfaces subjected to Convection $T_\infty = 25\,°C$ *and* $h = 2.5\ \frac{W}{m^2\,°C}$





All fillet R5

Plate thickneses 20mm
Sectional View

Determine the following:
Contour of pressure in (YZ-plane), at duct mid-plane
Vector of velocity in (YZ-plane), at duct mid-plane
Contour of velocity in (XZ-plane), at duct mid-plane

50 marks

University of Technology
Mechanical Engineering Department
Final Year Examination 2014/2015

Subject: CAE
Division: Automotive and Aircraft Engineering
Examiner(s): CAE group

Year: 4th year classes
Time: 3 Hrs.
Date: 26 /5 / 2014

Note: 1. Answer (one) question only. 2. Assume any missing data.

Q1. For the bracket shown in figure bellow simulate:

A) Free vibration to determine:

1-Mode shape. And 2- Natural frequencies.

B) Harmonic vibration to determine:

1- Deformation response of geometry at load direction.

2- Stress and strain at maximum peak frequency.

C) Transient structure analysis to determine deformation at time intervals t=2.5 sec. and t=9.5 sec. assume Δt=1 sec. and total time=10 sec.

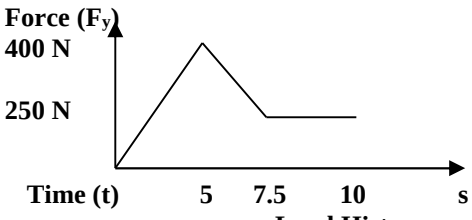
Assumption:

Apply excitation within the range of the natural frequency of geometry

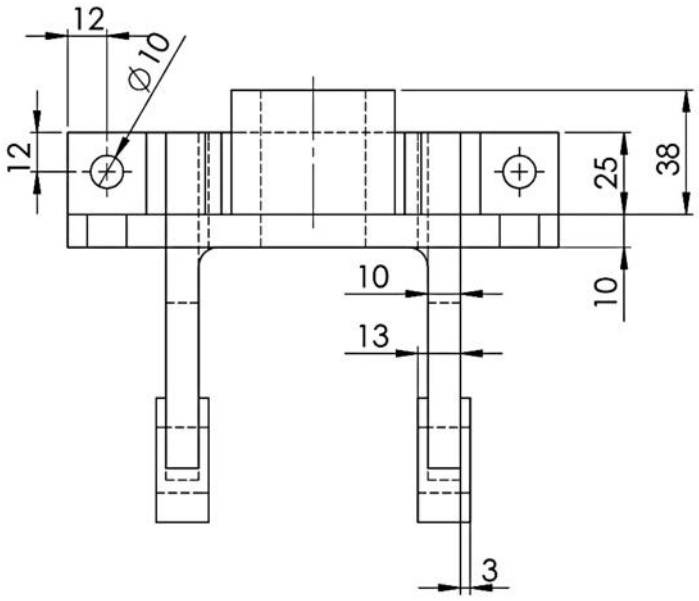
Material: steel

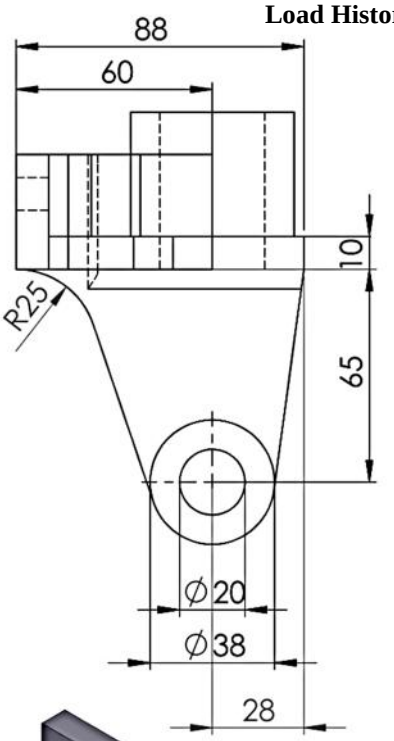
Elastic deformation

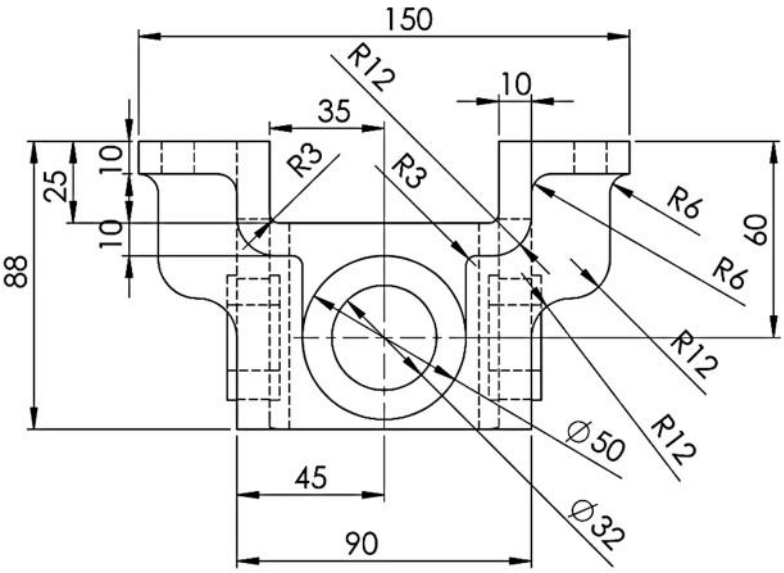
Dimension in mm

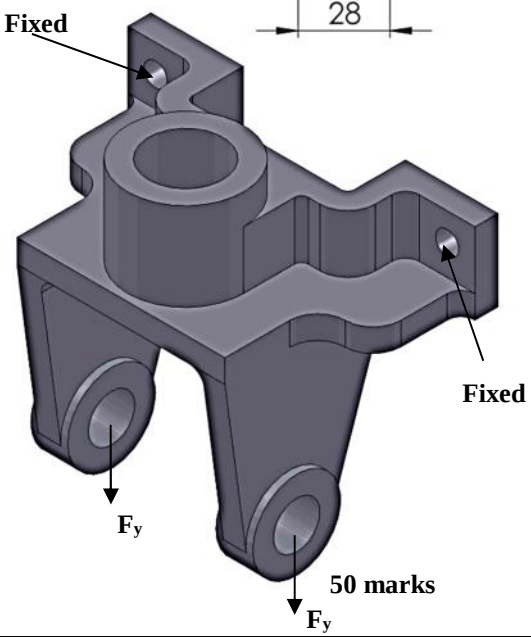


Load History





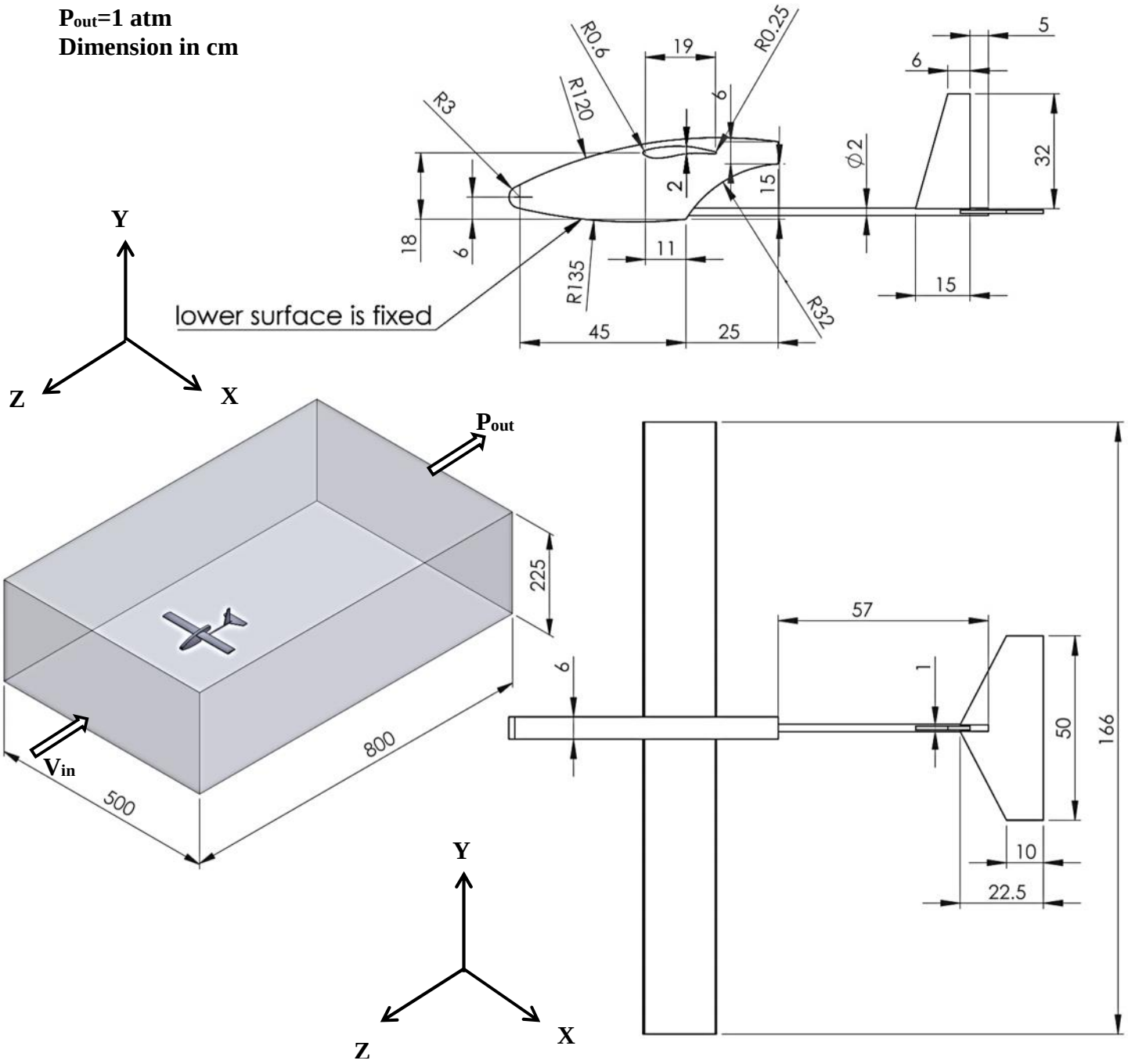




50 marks

Q2. Simulate fluid structure interaction to determine the stress and deformation in airplane due to fluid flow for the geometry shown in the figure below:

Assumption:
Steady state
Working fluid: air
Turbulent flow
V_{in}=15 m/s
P_{out}=1 atm
Dimension in cm



Determine the following:
Contour of pressure in (YZ-plane), at duct mid-plane
Vector of velocity in (YZ-plane), at duct mid-plane
Contour of velocity in (XZ-plane), at duct mid-plane

50 marks

University of Technology
Mechanical Engineering Department
First Term Examination 2014/2015

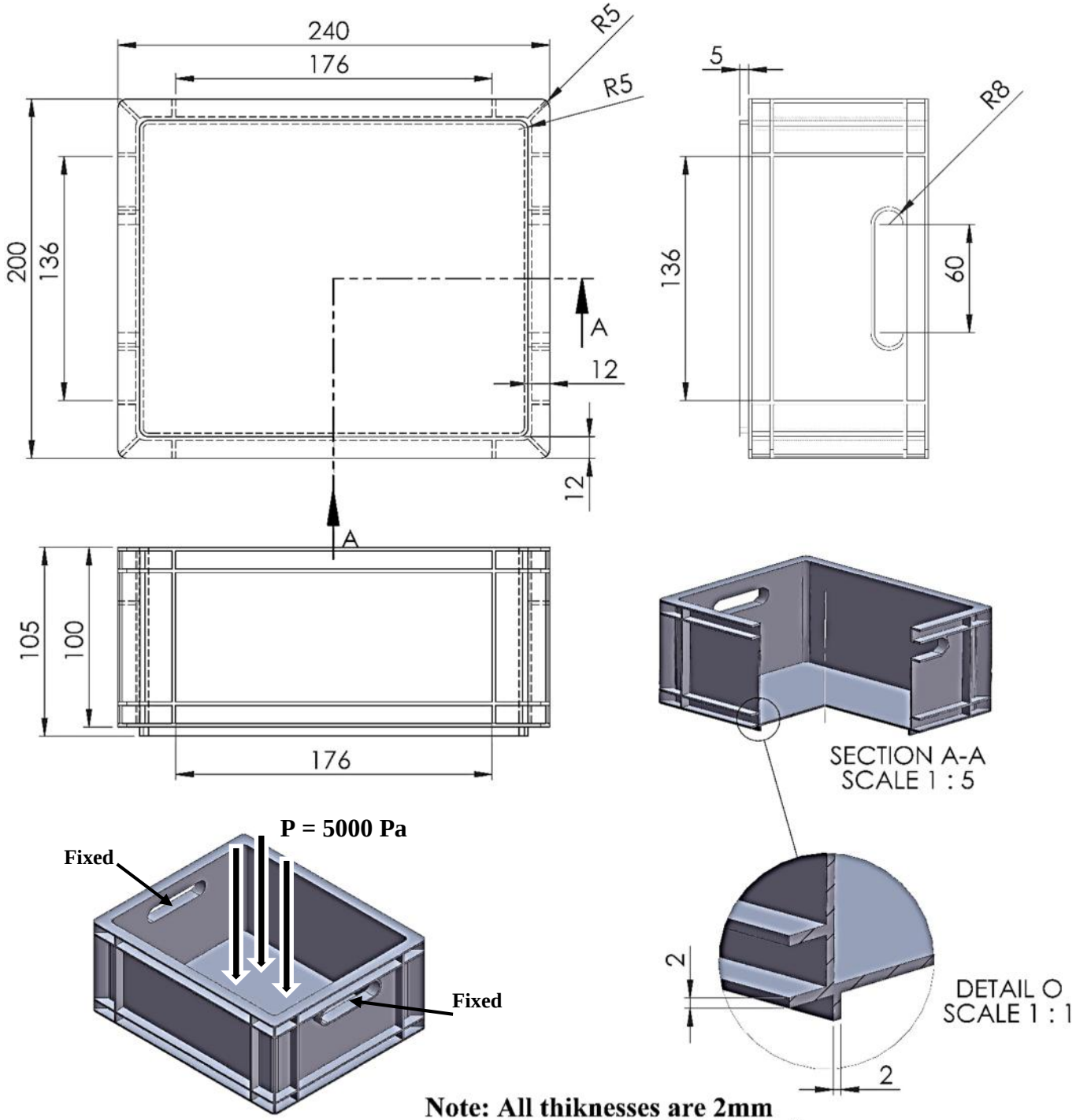
Subject: CAE (ANSYS) **Year: 4th year**
Division: Automotive and Aircraft Engineering **Exam Time: 1.5 Hrs.**
Examiner(s): CAE Group **Date: 29 / 1 / 2015**

Notes: 1. Answer (one) question only. 2. Assume all missing data. 3. All dimensions in millimeters.

Q1: Simulate deformation and stress for the box shown in figure below:

Assumption:

Steady state , Material: Polyethelene

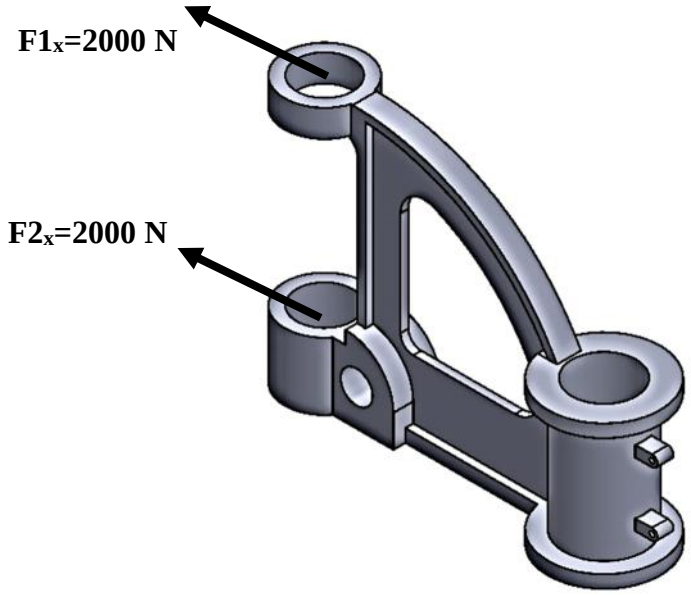


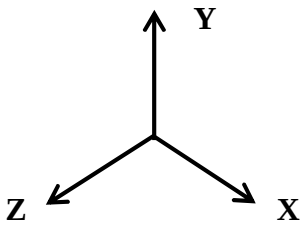
Note: All thiknesses are 2mm
All round and fillets are 5mm

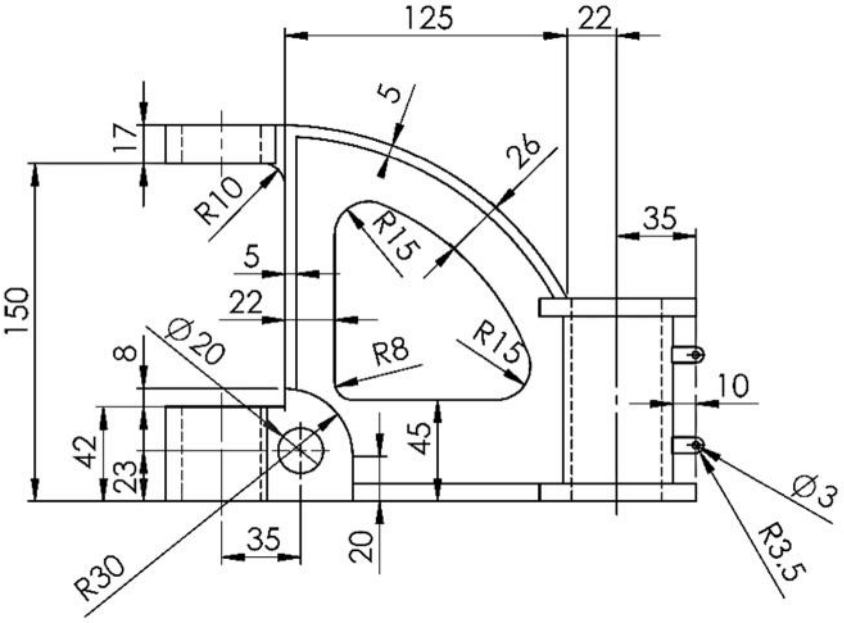
15 marks

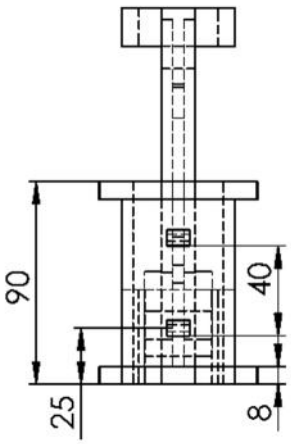
Q2: For the geometry shown in figure bellow, simulate temperature distribution, stress, strain and deformation due to forces and thermal load applied on body:

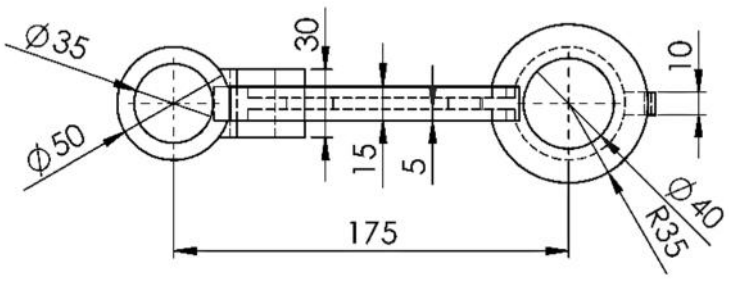
Assumption:
Material: steel, Elastic deformation
Lower surface is <u>fixed</u> and subjected to constant wall temperature = 250 ℃
All other surfaces are subjected to free convection heat transfer $T_\infty = 22\,℃ \;\; and \;\; h = 3\ \frac{w}{m^{2}℃}$











15 marks

University of Technology
Mechanical Engineering Department
First Term Examination 2014/2015

Subject: CAE (ANSYS) **Year: 4th year**
Division: Air Conditioning and Refrigeration Engineering **Exam Time: 1.5 Hrs.**
Examiner(s): CAE Group **Date: 27 / 1 / 2015**

Notes: 1. Answer (one) question only. 2. Assume all missing data. 3. All dimensions in millimeters.

Q1. Simulate thermal and structure interaction in heat sink shown in the figure bellow to determine temperature distribution, deformation, stress, and strain at mid-plane:

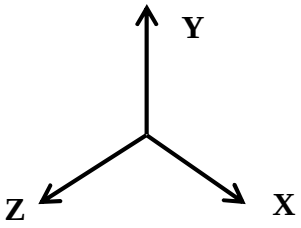
Assumption

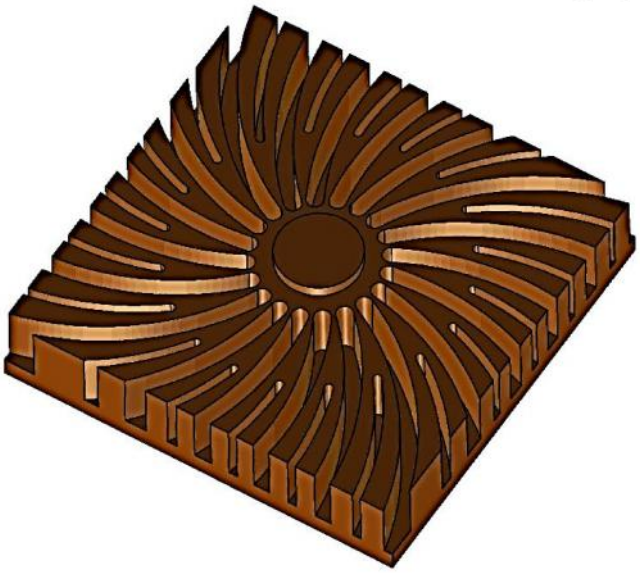
Steady state

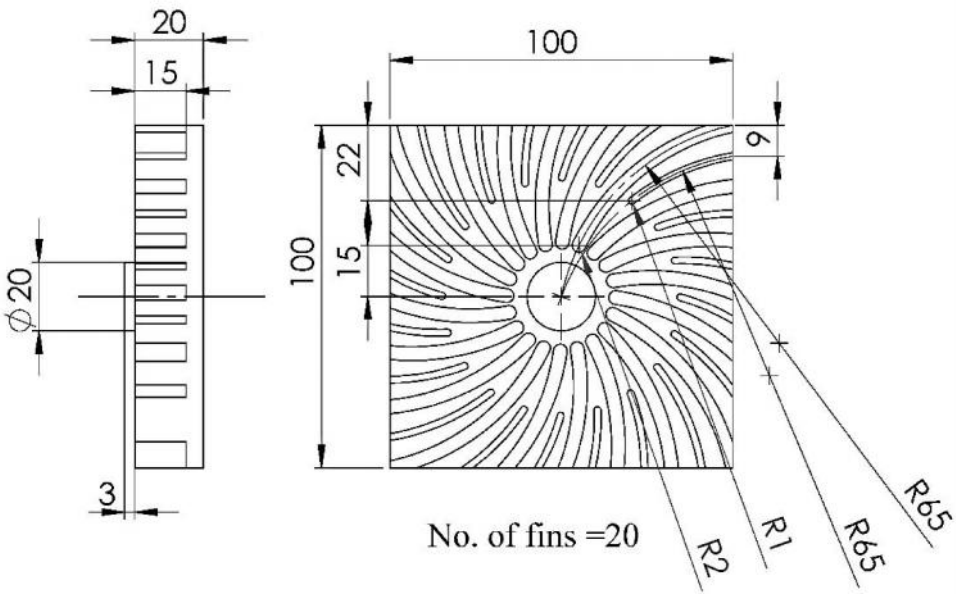
Lower face is fixed and subjected to constant temperature, T = 85 °C

All other faces are subjected to convection heat transfer, $T_\infty = 20\,℃ \;\; and \;\; h = 2.5\ \frac{W}{m^2\,℃}$

Material: Copper





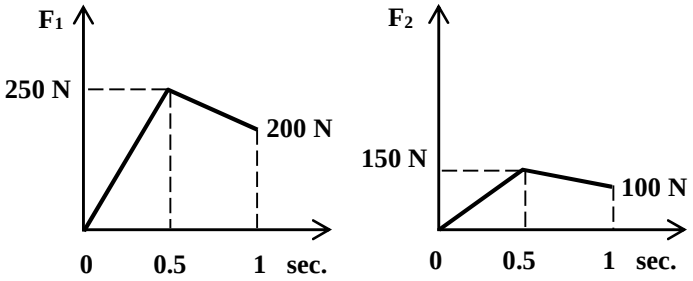


15 marks

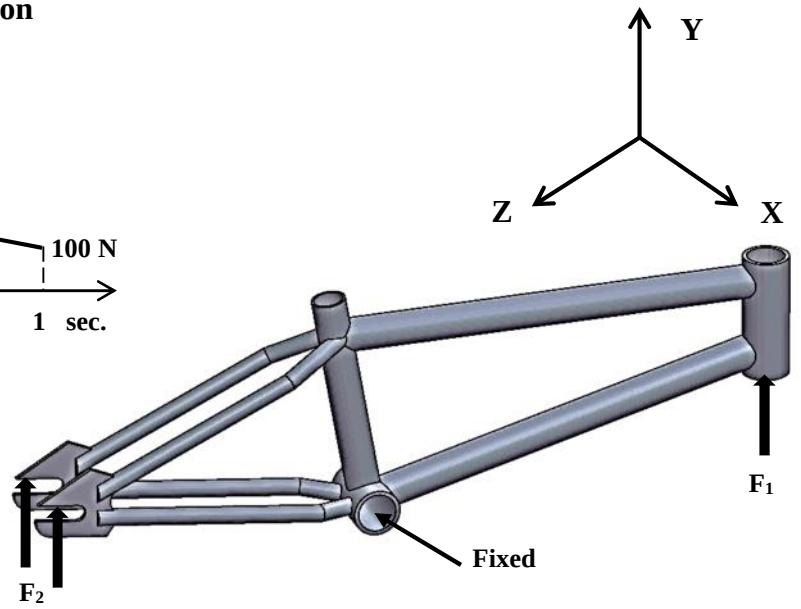
Q2: For the geometry shown in figure bellow simulate:

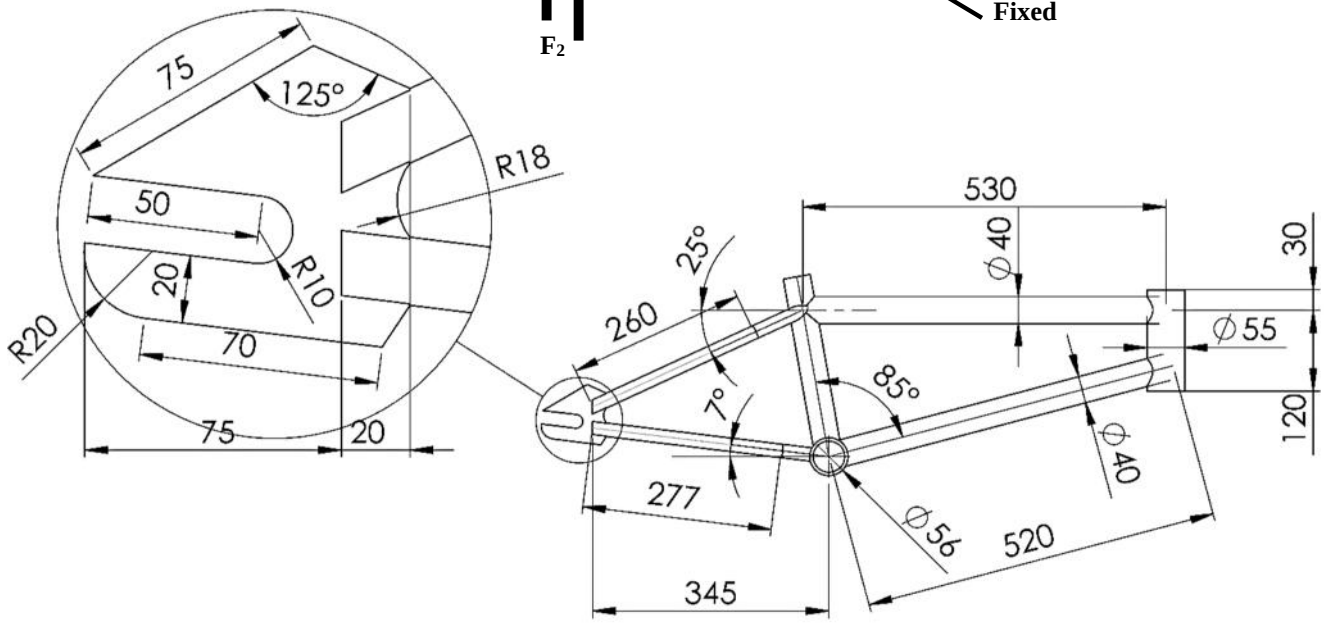
A) Free vibration to determine:
1- Mode shapes. And 2- Natural frequencies.
B) Harmonic vibration to determine:
1- Deformation response of geometry at load direction.
2- Stress and strain at maximum peak frequency.
C) Transient structural analysis to determine deformation at time intervals t=0.2 sec., t=0.4 sec. and t=1.0 sec. assume Δt=0.1 sec. and total time=1 sec. Apply excitation frequencies within the range of the natural frequencies of the geometry.

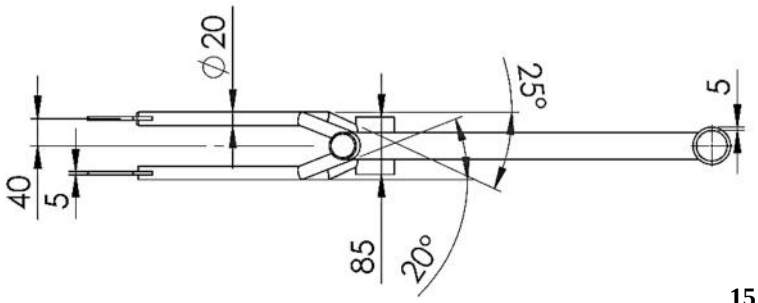
Assumption:
Material: steel , Elastic deformation



Loads History







15 marks

University of Technology
Mechanical EngineeringDepartment
First Term Examination 2014/2015

Subject: CAE (ANSYS) **Year:4th year**
Division: General Mechanical Engineering **Exam Time: 1.5 Hrs.**
Examiner(s): CAE Group **Date: 25 /1/2015**

Notes: 1. Answer (one) question only. 2. Assume all missing data. 3. All dimensions in millimeters.

Q1. For the geometry shown in figure bellow simulate:

A) Free vibration to determine:

1- Mode shape. And 2- Natural frequencies.

B) Harmonic vibration to determine:

1- Deformation response of geometry at load direction.

2- Stress and strain at maximum peak frequency.

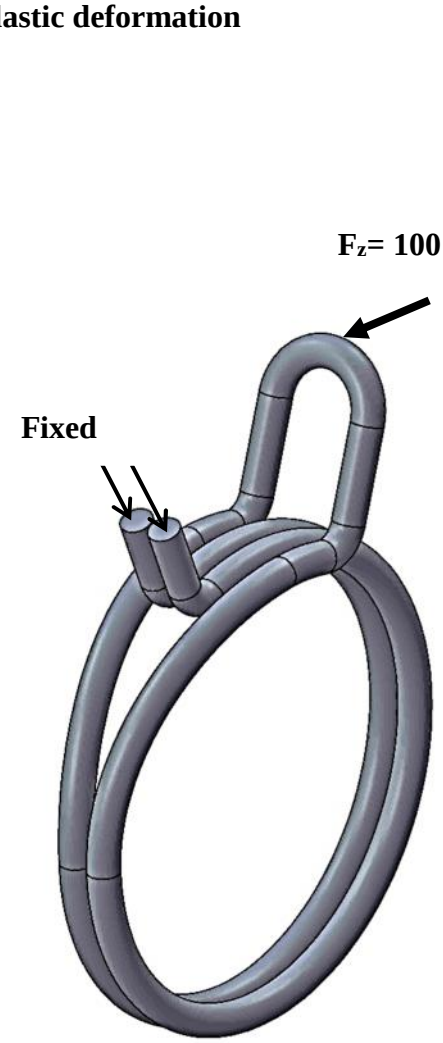
C) Static structure analysis to determine deformation and stress.

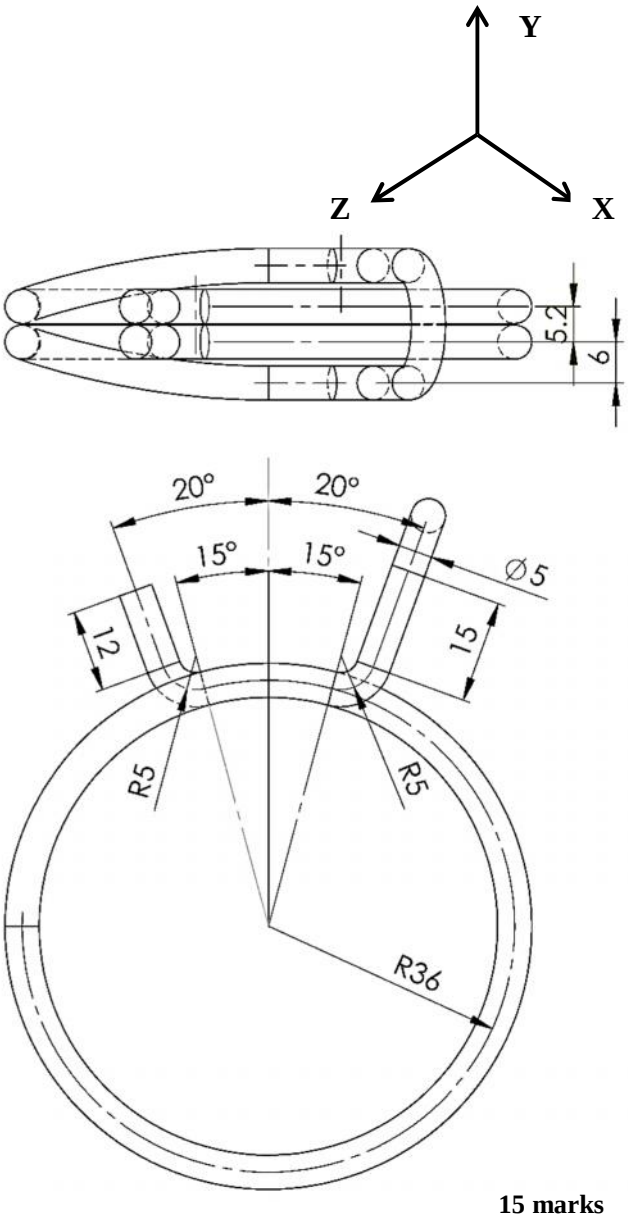
Assumption:

Apply excitation frequencies within the range of the natural frequencies of the geometry

Material: steel

Elastic deformation





15 marks

Q2. Simulate heat transfer in heat sink shown in the figure bellow:

Assumption

Transient state

Lower face is subjected to constant heat flux $\dot{q} = 2000 \frac{w}{m^2}$

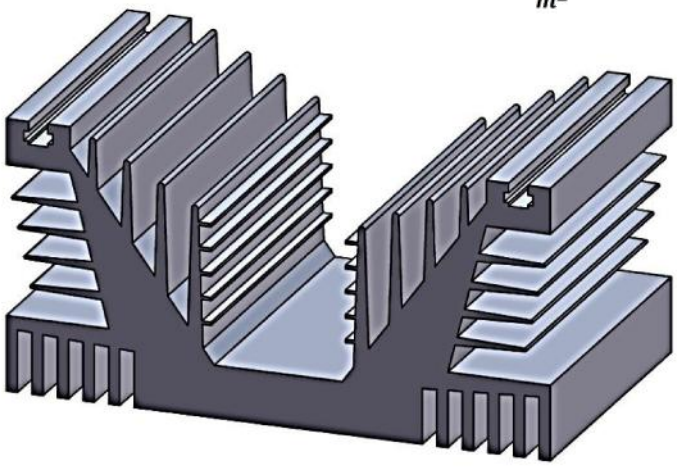
All other faces are subjected to free convection heat transfer $T_\infty = 35$ *and* $h = 2.5 \frac{W}{m^2}$

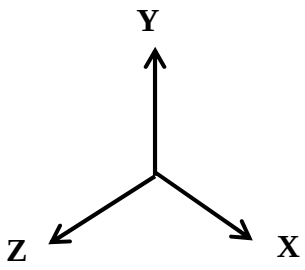
Material: Aluminum

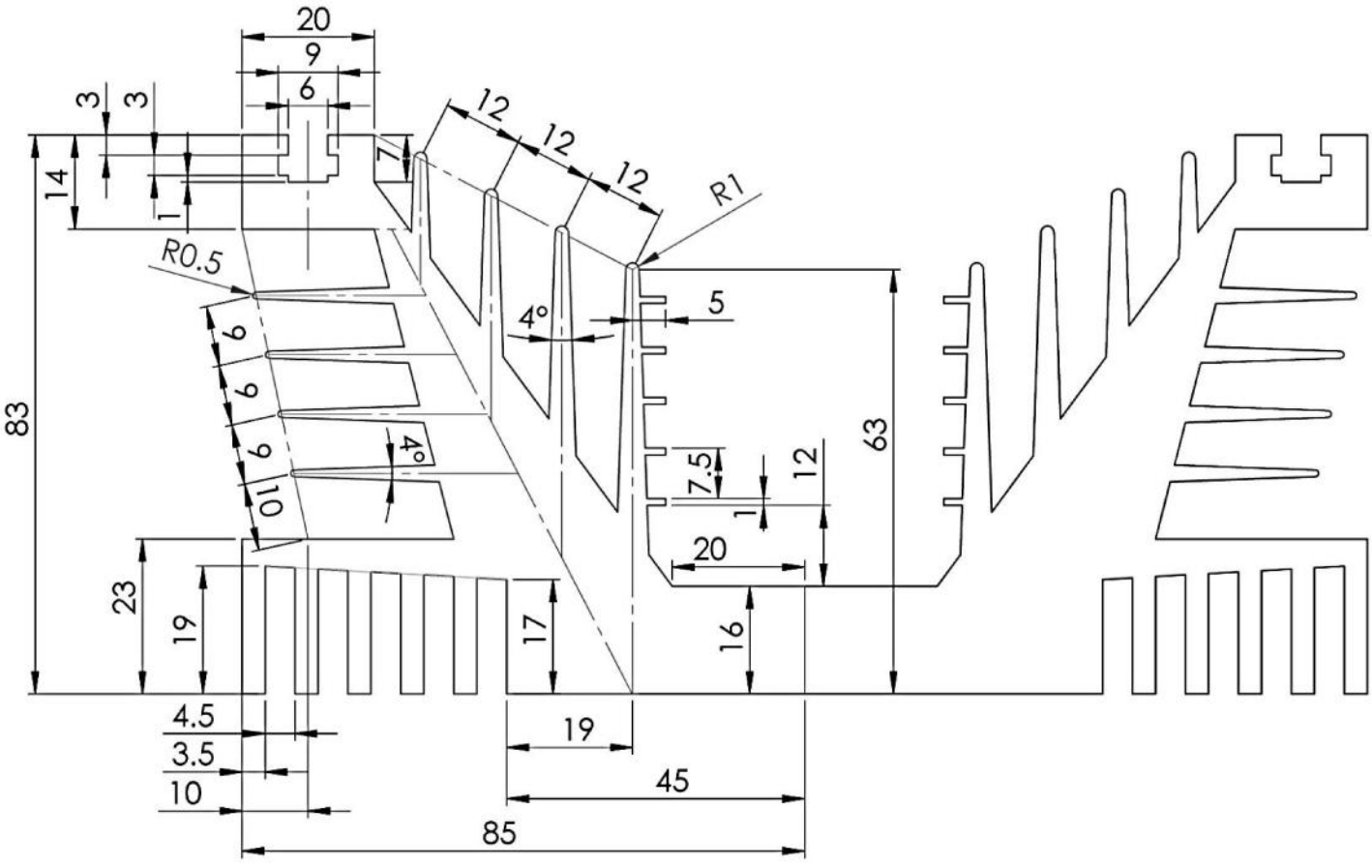
Time step (∆t) = 0.1 sec.

Total time = 5 sec.

Initial temperature = 100 °C







Determine the following

Temperature distribution in the mid (X-Y)-plane of the body at time interval:

t=1 sec.

t=3 sec.

t=5 sec.

15 marks

University of Technology
Department of Machines and Equipment Engineering
Final Year Examination 2013/2014

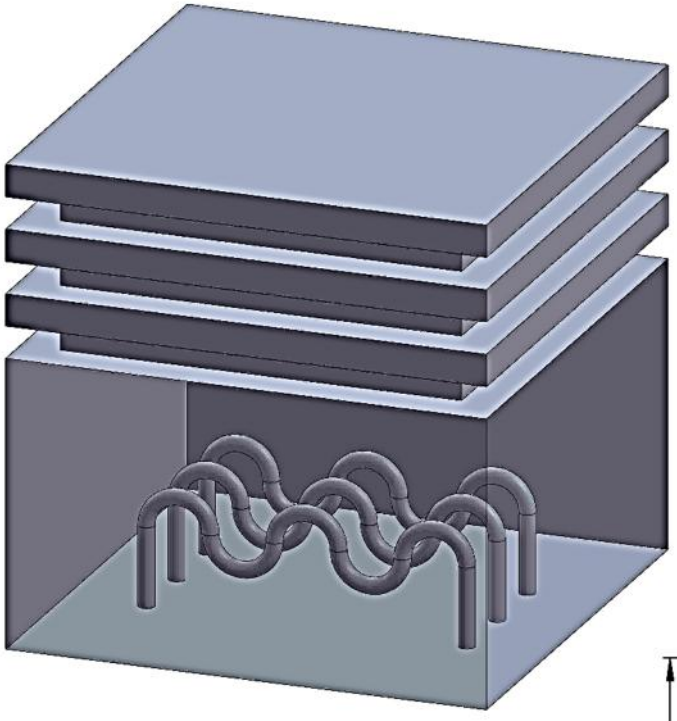
Subject: CAE (ANSYS)
Division: All Divisions
Examiner(s): Dr. Nabeh Natic and Dr. Laith Jaafer

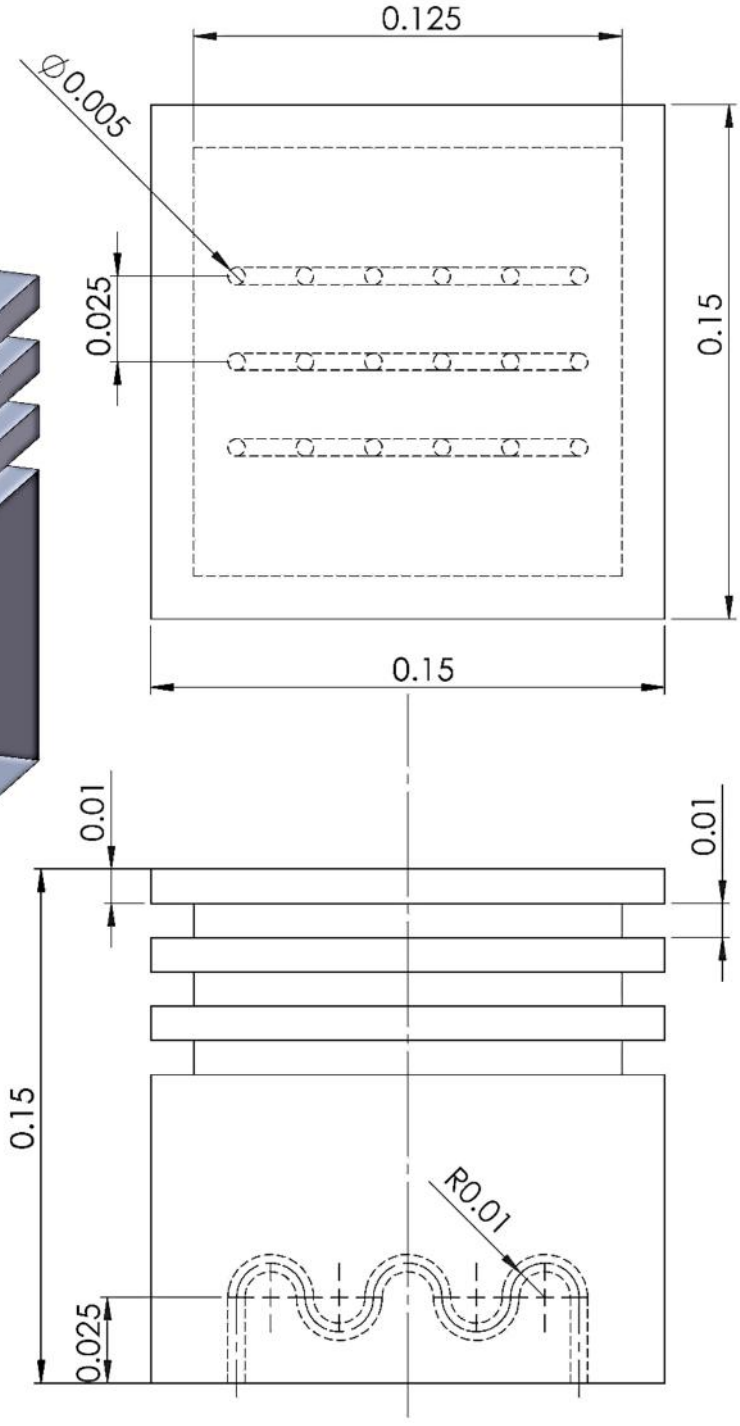
Year: 4th year
Exam Time: 3 Hrs.
Date: 19 / 11 / 2014

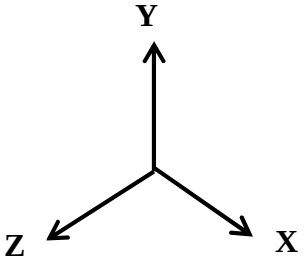
Note: 1. Answer (one) question only. 2. Assume all missing data.

Q1. For the geometry shown in the figure below, the lower surface (base) is insulated. All other surfaces are subjected to free convection boundaries. The three heaters are maintained at constant temperature (T=constant=400 K). Determine contours of temperature at mid-plane.

Assumptions:
Dimension in Meters
Working fluid: Air
T_∞=300 K , h_∞=4 W/m^2.K







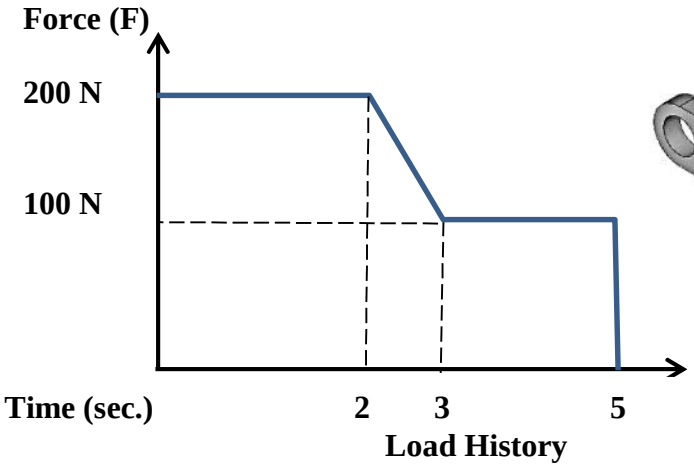
50 marks

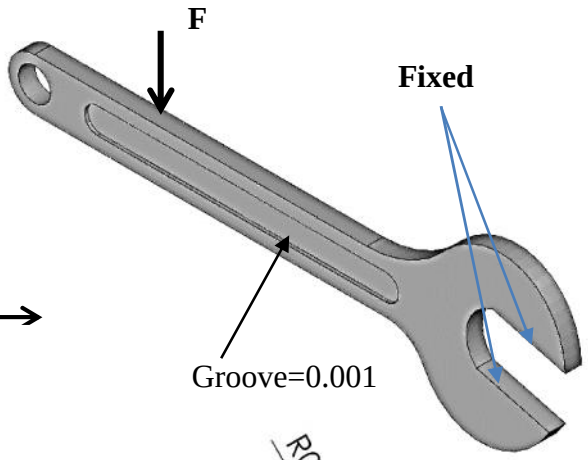
Subject: CAE (ANSYS)
Division: All Divisions
Examiner(s): Dr. Nabeh Natic and Dr. Laith Jaafer

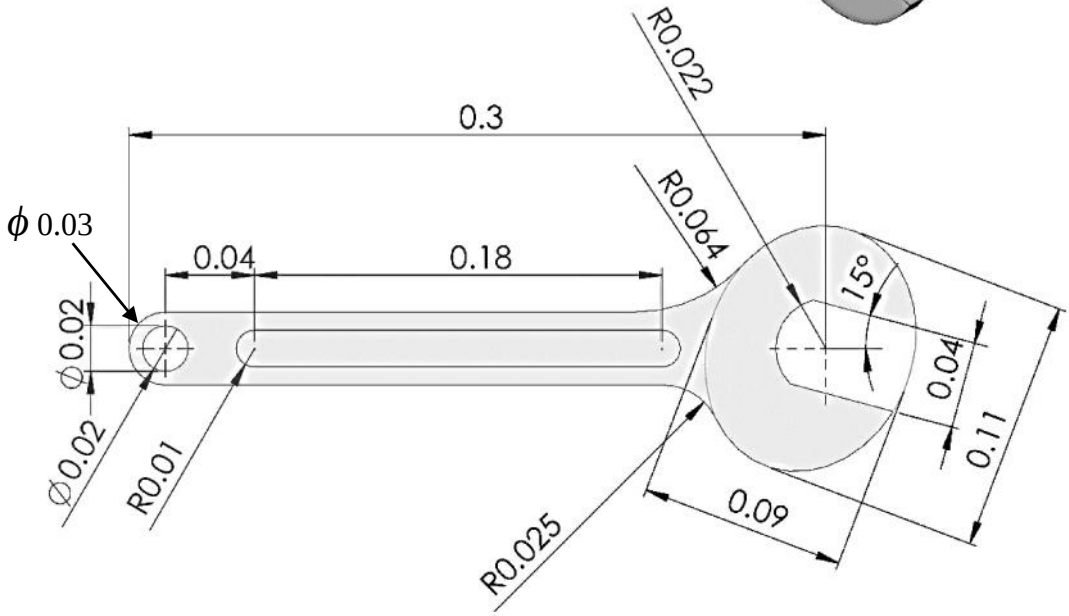
Year: 4th year
Exam Time: 3 Hrs.
Date: 19 / 11 / 2014

Q2. Simulate deformation and stress for the spanner shown in figure bellow:

Assumption
Transient state
Material: steel
Dimension in Meters
Load history shown in fig. bellow:







Determine deformation and stress distribution in spanner at time intervals:
t = 1 sec.
t = 2 sec.
t = 3 sec.
t = 4 sec.

50 marks

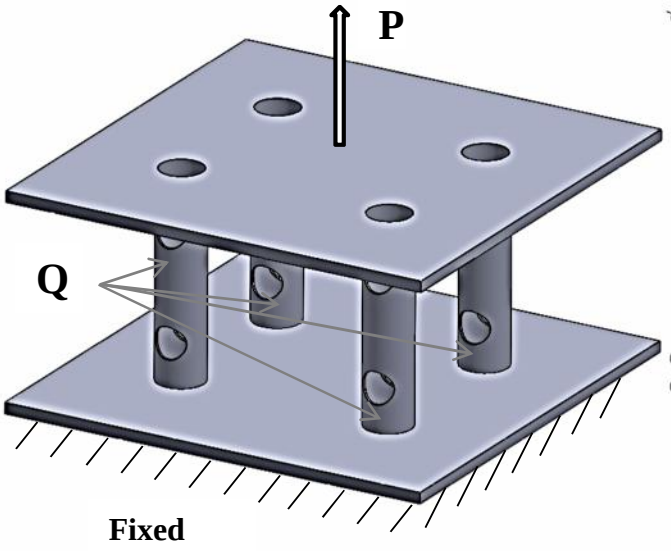
University of Technology
Department of Machines and Equipment Engineering
Final Year Examination 2013/2014

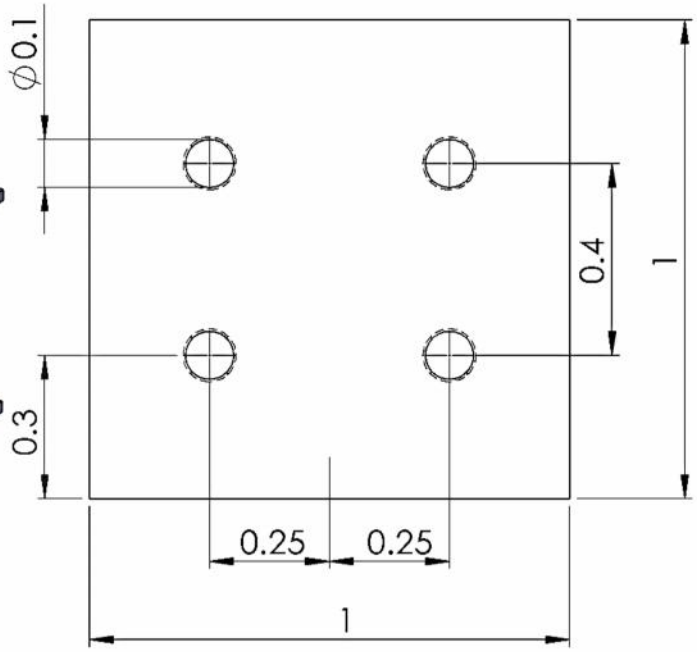
Subject: CAE (ANSYS)
Division: All Divisions
Examiner(s): Dr. Nabeh Natic and Dr. Laith Jaafer

Year: 4th year
Exam Time: 3 Hrs.
Date: 21 / 9 / 2014

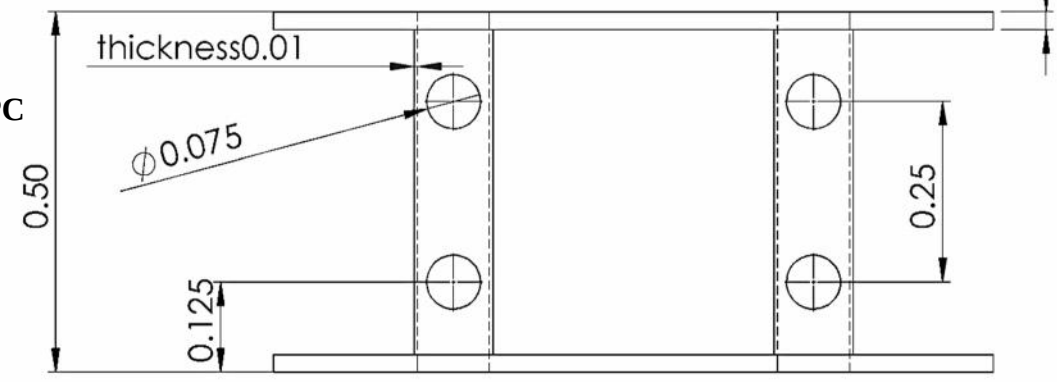
Note: 1. Answer (one) question only. 2. Assume all missing data.

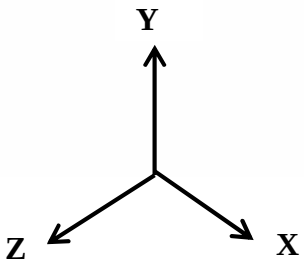
Q1. The geometry shown in the figure below is initially at 28 °C, heat is applied at the outer surface of the cylindrical bars. All other surfaces are subjected to convection boundaries (Q). Simulate transient thermal and transient structure interaction to determine temperature distribution at time interval 0.25 sec. and 2 sec., then perform structure analysis with (P) applied at the upper plate and temperature load from the previous thermal analysis to determine the stress and deformation at time interval 0.5 sec. and 1 sec.

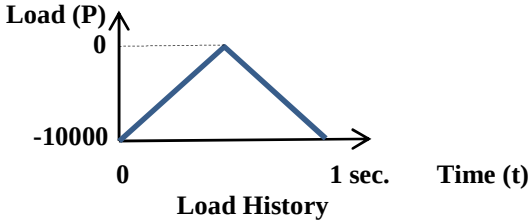




Assumption:
- **Dimension in Meters**
- **Material: Copper**
- **T_∞=30 °C , h_∞=2.5 W/m^2. °C**
- **Q=50000 W/m^2**





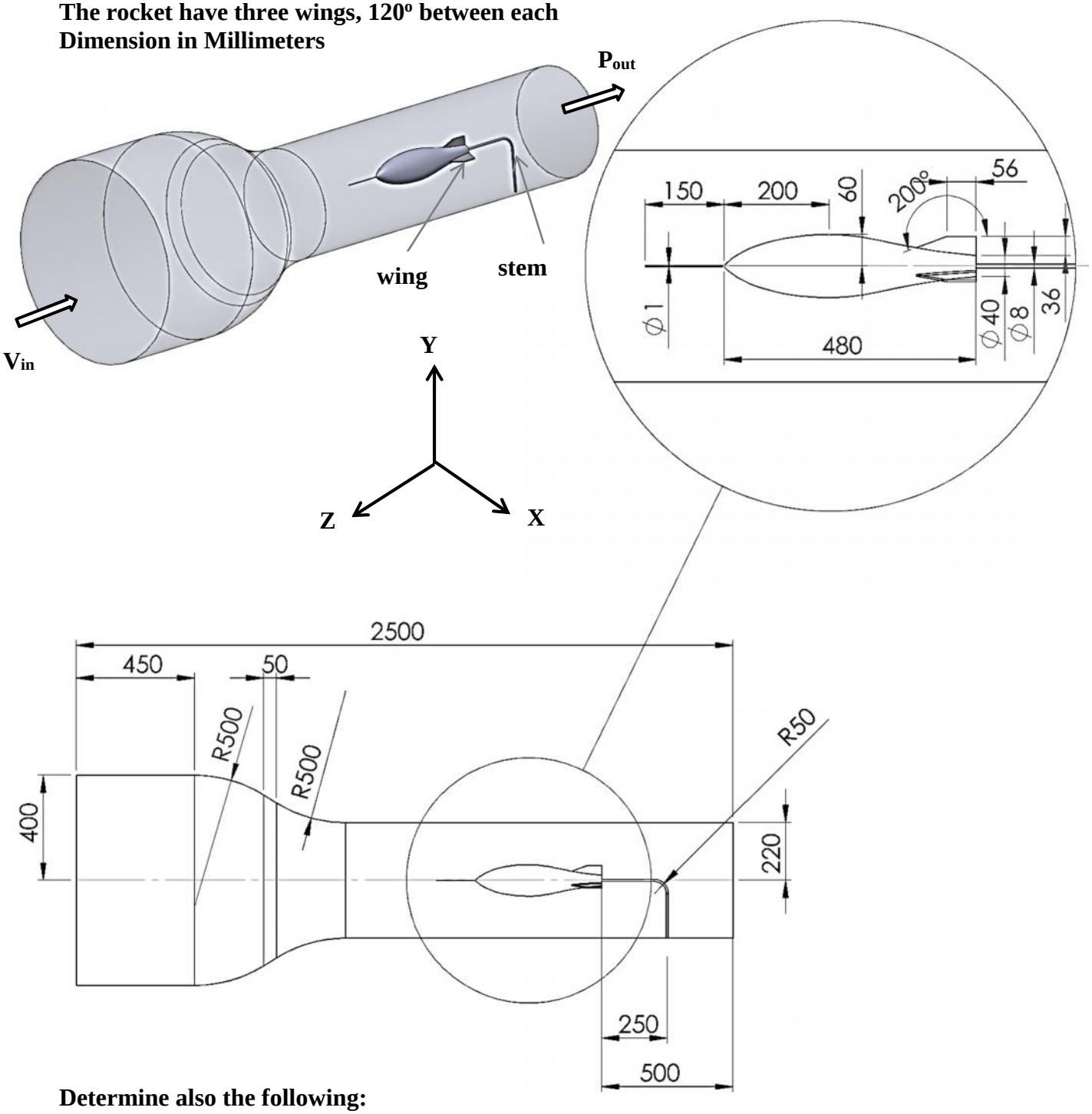


Load History

50 marks

Q2. Simulate fluid structure interaction to determine the stress and deformation on prototype rocket due to fluid flow for the geometry shown in the figure below:

Assumption:
Steady state , Working fluid: air , Turbulent flow
V_{in}=100 m/s , P_{out}=1 atm.
The stem is fixed at duct
The rocket have three wings, 120º between each
Dimension in Millimeters



Determine also the following:
Contours of pressure in (YZ-plane), at duct mid-plane
Vectors of velocity in (YZ-plane), at duct mid-plane
Contours of velocity in (XZ-plane), at duct mid-plane

50 marks

University of Technology
Department of Machines and Equipment Engineering
Final Year Examination 2013/2014

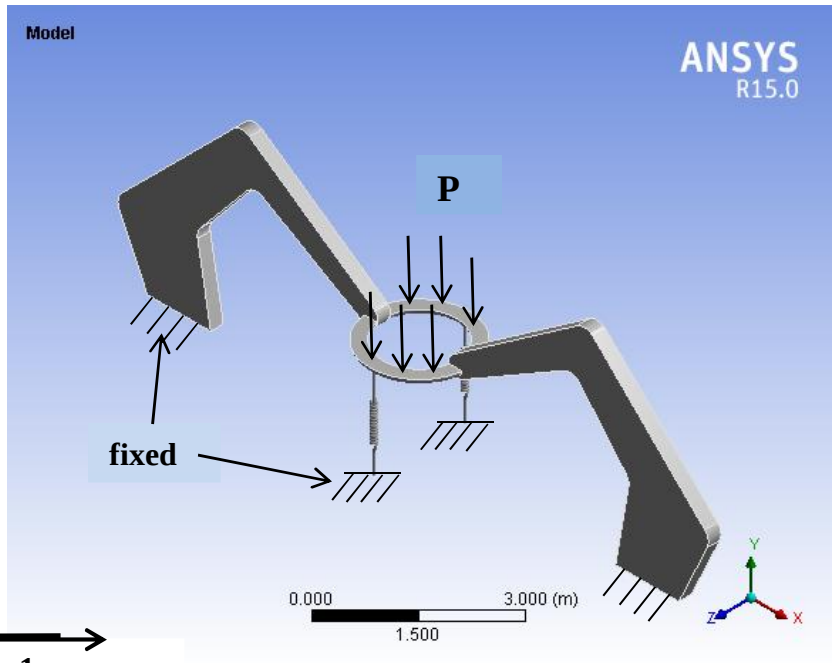
Subject: CAE (ANSYS)
Division: Automotive and Aircraft Engineering
Examiner(s): Dr. Nabeh Natic and Dr. Laith Jaafer

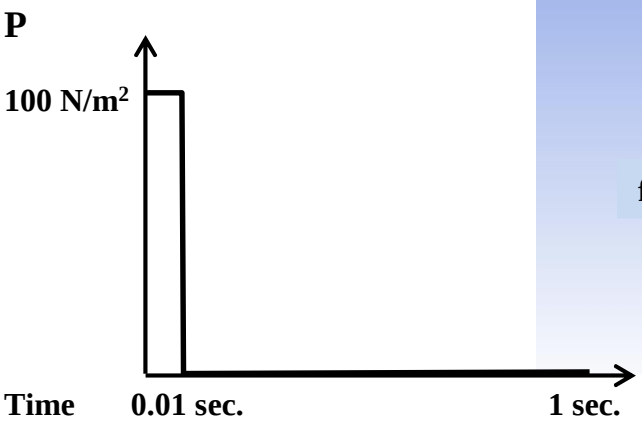
Year: 4th year
Exam Time: 3 Hrs.
Date: 10 / 6 / 2014

Note: 1. Answer (one) question only. 2. Assume all missing data.

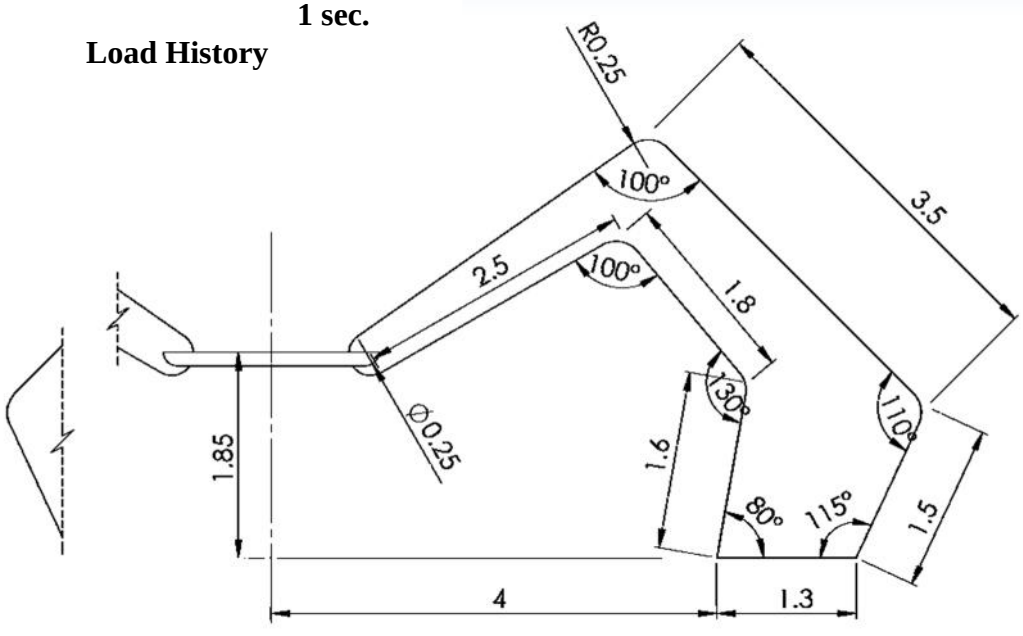
Q1. Simulate spring-structure system shown in the figure below to determine the stress and deformation due to pressure load at time interval t=0.25 s, t=0.5 s, and t=1 s.

Assumption:
Transient state
Time step =0.002 s
Total time =1 s
K_{spring}= 100 N/m
Dimension in Meters

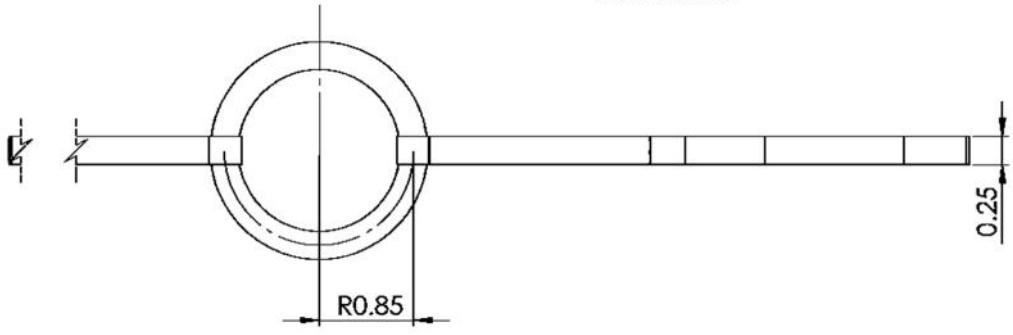




Load History



All fillet .25

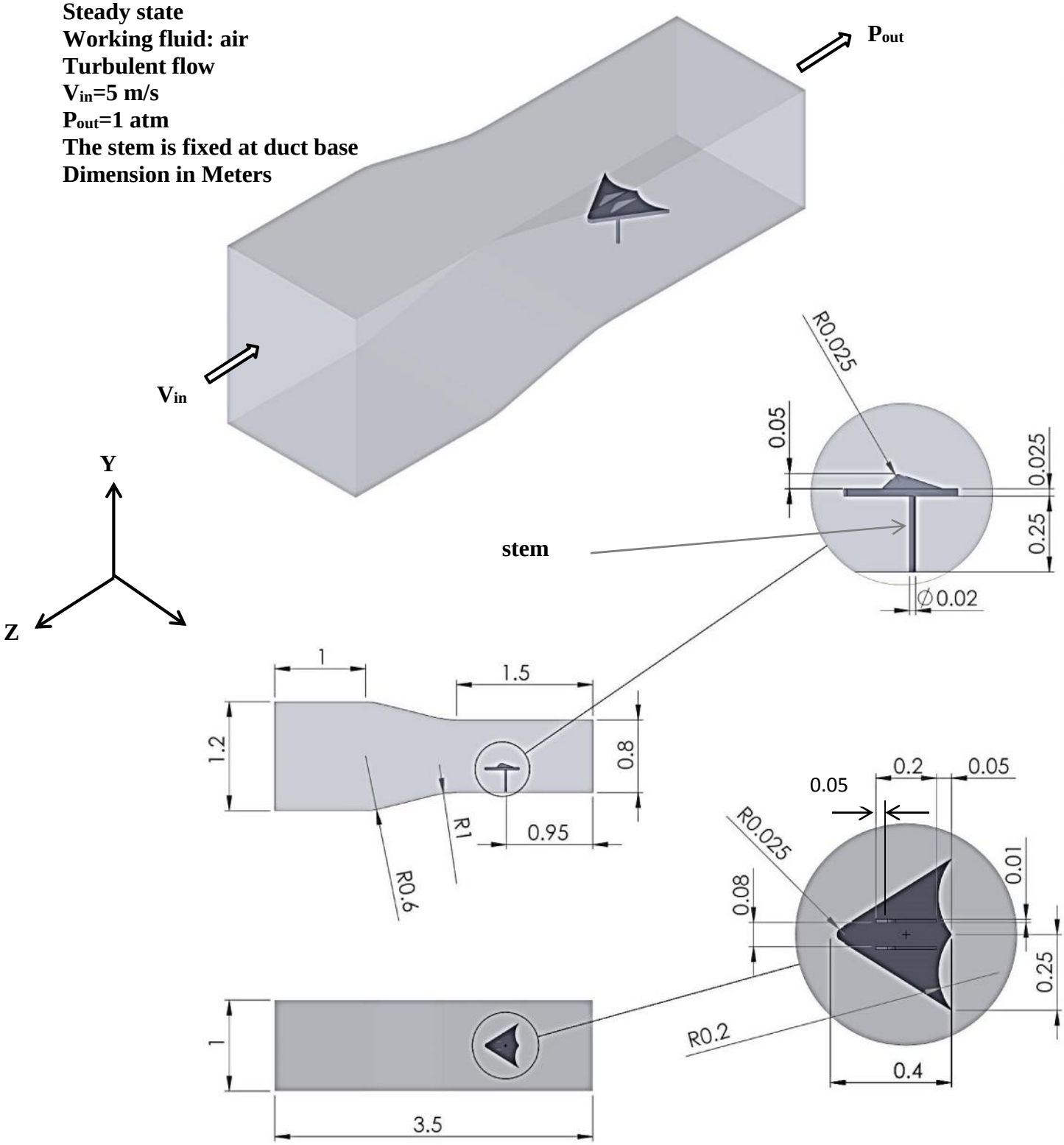


Subject: CAE (ANSYS)
Division: Automotive and Aircraft Engineering
Examiner(s): Dr. Nabeh Natic and Dr. Laith Jaafer

Year: 4th year
Exam Time: 3 Hrs.
Date: 10 / 6 / 2014

Q2. Simulate fluid structure interaction to determine the stress and deformation in airplane due to fluid flow for the geometry shown in the figure below:

Assumption:
Steady state
Working fluid: air
Turbulent flow
V_{in}=5 m/s
P_{out}=1 atm
The stem is fixed at duct base
Dimension in Meters



Determine the following:
Contour of pressure in (YZ-plane), at duct mid-plane
Vector of velocity in (YZ-plane), at duct mid-plane
Contour of velocity in (XZ-plane), at duct mid-plane

50 marks

University of Technology
Department of Machines and Equipment Engineering
Final Year Examination 2013/2014

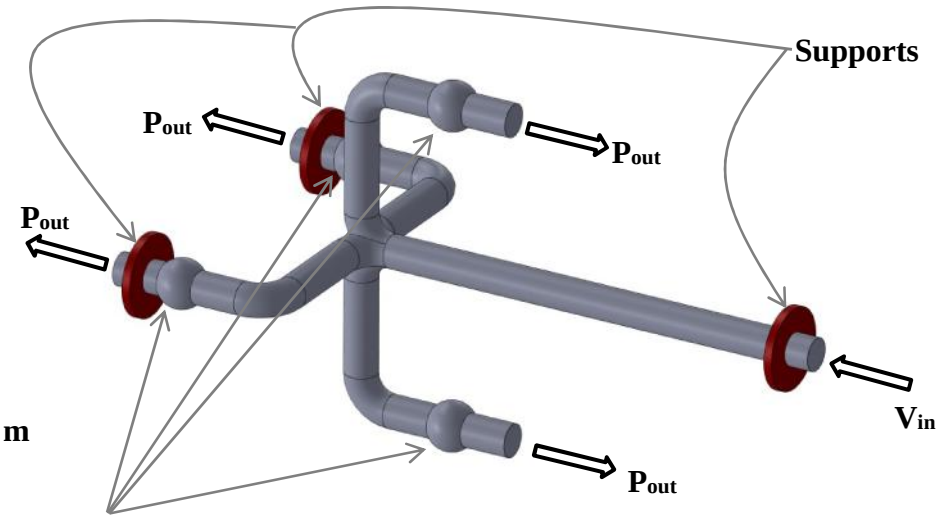
Subject: CAE (ANSYS)
Division: General Mechanical Engineering
Examiner(s): Dr. Nabeh Natic and Dr. Laith Jaafer

Year: 4th year
Exam Time: 3 Hrs.
Date: 3 / 6 / 2014

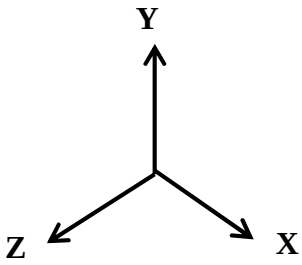
Note: 1. Answer (<u>one</u>) question only. 2. Assume all missing data.

Q1. Simulate fluid and thermal structure interaction to determine the stress and deformation due to fluid flow and thermal load for the geometry shown in the figure below:

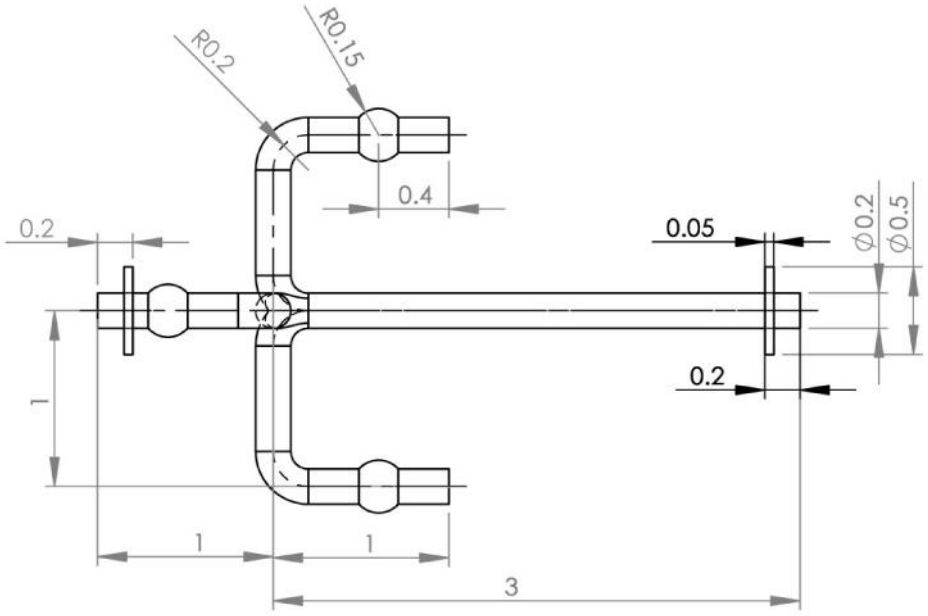
Assumption:
- **Steady state**
- **Working fluid: air**
- **Turbulent flow**
- **Dimension in Meters**
- **V_{in}=2 m/s**
- **T_{in}=150 ºC**
- **T_{se}=30 ºC**
- **P_{out}=1 atm**
- **All pipes thicknesses = 0.01 m**



Spherical expansion T_{se}=30 ºC



<u>The geometry is fixed at supports.</u>



Determine the following:
Contours of pressure in (XZ-plane), at pipes mid-plane
Vectors of velocity in (XY-plane), at pipes mid-plane
Contours of temperature in (XZ-plane), at pipes mid-plane

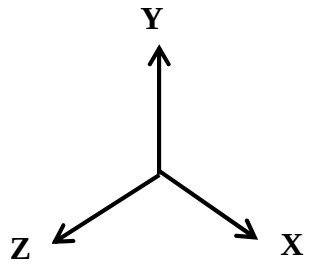
50 marks

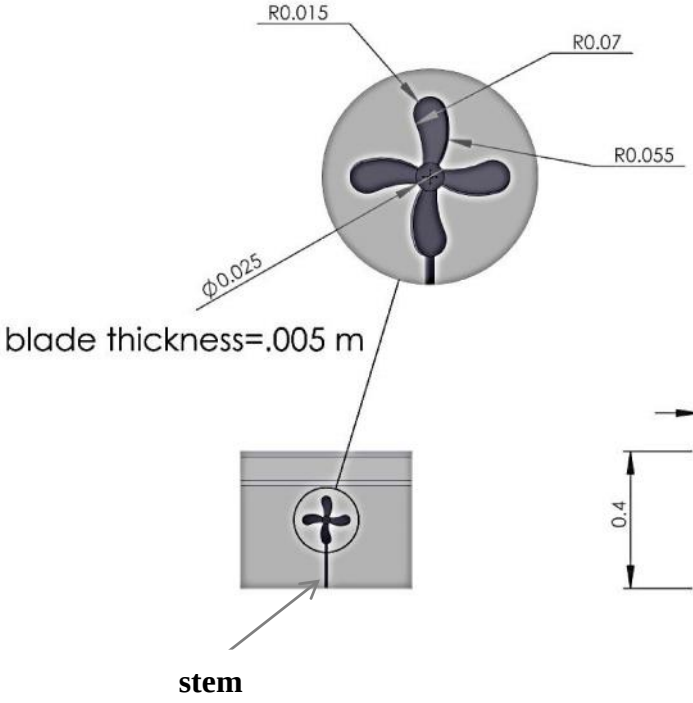
Subject: CAE (ANSYS)
Division: General Mechanical Engineering
Examiner(s): Dr. Nabeh Natic and Dr. Laith Jaafer

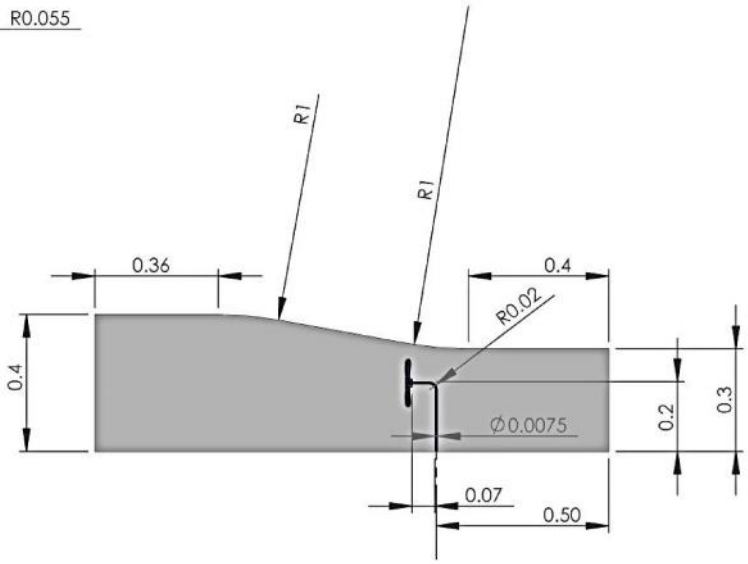
Year: 4th year
Exam Time: 3 Hrs.
Date: 3 / 6 / 2014

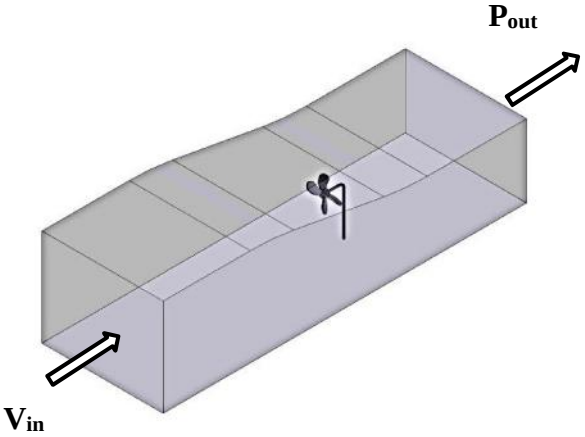
Q2. Simulate fluid structure interaction to determine the stress and deformation in blades due to fluid flow for the geometry shown in the figure below:

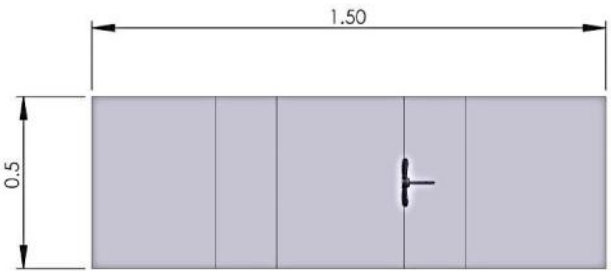
Assumption:
Steady state
Working fluid: air
Turbulent flow
V_{in}=5 m/s
P_{out}=1 atm
The stem is fixed at duct base
Dimension in Meters











Determine the following:
Contours of pressure in (YZ-plane), at duct mid-plane
Vectors of velocity in (YZ-plane), at duct mid-plane
Contours of velocity in (XZ-plane), at duct mid-plane

50 marks

University of Technology
Department of Machines and Equipment Engineering
Final Year Examination 2013/2014

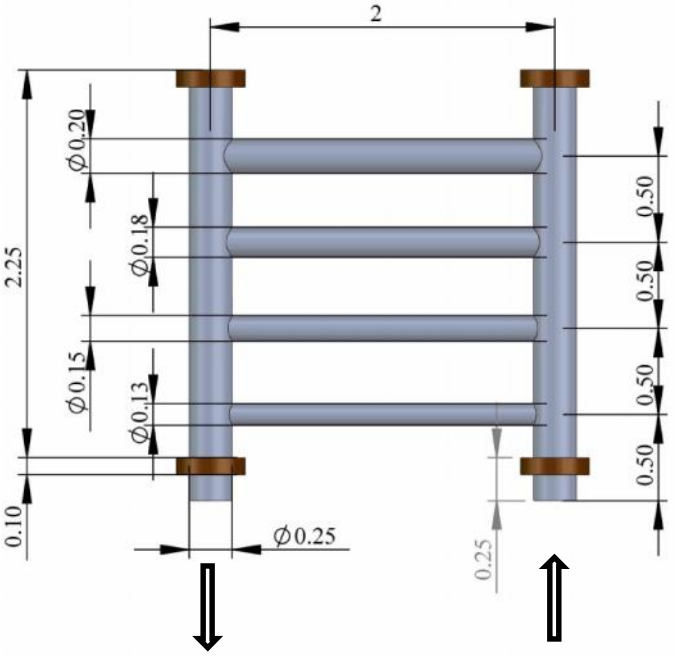
Subject: CAE (ANSYS)
Division: Air Conditioning and Refrigeration Engineering
Examiner(s): Dr. Nabeh Natic and Dr. Laith Jaafer

Year: 4th year
Exam Time: 3 Hrs.
Date: 1 / 6 / 2014

Note: 1. Answer (one) question only. 2. Assume all missing data.

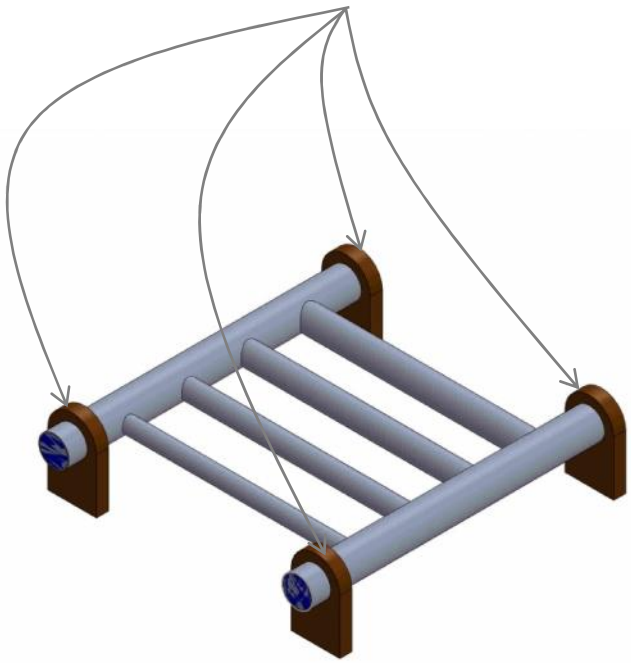
Q1. Simulate fluid structure interaction to determine the stress and deformation due to fluid flow for the geometry shown in the figure below:

Assumption:
Steady state
Working fluid: water
Turbulent flow
Dimension in Meters
V_{in}=0.5 m/s
P_{out}=1 atm



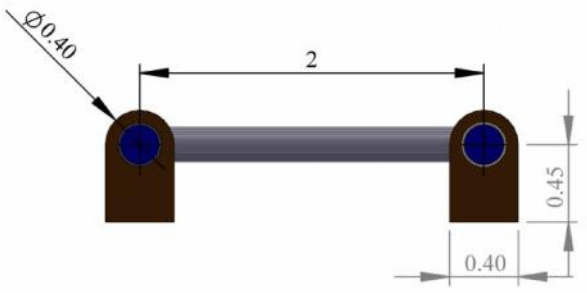
P_{out} **V_{in}**

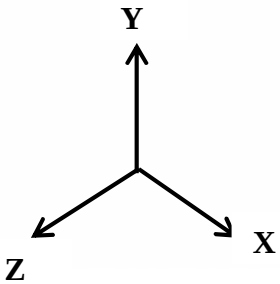
Supports



All pipes thicknesses = 0.01 m

The geometry is fixed at supports.





Determine the following:
Contour of velocity in (XZ-plane), at pipes mid-plane
Vector of velocity in (XZ-plane), at pipes mid-plane
Contour of pressure in (XZ-plane), at pipes mid-plane

50 marks

University of Technology
Department of Machines and Equipment Engineering
Final Year Examination 2013/2014

Subject: CAE (ANSYS)
Division: Air Conditioning and Refrigeration Engineering
Examiner(s): Dr. Nabeh Natic and Dr. Laith Jaafer

Year: 4th year
Exam Time: 3 Hrs.
Date: 1 / 6 / 2014

Q2.For the bracket shown in figure bellow simulate:

A) Free vibration to determine:

1- Mode shape. And 2- Natural frequencies.

B) Harmonic vibration to determine:

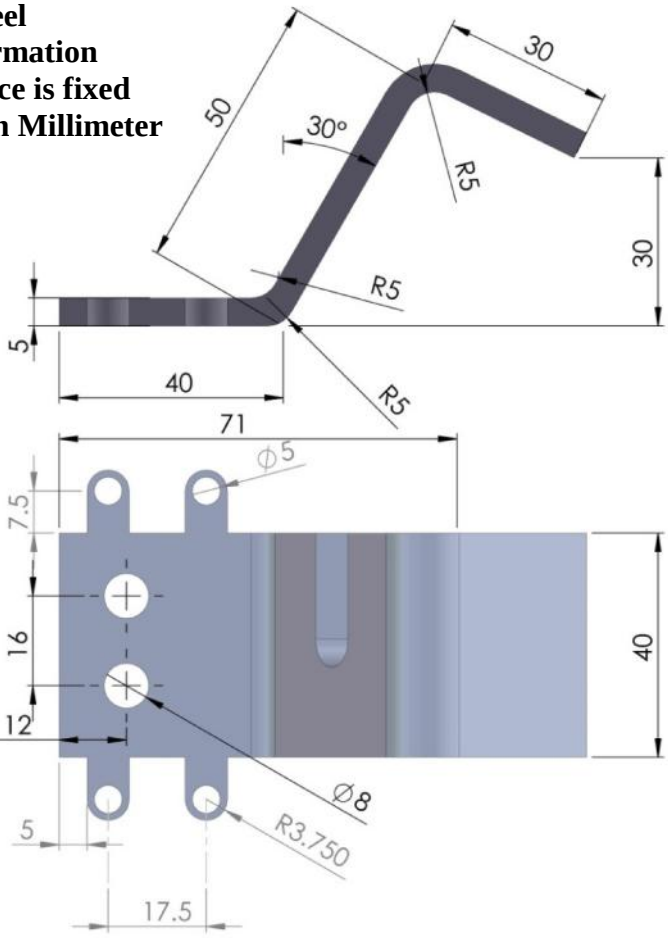
1- Deformation response of geometry at load direction.

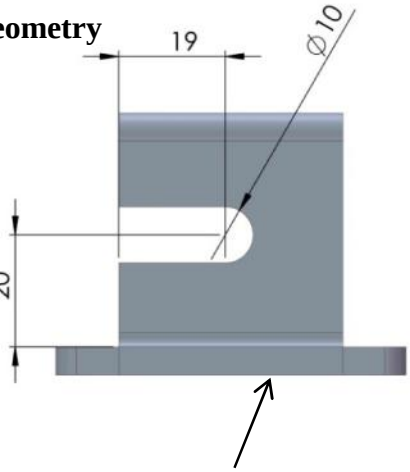
2- Stress and strain at maximum peak frequency.

C) Transient structure analysis to determine deformation at time intervals t=0.025 sec. and t=1.5 sec. assume Δt=0.01 sec. and total time=2 sec.

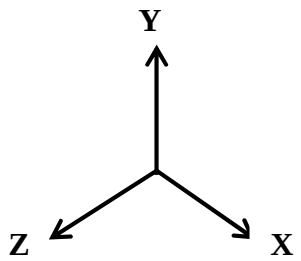
Assumption:

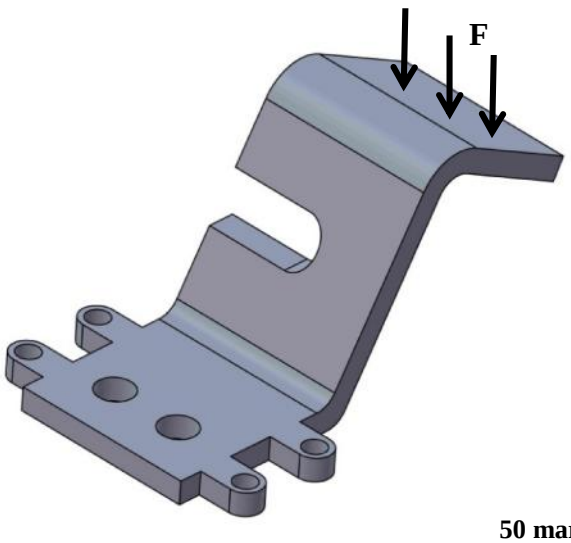
Apply excitation within the range of the natural frequency of geometry
Material: steel
Elastic deformation
Lower surface is fixed
Dimension in Millimeter

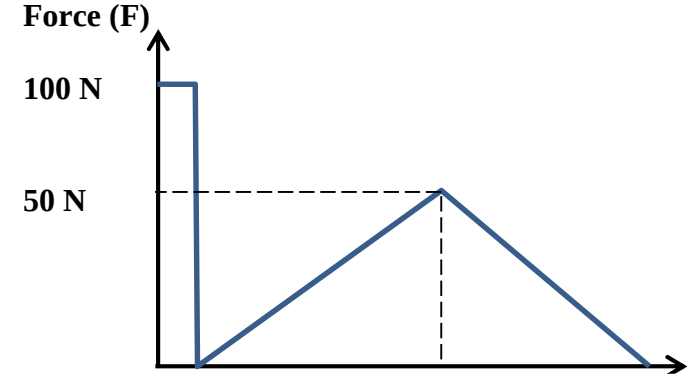




Lower surface







Load History

50 marks

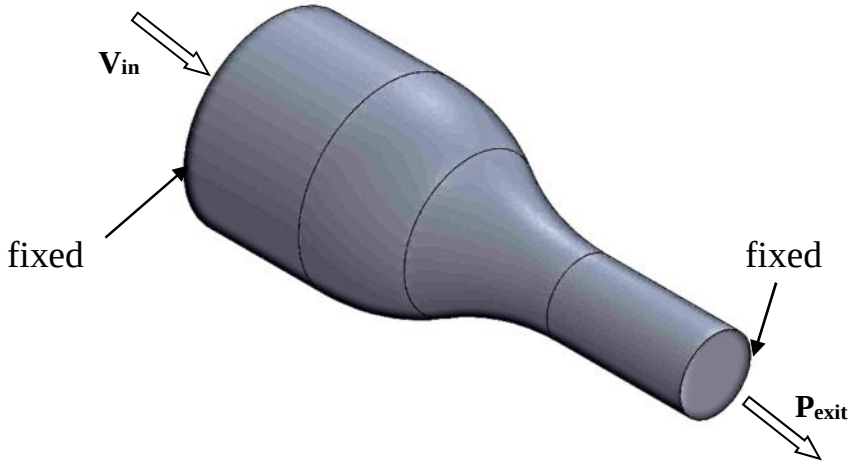
University of Technology
Department of Machines and Equipment Engineering
Second Term Examination 2013/2014

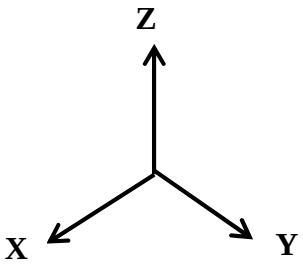
Subject: CAE (ANSYS) **Year: 4th year**
Division: General Mechanical Engineering **Exam Time:1.5 Hrs.**
Examiner(s): Dr. Nabeh Natic and Dr. Laith Jaafer **Date: 6 / 4 / 2014**

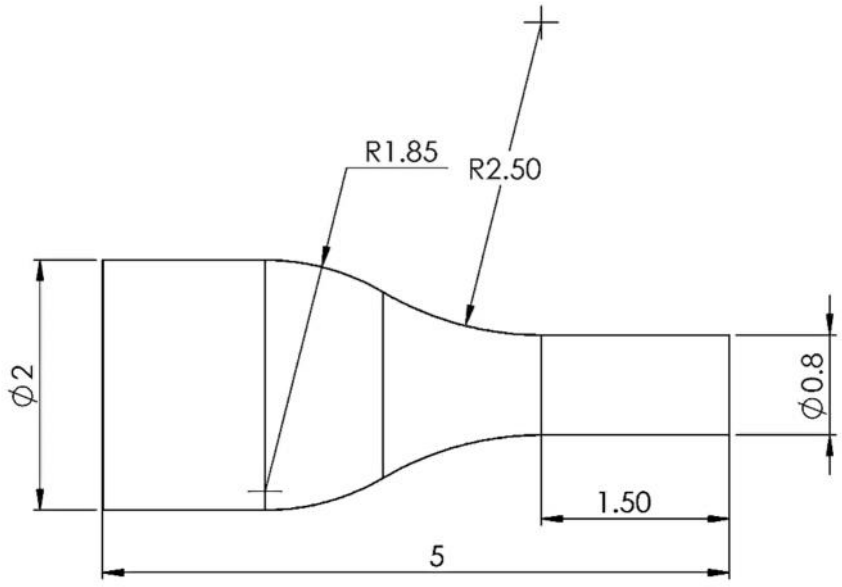
Notes: 1. Answer (<u>one</u>) question only. 2. Assume all missing data.

Q1: Simulate fluid structure interaction to determine the stress and deformation due to fluid flow in the figure shown below:

<u>Assumption</u>
Steady state flow
Turbulent flow
Working fluid: water
Duct thickness 3 mm
V_{in} = 1 m/s
P_{exit} = 1 atm.
All dimensions in meter



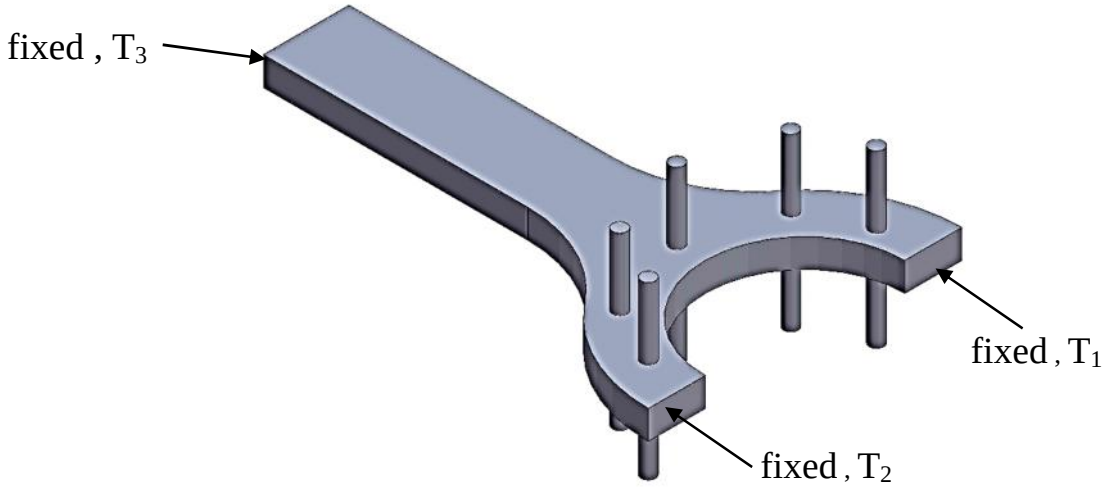


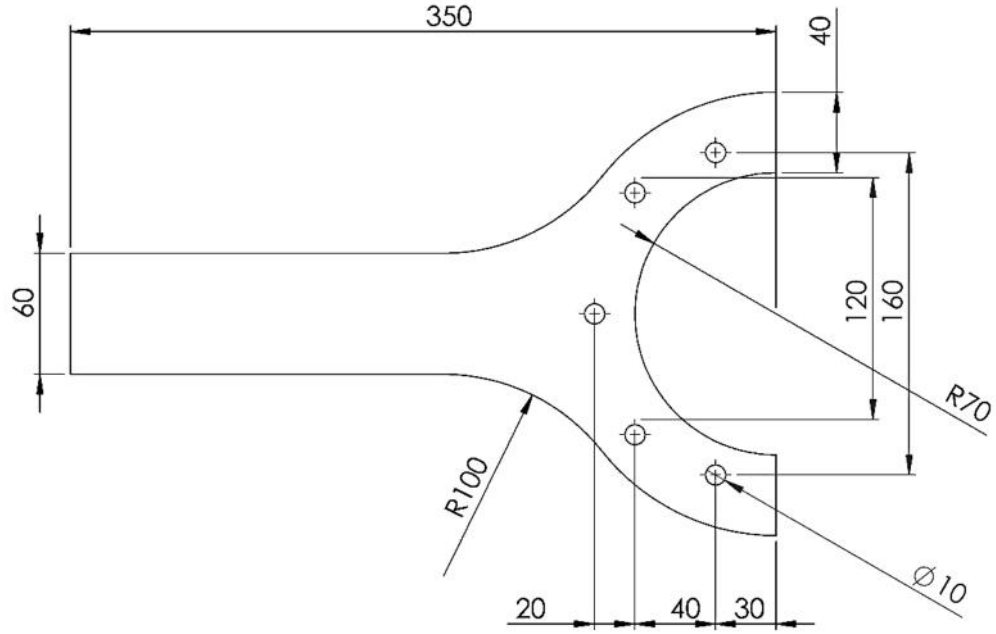


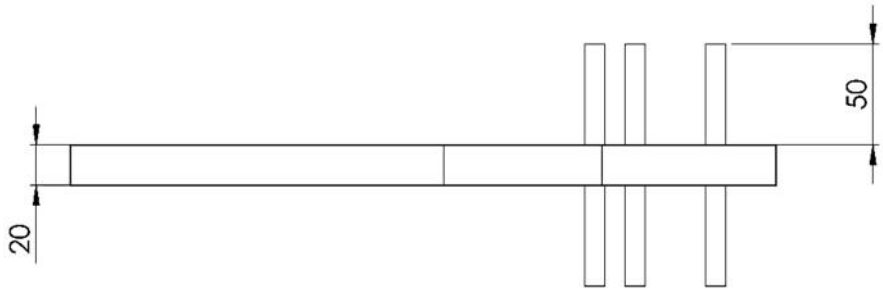
<u>Determine the following</u>
countor plot of velocity at yz plane (mid plane)
vector plot of velocity at yz plane (mid plane)

Q2: Determine total deformation and stress of the pinned bracket shown in figure bellow due to the applied thermal load:

<u>Assumption</u>
Material: steel
Steady state
$T_1 = T_2 = 100\ ^oC$ and $T_3 = 55\ ^oC$
All pins are exposed to convection boundary condition, $h = 3\ W/m^2.^oC$ and $T_\infty = 25\ ^oC$
All other surfaces are insulated
Dimensions of geometry in mm





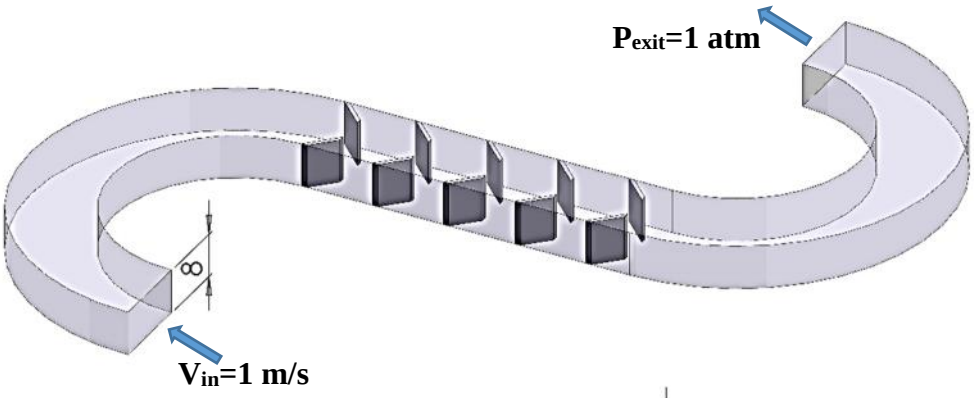


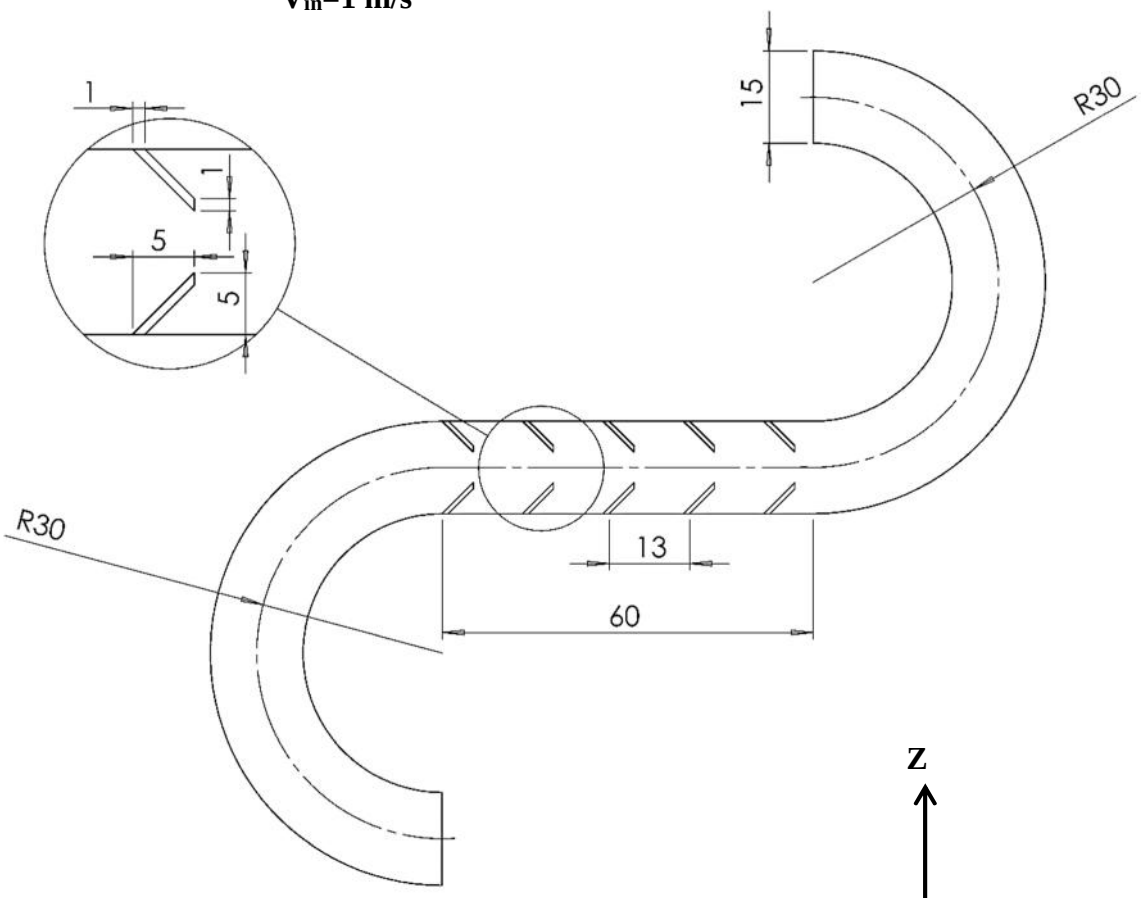
University of Technology
Department of Machines and Equipment Engineering
Second Term Examination 2013/2014

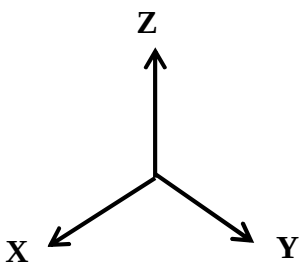
Subject: CAE **Year: 4th year classes**
Division: All Divisions **Exam Time:1.5 Hrs.**
Examiner(s): Dr. Nabeh Natic and Dr. Laith Jaafer **Date: 8 / 4 / 2014**

Q: Simulate fluid structure interaction to determine the stress and deformation on baffles due to flow in passage shown in figure below:

Assumption
Steady state flow
Turbulent flow
Working fluid: w
All dimensions ir







Determine also the following
Countor plot of velocity at yz plane (mid plane)
Vector plot of velocity at yz plane (mid plane)

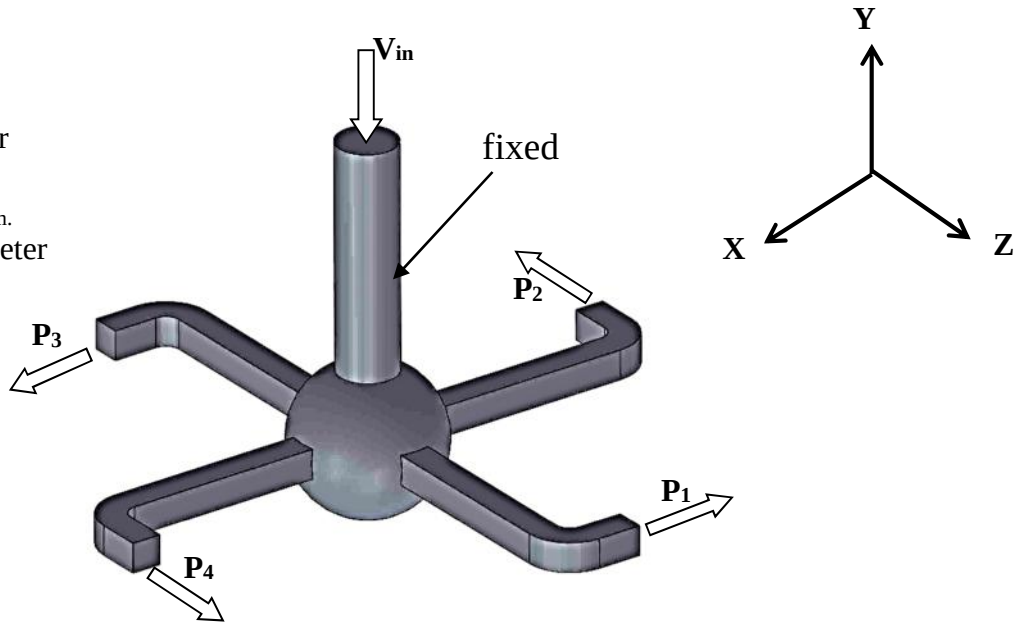
University of Technology
Department of Machines and Equipment Engineering
Second Term Examination 2013/2014

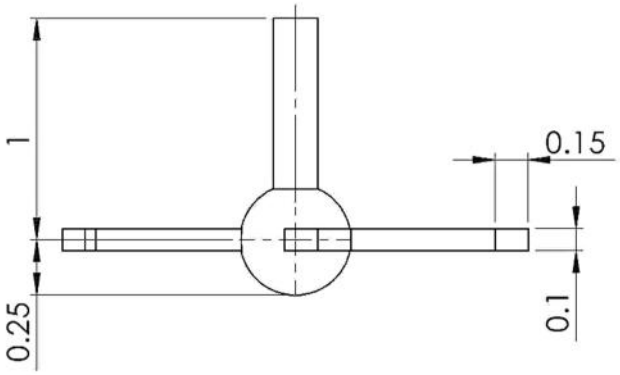
Subject: CAE (ANSYS) **Year: 4th year**
Division: Air Conditioning and Refrigeration Engineering **Exam Time:1.5 Hrs.**
Examiner(s): Dr. Nabeh Natic and Dr. Laith Jaafer **Date: 2 / 4 / 2014**

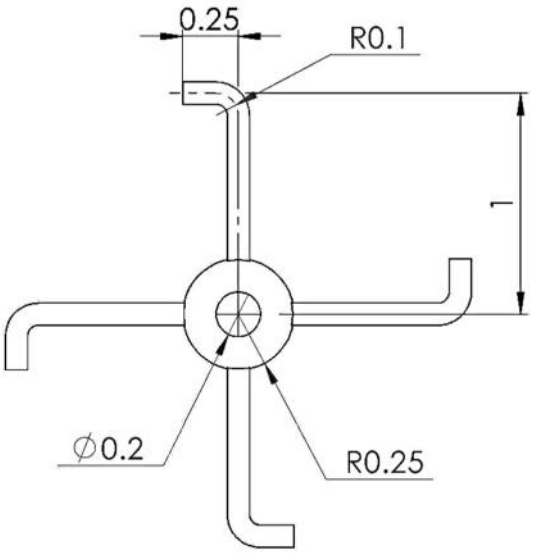
Notes: 1. Answer (one) question only. 2. Assume all missing data.

Q1: Simulate fluid structure interaction to determine the stress and deformation due to fluid flow in the figure shown below:

Assumption
Steady state flow
Turbulent flow
Working fluid: water
V_{in}= 30 m/s
P_1= P_2= P_3= P_4= $P_{atm.}$
All dimensions in meter





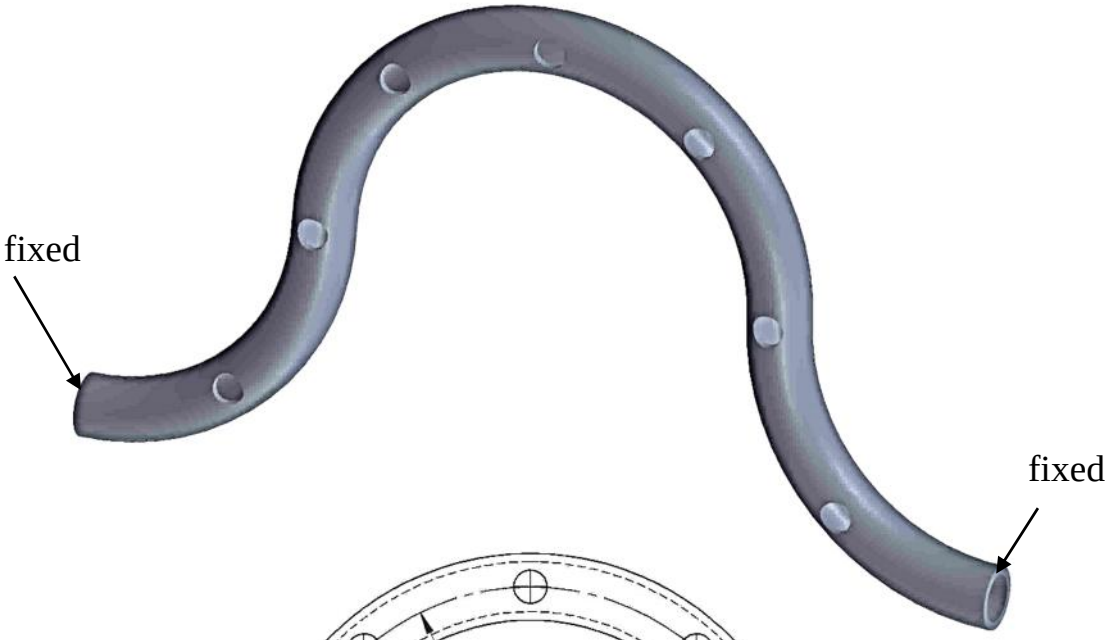


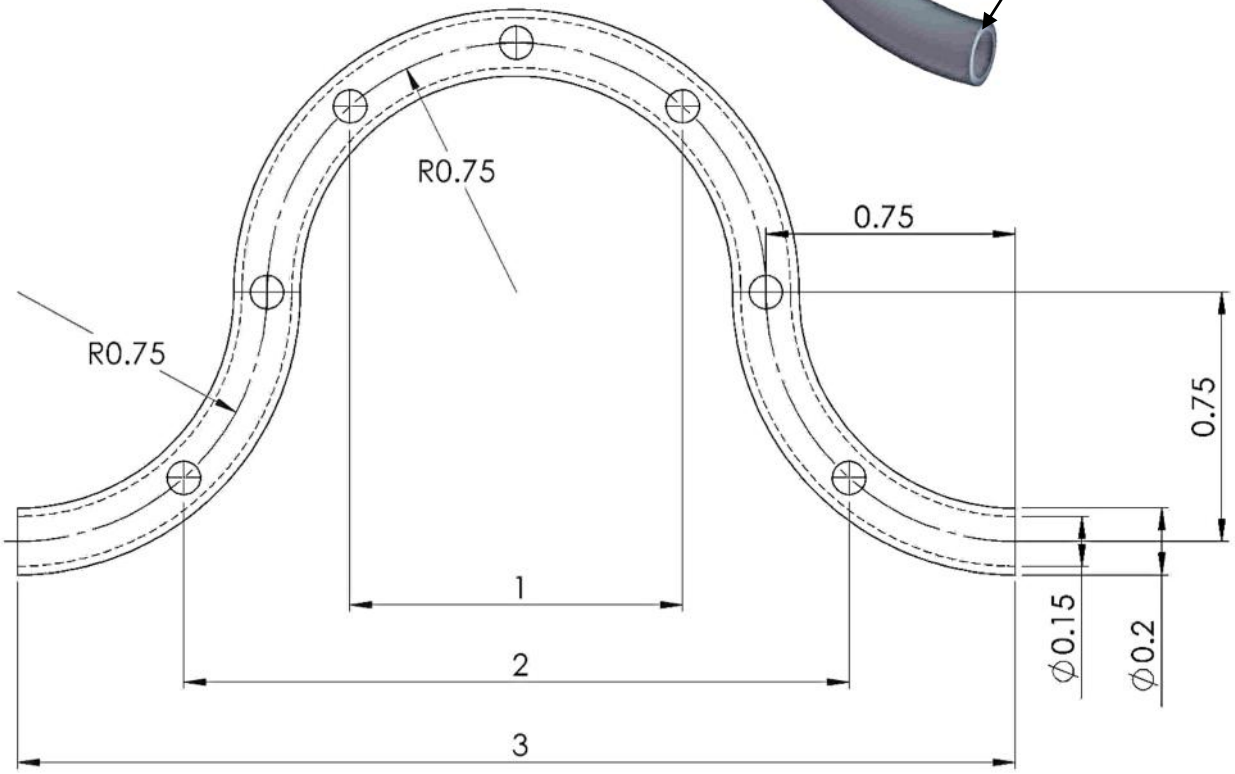
Determine the following
contour plot of velocity at yz plane (mid plane)
contour plot of stress on pipe
vector plot of velocity at yz plane (mid plane)

Q2: For the figure shown below, simulate thermal induce stress to determine stress and deformation due to convection:

Assumption

* Material: steel
* All outer surfaces are subjected to convection heat transfer T_∞ = 50 ^oC ; h = 3 $W/m^2.^oC$
* All inner surfaces are subjected to constant heat flux q^o = 1000 W/m^2





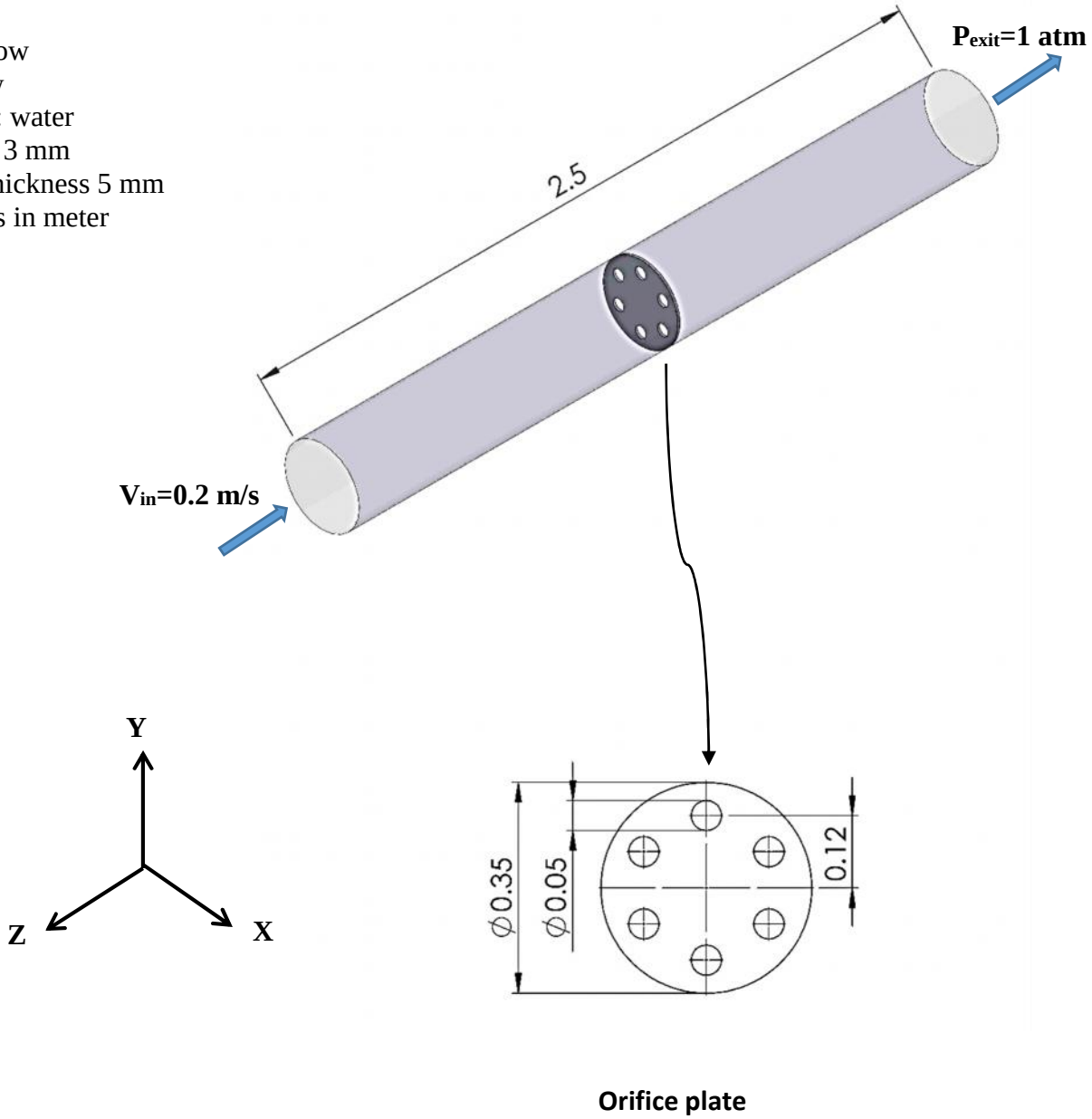
University of Technology
Department of Machines and Equipment Engineering
Second Term Examination 2013/2014

Subject: CAE (ANSYS) **Year: 4th year**
Division: General Mechanical Engineering **Exam Time:1.5 Hrs.**
Examiner(s): Dr. Nabeh Natic and Dr. Laith Jaafer **Date: 30 / 3 / 2014**

Notes: 1. Answer (one) question only. 2. Assume all missing data.

Q1: Simulate fluid structure interaction to determine the stress and deformation on orifice due to fluid flow in pipe with orifice shown in figure below:

Assumption
Steady state flow
Turbulent flow
Working fluid: water
Pipe thickness 3 mm
Orifice plate thickness 5 mm
All dimensions in meter



Orifice plate

Determine the following
countor plot of velocity at yz plane (mid plane)
countor plot of stress on pipe
vector plot of velocity at yz plane (mid plane)

Q2: For the plate shown in figure bellow Simulate:

A) Free vibration to determine mode shape and natural frequency.

B) Harmonic vibration to determine:

1- Deformation response of geometry at load direction.

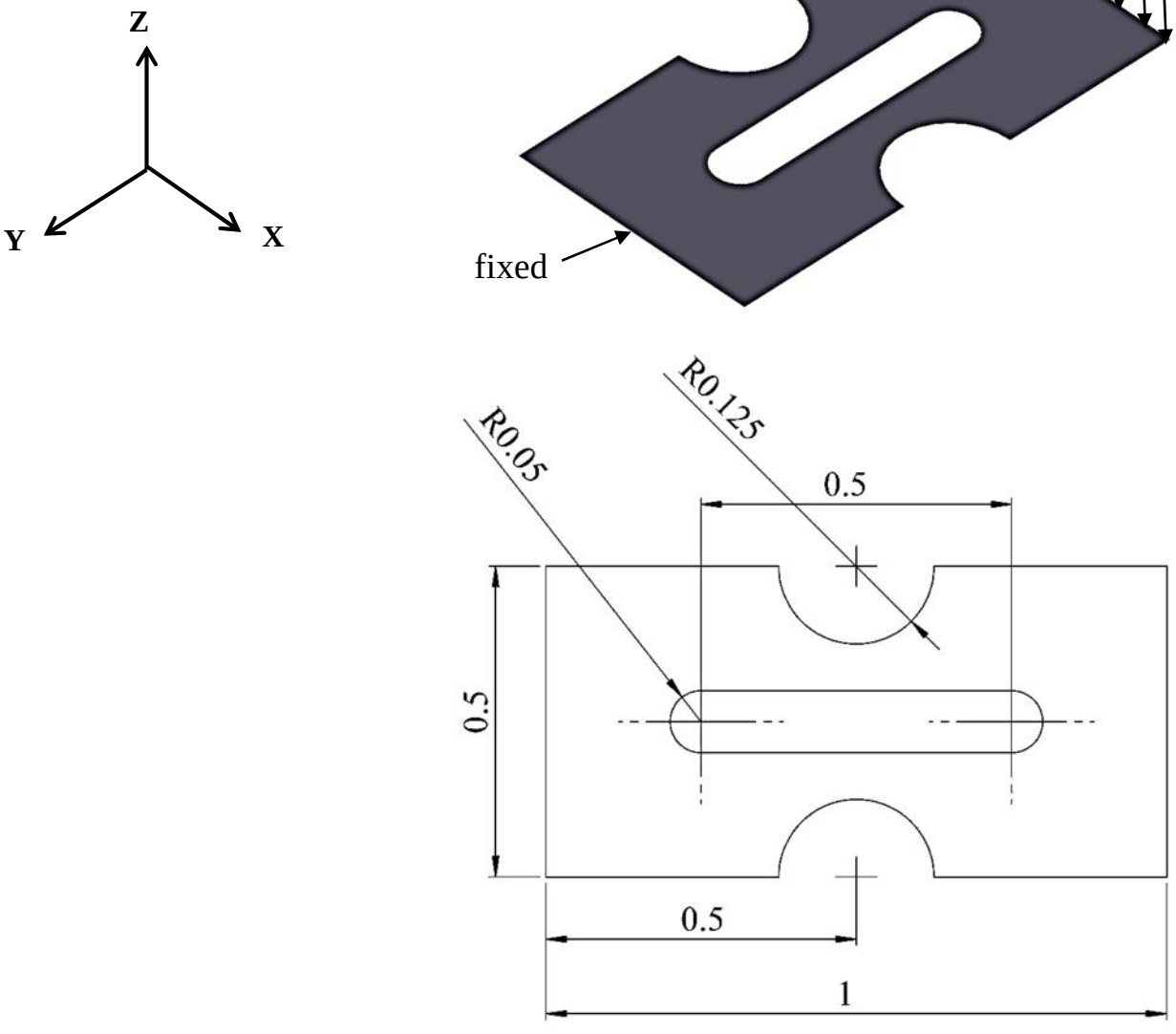
2- Stress and strain at maximum peak frequency.

Assumption

*Material: steel

*Apply excitation frequency within the range of the natural frequency of geometry

* Plate thickness 5 mm



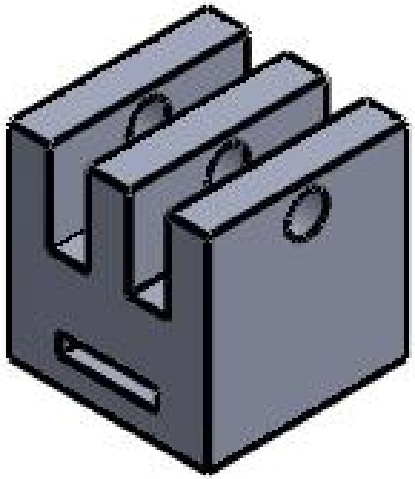
University of Technology
Department of Machines and Equipment Engineering
Second Term Examination 2013/2014

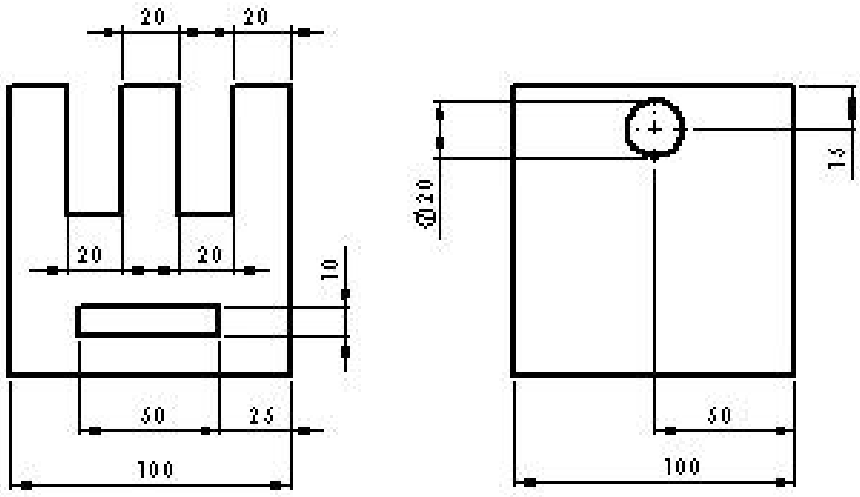
Subject: CAE (ANSYS) **Year: 4th year**
Division: Automotive and Aircraft Engineering **Exam Time: 1.5 Hrs.**
Examiner(s): Dr. Nabeh Natic and Dr. Laith Jaafer **Date: 8 / 3 / 2014**

Notes: 1. Answer (one) question only. 2. Assume all missing data.

Q1: Determine temperature distribution, stress and deformation of heat sink shown in figure below due to thermal load applied on body:

Assumption
Steady state flow
Lower face is subjected to constant heat flux $\dot{q}$ = 7000 $\frac{w}{m^2}$
All other faces are subjected to free convection heat transfer T_∞ = 20 and = 5 $\frac{w}{m^2}$
All dimensions in millimeters



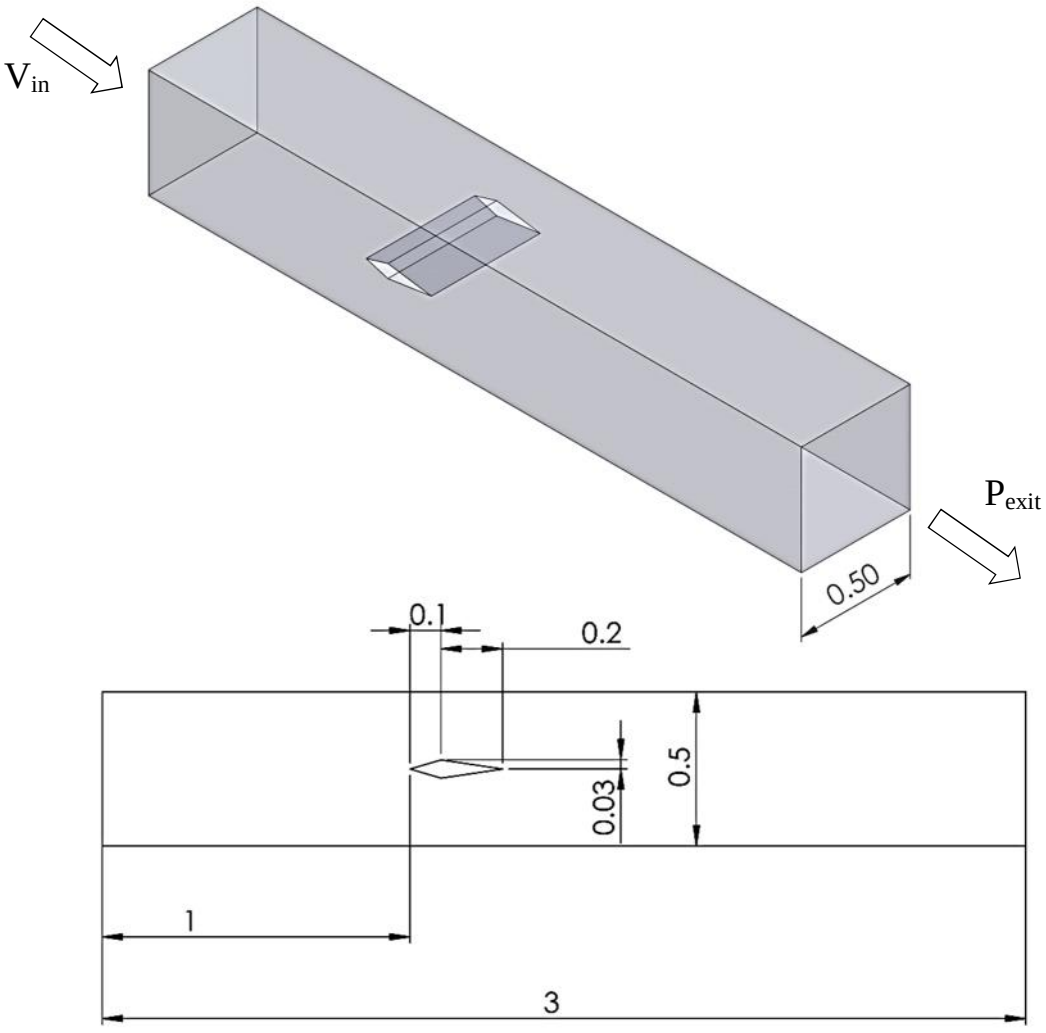


University of Technology
Department of Machines and Equipment Engineering
Second Term Examination 2013/2014

Subject: CAE (ANSYS) **Year: 4th year**
Division: Automotive and Aircraft Engineering **Exam Time: 1.5 Hrs.**
Examiner(s): Dr. Nabeh Natic and Dr. Laith Jaafer **Date: 8 / 3 / 2014**

Q2: Simulate fluid structure interaction to determine stress and strain on wedge due to fluid flow:

Assumption
Steady state
Turbulent flow
Working fluid = Air
V_{in} =10 m/s
P_{exit} =1 atm
All dimensions in meters

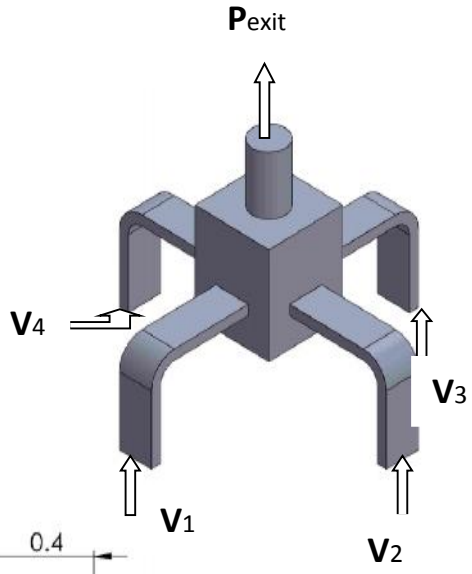


University of Technology
Department of Machines and Equipment Engineering
First Term Examination 2013/2014

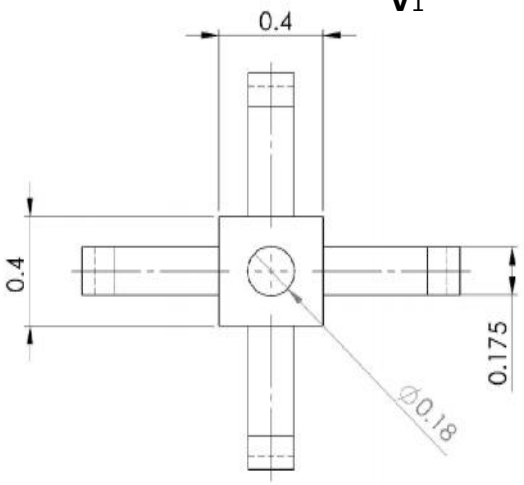
Subject: CAE (ANSYS) **Year: 4th year**
Division: All Divisions **Exam Time: 1.5 Hrs.**
Examiner(s): Dr. Nabeh Natic and Dr. Laith Jaafer **Date: / 1 / 2014**

Note: Assume all missing data.

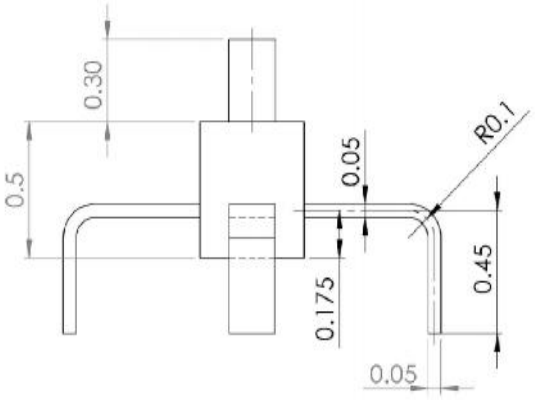
Q1: Simulate turbulent flow shown in figure bellow:



<u>Assumption</u>
Steady state flow
Turbulent flow
Working fluid: Air
$V_1 = V_2 = 1.5$ m/s
$V_3 = V_4 = 2$ m/s
$T_1 = T_2 = 20$ ºC
$T_3 = T_4 = 85$ ºC
$P_{exit} = 1$ atm
All dimensions in meter



Determine the following
countor plot of velocity at yz plane (mid plane)
countor plot of pressure at yz plane (mid plane)
vector plot of velocity at yz plane (mid plane)
countor plot of velocity at xz plane (y=0.45)
countor plot of temperature at yz plane (mid plane)



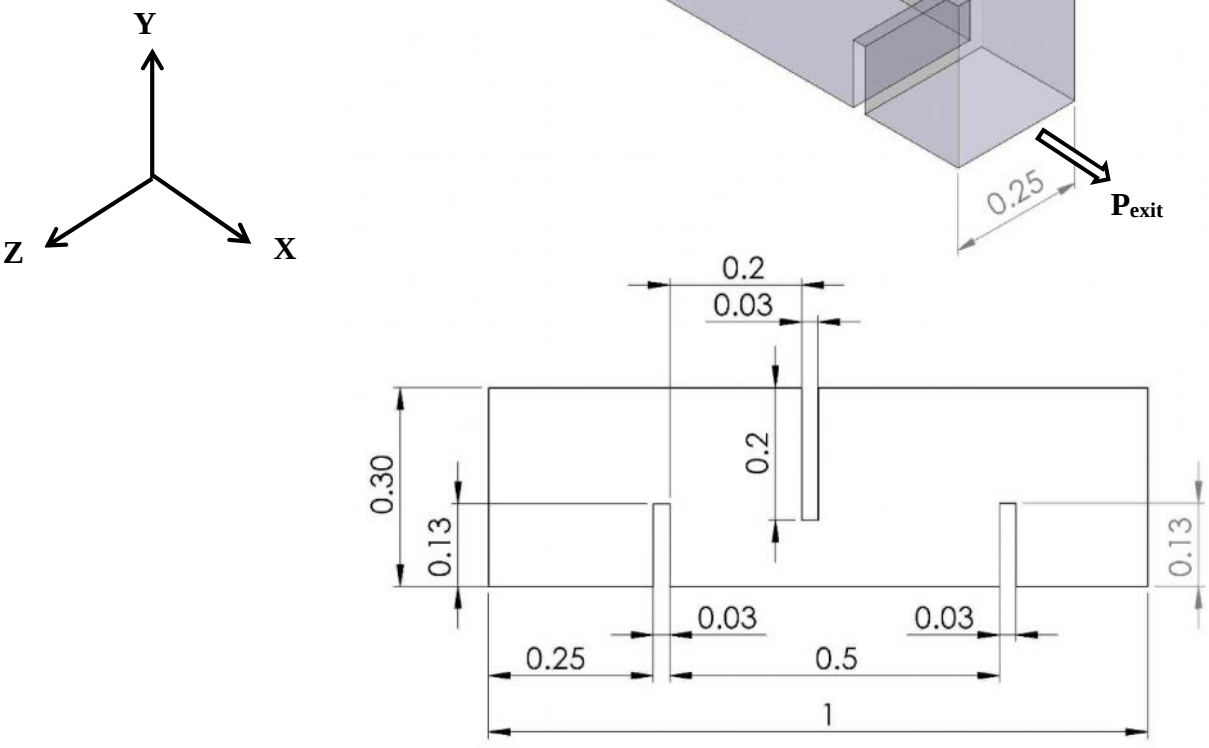
University of Technology
Department of Machines and Equipment Engineering
First Term Examination 2013/2014

Subject: CAE (ANSYS) **Year: 4th year**
Division: Automotive and Aircraft Engineering **Exam Time: 1.5 Hrs.**
Examiner(s): Dr. Nabeh Natic and Dr. Laith Jaafer **Date: 14 / 1 / 2014**

Notes: 1. Answer (one) question only. 2. Assume all missing data. 3. All dimensions in meter.

Q1: Simulate turbulent flow in duct with obstacle shown in figure bellow:

Assumption
Steady state flow
Turbulent flow
Working fluid: Air
V_{in}=7.5 m/s
P_{exit}= 1 atm



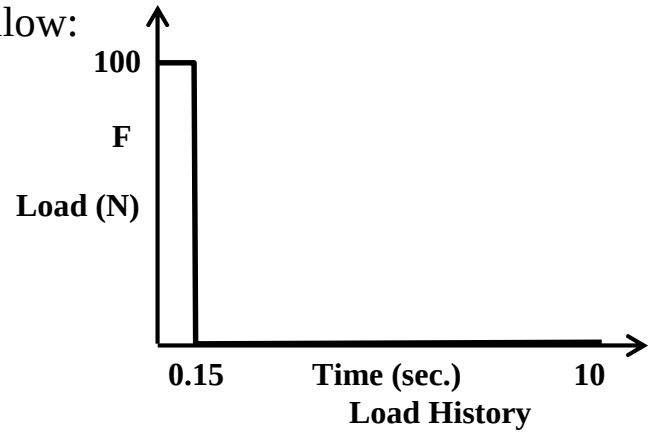
Determine the following
countor plot of velocity at yz plane (mid plane)
countor plot of pressure at yz plane (mid plane)
vector plot of velocity at yz plane (mid plane)
countor plot of velocity at xz plane (y=0.128)
countor plot of temperature at yz plane (mid plane)

University of Technology
Department of Machines and Equipment Engineering
First Term Examination 2013/2014

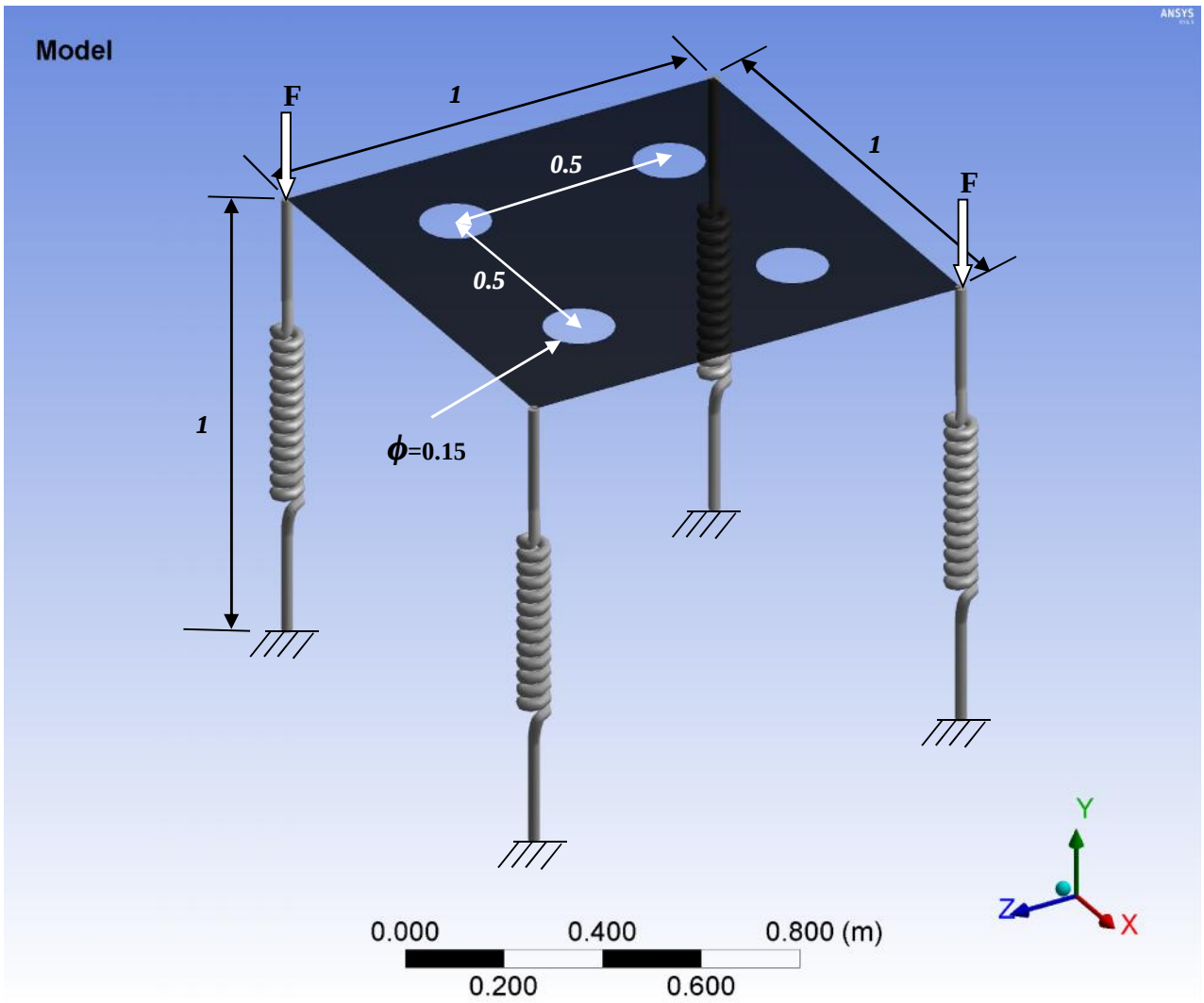
Subject: CAE (ANSYS) **Year: 4th year**
Division: Automotive and Aircraft Engineering **Exam Time: 1.5 Hrs.**
Examiner(s): Dr. Nabeh Natic and Dr. Laith Jaafer **Date: 14 / 1 / 2014**

Q2: Simulate transient vibration to determine deformation and stress in spring-plate system shown in figure bellow:

<u>Assumption</u>
Transient state
Material: steel
Plate thickness= 1 cm
Δt=0.05 s
Total time=10 s
K=200 N/m
C=3 N.s/m
Load history shown in figure.



Load History



<u>Determine the following</u>
Deformation and stress distribution in bracket at time intervals:
t=1 sec. , t=5 sec. , t=7.5 sec. and t=10 sec.

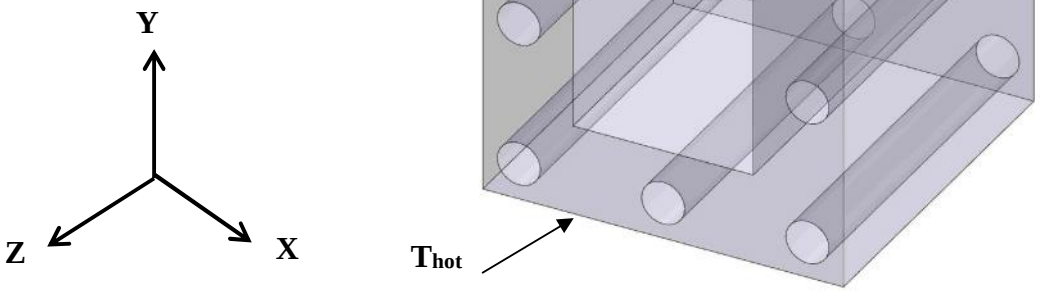
University of Technology
Department of Machines and Equipment Engineering
First Term Examination 2013/2014

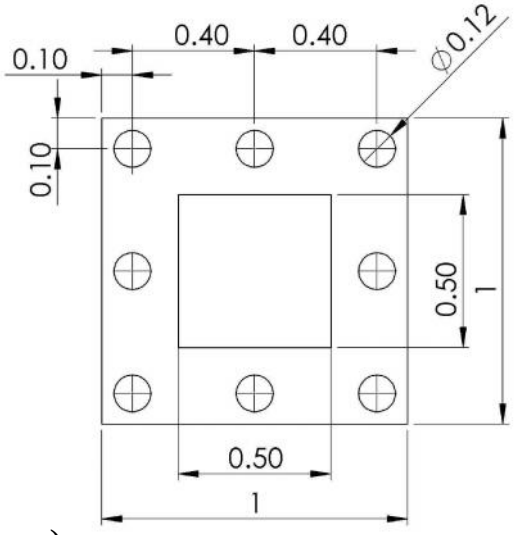
Subject: CAE (ANSYS) **Year: 4th year**
Division: AC **Exam Time: 1.5 Hrs.**
Examiner(s): Dr. Nabeh Natic and Dr. Laith Jaafer **Date: 9 / 1 / 2014**

Notes: 1. Answer (one) question only. 2. Assume all missing data.

Q1: Simulate free convection in the enclosure shown in figure bellow:

Assumption
Steady state flow
Laminar flow
Working fluid: Air
T_{hot}=85 ^oC (lower surface)
T_{cold}=15 ^oC (upper surface)
All other surfaces are insulated
All dimensions in meter



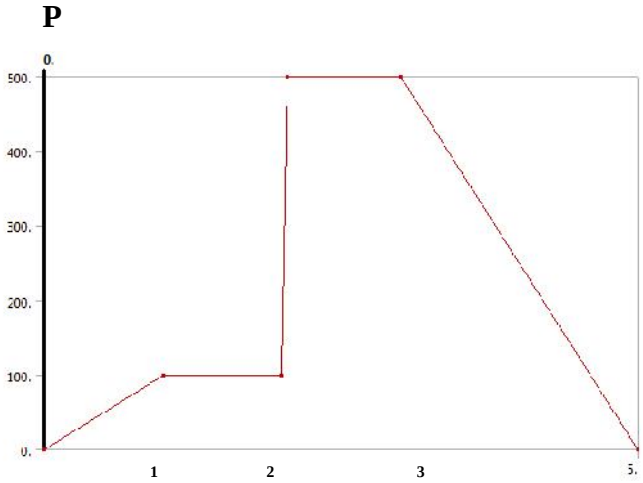


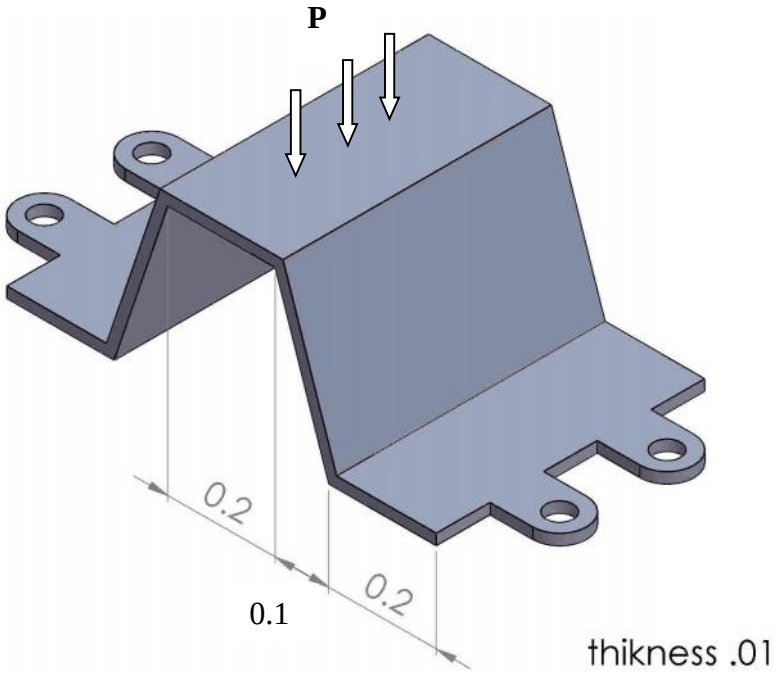
Determine the following
countor plot of velocity at yz plane(mid plane)
countor plot of pressure at yz plane(mid plane)
vector plot of velocity at yz plane(mid plane)
countor plot of velocity at xz plane(y= 0.5)
countor plot of temperature at yz plane(mid plane)

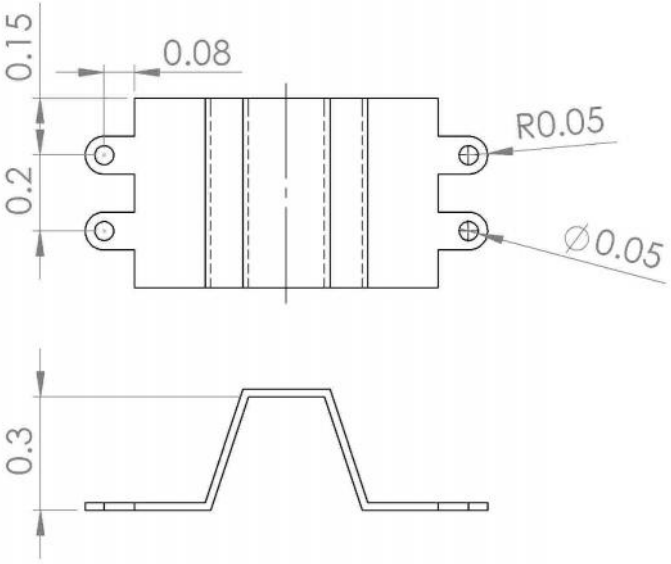
Q2: Simulate deformation and stress in bracket shown in figure bellow:

Assumption
Transient state
Material: steel

Load history shown in fig. bellow:







Determine the following
Deformation and stress distribution in bracket at time intervals:
t = 0.5sec.
t = 2 sec.
t = 4 sec.
t = 5 sec.

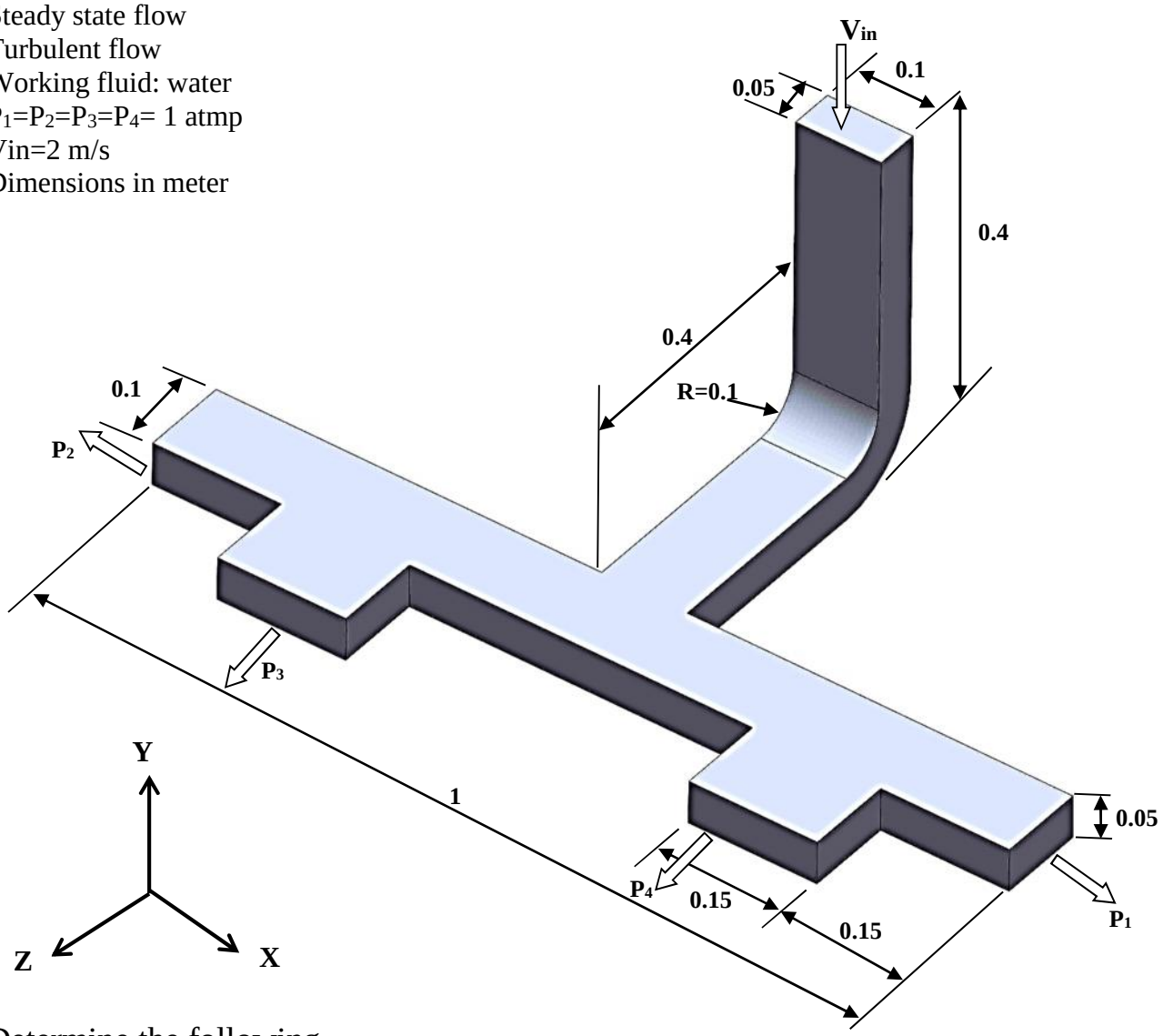
University of Technology
Department of Machines and Equipment Engineering
First Term Examination 2013/2014

Subject: CAE (ANSYS) **Year: 4th year**
Division: Air Conditioning and Refrigeration Engineering **Exam Time: 1.5 Hrs.**
Examiner(s): Dr. Nabeh Natic and Dr. Laith Jaafer **Date: 7 / 1 / 2014**

Notes: 1. Answer (one) question only. 2. Assume all missing data.

Q1: Simulate flow through in duct shown in figure bellow:

Assumption
Steady state flow
Turbulent flow
Working fluid: water
$P_1=P_2=P_3=P_4=$ 1 atmp
Vin=2 m/s
Dimensions in meter



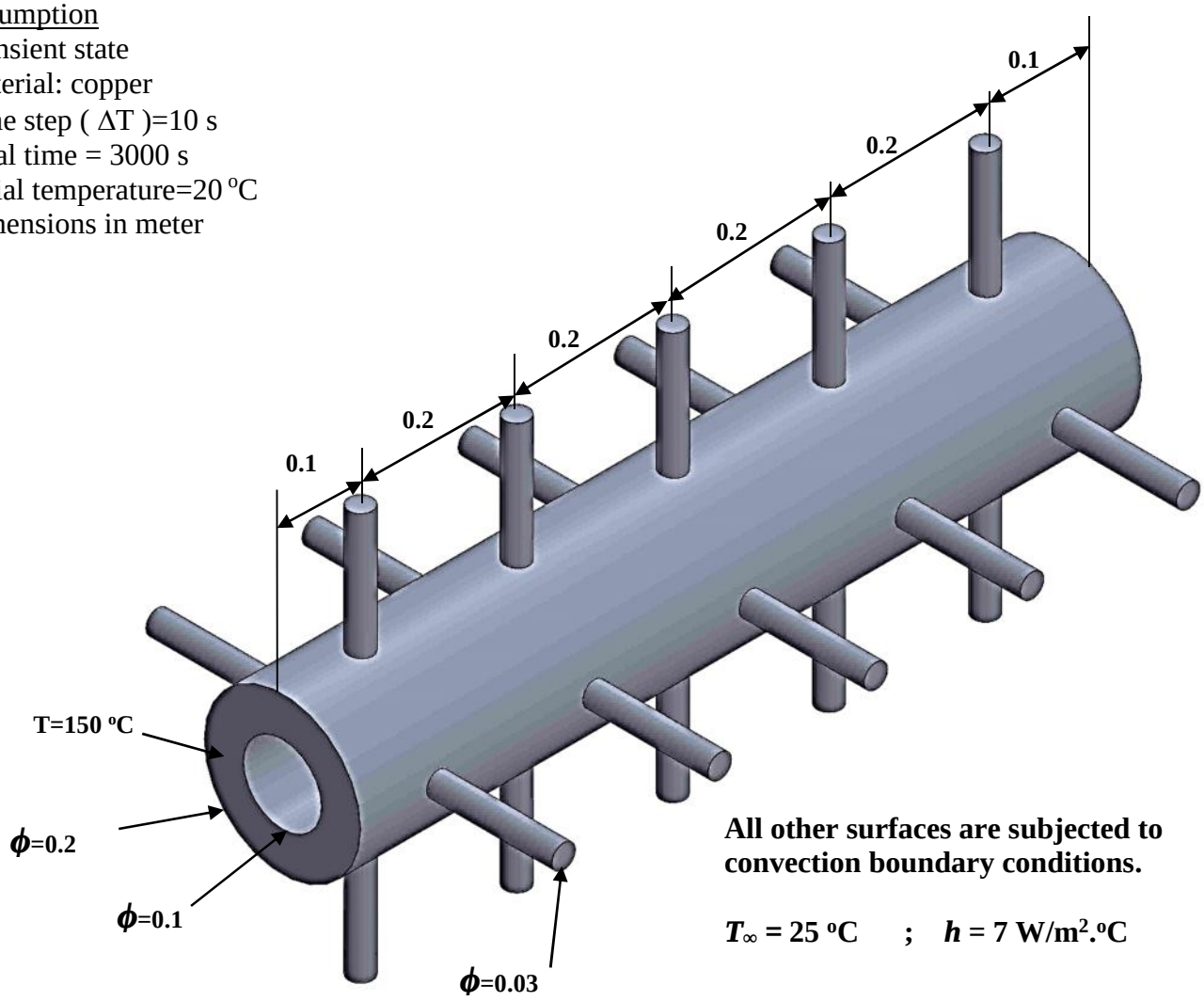
Determine the following
countor plot of velocity at yz plane (mid plane)
countor plot of pressure at yz plane (mid plane)
vector plot of velocity at yz plane (mid plane)
countor plot of velocity at xz plane (y= 0.025)

University of Technology
Department of Machines and Equipment Engineering
First Term Examination 2013/2014

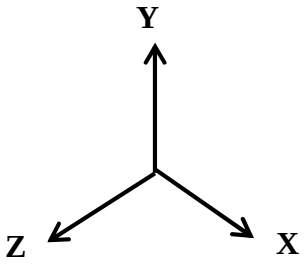
Subject: CAE (ANSYS) **Year: 4th year**
Division: Air Conditioning and Refrigeration Engineering **Exam Time: 1.5 Hrs.**
Examiner(s): Dr. Nabeh Natic and Dr. Laith Jaafer **Date: 7 / 1 / 2014**

Q2: Simulate heat transfer in pinned cylinder shown in figure bellow:

Assumption
Transient state
Material: copper
Time step (ΔT)=10 s
Total time = 3000 s
Initial temperature=20 ^oC
Dimensions in meter



All other surfaces are subjected to convection boundary conditions.

T_∞ = 25 ^oC ; h = 7 W/m^2.^{o}C

Determine the following
Temperature distribution in the body at time interval:
t=3000 s
t=2500 s
t=1000 s
t=10 s