Minoufia University
Faculty of Engineering
Shebin El-Kom
2nd Semester Exam.
Academic Year: *2014-2015*
Max. Marks. 100

Minufiya University

Year: Post Grad. (M.Sc Course)
Dept.: Mechanical Power Eng.
Subject: *Gas Dynamics*
Code: *MPE 630*
Time allowed: *3 hours*
Date: 15/06/2015

Allows the student to use only his own gas table & chart. Please do not use a pencil to write.

Assume any missing data from your point of view in the limits of what you studied.

(Note: Numbers of Exam. Papers are 2 pages.)

Answer all the following questions:

Question-1 [25 marks]

1- Derive an expression of movement of unsteady simple wave amplitude based on potential function.

2- Consider a tube at one end is open and at the other (left side) is closed. It's divided into two parts by a diaphragm. The left side has initial pressure and temperature 17 psi and 70 F. If the diaphragm suddenly broken, determine how the velocity, pressure, and density inside the tube vary with time, explain your answer through:-

1) Wave position diagram.

2) State diagram.

Question-2 [25 marks]

Explain the path line of the wave which generated by a piston moving in a tube of the following cases:-

a) The piston moves with a constant speed

b) The piston moves with a constant acceleration

c) The piston moves with a constant deceleration

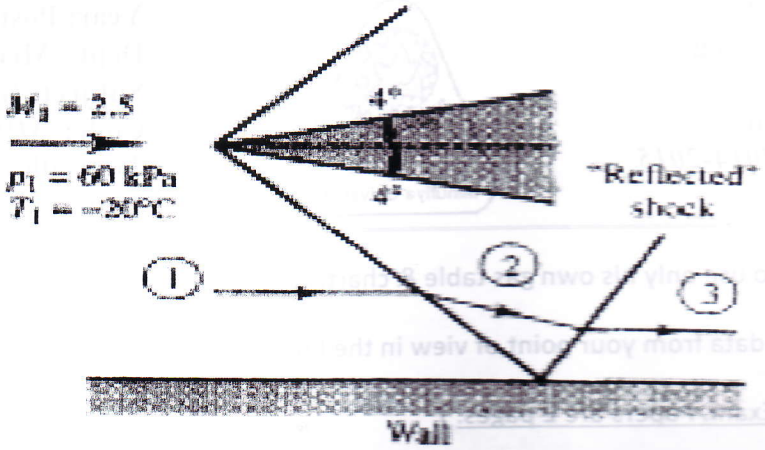
d) Explain the development mechanism of the generated shock wave in front of the accelerating piston. Explain its reflection at the open or closed end.

Question-3 [25 marks]

1- Prove that:

$$\frac{dM^2}{M^2} = 2\frac{dV}{V} - \frac{dT}{T}$$

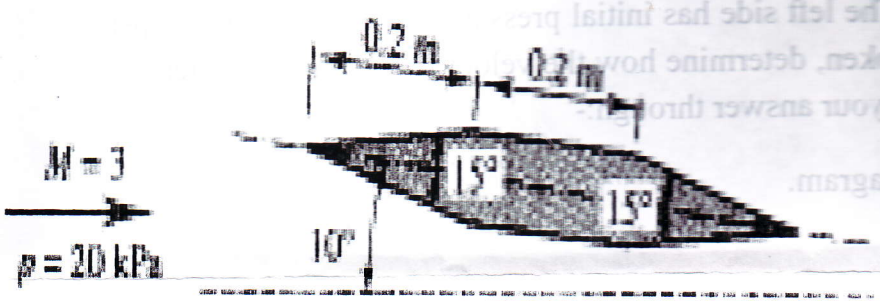
2- Air flowing with a Mach number of 2.5 with a pressure of 60 kPa and a temperature of $-20^{o}c$ passes over a wedge which turns the flow through an angle of 4^{o} leading to the generation of an oblique shock wave impings on a flat wall, which is paralle to the flow upstream of the wedge, and is "reflected" from it. Find the pressure and velocity behind the reflected shock wave.



Question-4 [25 marks]

1- Explain with drawing, the meaning of drag and lift forces on airfoil?

2- Consider a two-dimensional flow over the double-wedge airfoil in the following figure. Sketch the flow pattern and show graphically how does the pressure vary over the surface shown of the airfoil, then Find the lift and drag per meter span acting on the airfoil.



**********GOOD LUCK**********

Prof. Dr. Mostafa Nasr &Dr. Tarek Ghoneem.