KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY

Department of Mechanical Engineering

B. Sc. Engineering 2nd Year Backlog Examination, 2018

Hum 2105

(Industrial Environment and Sociology)

Time: 3 Hours Total Marks: 210

N.B.: i) Answer any THREE questions from each section in separate scripts.
ii) Figures in the right margin indicate full marks.

SECTION-A

1(a) What is meant by population growth? Critically explain the relation between population growth and sustainable development. 15

1(b) Explain Marxist view about population growth and economic development. 10

1(c) Describe key proposition of Malthus's theory on population growth. 10

2(a) What is meant by environmental pollution? Explain causes and consequences of different forms of environmental pollution. 20

2(b) What is industrial environment? Describe possible ways to keep industrial environment employee friendly. 15

3(a) What is industrialization? Explain social and environmental consequences of rapid industrialization in Bangladesh. 15

3(b) Describe concerns about energy consumption. 10

3(c) Explain non-occupational health impacts of energy use. 10

4(a) What is meant by sustainable development? Is sustainable development problematic for industrial growth? Give reason in favor of your opinion. 15

4(b) What is hazardous waste? Explain key steps of identification of hazardous waste. 10

4(c) Explain key propositions of Environmental Conservation Act, 1995. 10

SECTION-B

5(a) What is meant by crime? Discuss the causes of crime. 15

5(b) What is juvenile delinquency? Discuss the causes and remedies of juvenile delinquency. 15

5(c) What are the causes of poverty in our country? 05

6(a) What is meant by culture? Discuss the elements of culture. 10

6(b) What is material culture and non material culture? Explain briefly. 10

6(c) What are the differences between culture and civilization? 15

7(a)	What is meant by urbanization?	05
7(b)	Discuss the trend of urbanization with special reference to Bangladesh.	15
7(c)	Describe urban social problems with reference to your own city.	15
8(a)	What is meant by Society? Explain types and characteristics of society.	16
8(b)	What is meant by association? Explain functions of association with example.	12
8(c)	What is meant by sub-urbanization? Briefly explain the social impact of sub-urbanization.	07

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY

Department of Mechanical Engineering

B. Sc. Engineering 2nd Year Backlog Examination, 2018

ME 2209

(Engineering Mechanics II)

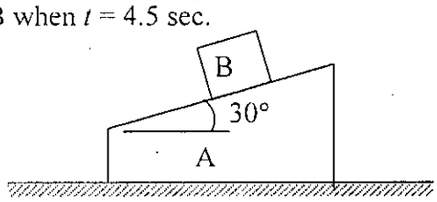
Time: 3 Hours | Total Marks: 210

N.B.: i) Answer any THREE questions from each section in separate scripts.
ii) Figures in the right margin indicate full marks.
iii) Assume reasonable data if any missing.

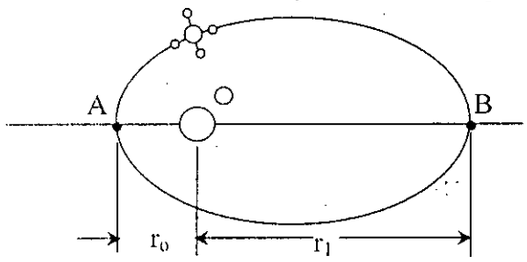
SECTION-A

1(a) A stone is thrown vertically upward from a point on a bridge located 40 m above the water. Knowing that it strikes the water 4.5 sec after release, determine– (i) the speed with which the stone was thrown upward, (ii) the speed with which the stone strike the water, (ii) the maximum height reached by the stone. 17

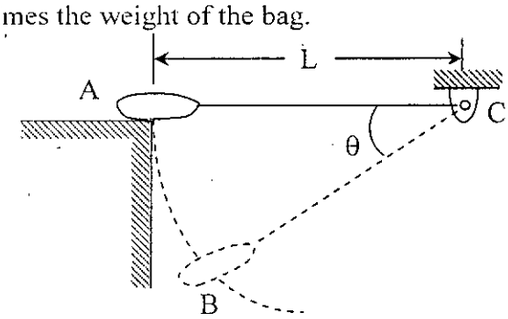
1(b) At $t = 0$, wedge A starts moving to the right with a constant acceleration of 100 mm/sec^2 and block B starts moving along the wedge toward the left with a constant acceleration of 150 mm/sec^2 relative to the wedge. Determine– (i) the acceleration of block B, (ii) velocity of block B when $t = 4.5$ sec. 18



2(a) A satellite describes an elliptic orbit about a planet. Denoting by r_o and r_1 the distances corresponding, respectively, to the perigee and apogee of the orbit, show that the curvature of the orbit at each of these two points can be expressed as $\frac{1}{\rho} = \frac{1}{2}\left(\frac{1}{r_o} + \frac{1}{r_1}\right)$. 17

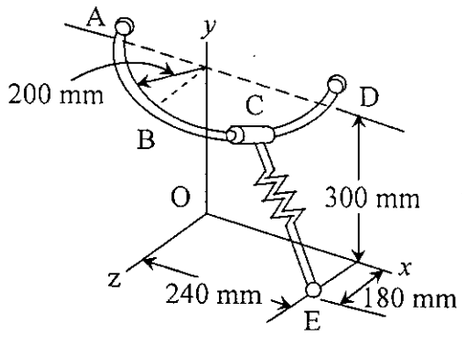


2(b) A bag is gently pushed off the top of a wall at A and swings in a vertical plane at the end of a rope of length L. (i) For any position B of the bag, determine the tangential component of its acceleration and obtain its velocity by integration, (ii) determine the value of θ for which the rope will break, knowing that it can withstand a maximum tension equal to 2.25 times the weight of the bag. 18

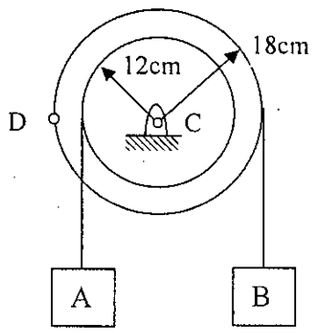


3(a) A 50 gm bullet is fired with a horizontal velocity of 500 m/sec into a 4 kg wooden block which is at rest on a frictionless, horizontal surface. Determine– (i) the final velocity of the block, (ii) the ratio of the final kinetic energy of the block and bullet to the initial kinetic energy of the bullet. 18

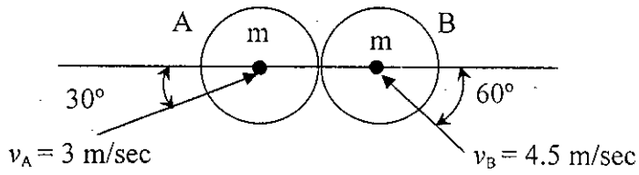
3(b) A 600 g collar C may slide along a horizontal, semicircular rod ABD. The spring CE has an undeformed length of 250 mm and a spring constant of 135 N/m. Knowing that the collar is released from rest at A and neglecting friction, determine the speed of the collar (i) at B, (ii) at D. 17



4(a) A pulley and two loads are connected by inextensible cords as shown. The pulley starts from rest at t = 0, and is accelerated at the uniform rate of 2.4 rad/sec^2 clockwise. At t = 4 sec, determine the velocity and position (i) of load A, (ii) of load B. 18

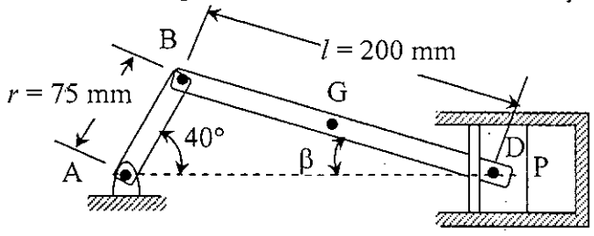


4(b) The magnitude and direction of the velocities of two identical frictionless balls before they strike each other are as shown. Assuming e = 0.90, determine the magnitude and direction of the velocity of each ball after the impact. 17

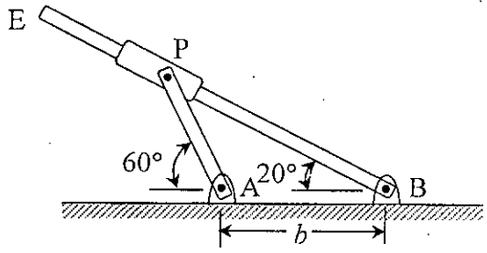


SECTION-B

5(a) Crank AB of the engine system as shown in figure has a constant clockwise angular velocity of 2000 rpm. For the crank position as shown in figure, determine the angular acceleration of the connecting rod BD and the acceleration of point D. 18

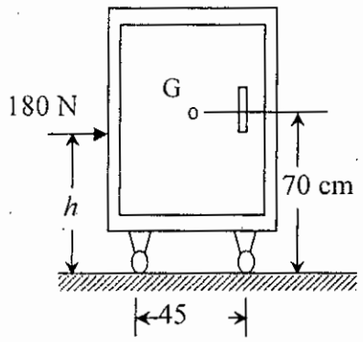


5(b) Two rotating rods connected by slider block P. Two rods attached at A rotates with a constant angular velocity ω_A. For the given data, determine for the position shown (i) the angular velocity of the rod attached at B, (ii) the relative velocity of the slider block P with respect to the rod on which it slides. Given, b = 20 cm, ω_A = 6 rad/sec. 17

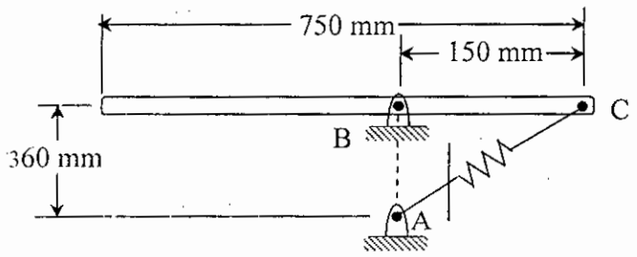


6(a) Show that when a rigid body about a fixed axis, its angular momentum is the same about any two points A and B on the fixed axis ($H_A=H_B$), if and only if, the mass centre G of the body is located on the fixed axis. 18

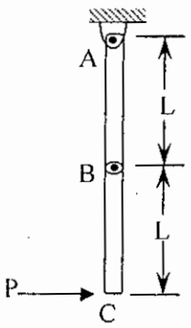
6(b) A 35 kg cabinet is mounted on casters, which allow it to move freely on the floor. If a 180 N force is applied as shown, determine– (i) the acceleration of the cabinet, and (ii) the range of values of '*h*' for which the cabinet will not tip over. 17



7(a) A 4 kg slender rod can rotates in a vertical plane about a pivot at B. A spring of constant k = 400 N/m and of unstretched length 150 mm is attached to the rod as shown. Knowing that the rod is released from rest in the position, determine the angular velocity of the rod after it has rotated through (i) 90°, and (ii) 180°. 18

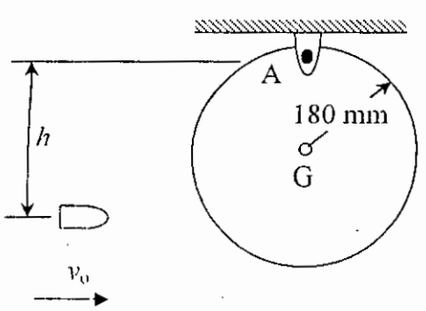


7(b) Each of the bars AB and BC is of length L = 45 cm and weight 1.5 kg. A horizontal force P of magnitude 25 N is applied at C. Determine the angular acceleration of each bar. 17



8(a) What is meant by Gyroscopic motion? Deduce an expression for angular momentum of a rigid body, when the body creates gyroscopic motion. 17

8(b) A 45 gm bullet is fired with a horizontal velocity of 950 m/sec into a 7.5 kg wooden disk suspended from a pin support A. Knowing that the disk is initially at rest, determine– (i) the required distance *h* if the impulsive reaction at A is to be zero, (ii) the corresponding velocity of the center G of the disk immediately after the bullet becomes embedded. 18



KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY

Department of Mechanical Engineering

B. Sc. Engineering 2nd Year Backlog Examination, 2018

ME 2211

(Mechanics of Solid)

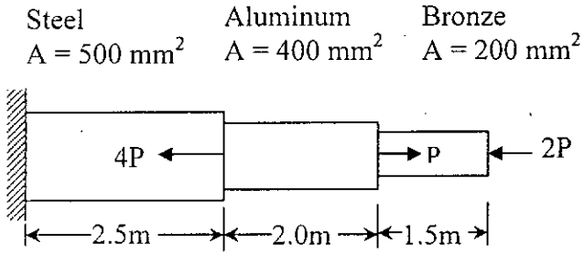
Time: 3 Hours | Total Marks: 210

N.B.: i) Answer any THREE questions from each section in separate scripts.
ii) Figures in the right margin indicate full marks.
iii) Assume reasonable data if missing any.
iv) Table B-4 may be supplied on request.

SECTION-A

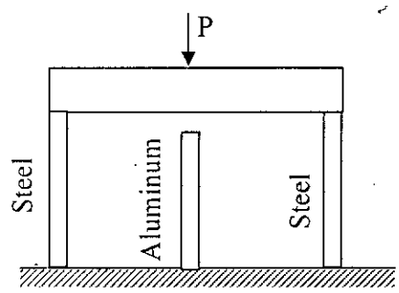
1(a) Explain the following terms: 08
(i) Hook's law, (ii) Poisson's ratio, (iii) Yield strength, and (iv) Rupture strength.

1(b) An aluminum rod rigidly is rigidly attached between a steel rod and a bronze rod as shown in figure. Axial loads are applied at the positions indicated. Find the maximum value of P that will not exceed a stress in steel of 140 MPa, in aluminum of 90 MPa, or in bronze of 100 MPa. 15

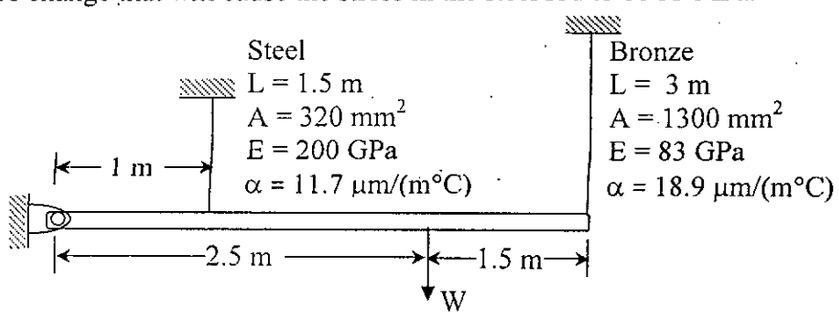


1(c) A cylindrical steel pressure vessel 400 mm in diameter with a wall thickness of 20 mm is subjected to an internal pressure of 4.5 MN/m^2. (i) Calculate the tangential and longitudinal stresses in the steel. (ii) To what value may the internal pressure be increased if the stress in the steel is limited to 120 MN/m^2? (iii) If the internal pressure were increased until the vessel burst, sketch the type of fracture that would occur. 12

2(a) The rigid platform as shown in figure has negligible mass and rests on two steel bars, each 250.00 mm long. The center bar is aluminum and 249.90 mm long. Compute the stress in the aluminum bar after the center load P = 400 kN has been applied. For each steel bar, the area is 1200 mm^2 and E = 200 GPa. For the aluminum bar, the area is 2400 mm^2 and E = 70 GPa. 17

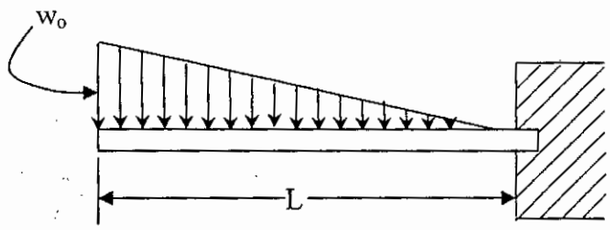


2(b) A rigid bar of negligible weight is supported as shown in figure. If W = 80 kN, compute the temperature change that will cause the stress in the steel rod to be 55 MPa. 18



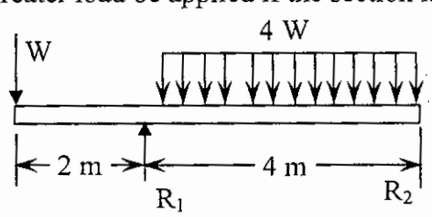
3(a) Show that a hollow circular shaft whose inner diameter is half the outer diameter has a torsional strength equal to 15/16 of that of a solid shaft of the same outside diameter. 18

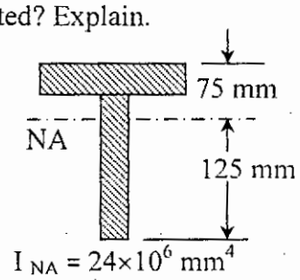
3(b) Write shear and moment equations for the beam as shown. Also draw the shear and moment diagrams, specifying values at all change of loading positions and at all points of zero shear. Neglect the mass of the beam. 17



4(a) Derive the formula for horizontal and vertical shear stress in a beam. 17

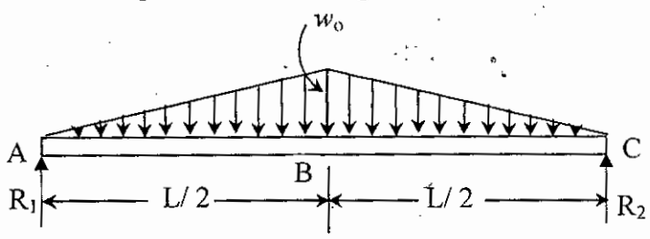
4(b) A beam carries a concentrated load W and a total uniformly distributed load of 4W as shown in figure. What safe value of W can be applied if $\sigma_c \leq 100$ MPa and $\sigma_t \leq 60$ MPa? Can a greater load be applied if the section is inverted? Explain. 18



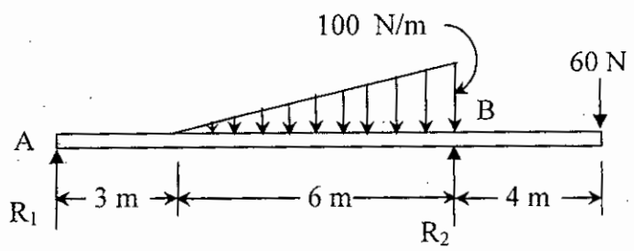


SECTION-B

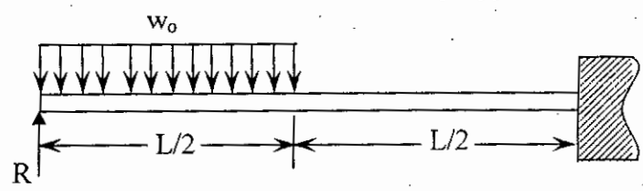
5(a) A simply supported beam caries the triangularly distributed load as shown in figure. Determine the deflection equation and the magnitude of the maximum deflection. 17



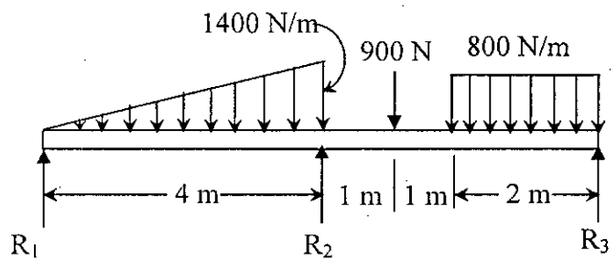
5(b) Determine the value of EIδ at the right of the overhanging beam shown in figure. Is the deflection up or down? 18



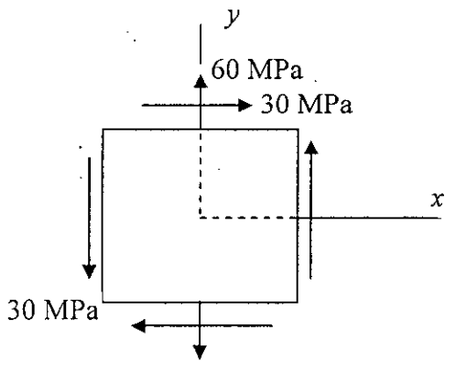
6(a) ***Find the relation R and the moment*** at the wall for the propped beam as shown in figure. 18



6(b) The continuous beam as shown in figure is supported on rigid foundations that are at the same level. Determine the bending moments in the beam over the supports. 17



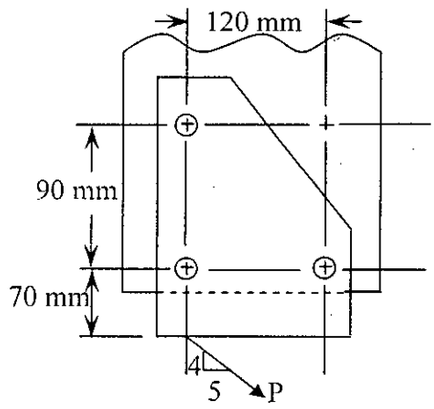
7(a) For the state of stress shown in figure, determine the principal stresses and the maximum in-plane shearing stress. Show all results on complete sketches of differential elements. 20



7(b) A timber beam 150 mm wide by 250 mm deep is to be reinforced at the top and bottom by steel plates of 10 mm thick. How wide should the steel plates be if the beam is to resist a moment of 40 kN-m? Assume that n = 15 and the allowable stresses in the wood and steel are 10 MPa and 120 MPa respectively. 15

8(a) Two C310×45 channels are latticed together so they have equal moment of inertia about the principal axis. Determine the minimum length of a column having this section assuming pinned ends. E = 200 GPa and a proportional limit of 240 MPa. What safe load will the column carry for a length of 12 m with a factor of safety 2.5? 17

8(b) For the riveted connection as shown in figure, determine the allowable load P if the shearing stress in the 25 mm rivets is limited to 140 MPa. 18



KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
Department of Mechanical Engineering
B. Sc. Engineering 2nd Year Backlog Examination, 2018
ME 2213
(Fluid Mechanics II)

Time: 3 Hours. Total Marks: 210

N.B. i) Answer any THREE questions from each section in separate scripts.
ii) Figures in the right margin indicate full marks.
iii) Assume reasonable data if any missing.

SECTION - A

1(a) State laws of fluid friction for both laminar and turbulent flows, on the basis of experimental observations. 08

1(b) What is a compound pipe? Determine the equivalent size of a compound pipe? 12

1(c) A pipe 0.15 m diameter taking off from a reservoir suddenly expands to 0.3 m at the end of 18 m and continues for another 15 m. If the head above the inlet of the pipe is 4.88 m, determine the actual velocity at the exit, taking into consideration of all the losses. Assume $f = 0.04$ for the complete pipe line. 15

2(a) Derive an expression for the head loss in a pipe of diameter D and length L in terms of Reynolds number and velocity head. 18

2(b) Two parallel plates kept at 0.15 m apart have laminar flow of oil between them with a maximum velocity of 2 m/sec. Calculate the discharge per unit width, the shear stress at the plates and the pressure difference between two points 20 m apart. 17

3(a) Prove that the maximum velocity in a circular pipe for viscous flow is equal to two times the average velocity of the flow. 18

3(b) Water flows at a steady mean velocity of 1.5 m/sec through a 50 mm diameter pipe sloping upwards at 40° to the horizontal. At a section some distance downstream of the inlet, the pressure is 650 kPa and at a suction 30 m further along the pipe, the pressure is 450 kPa. Determine the average shear stress at the wall of the pipe and at a radius of 10 mm. 17

4(a) Discuss lift and drag with their general mathematical expressions. 06

4(b) Distinguish between friction drag and form drag. Also sketch roughly the characteristics of steady, viscous flow along a flat plate parallel to the upstream velocity for increasing Reynolds number. 17

4(c) A smooth flat plate 4 m wide and 6 m long is towed through still water at 20°C at a speed of 8 m/sec. Determine the total drag on the plate. 12

SECTION - B

5(a) Define the terms: displacement thickness, momentum thickness, and energy thickness. 09

5(b) Define boundary layer and explain the fundamental causes of its existence. 10

5(c) For the velocity profile, $\frac{u}{U} = \sin\left(\frac{\pi}{2}\frac{y}{\delta}\right)$, calculate– 16

(i) Momentum thickness, (ii) Displacement thickness, and (iii) Energy thickness.

6(a) Show that the skin friction coefficient $C_f = 1.4\,\mathrm{Re}^{-\frac{1}{2}}$ for laminar boundary layer formed over a flat plate in the absence of a pressure gradient in the flow direction. 20

6(b) Explain the methods of controlling the separation of boundary layer. 15

7(a) For a variable flow cross-sectional area, prove that $\frac{dA}{dV} = \frac{A}{V}\left(Ma^2 - 1\right)$. Also explain variation of velocity with change in area for the subsonic and supersonic velocities. 17

7(b) Show that the maximum mass flow rate for a fluid through a converging nozzle at the speed of sound for a given area and the stagnation properties of the fluid. 18

8(a) Derive the Rankine-Hugonoit equation for a normal shock of compressible flow. 18

8(b) For an adiabatic flow through a constant area duct of diameter 25 mm, the Mach number at the inlet is 1.50. Calculate the critical length of pipe. Assume, $f = 0.005$. 17