

USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks.

Symbols used have their usual meaning.

SECTION – AThere are **FOUR** questions in this section. Answer any **THREE**.

1. (a) Find the differential equation from $\phi(x+y+z, x^2+y^2-z^2)=0$. (11)
- (b) Solve partial differential equation $(y+z)p+(z+x)q=x+y$. (12)
- (c) Find the complete integral of the equation $px+qy=pq$. (12)

2. Solve the following higher order partial differential equations:

(a) $(D_x^2 + D_x D_y + D_y - 1)z = \sin(x+2y)$. (12)

(b) $(D_x^2 - 5D_x D_y + 6D_y^2)z = e^{x-y}xy$. (11)

(c) $(D_x^2 + D_x D_y - 6D_y^2)z = x^2 \cos(x+y)$. (12)

3. (a) For which values of 'a' will the system (17)

$$4x + y + 2z = 6$$

$$3x - y + 5z = 2$$

$$4x + y + (a^2 - 14)z = a + 2$$

have no solutions? Unique solution? Infinitely many solutions?

(b) Reduce the matrix $A = \begin{pmatrix} 1 & 2 & -1 & 2 \\ 3 & 1 & -2 & -1 \\ 4 & -3 & 1 & 1 \end{pmatrix}$ to the normal form B and obtain the

non-singular matrices P and Q such that $PAQ = B$. (18)

4. (a) Find the inverse of the matrix $A = \begin{pmatrix} -1 & 2 & -3 \\ 2 & 1 & 0 \\ 4 & -2 & 5 \end{pmatrix}$ using elementary row

operations. Hence check your answer. (17)

(b) Deduce the matrix $A = \begin{pmatrix} 1 & 2 & -1 & 2 \\ 3 & 1 & -2 & -1 \\ 4 & -3 & 1 & 1 \\ 6 & 2 & -4 & -2 \end{pmatrix}$ to the echelon form then to the

canonical form and write down the rank of the matrix A. (18)

MATH 283

SECTION – B

There are **FOUR** questions in this section. Answer any **THREE**.

5. (a) Find the eigenvalues and corresponding eigenvector of the matrix $A = \begin{pmatrix} -1 & -2 & -2 \\ 1 & 2 & 1 \\ -1 & -1 & 0 \end{pmatrix}$.

Also find the matrix P that diagonalizes A and determine $P^{-1}AP$. (17)

- (b) Find the linear transformation which will transform the following quadratic form into a sum of squares and find the reduced form. (18)

$$q = 4x_1^2 + 3x_2^2 + x_3^2 - 8x_1x_2 - 6x_2x_3 + 4x_1x_3$$

Also find the rank, index and signature.

6. (a) Calculate mode and quartiles from the following distribution of ages of 60 children (10)

Age (in year)	0 - 4	4 - 8	8 - 12	12 - 16	16 - 20
Number of children	10	12	22	9	7

- (b) From the following frequency distribution for weight of 100 students, find four moments of the distribution about 65. Also find the coefficient of skewness and kurtosis of the distribution. (15)

Weight (in Kg)	60 - 62	63 - 65	66 - 68	69 - 71	72 - 74
Number of students	5	18	42	27	8

- (c) Find moment generating function of the exponential distribution and hence find β_1 and β_2 and comment on the nature of the distribution. (10)

7. (a) A department store has the following statistics of sales(Y) for a period of last one year of 10 sales persons, who have varying years of experience(X) in sales promotion. (18)

- (i) Find the regression line of Y on X.
 (ii) Predict the annual sales volume of persons who have 12 and 15 years of sales experience.

Experience (X)	1	3	4	4	6	8	10	10	11	13
Annual sales ('000Tk)	80	97	92	102	103	111	119	123	117	136

- (b) A bag contains 3 white balls and 4 black ones. In succession, three persons X, Y and Z, each draw a ball, without replacing it in the bag. The first person, who draws a white ball, wins. What are the respective chances of winning of the person drawing first, the person drawing second, and the person drawing third? (They continue until someone wins). (17)

MATH 283

8. (a) The average number of calls received by a telephone operator during a time interval of 10 minutes during 5 PM to 5.10 PM daily is 3. What is the probability that the operator will receive (i) no call (ii) one call and (iii) at least two calls tomorrow during the same time interval?

(17)

(b) A bulb manufacturing company claims that the average longevity of their bulb is 4 years with a standard deviation of 0.16 years. A random sample of 40 bulbs gave a mean longevity of 3.45 years. Does the sample mean justify the claim of the manufacturer? Use a 5 percent level of significance (the critical values are -1.96 and 1.96).

(18)

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE**.

Symbols have their usual meaning. Assume reasonable data, where missing.

1. (a) What do you mean by doublet? Explain. (5)
 (b) Derive an expressions for ϕ and ψ for a doublet. (10)
 (c) Draw and discuss equipotential lines and streamlines for a doublet at the origin. (10)
 (d) Show that the magnitude of the velocity is constant on any circle centred on the doublet. (10)

2. (a) Derive the equation of the velocity profile for parallel viscous flow between two fixed parallel plates. (15)
 (b) What do you mean by boundary layer separation? Water at 70°F flows past a smooth plane surface. Near a point on the surface several feet from the leading edge the velocities at $\frac{1}{4}$ inch and $\frac{1}{2}$ inch from the wall are 6.0 and 6.5 ft./sec, respectively. Assuming that the boundary layer is turbulent determine y' , v^* and δ' and estimate the velocity one inch from the wall. Given, $\nu = 1.06 \times 10^{-5}$ ft.²/sec. (20)

3. (a) What do you mean by circulation? Explain. (5)
 (b) Show that circulation around all streamlines of the vortex is constant and equal to the strength of the vortex. (10)
 (c) Show that a combination of source, sink and uniform flow constitutes the flow past a 'Rankine' body. Also determine the expressions for length, profile and width of the 'Rankine' body. (20)

4. (a) Explain analytic function with example. For complex velocity, prove that $\frac{dw}{dz} = |v| \cdot e^{-i\alpha}$; where the symbols have their usual meaning. (10)
 (b) Determine the magnitude and direction of the velocity for the following patterns of flows. (10)
 - (i) $\omega = 3\left(z + \frac{5}{z}\right) + 4ih(z)$ at the point $z = 3 + 4i$
 - (ii) $\omega = \frac{15}{z}$ at the point $z = 3 + 4i$.

- (c) If $\omega = f(z)$ where $\omega = \Phi + i\psi$ and $z = x + iy$, find the values of Φ and ψ for the following functions of z and with neat sketch identify the flow patterns in the z -plane. (15)
 - (i) $w = m h(z - a)$
 - (ii) $w = \frac{\mu}{z}$

NAME 223

SECTION – B

There are **FOUR** questions in this section. Answer any **THREE**.

5. (a) What is ideal fluid? Write five characteristics of ideal fluid. (15)
 (b) Why is a liquid flow incompressible? (5)
 (c) How do you prove that in an ideal fluid, even if the fluid is accelerating the pressure at a point is same in all directions? (15)
6. (a) Show that the ellipsoid $\frac{x^2}{a^2k^2t^4} + kt^2 \left\{ \left(\frac{y}{b} \right)^2 + \left(\frac{z}{c} \right)^2 \right\} = 1$ is a possible form of the boundary surface a liquid flow. Also find the velocity components. (18)
 (b) What is continuity equation? Deduce the continuity equation for three dimensional flow in an ideal fluid. (17)
7. (a) Define path line, streak line and streamline. Determine the path line, streak line and the streamline of the particles if $u = \frac{x}{1+t}$, $v = \frac{y}{1+2t}$, $w = 0$. (20)
 (b) What is flow nets? Write at least five characteristics of flow nets. (15)
8. (a) Prove that for an irrotational flow, stream function satisfies the Laplace equation. (5)
 (b) The velocity components in a two dimensional flow field for an incompressible fluid are given by $u = e^x \cdot \cosh y$ and $v = -e^x \sinh y$. Is it possible flow field? Is this a irrotational flow? (10)
 (c) Show that the total kinetic energy of a flow in terms of conditions over its surface is (20)

$$T = -\frac{\rho}{2} \iint \varphi \frac{\partial \varphi}{\partial \eta} ds$$

Where

T = The total kinetic energy

ρ = density of the fluid

φ = velocity potential of the flow field

s = surface area

η = normal direction

L-2/T-2/NAME

Date : 25/01/2017

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-2 B. Sc. Engineering Examinations 2015-2016

Sub : **HUM 211** (Sociology)

Full Marks: 140

Time : 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks.

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE**.

1. (a) 'Sociology is a categorical discipline not a normative discipline' — Explain. (10)
(b) Critically discuss conflict theoretical perspective of sociology. (13 ⅓)
2. (a) Make a comparison between patriarchal family and nuclear family. (10)
(b) Briefly discuss the changing roles and patterns of family in the context of Bangladesh. (13 ⅓)
3. (a) What do you understand by socialization? Explain primary socialization and anticipatory socialization with examples. (10)
(b) Explain Charles Horton Cooley's looking glass self theory. (13 ⅓)
4. Write short notes on any **three** of the following: (23 ⅓)
 - (a) Estate system and caste system,
 - (b) Differences between culture and civilization,
 - (c) Classification of social mobility,
 - (d) Social norms and social values.

SECTION-B

There are **FOUR** questions in this section. Answer any **THREE**.

5. (a) Globalization process is usually recognized as being driven by a combination of economic, technological, socio-cultural and political factors. Illustrate. (13 ⅓)
(b) Explain the social and economic impacts of industrial revolution in Indian subcontinent. (10)
6. (a) During industrial revolution in Britain, how did inventions change the way cotton and its products were manufactured? Which were the most important inventions? (13 ⅓)

Contd P/2

HUM 211/NAME

Contd... Q. No. 6

- (b) "Natural disaster and criminal activities are the two most influential reasons of 'rural to urban' migration in Bangladesh." — Justify the statement. **(10)**
7. (a) Enumerate the crucial elements of demography usually used during population survey in Bangladesh. How do these elements help to understand population dynamics? **(13 $\frac{1}{3}$)**
- (b) Demonstrate Burgess's 'Concentric Zone Model'. **(10)**
8. Write short notes on any **three** of the followings: **(23 $\frac{1}{3}$)**
- (a) Noise pollution,
 - (b) Infant Mortality Rate (IMR),
 - (c) Chernobyl disaster,
 - (d) Urban Ecology.
-

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE**.

Assume missing data (if any).

1. (a) What are the three ship design categories? Write short notes on Deadweight carrier and Linear dimension ship. (15)
 (b) For basic design of a ship, which dimensional relationships are essential? Elaborately discuss the affects of beam/length and beam/depth relationship on ship's performance and characteristics. (20)
2. (a) What is freeboard? What is the purpose of freeboard? (10)
 (b) What are the factors that influence the safety of a ship? Explain with necessary diagram. (15)
 (c) Make a discussion on the three groups of power components which are required for ship propulsion. (10)
3. (a) Define moulded capacity, grain capacity, bale capacity and insulated volume. (12)
 (b) For a vessel the moulded capacity is 20,000 m³. Estimate the approximate corresponding grain, bale and insulated capacities. (10)
 (c) Estimate the final grain and bale capacities of a new design from a basic ship as shown in the attached table. (13)
4. Estimate the principal dimensions of a ship as described in Watson and Gilfillian (1976). The owner requires 2000 tons of deadweight to be carried between the Port of Colombo and the Port of Chittagong in 7 days. Now, (35)
 - (i) What could be the service speed? Consider the distance between the ports is 1680 nautical mile.
 - (ii) What could be the possible length of the ship according to Ayre and Posdunine? Use iterative approach.
 - (iii) Choose 5 different lengths to make range which encompass the lengths obtained in (ii). From the 5 different lengths corresponding Beams, Depths, Drafts, Displacements and Deadweights.
 - (iv) Plot length vs. deadweight curve using the values obtained in (iii). What is the length of the ship that satisfies the owner's requirement?

NAME 217

Contd... Q. No. 4

- (v) Out of the 5 designs which ship seems to have better statical stability than the others? Also which ship seems to have deficiency in directional stability than the others?

For this problem the draft can be assumed 70% of depth. Length can be taken 12 times larger than depth. There are no appendages to consider. The sea water density can be taken 1.025 kg/l. The deadweight is 70% of the displacement.

SECTION-B

There are **FOUR** questions in this section. Answer any **THREE**.

5. (a) What is a design team? What is the function of chief designer? Is it possible a ship be designed by a single Naval Architect? (15)
(10)
- (b) What is design philosophy? Describe at least ten philosophical aspects which are essential in the ship design process. (20)
6. (a) Write seven basic requirements of every ship that she needs to perform. (10)
- (b) What are the requirements of a tugboat which are essential to its purpose? (15)
- (c) A 110000 tonnes dwt oil tanker is 258m LBP, 43 m Breadth (Mld) and 14.20 m Draft (Mld). A new similar design of 120000 tonnes is being considered. Using Geosim method, estimate the LBP, Breadth (Mld) and Draft (Mld) for larger ship. (10)
7. (a) Describe the prefabrication method for steel work of a new ship with necessary flow diagram. Write the advantages of the prefabrication method. (20)
- (b) Data for selected basic ship Diesel machinery is as follows: (15)
- Break power (P_B) = 4600 kw
Displacement (w) = 15272 tonnes
Speed (v) = 15.50 Knots
Machinery weight = 663 tonnes
- A new similar design has:
 $W = 14733$ tonnes
 $V = 15.25$ Knots.
- Estimate the machinery weight for the new design.
8. (a) Discuss the possible affects of increasing length, breadth, depth, draft and block coefficient of ship. (20)
- (b) What are the factors to consider while choosing main machinery of a ship? What are the main engine systems that a Naval Architect must keep in mind while designing a ship? (15)

Table for Q. No. 3 (c)

<i>Item</i>	<i>Basic ship</i>	<i>New design</i>
LBP (m)	134.0	137.0
Br. Mld (m)	18.50	19.50
Depth Mld (m)	12.00	12.20
Grain Capacity (m ³)	17 600	—
Tank Top (m)	1.25	1.40
C _B @ SLWL	0.760	0.745
Deck sheer for'd (m)	2.52	3.20
Deck sheer aft (m)	1.20	1.46
Deck camber (m)	0.38	0.46
Tank ceiling (m)	0.06	0.06
None-cargo spaces (m ³)	3700	4490