BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T-2   B. Sc. Engineering Examinations 2010-2011

Sub : **WRE 103** (Surveying)

Full Marks : 280   Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

1. (a) Give a short list of modern surveying instruments. Enlist the use of 'total station' and 'hand GPS'. **(12)**

   (b) Give a definition sketch for a simple circular curve. Discuss the methods of ranging a circular curve. **(12)**

   (c) Two tangents intersect at chainage 1200 m, the deflection angle being 35°. Calculate all the data necessary for setting out a circular curve with a radius of 290 m by one theodolite method. The chain is 30 m long. **(22⅔)**

2. (a) What is transition curve? Give an expression for shift of a transition curve. **(10⅔)**

   (b) Write short notes on (i) Celestial equator (ii) Horizon (iii) Latitude (iv) Longitude (v) Altitude (vi) Declination. **(18)**

   (c) Discuss about the system of time. **(10)**

   (d) Calculate the local time at New York (Longitude 74° 10′ W) when it is 6:30 PM at Dhaka (Longitude 90° E). **(8)**

3. (a) What are the methods of locating soundings? Discuss about the method "Location by two angles from the shore". **(14)**

   (b) What is current meter? What is calibration of a current meter? Discuss the method of calibration. **(12)**

   (c) Develop a calibration equation from the following data for a current meter. **(20⅔)**

n (rev/sec) :	0.5	1.2	1.7	2.3	2.5
V (m/sec) :	1.5	4.9	6.8	8.4	8.9

4. (a) What are uses of aerial photogrammetry? **(8)**

   (b) Write short notes on (i) "Ground control" (ii) Crab (iii) Drift. **(9)**

   (c) Enlist the required data for flight plan. **(9)**

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Contd ... Q. No. 4

(d) The scale of the photograph is 1 cm = 100 m. The size of photograph is 18 cm × 18 cm. Determine the number of photographs required to cover an area of 8 km × 18 km if the longitudinal overlap is 60% and side lap is 30%. **(20⅔)**

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

5. (a) Define surveying. Describe the instruments used in chain surveying. **(16)**

   (b) Describe a procedure to overcome the difficulty to ranging, out chaining. **(10)**

   (c) A coastal embankment at a constant reduced level of 12 m is to be constructed. The width of the formation level is 7 m and the side slopes of the embankment is 2H : 1V. The transverse ground is leveled. The following are the ground surface elevation along the alignment at 50 m interval: **(20⅔)**

Chainage (m) :	0	50	100	150	200	250	300	350
Elevation of ground surface (m) :	5.8	5.6	5.4	5.0	4.8	5.2	5.7	5.8

Calculate the earthwork necessary to construct the embankment according to Simpson's rule.

6. (a) Describe the distance and elevation formula for inclined sights with staff remain vertical at any uneven ground, provided that the ground point has a vertical depression angle. **(15)**

   (b) Show a comparison among different types of level. **(8)**

   (c) For a four sided closed traverse ABCDA, find out the missing values from the following data: **(23⅔)**

Side	Length (m)	Bearing
AB	500	roughly east
BC	245	168°
CD	?	270°
DA	216	10°

Also sketch the traverse qualitatively.

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7. (a) Describe the direct method of chain survey on sloping ground. **(13)**

   (b) Explain the mechanism of an optical square to setout a line at right angles to another line. **(13)**

   (c) The following staff readings were observed successively with a level and the instrument was moved after third, sixth and eighth readings: 2.228, 1.606, 0.988, 2.090, 2.864, 1.262, 0.602, 1.982, 1.044 and 2.684 meters. **(20⅔)**

   Enter the above readings in a level book (make a typical page) and calculate the RL of points if the first reading was taken with a staff held on a bench mark of 432.384 m. Also check the accuracy of the readings.

8. (a) Define closing error. How this error can be adjusted? **(10)**

   (b) Write short note on: (i) GIS (ii) GPS. **(12)**

   (c) In a proposed hydro-electric project a reservoir was required for storage of 4.5 million cubic meter between lowest draw down and top water level. The areas contained within the stated contours and upstream face of the dam were as follows: **(24⅔)**

Contour (m)	100	95	90	85	80	75	70	65
Area (ha)	30	25	23	17	15	13	7	2

If lowest draw down is to be 67 m, calculate the top water level for:
(i) Full storage capacity (ii) 70% of full storage capacity

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T-2   B. Sc. Engineering Examinations 2010-2011

Sub: HUM 113 (Economics)

Full Marks : 140   Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

1. (a) Distinguish between the concepts of microeconomics and macroeconomics. Discuss the relative importance of microeconomics and macroeconomics in the formation of national economic policies of a country. **(10)**

(b) Mathematically derive the cardinal theory of consumer equilibrium both for independent and interdependent commodities. **(10)**

(c) Why does demand curve slope downward to the right? **(3⅓)**

2. (a) Define demand function. Discuss the factors that affect the demand for a commodity in general. **(8)**

(b) Define 'change in demand' and 'change in quantity demanded'. Discuss graphically the following situations of demand curve: **(8⅓)**

(i) Shift of the demand curve

(ii) Movement along the same demand curve.

(c) Calculate the equilibrium price and quantity from the following market demand and market supply functions and show the result in a graph. **(7)**

$$QD_x = 8000 - 1000P_x$$
$$QS_x = -4000 + 2000P_x$$

3. (a) Explain how the supply of a commodity depends on the state of technology. **(5⅓)**

(b) Define income elasticity of demand and write down its formula. "A commodity may be luxury at 'low' levels of income, a necessity at 'intermediate' levels of income and an inferior commodity at 'high' level of income" – Explain the statement with suitable example. **(10)**

(c) What is meant by cross elasticity of demand? Write down the formula for cross elasticity of demand and give suitable example. **(8)**

4. (a) What are the assumptions of indifference curve analysis? **(3⅓)**

(b) Explain the concepts of 'marginal rate of substitution' and 'budget line'. **(10)**

(10)

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SECTION – B

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

5. (a) Define 'total product' (TP), 'marginal product' (MP) and 'average product' (AP). How would you drive AP and MP curves from TP curve? Show the relationship between TP, MP and AP. **(8)**

    (b) Given the total production (TP) function: **(8)**

$$TP = -5L^3 + 450L^2$$

Sketch the graphs of 'total product' (TP), 'marginal product' (MP) and average product curves.

    (c) Explain the properties of perfect competition. Graphically show the 'super normal profit', 'abnormal loss' and 'normal profit' of a firm in a perfectly competitive market. **(7 ⅓)**

6. (a) Derive the 'average cost' (AC) and 'marginal cost' (MC) curves from the 'total cost' (TC) curve. Show the relationship between AC, MC and TC. **(8)**

    (b) Given the total cost functions: **(8)**

$$TC = 4Q^3 - 72Q^2 + 3000Q$$

Sketch the graphs of 'total cost' (TC), 'marginal cost' (MC) and 'average cost' (AC) curves.

    (c) Mention the main characteristics of a monopoly market. Give an example of a monopoly market in Bangladesh. How can a monopolist attain his/her equilibrium? (Use necessary graphs). **(7 ⅓)**

7. (a) Distinguish between Gross Domestic Product (GDP) and Gross National Product (GNP). **(5 ⅓)**

    (b) Explain the 'expenditure', 'income' and 'value addition' methods to measure GDP. What are not counted in GDP? **(8)**

    (c) Explain the causes of 'demand pull' and 'cost push' inflation. Compare the effects of these inflation on any economy. **(10)**

8. (a) Define 'isocost' and 'isoquant'. Explain the properties of an isoquant. **(6)**

    (b) From the following equations of iso-cost and isoquant, find out the equilibrium quantity of labour and capital, and show them graphically: **(6)**

$$K + L = 10$$
$$\text{and} \quad KL = 25$$

    (c) What do you mean by 'returns to scale'? Explain different types of 'return to scale'. **(6)**

    (d) Define "Economies of Scale" and "Diseconomies of Scale"? **(5 ⅓)**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T-2   B. Sc. Engineering Examinations 2010-2011

Sub : **PHY 105** (Electricity and Magnetism, Structure of Matter and Modern Physics)

Full Marks : 210   Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

1. (a) Calculate number of atoms per unit cell for various space lattices in cubic crystal system. **(12)**

   (b) What are Miller indices? How the Miller indices are determined? **(15)**

   (c) Draw the (110) plane and [$\bar{1}$10] direction in the cubic crystal system. **(8)**

2. (a) What do you mean by primitive cell? How the Wigner-Seitz primitive cell is constructed for two dimensional lattices? **(12)**

   (b) Explain the crystal structure of NaCl. **(11)**

   (c) If unit cells have following characteristics – **(4)**

   (i) $a = 10.8$ Å, $b = 9.47$ Å, $c = 5.2$ Å

        $\alpha = 41°$, $\beta = 83°$, $\gamma = 93°$

   (ii) $a = b = 10.73$ Å, $c = 14.3$ Å

        $\alpha = \beta = 90°$ and $\gamma = 120°$

   identify to which crystal system do these unit cells belong?

   (d) The distance between consecutive (111) planes in a cubic crystal is 2 Å. Determine the lattice parameter. **(8)**

3. (a) Explain Bragg's law in x-ray diffraction? What are the characteristic features of Bragg's law? **(15)**

   (b) Distinguish between metal, insulator and semiconductor according to the band theory of solids. **(12)**

   (c) The Bragg angle for reflection from the planes for which $h^2 + k^2 + l^2 = 8$ is 20.2° for an x-ray wavelength of 1.54 Å. Find the lattice constant of the crystal. **(8)**

4. (a) Briefly explain why a nucleus becomes unstable? Define isotopes, isotones, isobars and isomers with examples. **(13)**

   (b) What is radioactivity? Derive an expression for the law governing radioactive decay. **(8)**

   (c) What is binding energy of a nucleus? What are the characteristics of nuclear forces? **(8)**

   (d) The half-life of radium is 1620 yrs. In how many years will one gram of pure element lose centigram? **(6)**

PHY 105 (WRE)

SECTION – B

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

5. (a) Derive the Lorentz transformation formulae. Show that for v << c, Lorentz transformation reduced to Galilean one. **(14)**

(b) Derive an equation for the relativistic kinetic energy of a body and show this kinetic energy reduces to classical value for low speeds. **(15)**

(c) A stationary body explodes into two fragments, each of rest mass 1.20 kg that moves apart at speed 0.75 c relative to the original body. Find the rest mass of the original body. **(6)**

6. (a) What are the inadequacies of classical physics which introduce the concept of quantum mechanics? **(7)**

(b) What is Compton scattering? Derive the relation for change in wavelength in Compton scattering? What is Compton wavelength? **(20)**

(c) X-rays with $\lambda \approx 20$ pm are scattered from a carbon block at an angle 45° with the incident beam. (i) What is the Compton shift $\Delta\lambda$ and the fractional wavelength shift? (ii) What is the fractional photon energy change? and (iii) What kinetic energy is imparted to the recoiling electron? **(8)**

7. (a) What is a dielectric material? Describe an expression for Gauss' law after applying a dielectric. **(17)**

(b) Calculate the capacitance of a cylindrical capacitor of length L formed by two coaxial cylinders of radii a and b. **(10)**

(c) A capacitor is charged with 9.6 nc and has a 120 V potential difference between its terminals. Calculate its capacitance and the energy stored in it. **(8)**

8. (a) Define magnetic field vector. If a metal wire of length l carrying a current i is placed at right angles to a uniform magnetic field $\overline{B}$, show that the forces exerted on the wire is given by $\overline{F} = i\overline{l} \times \overline{B}$. **(10)**

(b) State Biot-Savart law. Apply this law to find the magnetic field at a point due to a long infinite wire carrying a current. **(17)**

(c) A current of 1 amp flows in a length 10 cm placed in a magnetic field of 5000 Gauss. Calculate the force acting on the wire when the wire makes an angle of (i) 90° and (ii) 0°, with respect to the magnetic field. **(8)**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T-2   B. Sc. Engineering Examinations 2010-2011

Sub : **MATH 133** (Matrices and Three Dimensional Co-ordinate Geometry)

Full Marks: 210   Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

Symbols used have their usual meanings.

1. (a) Find the inverse of   **(20)**

$$A = \begin{pmatrix} 1 & -1 & 2 & 1 \\ 3 & 0 & 2 & 2 \\ 2 & 1 & -1 & 1 \\ 1 & 0 & 1 & 1 \end{pmatrix}$$

and hence check your answer.

(b) Find the rank of the matrix by reducing it to echelon form.   **(15)**

$$A = \begin{pmatrix} 2 & 3 & -1 & -1 \\ 1 & -1 & -2 & -4 \\ 3 & 1 & 3 & -2 \\ 6 & 3 & 0 & -7 \end{pmatrix}$$

2. (a) Determine the values of λ such that the following system in unknowns x, y and z

has (i) a unique solution, (ii) no solution and (iii) more than one solution: **(15)**

$$\lambda x + y + z = 1$$
$$x + \lambda y + z = 1$$
$$x + y + \lambda z = 1$$

(b) Find the eigenvalues of the matrix   **(20)**

$$A = \begin{pmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{pmatrix}$$

Also find the eigenvectors corresponding to the eigenvalues.

3. (a) State Cayley-Hamilton theorem. Verify Cayley-Hamilton theorem for the matrix   **(25)**

$$A = \begin{pmatrix} 1 & 2 & 3 \\ 1 & 3 & 5 \\ 1 & 5 & 12 \end{pmatrix}$$

and hence find A^{-1}.

(b) If the vector set $\{V_1, V_2, V_3\}$ is independent, prove that   **(10)**

(i)   the set $\{V_1 + V_2 - 2V_3, V_1 - V_2 - V_3, V_1 + V_3\}$ is independent, and

(ii) the set $\{V_1 + V_2 - 3V_3, V_1 + 3V_2 - V_3, V_2 + V_3\}$ is dependent.

MATH 133

4. (a) Find two non-singular matrices P and Q such that PAQ is in the normal form where **(18)**

$$A = \begin{pmatrix} 1 & 1 & 1 \\ 1 & -1 & -1 \\ 3 & 1 & 1 \end{pmatrix}$$

(b) Reduce the quadratic form $q = 12x_1^2 + 4x_2^2 + 5x_3^2 - 6x_1x_2 - 4x_2x_3 + 6x_1x_3$ to the canonical form and hence find the rank, index and signature of the form. **(17)**

SECTION – B

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

5. (a) If (l_1, m_1, n_1), (l_2, m_2, n_2), (l_3, m_3, n_3) be the direction cosines of three mutually perpendicular lines, then find the direction cosines of a line whose direction-ratios are $l_1 + l_2 + l_3$, $m_1 + m_2 + m_3$, $n_1 + n_2 + n_3$ and hence find the angles between the fourth line with the first three given lines. **(18)**

(b) Find the direction-cosines of two lines connected by the relations $l - 5m + 3n = 0$ and $7l^2 + 5m^2 - 3n^2 = 0$. **(17)**

6. (a) Find the equation of the plane through the intersection of the planes $x + 3y + 6 = 0$, and $3x - y - 4z = 0$, whose perpendicular distance from the origin is unity. **(17)**

(b) Determine the constant K, so that the planes $x - 2y + Kz = 0$ and $2x + 5y - z = 0$ are at right angles, and then find the plane through the point $(1, -1, -1)$ and perpendicular to both the given planes. **(18)**

7. (a) Find the equation of the plane through the line $3x - 4y + 5z = 10$, $2x + 2y - 3z = 4$ and parallel to $x = 2y = 3z$. **(17)**

(b) Find the shortest distance between the lines $\dfrac{x-3}{3} = \dfrac{y-8}{-1} = \dfrac{z-3}{1}$; $\dfrac{x+3}{-3} = \dfrac{y+7}{2} = \dfrac{z-6}{4}$. Find also the equations and the points in which it meets the given lines. **(18)**

8. (a) Find the equation of a sphere for which the circle $x^2 + y^2 + z^2 + 7y - 2z + 2 = 0$, $2x + 3y + 4z = 8$ is a great circle. **(18)**

(b) Find the equation of tangent planes to the ellipsoid $7x^2 + 5y^2 + 3z^2 = 60$ which pass through the line $7x + 10y - 30 = 0$, $5y - 3z = 0$. **(17)**