L-1/T-1/CE **Date : 12/07/2011**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T-1 B. Sc. Engineering Examinations 2009-2010

Sub : **MATH 137** (Differential and Integral Calculus, Matrices)

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 have their usual meanings.

1. (a) A function f(x) is defined as follows: **(17)**

$$f(x)=\begin{cases} x^2+1 & when \quad x\le 0 \\ 2x-1 & when \quad 0<x\le 1 \\ x^2-x+1 & when \quad x>1 \end{cases}$$

Test the continuity and differentiability of the function f(x) at the point x = 1. Also sketch the graph of f(x).

(b) Evaluate: $\lim_{x\to 0} \dfrac{x-\sin x}{\tan^3 x}$ **(10)**

(c) Expand $x/(e^x - 1)$ in a series of ascending powers of x. **(8)**

2. (a) If $F(v^2 - x^2, v^2 - y^2, v^2 - z^2) = 0$, where $v = f(x, y, z)$ then find the value of $\dfrac{1}{x}\dfrac{\partial v}{\partial x}+\dfrac{1}{y}\dfrac{\partial v}{\partial y}+\dfrac{1}{z}\dfrac{\partial v}{\partial z}$ in terms of v. **(13)**

(b) Find the pedal equation of the ellipse $\dfrac{x^2}{a^2}+\dfrac{y^2}{b^2}=1$. **(10)**

(c) If $y = A \cos \{m \sin^{-1} (ax + b)\}$ then show that

$$\{1-(ax+b)^2\}y_{n+2}-(2n+1)a(ax+b)y_{n+1}+(m^2-n^2)a^2y_n=0.$$ **(12)**

3. (a) State Lagrange's Mean value theorem. Find the value of c in the Mean value theorem for the function $f(x) = x^3 - 5x^2 + 12x - 20$ in the interval (0, 4). **(11)**

(b) Show that in the curve $a^2y^5 = k(bx + c)^4$, the cube of the subtangent varies as the fifth power of the subnormal. **(11)**

(c) Find the volume of the greatest right circular cylinder which can be inscribed in a cone of height h and semivertical angle α. **(13)**

4. (a) Evaluate the following integrals:

(i) $\int \dfrac{x^3+6x^2+9x-1}{\sqrt{x^2+4x+1}}dx$ (ii) $\int e^x \dfrac{2-\sin 2x}{1-\cos 2x}dx$ **(12+11)**

Contd P/2

MATH 137(CE)

Contd ... Q. No. 4

(b) Deduce the reduction formula for **(12)**

$\int \sin^m x \cos^n x\, dx$ and hence evaluate $\int \sin^4 x \cos^5 x\, dx$.

SECTION – B

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

Symbols have their usual meanings.

5. Evaluate the following:

(a) $\underset{n\to\infty}{Lim}\left[\left(1+\frac{1}{n}\right)\left(1+\frac{2}{n}\right)^{1/2}\left(1+\frac{3}{n}\right)^{1/3}\ldots\ldots\ldots\left(1+\frac{n}{n}\right)^{1/n}\right]$ **(11)**

(b) $\int_0^{\pi/2} \frac{dx}{\left(a^2\cos^2 x + b^2 \sin^2 x\right)^2}$ (c) $\int_0^{\infty} \frac{x\, dx}{(1+x)(1+x^2)}$ **(12+12)**

6. (a) Prove that $\beta(m,n) = \frac{\Gamma m \Gamma n}{\Gamma(m+n)}$ **(12)**

(b) Show that $\int_0^1 x^m (\log x)^n dx = \frac{(-1)^n \Gamma(n+1)}{(m+1)^{n+1}}$ (c) Evaluate: $\int_{-1}^{1}\int_{x^2}^{4-x^2}\int_0^{4-z} y\, dy dz dx.$ **(12+11)**

7. (a) Reduce the matrix A to canonical form where **(18)**

$$A = \begin{bmatrix} 2 & 7 & 3 & 5 \\ 1 & 2 & 3 & 4 \\ 3 & 8 & 1 & -2 \\ 4 & 13 & 1 & -1 \end{bmatrix}$$ and hence find the rank.

(b) Using matrix solve the following system of equations **(17)**

$$x_1 + 2x_2 - 2x_3 - 4x_4 = 3$$
$$x_1 + 3x_2 + x_3 - 2x_4 = 2$$
$$2x_1 + 5x_2 - 2x_3 - 5x_4 = 5$$

8. (a) State Cayley-Hamilton theorem. Using this theorem find the inverse of **(17)**

$$A = \begin{bmatrix} 3 & 2 & 2 \\ 1 & 3 & 2 \\ 1 & 2 & 3 \end{bmatrix}$$

(b) Find all eigen values and corresponding eigen vectors of the matrix **(18)**

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

L-1/T-1/CE **Date : 19/07/2011**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

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

Sub : **HUM 375** (Government)

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) How do you define state? What are the elements of a state? **(11 1/3)**

   (b) Discuss various types of constitution with examples. **(12)**

2. (a) What is meant by the terms 'nationality', 'nation' and 'nationalism'? Describe the demerits of nationalism. **(11 1/3)**

   (b) Make a comparative discussion between democracy and dictatorship. **(12)**

3. (a) Analyze the different methods for acquiring citizenship. **(11 1/3)**

   (b) Discuss the safeguards of citizen rights in a state. **(12)**

4. (a) What are the different kinds of executive? Explain the role of executive in a state. **(11 1/3)**

   (b) Describe the functions of legislature as an organ of government. **(12)**

SECTION – B

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

5. (a) What is local government? Discuss the functions of city corporation as a local government body in Bangladesh. **(11 1/3)**

   (b) Analyze the internal and external determinants of the foreign policy of Bangladesh. **(12)**

6. (a) Define bureaucracy, why has bureaucracy overdeveloped in third world countries? **(11 1/3)**

   (b) What is good governance? Analyze the elements of good governance in a state. **(12)**

7. (a) Discuss the significance of language Movement of 1952. **(11 1/3)**

   (b) What was the impact of Great Mass Upsurge of 1969? **(12)**

8. (a) Describe the characteristics of the constitution of Bangladesh. **(11 1/3)**

   (b) What do you know about the principal organs of United Nations Organization? **(12 1/3)**

L-1/T-1/CE **Date : 19/07/2011**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

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

Sub : **HUM 355** (Sociology)

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) 'Sociology is the study of social relationship' ——Justify this statement on the basis of nature of sociology. **(10)**

   (b) Write the main features of conflict theoretical perspective of sociology. **(13 1/3)**

2. (a) What is ethnocentrism? Explain the normative roles of a culture in a society. **(10)**

   (b) What is meant by socialization? Explain with examples primary socialization and anticipatory socialization. **(13 1/3)**

3. (a) Discuss Emile Durkheim's explanation of anomie of a society. **(10)**

   (b) Briefly discuss C.H. Cooley's looking glass self theory. **(13 1/3)**

4. Write short notes on any three of the following: **(23 1/3)**

   (a) Globalization.
   (b) System of social stratification.
   (c) Condition of successful learning.
   (d) Types of social mobility.

SECTION – B

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

5. (a) What do you know about industrial revolution? **(3 1/3)**

   (b) Write down the important characteristics of capitalism. **(10)**

   (c) Describe the social consequences of industrial revolution. **(10)**

6. (a) What do you mean by environment and pollution? Briefly discuss the major pollution issues in Bangladesh. **(10)**

   (b) How do you define greenhouse gases? Briefly discuss the potential consequences of global warming. **(13 1/3)**

Contd P/2

HUM 355

7. (a) What do you understand by urbanization and urbanism? **(5 1/3)**

   (b) Describe the stages of demographic transition theory. **(8)**

   (c) Briefly describe the bright side and dark side of urban life. **(10)**

8. Write short notes on any three of the following: **(23 1/3)**

   (a) Sources of social change

   (b) The growth of cities

   (c) Malthusian population theory

   (d) Nature of work.

L-1/T-1/CE **Date : 27/06/2011**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

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

Sub : **CE 101** (Engineering Mechanics)

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) A sphere of weight 250 lb remains in equilibrium as shown in Fig. 1. The diameter of the sphere is 8 ft. The length and weight of the member AB are 30 ft and 90 lb, respectively. All the contact surfaces are smooth. Calculate the tension in the cable BD and components of pin reactions at A. **(14)**

   (b) The blocks A and B in Fig. 2 weigh 400 N and 200 N, respectively. The coefficient of static friction between block A and the horizontal plane is 0.3 while it is 0.2 between the blocks A and B. Determine the magnitude of force Q that will cause the block A to have impending motion towards right. **(12)**

   (c) A flexible chord of weight w per unit length is suspended between two points and acted on by the force of gravity only. Prove that the shape of the chord is a catenary. **(9)**

2. (a) A table top supports a load of 100 N at point D as shown in Fig. 3. The weight of the triangular top is 200 N. The length of each side of the table is 900 mm. Determine the values of reactions at the supporting legs at A, B and C. **(12)**

   (b) A ladder of length 5 m and weighing 250 N is placed against a vertical wall as shown in Fig. 4. The coefficient of static friction between the wall and the ladder is 0.3 and that between the floor and the ladder is 0.2. The ladder also supports a man weighing 800 N. Determine the minimum horizontal force P to be applied at the bottom of the ladder to prevent sliping of the ladder. **(12)**

   (c) A cable in the form of a catenary is 400 ft long. How far apart may be the supports on the same levels, if the maximum tension is not to exceed 400w, where w is the weight of the cable in pounds per foot? **(11)**

3. (a) The frame shown in Fig. 5 consists of two vertical members AE and BD, a horizontal member CD and an inclined member DE. All the member have been assumed to be weightless. **(13)**

   (i) Identify the two force member(s).

   (ii) Calculate the components of pin reactions at A.

   (iii) Determine the axial force in the two force member(s).

Contd P/2

CE 101

Contd ... Q. No. 3

(b) Two cables AC and BC terminate on a pole and exert forces in a horizontal plane x′y′ at C as shown in Fig. 6. Forces in the cables AC and BC are 5000 lb and 4000 lb, respectively. Find the angle α, force in the pole CE and tension in the cable CD. **(11)**

(c) For the shaded area shown in Fig. 7 find y coordinate of the centroid $(\bar{y})$ by direct integration. Also find the volume generated by revolving this area through 120° about x-axes. **(11)**

4. (a) For the truss shown in Fig. 8, find the force in the members bl, cm, pq, pd and fg. **(14)**

(b) The body A in Fig. 9 weights 200 lb. The coefficients of static friction are 0.3 between the body A and the inclined plane and 0.2 between the rope and the drums. What value of W will cause motion of the body A to impend up the plane? **(12)**

(c) For the simply supported beam shown in Fig. 10, calculate the reactions at the supports A and B. **(9)**

SECTION – B

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

Assume reasonable value (values) for missing data only.

5. (a) The speed of a particle traveling along a straight line within a liquid is measured as a function of its position as v = (100 – S) mm/sec, where S is given in millimeters. Determine : **(12)**

(i) the particle's deceleration when it is located at point 'A'. Where S_A = 75 mm,

(ii) the distance the particle travel before it stop S, and

(iii) the time needed to stop the particle.

(b) A race car travels around a horizontal circular truck that has a radius of 300m. If the car increases its speed at a constant rate of 7 m/sec^2 starting from rest; determine the time needed for it to reach an acceleration of 8 m/sec^2. **(11)**

(c) The crate 'C' is being dragged across the ground by the truck 'T' (Fig. 11). If the truck is travelling at a constant speed of 6 m/sec., determine speed of crate for any angle θ of the rope. The rope has a length of L = 100 m and passes over a pulley of small size. **(12)**

6. (a) A 50 N block is released from rest on an inclined plane (Fig. 12) which is making an angle 35° to the horizontal. The block starts from 'A', slides down a distance of 1.2 m and strikes a spring with a stiffness of 8 kN/m. The coefficient of friction between the inclined plane and the block is 0.25. Determine: **(20)**

(i) the amount the spring gets compressed, and

(ii) the distance, the block will rebound up the plane from the compressed position.

Contd P/3

CE 101

Contd ... Q. No. 6

(b) Block 'A' and 'B' are connected with a bar of negligible weight as shown in Fig. 13. If A and B each weigh 300 N, with $\mu_A = 0.25$ and $\mu_B = 0.5$, calculate the acceleration of the system and the force in the bar. **(15)**

7. (a) A mass 12 kg travelling to the right with a speed of 7.5 m/sec collide with another mass 24 kg, travelling to the left with a speed of 25 m/sec. If the coefficient of restitution is 0.6, find the velocity of the particles after collision and the loss of kinetic energy. What is the impulse acting on either particle during the impact? **(14)**

(b) Calculate the radius of gyration about x axis of an area bounded by the curve $y^2 = 4x$ and the line $y = x$. **(10)**

(c) A glass rod AB weighing 2 N is placed on a glass breaker of 100 mm diameters in a position of equilibrium as shown in Fig. 14. Determine the length of the rod and the reactions at contact points A and E. Assume all the surfaces to be smooth. **(11)**

8. (a) A uniform rod AB (Fig. 15) has a weight of 10 lb. If the spring DC is unstretched when $\theta = 90°$, determine the angle θ for equilibrium using the principle of virtual work. The spring always acts in the horizontal position because of the roller guide at D. **(10)**

(b) Determine $\bar{x}$, $\bar{y}$ for the area shown in Fig. 16. **(10)**

(c) Determine the moment of inertia of the steel spool shown in Fig. 17 about the geometric axes AB. Steel weigh 490 lb per cu feet. **(15)**

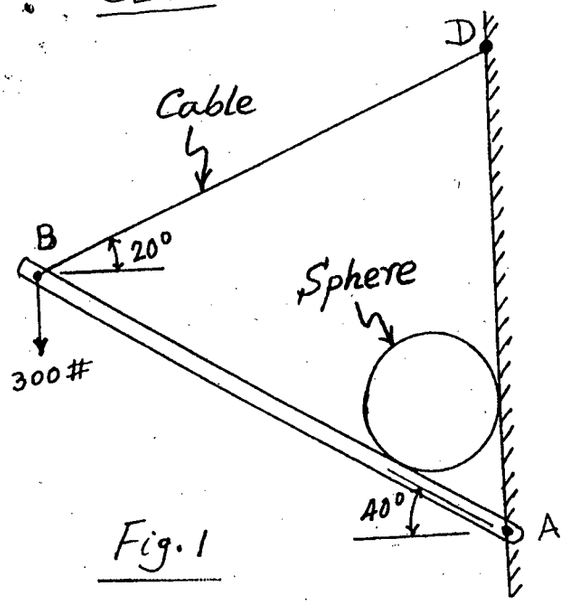


Fig. 1

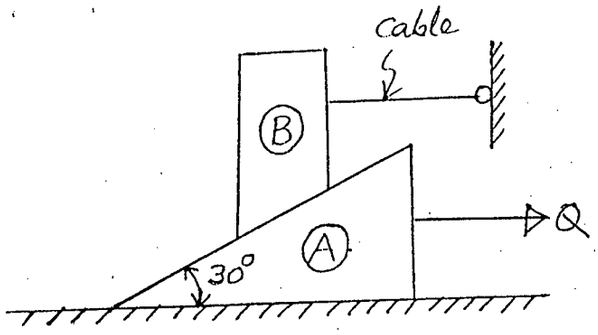


Fig. 2

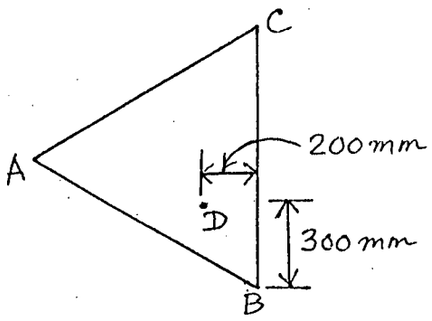


Fig. 3

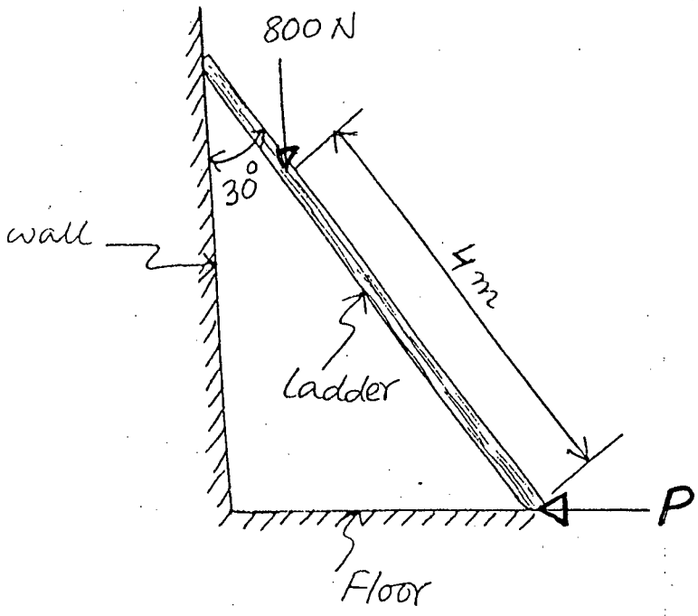


Fig. 4

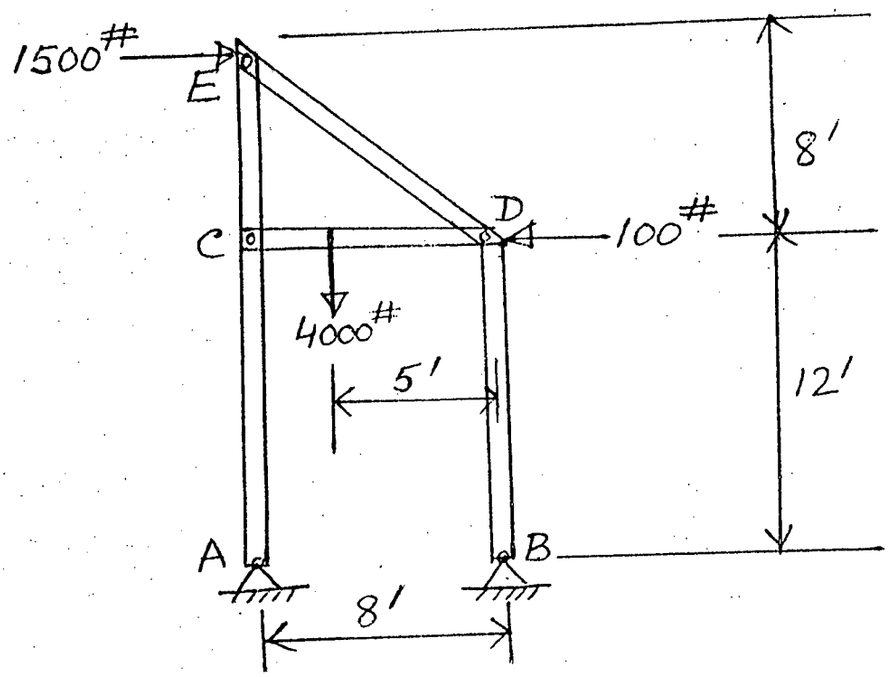


Fig. 5

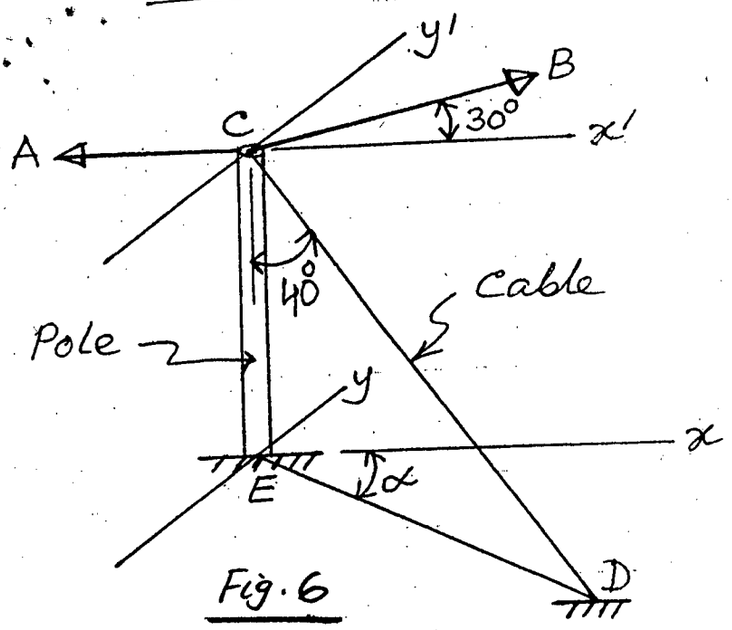


Fig. 6

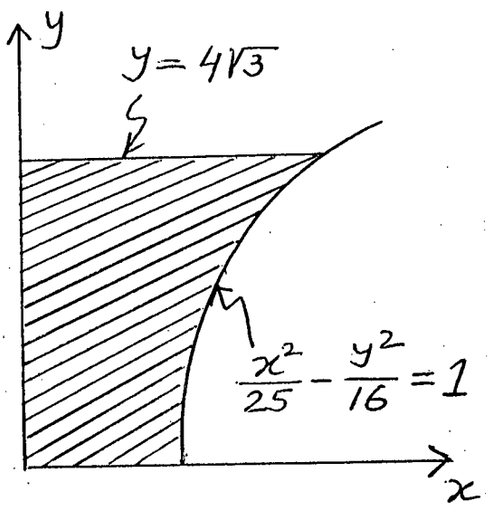


Fig. 7

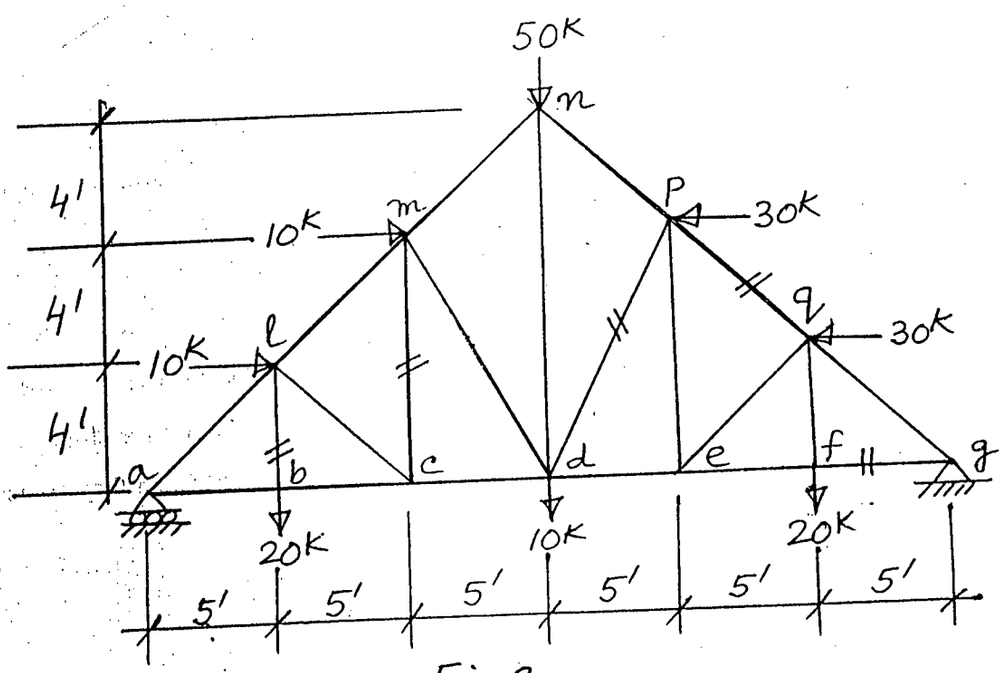


Fig. 8

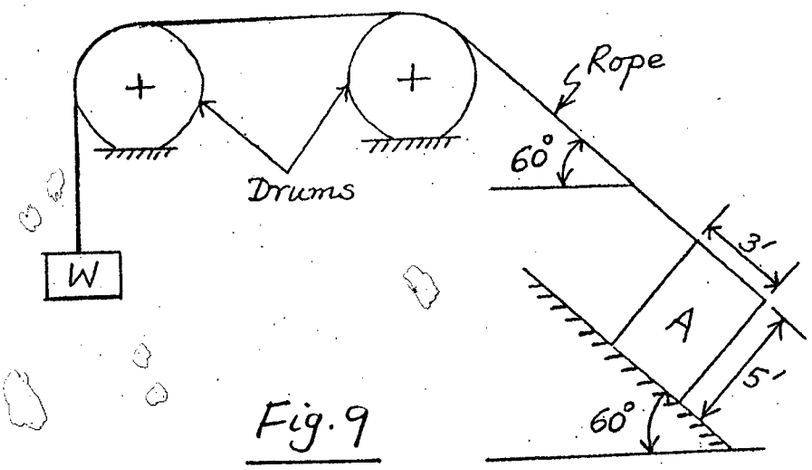


Fig. 9

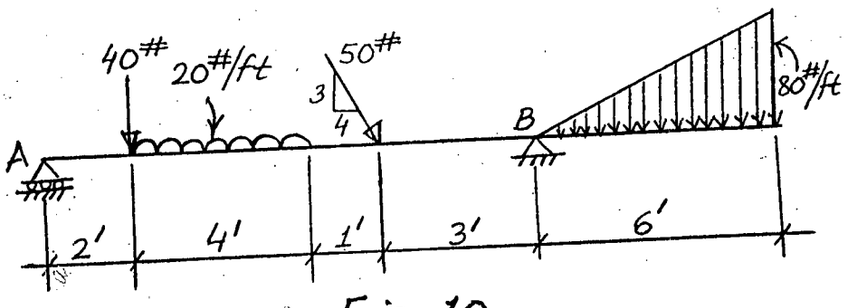
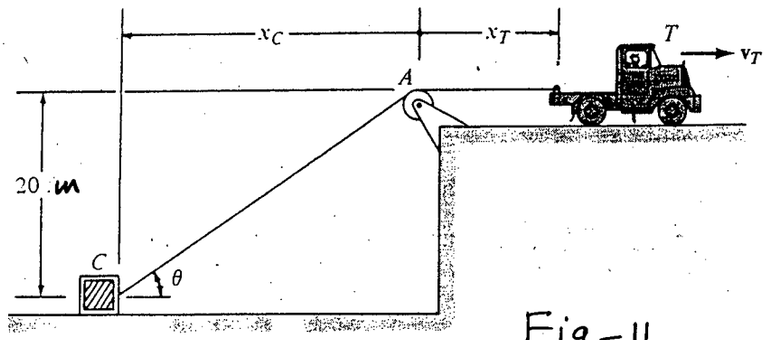
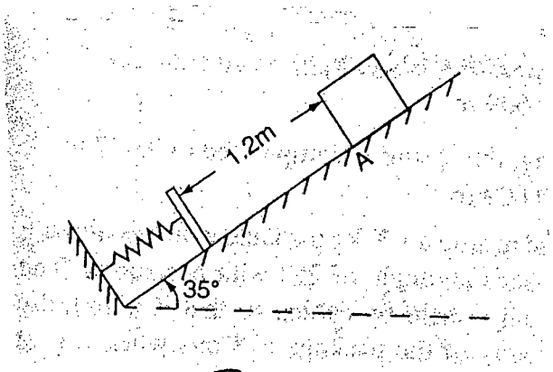


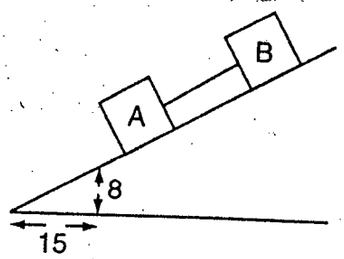
Fig. 10



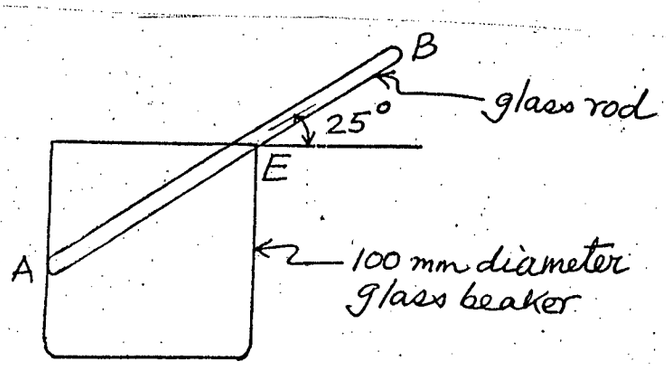
Fig–11



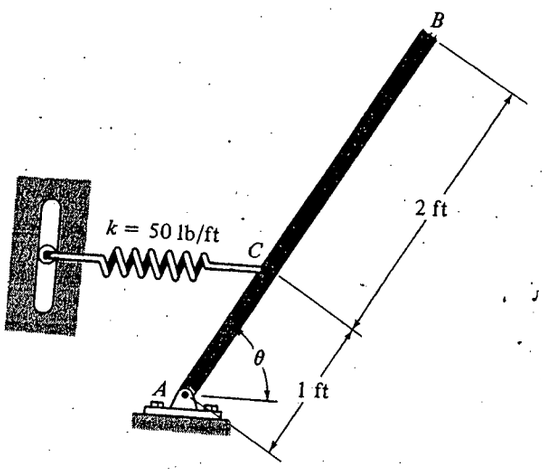
Fig–12



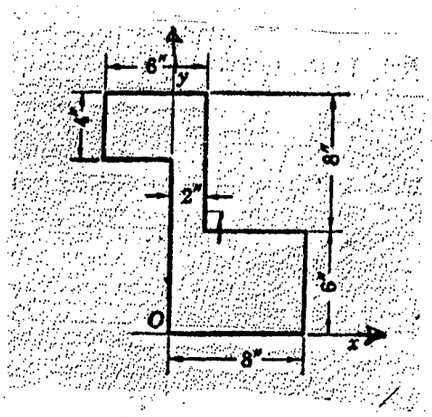
Fig–13



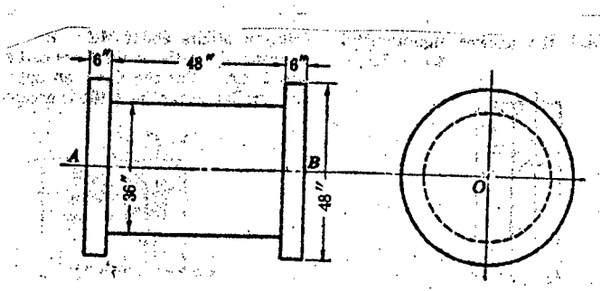
Fig–14



Fig–15



Fig–16



Fig–17

L-1/T-1/CE/WRE **Date : 01/08/2011**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

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

Sub : **CHEM 103** (Chemistry I)

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) Discuss the homogeneous and heterogeneous concepts of a solution. Explain, with an example and mechanistic feature, how electrical phenomenon is operating in a dissolution process. **(4+6=10)**

   (b) Show that solubility of a solid in liquid at a given temperature is constant. Sketch and describe different types of solubility curves with suitable example. **(4+6=10)**

   (c) Discuss the effect of pressure on the solubility of a gas in liquid. The solubility of carbon dioxide in water is 0.161 g per 100 mL of water at 20°C and 1.00 atm. A soft drink is carbonated with carbon dioxide gas at 5.50 atm pressure. What is the solubility (in g/L) of carbon dioxide in water at this temperature? **(10+5=15)**

2. (a) State Raoult's law and explain the causes of deviations from the law. Draw and discuss the t-c diagram of the ethanol-water liquid pair. **(4+6=10)**

   (b) What is reverse osmosis? Discuss, how the arsenic contaminated drinking water can be made arsenic free by reverse osmosis process. State the laws of osmotic pressure and thus prove that, $\pi = CRT$ (symbols have their usual meaning). **(6+4=10)**

   (c) Explain the term "equivalent conductance at infinite dilution". Construct an electrolysis cell and discuss the mechanism for the electrolysis of molten NaCl in the cell. Electrolysis of molten magnesium chloride is carried out with a current of 2.50×10^3 A. What masses of magnesium and chlorine are produced in 2.5 hours? **(3+5+7=15)**

3. (a) Explain the term colloidal solution. Describe briefly different methods of preparation of colloidal solution. **(3+12=15)**

   (b) Discuss the electrical and optical properties of colloids. **(10)**

   (c) Write notes on: **(5+5)**

   (i) formation of deltas at the interjunction between river water and sea water.

   (ii) purification of industrial fumes by Cottrell method.

4. (a) What are the main sources of natural water? Water from which source do you consider most suitable for municipal use? Explain your answer. **(12)**

   (b) Discuss ion exchange method for the removal of hardness, arsenic and silica with suitable reactions from under-ground water. **(13)**

   (c) The hardness of 50,000 litres of a sample water was completely removed by passing it through a zeolite bed. This zeolite bed is then required 500 litres of brine containing 100 g/L NaCl for its complete regeneration. Calculate the hardness of the sample water and express it as ppm $CaCO_3$. **(10)**

Contd P/2

CHEM 103

SECTION – B

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

5. (a) Define Portland cement. Write the symbols used for representing basic components of cement. **(5)**

   (b) What do you understand by setting and hardening of cement? Discuss the theories of setting and hardening of cement with suitable chemical reactions. **(11)**

   (c) Discuss with chemical reaction the changes of raw materials that occur in different section of rotary Kiln. Discuss the effects of cooling rate of clinker on the quality of cement. **(10)**

   (d) Write the names of common additives used in Portland cement. Give examples of each of them and mention their specific function. **(9)**

6. (a) Discuss the factors that are responsible for the strength of acids and bases. Illustrate your answer with examples. **(10)**

   (b) Write down the basic principles of the modern theories of acids and bases. What are the advantages and limitations of these theories? **(10)**

   (c) Discuss the classification of Lewis acids and bases. Give three examples from each class. **(8)**

   (d) Explain the principle of Hard and Soft Acids and Bases (HSAB). Illustrate your answer with examples. **(7)**

7. (a) Prove that $\Delta x \cdot \Delta p \approx h$, where Δx = Uncertainty in position of an electron, Δp = Uncertainty in momentum of the same electron and h = Planck's constant. **(10)**

   (b) Explain why Heisenberg's Uncertainty principle is applicable only for sub-atomic particle like electron. **(5)**

   (c) With the help of potential energy diagram explain bond length and bond energy taking hydrogen molecule of an example and justify the presence of two neutral hydrogen atoms in its molecule. **(6+4)**

   (d) Draw molecular orbital diagram and write down the molecular electronic configuration for the following species. **(10)**

   (i) NO^- (ii) O_2^{2-} (iii) CO^{2+}

8. Explain why?: **(7×5=35)**

   (i) Potassium is more reactive than copper though they have $4s^1$ electron in their outer shell orbital.

   (ii) Transition metals generally can form coloured compounds.

   (iii) Coordination number of Fe^{++} is six, but coordination number of Zn^{++} is four.

   (iv) Copper and gold are coloured but silver is not, though they are the elements of same group.

   (v) H_2O is liquid but H_2S is gas at room temperature.

   (vi) CO is more stable than NO.

   (vii) $[Fe(CN)_6]^{3-}$ is a low spin complex ion but $[Fe(H_2O)_6]^{3+}$ is a high spin complex ion.

L-1/T-1/CE/ChE/WRE **Date : 25/07/2011**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

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

Sub : **PHY 101** (Physical Optics, Waves and Oscillation and Heat and Thermodynamics)

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) What do you mean by interference of light? What are the basic requirements for obtaining permanent interference pattern? **(6)**

   (b) Give the theory of Newton's rings and how from this study the radius of curvature of the plano-convex lens can be determined. In the Newton's ring experiment the fringes are circular and the central fringe is dark. Why? **(23)**

   (c) In Young's double slit experiment, the fringe obtained is 0.6 cm, when light of wavelength 4800 Å is used. If the distance between the screen and the slit is reduced to half, what should be the wavelength of light used to obtain fringes 0.0045 m wide? **(6)**

2. (a) Distinguish between a single-slit and a double-slit diffraction patterns. **(6)**

   (b) Deduce an expression for the intensity distribution due to Fraunhofer diffraction at a single slit is $I = I_0 \frac{\sin^2 \beta}{\beta^2}$. **(18)**

   (c) State and explain Rayleigh's criterion of resolution. **(6)**

   (d) A double-slit having each slit width a = 8.8×10^{-3} cm and a separation between the slits b = 7.0×10^{-2} cm is illuminated with light of wavelength $\lambda = 6.328 \times 10^{-5}$ cm. How many interference maxima will occur between the two diffraction minima on either side of the central maximum? **(5)**

3. (a) Explain the terms: **(6)**

   (i) polarization of light, (ii) polarizing angle, (iii) optic axis of a crystal.

   (b) Discuss the phenomenon of double refraction. What do you mean by positive crystal and negative crystal? **(6)**

   (c) State and explain Brewster's law. Show that at the Brewster's angle, the reflected and refracted rays are mutually perpendicular to each other. **(17)**

   (d) Two polarizing sheets have their polarizing directions parallel so the intensity of the transmitted light is a maximum. Through what angle must either sheet be turned so that intensity become one half of the initial value? **(6)**

Contd P/2

PHY 101(CE/WRE/ChE)

4. (a) State third low of thermodynamics. **(5)**

   (b) Derive Vander Wall's equation for gases. **(20)**

   (c) Calculate the Vander Wall's constant for a gram-molecule of helium (Given: $T_c = 5.3$ K, $\rho_c = 2.25$ atmosphere. R per mole $= 8.3 \times 10^7$ erg/K) **(10)**

SECTION – B

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

5. (a) State and prove Carnot's theorem. **(15)**

   (b) Define thermodynamic functions. **(5)**

   (c) Deduce the Maxwell's thermodynamics relation by using the thermodynamic functions. **(15)**

6. (a) State the principle of equipartition of energy. Find the relation between the ratio of two specific heats and the degree of freedom. **(10)**

   (b) Evaluate the average energy of a gas molecule according to Maxwell's law of distribution of velocities. **(15)**

   (c) A engine whose temperature of the source is 400 K takes 200 calories of heat at this temperature and rejects 150 calories of heat in the sink of temperature 200 K. Calculate the efficiency of the engine. **(10)**

7. (a) Define simple harmonic motion and discuss its characteristics. **(5)**

   (b) Establish the differential equation for simple harmonic motion and solve it to obtain an expression for the displacement of a particle executing simple harmonic motion. **(20)**

   (c) A particle executes simple harmonic motion given by the equation **(10)**

$$y = 12 \sin\left(\frac{2\pi}{10}t + \frac{\pi}{4}\right)$$

   Where displacement is in centimeters, phase angle is in radian and t is in second. Calculate (i) epoch, (ii) displacement at t = 1.25 seconds, (iii) velocity at t = 2.5 seconds.

8. (a) What are the forced vibrations and Resonance? **(5)**

   (b) Two oscillating bodies of masses m_1 and m_2, are connected by a spring on a horizontal frictionless surface. Show that their relative motion can be represented by the oscillation of a single body having reduced mass μ. **(20)**

   (c) Two masses $m_1 = 3$ kg and $m_2 = 4$ kg are connected by a spring. Find the oscillation frequency of the two body system. Given that the extension of the spring is 1. 0 cm for the applied force of 2.5 Newton. **(10)**