L-1/T-1/CE **Date : 06/12/2014**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T-1 B. Sc. Engineering Examinations 2013-2014

Sub : **CE 101** (Analytic 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 table supports a load of 250 N at point D as shown in Fig. 1. The weight of the triangular top is 100 N. Determine the reactions at the supporting legs A, B and C. The length of each side of the table is 800 mm. **(12)**

   (b) A bar of weight 500 N is hinged to a wall at A and supported by a cable as shown in Fig. 2. Determine the components of pin reactions at A and C. **(13)**

   (c) Derive an expression for the span length of a symmetrical catenary in terms of sag (d), tension at low point (Q) and weight per foot (w) of the catenary. **(10)**

2. (a) The cantilever frame shown in Fig. 3 consists of two horizontal members AC and DF, a vertical member BE and an inclined member CF. All the members have been assumed to be weightless. Calculate the components of pin reaction at A and force in the member CF. **(13)**

   (b) Using direct integration, determine the co-ordinates of the centroid of the area bounded by the parabola $x^2 = 4y$, the straight line $y = 9$ inch and the y-axis. **(10)**

   (c) A slender brass rod of uniform cross-section has been welded at the centre of the base of a cast-iron cone as shown in Fig. 4. Weight of the rod and unit weight of cast-iron are 29 lb and 490 lb/ft^3, respectively. Calculate the radius of gyration of this composite mass with respect to y' axis. **(12)**

3. (a) For the truss shown in Fig. 5, determine the force in the members bi, gi, dh and fh. **(13)**

   (b) The blocks A and B in Fig. 6 weigh 500 N and 300 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 the force P that will cause the block A to have impending motion towards right. **(12)**

   (c) Calculate the moment of inertia of the shaded area as shown in Fig. 7 about the line $y = 8$ inch. **(10)**

Contd P/2

CE 101

4. (a) A mast AB, supported by a spherical socket at A and horizontal guy cables BC and BD, carries a vertical load of 200 lb at B as shown in Fig. 8. The cables BC and BD intersect at B at right angle in a horizontal plane. Determine the force in the mast AB and tension in the cables BC and BD. Neglect weight of the mast AB. **(12)**

(b) The body A in Fig. 9 weighs 200 lb. The coefficients of static friction are 0.35 between the body A and the inclined plane, and 0.25 between the rope and the drums. What value of W will cause motion of the body A to impend up the plane? **(12)**

(c) A flexible cable weighing 3 lb/ft is strung between two supports. One support is 150 ft higher than the other and the sag measured from the upper support is 250 ft. The tension in the cable at the lower support is 6000 lb. Calculate the following: **(11)**

(i) Distance between the two supports.

(ii) Total length of the cable.

(iii) Slope in degree at the upper support.

(iv) Tension at the upper support.

SECTION – B

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

5. (a) The angular displacement of a rotating body follows the law $\theta = t - 0.1t^2$ radian, where t is in seconds. What are the tangential and normal accelerations of a point whose radius is 2 ft after 3 seconds? **(10)**

(b) A homogeneous cylinder, D = 12 inch, rolls down a rough 30° inclined plane as shown in Fig. 10. If the initial speed of its center of gravity is 10 fps down the plane, find the minimum value of the coefficient of friction that will cause pure rolling. Use the principle of impulse and momentum. **(13)**

(c) Determine the x and y coordinates of the centroid of the shaded area shown in Fig. 11. **(12)**

6. (a) The bodies A and B in Fig. 12 are moving towards the right at 20 fps. Let $W_B = 225$ lb., P = 190 lb., and $f_A = 1/3$. The weight of the cable and pulley and the friction at the pulley are negligible. Determine the weight of A using Newton's law of motion. **(10)**

(b) The weight of the rotating drum assembly B in Fig. 13 is 2576 lb. and its radius of gyration with respect to the axes of rotation is 14 inch. The weight W is suspended from a cable which wraps about the D = 32 inch diameter. While W moves downward through a distance of 40 ft, the speed of the drum is increased from 20 rpm to 40 rpm. If the frictional effects are negligible, what is the weight W? Use the principle of impulse and momentum. **(13)**

(c) A cylindrical oil drum is pulled by a force P as shown in Fig. 14. The oil drum weighs 1500 N. The value of coefficient of static friction for all surfaces is 0.5. Calculate the magnitude of force P when the drum just starts spinning. **(12)**

Contd P/3

CE 101

7. (a) In Fig. 15 the reaction at B is 10 lb. upward, Q = 125 lb., and f_k = 0.2. Find W, the weight of the bar AB. Solve with REF. Neglect the size and weight of the wheel and of the block. **(12)**

   (b) Using virtual work method, find the force in the member GH of the truss structure shown in Fig. 16. **(12)**

   (c) A glass rod AB of weight 8 oz. is placed in a glass beaker of 5 inch diameter in a position of equilibrium as shown in Fig. 17. Considering all the surfaces to be smooth, determine the length of the glass rod and reactions at contact points A and C. **(11)**

8. (a) In Fig. 18 the uniform bar A weighs 48.3 lb., the drum B weighs 128.8 lb. and has a radius of gyration $\bar{k}$ = 10 inch, the sheave C and the cable are considered weightless, the body D weighs 644 lb. All friction is negligible. The bar A is released from rest in the horizontal position shown. Using the principle of work and kinetic energy, determine the velocity of D when impact occurs. **(13)**

   (b) In the system of the sheaves shown in Fig. 19, what force F will hold a weight of W = 800 lb. in equilibrium? There are no frictional losses. Use the principle of virtual work. **(12)**

   (c) Using direct integration, derive an expression for the moment of inertia of a right circular cylinder about a diameter of its base. **(10)**

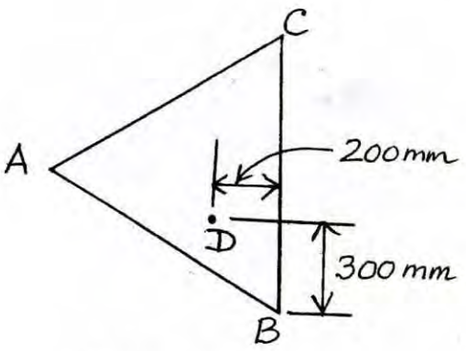

Fig. 1

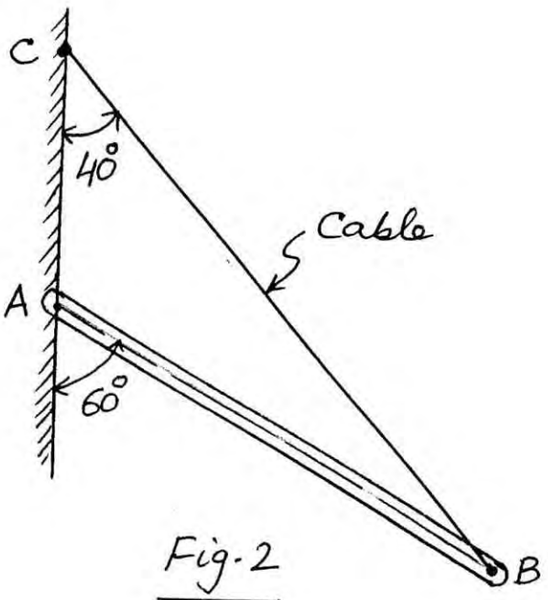

Fig. 2

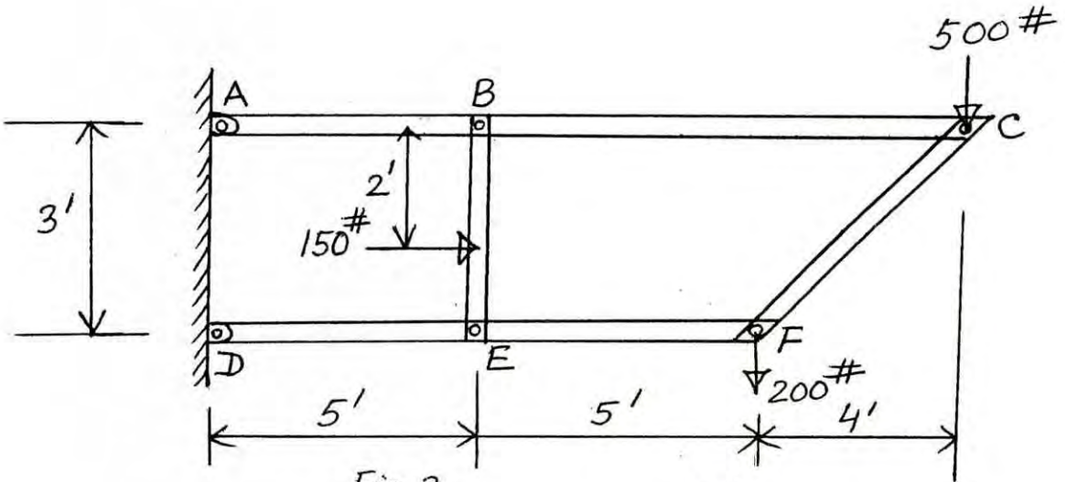

Fig. 3

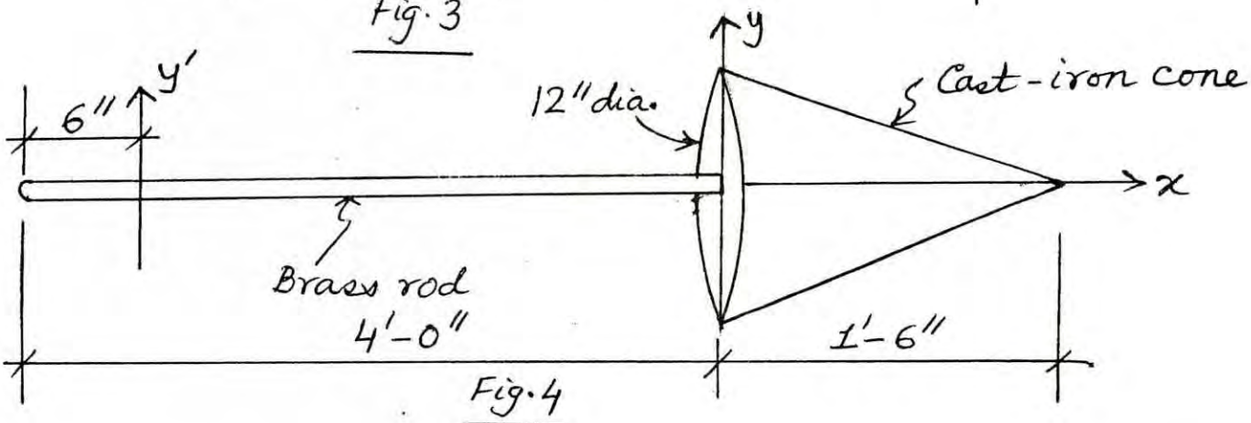

Fig. 4

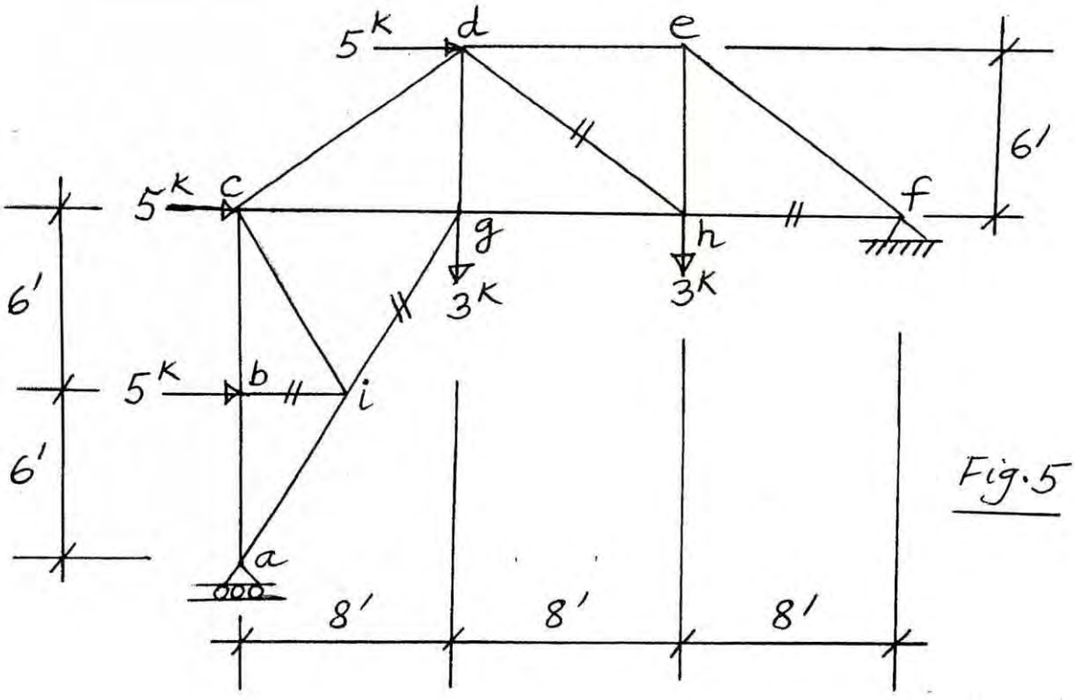

Fig. 5

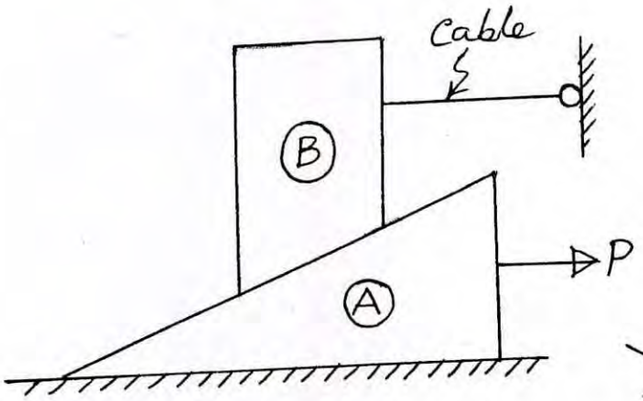

Fig. 6

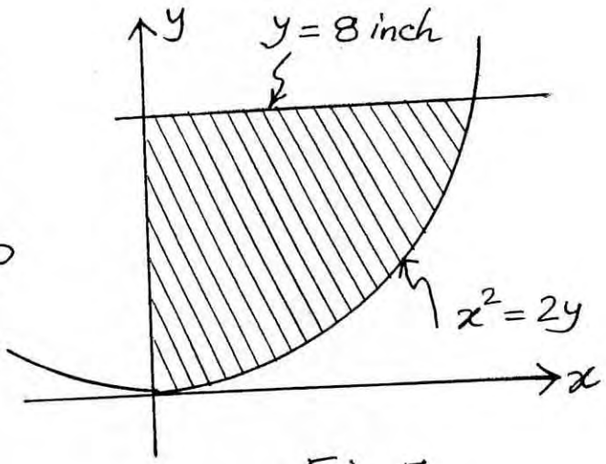

Fig. 7

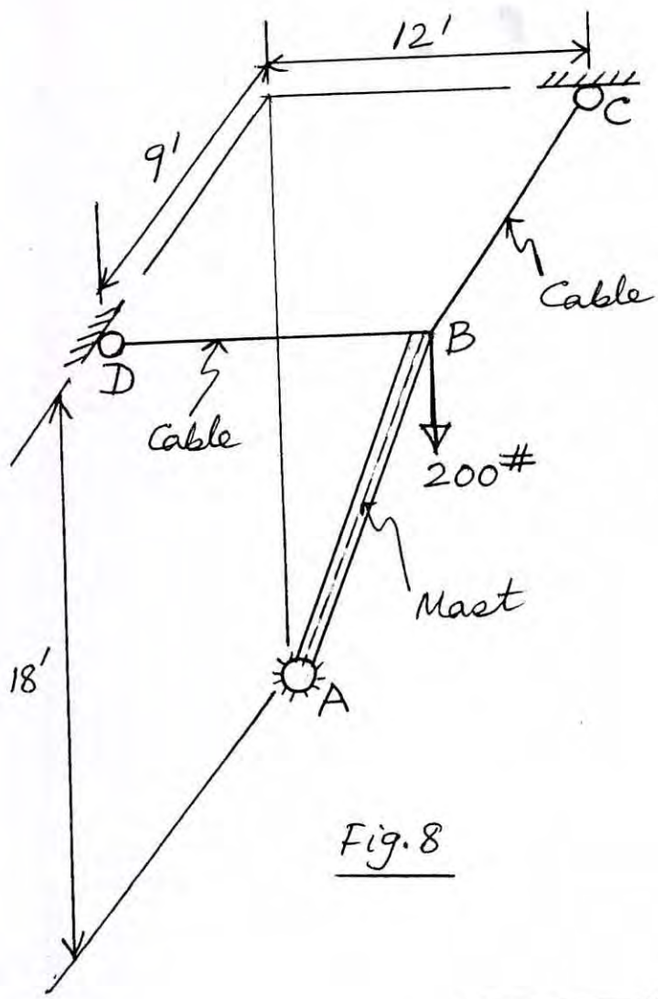

Fig. 8

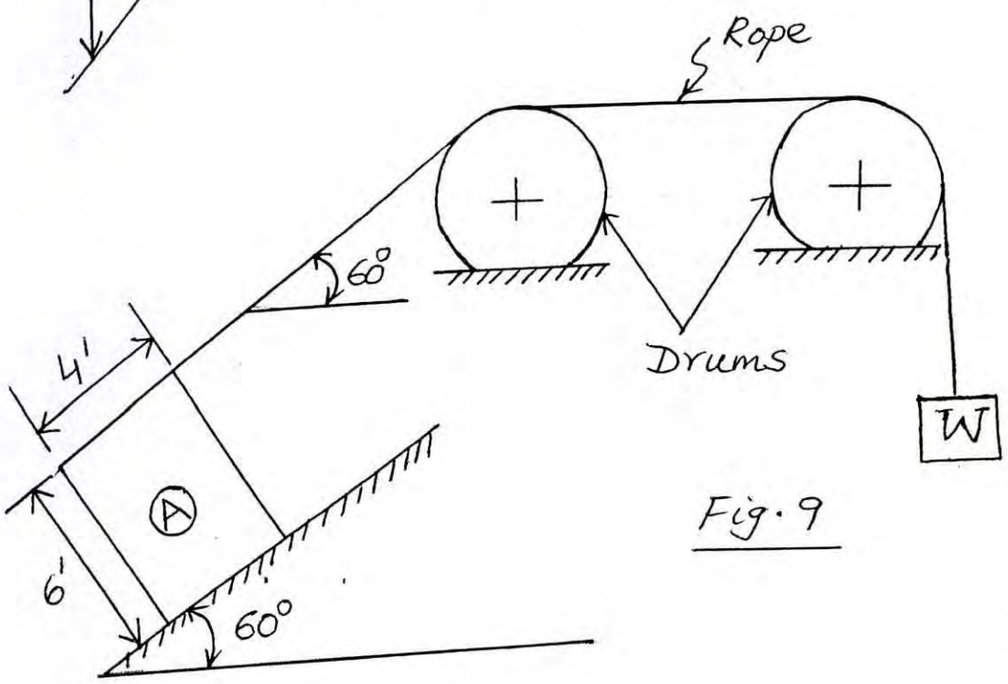

Fig. 9

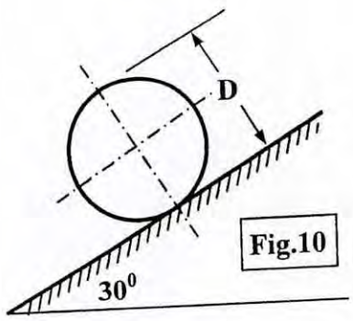

Fig.10

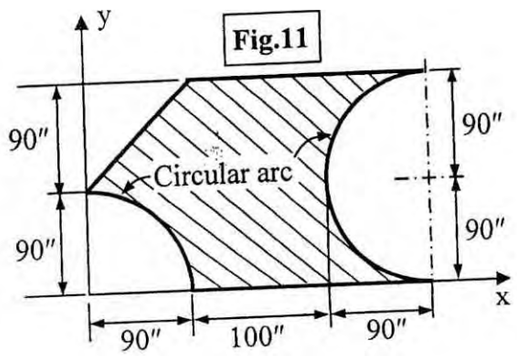

Fig.11

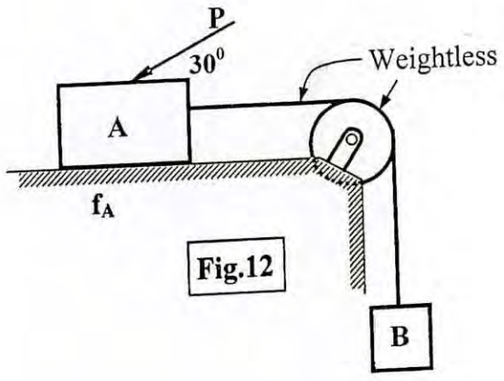

Fig.12

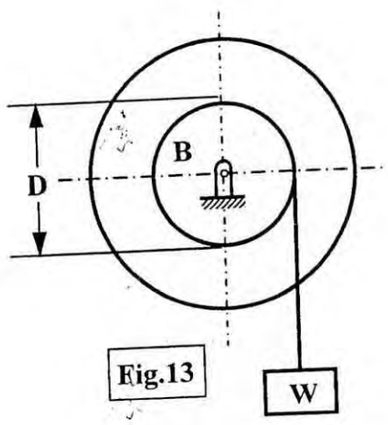

Fig.13

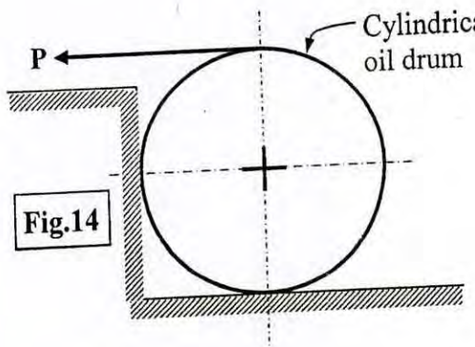

Fig.14

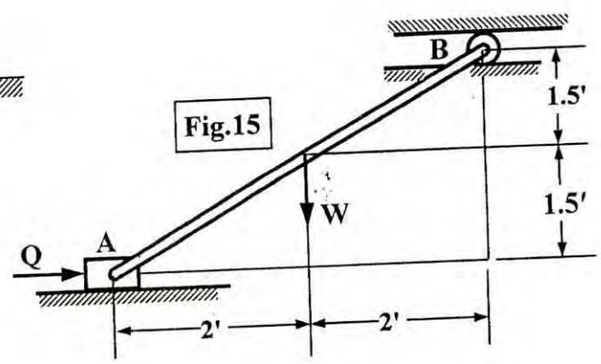

Fig.15

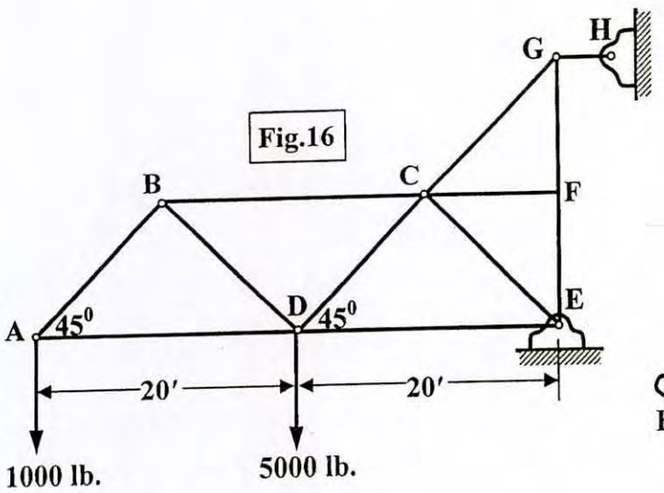

Fig.16

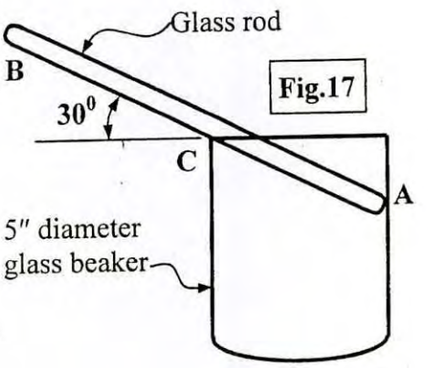

Fig.17

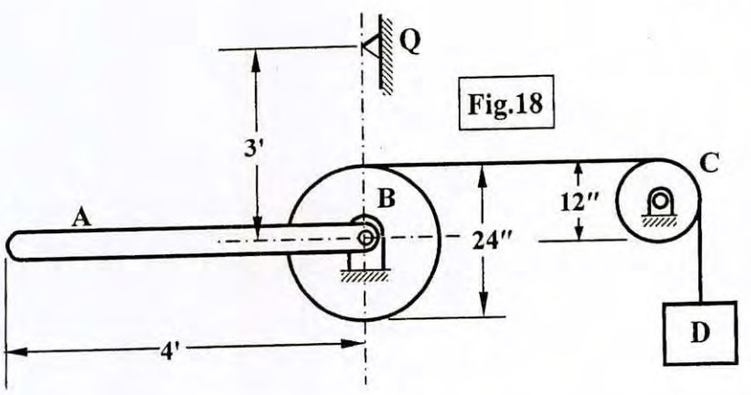

Fig.18

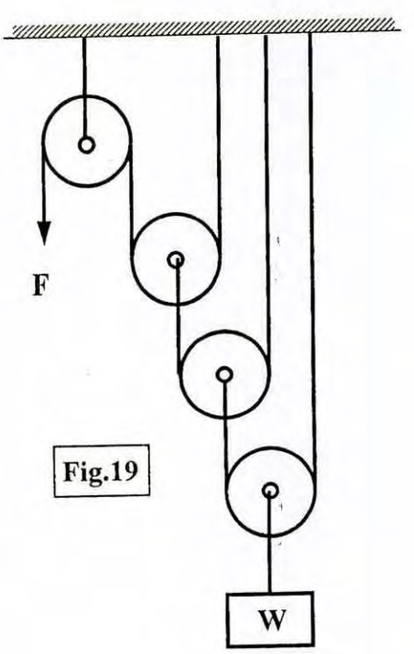

Fig.19

L-1/T-1/CE Date : 11/12/2014

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T-1 B. Sc. Engineering Examinations 2013-2014

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) What are the constituents of the Portland cement? Show the flow sheet diagram for the manufacturing of Portland cement. **(6)**

   (b) Describe the operating temperature and the change of raw materials of the cement into different zones of the rotary kiln. **(7)**

   (c) Discuss the function of different additives which are used in the manufacturing of the Portland cement. **(10)**

   (d) What do you understand by setting and hardening of cement? Discuss the theories of setting and hardening with chemical reactions. **(6+6=12)**

2. (a) What is zeolite? Discuss the principle of softening hard water using zeolite. **(2+8=10)**

   (b) Discuss the effects of rocks and minerals as the sources of impurities of underground water. How would you classify the impurities that are usually found in natural water? **(6+5=11)**

   (c) How permanent hardness can be removed by lime soda process? **(6)**

   (d) The hardness of 12,000 litres water sample was completely removed by passing it through a zeolite softener. The zeolite softener required 100 litre of NaCl solution for complete regeneration. If sample water has the hardness equivalent to 250 ppm as $CaCO_3$, then calculate the concentration of NaCl solution used for regeneration. **(8)**

3. (a) What do you mean by the following terms? **(12)**

   (i) Scale (ii) Sludge (iii) Priming (iv) Caustic embrittlement

   (b) How silica scale, dissolved oxygen and dissolved carbondioxide can be removed from the boiler feed water by chemical treatment? **(8)**

   (c) Discuss the different factors which influence the degree of dissociation. **(8)**

   (d) Find the value of degree of dissociation of HF in 1 M aqueous solution if K is 7.2×10^{-4}. **(7)**

4. (a) What is quantum number? How quantum numbers can be applied to get the complete description of electrons in an atom? **(3+12=15)**

   (b) What is the standing wave concept of de-Broglie? **(6)**

   (c) Deduce the equation by which the propagation of electron wave in space can be described. How the solution of the equation can be applied for the probability of finding the electron in space? **(7+7=14)**

Contd P/2

CHEM 103 (CE)

SECTION – B

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

5. (a) How does heat evolve or absorb during dissolution of ionic compound in polar solvent? **(10)**

   (b) State and explain different forms of Henry's law. **(10)**

   (c) What type of liquid pairs can be steam distilled? What are the importance of steam distillation? A mixture of quinoline and water boils at 98.9°C under a pressure of 740 mm Hg. The distillate contains 7.79 g of quinoline and 100.0 g of water. The vapour pressure of quinoline at 98.9°C is 7.96 mm Hg. Calculate the molor mass of quinoline. **(2+3+10)**

6. (a) What do you mean by colligative property of dilute solution? Discuss its importance. **(5)**

   (b) Derive thermodynamically the relationship between the depression of freezing point of the dilute solution and the molality of the dissolved solute with the help of vapour pressure vs temperature diagram. **(12)**

   (c) Derive Van't Hoff equation for osmotic pressure. **(9)**

   (d) What mass of the anti-freeze ethylene glycol ($HOCH_2CH_2OH$) must be added to 5.0 kg of water to form a solution that freezes at –5.0°C? Cryoscopic constant is 1.86 °C/mole. **(9)**

7. (a) Give the classification of colloids. **(8)**

   (b) Define internal energy of a system. Derive a relation between internal energy and heat of reaction of a system at constant volume and at constant pressure. **(10)**

   (c) Derive thermodynamically Kirchoff's equation of heat of reaction at variable temperature and at constant pressure. **(9)**

   (d) Draw the molecular orbital diagram of oxygen and show that oxygen is paramagnetic. **(8)**

8. (a) Draw the potential energy diagram of hydrogen molecule and using the diagram define bond length and bond dissociation energy. **(4+5)**

   (b) Predict and draw the geometry of the followings: **(10)**

   (i) IF_2 (ii) SOF_4 (iii) CH_3Cl (iv) SO_2

   (c) What is the hybridized state of carbon in acetylene? Show the process of hybridization. **(10)**

   (d) Explain that ionic bond is an extreme case of polar covalent bond. **(6)**

CE 203 (2+3)

L-1/T-1/CE Date : 03/01/2015

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T-1 B. Sc. Engineering Examinations 2013-2014

Sub : **PHY 101** (Physical Optics, Wave and Oscillation, 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) State the law of equipartition of energy and find an expression for energy associated with each degree of freedom for a molecule. **(10)**

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

   (c) Calculate the average energy of a molecule of hydrogen at 27°C, Boltzman's constant $k = 1.38 \times 10^{-16}$ erg/k-atom. **(10)**

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

   (b) Show that the entropy remains constant in a reversible adiabatic process and increases in an irreversible process. **(12)**

   (c) An engine whose temperature of the source is 400 K takes 200 calories of heat at this temperature and rejects 100 calories of heat in the sink of temperature of 300 K. Calculate the efficiency of the engine. **(8)**

3. (a) State third law of thermodynamics. **(5)**

   (b) Deduce the Maxwell's thermodynamics relation by using the thermodynamic functions. **(20)**

   (c) One gram molecules of a gas expands isothermally to four times its volume. Calculate the change of entropy. Given R = 8.32 J/mole-K and J = 4.2 J/cal. **(10)**

4. (a) What do you mean by the term interference of light? When two light waves interfere destructively, what happens to their energy? **(7)**

   (b) Draw schematically the experimental arrangement of Fresnel's biprism experiment. Discuss in brief how the wavelength of monochromatic light can be determined with biprism experiment. **(20)**

   (c) A thin film of 4×10^{-5} cm thick is illuminated by white light normal to its surface. Its index of refraction is 1.5. What wavelength within the visible spectrum will be intensified in the reflected beam? **(8)**

Contd P/2

PHY 101 (CE)

SECTION – B

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

5. (a) What is diffraction of light? Write down the equation for diffraction grating by mentioning each term. **(10)**

   (b) Discuss in details the diffraction of light due to a single slit. Write down an expression in terms of slit width for the angle between the central maximum and the first minimum of an intensity distribution curve. **(18)**

   (c) In a single slit diffraction pattern the distance between the first minimum on the right and the first minimum on the left is 5.62 mm. The screen on which the pattern is displayed is 82.3 cm from the slit. The wavelength of the beam used is 546 mm. Calculate the slit width. **(7)**

6. (a) Distinguish between polarized light and unpolarized light. **(8)**

   (b) Discuss the process of production of plane polarized light by reflection. What is double refraction? **(17)**

   (c) What is optical activity? Write down an expression to calculate specific rotation of an optically active material. **(10)**

7. (a) What is forced oscillation? Write down its differential equation. Solve the equation for steady state. **(26)**

   (b) An object of mass 0.2 kg is hung from a spring whose spring constant is 80 N/m in a resistive medium where damping coefficient P = 10 sec^{-1}. The object is subjected to a sinusoidal driving force given by $F(t) = F_0 \sin\omega' t$ where $F_0 = 2N$ and $\omega' = 30\ sec^{-1}$. In the steady state what is the amplitude of the forced oscillation. Also calculate the resonant amplitude. **(9)**

8. (a) What are the characteristics of a mechanical wave? Deduce the one dimensional differential equation of a mechanical wave. **(15)**

   (b) A wave is travelling in the –ve x-direction and is reflected from a rigid support. What will be the resultant equation of the incident and reflected wave? What is the name of the resultant wave? **(8)**

   (c) The displacement equation of a standing wave on a string fixed at both ends is $\psi = 0.10 \sin 5\pi x \cos 4\pi t$ where ψ and x are in meters and t is in second. It produces four loops. **(12)**

   (i) What is the wavelength and wave speed of the individual waves? (ii) Find the length of the string. (iii) Is there a node or antinode at x = 0? (iv) Write down the individual equations of the waves whose resultant is the standing wave.

L-1/T-1/CE Date : 08/01/2015

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T-1 B. Sc. Engineering Examinations 2013-2014

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) Explain how sociologists maintain a value neutral position while studying social relationships. Write your answer highlighting the discussion of sociological imagination. **(10)**

   (b) Describe the principles and properties of functionalist theoretical perspective of sociology. **(13 1/3)**

2. (a) What do you understand by socialization? Critically evaluate the roles of social agents in socialization process. **(13 1/3)**

   (b) What is meant by 'self'? Discuss C.H. Cooley's looking glass 'self theory'. **(10)**

3. (a) What do you understand by mass media? Discuss the functionalist view of mass media of a society. **(13 1/3)**

   (b) 'Feminist theorists consider that mass media stereotype and misrepresent social reality' – show arguments in favour of your answer. **(10)**

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

   (a) Dominant ideology
   (b) Systems of social stratification
   (c) Marxist theory of class differences
   (d) Ethnocentrism.

SECTION – B

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

5. (a) Industrial revolution brought a lot of modifications in human affairs, in economic life and in social institutions. What do you think about the statement? **(15 1/3)**

   (b) Describe 'deviance' as a social problem. **(8)**

Contd P/2

HUM 355 (CE)

6. (a) What are the positive and negative consequences of Max Weber's 'Ideal Type of Bureaucracy'? **(13 1/3)**

   (b) Discuss job insecurity, unemployment and the social significances of work. **(10)**

7. (a) Critically discuss two theories of population. **(13 1/3)**

   (b) What are the major differences between 'urban ecology' and 'new urban sociology'? **(10)**

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

   (a) Population pyramid

   (b) Causes and effects of 'soil pollution'

   (c) 'Work'

   (d) Calculation of 'CBR', 'CDR' and 'TFR' as the elements of demography.

L-1/T-1/CE Date : 08/01/2015

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T-1 B. Sc. Engineering Examinations 2013-2014

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) Define constitution. Explain the characteristics of a good constitution. **(11 1/3)**

   (b) Write an analytical note on nationalism. **(12)**

2. (a) Discuss the necessary conditions for the success of democracy. **(11 1/3)**

   (b) Describe briefly strengths and weaknesses of parliamentary form of government. **(12)**

3. (a) What are the different kinds of executive? **(7)**

   (b) Distinguish between a written constitution and an unwritten constitution. **(8)**

   (c) Analyze the functions of local government institution. **(8 1/3)**

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

   (a) Rule of Law
   (ii) Good Governance
   (iii) Political Rights
   (iv) Popular Sovereignty

SECTION – B

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

5. (a) What is e-government? Discuss the merits and demerits of e-government. **(11 1/3)**

   (b) Make a comparative analysis on 'Socialism' and 'Welfare state'. **(12)**

6. (a) Explain the salient features of the constitution of Bangladesh. **(11 1/3)**

   (b) Analyze the principles of Bangladesh foreign policy. **(12)**

7. (a) Discuss the significance of 1970s election on the emergence of Bangladesh. **(11 1/3)**

   (b) Critically analyse the functions of NGOs in Bangladesh. **(12)**

8. (a) What is United Nations Organization (UNO)? Discuss the principal organs of UNO. **(11 1/3)**

   (b) Write short notes on any two (2) of the following: **(12)**

   (i) Public Policy
   (ii) SAARC
   (iii) Public Service Commission

L-1/T-1/CE **Date : 13/01/2015**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T-1 B. Sc. Engineering Examinations 2013-2014

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

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

Symbols used have their usual meaning.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

1. (a) Is f(x) defined below continuous at x = 1 and x = 3? Does f′(x) exist for these values? **(15)**

$$f(x)=\begin{cases}|x|, & 0<x<1\\ 2+x, & 1\le x\le 3\\ x+\frac{1}{2}x^2, & x>3\end{cases}$$

Also sketch f(x).

(b) Evaluate the following limits:

(i) $\lim\limits_{x\to 2}\left[\frac{4}{x^2-4}-\frac{1}{x-2}\right]$ **(10)**

(ii) $\lim\limits_{x\to 0}\left[\frac{\left(e^x-1\right)\tan^2 x}{x^2}\right]$ **(10)**

2. (a) State Leibnitz's theorem and utilize this theorem to find the value of **(15)**

$$(y_n)_0, \text{ if } y=\left[\ln\left\{x+\sqrt{1+x^2}\right\}\right]^2$$

(b) If $u=\left(\frac{x^3+y^3}{x+y}\right)$ then prove that $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}=\sin 2u$. Hence or otherwise evaluate

$$x^2\frac{\partial^2 u}{\partial x^2}+2xy\frac{\partial^2 u}{\partial x\partial y}+y^2\frac{\partial^2 u}{\partial y^2}.$$ **(20)**

3. (a) A rectangular warehouse with a flat roof is to have a floor area of 9600 square feet. The interior is to be divided into store room and office space by an internal wall parallel to one pair of the sides of the warehouse. The roof and the floor area are same. Find the dimensions that minimize the total length of the wall. **(15)**

(b) State Cauchy's Mean Value theorem and verify the same for the functions x^2 and x^3 in the interval (1, 2) and find all values of c in that interval which satisfy the conclusion of the theorem. **(10)**

(c) Show that in the parabola $\frac{2a}{r}=(1-\cos\theta)$ the tangent is inclined at a constant angle $\left(\pi-\frac{\theta}{2}\right)$ to the radius vector. **(10)**

Contd P/2

MATH 137 (CE)

4. Workout the following integrals:

(a) $\int \frac{dx}{(x+1)\sqrt{1+2x-x^2}}$ **(11)**

(b) $\int \frac{(2x-1)\,dx}{\sqrt{2+4x+4x^2}}$ **(12)**

(c) $\int \frac{dx}{1+\sin x+\cos x}$ **(12)**

SECTION – B

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

5. (a) Show that $\int_0^{\pi} \frac{x\tan x}{\sec x+\tan x}\,dx = \pi\left(\frac{\pi}{2}-1\right)$. **(10)**

(b) Evaluate $\int_0^{\pi/2} \log(\sin x)\,dx$. **(10)**

(c) Show that $\int_0^{\pi/2} \sin^n x\,dx = \int_0^{\pi/2} \cos^n x\,dx = \begin{cases} \frac{n-1}{n}\cdot\frac{n-3}{n-2}\cdot\frac{n-5}{n-4}\cdots\frac{3}{4}\cdot\frac{1}{2}\cdot\frac{\pi}{2} \\ \qquad (n \text{ is even positive int eger}) \\ \frac{n-1}{n}\cdot\frac{n-3}{n-2}\cdot\frac{n-5}{n-4}\cdots\frac{4}{5}\cdot\frac{2}{3}\cdot 1 \\ \qquad (n \text{ is odd positive integer}) \end{cases}$ **(15)**

6. (a) Show that $\Gamma(\frac{1}{2}) = \sqrt{\pi}$. **(15)**

(b) Evaluate $\int_0^2 x\sqrt[3]{8-x^3}\,dx$. **(10)**

(c) Compute $\iiint \frac{dxdydz}{(x+y+z+1)^2}$, if the region of integration is bounded by the coordinate planes and the plane $x+y+z=1$. **(10)**

7. (a) Show that $A(\text{adj.}A) = (\text{adj.}A)A = |A|I_n$. **(10)**

(b) Find the inverse of the matrix $A = \begin{bmatrix} 1 & -1 & 0 & 0 \\ 1 & 2 & 0 & 0 \\ -6 & 0 & 1 & -2 \\ 8 & 1 & -2 & 1 \end{bmatrix}$ by using only row transformation. **(15)**

Contd P/3

MATH 137 (CE)

Contd ... Q. No. 7

(c) Test whether the following equations are consistent. If found consistent, find the solution: **(10)**

$$x_1 + x_2 + x_3 + x_4 = 4$$
$$2x_1 - x_2 - x_3 + 3x_4 = 6$$
$$3x_1 + 4x_2 - 5x_3 + 6x_4 = -11$$
$$7x_1 - 5x_2 + 7x_3 + x_4 = 46$$

8. (a) Verify Cayley's Hamilton theorem for the given matrix A and using this theorem find A^{-1} and A^{-3}, **(17)**

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

(b) Find all eigenvalues and corresponding eigenvectors of the matrix A, where **(18)**

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