L-1/T-1/CE **Date : 21/08/2017**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T-1 B. Sc. Engineering Examinations 2016-2017

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) Derive radius of Hydrogen atom using the postulates of Bohr's atomic model. **(10)**

   (b) Calculate the wave length of radiation during the transition of e^- of Li^{2+} ion from N level to K level, where Rydberg constant = 109700 cm^{-1}. **(7)**

   (c) Show that Bohr's principle of quantization of angular momentum of a moving e^- can be derived from de Broglie concept. **(7)**

   (d) Derive the Schrödinger equation for the motion of a particle in one dimension. **(11)**

2. (a) What are the factors favoring the formation of covalent bond between A and B. **(6)**

   (b) Discuss the differences between Bonding Molecular orbitals and Antibonding Molecular orbitals with diagram. **(10)**

   (c) The N_2^+ ion can be prepared by bombarding the N_2 molecule with fast moving electron. Predict the following properties of N_2^+. **(9)**

   (i) The electronic configuration (ii) Bond order (iii) Magnetic properties.

   (d) Discuss the dissimilarities between valence bond theory (VBT) and Molecular orbital theory (MOT). **(10)**

3. (a) Define Internal Energy of a system. What are the characteristics of internal energy? How is it related with heat of reaction of a system at constant pressure and at constant volume? **(12)**

   (b) What are the factors that affect enthalpy change? Give examples. **(5)**

   (c) How is heat of reaction varied with different temperature of the reaction? Derive Kirchoff's equation to calculate heat of reaction at variable temperature of the reaction at constant pressure. **(4+10)**

   (d) What is the difference between integral heat of solution and integral heat of dilution? **(4)**

4. (a) The standard reduction potentials for the following half reaction are **(9)**

$$Mn^{2+}(aq) + 2e \rightarrow Mn(s) \qquad E^\circ = -1.029V$$
$$Ni^{2+}(aq) + 2e \rightarrow Ni(s) \qquad E^\circ = -0.23V$$

Contd P/2

CHEM 103(CE)

Contd ... Q. No. 4(a)

How can a galvanic cell be constructed of Manganese and Nickel rods, and of Mn^{2+} and Ni^{2+} ion solutions? Which rod acts as the anode of the cell? Calculate the standard potential of the cell. What is the direction of electron flow in the cell?

(b) What are the factors which change the Magnitude of the cell potential and which do not change? **(6)**

(c) Show that the rusting (corrosion) of iron is electrochemical cell reaction. **(8)**

(d) A laboratory method for preparation of chlorine gas is the reaction of Manganese (iv) oxide with hydrochloric acid: **(12)**

$$MnO_2(s) + 4H^+_{aq} + 2Cl^-_{(aq)} = Cl_{2(g)} + Mn^{2+}_{(aq)} + H_2O_{(l)}$$

Where $MnO_{2(s)} \rightarrow Mn^{2+}_{(aq)}$ $\quad E^\circ = -1.208\ V$

$2Cl^-_{(aq)} \rightarrow Cl_{2(g)}$ $\quad E^\circ = -1.3583\ V$

Is this reaction spontaneous under standard conditions? What is the potential for the reaction at instant when $[H^+] = 10$ M, $[Cl^-] = 10$ M

$P_{Cl_2} = 1.0$ atm, and $[Mn^{2+}] = 1.0 \times 10^{-10}$ M ?

Is the reaction spontaneous under these conditions?

SECTION – B

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

5. (a) How would you differentiate between a solution and a chemical compound? Write down the structures of the solvated form of KCl in water. Make a comparative statement of the effect of temperature on the solubility of solid in liquid and gas in liquid. **(4+4+7=15)**

(b) Explain the following statements **(9)**

(i) The volume of the gas absorbed in a liquid is dependent on the pressure at which the gas dissolves.

(ii) The mole fraction of the dissolved gas is proportional to the pressure of the gas.

(iii) A dynamic equilibrium exits in a saturated solution.

(c) What are the different forms of liquid-liquid systems? Discuss the solubility behaviour of nicotine-water system with respect to change in temperature. **(4+7=11)**

6. (a) Distinguish between the true solution and the colloidal solution. How purification of sols can be accomplished by (i) dialysis, (ii) electro-dialysis and (iii) ultrafiltration methods? **(3+912)**

(b) Discuss the following properties of sols

(i) Optical properties (ii) Kinetic properties (iii) and Electrical properties. **(9)**

Contd P/3

CHEM 103(CE)

Contd ... Q. No. 6

(c) Deduce an expression to establish a relation between the molecular weight of a solute and the elevation of boiling point. **(7)**

(d) A solution contains 5 gm of urea (M = 60) per 100 gm in water. If the density of water at 25°C is 0.998 gm-cm^{-3}, calculate the osmotic pressure of the solution at the same temperature. (R = 0.082 litre. atm.deg^{-1}.mole^{-1}). **(7)**

7. (a) What do you mean by the dielectric constant and hydration number of water? Explain the basic principle and softening technique of hard water by cation exchange method. **(3+3+6=12)**

(b) Show by chemical equations how would you calculate the following impurities present in water? (i) Dissolved Oxygen content (ii) Chloride content (iii) Free chlorine content and (iv) Total hardness. **(12)**

(c) How bacteria and microorganism can be removed from water to make it fit for drinking? Describe a suitable method to remove permanent hardness by chemical treatment. **(6+5=11)**

8. (a) Distinguish between scale and sludge. Write the chemical reactions involved in the formation of scale and sludge in the boiler. How corrosion can be removed from the boiler feed water by chemical treatment? **(3+3+5=11)**

(b) What are the different steps involved in the manufacturing of Portland cement? Discuss the functions of each step. **(6)**

(c) What do you understand by setting and hardening of cement? Discuss the theories of setting and hardening of the cement with suitable chemical equations. **(3+6=9)**

(d) Write short notes on the following **(9)**

(i) Calcareous materials (ii) Argillaceous materials (iii) Hydrophobic cement.

L-1/T-1/CE **Date : 17/08/2017**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T-1 B. Sc. Engineering Examinations 2016-2017

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) 'Sociological imagination is an unusual type of creative thinking for understanding social relationships' – Explain. **(10)**

   (b) Critically discuss functionalist theoretical perspective with examples. **(13 ⅓)**

2. (a) How does socialization shape human behaviour? Write your answer highlighting the roles of different agents of socialization. **(10)**

   (b) Briefly discuss C.H. Cooley's looking glass self theory. **(13 ⅓)**

3. (a) What is research methodology? Explain the steps of scientific method. **(15)**

   (b) What is survey method? Illustrate the two different forms of survey method. **(8 ⅓)**

4. Write short notes on any three of he following: **(23 ⅓)**

   (a) Social norms. (b) Dominant ideology. (c) Ethnocentrism. (d) Cultural lag.

SECTION – B

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

5. (a) Describe the effects of industrial revolution on urban life, social classes, family life, and standards of living. **(13 ⅓)**

   (b) How did agricultural revolution help to bring about the Industrial Revolution in Britain? **(10)**

6. (a) Critically discuss the characteristics of bureaucracy identified by Max Weber. **(13 ⅓)**

   (b) What do you mean by poverty? Explain different types of poverty and give examples from your society.

7. (a) Compile the crucial elements of demography. How do these elements help to understand population dynamics? **(13 ⅓)**

   (b) Show the sustainable ways to reduce environmental pollution in Bangladesh.

8. Write short notes on any THREE of the following: **(23 ⅓)**

   (a) Infant Mortality Rate (IMR) (b) Fatalism

   (c) The Permanent Settlement (d) New urban sociology.

L-1/T-1/CE **Date : 17/08/2017**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T-1 B. Sc. Engineering Examinations 2016-2017

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) Discuss the constituent elements of a modern state. **(11 ⅓)**

   (b) What is nationalism? Discuss the merits of nationalism. **(12)**

2. (a) Describe various types of sovereignty with examples. **(11 ⅓)**

   (b) What is constitution? Describe the qualities of a good constitution. **(12)**

3. (a) Explain the advantages of parliamentary form of government. **(11 ⅓)**

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

4. Write short notes on any three (3) of the following: **(23 ⅓)**

   (a) Political sovereignty

   (b) Despotic type of government

   (c) Internationalism

   (d) Independence of Judiciary

SECTION – B

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

5. (a) Who is citizen? Analyze the methods of acquiring citizenship. **(11 ⅓)**

   (b) What is Rights? Explain the political rights and duties of a citizen a state. **(12)**

6. (a) Discuss the functions of the Legislature in a state. **(11 ⅓)**

   (b) What are the different types of NGOs? Discuss the major functions of NGOs in a developing country. **(12)**

7. (a) What is local government? Discuss the role and functions of Pourashava as a local government institution in Bangladesh. **(11 ⅓)**

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

8. Write short notes on any three (3) of the following: **(23 ⅓)**

   (a) Socialism (b) Bureaucracy (c) Non-political executive (d) Good governance.

L-1/T-1/CE **Date : 17/07/2017**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T-1 B. Sc. Engineering Examinations 2016-2017

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) The frame shown in Fig. 1 consists of two horizontal member AE and BF, a vertical member EF and an inclined member CD. All the members have been assumed to be weightless. Calculate the components of pin reactions at A and force in the member EF. **(13)**

   (b) In Fig. 2, the bodies A and B weigh 300 N and 600 N, respectively. The coefficient of static friction for all surfaces is 0.2. The cord is cord is parallel to the inclined plane CD. Determine the values of the angle θ and tensions in the cord when motion of the body B impends down the plane CD. **(12)**

   (c) A cable weighing 3 lb/ft is strung between two supports. One support is 300 ft higher than the other and the sag measured from the lower support is 200 ft. the tension in the cable at the upper support is 12000 lb. Calculate the following. **(10)**

   (i) Distance between the two supports

   (ii) Total length of the cable

   (iii) Slope in degree at the lower support.

   (iv) Tension at the lower support.

2. (a) A ladder of length 5 m and weighing 300 N is placed against a vertical wall as shown in Fig. 3. The ladder also supports a man weighing 550 N. 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. Calculate the minimum horizontal force P to be applied at the bottom of the ladder to prevent slipping of the ladder. **(12)**

   (b) In Fig. 4, the bodies A and B weighing 250 N and 300 N, respectively are connected by a cord and rest on smooth inclined planes. Find the values of the angle θ and the reactions at the inclined planes, if the bodies are in equilibrium. **(11)**

   (c) Fig. 5 shows a boom made of two timbers AB and AC. The cable AE holds the timber in a horizontal plane of the boom and supports a vertical load of 3000 lb. The line BC is the intersection of the horizontal plane of the boom with the vertical plane BCGF. Determine the force in the timbers AB and AC and tension in the cable AE. Given, AB = 10′, AC = 12′, AD = 8′ and DE = 6′. **(12)**

Contd P/2

CE 101

3. (a) The body A in Fig. 6 weighs 200 lb. The coefficient of static friction between the body A and the inclined plane is 0.4. The coefficient of static friction between the rope and the drum 1 is 0.3 while it is 0.2 between the rope and the drum 2. What value of W will cause motion of the body A to impend up the plane? **(12)**

   (b) For the truss shown in Fig. 7, find the force in the members ab, pe, fq, dm and lm. **(14)**

   (c) Write neat figures derive an expression for the total length of a symmetrical catenary in terms of weight per foot (w), span length (L) and tension at the low point (Q) of the catenary. **(9)**

4. (a) A bar of weight 100 lb is hinged to a vertical wall at A and has been supported by a cable as shown in Fig. 8. Determine the tension in the cable and components of pin reactions at A and C. **(13)**

   (b) Using direct integration, determine the co-ordinates of the centroid of the area bounded by the parabola $y^2 = 8x$ and the straight line $y = 2x$. **(10)**

   (c) A right-angled bend pipe is supported in a horizontal plane with the help of three cables AB, CD and EF as shown in Fig. 9. The pipe weighs 10 kg/m. Calculate the tension in the cables AB, CD and EF. **(12)**

SECTION – B

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

5. (a) A point moves along the path $x^2 = 36\ y$. At the position where $x = 40$ ft, the tangential velocity is $v = 12$ fps. At this position, what are the components v_x and v_y of the velocity? **(10)**

   (b) In Fig. 10, the 4 ft solid cylinder **A** weighs 644 lb and $\theta = 30°$. The weight of **B** is 96.6 lb and the pulley **C** has negligible friction. The system starts from rest. Determine the velocity of the cg of **A** after 10 sec. and the tension Q in the cord. Use the Principle of Impulse and Momentum. **(13)**

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

6. (a) In Fig. 12, the weight of the rotating parts **B** is 6440 lb., their radius of gyration $\bar{k} = 3$ ft and the axis is frictionless. Also, $W_A = 12{,}880$ lbs, $f_A = ¼$ and $\theta = 30$ deg. If the body A moves 100 ft with a constant acceleration up the plane from rest during 40 sec., determine the weight C and the tension in the cord attached to it. **(11)**

   (b) The bodies A and B (Fig. 13) weigh respectively 500 lb and 150 lb. The rotating part C weighs 600 lb and has a radius of gyration of 3 ft with respect to its axis. Determine the speed of A and the angular acceleration of C after B has moved 10 ft from rest. Use the Principle of Impulse and Momentum. **(13)**

Contd P/3

CE 101

Contd ... Q. No. 6

(c) In Fig. 14, W_A = 2000 lb, f_A = 1/3 and f_B = 0.15. Determine W_B for impending clockwise motion of the pulley. The bearing at **C** is smooth. **(11)**

7. (a) The rotating assembly in Fig. 15 weighs 161 lb, **D** = 2 ft and the weight **W** = 32.2 lb. If **W** is released from rest and descends 20 ft in 4 sec., find the tension in the cable and the radius of gyration of the rotating assembly. Neglect friction and the mass of the cable. Use the Principle of Work and Kinetic Energy. **(12)**

   (b) Using Virtual Work method determine the reaction force at **B** of the Fig. 16. **(13)**

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

8. (a) A homogenous sphere of 12 inch diameter rolls down a rough 30° inclined plane. If the initial speed of its center of gravity is 10 fps down the plane, find the speed 8 sec. later, and find the minimum value of the coefficient of friction that will cause pure rolling. Use the Principle of Work and Kinetic Energy. **(13)**

   (b) Two forces **P** and **Q** acting on a bellcrank (Fig. 17) maintains equilibrium. Given, **P** = 100 kg determine the force **Q** using the Principle of Virtual Work. **(12)**

   (c) Determine the reactions at support **A** and **B** of the simply supported beam shown in Fig. 18. **(10)**

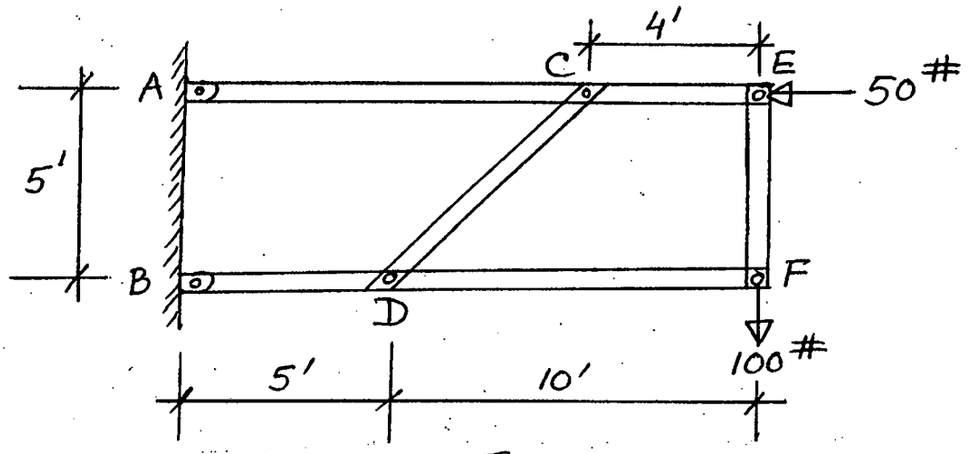

Fig. 1

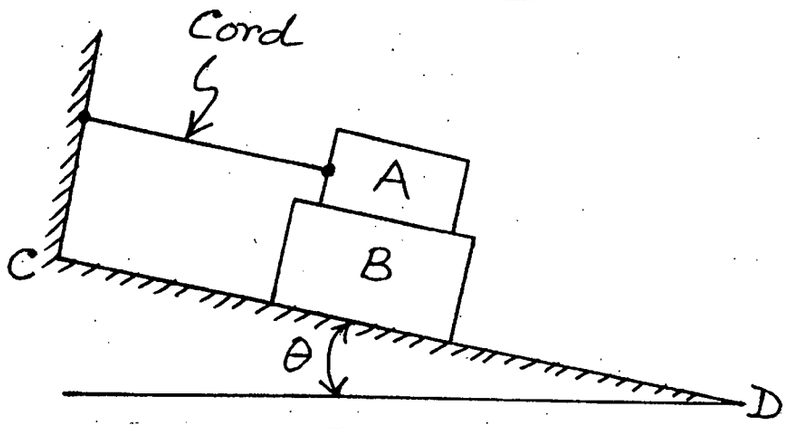

Fig. 2

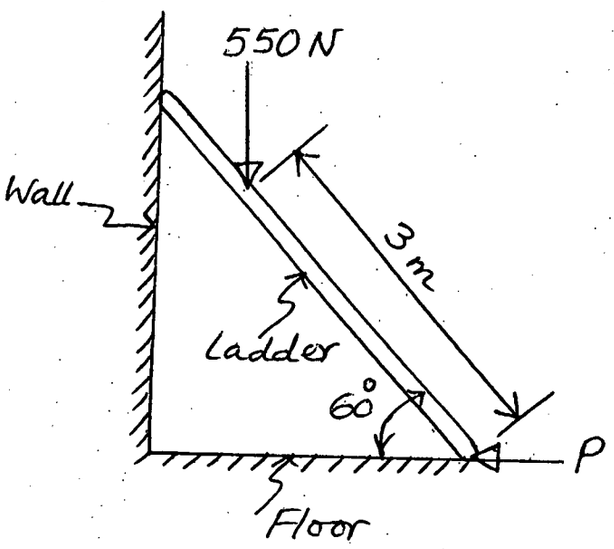

Fig. 3

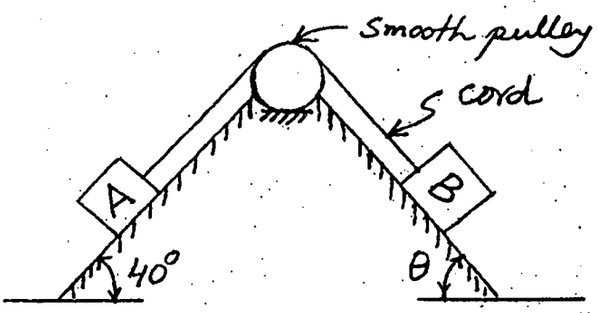

Fig. 4

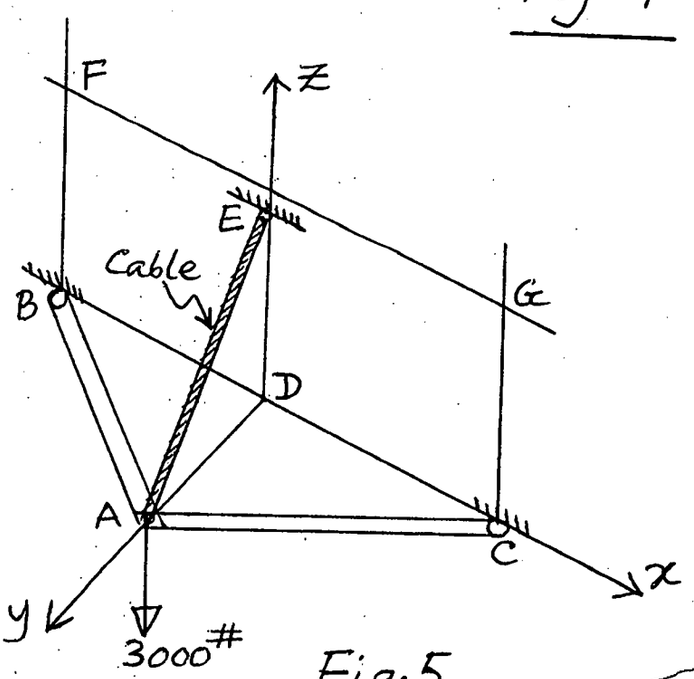

Fig. 5

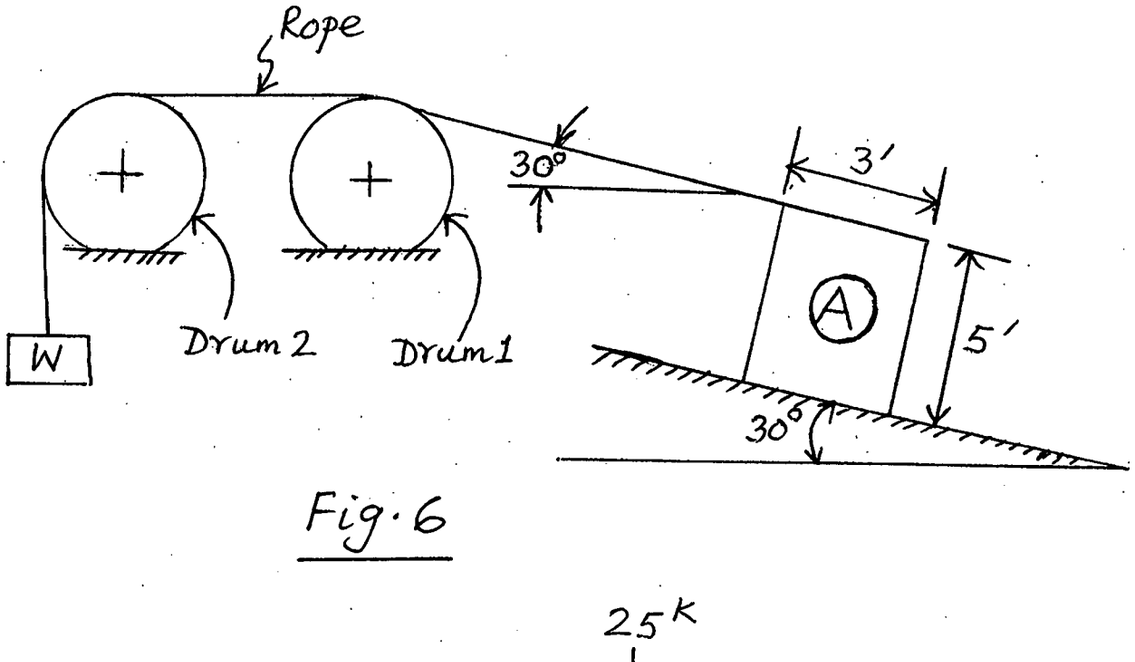

Fig. 6

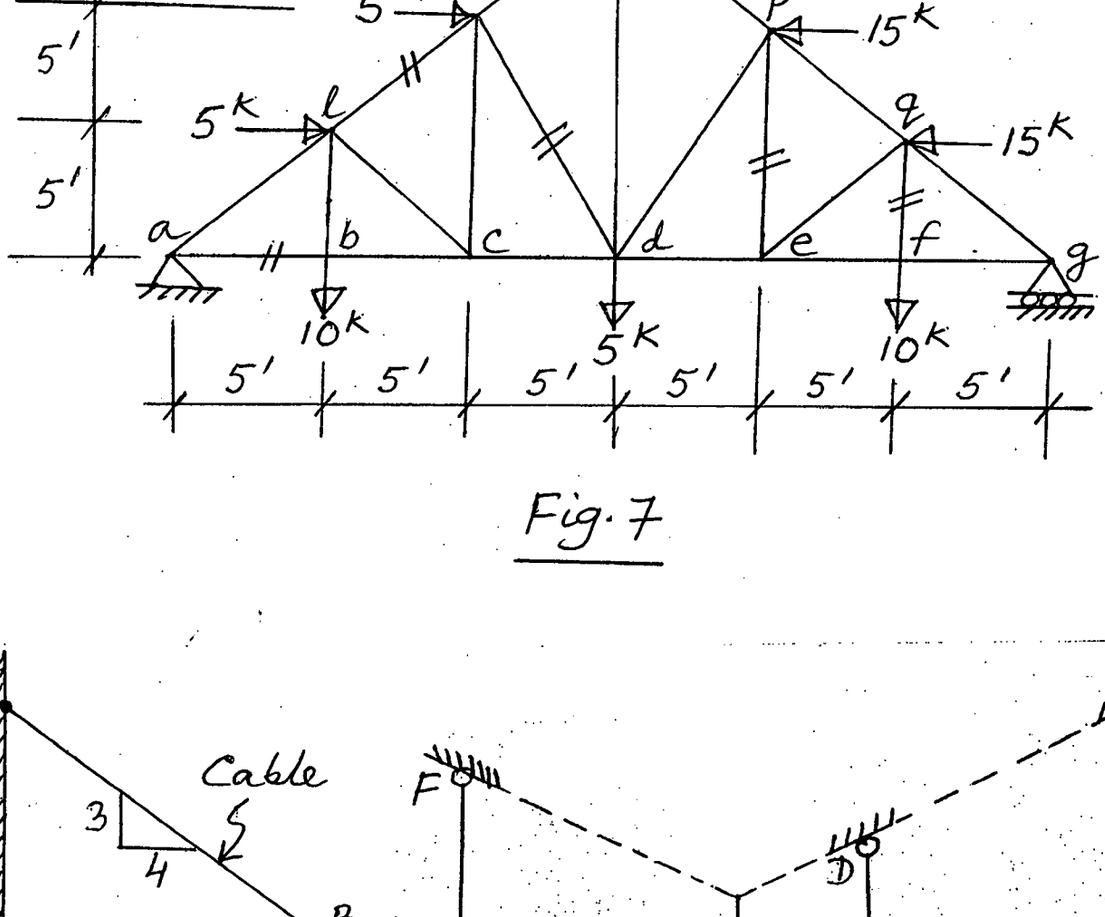

Fig. 7

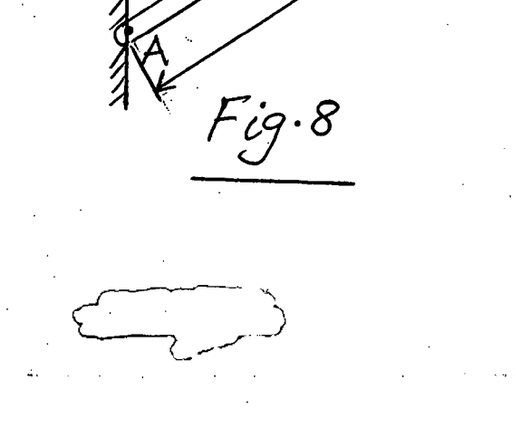

Fig. 8

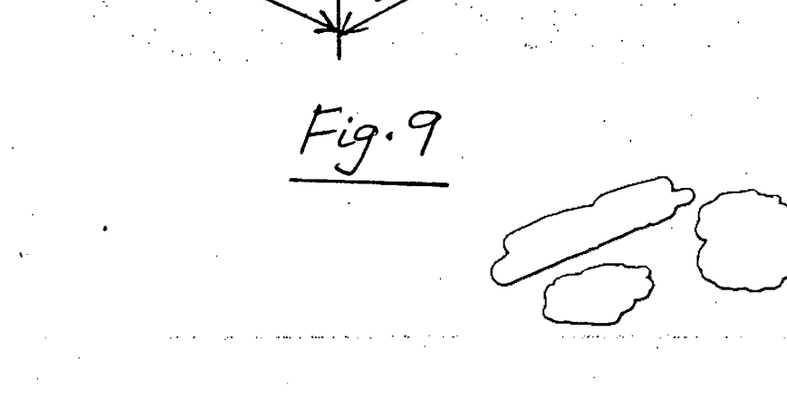

Fig. 9

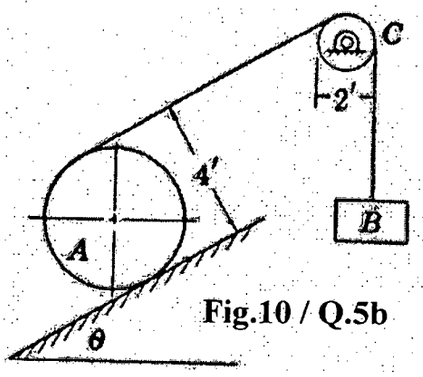

Fig.10 / Q.5b

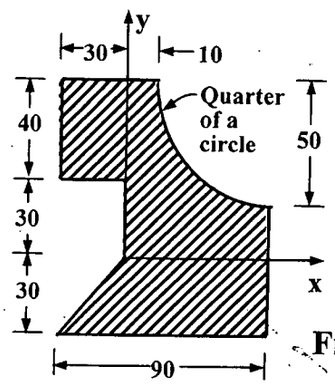

Fig.11 / Q.5c

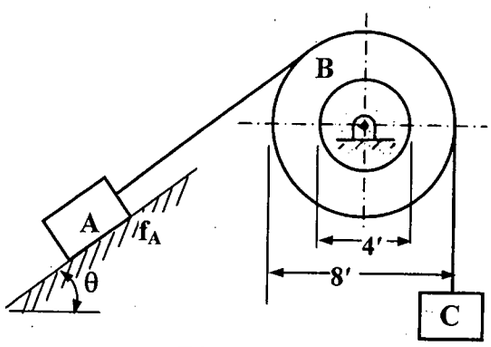

Fig.12 / Q.6a

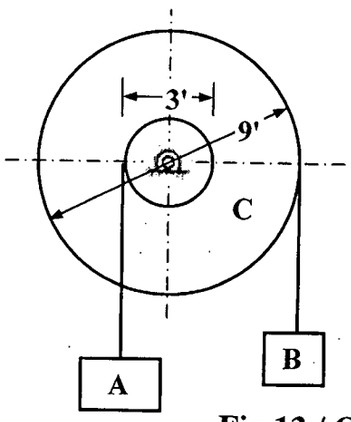

Fig.13 / Q.6b

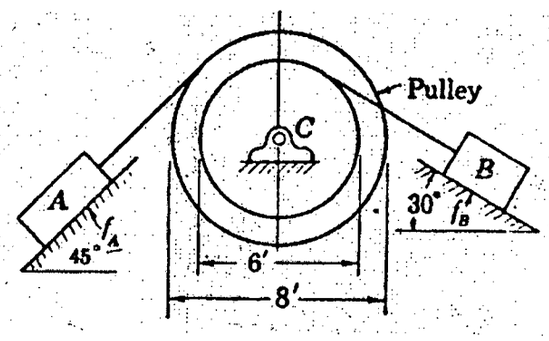

Fig.14 /Q.6c

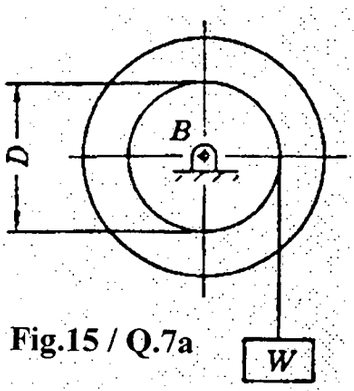

Fig.15 / Q.7a

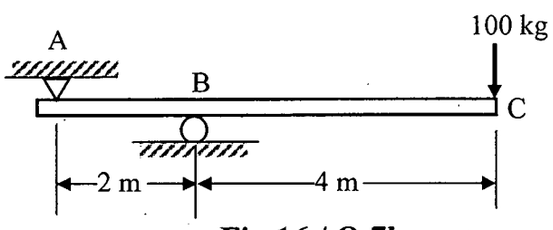

Fig.16 / Q.7b

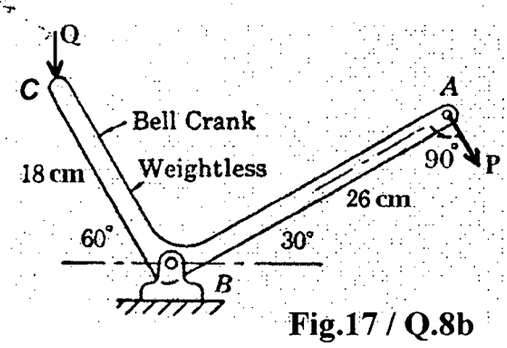

Fig.17 / Q.8b

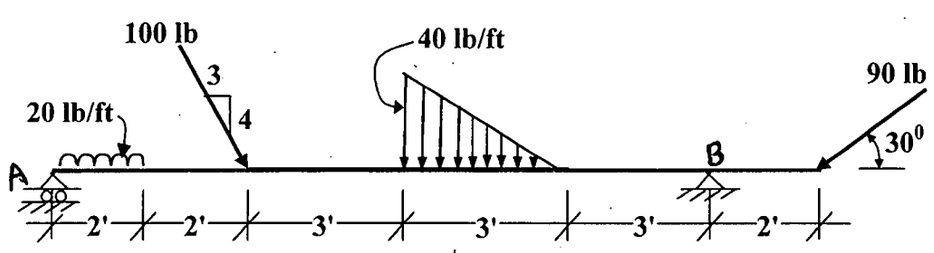

Fig.18 / Q.8c

L-1/T-1/CE **Date : 12/08/2017**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T-1 B. Sc. Engineering Examinations 2016-2017

Sub : **PHY 101** (Physical Optics, Waves 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) What are coherent and incoherent waves? **(6)**

   (b) Light from a source falls obliquely on a thin film of optical medium. Find an expression for the effective path difference between a part of a ray reflected externally at the first surface and the part which suffers on reflection internally at other surface. **(22)**

   (c) In Young's double slit experiment, the central fringe of the interference pattern produced by light having a wavelength of 650 nm is shifted to the position of 5th bright fringe when a thin transparent sheet of refractive index 1.5 is introduced in front of the slits. Find the thickness of the sheet. **(7)**

2. (a) How can diffraction be explained on the basis of wave theory. **(7)**

   (b) Discuss the Fraunhofer diffraction at double-slits and hence obtain the expression of intensity pattern formed on a screen. **(22)**

   (c) A light of 589 nm wavelength falls normally on a grating of 2.5 cm length. The second order spectrum is obtained at 44° from the normal. Calculate the total number of lines on the grating surface. **(6)**

3. (a) How does polarized light differ from ordinary light? **(6)**

   (b) (i) Discuss how light is polarized by reflection and refraction and explain this polarization by elastic-solid theory of Fresnel. **(20)**

   (ii) Write down the Brewster's law. **(4)**

   (c) To introduce a path difference of $\frac{\lambda}{2}$ between O-ray and e-ray for light of 600 nm wavelength, calculate the required thickness of doubly refracting crystal. Given that $\mu_o = 1.65$ and $\mu_e = 1.48$. **(5)**

4. (a) Write down thermodynamic laws. **(10)**

   (b) Deduce Clausias-Clapeyron's equation for latent heat. **(15)**

   (c) Calculate the latent heat of ice given that change of pressure of 1 atmosphere changes the melting point of ice by 0.0074°C and when 1 gm of ice melts volume changes by 0.0907 cc. **(10)**

Contd P/2

PHY 101(CE)

SECTION – B

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

5. (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) A Carnot engine has an efficiency of 22%. It operates between constant temperature reservoirs differing in temperatures by 75°C. What are the temperatures of the two reservoirs? **(8)**

6. (a) What are the thermodynamic functions. **(5)**

   (b) Deduce the Maxwell's thermodynamic relations by using the thermodynamic functions. **(15)**

   (c) Evaluate the average energy of a molecule by using the Maxwell's law of distribution of velocities of a gas molecule. **(15)**

7. (a) What are free and damped oscillations. **(2+2)**

   (b) Establish the differential equation of a damped harmonic oscillator and solve it for critically damped condition to obtain an expression for the displacement of the oscillator. Draw a graph for the aperiodic, critically damped and oscillatory conditions. **(4+17+3)**

   (c) A massless spring suspended from a rigid support carries a mass of 560 gm at its lower end and the system oscillates with a frequency of 6 hz. If the amplitude is reduced to half its undamped value in 25s, calculate the quality factor of the system. **(7)**

8. (a) What is forced Vibration? How does the amplitude of forced vibration depend on natural frequency of an oscillator? **(2+2)**

   (b) Establish the differential equation of forced vibrations for an oscillator. Solving this equation and hence discuss the resonance and sharpness of resonance. **(4+14+6)**

   (c) A harmonic oscillator of quality factor 20 is subjected to a sinusoidal applied force of frequency two times the natural frequency of the oscillator. If the damping is small, obtain the amplitude of the forced oscillation in terms of its maximum amplitude. **(7)**

L-1/T-1/CE **Date : 06/08/2017**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T-1 B. Sc. Engineering Examinations 2016-2017

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

Full Marks : 210 Time : 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks.

Symbols used have their usual meaning.

SECTION – A

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

1. (a) A function $f(x)$ is defined as follows: **(15)**

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

Discuss the continuity and differentiability of $f(x)$ at $x = 2$. Also sketch the graph of $f(x)$.

(b) Evaluate: $\lim_{x\to 0}\left(e^x + x\right)^{1/x}$. **(10)**

(c) Find the n-th derivative of the function $y = \sin x \sin 2x \sin 3x$. **(10)**

2. (a) If $y=\left(x+\sqrt{1+x^2}\right)^m$ prove that $\left(1+x^2\right)y_{n+2} + (2n+1)xy_{n+1} + \left(n^2-m^2\right)y_n = 0$

and also find the value of y_n when $x = 0$. **(13)**

(b) Expand $y = e^x \cos x$ in a series of ascending powers of x. **(10)**

(c) If $u = \cos ec^{-1}\sqrt{\dfrac{x^{1/2}+y^{1/2}}{x^{1/3}+y^{1/3}}}$, then find the value of $x\dfrac{\partial u}{\partial x} + y\dfrac{\partial u}{\partial y}$. **(12)**

3. (a) Prove that the semi-vertical angle of a cone of maximum volume and given slant height is $\tan^{-1}\sqrt{2}$. **(13)**

(b) If $lx + my = 1$ is the normal to the parabola $y^2 = 4ax$, then show that $al^3 + 2alm^2 = m^2$. **(12)**

(c) If $u = f\left(x^2+2yz, y^2+2zx\right)$ then show that **(10)**

$$\left(y^2-zx\right)\frac{\partial u}{\partial x} + \left(x^2-yz\right)\frac{\partial u}{\partial y} + \left(z^2-xy\right)\frac{\partial u}{\partial z} = 0.$$

Contd P/2

MATH 137/CE

4. Find the following: **(12+12+11)**

(i) $\int \frac{1}{x^4\sqrt{x^2-1}}dx$ (ii) $\int \frac{\cos x}{5-3\cos x}dx$

(iii) $\int \frac{1}{x^4+x^2+1}dx$

SECTION – B

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

5. (a) Find the reduction formula for $I_n = \int e^{ax}\cos^n x dx$ hence find I_2. **(15)**

(b) Evaluate $\int_a^b \sin x dx$ using summation. **(10)**

(c) Evaluate $\int_0^{\pi/2} \frac{dx}{5+3\sin x}$. **(10)**

6. (a) Define Beta function and Gamma function. Find the relation between them. **(17)**

(b) Evaluate $\iiint_R xydzdydx$ **(18)**

where R: $xy \le z \le x^2y^3$, $x \le y \le x^2$, $0 \le x \le 1$.

7. (a) Prove that every square matrix can be expressed as the sum of Hermitian and skew Hermitian matrices. Find the Hermitian and skew Hermitian matrices parts of the matrix. **(17)**

$$A = \begin{bmatrix} i & 2+3i & -i \\ 0 & 1+i & 2 \\ 4-i & 5 & 4i \end{bmatrix}$$

(b) Find the inverse of the matrix $A = \begin{bmatrix} 1 & 3 & 3 \\ 1 & 4 & 3 \\ 1 & 3 & 4 \end{bmatrix}$ using elementary row transformations. **(18)**

8. (a) Find the canonical form of the matrix $\begin{bmatrix} 1 & 2 & -2 & -1 \\ -1 & -4 & 4 & 0 \\ 2 & -7 & 4 & -7 \\ 1 & 6 & -5 & 1 \end{bmatrix}$. **(17)**

(b) Find the solution of the following set of equations by using matrix. **(18)**

$$3x_1 + 2x_2 + 3x_3 = 16$$
$$5x_1 - 3x_2 + 5x_3 = 14$$
$$9x_1 + 4x_2 - 7x_3 = -4$$
$$x_1 + x_2 + x_3 = 6$$
