

06-10-13

L-1/T-2/MME

Date : 06/10/2013

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T-2 B. Sc. Engineering Examinations 2011-2012

Sub: **MATH 173** (Vector Analysis and Matrices)

Full Marks: 210

Time: 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks.

**SECTION - A**

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

Symbols used have their usual meaning.

1. (a) Give geometrical meaning of scalar triple product. Show that the scalar triple product is independent of dot and cross. (13)  
 (b) Prove that  $[\underline{b} \times \underline{c} \quad \underline{c} \times \underline{a} \quad \underline{a} \times \underline{b}] = [\underline{a} \quad \underline{b} \quad \underline{c}]^2$ . (9)  
 (c) Find a set of vectors reciprocal to the set  $2\hat{i} + 3\hat{j} - \hat{k}$ ,  $\hat{i} - \hat{j} - 2\hat{k}$  and  $-\hat{i} + \hat{j} + 2\hat{k}$ . (13)
  
2. (a) Explain physical significance of line integral  $\int_C \underline{F} \cdot d\underline{r}$ . Evaluate  $\int_C \underline{F} \times d\underline{r}$  along the curve  $\underline{r} = \left(t, \frac{t^2}{\sqrt{2}}, \frac{t^3}{3}\right)$  from the origin O to the point A  $\left(1, \frac{1}{\sqrt{2}}, \frac{1}{3}\right)$  where  $\underline{F} = (x, 2y, 3z)$ . (18)  
 (b) If  $\underline{F} = 2xz\hat{i} - x\hat{j} + y^2\hat{k}$ , evaluate  $\iiint_V \underline{F} dV$  where V is the region bounded by the surfaces  $x = 0, y = 0, y = 6, z = x^2, z = 4$ . (17)
  
3. (a) Prove that  $\text{div}(\underline{F} \times \underline{G}) = \underline{G} \cdot \text{curl } \underline{F} - \underline{F} \cdot \text{curl } \underline{G}$ . (9)  
 (b) Find the directional derivative of  $u = x^2 + y^2 + z^2$  at (0,1,2) in the direction of the line  $x/3 = y/4 = z/5$ . Find the maximum rate of increase of u at (0,1,2). (13)  
 (c) Is  $\underline{F} = \hat{i}(x^3z - 2xyz) + \hat{j}(xy - 3x^2yz) + \hat{k}(yz^2 - xz)$  solenoidal? If so find a vector potential  $\underline{V}$  such that  $\underline{F} = \nabla \times \underline{V}$ . (13)
  
4. State and prove Gauss's divergence theorem. From the divergence theorem deduce that  $\int_V \underline{v} \cdot \nabla p dV = \int_S p \underline{v} \cdot \underline{n} dS - \int_V p \text{div } \underline{v} dV$ . (35)

Contd ..... P/2

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**MATH 173****SECTION – B**

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

5. (a) Prove that every square matrix can be expressed in one and only one way as the sum of a symmetric matrix and a skew-symmetric matrix. (15)

(b) Compute the inverse of  $A = \begin{bmatrix} 1 & 2 & 3 & 4 \\ 2 & 3 & 4 & 5 \\ 3 & 4 & 5 & 7 \\ 4 & 5 & 5 & 7 \end{bmatrix}$  by using elementary row operations.

Hence check your answer. (20)

6. (a) Find the Canonical matrix row equivalent to the following matrix

$$A = \begin{bmatrix} 1 & 2 & 1 & 0 \\ 3 & 2 & 1 & 2 \\ 2 & -1 & 2 & 5 \\ 5 & 6 & 3 & 2 \end{bmatrix}. \text{ Also find the rank of the matrix } A. \quad (17)$$

(b) Reduce  $A = \begin{bmatrix} 1 & 2 & -1 & 2 \\ 3 & 1 & -2 & -1 \\ 4 & -3 & 1 & 1 \end{bmatrix}$  to the normal form  $B$  and compute the matrices  $P$

and  $Q$  such that  $PAQ = B$ , where  $A$  and  $B$  are equivalent matrices. (18)

7. (a) Solve the following system of linear equations (17)

$$\begin{aligned} x_1 + x_2 - x_3 + x_4 + 2x_5 &= 1 \\ 2x_1 - x_2 + x_3 + 5x_4 + 4x_5 &= 2 \\ 3x_1 + 2x_2 - 2x_3 + 5x_4 + 6x_5 &= 3 \end{aligned}$$

(b) Reduce the quadratic form  $q = x_1^2 + 2x_2^2 - 3x_3^2 + 8x_1x_2 + 10x_1x_3 - 16x_2x_3$  to the canonical form and find the rank, index and signature of the form. (18)

8. (a) State Cayley-Hamilton theorem. Verify the theorem for the matrix  $A = \begin{bmatrix} 1 & -1 & 1 \\ 1 & 2 & 1 \\ 1 & 0 & 3 \end{bmatrix}$

and hence find its inverse. (17)

(b) Find the Eigen values and the corresponding Eigen vectors of the matrix

$$A = \begin{bmatrix} 5 & 4 & -1 \\ 4 & 5 & -1 \\ -4 & -4 & 2 \end{bmatrix}. \quad (18)$$

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L-1/T-2/MME

Date : 23/09/2013

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T-2 B. Sc. Engineering Examinations 2011-2012

Sub : **HUM 101** (English)

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 **Q. No. 1** and any **TWO** from the rest.

**Q. No. 1 is COMPULSORY.**

1. (a) Explain with reference to the context any two from the following: (15)
- (i) "Feeling like these are the normal by-products of imperialism; ask any Anglo-Indian official, if you catch him off-duty".
- (ii) "This is our island. It's a good island. Until the grown-ups come to fetch us we'll have fun".
- (iii) "At last I came to the conclusion that I could never find the one, complete and satisfying book I sought, and I made up my mind that I must write it for myself".
- (b) Answer any one of the following: (15)
- (i) "Ralph and Jack are characters of two different poles". Explain the statement providing illustrations from the text.
- (ii) How did the astrologer get rid of the 'great load' that had burdened him for so many years?
- (c) Answer any three of the following questions. (15)
- (i) Why was the author so annoyed with the natives of Burma?
- (ii) What does the 'Conch' stand for in the story 'Fire on the Mountain'?
- (iii) Give a description of the place where the astrologer sat for his profession.
- (iv) What does Somerset Maugham say about Bertrand Russel in 'The Use of Philosophy'?
- (v) Comment on the ending of the short story 'Fire on the Mountain'.
2. (a) Correct any ten of the following sentences: (15)
- (i) That picture is highly invaluable.
- (ii) The teacher told he and I to leave early.
- (iii) We walked further down the street.
- (iv) Joe and Jim is to help us.
- (v) The team played real good in the match.
- (vi) Ria is so capable as her sister.
- (vii) We were enthused about the idea.
- (viii) The child was unmistakably ill-bred.
- (ix) He is going to repeat the lecture again next week.
- (x) I like to swim, playing tennis, and riding.
- (xi) The Principle of the school was absent in the meeting.
- (xii) Either Zia nor I am not going to the programme.
- (b) Give the meanings of and make sentences with any ten of the following words: (15)
- Hasty, Outrageous, Prolific, Keen, Quell, Mansion, Elusive, Amplify, Castigate, Perilous, Intrepid, Bleak.

**HUM 101**

3. Amplify the idea contained in any one of the following: (30)
- (i) Every cloud has a silver lining.
  - (ii) Diligence is the mother of good luck.

4. Write a precis of the following passage with a suitable title. (30)

When you meet people who love to read, love literature, it usually turns out that their parents read to them and told them stories or you'll hear 'I was so lucky' my teacher loved books and I caught the passion from her'. It is usually, but not always, her. Busy parents park their children in front of a television and think that they will get their quota of stories, but quite apart from the crudeness of imagery in most children's fare, what is seen is not the same as what is listened to. One teaches the brain passivity, and there are many who how believe that our brains have been physically damaged by television, and that a general 'dumbing down' is the result of this damage. The other involves imagination, memory, and the secret dreams of a child. There is no more potent witchcraft than 'Tell us a story .....' and then. Once upon a time .....!' and in later life often the brightest of childhood memories are of sitting very close to a parent, being read to, or, if parents are able to invent, 'There was once a little girl who, oddly enough, had the same name as you .....!' or 'A boy called .....!'

**SECTION – B**

There are **FOUR** questions in this section. Answer **Q. No. 5** and any **TWO** from the rest.

**Q. No. 5 is COMPULSORY.**

5. Read the passage carefully and answer the questions that below: (45)

Tension is so common a term but so difficult to define. It means mental strain or excitement or condition when feelings are tense, when relation between persons, groups, states, etc are strained. As regards an individual's tension, it saps his energy, destroys his power of imagination, deadens his sensibility and creativity and eats into the vitals of life. No medicine has yet been invented to cure this disease, as it is no disease at all, yet it is the greatest one. It springs from many a factor; from the unfulfilment of desire and from the frustration in life. A man of gigantic figure, tremendous physical strength, endless wealth and vast knowledge can be a victim of tension, but it never meets a man who has indomitable courage, strong will force, unyielding spirit and who can think man is born to brave the theories of life and sweet are the uses of adversity. He can smile away grief, shake off cares and anxieties always take positive steps, welcome sorrow and sufferings and bear the brunt of life with fortitude and forbearance, calm and composure and prudence and sagacity. Hence, the man who harbours optimistic attitude to life, cherishes hopes and aspirations even in the midst of a sea of troubles and nourishes steadfastness and singleness of spirit and purpose never yields to tension. And as regards tension between persons or groups or states, it can be overcome when the problems creating this condition are freely discussed.

## **HUM 101**

### **Contd ... Q. No. 5**

#### **Questions:**

- (a) What is the effect of tension on an individual?  
(b) Who can be free from tension?  
(c) How does tension spring from?  
(d) "Tension is no disease at all; yet it is the greatest one" how?  
(e) Write down the meaning of the following words as used in the passage:  
    Deaden, indomitable, adversity, fortitude, composure, prudence,  
    harbour, tremendous, yield.
6. (a) What are the basic parts of a business letter? (10)  
(b) Write a letter to the Managing Director of Apes Industries motivating him to purchase your company's new brand of computer which is not vulnerable to viruses. (10)  
(c) Write phonetic transcription of any five of the following words: (10)  
    Disable, education, failure, pleasure, language, engineer.
7. (a) What is a report? What are the components of 'Front Matters' of a formal report? (5)  
(b) Write a short essay on any one of the following: (15)  
    (i) Reading for pleasure;  
    (ii) Expected education system;  
    (iii) Civil society.  
(c) Write a dialogue between two conscientious citizens of the country about the intrusion of foreign culture upon Bangladeshi culture. (10)
8. (a) Transform the following sentences as directed (any five): (10)  
    (i) Bad as things are they might be worse. (Compound)  
    (ii) If I make a promise I keep it. (Simple)  
    (iii) While there is life there is hope. (Simple)  
    (iv) He was universally respected on account of his virtue. (Compound)  
    (v) A lost moment is lost for ever. (Complex)  
    (vi) He is something of a poet, but rather more of a philosopher. (Complex)  
(b) What are the characteristic features of a letter of complaint? (5)  
(c) Write short notes on any three of the following: (15)  
    (i) Back Matter of a report;  
    (ii) Glossary  
    (iii) Inviting Quotation;  
    (iv) Function of topic sentence;  
    (v) Dos and don'ts in a written dialogue.
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**SECTION – A**

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

1. (a) Write down the postulates of special theory of relativity and hence obtain the Lorentz space-time transformation formulae. (17)
- (b) Find the relativistic acceleration of a particle of mass  $m$  and velocity  $v$  when it is acted upon by the constant force  $F$ , where  $F$  is parallel to  $v$  and hence show that, the particle can never reach the speed of light. (10)
- (c) An astronaut whose height on the earth is exactly 6 ft is lying parallel to the axis of a spacecraft moving at  $0.90c$  relative to the earth. What is his height as measured by an observer in the same spacecraft? By an observer on the earth? (8)
  
2. (a) What is Compton scattering? An energetic photon strikes an electron at rest in the laboratory coordinate system. Show that the shift in wavelength of the scattered photon is (19)

$$\lambda - \lambda' = \frac{h}{m_0 c} (1 - \cos \phi)$$

where the symbols have their usual meaning.
- (b) When the wavelength shift in Compton scattering will be maximum and minimum? (8)
- (c) A photon of wavelength  $0.4 \text{ nm}$  strikes an electron at rest and rebounds at an angle of  $150^\circ$  to its original direction. Find the speed and wavelength of the photon after the collision. (8)
  
3. (a) Define isotope, isobar, isotone and mirror nuclei. Describe the nature of nuclear force. (15)
- (b) What is nuclear fission? Describe the various components of a nuclear reactor. (15)
- (c) In a particular fission reaction, a  ${}_{92}^{235}\text{U}$  nucleus captures a slow neutron; the fission products are three neutrons, a  ${}_{57}^{142}\text{La}$  nucleus, and a fission product  ${}_z\text{X}^{57}$ , determine the value of  $z$ . (5)

**PHY 157 (MME)**

4. (a) State and explain Coulomb's law of electrostatic force between two electric charges and express it in vector form. (6)
- (b) What is an electric dipole? Derive an expression for the electric field due to an electric dipole at a point on the perpendicular bisector of the dipole. (17)
- (c) An electric dipole consists of two opposite charges of magnitude  $1.0 \times 10^{-6}$  coul separated by 2.0 cm. The dipole is placed in an external field of  $1.0 \times 10^5$  N/coul.
- (i) What maximum torque does the field exert on the dipole? (ii) How much work must an external agent do to turn the dipole end for end, starting from a position of alignment ( $\theta = 0$ )? (12)

**SECTION – B**

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

5. (a) Define capacitance of a capacitor. Explain the term dielectrics and its effect on a capacitor. Deduce Gauss's law for electricity with a dielectric of dielectric constant  $k$ . (17)
- (b) A dielectric slab of thickness  $b$  and dielectric constant  $k$  placed between the plate of a parallel plate capacitor of plate area  $A$  and separation  $d$ . A potential difference  $v_0$  is applied with no dielectric present. The battery is then disconnected and the dielectric slab is inserted. Assume that  $A = 140 \text{ cm}^2$ ,  $d = 1.4 \text{ cm}$ ,  $b = 0.70 \text{ cm}$ ,  $k = 7.0$ , and  $v_0 = 150$  volts. Calculate the following (18)
- (i) Capacitance  $C_0$  before the slab is inserted
  - (ii) Free charge  $q$
  - (iii) Electric field strength in the gap
  - (iv) Electric field strength in the dielectric
  - (v) Potential difference between the plates
  - (vi) Capacitance when the slab is in place.
6. (a) Explain different types of magnetic materials with examples. (12)
- (b) Derive an expression for the inductance of a solenoid of length  $l$  and area of cross-section  $A$ . (13)
- (c) A solenoid is 2 meter long and 4 cm in diameter. It has seven layers of windings of 950 turns each and carries of 6 amp/current (10)
- (i) what is the value of magnetic field at the centre
  - (ii) what is the magnetic flux  $\phi_3$  for a cross-section of the solenoid at its centre?

**PHY 157 (MME)**

7. (a) Define surface tension. Show that the excess-pressure inside a liquid drop of radius "r" over the atmospheric pressure outside it is equal to  $\frac{2T}{r}$ , where T is the surface tension of the liquid. **(10)**
- (b) Derive the expression of surface tension of water for capillary rise method. **(17)**
- (c) Water rises to a height of 5 cm in a certain capillary tube. In the same tube the level of mercury surface is depressed by 1.54 cm. Compare the surface tension of water and mercury. Given that the specific gravity of mercury is 13.6, the angle of contact for water is  $0^\circ$  and for mercury  $130^\circ$ . **(8)**
8. (a) Explain the term Poisson's ratio and discuss its limiting values. **(10)**
- (b) State and prove Bernoulli's theorem for fluid motion. **(17)**
- (c) A fire engine pumps water from a hydrant at the rate of  $10^3$  litres/sec. It ejects water from a nozzle 5 m above the surface of water in the hydrant with a velocity of 10 m/sec. Calculate **(8)**
- (i) The pressure difference between the water at the pump and the nozzle and
- (ii) Power of the engine.
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BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T-2 B. Sc. Engineering Examinations 2011-2012

Sub : **ME 141** (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) In the position as shown in the Fig. for Q. 1(a), collar B moves to the left with a velocity of 150 mm/s. Determine: (18)

- (i) The velocity of collar A  
 (ii) The velocity of portion C of the cable  
 (iii) The relative velocity of portion C with respect to the collar B of the cable.

- (b) The rotation of rod OA about O as shown in the Fig. for Q 1(b) is defined by the relation  $\theta = \frac{\pi}{2}(4t - 3t^2)$

Where  $\theta$  expressed in radians and t is in seconds. Collar B slides along the rod such that its distance from O can be given by  $r = 25t^3 - 50t^2$ . where r is expressed in millimeters and t in seconds. When  $t = 1$  s, determine (17)

- (i) The velocity of collar B  
 (ii) The total acceleration of the collar B  
 (iii) The acceleration of the collar B relative to the rod

2. (a) As shown in the Fig. for Q. 2(a), block A has a mass of 30 kg and block B a mass of 15 kg. The coefficient of friction between all surfaces in contact are  $\mu_s = 0.15$  and  $\mu_k = 0.10$ . Knowing that  $\theta = 30^\circ$ , and the magnitude of the force applied to block A, (P) is 250 N, determine (20)

- (i) The acceleration of block A (ii) The tension in the cord

- (b) A single wire ACB passes through a ring at C to a 6 kg sphere which revolves at the constant speed v in the horizontal circle as shown in the Fig. for Q. 2(b). Knowing that the tension is the same in both portions of the wire determine the speed v. (15)

3. (a) A 200 g pellet is released from rest at A and slides without friction along the surface as shown in the Fig. for Q. 3(a). Determine the force exerted by the surface on the pellet as it passes through Point B (ii) Point C. (18)

- (b) Two blocks are joined by an inextensible cable as shown in the Fig. for Q. 3(b). If the system is released from rest, determine the velocity of block A after it has moved 1.75 m. Assume that  $\mu_k = 0.25$  between block A and the plane and neglect the mass and friction of the pulley. (17)

**ME 141**

4. (a) A 2 kg sphere A is released from rest when  $\theta_A = 30^\circ$ , and strikes block B, which is at rest as shown in the Fig. for Q. 4(a). Knowing that the coefficient of restitution between the sphere and the block is 0.75 and the coefficient of kinetic friction between the floor and the block is  $\mu_k = 0.25$ , determine (20)
- (i) how far block B will move
  - (ii) the percentage of the initial kinetic energy lost in friction between the block and the floor.

- (b) In the position as shown in the Fig. for Q. 4(b), bar AB has a constant angular velocity of 3 rad/s counter clockwise. Determine the angular velocity of bars BD and DE. (15)

**SECTION - B**

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

5. (a) Two cables are tied together at C and loaded as shown in Fig. for Q. 5(a). Knowing that  $P = 500$  N and  $\alpha = 60^\circ$ , determine the tension in AC and BC. (17)

- (b) A precast concrete wall section is temporarily held by two cables as shown in Fig. for Q. 5(b). Knowing that the tension in cable BD is 900 N., determine the moment about point O of the force exerted by the cable at B. (18)

6. (a) A vertical load P is applied at end B of rod BC as shown in Fig. for Q. 6(a). The constant of the spring is k and the spring is unstretched when  $\theta = 0$ . Neglecting the weight of the rod, express the angle  $\theta$  corresponding to the equilibrium position in terms of P, k and l. (17)

- (b) One end of rod AB rests in the corner A and the other end is attached to cord BD as shown in Fig. for Q. 6(b). If the rod supports 200 N load at its midpoint C, find the reaction at A and the tension in the cord. (18)

7. (a) Determine the location of the centroid of the plane area as shown in Fig. for Q. 7(a). (17)

- (b) Determine the force in members FG and FH of the truss as shown in Fig. for Q 7(b). Given that  $P = 35$  kN. (18)

8. (a) Determine the components of the reactions at A and B, if the 500 N load is applied as shown in the Fig. for Q. 8(a). (17)

- (b) The end A of a slender, uniform rod of length L and weight W bears on a horizontal surface, while its end B is supported by a cord BC as shown in Fig. for Q. 8(b). Knowing that the co-efficients of friction are  $\mu_s = 0.30$  and  $\mu_k = 0.25$ , determine whether the rod is in equilibrium when  $\theta = 30^\circ$  and find the magnitude and direction of the friction force exerted on the rod. (18)

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ME 141  
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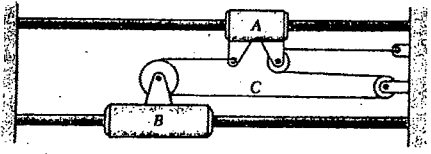


Fig. for Q 1.(a)

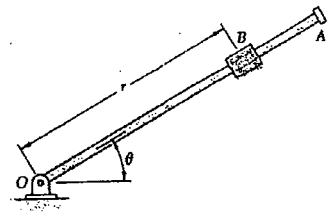


Fig. for Q 1.(b)

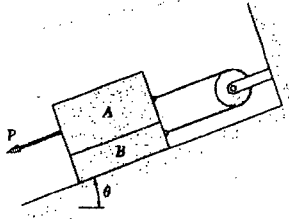


Fig. for Q 2.(a)

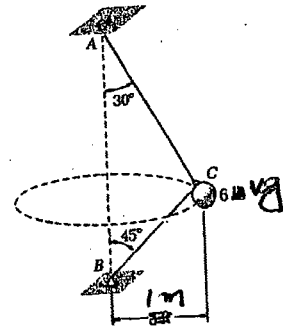


Fig. for Q 2.(b)

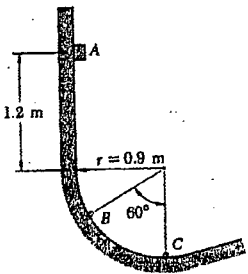


Fig. for Q 3.(a)

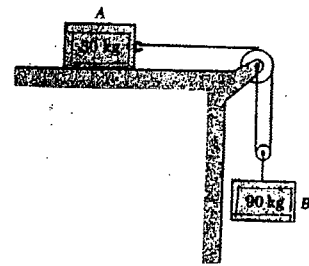


Fig. for Q 3.(b)

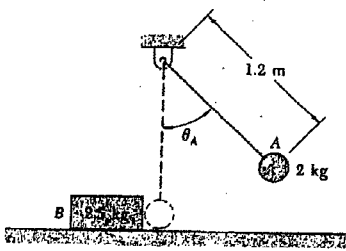


Fig. for Q 4.(a)

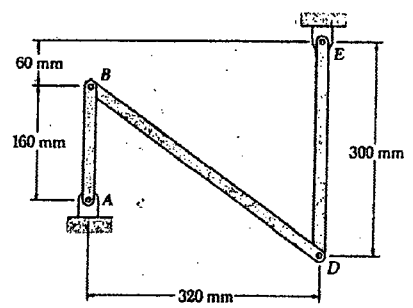


Fig. for Q 4.(b)

ME 141  
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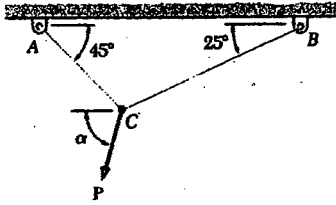


Figure for Q.5(a)

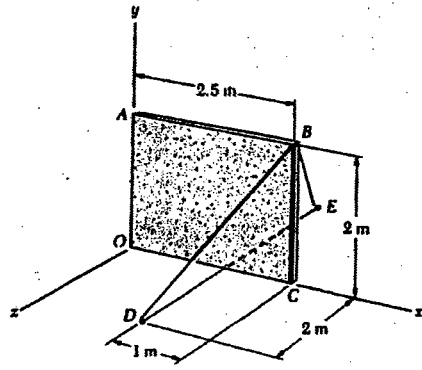


Figure for Q.5(b)

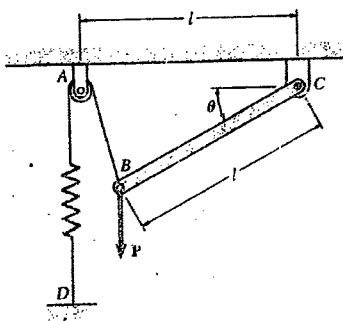


Figure for Q.6(a)

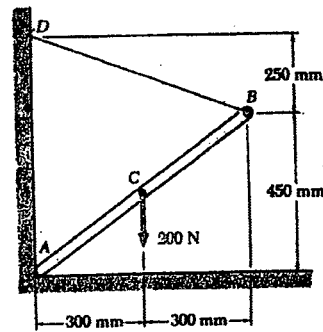


Figure for Q.6(b)

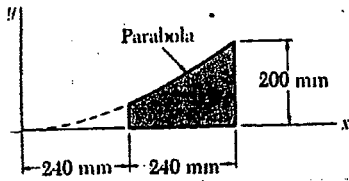


Figure for Q.7(a)

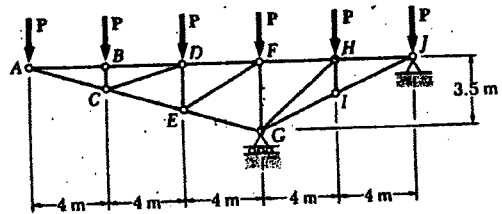


Figure for Q.7(b)

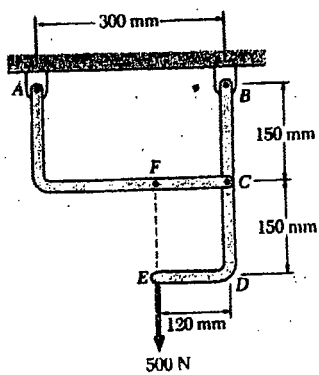


Figure for Q.8(a)

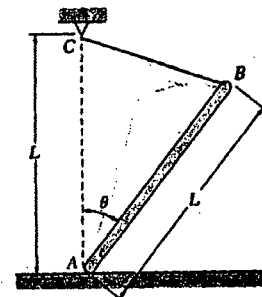


Figure for Q.8(b)

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L-1/T-2/MME

Date : 08/07/2013

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T-2 B. Sc. Engineering Examinations 2011-2012

Sub : **CHEM 121** (Organic Chemistry)

Full Marks: 210

Time : 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks.

**SECTION - A**

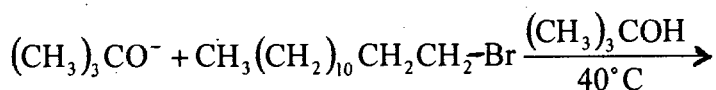
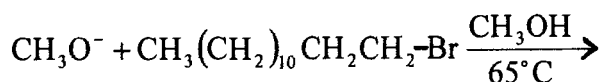
There are **FOUR** questions in this section. Answer any **THREE**.

1. (a) What are pentosans? Starting with pentosan give a synthesis to pyrrole. (6)  
(b) Prove that pyrrole is not only a weak base but also a weak acid. (7)  
(c) Explain the difference between  $SP^2$  hybridization of nitrogen in pyrrole and pyridine. (5)  
(d) Pyridine undergoes both electrophilic and nucleophilic substitution. Justify with reasons and examples. (12)  
(e) What does happen when thiophene is subjected to mild and catalytic reduction? (5)
  
2. (a) What are condensed ring heterocycles? Draw the structures of the following condensed ring heterocycles. (4+4=8)  
(i) Indole (ii) Quinoline (iii) Isoquinoline and (iv) Indigo  
(b) Write with a probable mechanism the Skraup synthesis for  $\alpha, \beta$  - Benzopyridine. (6)  
(c) Prove the following statements: (4×3=12)  
(i) Pyridine has a ring structure with 5 carbons and 1 nitrogen  
(ii) Pyridine contains a tertiary nitrogen  
(iii) Pyridine exhibits aromatic character.  
(d) Describe a commercial method for the synthesis of fibre nylon 6-6 from tetrahydrofuran (THF). (09)
  
3. (a) Classify the following alkaloids on the basis of heterocyclic rings present in them and write their structures also. (12)  
(i) Hygriene (ii) Coniine (iii) Quinine (iv) Papavarine (v) Gramine & (vi) Nicotine  
(b) Briefly discuss how the structure of coniine was established. (10)  
(c) Describe a method for the synthesis of the following two alkaloids (8)  
(i) Nicotine and (ii) Coniine  
(d) Mention some of the important physiological activities of alkaloids. (5)

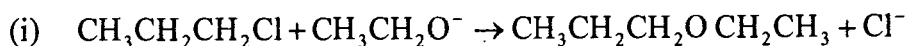
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**CHEM 121**

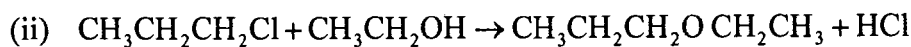
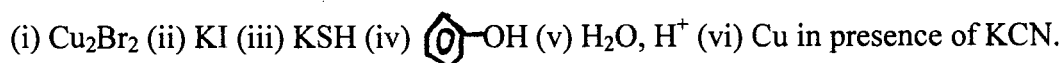
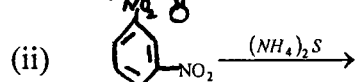
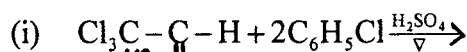
4. (a) Complete the following reactions—

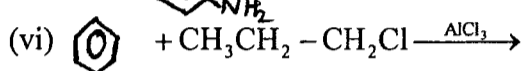
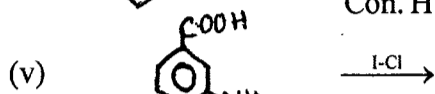
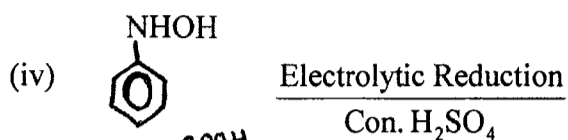
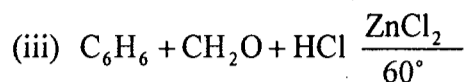
**(8+8=16)**

Predict the major products of the reactions and give the reasons of your prediction.

(b) Which  $\text{S}_\text{N}^2$  reaction of each pair would you expect to take place more rapidly in a protic solvent and why? **(7)**

or

(c) Give the structure and name of the product that would be obtained from the ionic addition of IBR to propene. Show the mechanism. **(12)****SECTION - B**There are **FOUR** questions in this section. Answer any **THREE**.5. (a) Explain with mechanism Friedel Craft's alkylation reaction and mention two important limitations. **(11)**(b) What do you understand by the term "diazotization"? Show the formation of benzenediazonium chloride citing its mechanism too. **(12)**(c) Give the reactions of benzenediazonium chloride with the following: **(12)**6. (a) Give three methods of preparation of aromatic amine. Give mechanism of at least one method. **(12)**(b) How can you prepare p-aminobenzoic from p-toluidine? Give all the possible steps. **(8)**(c) How can distinguish between chlorobenzene and benzyl chloride? **(6)**(d) How can phenyl acetic acid be synthesised from benzene. **(9)**7. (a) Describe the effect of ring activator and deactivators in benzene disubstitution reaction. **(6)**(b) Complete the following reactions and name the products: **(12)**

**CHEM 121****Contd... Q. No. 7(b)**

(c) Consider the general problem of converting a tertiary alkyl halide to an alkene, eg, the conversion of tert-butyl chloride to 2-methyl-propene. What experimental condition should be chosen to ensure that elimination is favoured over substitution? (9)

(d) If the goal of a synthesis is to prepare chloromethane ( $CH_3Cl$ ), its formation can be maximized and the formation of  $CH_2Cl_2$ ,  $CHCl_3$  and  $CCl_4$  minimized by using large excess of methane in the reaction mixture. Explain why this is possible? (8)

8. (a) How will you distinguish between enantiomers and diastereomers? Write the enantiomeric forms of bromochlorofluoromethane and assign each enantiomer its correct (R) or (S) designation. (5+5=10)
- (b) When 3,3-dimethyl-2-butanol is heated with acid, is slowly converted into an 85 : 15 mixture of two alkenes of formula  $C_6H_{12}$ . What are these alkenes? Give the mechanism of the reaction. Which one is the major product and why? (2+8+5=15)
- (c) How will you synthesize isopropyl alcohol from (i) acetone (ii) propene. (5+5=10)
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