

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
 B.Sc. Engineering 1st Year 2nd Term Examination, 2024
 Department of Computer Science and Engineering
 CSE 1203
 Digital Logic Design

TIME: 3 hours

FULL MARKS: 210

- N.B. i) Answer **ANY THREE** questions from each section in separate scripts.
 ii) Figures in the immediate right column of the questions indicate full marks.
 iii) The rightmost column indicates course outcomes.

SECTION A

(Answer **ANY THREE** questions from this section in Script A)

1. a) What is Gray code? Determine a combination for Gray code. (08) [CO1]
- b) A majority gate is a digital circuit whose output is equal to 1 if the majority of the inputs are 1's. The outputs are 0 otherwise. By means of a Truth Table, find the Boolean function implemented by a 3-input majority gate. Simplify the function. (10) [CO2]
- c) An industrial chemical tank has three sensors located at different heights: Low (L), Medium (M), and High (H). The operational constraints regarding the valid states of the sensors are as follows: (17) [CO3]
 - When the liquid covers a sensor, the sensor outputs a logic 1, otherwise 0.
 - Since the liquid fills from the bottom up, it is physically impossible for a higher sensor to be 1 if a lower sensor is 0 (e.g., High=1 while Low=0 is an error).

An engineer needs to design a sensor error detection circuit that monitor these sensors. The circuit should output an ALARM (A=1) if it detects any physically impossible combination of sensor states (sensor malfunction). Otherwise, the ALARM output should be 0.

- i) Determine the Truth Table for the inputs (H, M, L) and the output (A).
- ii) Simplify the Boolean function for A using a K-Map.
- iii) Draw the logic diagram using minimum logic gates.

2. a) Plot the following functions on the K-Map and determine the minimum POS form: (12) [CO2]

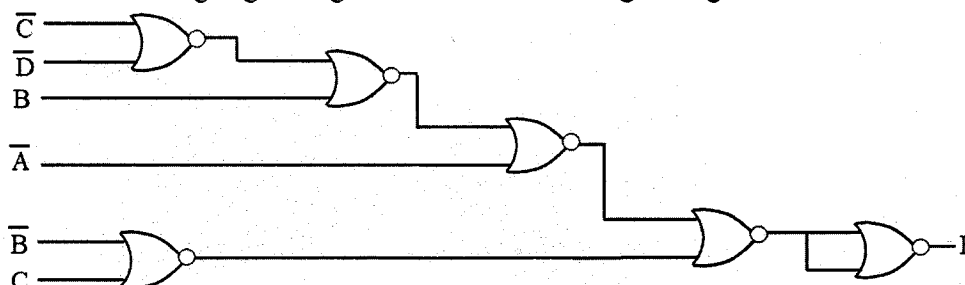
$$F(A, B, C, D) = (A + D')(A + B')(B + D')(A' + C + D)$$
- b) Find the complements of the following Boolean functions and reduce them to minimum number of literals: (10) [CO2]

$$F(A, B, C, D) = (AD' + B'D)(AC' + BD')$$
- c) Perform BCD addition to add $(+738)_{10}$ and $(-832)_{16}$ by applying the radix complement. (13) [CO1]

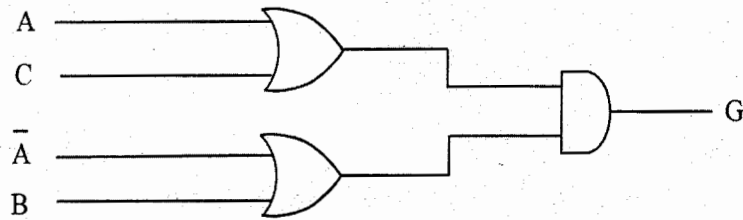
3. a) A digital system requires a customized comparator circuit for a voting system with three members: Chairperson (C), Member 1 (M1), and Member 2 (M2). Each member votes either YES (1) or NO (0). The circuit output Pass (P) is determined by the following rules: (15) [CO3]
 - If the Chairperson (C) votes YES, the vote passes if at least one other member votes YES.
 - If the Chairperson (C) votes NO, the vote passes only if both M1 and M2 vote YES (a veto override).

Now, design the circuit using a 4-to-1 Multiplexer. Use M1 and M2 as the selection lines and derive the inputs for the Multiplexer.

- b) Construct a 5×32 decoder with four 3×8 decoders/demultiplexers and a 2×4 decoder. (06) [CO2]
 Use a block diagram construction.
- c) What are the steps of combinational circuit design procedure? (04) [CO1]
- d) Convert the following logic diagram into AND-OR logic diagram. (10) [CO2]



4. a) Determine if the following circuit is hazard-free. If not, modify the circuit to eliminate the hazard. (10) [CO2]

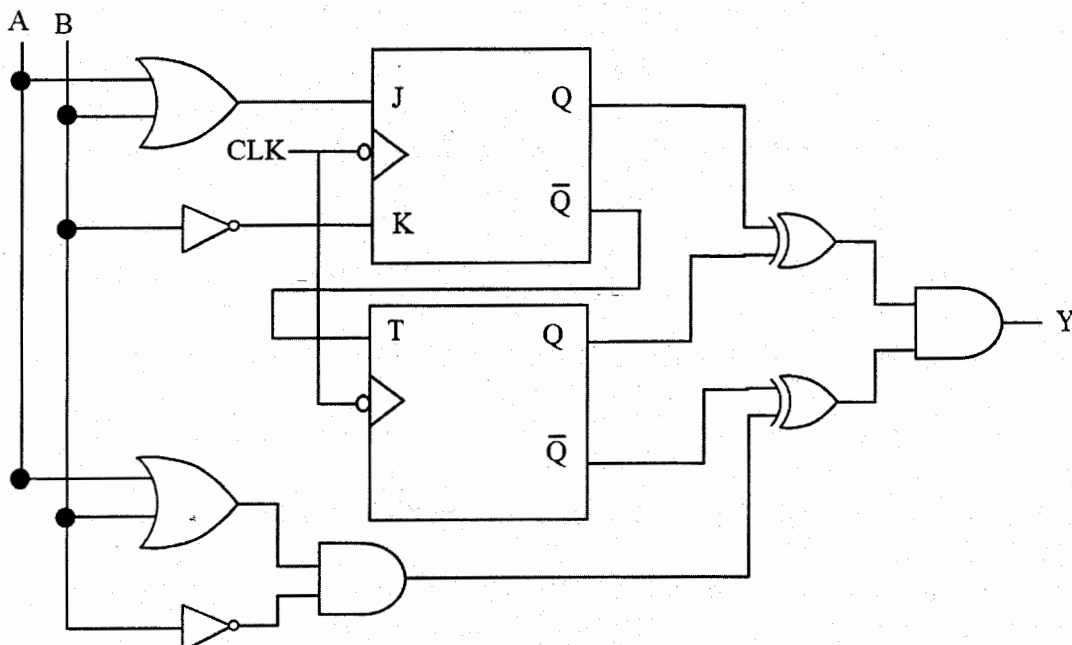


- b) A fully automated factory uses a 4-bit Binary Coded Decimal (BCD) sensor to identify boxes on a conveyor belt. The sensor reads the Box ID (A, B, C, D) ranging from 0 to 9. (Assume input combinations 10 to 15 never occur and can be treated as don't cares). You need to design the Routing Controller using a Programmable Logic Array (PLA). The controller has three output signals that activate diverter arms. The operational constraints for the diverter arms are as follows:
- *Priority Lane (P)*: Activates if the Box ID is a Prime Number (2, 3, 5, 7).
 - *Maintenance Lane (M)*: Activates if the Box ID is a Multiple of 3 (0, 3, 6, 9).
 - *Odd Lane (O)*: Activates if the Box ID is an Odd Number.
- i) List the Truth Table for the inputs and three outputs (P, M, O).
 - ii) Obtain the simplified Boolean expressions for P, M, and O in Sum-of-Products form. Identify common product terms that can be shared between outputs to minimize the PLA size.
 - iii) Construct the PLA Program Table. Specify the input buffers (True/Complement), the product terms, and the connections to the OR gates (outputs).
- c) State any three reasons why PLA is often preferred than ROM for implementing combinational logic. Design a 2048-bit ROM which word size is 8 bits. (10) [CO1]

SECTION B

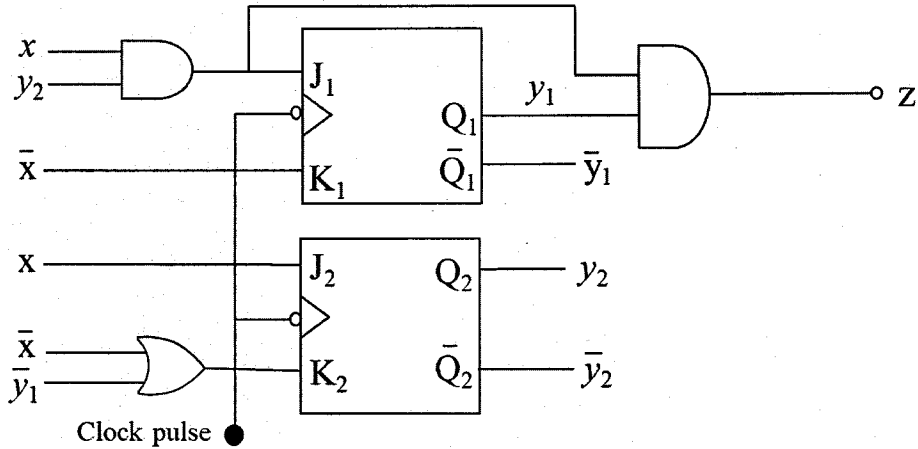
(Answer ANY THREE questions from this section in Script B)

5. a) Can race-around condition occur in a T flip-flop? Describe how this condition occurs in a JK flip-flop with proper timing diagrams. And discuss the techniques to overcome it. (13) [CO4]
- b) Explain the process of converting a level-triggered memory element into an edge-triggered one. Why are edge-triggered devices generally preferred in synchronous digital systems? Provide proper block and timing diagrams to support your explanation. (14) [CO4]
- c) Determine whether the following sequential circuit represents a Mealy or Moore machine. Also explain the fundamental differences between these two models. (08) [CO3]

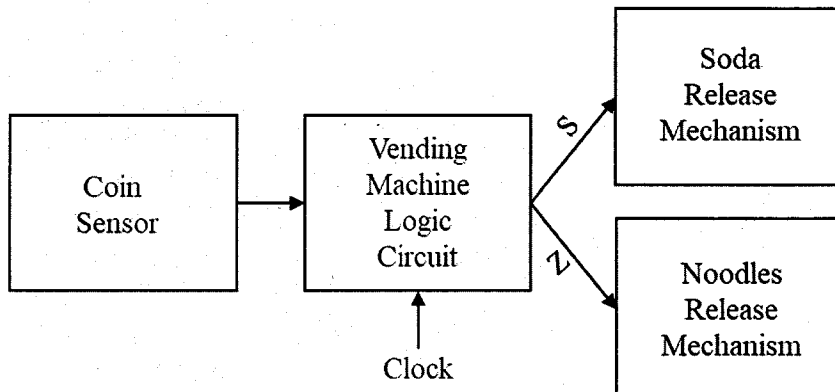


6. a) Design a sequential circuit that continuously reads a serial stream of input bits and outputs a "1" whenever it detects the sequence "1011". Derive the state equations using a T flip-flop and a D flip-flop. Explain all the steps of this design process with necessary diagrams and tables. (17) [CO3]
- b) What is a register? Design the 4-bit parallel-in serial-out shift register with a load line using D flip-flops. (11) [CO1]
- c) Compare a 4-bit sequential and combinational adder in terms of speed, hardware, and operation. Which design is preferable? (07) [CO4]

7. a) What is sequential circuit? Explain the functional models of sequential circuits. (09) [CO1]
 b) "Circuit design with JK flip-flop gives more don't care options with respect to other flip-flops" – justify the statement with flip-flop excitation tables. (09) [CO2]
 c) Analyze the following sequential circuit in terms of the followings: (17) [CO3]
 (i) Input and output equations,
 (ii) State diagram,
 (iii) State table, and
 (iv) Timing diagram for $x = 001110$ and $y_1^0 y_2^0 = 10$ (initial state).



8. a) Design a Ripple counter which counts from 3-to-6. (12) [CO3]
 b) Suppose you are engineer working for a hardware-design company. Your supervisor has asked you to design a logic circuit for a vending machine operation, that's specifications are: (18) [CO3]
 i) Deliver a soda bottle after 5 coins are deposited.
 ii) Deliver a package of instant noodles after 15 coins deposit.
 iii) There is no change of coins.
 iv) Release mechanism is activated with the following output signals:
 • $S = 1$, a soda bottle is dispensed.
 • $N = 1$, a pack of instant noodles is dispensed.
 Now, design the sequential circuit with described constraints in mind.



- c) Note down the differences between an asynchronous and a synchronous counter. (05) [CO1]

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 1st Year 2nd Term Examination, 2024
Department of Computer Science and Engineering
CSE 1205

Object Oriented Programming

TIME: 3 hours

FULL MARKS: 210

- N.B. i) Answer **ANY THREE** questions from each section in separate scripts.
ii) Figures in the immediate right column of the questions indicate full marks.
iii) The rightmost column indicates course outcomes.

SECTION A

(Answer **ANY THREE** questions from this section in Script A)

1. a) "Constructors should be declared as public", do you agree with this statement? If yes, (10) [CO1] then is there any exception to this? Explain with example.
b) Define destructors in OOP. What are the times when it is invoked automatically? Can (10) [CO1] they be called explicitly?
c) Analyze how the pairing of constructors and destructors changes the fundamental (15) [CO2] definition of an object compared to a C "struct". Explain with suitable example.

2. a) Describe the diamond problem of multiple inheritance. How do different languages (12) [CO1] handle the diamond problem?
b) Differentiate between method overloading and overriding. (05) [CO1]
c) Design a C++ architecture for the "Nig-Home" automation system. The system (18) [CO3] manages generic "SmartDevice" objects (containing "deviceID", "brand", and "isOn"), which serves as parent for specific devices like "SmartLight" (adds "brightness") and "Thermostat" (adds "temperature"). The system hierarchy is defined by two specific lifecycle rules:
"A house is made up of Rooms. A room contains SmartDevices. If you destroy the house, the rooms will be destroyed. However, the smart devices may be moved elsewhere (i.e., another house)."
You may design it using diagrams or pseudocodes.

3. a) "Virtual destructors are useful, where virtual constructors are useless". Do you agree (10) [CO1] with this statement? Justify your decision.
b) Differentiate between abstract class and interface. Describe how will you create an (10) [CO1] interface using a language like C++, where "interface" keyword is not defined.
c) Consider a scenario where you have a base class pointer "Animal *ptr" that (15) [CO3] currently points to a Lion object in memory. You mistakenly attempt to cast this to an unrelated derived type (Bird*). Compare the behaviour of C-style cast against C++ dynamic-cast in this scenario.

4. a) "It is preferable to use unnamed namespace over static declaration, in the case of (10) [CO4] restricting access to a global variable to a single file". Do you agree with the statement? Justify your answer.
b) "The 'using namespace x;' directive is convenient, yet risky". Justify the (10) [CO4] statement.
c) Describe the error scenarios that may arise while handling as exception. (08) [CO4]
d) "Destructors shouldn't throw any exception". Do you agree with the statement? (07) [CO2] Justify your answer.

SECTION B

(Answer **ANY THREE** questions from this section in Script B)

5. a) Create two classes, Point and Triangle. The Point class stores the coordinates (x, y) of (15) [CO2] a point, while the Triangle class stores three point objects as its vertices. Write a program that reads three points from the user and uses a friend function to calculate and display the area of the triangle.
b) What are the ways to insert a custom object in a set? Explain with appropriate code (08) [CO4] only.

- c) Determine the output of the following code. Design a comparator that stores the elements in descending order. (12) [CO4]

```
class Lsb_less{
public:
    bool operator()(int x,int y){
        return(x%10)<(y%10);}
};
set<int,Lsb_less> S = {21, 23, 26, 27};
set<int,Lsb_less> :: iterator itr1,itr2;
itr1 = find(s.begin(), s.end(), 36); // output = ??
itr2 = s.find(36); // output = ??
```

6. a) In the realm of C++, the allocation of memory dynamically can be accomplished using both 'new' and 'malloc' methods. Which one do you prefer, and why? Justify your choice with an example. (10) [CO2]
- b) Imagine you are on a team developing an online classroom management system for a big university. The system has several components, including a user module with a Student class, a course management module with a Course class, and an assessment module with a Quiz class. These components need to share some common data across the whole system. Explain with code examples how would you use static member variables inside these classes to maintain and store this global information. (15) [CO1]
- c) Describe the problem with shallow-copy. Provide proper solutions to these problems with example. (10) [CO2]
7. a) Describe the concept of custom signal handlers and their importance in application development. Demonstrate how to set up a custom signal handler for the SIGINT signal and specify what action it should perform when the signal is received. (10) [CO4]
- b) Mr. X is developing an inventory system for a large warehouse. To handle different kinds of items, he decides to create a generic class named 'Item' with two member variables 'itemcode', which is an integer by default but may vary, and item 'itemcost', which can store a floating point value representing the cost. Now, design the generic item class with a default constructor and a parameterized constructor so that it can manage a wide variety of item types and their respective costs. (15) [CO4]
- c) What problem arises in the following code scenario? How can you solve this problem? Explain with proper code. (10) [CO2]

<pre>class Data{ int *data; }; void process() { data *pData = new Data(); }</pre>	<pre>int main() { while(1) { process(1); } }</pre>
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8. a) "The speed benefits of using inline functions diminish as the function grows in size". Justify this statement by discussing the relationship between function size, inline function optimization. (10) [CO1]
- b) Consider the following program. Apply operator overloading using friend function to overload required operators of Product class, such that program executes without any error. (13) [CO3]

<pre>class Product{ public: int product_id; string product_name; double product_price; };</pre>	<pre>int main() { ifstream in("input.txt"); ofstream out("output.txt"); Product p; in>>p; out<<p; }</pre>
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- c) What will be the problem when you write the following code segment? How can you fix the problem using `std::unique_ptr`, and are there any other smart pointers that could be used to solve this issue? If so, explain how those alternative smart pointers can be utilized to resolve the problem. (12) [CO4]

```
unique_ptr <Myclass> myptr(newMyclass());
unique_ptr <Myclass> myptr2 = myptr;
```

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
 B.Sc. Engineering 1st Year 2nd Term Examination, 2024
 Department of Computer Science and Engineering
 EEE 1207

Basic Electrical Engineering

TIME: 3 hours

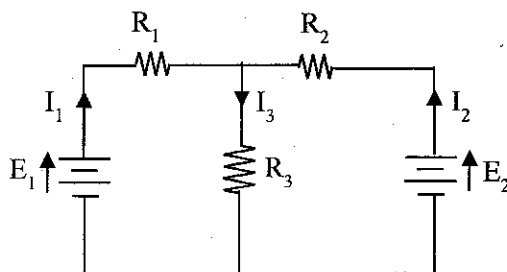
FULL MARKS: 210

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 ii) Figures in the immediate right column of the questions indicate full marks.
 iii) The rightmost column indicates course outcomes.
 iv) BH Curve will be supplied.

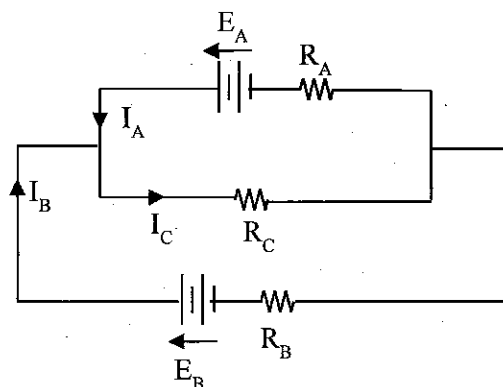
SECTION A

(Answer **ANY THREE** questions from this section in Script A)

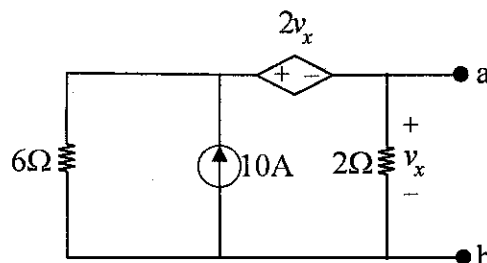
1. a) Transfer delta network to equivalent wye network and wye network to equivalent delta network with necessary diagrams. (10) [CO1]
 b) Suppose, you have the following electrical network. Find the different currents by using (i) Branch current method, (ii) Mesh current method, and (iii) Nodal method. (14) [CO4]
 Given: $E_1 = 12V, E_2 = 10V, R_1 = 4\Omega, R_2 = 2\Omega, R_3 = 8\Omega$



- c) For the following electrical network, calculate $I_A, I_B,$ and I_C using the superposition theorem. (11) [CO4]
 Given: $E_A = 30V, E_B = 120V, R_A = 50\Omega, R_B = 20\Omega, R_C = 15\Omega$.



2. a) Explain Millman's theorem. (10) [CO1]
 b) Find the Norton's equivalent of the following electrical network. (13) [CO4]



- c) State and explain Ampere's Circuit law and Biot-Savart law. Compare between electrical circuit and magnetic circuit in a tabular form. (12) [CO1]
3. a) Derive an expression to relate magnetic field intensity (H) and flux density (B) suitable for an air-gap of a magnetic circuit. (10) [CO3]
 b) A magnetic circuit is realized by a cast-steel ring of circular cross section. The outside diameter of the ring is 8 inch and inside diameter is 6 inch. Find the MMF necessary to establish a flux of 0.0006 weber. (10) [CO3]
 c) Classify DC Generators and draw their circuit diagrams. A shunt generator delivers 450A at 230V and resistance of the shunt field and armature are 50Ω and 0.03Ω respectively. What is the value of generated voltage? (15) [CO2]

4. a) What is the significance of back emf in a dc motor? Derive the condition for maximum power in a dc motor. Is the condition realized in practice? Explain shortly. (10) [CO1]
- b) A 25KW, 250V dc shunt generator has R_a and R_{sh} of 0.06Ω and 100Ω respectively. Determine the power developed when working (i) as a generator delivering 25KW output and (ii) as a motor taking 25KW input. (11) [CO2]
- c) What are the factors that control motor speed? Describe any two of them. (14) [CO2]

SECTION B

(Answer ANY THREE questions from this section in Script B)

5. a) Explain the following terms with necessary illustration. (10) [CO1]
(i) Oscillating current, (ii) Periodic current, (iii) Alternating current, (iv) Period, and (v) Cycle.
- b) Draw R-L, R-C, and R-L-C circuits and draw the impedance vector diagrams for each case mentioning their respective equations. (14) [CO1]
- c) What is phasor? Write the significance of operator j . Find all possible roots of the expression shown below (11) [CO2]

$$\sqrt[3]{\frac{10\angle 70^\circ}{3-j4} + \log_e(8+j5)}$$

6. a) Deduce the values of form factor and crest factor of a sinusoidal wave. What is power factor? (10) [CO1]
- b) An impedance $Z_1 = 8 - j5$ is in parallel with an impedance $Z_2 = 3 + j7$ ohms. Find the resultant impedance of the combination. What is the overall power factor? (12) [CO2]
- c) What are the differences between alternator and synchronous motor? Write the advantages of stationary armature in an alternator. Describe v-curves. (13) [CO1]
7. a) Deduce the expressions for the amount of energy stored during a quarter cycle of an inductor and a capacitor. Show that the power absorbed by pure inductive capacitive load is zero. (13) [CO1]
- b) Draw the different equivalent circuits of a transformer with proper explanations. (09) [CO1]
- c) Mention the differences between stepper motor and conventional DC/AC motors. Write the applications of stepper motor. Classify stepper motors and also describe any one. (13) [CO2]
8. a) Describe the working principle of a single-phase transformer. (10) [CO4]
- b) What are the losses in a transformer? Define commercial efficiency and all-day efficiency. Find the condition for maximum efficiency. (12) [CO2]
- c) What are the different types of 3- ϕ transformer connections? Describe them briefly. Write advantages and drawbacks of 3- ϕ transformer. (13) [CO4]

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 1st Year 2nd Term Examination, 2024
Department of Computer Science and Engineering
CHEM 1207
Chemistry

TIME: 3 hours

FULL MARKS: 210

- N.B. i) Answer **ANY THREE** questions from each section in separate scripts.
ii) Figures in the immediate right column of the questions indicate full marks.
iii) The rightmost column indicates course outcomes.

SECTION A

(Answer **ANY THREE** questions from this section in Script A)

1. a) Define unit cell and crystal lattice. Derive the relation $n\lambda = 2d \sin \theta$ in crystallography. (10) [CO2]
b) What is Miller indices? Draw a crystal plane which is cut through the crystal axes $2a$, $-3b$, c . (08) [CO2]
c) Define crystal defects. Explain how crystal defects influence mechanical properties, including ductility and hardness. (09) [CO4]
d) What is semiconductor? Why is silicon classified as a semiconductor? Draw unit crystal structure of silicon. (08) [CO3]
2. a) Define hydrogen bonding. Differentiate between intermolecular and intramolecular hydrogen bonding with examples. (08) [CO2]
b) Using VBT and hybridization concepts, explain the bonding and geometry of BF_3 and NH_3 . (10) [CO2]
c) What is bond order? Predict on bond order and magnetic nature of H_2 , H_2^- , O_2^+ and O_2^- species. (10) [CO1]
d) Predict on nature of bonding and density of ice of South pole of the earth. (07) [CO2]
3. a) Define intercalation in Li-ion battery. Explain the working principle of Li-ion battery during charging and discharging. (10) [CO2]
b) Illustrate the role and formation mechanism of the solid electrolyte interface (SEI) layer. (10) [CO1]
c) Compare Ni-Cd and Li-ion batteries in terms of suitability for mobile computing. (08) [CO2]
d) Calculate the EMF of the cell:
$$\text{Zn}|\text{Zn}^{2+}(0.001 \text{ M})||\text{Ag}^+(0.1 \text{ M})|\text{Ag}$$

The standard potential of $\text{Ag}|\text{Ag}^+$ half cell is 0.080V and $\text{Zn}|\text{Zn}^{2+}$ is -0.76V . (07) [CO5]
4. a) Define EMF and voltage. Derive the relation between EMF and free energy. (10) [CO1]
b) What is ion selective electrode? How does an ion selective electrode convert ionic activity into a measurable voltage? (09) [CO2]
c) Find the pH of a solution placed in a hydroquinone half cell which was coupled with standard calomel electrode. The emf of the combined cell was determined to be 0.123V at 25°C. (07) [CO2]
d) Illustrate the various vibrational modes of molecule in IR spectroscopy using suitable diagrams. (09) [CO4]

SECTION B

(Answer **ANY THREE** questions from this section in Script B)

5. a) Define secondary reaction and photosynthesis process. (08) [CO1]
b) State and explain the laws of photochemistry. (10) [CO5]
c) What is low quantum yield reaction? Calculate the no. of photons absorbed in a photochemical reaction having quantum yield 100 and the products formed are 10,000 mole. (10) [CO5]
d) Explain the Jablonski diagram. (07) [CO5]
6. a) Define degree of polymerization with examples. (08) [CO1]
b) What is free radical? Describe the free radical mechanism of polymerization process. (10) [CO2]
c) Synthesize Bakelite and Nylon-6 polymers. (10) [CO5]
d) How can you get workable rubber from natural source? (07) [CO2]

7. a) Define p-type and n-type conducting polymers. (08) [CO5]
b) Synthesize a conducting polymer giving the formation mechanism and mention applications. (10) [CO5]
c) Describe the conduction mechanism of conducting polymer considering the band theory. (10) [CO2]
d) Explain the photosensitized reaction. (07) [CO5]
8. a) What is cytotoxicity? Compounds A and B having LD_{50} 5mg/kg and 50mg/kg respectively. Compare the toxic nature of these two compounds. (08) [CO1]
b) Discuss the impacts of nuclear hazards on plants and human body. (10) [CO5]
c) Outline the role of pollutants that cause the air pollution. (10) [CO1]
d) Explain the importance of nitrogen cycle and thunderstorm on plants and animal lives. (07) [CO1]

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 1st Year 2nd Term Examination, 2024
Department of Computer Science and Engineering
Math 1207

Coordinate Geometry and Differential Equations

TIME: 3 hours

FULL MARKS: 210

- N.B. i) Answer **ANY THREE** questions from each section in separate scripts.
ii) Figures in the immediate right column of the questions indicate full marks.
iii) The rightmost column indicates course outcomes.

SECTION A

(Answer **ANY THREE** questions from this section in Script A)

1. a) Define invariants. Give an example of invariants. (04) [CO1]
b) Find the angle through which the rectangular axes can be rotated so that the expression $x^2 + 6\sqrt{2}xy + y^2$ is transformed into $5x^2 + 2\sqrt{2}xy - 3y^2$. (06) [CO2]
c) Transform the equation $17x^2 + 18xy - 7y^2 - 16x - 32y - 18 = 0$, into another form where are no terms involving x and y . (10) [CO3]
d) Reduce the equation of curve $3x^2 + 4xy + 3y^2 + 4x - 4y + 5 = 0$ to the standard form and find its latus rectum length. (15) [CO4]

2. a) Define direction cosines of a line. (02) [CO1]
b) If $P(2, 2, 3), Q(-4, -1, 5), R(0, 3, 4)$ are three points and "O" is the origin, then find the projection of PQ segment on the OR line. Find also the angle between the line PQ and the x -axis. (10) [CO3]
c) Find the cylindrical and spherical polar coordinates for a point whose cartesian coordinates are $(2, -2\sqrt{3}, 4)$. (12) [CO2]
d) Determine the equation of plane which passes through the intersection line of two planes $x - 2y = 0$ and $3z + 2y = 0$, and perpendicular to the plane $6x - 6y + 7z - 1 = 0$. (11) [CO3]

3. a) Determine the equation of the plane passing through the points $(2, 2, 1), (1, -2, 3)$ and parallel to the line joining the points $(2, 1, -3), (-1, 5, -8)$. (11) [CO3]
b) Find the length of the shortest distance (S.D.) between two skew-lines $\frac{x-1}{2} = \frac{y-2}{3} = \frac{z-5}{4}$ and $\frac{x-2}{2} = \frac{y-4}{4} = \frac{z-3}{5}$. Find also the coordinates of the points where the S.D. line meets the given two lines. (12) [CO3]
c) Find the equation of a sphere in which the circle $x^2 + y^2 + z^2 - 2x + 4 = 0$, $6x + 2y + 4z + 38 = 0$ is a great circle. (12) [CO3]

4. a) What is meant by a right circular cone? (03) [CO1]
b) Find the equations of a right circular cone whose vertex is at $(1, 1, 0)$ and base is the curve, $y = 0, x^2 + z^2 = 4$. (10) [CO3]
c) Find the angle between the line $2x + 4y - 2z + 3 = 0 = 4x - 2y + 2z + 5$ and the plane $5x - 4y + 3z - 5 = 0$. (10) [CO2]
d) Reduce the equation $3x^2 - y^2 - z^2 + 6yz + 6y - 6x - 2z - 2 = 0$ to the standard form and state the nature of the conicoid. (12) [CO4]

SECTION B

(Answer **ANY THREE** questions from this section in Script B)

5. a) Define order and linearity of an ordinary differential equation (D.E.). (04) [CO1]
b) Transform $xy = Ae^x + Be^{-x} + 2x$, into differential equation, where A and B are arbitrary constants. (08) [CO2]
c) Solve $\frac{dy}{dx} = \sin(x + y)$. (11) [CO3]
d) Identify whether the equation $xy dx = (x^2 + y^2) dy$ is homogeneous or not. Hence solve it. (12) [CO3]

6. a) Solve the D.E. $(x^3 + y^2\sqrt{x^2 - y^2}) dx - (xy\sqrt{x^2 - y^2}) dy = 0$. (12) [CO3]
b) Solve $x \frac{dx}{dy} + \sin 2y = x^4 \cos^2 y$. (12) [CO3]
c) Solve the D.E. $(4x - 2y + 1) dy = (12x - 6y + 1) dx$. (11) [CO3]

7. a) Solve $(D^2 - 4D + 4)y = x^2 e^{2x}$, where $D = \frac{d}{dx}$. (12) [CO3]
b) Solve the D.E. $(D^2 + 3D + 2)y = x \sin 3x$. (12) [CO3]
c) Solve the partial D.E. $2r - 5s + 2t = 24(y - x)$, (11) [CO3]
where $r = \frac{\partial^2 z}{\partial x^2}$, $s = \frac{\partial^2 z}{\partial x \partial y}$, and $t = \frac{\partial^2 z}{\partial y^2}$.
8. a) Define Ordinary and Singular Points. (04) [CO1]
b) Solve $\frac{\partial u}{\partial t} = 3 \frac{\partial u}{\partial x}$ $u(x, 0) = 8e^{-2x}$ by the method of separation of variables. (15) [CO4]
c) Solve the D.E. $2x^2 y'' - xy' + (x - 5)y = 0$ in some interval $0 < x < \mathbb{R}$ using the Frobenius method. (16) [CO4]