

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY  
 B.Sc. Engineering 1<sup>st</sup> Year 2<sup>nd</sup> Term Examination, 2022  
 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.

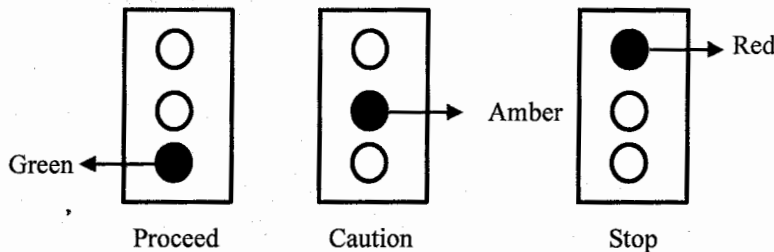
**SECTION A**

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

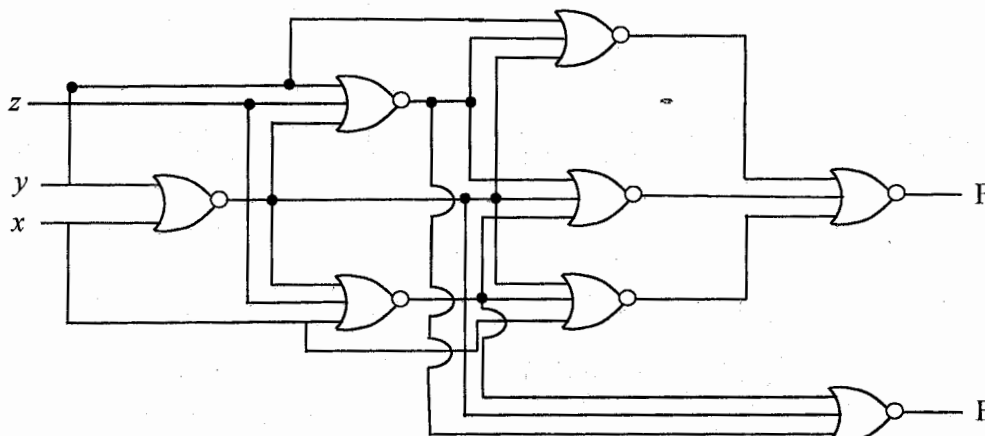
1. a) "Gray code is called reflective code". Explain the statement with an example. (05) [CO1]
- b) Design a combinational circuit with 3 inputs  $x, y,$  and  $z$  and 3 outputs:  $A, B,$  and  $C$ . (10) [CO2]  
 When the binary input is 0, 1, 2, or 3. The binary output is positive odd numbers less than 8 respectively. When the binary input is 4, 5, 6, or 7, the binary outputs is positive even number less than 8 respectively.
- c) Perform BCD addition to add  $(+965)_{10}$  and  $(-731)_{10}$ . (Use the diminished radix complement if necessary). (10) [CO1]
- d) Express the following function in sum of minterms and product of maxterms. (10) [CO2]  

$$F(A, B, C, D) = A(B' + D) + D'A$$

2. a) What is a parity checker? Derive the circuits for a 3-bit parity generator and a 4-bit parity checker using an even parity bit. (10) [CO2]
- b) A hardware engineer has been asked to design a logic circuit that tests the operation of a traffic light. If the control circuitry for the traffic light malfunctions, it is possible that an invalid combination of signal lamps will appear. The sole purpose of the test circuit is to detect any invalid combinations, and then generate an error signal that can be conveyed to the city traffic light maintenance crew. The valid combinations are shown in the following figure. Design the requested circuit following the combinational circuit design procedure. (15) [CO3]



- c) Simplify the Boolean function  $F(w, x, y, z) = \sum(3,7,8,10,11,15)$ , where the don't care conditions are  $d(w, x, y, z) = \sum(0,2,6)$ , in sum of products and product of sums. (10) [CO1]
3. a) "NOR and NAND gates are functionally complete" – justify this statement. (10) [CO2]
- b) Design a 4-bit parallel adder-subtractor using carry look-ahead circuit. (15) [CO3]
- c) Construct an  $8 \times 4$  RAM with all necessary control signal input. (10) [CO3]
4. a) Write down the output Boolean functions and truth table for following circuit. What is the function of the circuit? (12) [CO1]

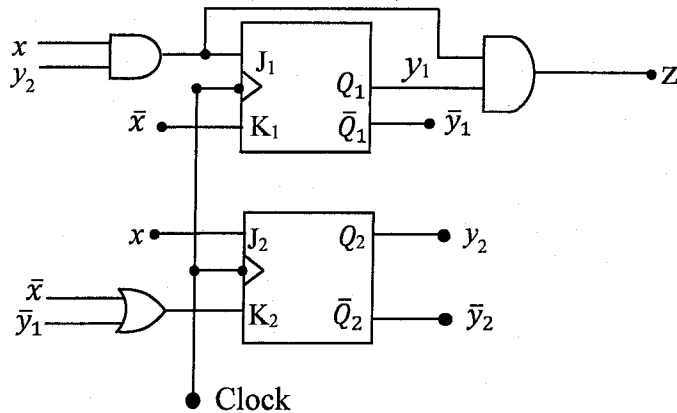


- b) By using of personality matrix. Implement following functions using PLA. (10) [CO1]
- (i)  $X(A, B, C) = \sum(2,3,5,7)$ ,
  - (ii)  $Y(A, B, C) = \sum(0,1,5)$ , and
  - (iii)  $Z(A, B, C) = \sum(0,2,3,5)$
- c) Suppose, you need a 3-bit binary to gray code converter for an experiment. But in lab, you could not find enough basic gates, instead you found plenty of 4 to 1 MUX. Can you use such MUX to design code converter? If possible then design the circuit. (13) [CO2]

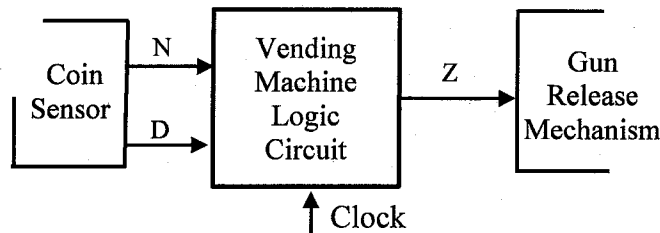
**SECTION B**

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

5. a) What is a sequential circuit? Explain the functional models of sequential circuits. (10) [CO1]
- b) "If  $\bar{Q}$  output of a D-flip-flop is connected to the D input then it acts as a T-flip-flop" - justify the statement. (07) [CO1]
- c) Analyze the following sequential circuit in terms of the followings: (18) [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).



6. a) Design a synchronous counter with T-flip-flop for the binary sequence 2, 1, 0, 7, 3, 4, and repeat. (10) [CO3]
- b) What is a register? Explain the operation of a 4-bit shift register with parallel load designed with D flip-flops. (10) [CO1]
- c) Suppose you are a hardware engineer working for a company. Your supervising manager has ask you to design a logic circuit for a vending machine operation. The vending machine needs to meet the following specifications: (15) [CO3]
- (i) Deliver a package of gum after 15 cents deposited,
  - (ii) Single coin slot for dimes (10 cents) and nickels (5 cents),
    - N=1, when a nickel is deposited, •D=1 when a dime is deposited,
  - (iii) There is no change of coins.



Now design the logic circuit using sequential circuit design steps.

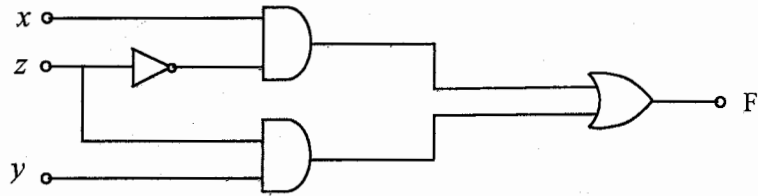
7. a) What do you mean by state reduction and state assignment? Reduce the number of states in the following state table. Hence, give an optimal state assignment. (13) [CO1]

Present State	Next State		Output	
	$x = 0$	$x = 1$	$x = 0$	$x = 1$
a	f	b	0	0
b	d	c	0	0
c	f	e	0	0
d	g	a	1	0
e	d	c	0	0
f	f	b	1	1
g	g	h	0	1
h	g	a	1	0

b) What is a BCD counter? Design a BCD counter with JK flip-flops. (13) [CO3]

c) What is a Johnson counter? Draw and explain the operation of a 4-bit Johnson counter. (09) [CO1]

8. a) Define the different kind of hazards that may present in a combinational network. (10) [CO2]  
Identify the kind of hazard present in the following circuit. Explain how to remove it from the circuit.



b) What is a ripple counter? Draw a 4-bit decade counter circuit and explain its operation. (10) [CO1]

c) What is the function of a sequence detector? Design a circuit that detects a sequence of three consecutive 1's in a string of bits coming through an input line (Serial bit stream). (15) [CO3]

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY  
 B.Sc. Engineering 1<sup>st</sup> Year 2<sup>nd</sup> Term Examination, 2022  
 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) Differentiate among composition, aggregation and inheritance with appropriate example(s). (12) [CO1]
  - b) What is the problem of shallow copy? Provide a solution to this problem with coding example. (10) [CO2]
  - c) Design two classes, Polar and Rectangle to represent points in the polar and rectangle systems. Use constructors to convert from one system to another. Now, write down the full program showing the conversion from Polar point to Rectangle point and vice-versa. (13) [CO3]
2. a) When is virtual destructor needed? Write down the scenario with programming example. (07) [CO2]
  - b) Predict the output of the following program, if any error occurs, then provide the solution by redefining the class(es) only, without changing main(). (10) [CO3]

<pre>class A{ public: virtual void fun()=0; };</pre>	<pre>class B:public A{ public: void fun(){ cout&lt;&lt;"B fun"&lt;&lt;endl; }};</pre>
<pre>class C: public B{ };</pre>	<pre>int main() { A *P; B b; C c; D d; P=&amp;c; P-&gt;fun(); P=&amp;d; P-&gt;fun(); return 0;}</pre>
<pre>class D: public A{ };</pre>	

- c) Explain assertion in C++ with coding example. (06) [CO1]
  - d) Design a C++ program to add two 2x2 matrix of complex numbers. Write the declarations of complex number class into *ComplexNumber.h* file and definition into *ComplexNumber.cpp* file. Then create a template class Matrix to perform matrix addition. (12) [CO4]
3. a) Explain the constructor calling order in inheritance by listing all the steps and using appropriate example. (10) [CO3]
  - b) Will the program shown in the following figure compile successfully? If not, explain what modification should be done to compile it successfully. (12) [CO2]

<pre>#include&lt;iostream&gt; template&lt;typename T&gt; T max(T a, T b){ if(a&gt;b) return a; else return b; }  class Test{ private: int val; public: Test(int val():val(val) {} }</pre>	<pre>int main() { Test t1=10, t2; t2=5; Test t3=max(t1, t2); std::cout&lt;&lt;t3; return 0; }</pre>
---	---

- c) How exception can be handled in C++? Explain with appropriate example. (06) [CO4]
- d) Explain "Has-A-Relation" with proper example. (07) [CO2]

4. a) How does virtual functions in C++ work? Explain with proper illustration. (06) [CO3]  
 b) Write a program that reads a text file and creates another file that is identical except that every sequence of consecutive blank spaces is replaced by a single space. (11) [CO1]  
 c) Create a class "Polygon" with two pure virtual functions, "area()" to calculate area and "name()" to display class name. Now, inherit this class to three other classes with following member variables: Rectangle(height, width), Triangle(height, width), Square(side). (18) [CO4]  
 (i) Create a function showDetails() with Polygon \*parameter. Print a line "It's a Rectangle" if it is Rectangle object, do similar for other classes and show the area().  
 (ii) Create a function showDetails Using RTTI() to produce the similar result of (i) but using RTTI and dynamic casting instead of using name() function.

### SECTION B

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

5. a) What are the key differences and characteristics that set a C++ structure apart from a C++ class? Describe briefly. (08) [CO1]  
 b) Create two classes, TimeHM and TimeMS, which represent time values. The TimeHM class stores time in hours and minutes, while the TimeMS class stores time in minutes and seconds. Design a program that reads values for objects of these classes and adds one TimeHM object to another TimeMS object. Use a friend function to perform the addition operation. (15) [CO2]  
 c) Clarify how std::map handles duplicate keys, and when multiple key-value pairs with the same key are allowed. Provide an example illustrating the use of std::multimap for string duplicates. (12) [CO4]
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. (12) [CO2]  
 b) Imagine you are on a team building software for a big university's library system. The system has multiple components, including a cataloging module having Book class, a borrowing and returning module having Library class, and a notification module having Notification class. These components need to share essential information and functionality. Explain how you would use static number variables within the classes representing these modules to maintain shared data. (15) [CO1]  
 c) Define a 'Namespace conflict' in C++ and provide a scenario where it can occur. Explain in detail how a 'Namespace conflict' can be resolved in C++? (08) [CO4]
7. a) Describe the concept of custom signal handlers and their importance in application development. Demonstrates how to set up a custom signal handler for the SIGINT signal and specify what actions it should perform when the signal is received. (10) [CO1]  
 b) Mr. X is developing a software application to manage different types of products in a store. To achieve this, he decides to create a generic class named 'Product' with two member variables 'product\_id' which is an integer by default but can vary, and 'product\_price' which can be a floating point value representing the price. Now, design the generic 'product' class, including both a parameterized and a default constructor, to handle a wide range of product types and their respective prices. (15) [CO3]  
 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();     } }</pre>
---	---

8. a) "The speed benefits of using inline functions diminish as the function grows in size". (10) [CO1]  
Justify this statement by discussing the relationship between function size, inline function optimization.
- b) Consider the following program. Apply operator overloading using friend function (13) [CO3]  
to overload required operators of Product class, such that program executes without any error.

<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&gt;&gt;P;     out&lt;&lt;P; }</pre>
---	---

- c) What would be the problem when you write the following code segment. (12) [CO4]

```
unique_ptr<MyClass> myPtr(new MyClass());
unique_ptr<MyClass> myPtr2=myPtr
```

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.

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY  
 B.Sc. Engineering 1<sup>st</sup> Year 2<sup>nd</sup> Term Examination, 2022  
 Department of Computer Science and Engineering  
 EEE 1207

Basic Electrical Engineering

TIME: 3 hours

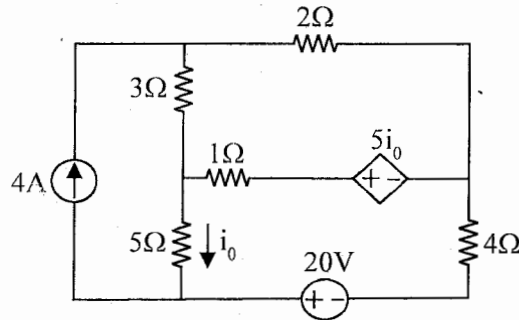
FULL MARKS: 210

- 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.

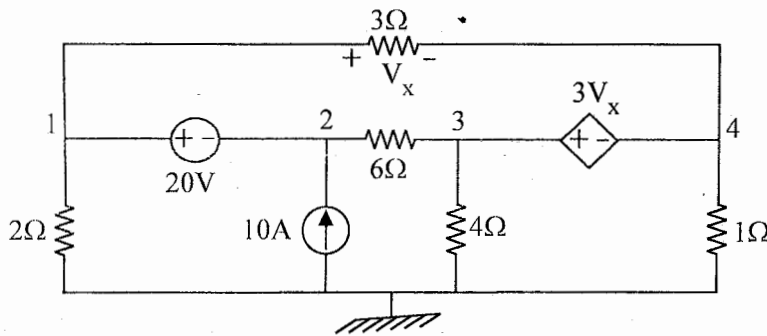
**SECTION A**

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

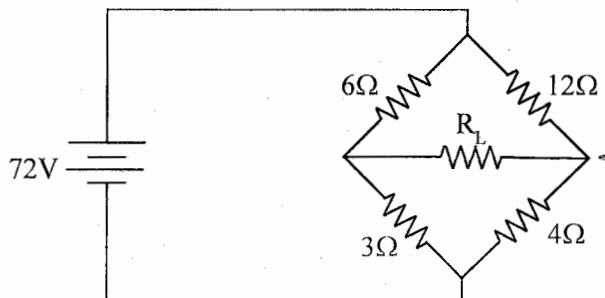
1. a) Convert a wye network to an equivalent delta network, and find each of the delta-connected resistances in terms of wye resistance. (10) [CO1]  
 b) Apply the superposition theorem to find the current  $i_0$  in following figure. (11) [CO4]



- c) Solve the circuit of the following figure using nodal analysis to find the node voltages. (14) [CO4]



2. a) State and explain KVL, KCL, and ohm's law. (06) [CO1]  
 b) An electrical heater takes 1kw from main supply with certain voltage. If the voltage is increased by 20%, the current through the heater is 8A. (08) [CO4]  
 i. What is the original voltage?  
 ii. What is the resistance of the coil?  
 c) "The power delivered to a load will be maximum when the load resistance is equal to the line resistance" – justify the statement. Find efficiency at maximum power. (09) [CO1]  
 d) Find the Thevenin's equivalent circuit for the network shown in the following figure (12) [CO4] across the  $R_L$ .



3. a) Explain the operation of a DC generator and show its various power stages. (12) [CO2]  
 b) Describe the internal and external characteristics of a separately excited DC generator. (10) [CO1]  
 c) Consider a separately excited generator running at 1000rpm, supplied 200A at 125V. Calculate the load current when the speed drops to 800rpm if  $I_f$  (field current) is unchanged. Given, brush drop = 2V and armature resistance =  $0.04\Omega$ . (13) [CO2]

4. a) Define (i) Permeability, (ii) Permittivity, (iii) Magnetic field, and (iv) Electric field intensity. (12) [CO3]  
 b) State and explain Ampere's circuital law. Compare between electrical circuit and magnetic circuit. (12) [CO3]  
 c) Mention the methods of speed control of a DC motor. Describe any one of them. (11) [CO2]

**SECTION B**

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

5. a) Define impedance. Find the impedance of an 'L' branch and a 'C' branch from their dynamic equilibrium equations. (15) [CO4]  
 b) Deduce the equation for energy delivered to an inductor during a quarter cycle. (10) [CO4]  
 c) A voltage  $v = -150 \sin 377t$  is applied to a particular circuit element and it is found  $i = 10 \cos 377t$  ampere. Make a sketch of  $v$  and  $i$  waves. Find the nature and magnitude of the circuit parameter. (10) [CO4]

6. a) Deduce the values for crest factor and form factor of sinusoidal wave. (10) [CO1]  
 b) Calculate real power and reactive power employing complex forms. The voltage of a circuit is  $v = 200 \sin(\omega t + 30^\circ)$  and the current is  $i = 50 \sin(\omega t + 60^\circ)$ . What are p.f, r.f, and volt-amp? (11) [CO1]  
 c) What is phasor? Write the significance of operator  $j$ . Find all possible roots of the following: (14) [CO2]

$$\sqrt[3]{\frac{10 \angle 45^\circ 5 e^{j6^\circ} (-4.047 - j2.94)}{1 - j1.732}}$$

7. a) Mention some applications of transformer. What are the main components of a transformer? (08) [CO2]  
 b) What are different 3- $\phi$  transformer connections? Write their advantages and disadvantages. Describe two 3- $\phi$  transformers. (12) [CO2]  
 c) Write down the working principle of an alternator. What are the advantages of stationary armature of an alternator? (08) [CO2]  
 d) What are stepper motors? Write their applications and classify them. (07) [CO1]
8. a) "The core loss is practically the same under all load conditions" – justify the statement with a proper illustration. (13) [CO2]  
 b) Describe the test by which the core loss of a transformer can be determined. (12) [CO2]  
 c) A single-phase transformer with a ratio of 440/110V takes a no load current of 5A at 0.2 power factor lagging. If the secondary supplies a current of 120A at a p.f. of 0.8 lagging, calculate the current taken by the primary. (10) [CO2]

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY  
B.Sc. Engineering 1<sup>st</sup> Year 2<sup>nd</sup> Term Examination, 2022  
Department of Computer Science and Engineering  
CHEM 1207  
Chemistry

TIME: 3 hours

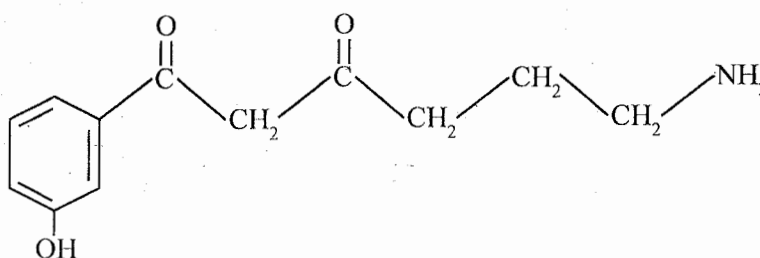
FULL MARKS: 210

- 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) What is Miller indices? Draw (1 2 1), (0 2 0), and (3  $\bar{4}$  1) planes for cubic unit cell. (10) [CO1]  
b) "No perfect crystal exists in reality" – explain. (08) [CO2]  
c) Find the interplanar distance in a crystal in which a series of planes produce a first order reflection from a copper x-ray tube ( $\lambda = 1.539\text{\AA}$ ) at an angle of  $22.5^\circ$ . (07) [CO5]  
d) Define point defects. How these defects drive the malleability and ductility of materials? (10) [CO5]
2. a) Define different types of hydrogen bonding giving examples. (08) [CO1]  
b) Compare with examples, the valence bond and molecular orbital theories of the chemical bonds. (10) [CO1]  
c) "NaCl boils at  $1470^\circ\text{C}$ , whereas  $\text{CCl}_4$  boils at  $77^\circ\text{C}$ " – explain based on polarity concept. (07) [CO3]  
d) What is resonance? How is the concept of resonance useful in explaining the stability of compounds? Illustrate with suitable example. (10) [CO5]
3. a) Explain the reaction mechanism of Lithium-polymer battery. Why this battery is called non-aqueous battery? (10) [CO1]  
b) What is EMF in electrochemistry? Derive the relation between EMF and Gibbs free energy. (10) [CO2]  
c) Calculate the equivalent conductance of  $2N$  strong electrolyte solution. Given that the cell constant =  $1.15\text{ cm}^{-1}$  and  $R = 2.5 \times 10^3$  ohms. (07) [CO3]  
d) Define zeta potential. What is the use of it in materials processing technology? (08) [CO3]
4. a) What is meant by electromagnetic radiations? Describe the range of electromagnetic radiations useful for UV-visible, IR, and microwave spectroscopy. (10) [CO1]  
b) Explain the different types of vibration modes of a molecule with diagrams. (10) [CO4]  
c) Explain K-bands and R-bands of UV-visible spectrum. (08) [CO4]  
d) Write down the probable IR-spectrum of the following compound: (07) [CO5]



**SECTION B**

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

5. a) Define thermal and photochemical reactions with examples. (08) [CO1]  
b) State and explain the laws of photochemistry. (12) [CO1]  
c) Quantum yield of a photochemical reaction is  $10^{16}$  and the number of product molecules is  $10^{116}$ . Calculate the absorbed energy of the reaction. (08) [CO5]  
d) What do you mean by photosensitized reaction? Explain with example. (07) [CO5]
6. a) Define living polymer and degree of polymerization giving examples. (08) [CO1]  
b) What is conducting polymer? Synthesize and mention the modes of structure of polyaniline polymers. (12) [CO5]  
c) Compare the conduction mechanism of metallic wire and conducting polymer. (08) [CO5]  
d) Nylon polymer shows high strength. Why? (07) [CO2]

7. a) What do you mean by LD<sub>50</sub> of a pollutant? Explain. (08) [CO1]  
b) Explain stratospheric pollution based on formation and breakdown of ozone. (12) [CO1]  
c) Discuss about the effects of nuclear hazards. (08) [CO5]  
d) Present the application of greenhouse effect concept on the development of agriculture sector. (07) [CO5]
8. a) What do you mean by fluorescence and chemiluminescence? Explain with examples. (08) [CO1]  
b) What is free radical? Discuss the free radical mechanism of polymerization process. (12) [CO1]  
c) Write down notes on chemical corrosion and soil pollution. (08) [CO5]  
d) Explain the reasons of absorption colors and spectra. (07) [CO4]

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY  
B.Sc. Engineering 1<sup>st</sup> Year 2<sup>nd</sup> Term Examination, 2022  
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. (05) [CO1]  
b) Transform the coordinates of  $(-2, 4)$  with respect to the new rectangular axes of  $x$  and  $y$ , whose equations are  $3x + 4y - 5 = 0$  and  $-4x + 3y + 15 = 0$ , respectively. (06) [CO2]  
c) Determine the transformed equation of  $17x^2 - 12xy + 8y^2 - 80 = 0$  when the rectangular axes are rotated through an angle  $\cos^{-1} \frac{1}{\sqrt{5}}$ . Also sketch the graph for the transformed equation. (11) [CO3]  
d) Develop the standard form of the curve,  $x^2 + 2xy + y^2 - 6x - 2y + 4 = 0$  and find its vertex. (13) [CO3]
  
2. a) Convert the cylindrical polar coordinates  $(2, \frac{5\pi}{3}, -2)$  into the rectangular coordinates and spherical polar coordinates. (10) [CO2]  
b) If 1, 2, 3 are the projections of a line segment on the rectangular coordinate axes of  $x$ ,  $y$  and  $z$ , respectively, calculate the original length of the line segment and its direction cosines. (13) [CO4]  
c) Determine the equation of the plane through the points  $(2, 2, 1)$ ,  $(1, -2, 3)$  and parallel to the line joining the points  $(2, 1, -3)$ ,  $(-1, 5, -8)$ . Also, find the direction cosines of its normal. (12) [CO3]
  
3. a) Find the angle between the plane  $x - 2y + 2z + 9 = 0$  and the line passing through the points  $(3, 0, -2)$  and  $(1, -3, 4)$ . (10) [CO3]  
b) Compute the distance from the point  $(2, 4, 5)$  to the plane  $x + y + z - 1 = 0$  measured parallel to the line  $\frac{x-1}{2} = \frac{y-2}{-3} = \frac{z-1}{6}$ . (12) [CO3]  
c) Test whether the lines  $\frac{x-5}{4} = \frac{y-7}{4} = \frac{z+3}{-5}$  and  $\frac{x-8}{7} = \frac{y-4}{1} = \frac{z-5}{3}$  are coplanar or not. If it is coplanar, then deduce the equation of the plane containing them. (13) [CO4]
  
4. a) Determine the equation of the right circular cone whose vertex is  $(1, -1, 2)$ , axis along the line  $\frac{x-1}{2} = \frac{y+1}{1} = \frac{z-2}{-2}$  and semi-vertical angle is  $45^\circ$ . (12) [CO4]  
b) Find the equation of sphere in which the circle  $x^2 + y^2 + z^2 - 2x + 4y - 6z - 9 = 0$  is a great circle. (10) [CO3]  
c) Determine the length of the shortest distance between two skew lines  $\frac{x+1}{1} = \frac{y-1}{-1} = \frac{z-4}{0}$  and  $\frac{x-1}{4} = \frac{y-2}{3} = \frac{z-36}{-6}$ . (13) [CO3]

**SECTION B**

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

5. a) Define order of an ordinary differential equations (D.E). (02) [CO1]  
b) Transform  $y = Ae^x + Be^{3x}$  into D.E, where A and B are arbitrary constants. (08) [CO2]  
c) Solve the D.E.  $(y + x - 5)dy = (y - x + 1)dx$ . (12) [CO3]  
d) Determine the general solution of  $\frac{dy}{dx} - \frac{\tan y}{1+x} = (1+x)e^x \sec y$ . (13) [CO3]

6. a) Solve  $ydx - xdy = \sqrt{x^2 + y^2}dx; y(1) = 0.$  (11) [CO3]  
 b) Solve the D.E.  $xdy - \{y + xy^3(1 + \ln x)\}dx = 0.$  (12) [CO3]  
 c) Determine the general solution of  $\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 3y = e^{-3x} + \cos 2x.$  (12) [CO3]
7. a) Write down the general form of homogeneous linear differential equation of 2nd order. (03) [CO2]  
 b) Solve  $x^2 \frac{d^2y}{dx^2} - x \frac{dy}{dx} + 3y = x^2 \log x.$  (15) [CO3]  
 c) Determine the general solution of  $\frac{d^2y}{dx^2} + y = \operatorname{cosec} x$  by the method of variation of parameters. (17) [CO3]
8. a) State Lagrange's method for solving the linear partial differential equation of order one. (03) [CO1]  
 b) Solve  $\frac{\partial u}{\partial t} = 2 \frac{\partial^2 u}{\partial x^2}$  by the method of separation of variables. (13) [CO3]  
 c) Calculate the indicial roots and recurrence relation from (19) [CO4]  
 $2x^2 \frac{d^2y}{dx^2} + x \frac{dy}{dx} + (x^2 - 3)y = 0$  by using Frobenius method.