Khulna University of Engineering & Technology
B. Sc. Engineering 1st Year 2nd Term Examination, 2022
Department of Biomedical Engineering

BME 1201
Biochemistry

Time: 3 Hours **Full Marks: 210**

N.B. i) Answer **any THREE** questions from each section in separate scripts
ii) Figures in the right margin indicate full marks.

Section A

(In Script A: Answer ANY THREE questions from this section)

1. a) Define biomolecules. Why are they called the building blocks of cells? Describe the geometry of carbon bonding in biomolecules with neat sketch. (15)

b) What distinguishes between living and nonliving things? Explain the underlying principle that governs the life of living organism. (10)

c) Why lipids are considered an exception as biomacromolecules? (05)

d) Draw the flow of energy in human life. (05)

2. a) How do the principles of thermodynamics apply to the field of bioenergetics? Describe the relationship of Gibbs free energy ΔG with entropy and enthalpy in bioenergetics. (15)

b) Write short notes (any three): (09)
(i) Cyclization of monosaccharides
(ii) Pyranose and Furanose
(iii) Enantiomers
(iv) Stereoisomers.

c) Write down the pathway of glycolysis in flowchart with energy yielding and expanding. (06)

d) Differentiate between endergonic and exergonic reaction. (05)

3. a) Briefly discuss the digestion of carbohydrate with simple diagram. How does α-amylase participate in the degradation of dietary glycogen? (10)

b) Define digestion, absorption, and metabolism. How does monosaccharide absorption take place in the intestinal mucosal cell? (15)

c) What are the major pathways of carbohydrate metabolism? (04)

d) Why is alanin called a glucogenic amino acid? (06)

4. a) What is lipid? What are the building blocks of lipid? Classify fatty acids with example. (15)

b) Explain different pathways of lipid metabolism. (15)

c) What are bile acids? Specify their functions. (05)

Section B

(In Script B: Answer ANY THREE questions from this section)

5. a) Define protein. Describe different structures of protein with neat sketch. Also mention the significance of each structure. *(15)*

   b) What are the functions of protein? (05)

   c) Define electrophoresis. Write about SDS-PAGE electrophoresis in details. (15)

6. a) What is enzyme? How does enzyme work in reducing activation energy? (10)

   b) Which enzyme is represented by the EC number "3. 4. 11. 4"? Give a brief explanation. (05)

   c) Why is enzyme inhibition important? Explain the reversible inhibition of enzymes, including types and mechanisms. (10)

   d) What is the procedure of ELISA? Shortly explain the indirect and sandwich ELISA. (10)

7. a) Why DNA is called the center of genetic information? Mention the differences among DNA, gene, and genome. (06)

   b) Explain the forces to stabilize different protein structures. (10)

   c) Does PCR result in exponential amplification of the target DNA? Explain with proper diagram in case of forensic analysis. (10)

   d) Write down the structural characteristics of *t*-RNA. (09)

8 a) Why chromatography is used in biochemistry? Write short notes on- (12)
   (i) Column chromatography
   (ii) Ion-exchange chromatography
   (iii) Affinity chromatography

   b) What are the basic steps of enzyme isolation and purification? Briefly explain the spectro-photometric measurement of enzymes. (08)

   c) Define enzyme biotechnology. Draw an overview of recombinant DNA technology. (06)

   d) How does the conformation of polypeptides occur? Describe the factors influencing the conformation. (09)

Khulna University of Engineering & Technology
B. Sc. Engineering 1st Year 2nd Term Examination, 2022
Department of Biomedical Engineering

CSE 1215
Computer Programming

Time: 3 Hours **Full Marks: 210**

N.B. i) Answer **any THREE** questions from each section in separate scripts
ii) Figures in the right margin indicate full marks.

Section A

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

1. a) If you want to learn English natural language, then you have to learn alphabets, words, sentences, and paragraph in sequence. Now, if you want to learn a computer language like C, then what will be the steps? Describe with examples. (11)

b) Why does C language call a structural programming language? (10)

c) Discuss about the datatypes used in C. List the format specifiers used for these datatypes. (08)

d) Write short notes on i) increment operator and ii) decrement operator. (06)

2. a) Suppose, "XYZ" is a signed integer data type of size 6 bits with format specifier "%x". Then what will be the output of the following code segment. (10)

```
XYZ var = 127;
printf("%x", var);
```

b) Illustrate the output of the program shown in Figure 2(b). (12)

```
#include <stdio.h>
int main(){
    int a=1, b=9;
    a<<=1;
    if (a==1 && b++=9)
        printf("a=%d, b=%d\n", a, b);
    return 0;
}
```

Figure 2(b)

c) Rewrite the code of "if/else-block" as shown in Figure 2(c) into equivalent "swith-case block". (13)

```
#include <stdio.h>
int main(){
    int a=2, b=1;
    if (a==2 && b==1)
        printf("okay\n");
    return 0;
}
```

Figure 2(c)

3. a) Draw the flowchart for the control of "do while" loop. (07)

b) Write a C program to print the following pattern: (08)

```
1
2  2
3  3  3
4  4  4  4
```

c) Write a C program to check whether an integer number is prime or not. (10)

d) What are the main differences of C and C++ programming languages? (10)

4. a) Differentiate between structure and union. (08)

b) Create a user defined data type called "student" using structure containing first name, last name, roll, and cgpa. Then, declare an array of 50 students of type "student". A file named "input.txt" has 50 lines where each line contains the above information of a student. Now put these data into the array and find the highest and average cgpa of the students and print these to console. (15)

c) A file (data.txt) contains some data. Write a C program to count the number of characters, digits, alphabets, and special symbols. (12)

Section B

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

5. a) What are the rules for naming a variable in C? Why 'b' and 'B' are not same in C programming? (08)

b) Show implicit and explicit type casting with examples. (10)

c) Is there any problem in the program shown in Figure 5(c)? If yes, debug the program and mark the debugged parts of the program. (10)

```
# include <stdio.h>;
int main ()
{   Int 1a, b, area;
    scanf ("%f %f", & 1a, & b);
    area = 1a × b;
    Print ("Area = %d", & area);}
```

Figure 5(c)

d) Suppose X and Y are two unsigned datatypes of size 3 bits and 5 bits, respectively. Then consider the code shown in Figure 5(d). (07)

```
# include <stdio.h>;
int main ()
{   X  x = 18;
    Y  y = 37;}
```

Figure 5(d)

What are the values that will be stored in variable x and y.

6. a) What is operator in C? Write short notes on i) Binary operator, ii) Unary operator, and iii) Relational operator. (08)

b) Differentiate between logical AND operator and bitwise AND operator with example(s). (08)

c) Consider the code segment shown in Figure 6(c). Analyze the output of each code segment. (09)

(i)
```
# include <stdio.h>
int main ()
{
   int x = 20;
if (x % 2)
{ printf("Morning");
  }
else
{ printf("Night");
  } return 0;
}
```

(ii)
```
# include <stdio.h>
int main ()
{
   int a = 1, b = 0;
int c = -1, x, y;
  x = b && a++;
  y = ++c | ++a;
printf("x = %d", x);
printf("y = %d", y);
printf("a = %d", a);
printf("c = %d", c);
```

(iii)
```
# include <stdio.h>
int main (){
int x;
x = 4*5/2 +9;
printf("x = %d", x);
}
```

Figure 6(c)

d) Why does stack overflow problem occur in recursion? Show example(s) to illustrate the answer. (10)

7. a) What is the basic difference between character array and string? Write short notes on- i) strcpy(), ii) strcmp(), and iii) strcat(). (10)

b) Write a C program to reverse a string without using strrev() function. (08)

c) Write a C program to add the even numbers of the following array and print the sum. (07)

int arr [10] = {2, 7, 9, 4, 8, 10, 15, 55, 6, 12}

d) Design a user defined function that concatenate two strings where the strings are parameters of that function and no built-in function can be used. (10)

8 a) Is it possible to return multiple values from a user defined function? If yes, design a user defined function which returns summation, subtraction, and multiplication of two integer values taking as parameters. (12)

b) Write down the advantages of using function in C program. (07)

c) Compare call by value and call by references with necessary examples. (10)

d) Suppose you have a 5 by 5 matrix as shown below; (06)

int matrix [5] [5];

How can you access matrix [2] [3] element of the mentioned two dimensional array using pointer?

Khulna University of Engineering & Technology
B. Sc. Engineering 1st Year 2nd Term Examination, 2022
Department of Biomedical Engineering

EEE 1215
Analog Electronics

Time: 3 Hours **Full Marks: 210**

N.B. i) Answer **any THREE** questions from each section in separate scripts
ii) Figures in the right margin indicate full marks.

Section A

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

1. a) Differentiate among conductor, semiconductor, and insulator explaining their respective energy level diagrams. Describe the formation process of the depletion layer in a semiconductor diode. (13)

b) What are the types of resistance levels and equivalent circuits of a semiconductor diode? Find the voltage (V_Q) and currents (I_{D1}, I_{D2}) for the network shown in Figure 1(b). Use the simplified model. (10)

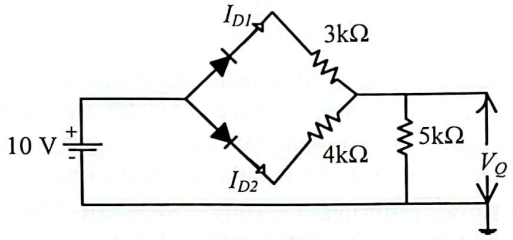

Figure 1(b)

c) What is meant by Zener diode? For the network shown in Figure 1(c), determine the range of R_L and I_L that will result in V_{RL} being maintained at 10V. (12)

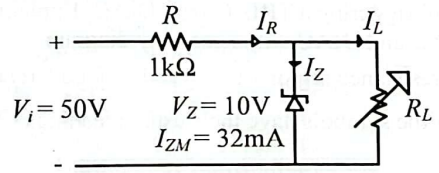

Figure 1(c)

2. a) Explain the working principle of a full-wave bridge rectifier circuit. (07)

b) Define ripple factor. Also show that the ripple factor of half and full wave rectifier are 1.21 and 0.48 respectively. (08)

c) Describe how a npn transistor can act as an i) amplifier and ii) switch with necessary sketches. (10)

d) A transistor is connected in a common emitter configuration in which collector supply is 8V and the voltage drop across the resistance (R_C) connected in the collector circuit is 0.5V. The value of $R_C = 800\Omega$. If $\alpha = 0.96$, determine i) collector-emitter voltage and ii) base current. (10)

3. a) What is Q point for a BJT transistor? Explain how Q point can be affected by circuit values in three ways. (10)

b) Prove that i) $I_E = (\beta + 1)I_B + I_{CBO}$; ii) $\beta = \dfrac{\alpha}{1-\alpha}$; (10)
where symbols carry their usual meanings.

c) Determine the voltage (V_{CE}) and the current I_C for the following voltage divider configuration of Figure 3(c). (15)

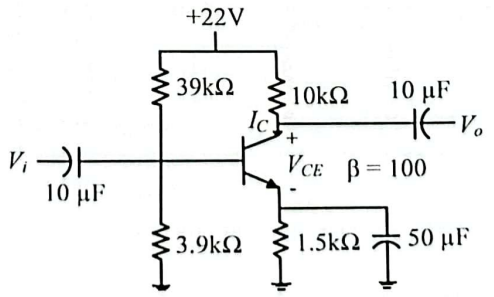

Figure 3(c)

4. a) Differentiate between BJT and FET. Explain the operation of a n-channel E-MOSFET when i) $V_{GS} = 0$ V, ii) V_{GS} = '+ve' V, and iii) at pinch off. (13)

b) Describe the construction and working principle of a n-channel JFET with relevant diagram. Draw the corresponding characteristic curve. (12)

c) For the network in Figure 4(c), determine i) I_{DQ} and V_{GSQ}, and ii) V_D. (10)

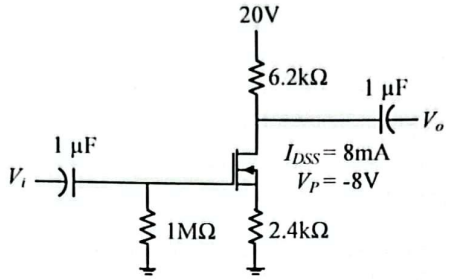

Figure 4(c)

Section B

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

5. a) Draw the V-I characteristics curve of an SCR indicating all the regions of operation. Define the terms: i) Breakover voltage, ii) Peak reverse voltage, iii) Holding current, and iv) Latching current. (09)

b) State the conditions and methods for turning ON and turning OFF an SCR. Explain the anode current interruption method and forced commutation method with relevant diagrams. (13)

c) Power (brightness) of a 100W, 110V tungsten lamp is to be varied by controlling the firing angle of an SCR in a half-wave rectifier circuit supplied with 110V ac (rms). What rms voltage and current are developed in the lamp at firing angle $\alpha = 60^o$? (13)

6. a) What are the differences between DIAC and TRIAC? Explain the operating principle of TRIAC. (10)

b) Mention the advantages of triggering a TRIAC with DIAC. Explain the operation of a heat control circuit consisting of TRIAC and DIAC with necessary diagram. (12)

c) Briefly Explain negative resistance region of a UJT? For a UJT relaxation oscillator, show that $f = \frac{1}{R_1 C \, ln\left[\frac{1}{1-\eta}\right]}$ where the symbols have their usual meanings. (13)

7. a) Define Op-Amp. Write down the salient features of an Op-Amp. (05)

b) Derive the equations of closed-loop gain of inverting and non-inverting amplifier from their respective equivalent circuits. (10)

c) Design the circuit diagrams using Op-Amp which provide the following output voltage: (10)

i) $V_o = 8V_1 - 10\frac{dV_2}{dt}$ ii) $V_o = 5\int V_1 dt + 3V_2$

d) Design a second-order high pass active filter with resonant frequency 5kHz and closed-loop gain 50. (10)

8. a) State the Barkhausen criterion. What are the essentials of a transistor oscillator circuit? Explain the operation of a Tank circuit. (08)

b) What are the different types of transistor oscillator? Determine the i) operating frequency and ii) feedback fraction for Colpitt's oscillator shown in Figure 8(b). (09)

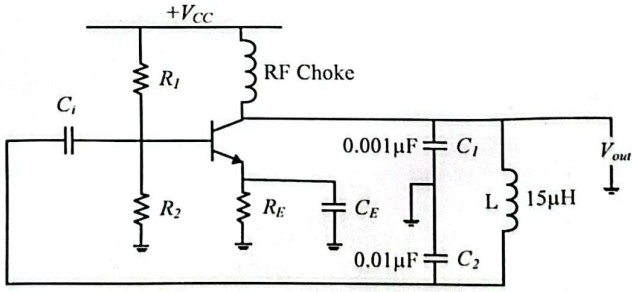

Figure 8(b)

c) Define and classify tuned amplifier. Explain the operation of transformer-coupled push-pull amplifier circuit. (10)

d) When negative voltage feedback is applied to an amplifier of gain 100, the overall gain falls to 50. i) Calculate the fraction of the output voltage feedback, ii) if this fraction is maintained, calculate the value of the amplifier gain required if the overall stage gain is to be 75. (08)

Khulna University of Engineering & Technology
B. Sc. Engineering 1st Year 2nd Term Examination, 2022
Department of Biomedical Engineering

Hum 1215
Technical English

Time: 3 Hours **Full Marks: 210**

N.B. i) Answer **any THREE** questions from each section in separate scripts
ii) Figures in the right margin indicate full marks.

Section A

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

1. a) Frame wh questions from the underlined parts of the following sentences: (14)
i) He ate as much rich as he could.
ii) He could not come on account of his illness.
iii) The Chitra express will arrive now.
iv) The Chitra express leaves at 8.30 am.
v) He likes folk song.
vi) I am talking to an old man.
vii) The BCS examination is very difficult.

b) Make sentences using the following words as directed: (12)
Book (as verb); Back (as verb); Back (as adverb); Class (as adjective); Home (as adverb); Round (as noun).

c) Change the following words as directed and make sentences with the changed words: (09)
Glass (into verb); Book (into adjective); Class (into noun); Mouth (into adjective); Act (into adverb); Danger (into verb).

2. a) Transform the following sentences as directed: (14)
i) Only the stars are visible. (Negative)
ii) None but a cheat can do it. (Affirmative)
iii) Everybody longs for happiness. (Interrogative)
iv) The sun set and we finished the discussion. (Simple)
v) We listen to understand. (complex)
vi) Day light is not clearer than the matter. (Positive)
vii) Cure is not so good as prevention. (Comparative)

b) Provide correct form of verbs given in brackets: (12)
i) A drunken man (drive) the car.
ii) She (reward) for a great score.
iii) Rome (build) in a day.
iv) The goods (deliver) to the customer.
v) The task (carry) on by her.
vi) He (hang) for murder.

c) Make sentences with the following phrases and idioms: (09)
call it a day, cup of tea, on thin ice, burn bridges, as right as rain, talk turkey.

3. a) Make sentences on the following structures: (14)
i) Subject + Intransitive verb + Adverbial.
ii) Subject + Transitive verb + Gerund as object.
iii) Subject + Transitive verb + Infinitive as object.
iv) Subject + Linking verb + Adjective complement + Extension.
v) Subject + Linking verb + Noun complement + Extension.
vi) Subject + Transitive verb + Object + Adjective complement.
vii) Subject + Transitive verb + Object + Object.

b) Make sentences using the following Modals as directed: (12)
i) My (To guess about the present)
ii) Should (To express duty in the past)
iii) Need (To express unnecessary action in the past)
iv) Had better (To express performance)
v) Be to (To express command)
vi) Be going to (To express plan/intention)

c) Make a new word with the following prefixes and suffixes and make sentences with the new words:____y, ____s, ____ation, ____ity, under ____, re ____ (09)

4. a) Complete the sentences with subordinate clauses as directed: (14)
i) He strongly disapproved of ..... . (Noun clause)
ii) We must face the fact ..... . (Noun clause)

iii) The house ..... is a grand one. (Adjective clause)
iv) Do it ..... . (Adv. clause of time)
v) Read it very carefully ..... . (Adv. clause of purpose)
vi) I would help them ..... (Adv. clause of condition)
vii) ..... , he did not say sorry for this. (Adv. clause of concession).

b) Make sentences expressing the following emotions/notions: (12)
i) Apology ii) Invitation iii) Greetings iv) Suggestion v) Good wish vi) Threat

c) Supply a suitable word to fill up the gaps: (09)
i) I could not help ..... at his behavior.
ii) They are ..... upon doing it.
iii) He is interested to ..... there.
iv) The men were ..... with fear.
v) The sooner they leave, the ..... they will get there.
vi) Have you ever ..... in London.

Section B

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

5. a) Read the passage and answer the following questions: (20)

As Andrea turned off the motorway onto the road to Brockbourne, the small village in which she lived was falling behind the hills. The interior of the car was not cold, but the harsh wind and the snow heaped in the fields made her feel chilly inside and a little lonely. She was just coming out of the village when she saw the old lady, standing by the road, with a crude hand-written sign saying "Brockbourne" in her hand. Andrea was surprised to witness an old lady hitchhiking. However, the weather and the coming darkness made her feel sorry for the lady. Normally, Andrea would never pick up a hitchhiker when she was alone, thinking it was too dangerous, but what was the harm in doing a favor for a little old lady. Andrea pulled up her car and the lady, holding a big shopping bag, hurried over to climb in the door which Andrea had opened for her. When she did get in Andrea could see that she was not, in fact, so little. Broad and fat, the old lady got into the car with great difficulty. She wore a long, shabby old dress, and she had a yellow hat pulled down low over her eyes. Almost in a whisper, she said "Thank you dearie." "Do you live in Brockbourne?" asked Andrea. "No, dearie", the passenger answered in a soft voice, "I'm just going to visit a friend. He was supposed to meet me back there at Mickley, but his car won't start, so I decided to hitchhike. I knew some kind soul would give me a lift."

Something in the way the lady spoke, and the way she never turned her head, but stared continuously into the darkness ahead from under her hat, made Andrea uneasy about this strange hitchhiker. She didn't know why, but she felt instinetly that there was something wrong and dangerous. Andrea look sideways and studied the hat, the dirty collar, the shapeless body, the arms with thick black hairs ..... Hairy arms? Andrea's blood froze. This wasn't a women. It was a man. She was terrified and didn't know what to do. Swinging the wheel suddenly, she threw the car into a skid and brought it to a halt. "My God! I hit the child! Did you see her?" The old said, "I didn't see anything." "I'm sure it was a child!" insisted Andrea. "Could you get out and have a look? Just see if there's anything on the road?" thinking her plan would work?

The lady climbed out of the car leaving her bag inside. As soon as she was out of the car, Andrea gunned the engine and accelerate madly away. Soon she was a good three miles away. She then thought about the bag which would provide the read identity of the stranger. She lifted the bag on her lap and found only one item- a small hand axe with a razor- sharp blade. The axe and the inside of the bag were covered with dark red stains of dried blood. Andrea began to scream.

i) Describe the old lady.
ii) Why did Andrea scream?
iii) What was the old lady probably going to do to Andrea?
iv) How would have you reacted if you were in Andrea's situation?

b) Make a precis of the above passage 5(a) with a title. (15)

6. a) Write a cause and effect paragraph on sleep deprivation on cognitive functioning. (15)

b) Amplify the idea contained in of the statement: Time is money. (20)

7. a) Iqarus is looking for a certified biomedical engineer with experience in multi-modality hospital-based employment. Prepare your CV and apply for the post. (20)

b) Suppose you are the Vice President of Finance and Services. Write a memo to inform all the employees about the improved vacation policy with paid services. (15)

8. Write a free composition on any one of the followings: (35)
i) A character from a book or a movie.
ii) Is technology too isolating?

Khulna University of Engineering & Technology
B. Sc. Engineering 1st Year 2nd Term Examination, 2022
Department of Biomedical Engineering

Math 1215
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 right margin indicate full marks.

Section A

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

1. a) Reduce the equation $5x^2 + 2xy + 5y^2 - 24x + 34y + 55 = 0$ into standard form and find its any two properties. (15)

b) Remove the first degree terms from the equation $x^2 + 2xy + 3y^2 + 2x - 4y - 1 = 0$. (10)

c) Find the cylindrical polar and spherical polar coordinates where rectangular coordinate is $(3, 2\sqrt{2}, -4)$. (10)

2. a) Define direction cosine and direction ratios of a line. Show that $sin^2\alpha + sin^2\beta + sin^2\gamma = 2$. (10)

b) If the direction cosines of two lines are connected by the relation $al + bm + cn = 0$ and $ul^2 + vm^2 + wn^2 = 0$, find the condition that two lines are perpendicular. (15)

c) Find the equation of the plane through the point (1, 2, 3), perpendicular to the plane $x + 2y + 3z = 1$ and parallel to z-axis. (10)

3. a) A variable plane at a constant distance λ from origin meets the axes in A, B, and C. Through A, B, C planes are drawn parallel to the coordinate planes. Show that the locus of their points of intersection is $x^{-2} + y^{-2} + z^{-2} = \lambda^{-2}$. (15)

b) Find the distance of the point $(-1, 5, -10)$ from the point of intersection of the line $\frac{x-2}{2} = \frac{y+1}{4} = \frac{z-2}{12}$ and the plane $x - y + z = 5$. (10)

c) Define right circular cone. Find the equation of the right circular cone whose vertex is the origin, axes the z-axes and semi-vertical angle β. (10)

4. a) Find the length and equation of shortest distance (S. D.) between the lines whose equations are $\frac{x-1}{4} = \frac{y-2}{3} = \frac{z-36}{-6}$ and $x + y = 0,\ z = 4$. (15)

b) Find the equation of the sphere for which the circle $x^2 + y^2 + z^2 + 10y - 4z - 8 = 0$, $x + y + z - 3 = 0$ is a great circle. (10)

c) A sphere of radius p passes through the origin and meets the axes in A, B, and C. Prove that the centroid of the triangle ABC lies on the sphere $q(x^2 + y^2 + z^2) = 4p^2$. (10)

Section B

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

5. a) What is meant by order and degree of a differential equation? By eliminating the constants λ_1 and λ_2 obtain the differential equation for which $xy = \lambda_1 e^x + \lambda_2 e^{-x}$ is a solution. (12)

b) Identify and solve $(xy^2 + x)dx + (x^2y + y)dy = 0$. (08)

c) Use separation of variables method to solve $\frac{\partial u}{\partial t} = 2\frac{\partial^2 u}{\partial x^2}$ subject to the boundary conditions $u(0,t) = 0, u(3,t) = 0,$ and $u(x,0) = 3sin3\pi x$. (15)

6. a) Identify and solve $(x - y^2)dx + 2xydy = 0$. (12)

b) Identify and solve $ydx + ydy = xdy - xdx$. (10)

c) Identify and solve $(3x^2y^4 + 2xy)dx + (2x^3y^3 - x^2)dy = 0$. (13)

7. a) Solve the differential equation $y'' - 4y' + 3y = 3e^x cosx + 2xe^{3x}$. (12)

b) Solve the differential equation $x^2\frac{d^2y}{dx^2} - 3x\frac{dy}{dx} + 4y = x + x^2 logx$. (11)

c) Solve the differential equation $x^2y'' - 3xy' + 4y = x^2 logx$. (12)

8. a) Define ordinary point, singular point, and regular point of a differential equation with example. Find the indicial roots and recurrence relation of the differential equation $x^2\frac{d^2y}{dx^2} + x\frac{dy}{dx} + (x^2 - 1) = 0,$ by the method of Frobenius. (24)

b) Find a particular solution of $y'' + 4y' + 8y = 3e^{-2x}$ where $y(0) = 2$ and $y'(0) = 4$. (11)