B.Tech. Autumn (III SEMESTER) EXAMINATION
(COMPUTER ENGINEERING)
HIGHER MATHEMATICS
(AM-261)

Maximum Marks : 60
Duration: 3 Hours

Answer all questions.

1. (a) If \( f(z) \) is an analytic function, prove that
\[
\left( \frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2} \right) f(z) = n^2 |f'(z)|^2 - |f(z)|^2.
\]
(b) Show that the functions
\[
u = \frac{\sin 2x}{\cosh 2y - \cos 2x}
\]
is harmonic and find its conjugate function \( v \).
Express \( u + iv \) in terms of \( x \).
(c) Evaluate:
\[\oint (8\mathbb{I} - 3z) \, dz, \text{ where } C \text{ is the closed curve } x^{20} + y^{20} - 1 = 0.
\]

OR

(a') Evaluate the following integral using Cauchy's integral formula
\[
\oint \frac{dz}{z^2 + 9}, \text{ where } C \text{ is}
\]
(i) \( |z - 3i| = 4 \),
(ii) \( |z| = 5 \)

2. (a) Find Laurent's series of
\[f(z) = \frac{z^2}{z^2 - 1}\]
about \( z = 1 \). Find the region of convergence.
(b) Use residue theorem to evaluate
\[
\oint \frac{12z^2 - 7}{(z - 1)^2 (2z + 3)} \, dz, \text{ where } c = |z + 1| = \sqrt{3}
\]
(c) Using contour integral, evaluate
\[
\oint \frac{x \, dx}{x^2 + 4x - 13}.
\]

3. (a) Find the constants \( a \) and \( b \) so that the surface \( ax^2 - byz = (a-2)x \) will be orthogonal to the surface \( 4x^2 - z^2 = 4 \) at the point \( (1, -1, 2) \).

OR

(a') Find the magnitude of the velocity and acceleration of a particle which moves along the curve \( x = 2 \sin 3t, y = 2 \cos 3t, z = 8t \) at any time \( t > 0 \). Find unit tangent vector to the curve.

Contd......2
4. (a) Using Green's theorem in the plane prove that area \( \Lambda \) of the region \( R \) bounded by a simple closed curve \( C \) is given by \( \Lambda = \frac{1}{2} \oint_C (xdy - ydx) \).

Hence find the area of the region in the first quadrant bounded by the curves \( y = x \), \( y = \frac{1}{x} \), \( y = \frac{x}{4} \).

(b) Use Stokes' theorem to evaluate
\[ \iint_S (\nabla \times \mathbf{F}) \cdot d\mathbf{S} \]
where \( \mathbf{F} = y\mathbf{i} + (x - 2xz)\mathbf{j} - xy\mathbf{k} \) and \( S \) is the surface of the sphere \( x^2 + y^2 + z^2 = a^2 \) above the xy plane.

(c) Verify Gauss' divergence theorem for \( \mathbf{F} = xi + 2yj + 3zk \) taken over the entire surface of the sphere \( x^2 + y^2 + z^2 = 4 \).
**Question**

1(a) Define the following terms related to object oriented paradigms

   i. Inheritance
   ii. Exception handling
   iii. Polymorphism and dynamic binding

1(b) What is data hiding? What are the different mechanisms for protecting data from the external users of a class?

2(a) What is copy constructor? Explain through an example.

2(b) Explain the use of inline function.

2(c) Give an example for concrete class. State the problems with concrete classes. How it could be solved?

2(d) What is operator overloading? List the operators that cannot be overloaded and justify why they cannot be overloaded.

**OR**

2'(a) When do we declare a member of a class "Static"?

2'(b) Differentiate between over loading and over riding of methods of a class.

2'(c) Write a C++ program for finding the volume of a cube using constructor overloading.

2'(d) What is generic programming? Highlight the features of generic programming.

3(a) Explain in detail with the help of diagram the JAVA Architecture.

3(b) With a suitable example explain the structure of a java program.

3(c) Name the different types of API and packages in java and explain the concept of various access specifier with related to sub-class in same and different packages

3(d) Explain the following with example:

   i. Polymorphism in java
   ii. Statements in java

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**Answer all the questions.**

**Assume suitable data if missing.**

**Notations used have their usual meaning.**

**Maximum Marks: 50**

**Credits: 04**

**Duration: Three Hours**
3'(d) What are the features of SWING. Write a SWING application to construct a window which contains two buttons (yes, no) a text field and two check boxes. Arrange all the components using flowlayout.

4(a) Draw a UML Class Diagram representing the following elements from the problem domain for a hockey league.
   - A hockey league is made up of at least four hockey teams. Each hockey team is composed of six to twelve players, and one player captains the team. A team has a name and a record. Players have a number and a position. Hockey teams play games against each other.
   - Each game has a score and a location. Teams are sometimes led by a coach. A coach has a level of accreditation and a number of years of experience, and can coach multiple teams. Coaches and players are people, and people have names and addresses.
   - Draw a class diagram for this information, and be sure to label all associations with appropriate multiplicities.

4(b) Write out difference between aggregation and composition with the help of class diagram.

4(c) Explain the following
   i. Use UML to model a dining room. Every dining room has to have a table, four or more chairs, and a sideboard.
   ii. What are actors and use cases in use case model. Draw a use case diagram for library management system. The actors are librarian and member.

OR

4'(c) Explain in brief with suitable example
   i. Activity diagrams
   ii. Sequence diagrams
2014-15
B.TECH. (AUTUMN SEMESTER) EXAMINATION
COMPUTER ENGINEERING
ALGORITHMS AND DATA STRUCTURES
CO206

Maximum Marks: 60
Credits: 04
Duration: Three Hours

Answer all the questions.
Assume suitable data if missing.
Notations used have their usual meaning.

Q.No.       Question                        M.M.
1(a) Suppose $F(n) = a_1 + a_2 n + a_3 n^2 + \ldots + a_m n^m$ be a polynomial of degree $m$. Prove that $F(n) = O(n^m)$. [04]

1(b) Describe Bubble Sort algorithm. Sort the individual characters of the following string in alphabetical order using Bubble Sort algorithm.

DATA STRUCTURES

Write all intermediate steps.

OR

1(b') Describe Binary Search algorithm. Let DATA be the following sorted 13 element array.

DATA: 11 22 30 33 40 44 55 60 66 77 80 88 99

Apply binary search algorithm to DATA to search the following items: (i) 40, and (ii) 85. Write all intermediate steps.

2(a) Describe row major order and column major order for representing a multidimensional array in memory. How can one compute the address of an arbitrary element of a multidimensional array in row major order and in column major order? [06]

OR

2(a') Suppose multidimensional arrays $A$ and $B$ are declared using $A(-2:2, 2:22)$ and $B(1:8, -5:5, -10:5)$.

(i) Find the length of each dimension and the number of elements in $A$ and $B$.

(ii) Consider the element $B[3, 4, 4]$ in $B$. Find the effective indices $i_1, i_2, i_3$ and the address of the element in column major order as well as in row major order. Assume that Base($B$) = 400 and every element of the given multidimensional arrays occupies 4 memory cells.

OR

2(b) Describe a linked list. What are the merits and demerits of a linked list as compared to a linear array? With the help of an example, describe how one can represent a linked list inside the memory of a computer. [06]
3(a) Write an algorithm for transforming an infix expression into postfix expression. Using the algorithm transform the following infix expression into its equivalent postfix expression.

\[ A - (B / C + (D * F - G) * H) \]

OR

3(a') Briefly describe the preorder, inorder, and postorder traversals of a binary tree. Let there be the following algebraic expression.

\[ [a + (b - c)] * [(d - e) / (f + g - h)] \]

Draw a binary tree that represents the above expression. Write the preorder and postorder traversals of the tree. Manually convert the expression into equivalent prefix and postfix notations and verify that the preorder traversal corresponds to the prefix notation and the postorder traversal corresponds to the postfix notation.

3(b) Let there be the following list of numbers:

\[ 42 \ 31 \ 11 \ 54 \ 76 \ 91 \ 41 \ 62 \ 97 \ 21 \ 87 \ 65 \]

Sort them using Quick Sort algorithm. Write all intermediate steps. What is the complexity of Quick Sort algorithm in the worst case and in the average case?

4(a) Let \( n \) be the size of input data. Show that the lower bound on the time complexity of a comparison based sorting algorithm is \( \Omega(n \log n) \).

4(b) Define a heap. Sort the following list in ascending order using Heap Sort algorithm.

\[ 44 \ 33 \ 11 \ 55 \ 77 \ 90 \ 40 \ 60 \ 99 \ 22 \ 88 \ 66 \]

4(b') Let there be an array with 14 elements that are as follows.

\[ 66 \ 33 \ 11 \ 40 \ 22 \ 55 \ 88 \ 60 \ 80 \ 20 \ 50 \ 44 \ 77 \ 30 \]

Sort the array using Merge Sort algorithm. What is the complexity of Merge Sort algorithm?

5(a) Describe an algorithm for Selection Sort. Sort the following data using Selection Sort algorithm:

\[ 28 \ 22 \ 44 \ 11 \ 77 \ 33 \ 66 \ 55 \]

What is its complexity in the worst case and in the average case? Justify your answer.

OR

5(a') Describe an algorithm for Insertion Sort. Sort the following data using Insertion Sort algorithm.

\[ 66 \ 55 \ 11 \ 77 \ 22 \ 44 \ 33 \ 88 \]

What is its complexity in the worst case and in the average case? Justify your answer.
5(b) Describe some popular hash functions used in hashing. Consider a company XYZ Limited with 68 employees. All the employees are assigned a unique 4-digit employee number. Suppose the set of memory addresses consists of 100 two-digit addresses numbered from 00 to 99. Apply the hash functions to compute the address for the employee number 3205. What are the methods used for collision resolution? Briefly describe them.
# 2014-15
## B.TECH. (AUTUMN SEMESTER) EXAMINATION
### COMPUTER ENGINEERING
#### LOGIC THEORY & COMPUTER ORGANIZATION
**CO-207 / CO-202**

Maximum Marks: 60  
Credits: 04 /05  
Duration: Three Hours

*Attempt all the questions. Assume suitable data if missing.*
*Notations used have their usual meaning.*

<table>
<thead>
<tr>
<th>Q.No.</th>
<th>Questions</th>
<th>M.M.</th>
</tr>
</thead>
</table>
| 1(a)  | Using Boolean Algebra Laws, prove the following:  
(i) $AC + BC' = AC + BC' + AB$  
(ii) $A \cdot (A' + C) \cdot (A'B + C) \cdot (A'BC + C') = 0$ | 02:03 |
| 1(b)  | What do you mean by maxterm and minterm in Combinational Logic? Express the following Boolean function:  
$F = A + B' \cdot C$ in a sum of minterm form  
$F = xy + x'z$ in a product of maxterm form | 05 |
| 1(c)  | Simplify the following Boolean function in (a) sum of products, and (b) product of sums form  
$F(A,B,C,D) = \sum (0,1,2,5,8,9,10)$  
Draw the Gate implementation of the functions in (a) and (b). | 05 |
| 2(a)  | Implement the following Boolean expressions using a 3-to-8 decoder and logic gates.  
$F_1(A,B,C) = \sum (0,4,6)$,  
$F_2(A,B,C) = \sum (0,5)$,  
$F_3(A,B,C) = \sum (1,2,3,7)$ | 05 |
| 2(b)  | Design a combinational circuit with three bit input $xyz$ and three output $ABC$.  
When the binary input is 000,001,010, or 011, the binary output is two greater than the input. When the binary input is 100,101,110, or 111, the binary output is three less than the input. | 05 |
| 2(c)  | Write Logic equations and draw the truth table and circuit diagram for 1-bit magnitude comparator. Write the logic equations for $n$-bit magnitude comparator. | 05 |
3(a) What do you mean by sequential circuit? Explain using block diagram. Draw the circuit of a clocked RS flip flop using only NAND gates. Explain its operation along-with its characteristics table and characteristics equation.

3(b) Design a sequential circuit with four Flip Flops A, B, C, and D. The next states of B, C, and D are equal to the present states of A, B, and C respectively. The next state of A is equal to the exclusive-OR of the present state of C and D. Draw the circuit diagram using D type Flip Flop.

3(c) Draw and explain a 4-bit serial input shift register using a D type Flip Flop. Also draw the waveform.

3'(a) Draw and write the logic diagram, characteristic table, characteristic equations using K-map, and excitation table for (i) J-K Flip Flop (ii) RS Flip Flop; (iii) D-Flip Flop and (iv) T-Flip Flop. Also draw the state diagram of these flip flops.

3'(b) Construct a 4-bit (a) Ring Counter and (b) Johnson counter. Show the waveform for 10 clock cycles.

4(a) What do you mean by Operation Code or op-code? Give three possible instruction formats. Differentiate between Micro-Operation and Macro-Operation with suitable examples.

4(b) Design a simple computer that is capable to execute the following instructions

(i) Move a register R to A
(ii) Load an Operand into A
(iii) Load an Operand specified by an address ADRS into A.

Write the micro-operations for Instruction Fetch Cycle, and Execution of the above three types of instructions. Thus derive the hardware specifications including control functions of this computer. Show the block diagram design.
4'(a) What is the function of Program Counter (PC)? Explain what the following micro-operations perform. What is the final value contained in register A.

\[ t_1: \text{MBR} \leftarrow A \]
\[ t_2: A \leftarrow A' \]
\[ t_3: A \leftarrow A \text{ AND MBR} \]

4'(b) What is a Fetch cycle? Why timing counter T is reset every time an instruction is executed? In a particular configuration of a computer, each memory location contains 16-bit data. In program memory, if 4 MSB (Most Significant Bit) contains op-code and rest contains address of memory locations, give (a) Number of op-codes (b) size of memory, (c) size of PC, IR, A, MAR, and MBR.
2014-15
B.TECH. IIIrd (AUTUMN SEMESTER) EXAMINATION
COMPUTER ENGINEERING
ELECTRONIC DEVICES AND CIRCUITS
EL-211

Maximum Marks: 60
Credits: 04
Duration: Three Hours

Answer all the questions.
Assume suitable data if missing.
Notations used have their usual meaning.

Q.No. Question M.M.
1(a). Explain the operation of a Schottky diode. Why is it known as a “hot carrier diode”? Also explain the term “reverse recovery time” (\( t_r \)) of a diode. Why is it low in case of a Schottky diode? [06]

1(b). For the circuit shown in Fig. 1 with \( V_{CC} = 10V \), \( R_C = 4.7\,k\Omega \) and \( R_E = 3.3\,k\Omega \), find the value to which the base voltage should be changed so that the transistor operates in saturation with a forced \( \beta \) of 5. [06]

![Fig. 1](image)

2(a). For the circuit shown in Fig. 2, find out the voltage \( V_D \) and \( V_C \). Assume \( R_A = 10M\Omega \), \( R_B = 10K\Omega \). \( V_t = 1V \) and \( k_T W/L = 0.5mA/V^2 \). [06]

Contd...
2(b). Why does the collector-to-base feedback-bias circuit offer a better stability factor than a fixed-bias circuit?

OR

2'(b). Determine the stability factor $S'$ of an emitter bias (self-bias) circuit. Also express $S'$ in terms of $S$.

3. Consider the emitter-degenerated circuit shown in Fig. 3. Draw its small signal equivalent circuit. Let the amplifier be fed from a signal source having $R_{ds} = 5\, \text{k}\Omega$ and $R_s = 5\, \text{k}\Omega$. Find the value of $R_C$ at which the result in $R_{df}$ would be equal to 4 times the source resistance $R_{ds}$. For this value of $R_C$, find $A_{o0}$, $R_{out}$, $A_o$, $G_o$ and $A_{ix}$.

Given that $V_{cc} = -V_{EB} = 10\, \text{V}$, $I_C = 1\, \text{mA}$, $R_E = 100\, \text{k}\Omega$, $R_C = 8\, \text{k}\Omega$ and $\beta = 100$.

Fig. 3
3'(a). Draw the small signal equivalent model for a common-collector amplifier. Derive the expression for input impedance and overall voltage gain. Why is it called an emitter-follower?

3'(b). For the circuit shown in Fig. 4, the NMOS transistor has $V_T = 0.9\,\text{V}$, $I = 500\,\mu\text{A}$, $R_G = 10\,\text{M}\Omega$, $R_L = 10\,\text{K}\Omega$, $V_A = 50\,\text{V}$ and operates at $V_D = 2\,\text{V}$. Draw its small signal equivalent model and determine its voltage gain $V_o/V_i$.

![Fig. 4]

4'(a). Define and derive the expression for MOSFET unity-gain frequency ($f_T$) by using a high-frequency model.

4'(b). Draw the high-frequency equivalent circuit of a common-source amplifier. Find the expression of its total input capacitance $C_{in}$.

OR

4'. Derive the expressions for corner (break) frequencies $f_{r1}$ and $f_{r2}$ due to $C_{c1}$ and $C_B$ of a common-emitter amplifier. If the amplifier has $C_{c1} = C_E = 1\,\mu\text{F}$, $R_B = 100\,\text{K}\Omega$, $R_{ds} = 5\,\text{K}\Omega$, $r_m = 40\,\text{mA}/\text{V}$, $r_n = 2.5\,\text{K}\Omega$, $R_E = 8\,\text{K}\Omega$, $R_L = 5\,\text{K}\Omega$ and $\beta = 100$. Assuming that the capacitors do not interact, find $f_{r1}$ and $f_{r2}$ and hence estimate $f_L$.

Contd. - 4.
5(a). Define piezoelectric effect of a crystal oscillator. Draw its characteristics and calculate its series and parallel resonant frequency.

5(b). The non-inverting buffer opamp configuration shown in Fig. 5 provides a direct implementation of the negative feedback loop. Assuming that the opamp has infinite input resistance and zero output resistance, what is $\beta$? If $A = 100$, what is the closed loop voltage gain? What is the amount of feedback in dB? For $V_i = 1V$, find $V_o$ and $V_i$. If $A$ decreases by 10%, what is the corresponding decrease in $A_v$?

---

$\begin{align*}
R_s & \quad + \quad + \\
V_i & \quad R_L & \quad R_o \\
\quad - & \quad - \\
V_o & \quad - & \quad - \\
\end{align*}$

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***************
1. a. What is monopoly? Give examples of some situations where it would be beneficial. Also explain how the price of a product may be determined in a monopoly. 04
   b. Explain the Law of Diminishing returns with suitable examples. 04
   c. A company 3 years ago borrowed Rs. 40,000 to pay for a new machine tool agreeing to repay the loan in 100 monthly instalments at an annual nominal interest rate of 12% compounded monthly. The company now wants to pay off the loan. How much would this payment be, assuming no penalty cost for early payment? 04

OR

1’ a. What is inflation? What are its causes? How does it affect the economy of a nation? 06
   b. Machines that have the following costs are under consideration for a robotized welding process. Using an interest rate of 10% per year, determine which alternative should be selected:

<table>
<thead>
<tr>
<th>Machine</th>
<th>Machine X</th>
<th>Machine Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Cost (Rs)</td>
<td>250,000</td>
<td>430,000</td>
</tr>
<tr>
<td>Annual operating cost (Rs/year)</td>
<td>60,000</td>
<td>40,000</td>
</tr>
<tr>
<td>Salvage Value (Rs)</td>
<td>70,000</td>
<td>95,000</td>
</tr>
<tr>
<td>Life (Years)</td>
<td>3</td>
<td>6</td>
</tr>
</tbody>
</table>

2. a. What is depreciation? What is the need for calculating it? 03
   b. Differentiate between defender and challenger. 06

   It is proposed to replace a two year old precision measuring instrument immediately. The expected costs and lives of the two instruments are as follows:

<table>
<thead>
<tr>
<th></th>
<th>Current</th>
<th>Proposed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Original purchase price (Rs.)</td>
<td>30,000</td>
<td>40,000</td>
</tr>
<tr>
<td>Current market value (Rs.)</td>
<td>17,000</td>
<td>15</td>
</tr>
<tr>
<td>Remaining life (years)</td>
<td>3</td>
<td>15</td>
</tr>
<tr>
<td>Estimated value in 3 years (Rs.)</td>
<td>9,000</td>
<td>20,000</td>
</tr>
<tr>
<td>Annual operating cost (Rs.)</td>
<td>8,000</td>
<td>3,000</td>
</tr>
</tbody>
</table>

Perform the replacement study for a 3 year replacement period.

   c. Five interdependent proposals are under consideration for a particular project. The present worth of capital requirement and benefits for each project are as follows:

<table>
<thead>
<tr>
<th>Alternative</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>PW of Capital (Rs.)</td>
<td>80,000</td>
<td>50,000</td>
<td>72,000</td>
<td>43,000</td>
<td>81,000</td>
</tr>
<tr>
<td>PW of Benefits (Rs.)</td>
<td>70,000</td>
<td>55,000</td>
<td>76,000</td>
<td>52,000</td>
<td>84,000</td>
</tr>
</tbody>
</table>

Select the best proposal on the basis of an incremental B/C analysis.

Contd...2.
3 a. What is the significance of decision making tools? Discuss any one decision making tool with suitable examples.

b. What are the major areas of social responsibility of corporate sector? Discuss the implications of corporate involvement in social causes.

OR

3' a. Discuss the role of information in the manager's job. Also, state the characteristics of useful information.

b. Discuss the Administrative model of decision making.

4 a. Why are organisational goals important? How are they classified? What are the differences between strategic goals and tactical goals?

b. Differentiate between:
   i. Job enlargement and Job enrichment
   ii. Functional departmentalization and Product departmentalization

OR

4' a. Discuss how control helps the organization. What are the steps involved in the control process?

b. How is authority different from power? Differentiate between line and staff authority with suitable examples.

5 a. Explain the Q/R Inventory system.

   A company needs 24,000 units/year of a certain component which will be used in its main product. The ordering cost is $150 per order and the carrying cost per unit per year is 18% of the purchase price per unit. The purchase price per unit is $75. Find the economic order quantity.

b. Demand for part number 1012 was 210 in January, 100 in February and 150 in March. The forecast for January was 140 units. With a smoothing constant of 0.30 and using first order exponential smoothing, what is the April forecast? Is 0.30 is a good choice as a smoothing constant?

c. Define Quality. Discuss the two aspects of quality. Name some quality control tools and explain any one of them.