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10MAT31

Third Semester B.E. Degree Examination, Dec.2014/Jan.2015
Engineering Mathematics – III

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***

PART – A

1 a. Expand $f(x)=\sqrt{1-\cos x}$, $0<x<2\pi$ in a Fourier series. Hence evaluate $\frac{1}{1.3}+\frac{1}{3.5}+\frac{1}{5.7}+\dots$ **(07 Marks)**

b. Find the half-range sine series of $f(x)=e^x$ in (0, 1). **(06 Marks)**

c. In a machine the displacement y of a given point is given for a certain angle x as follows:

x	0	30	60	90	120	150	180	210	240	270	300	330
y	7.9	8	7.2	5.6	3.6	1.7	0.5	0.2	0.9	2.5	4.7	6.8

Find the constant term and the first two harmonics in Fourier series expansion of y. **(07 Marks)**

2 a. Find Fourier transform of $e^{-|x|}$ and hence evaluate $\int_0^\infty \frac{\cos xt}{1+t^2}dt$. **(07 Marks)**

b. Find Fourier sine transform of $f(x)=\begin{cases} x, & 0<x\le 1 \\ 2-x, & 1\le x<2 \\ 0, & x>2 \end{cases}$. **(06 Marks)**

c. Solve the integral equation $\int_0^\infty f(x)\cos\lambda x\,dx = e^{-\lambda}$. **(07 Marks)**

3 a. Find various possible solution of one-dimensional heat equation by separable variable method. **(10 Marks)**

b. A rectangular plate with insulated surface is 10cm wide and so long compared to its width that it may be considered infinite in length without introducing an appreciable error. If the temperature of the short edge y = 0 is given by

$u = 20x, \quad 0\le x\le 5$

$\quad = 20\,(10-x), \quad 5\le x\le 10$

and the two long edges x = 0, x = 10 as well as the other short edge are kept at 0°C. Find the temperature u(x, y). **(10 Marks)**

4 a. Fit a curve of the form $y = ae^{bx}$ to the data: **(07 Marks)**

x	1	5	7	9	12
y	10	15	12	15	21

b. Use graphical method to solve the following LPP:

Minimize $Z = 20x_1 + 30x_2$

Subject to $x_1 + 3x_2 \ge 5$;

$2x_1 + 2x_2 \ge 20$;

$3x_1 + 2x_2 \ge 24$;

$x_1, x_2 \ge 0$. **(06 Marks)**

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

c. Solve the following LPP by using simplex method:
Maximize $Z = 3x_1 + 2x_2 + 5x_3$
Subject to $x_1 + 2x_2 + x_3 \le 430$
$3x_1 + 2x_3 \le 460$
$x_1 + 4x_2 \le 420$
$x_1 \ge 0,\ x_2 \ge 0.$ **(07 Marks)**

PART – B

5 a. Use the Gauss-Seidal iterative method to solve the system of linear equations. $27x + 6y - z = 85$; $6x + 15y + 2z = 72$; $x + y + 54z = 110$. Carry out 3 iterations by taking the initial approximation to the solution as (2, 3, 2). Consider four decimal places at each stage for each variable. **(07 Marks)**

b. Using the Newton-Raphson method, find the real root of the equation $x\sin x + \cos x = 0$ near to $x = \pi$, carryout four iterations (x in radians). **(06 Marks)**

c. Find the largest eigen value and the corresponding eigen vector of the matrix $A = \begin{pmatrix} 4 & 1 & -1 \\ 2 & 3 & -1 \\ -2 & 1 & 5 \end{pmatrix}$ by power method. Take $\begin{pmatrix} 1 \\ 0 \\ 0 \end{pmatrix}$ as the initial vector. Perform 5 iterations. **(07 Marks)**

6 a. Find f(0.1) by using Newton's forward interpolation formula and f(4.99) by using Newton's backward interpolation formula from the data: **(07 Marks)**

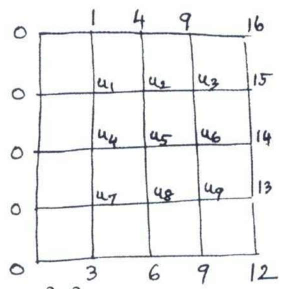
x	0	1	2	3	4	5
f(x)	-8	0	20	58	120	212

b. Find the interpolating polynomial f(x) by using Newton's divided difference interpolation formula from the data: **(06 Marks)**

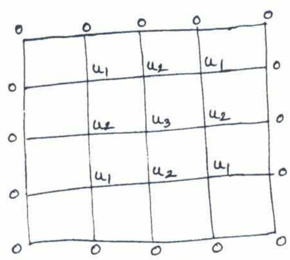
x	0	1	2	3	4	5
f(x)	3	2	7	24	59	118

c. Evaluate $\int_0^{1.2} e^x\,dx$ using Weddle's rule. Taking six equal sub intervals, compare the result with exact value. **(07 Marks)**

7 a. Solve $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ in the following square mesh. Carry out two iterations. **(07 Marks)**



b. Solve the Poisson's equation $\nabla^2 u = 8x^2y^2$ for the square mesh given below with u = 0 on the boundary and mesh length, h = 1. **(06 Marks)**



c. Evaluate the pivotal values of $\frac{\partial^2 u}{\partial t^2} = 16\frac{\partial^2 u}{\partial x^2}$ taking h = 1 upto t = 1.25. The boundary conditions are $u(0, t) = 0$, $u(5, t) = 0$, $\frac{\partial u}{\partial t}(x,0) = 0$, $u(x, 0) = x^2(5 - x)$. **(07 Marks)**

8 a. Find the Z-transforms of i) $\left(\frac{1}{2}\right)^n + \left(\frac{1}{3}\right)^n$ ii) $3^n \cos\frac{\pi n}{4}$. **(07 Marks)**

b. State and prove initial value theorem in Z-transforms. **(06 Marks)**

c. Solve the difference equation
$u_{n+2} - 2u_{n+1} + u_n = 2^n;\ u_0 = 2, u_1 = 1$. **(07 Marks)**

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10CS32

Third Semester B.E. Degree Examination, Dec.2014/Jan.2015
Electronics Circuits

Time: 3 hrs. Max. Marks:100

Note: 1. *Answer FIVE full questions, selecting at least TWO questions from each part.*
2. *Any missing data may be assumed suitably.*

PART – A

1 a. Explain how transistor can be used as switch. **(05 Marks)**

b. Determine the value of the resistors R_E and R_C for the circuit shown in Fig. Q1 (b) given that $R_1 = 5\ k\Omega$, $R_2 = 1\ k\Omega$, $\beta = 200$, $V_{CEQ} = 5$ V and $I_{CEQ} = 2$ mA for the silicon made transistor. **(08 Marks)**

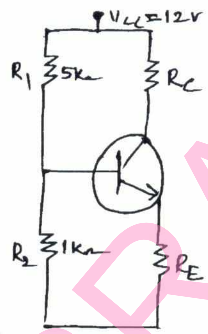

Fig. Q1 (b)

c. Briefly discuss the working operation of silicon controlled rectifier. **(07 Marks)**

2 a. Explain with neat sketches the operation and characteristics of N-channel DE-MOSFET. **(08 Marks)**

b. Calculate the value of operating point for the circuit shown in Fig. Q2 (b) given that threshold voltage for the MOSFET is 2V and $I_{D(ON)} = 6$ mA for $V_{GS(ON)} = 5$ V. **(07 Marks)**

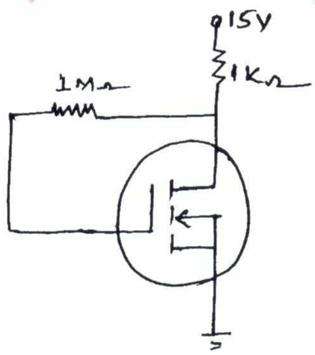

Fig. Q2 (b)

c. Write the advantages of MOSFET over JFET. **(05 Marks)**

3 a. Briefly discuss with necessary diagrams the working operation, characteristics and parameters of Light Emitting Diode. **(10 Marks)**

b. A photo diode has a noise current of 1 fA responsivity figure of 0.5 A/W. Determine its Noise Equivalent Power (NEP) and Detectivity (D). **(05 Marks)**

c. Briefly explain the working operation of opto-couplers. **(05 Marks)**

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

4 a. Explain the effect of Bypass capacitors and coupling on the low frequency response of the transistor based amplifier. **(06 Marks)**

b. Draw the hybrid equivalent circuit of the transistor in all three configurations given that the hybrid parameters for the transistor are h_{ie} = 1.5 kΩ, h_{fe} = 150, h_{re} = 1×10^{-4} and h_{oe} = 20 μmhos. **(10 Marks)**

c. What are the advantages of cascade amplifiers on overall frequency response of the amplifiers? **(04 Marks)**

PART – B

5 a. A power amplifier in class B operation provides a 20 V peak output signal to 15 Ω load the system operates on a power supply of 25 V. Determine the efficiency of the amplifier. **(08 Marks)**

b. The total harmonic distation of an amplifier reduces from 10% to 1% on introduction of 10% negative feedback. Determine the open loop and closed loop gain values. **(06 Marks)**

c. Explain the advantages of negative feedback in amplifiers. **(06 Marks)**

6 a. What are sinusoidal oscillators? Explain the Barkhausen criterion for sustained oscillations. **(08 Marks)**

b. With a neat circuit diagram, explain the principle of operation of Buffered RC phase shift oscillator. **(05 Marks)**

c. Discuss briefly the working operation of Astable Multivibrator using IC555 timer. **(07 Marks)**

7 a. Explain with neat diagram and relevant waveforms, the principle of operation of inverting regulator. **(08 Marks)**

b. The regulated power supply provides a ripple rejection of -80 db. If the ripple voltage in the inregulated input is 2V, calculate the output ripple. **(06 Marks)**

c. Explain the important features and parameters of switched mode power supplies (SMPS). **(06 Marks)**

8 a. What are active filters using op-amp? Explain first order low pass and high pass filters with gain. **(08 Marks)**

b. Explain with circuit the working operation of instrumentation amplifier. **(07 Marks)**

c. Calculate the values of R_1, R_2, C_1, C_2 and R_3. If the filter had a cut off frequency of 10 kHz. Q factor of 0.707 and input impedence not less than 10 KΩ for the Fig. Q8 (c) shows a second order low pass filter built around a single operational amplifier. **(05 Marks)**

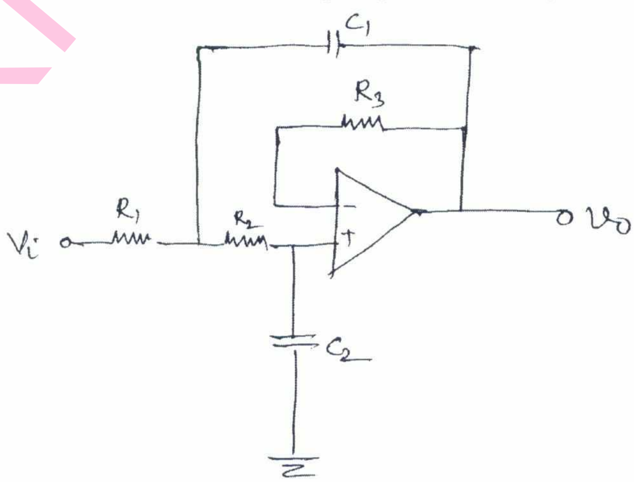

Fig.Q8 (c)

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Third Semester B.E. Degree Examination, Dec.2014/Jan.2015
Logic Design

Time: 3 hrs.   Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. What are universal gates? Realize $\overline{(A+B)\bullet(\overline{A}+\overline{B})}$ using only universal gates. **(05 Marks)**

b. Discuss the positive and negative logic and list the equivalences in positive and negative logic. **(05 Marks)**

c. An asymmetrical signal waveform is high for 2 m sec and low for 3 m sec. Find i) Frequency ii) Period iii) Duty cycle low iv) Duty cycle high. **(05 Marks)**

d. Explain the structure of VHDL / Verilog program. **(05 Marks)**

2 a. The system has four inputs, the output will be high only when the majority of the inputs are high. Find the following :
i) Give the truth table and simplify by using K-map.
ii) Boolean expression in $\sum m$ and $\prod M$ form.
iii) Implement the simplified equation using NAND – NAND gates and NOR – NOR gates. **(10 Marks)**

b. Find essential prime implicants for the Boolean expression by using Quine – Mc Clusky method.
$f(A, B, C, D) = \Sigma m(1, 3, 6, 7, 9, 10, 12, 13, 14, 15)$. **(10 Marks)**

3 a. Implement the Boolean function expressed by SOP :
$f(A,B,C,D) = \sum m(1, 2, 5, 6, 9, 12)$ using 8 – to – 1 MUX. **(06 Marks)**

b. Implement a full adder using a 3 – to – 8 decoder. **(06 Marks)**

c. Design 7 – segments decoder using PLA. **(08 Marks)**

4 a. Give state transition diagram of SR, D, JK and T Flip – Flop. **(06 Marks)**

b. With a neat logic diagram and truth table, explain the working of JK Master – Slave Flip – Flop along with its implementation using NAND gates. **(07 Marks)**

c. Show how a D Flip – Flop can be converted into JK Flip – Flop. **(07 Marks)**

PART – B

5 a. With a neat logic and timing diagram, explain the working of a 4-bit SISO register. **(10 Marks)**

b. Design two 4-bit serial Adder. **(06 Marks)**

c. Write the verilog code for switched tail counter using "assign" and "always" statement. **(04 Marks)**

6 a. Design synchronous mod-5 UP counter using JK Flip-Flop. **(10 Marks)**

b. Explain a 3-bit binary Ripple down counter, give the block diagram, truth table and output waveforms. **(10 Marks)**

7 a. With a neat block diagram, explain Mealay and Moore model. **(10 Marks)**

b. Design an asynchronous sequential logic circuit for state transition diagram shown in Fig. Q7 (b). **(10 Marks)**

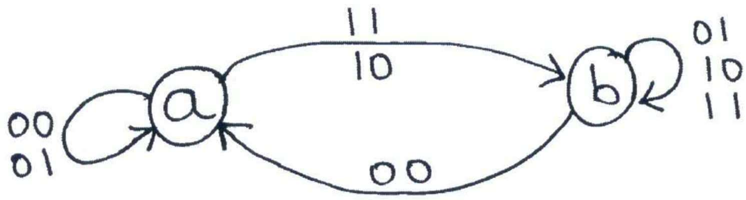

Fig. Q7 (b)

8 a. Explain the R/2R Ladder technique of D/A conversion. **(10 Marks)**

b. Explain with neat diagram, single slope A/D converters. **(10 Marks)**

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Third Semester B.E. Degree Examination, Dec.2014/Jan.2015
Discrete Mathematical Structures

Time: 3 hrs. Max. Marks:100

Note: *Answer FIVE full questions, selecting atleast TWO questions from each part.*

PART – A

1 a. Simply the set expression $\overline{\overline{(A\cup B)\cap C}\cup \overline{B}}$ with justification. **(06 Marks)**

b. i) Use membership table to establish the set equality of : $\overline{(A\cap B)\cup(\overline{A}\cap C)}=(A\cap\overline{B})\cup(\overline{A}\cap\overline{C})$. **(07 Marks)**

ii) If A = {1, 2, 3, 4, 5, 6, 7}, determine the number of subsets of A containing 3 elements, subsets of A containing 1, 2, and subsets of A with even number of elements.

c. The sample space of an experiment is S = {a, b, c, d, e, f, g, h}. If event A = {a, b, c} and event B = {a, c, e, g}, determine $P_r(A)$, $P_r(B)$, $P_r(A\cap B)$, $P_r(A\cup B)$, $P_r(\overline{A})$, $P_r(A\cap\overline{B})$ and $P_r(\overline{A}\cup B)$. **(07 Marks)**

2 a. Construct truth table for :

i) $[p\wedge(p\to q)]\to q$

ii) $[(p\to q)\wedge(q\to r)]\to(p\to r)$. **(06 Marks)**

b. Simplify the switching network using the laws of logic. **(07 Marks)**

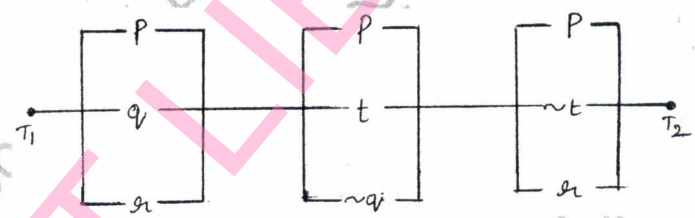

Fig. Q2(b)

c. Establish the following argument by the methods of proof by contradiction.

$P\to(q\wedge r)$
$r\to s$
$\sim(q\wedge s)$
$\therefore \sim p$ **(07 Marks)**

3 a. Negate and simplify each of the following :

i) $\exists x, [p(x)\vee q(x)]$

ii) $\forall x, [p(x)\wedge \sim q(x)]$

iii) $\forall x, [p(x)\to q(x)]$

iv) $\exists x, [(p(x)\vee q(x))\to r(x)]$. **(06 Marks)**

b. Find whether the following argument is valid. No engineering student of first and second semester studies logic.

Anil is an engineering student who studies logic
∴ Anil is not in second semester **(07 Marks)**

c. Give : i) a direct proof ii) an indirect proof and iii) proof by contradiction for the following statement. "If m is an even integer, then m + 7 is odd". **(07 Marks)**

4 a. If $H_1 = 1$, $H_2 = 1 + \frac{1}{2} +, ----, H_n = 1 + \frac{1}{2} + ---- + 1/n$ are harmonic numbers, then prove that for all $n \in z^+$

$$\sum_{i=1}^{n} H_i = (n+1)H_n - n.$$ **(06 Marks)**

b. For all $n \in z^+$ prove that :

$$\sum_{i=1}^{n} \frac{1}{i(i+1)} = \frac{n}{n+1}$$

$$\sum_{i=1}^{n} i(2^i) = 2 + (n-1)2^{n+1}.$$ **(07 Marks)**

c. i) If $A_1, A_2, ----, A_n \subseteq U$, then prove that :

$$\overline{A_1 \cap A_2 \cap ----- \cap A_n} = \overline{A} \cup \overline{A_2} \cup ----- \cup \overline{A_n}$$

ii) If $A, B_1, B_2, -----, B_n \subseteq U$ then prove that $A \cap (B_1 \cup B_2 \cup ---- \cup B_n) = (A \cap B_1) \cup (A \cap B_2) \cup ---- \cup (A \cap B_n)$. **(07 Marks)**

PART – B

5 a. Find the number of ways of distributing 6 objects among 4 identical containers with some containers possibly empty. **(06 Marks)**

b. (i) Prove that the function $f : R \times R \to R$ defined by $f(a, b) = \lceil a + b \rceil$ is commutative but not associative

(ii) Prove that if 30 dictionaries in a library contains a total of 61,327 pages, then atleast one of the dictionary must have atleast 2045 pages. **(07 Marks)**

c. Let $f : R \to R$ be defined by

$$f(x) = \begin{cases} 3x - 5 & \text{for } x > 0 \\ -3x + 1 & \text{for } x \leq 0 \end{cases}$$

then determine $f^{-1}(-1)$, $f^{-1}(3)$, $f^{-1}(6)$, $f^{-1}(-5, 5)$. **(07 Marks)**

6 a. Give a set A with $|A| = n$ and a relation R on A, let M denote the relation matrix for R then prove that :

i) R is symmetric if and only if $M = M^1$

ii) R is transitive if and only if $M.M = M^2 \leq M$. **(06 Marks)**

b. Let $A = \{1, 2, 3, 4, 6, 8, 12\}$ and R be the partial ordering on A defined by a R_b if a divides b then

i) Draw the Hasse diagram of the Poset (A, R)

ii) Determine the relation matrix for R

iii) Topologically sort the Poset (A, R) **(07 Marks)**

c. Let $A = \{1, 2, 3, 4, 5\} \times \{1, 2, 3, 4, 5\}$, and define R on A by (x_1, y_1) R (x_2, y_2) if $x_1 + y_1 = x_2 + y_2$

i) Verify that R is an equivalence relation on A

ii) Determine the equivalence classes [(1, 3)], [(2, 4)] and [(1, 1)]

iii) Determine the partition of A induced by R. **(07 Marks)**

7 a. In a group S_6, let

$$\alpha = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 3 & 1 & 4 & 6 & 2 & 5 \end{pmatrix}$$

$$\beta = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 4 & 2 & 6 & 1 & 3 & 5 \end{pmatrix}$$

Determine $\alpha\beta$, α^3, β^4, $(\alpha\beta)^{-1}$. **(06 Marks)**

b. Define cyclic group and prove that every subgroup of a cyclic group is cyclic. **(07 Marks)**

c. Define the coding function $E : Z_2^3 \to Z_2^6$ by means of parity – check matrix

$$H = \begin{bmatrix} 1 & 0 & 1 & 1 & 0 & 0 \\ 1 & 1 & 0 & 0 & 1 & 0 \\ 1 & 0 & 1 & 0 & 0 & 1 \end{bmatrix}$$ and determine all code words. **(07 Marks)**

8 a. Let $E : Z_2^m \to Z_2^n$ be an encoding function given by a generator matrix G or the associated parity check matrix H then prove that $C = E : \left(Z_2^m\right)$ is a group code. **(06 Marks)**

b. i) Define subring and ideal.

ii) If $A = \left\{ \begin{bmatrix} a & o \\ b & c \end{bmatrix} a, b, c \in z \right\}$ be the subset of the ring $R = M_2(z)$ then prove that A is a subring but not ideal. **(07 Marks)**

c. i) Prove that Z_n is a field if and only if n is a prime.

ii) Prove that in Z_n, [a] is a unit if and only if $\gcd(a, n) = 1$. **(07 Marks)**

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Third Semester B.E. Degree Examination, Dec.2014/Jan.2015
Data Structures with C

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***

PART – A

1 a. What are pointer variables? How to declare a pointer variable? **(05 Marks)**
b. What are the various memory allocation techniques? Explain how dynamic allocation is done using malloc( )? **(10 Marks)**
c. What is recursion? What are the various types of recursion? **(05 Marks)**

2 a. Define structure and union with suitable example. **(08 Marks)**
b. Write a C program with an appropriate structure definition and variable declaration to store information about an employee, using nested structures. Consider the following fields like: ENAME, EMPID, DOJ (Date, Month, Year) and Salary (Basic, DA, HRA). **(12 Marks)**

3 a. Define stack. Give the C implementation of push and pop functions. Include check for empty and full conditions of stack. **(08 Marks)**
b. Write an algorithm to convert infix to post fix expression and apply the same to convert the following expression from in fix to post fix:
i) (a ∗ b) + c/d ii) (((a/b (-c) + (d ∗ e)) – (a ∗ c)). **(12 Marks)**

4 a. Define linked list. Write a C program to implement the insert and delete operation on queue using linked list. **(10 Marks)**
b. Explain the different types of linked list with diagram. **(10 Marks)**

PART – B

5 a. Define the following:
i) Binary tree
ii) Complete binary tree
iii) Almost complete binary tree
iv) Binary search tree
v) Depth of a tree. **(10 Marks)**
b. In brief describe any five application of trees. **(05 Marks)**
c. What is threaded binary tree? Explain right and left in threaded binary tree. **(05 Marks)**

6 a. Write C function for the following tree traversals:
i) inorder ii) preorder iii) postorder. **(10 Marks)**
b. Explain min and max heap with example. **(10 Marks)**

7 a. Implement Fibonacci heap. **(10 Marks)**
b. What is binomial heap? Explain the steps involved in the deletion of min element from a binomial heap. **(10 Marks)**

8 a. Explain AVL tree. **(10 Marks)**
b. Explain the red-black tree. Also, state its properties. **(10 Marks)**

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Third Semester B.E. Degree Examination, Dec.2014/Jan.2015
Object Oriented Programming with C++

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting atleast TWO questions from each part.***

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

PART – A

1 a. Explain the terms encapsulation, polymorphism and inheritance in object oriented programming. **(06 Marks)**
b. Explain the different types of argument passing techniques, with example. **(06 Marks)**
c. What is function overloading? Write a C++ program to define three overloaded functions area( ) to find area of rectangle, area of rectangular box and area of circle. **(08 Marks)**

2 a. What is a constructor? How is a constructor different from member function? Illustrate with an example. **(06 Marks)**
b. What are static data members? Explain with an example? What is the use of static data members? **(06 Marks)**
c. Write a class 'rectangle' containing two data items 'length' and 'breadth' and four functions setdata( ), getdata( ), displaydata( ) and area( ) to set the length and breadth, to get the user inputs, to display and to find the area of the rectangle respectively. Also write a main program which declares the objects and uses the member functions of the class. **(08 Marks)**

3 a. Define friend function? Explain what are the rules to be used while using a friend function? Illustrate with an example. **(10 Marks)**
b. What is operator overloading? Write a C++ program to add two complex numbers by overloading the + operator. Also overload >> and << operators for reading and displaying the complex numbers. **(10 Marks)**

4 a. Explain and write a C++ program, the process when the base class is derived by the following visibility modes : i) public ii) private iii) protected **(10 Marks)**
b. What is inheritance? Explain different types of inheritance. Explain the inheriting multiple base classes with an example. **(10 Marks)**

PART – B

5 a. Explain with an example, the order of invocation of constructors and destructors and passing arguments to base class constructors in multilevel inheritance. **(10 Marks)**
b. What are the ambiguities that arise in multiple inheritance? How to overcome this? Explain with example. **(10 Marks)**

6 a. What are virtual functions? What is the need of virtual function? How is early binding different form late biding? **(06 Marks)**
b. How to inherit a virtual attribute? Explain with example. **(06 Marks)**
c. What is pure virtual function? Write a C++ program to create a class called NUMBER with an integer data member and member function to set the value for this data member. Derive three classes from this base class called HEXADECIMAL, DECIMAL and OCTAL. Include a member function DISPLAY( ) in all these three derived classes to display the value of base class data member in hexadecimal, decimal and octal respectively. Use the concept of pure virtual function. **(08 Marks)**

7 a. Define the concept of iostream provided in C++. Explain in detail IO stream class hierarchy. **(06 Marks)**

b. Write a C++ program to define a class called phonebook with data members name, area code, prefix and number and member functions readdata( ) which reads the values of the data members from the keyboard and writedata( ) which displays the values of the data members. Enter the data for atleast five phone numbers and store details in binary file phone and read the stored details and display on the screen. **(08 Marks)**

c. Explain the following member functions : setf( ), unsetf( ) and fill( ). **(06 Marks)**

8 a. What is exception handling? Write a C++ program to demonstrate the "try", "throw" and "catch" keywords for implementing exception handling. **(10 Marks)**

b. Explain the following with respect to STL :
   i) Containers
   ii) Types of containers
   iii) Iterators. **(10 Marks)**

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MATDIP301

Third Semester B.E. Degree Examination, Dec.2014/Jan.2015
Advanced Mathematics – I

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions.***

1 a. Express : $\dfrac{(3+i)(1-3i)}{2+i}$ in the form x + iy. **(05 Marks)**

b. Find the modulus and amplitude of the complex number $1 + \cos\alpha + i\sin\alpha$. **(05 Marks)**

c. If $(3x - 2iy)(2+i)^2 = 10(1+i)$, then find the values of x and y. **(05 Marks)**

d. Prove that $(\cos\theta_1 + i\sin\theta_1)(\cos\theta_2 + i\sin\theta_2) = \cos(\theta_1+\theta_2) + i\sin(\theta_1+\theta_2)$. **(05 Marks)**

2 a. Find the n^{th} derivative of $e^{ax}\cos(bx+c)$. **(06 Marks)**

b. If $y = a\cos(\log x) + b\sin(\log x)$ prove that $x^2y_{n+2} + (2n+1)xy_{n+1} + (n^2+1)y_n = 0$. **(07 Marks)**

c. Compute the n^{th} derivatives of $\sin x \sin 2x \sin 3x$. **(07 Marks)**

3 a. With usual notations prove that $\dfrac{1}{p^2} = \dfrac{1}{r^2} + \dfrac{1}{r^4}\left(\dfrac{dr}{d\theta}\right)^2$. **(06 Marks)**

b. Prove that the curves cuts $r^n = a^n\cos n\theta$, and $r^n = b^n \sin n\theta$ orthogonally. **(07 Marks)**

c. Expand $\log(1+\sin x)$ in powers of x by Maclaurin's theorem up to the terms containing x^3. **(07 Marks)**

4 a. If $u = x^2y + y^2z + z^2x$, prove that $\dfrac{\partial u}{\partial x} + \dfrac{\partial u}{\partial y} + \dfrac{\partial u}{\partial z} = (x+y+z)^2$. **(06 Marks)**

b. If $u = f(x-y, y-z, z-x)$, prove that $\dfrac{\partial u}{\partial x} + \dfrac{\partial u}{\partial y} + \dfrac{\partial u}{\partial z} = 0$. **(07 Marks)**

c. If $u = e^x\cos y$, $v = e^x \sin y$, find $J = \dfrac{\partial(u,v)}{\partial(x,y)}, J' = \dfrac{\partial(x,y)}{\partial(u,v)}$ and verify $JJ' = 1$. **(07 Marks)**

5 a. Obtain a reduction formula for $\int \sin^n x \; dx$. **(06 Marks)**

b. Evaluate : $\int_0^1\int_x^{\sqrt{x}}(x^2+y^2)dxdy$. **(07 Marks)**

c. Evaluate : $\int_0^a\int_0^x\int_0^{x+y} e^{x+y+z}\,dz\,dy\,dx$. **(07 Marks)**

6 a. Define Gamma function. Prove that $\Gamma(n+1) = n\Gamma(n)$. **(06 Marks)**

b. With usual notation prove that : $\beta(m,n) = \dfrac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$. **(07 Marks)**

c. Prove that $\beta\left(m,\frac{1}{2}\right) = 2^{2m-1}\beta(m,m)$. **(07 Marks)**

7 a. Solve : $\sec^2 x \tan y\, dx + \sec^2 y \tan x\, dy = 0$. **(05 Marks)**

b. Solve : $\frac{dy}{dx} = 1 + \frac{y}{x} + \left(\frac{y}{x}\right)^2$. **(05 Marks)**

c. Solve : $\frac{dy}{dx} + y \cot x = \sin x$. **(05 Marks)**

d. Solve : $(x^2 + y)dx + (y^3 + x)dy = 0$. **(05 Marks)**

8 a. Solve : $\frac{d^3y}{dx^3} - 6\frac{d^2y}{dx^2} + 11\frac{dy}{dx} - 6y = 0$. **(06 Marks)**

b. Solve : $y'' - 6y' + 9y = e^x + 3^x$. **(07 Marks)**

c. Solve : $\frac{d^2y}{dx^2} + 4y = x^2 + \sin 3x$. **(07 Marks)**

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