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10MAT31

Third Semester B.E. Degree Examination, Dec.2016/Jan.2017

Engineering Mathematics – III

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Obtain the Fourier series in $(-\pi, \pi)$ for $f(x) = x\cos x$. **(07 Marks)**

b. Obtain the Fourier half range sine series,

$$f(x) = \begin{cases} \frac{1}{4} - x & \text{in } 0 < x < \frac{1}{2} \\ x - \frac{3}{4} & \text{in } \frac{1}{2} < x < 1 \end{cases}.$$ **(07 Marks)**

c. Obtain the constant term and the coefficients of the first cosine and sine terms in the Fourier expansion of y from the table. **(06 Marks)**

x	0	1	2	3	4	5
y	9	18	24	28	26	20

2 a. Find the Fourier transforms of $f(x) = \begin{cases} 1 - x^2 & \text{for } |x| < 1 \\ 0 & \text{for } |x| \geq 1 \end{cases}$ and hence evaluate

$$\int_0^\infty \frac{x\cos x - \sin x}{x^3}\cos\frac{x}{2}\,dx.$$ **(07 Marks)**

b. Find the Fourier sine transform of $e^{-|x|}$. **(07 Marks)**

c. Find the inverse Fourier sine transform of $\hat{f}_s(\alpha) = \frac{e^{-a\alpha}}{\alpha}$, $a > 0$. **(06 Marks)**

3 a. Solve the wave equation $u_{tt} = c^2 u_{xx}$ given that $u(0,t) = 0 = u(2l, t)$, $u(x, 0) = 0$ and $\frac{\partial u}{\partial t}(x, 0) = a\sin^3\frac{\pi x}{2l}$ **(07 Marks)**

b. Solve the boundary value problem $\frac{\partial u}{\partial t} = c^2\frac{\partial^2 u}{\partial x^2}$ $0 < x < l$, $\frac{\partial u}{\partial x}(0,t) = 0$, $\frac{\partial u}{\partial x}(l,t) = 0$, $u(x, 0) = x$. **(07 Marks)**

c. Obtain the D'Alembert's solution of the wave equation, $u_{tt} = C^2 u_{xx}$ subject to the conditions $u(x,0) = f(x)$ and $\frac{\partial u}{\partial t}(x,0) = 0$. **(06 Marks)**

4 a. Fit a parabola $y = a + bx + cx^2$ for the data: **(07 Marks)**

x	0	1	2	3	4
y	1	1.8	1.3	2.5	2.3

b. Solve by using graphical method the L.P.P.

Minimize $z = 30x + 20y$

Subject to the constraints: $x - y \leq 1$

$x + y \geq 3$, $y \leq 4$

and $x \geq 0$, $y \geq 0$ **(07 Marks)**

c. Maximize $z = 3x + 4y$

subject to the constraints $2x + y \leq 40$, $2x + 5y \leq 180$,

$x \geq 0, y \geq 0$ using simplex method. **(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.

PART – B

5 a. Find the fourth root of 12 correct to three decimal places by using regula Falsi method. **(07 Marks)**

b. Solve $9x-2y+z=50$, $x+5y-3z=18$, $-2x+2y+7z=19$ by relaxation method obtaining the solution correct to two decimal places. **(07 Marks)**

c. Find the largest eigen value and the corresponding eigen vector of, $\begin{bmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{bmatrix}$ by using power method by taking initial vector as $[1 \quad 1 \quad 1]^T$. **(06 Marks)**

6 a. The table gives the values of $\tan x$ for $0.10 \le x \le 0.30$; Using interpolation formula find tan (0.26) **(07 Marks)**

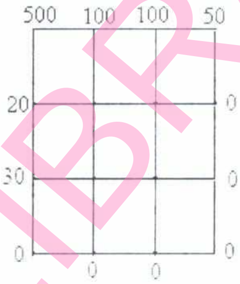
x	0.10	0.15	0.20	0.25	0.30
tanx	0.1003	0.1511	0.2027	0.2553	0.3093

b. Using Newton's forward and backward interpolation formula, calculate the increase in population from the year 1955 to 1985. The population in a town is given by, **(07 Marks)**

Year	1951	1961	1971	1981	1991
Population in thousands	19.96	39.65	58.81	77.21	94.61

c. Evaluate $\int_0^1 \frac{dx}{1+x}$ taking seven ordinates by applying Simpson's $\frac{3}{8}^{th}$ rule. Hence deduce the value of $\log_e 2$. **(06 Marks)**

7 a. Solve the Laplace's equation $u_{xx}+u_{yy}=0$, given that **(07 Marks)**



b. Solve $\frac{\partial^2 u}{\partial t^2} = 4\frac{\partial^2 u}{\partial x^2}$ subject to $u(0,t)=0$; $u(4,t)=0$; $u(x,0)=x(4-x)$. Take $h=1$, $K=0.5$ upto Four steps. **(07 Marks)**

c. Solve the equation $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ subject to the condition $u(x,\ 0) = \sin \pi x$, $0 \le x \le 1$, $u(0,t)=u(1,t)=0$ using Schmidt's method. Carry out computations for two levels, taking $h=\frac{1}{3}$, $K=\frac{1}{36}$. **(06 Marks)**

8 a. Find the z-transform of, (i) $\cosh n\theta$ (ii) $\sinh n\theta$ **(07 Marks)**

b. Obtain the inverse z-transform of, $\frac{4z^2-2z}{z^3-5z^2+8z-4}$. **(07 Marks)**

c. Solve the difference equation,
$y_{n+2}+2y_{n+1}+y_n=n$ with $y_0=y_1=0$ using z-transforms. **(06 Marks)**

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10CS32

Third Semester B.E. Degree Examination, Dec.2016/Jan.2017

Electronic Circuits

Time: 3 hrs. Max. Marks:100

Note: *Answer FIVE full questions, selecting at least 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 phenomenon of thermal runaway. **(06 Marks)**

b. Explain the working of a transistor switch. **(06 Marks)**

c. Determine the operating point for a fixed bias circuit shown in Fig.Q1(c).

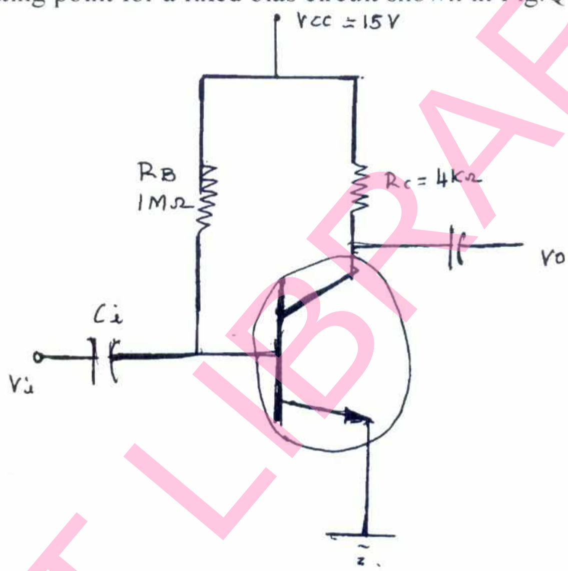

Fig.Q1(c) **(08 Marks)**

2 a. Explain the construction and working of a n channel enhancement MOSFET. **(10 Marks)**

b. What are the differences between JFETs and MOSFETs? **(05 Marks)**

c. Write a note on handling of MOSFETs. **(05 Marks)**

3 a. A photodiode has a noise current of 1FA, responsivity of 0.5 A/W, active area of 1 mm^2 and rise time of 3.5 ns. Determine: i) NEP, ii) Detectivity, iii) D*, iv) quantum efficiency. **(04 Marks)**

b. What is an opto coupler? Define forward opto coupling efficiency, isolation voltage and bandwidth. **(08 Marks)**

c. Explain the construction, characteristics and an application of a phototransistor with relevant diagrams. **(08 Marks)**

4 a. Derive expressions for A_i, Z_i, A_v and Y_o for a transistor amplifier using h-parameter model. **(12 Marks)**

b. Explain the need for cascading amplifier. Explain a two stage cascaded amplifier with a neat block diagram. **(08 Marks)**

PART – B

5 a. Explain the different classes of large signal amplifiers with their characteristic specifications. **(08 Marks)**

b. List the advantages of negative feedback. **(06 Marks)**

c. For the OPAMP based non-inverting amplifier circuit shown in Fig.Q5(c), determine the voltage gain, input impedance in the presence of feedback given that open loop gain and input impedance of OPAMP are 80 dB and 1 MΩ respectively.

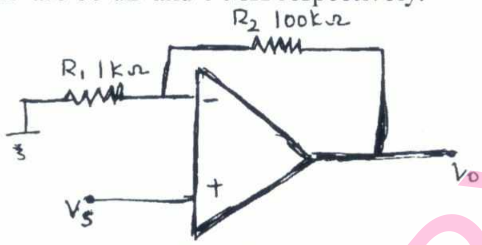

Fig.Q5(c) **(06 Marks)**

6 a. What are voltage controlled oscillators? Explain the working of voltage controlled Hartley oscillator with a neat circuit diagram. **(08 Marks)**

b. What is an RC high pass circuit? Explain how an RC high pass circuit can be used as a differentiator. **(08 Marks)**

c. Explain the frequency stability criterion. **(04 Marks)**

7 a. Explain the working of a three terminal IC voltage regulator with a neat functional block diagram. **(08 Marks)**

b. Define load regulation, line regulation, output, impedance, ripple rejection factor. **(08 Marks)**

c. Differentiate between linear power supply and switched mode power supply. **(04 Marks)**

8 a. Determine the common mode gain for an OPAMP with differential voltage gain and CMRR of an OPAMP of 110 dB and 100 dB respectively. **(04 Marks)**

b. Explain the working of an absolute value circuit with a neat circuit diagram. **(08 Marks)**

c. Explain the working of an inverting comparator with hysteresis with a neat circuit diagram and suitable transfer characteristics. **(08 Marks)**

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10CS33

Third Semester B.E. Degree Examination, Dec.2016/Jan.2017
Logic Design

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Define the following : i) Logic Gate and Logic Circuit ii) Fall time and Rise time iii) Period and frequency iv) Duty cycle [Symmetrical and Asymmetrical]. **(08 Marks)**

b. What are Universal gates? Prove their universalities. **(06 Marks)**

c. What is Positive Logic, Negative Logic and Assertion Level Logic? **(06 Marks)**

2 a. A digital system is to be designed in which the days of the week is given as input in 3-bit form. The day Sunday is represented as '000', Monday as '001' and so on. The output of the system has alternate 1's and 0's [ones and zero's] corresponding to the days of the week. Consider the excess number in beyond '110' as don't care conditions. For this system of three variables F(A, B, C) find the following :
i) Truth Table ii) Plot K – map iii) Simplified form of sum of product expression iv) Simplified form of product of sum expression. **(08 Marks)**

b. Using Quine Mc – Cluskey method, find the simplified sum of product expression for $F(A, B, C, D) = Y = \Sigma m\,(0, 1, 2, 8, 10, 11, 14, 15)$. **(10 Marks)**

c. Explain Static – 1 hazard. **(02 Marks)**

3 a. What is a Multiplexer? Explain 4:1 MUX with a neat block diagram, functional truth table and an equation. **(08 Marks)**

b. Implement the function $F(A, B, C, D) = \Sigma m\,(0, 3, 4, 7, 8, 10, 11, 13, 14, 15)$ using 8:1 multiplexer. **(06 Marks)**

c. Realize a full adder using a 3:8 decoder. **(06 Marks)**

4 a. With a neat sketch, explain Master – Slave JK flip flop. **(10 Marks)**

b. Define the following : i) Flip flop ii) Hold time iii) Propagation delay iv) Set up time v) Characteristic equation. **(10 Marks)**

PART – B

5 a. Draw the logic diagram of a 4-bit serial in serial out shift register using D – flip flop. Show the appropriate waveform and state table for shifting – in the input '0010'. **(10 Marks)**

b. List the applications of shift register. Explain Sequence Generator and Sequence detector. **(08 Marks)**

c. How long will it take to shift an 8-bit number into a 54164 shift register if the clock is set at 10 MHz? **(02 Marks)**

6 a. With a neat logic diagram, truth table and waveform, explain a 3 – bit binary ripple up – counter (Asynchronous). **(10 Marks)**

b. Design a synchronous Mod – 5 counter. **(10 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.

7 a. Write short notes on :
i) Mealy model ii) Moore model. **(10 Marks)**

b. What is an Algorithmic State Machine? What are the advantages of using ASM chart? Draw an ASM chart following Mealy model for the vending machine problem. **(10 Marks)**

8 a. Define a Binary ladder and draw a binary ladder for 4-bits. Design and explain a binary ladder with a digital input of '1000' and construct an equivalent circuit for the same. **(10 Marks)**

b. Define the following :
i) Binary Equivalent Weight.
ii) Millman's theorem.
iii) Analog to Digital conversion.
iv) Digital to Analog conversion. **(10 Marks)**

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Third Semester B.E. Degree Examination, Dec.2016/Jan.2017
Discrete Mathematical Structures

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. For any two sets A and B, prove that
$A-(A-B)=A\cap B$ **(05 Marks)**

b. If A, B, C are finite sets, then prove that
$|A-B-C|=|A|-|A\cap B|-|A\cap C|+|A\cap B\cap C|$ **(05 Marks)**

c. A professor has two dozen introductory text books on computer science and is concerned about their coverage of the topics (i) Compilers, (ii) Data structures, and (iii) Operating systems. The following is the data on the number of books that contain material on these topics.
$|A|=8,\ |B|=13,\ |C|=13,\ |A\cap B|=5, |A\cap C|=3,\ |B\cap C|=6,\ |A\cap B\cap C|=2.$
Find :
i) How many have no material on compilers.
ii) How many do not deal with any of the topics. **(05 Marks)**

d. A girl rolls (throws) a fair die three times. What is the probability that her second and third rolls are both larger than her first roll? **(05 Marks)**

2 a. Define Tautology. Prove that, for any propositions p, q, r the compound proposition.
$[(p\vee q)\wedge\{(p\rightarrow r)\wedge(q\rightarrow r)\}]\rightarrow r$ is a tautology. **(05 Marks)**

b. Without using truth tables, prove the following logical equivalence :
$[(p\vee q)\wedge(p\vee\neg q)]\vee q\Leftrightarrow p\vee q$ **(05 Marks)**

c. For any propositions p, q, r prove the following:
i) $p\uparrow(q\uparrow r)\Leftrightarrow\neg p\vee(q\wedge r)$
ii) $p\downarrow(q\downarrow r)\Leftrightarrow\neg p\wedge(q\vee r)$ **(05 Marks)**

d. Test the validity of the following argument : **(05 Marks)**
If I study, I will not fail in the examination.
If I do not watch TV in the evenings, I will study.
I failed in the examination.
____
$\therefore$ I must have watched TV in the evenings

3 a. Consider the following open statements with the set of all real numbers as the universe.
$p(x): x\geq 0$, $q(x): x^2\geq 0$
$r(x): x^2-3x-4=0$, $s(x): x^2-3>0$.
determine the truth values of the following statements :
i) $\forall x, p(x)\rightarrow q(x)$
ii) $\forall x, q(x)\rightarrow s(x)$
iii) $\forall x, r(x)\rightarrow p(x)$ **(06 Marks)**

b. Prove that the following argument is valid : **(07 Marks)**

$$\begin{array}{l} \forall x,[p(x) \rightarrow \{q(x) \wedge r(x)\}] \\ \underline{\forall x,[p(x) \wedge s(x)]} \\ \therefore \forall x,[r(x) \wedge s(x)] \end{array}$$

c. Give (i) a direct proof (ii) an indirect proof, and (iii) proof by contradiction, for the following statement :
"if n is an odd integer, then n + 9 is an even integer" **(07 Marks)**

4 a. Prove that $4n < (n^2 - 7)$ for all positive integers $n \geq 6$. **(06 Marks)**

b. Find an explicit definition of the sequence defined recursively by
$a_1 = 7$, $a_n = 2a_{n-1} + 1$ for $n \geq 2$. **(07 Marks)**

c. If $F_0, F_1, F_2, \ldots$ are Fibonacci numbers, prove that

$$\sum_{i=1}^{n} \frac{F_{i-1}}{2^i} = 1 - \frac{F_{n+2}}{2^n}$$

For all positive integers n. **(07 Marks)**

PART – B

5 a. Let f and g be functions from R to R defined by $f(x) = ax + b$ and $g(x) = 1 - x + x^2$. **(05 Marks)**

If $(g\circ f)(x) = 9x^2 - 9x + 3$, determine a, b.

b. Let A = {1, 2, 3, 4} and B = {1, 2, 3, 4, 5, 6}.
Find :
- i) The number of one-one function from A to B
- ii) The number of onto functions from A to B.
- iii) The number of onto functions from B to A. **(05 Marks)**

c. Let A = B = R the set of all real numbers, and the functions $f: A \rightarrow B$ and $g : B \rightarrow A$ be defined by $f(x) = 2x^3 - 1,\ \forall x \in A$; $g(y) = \left\{\frac{1}{2}(y+1)\right\}^{1/3},\ \forall y \in B$.

Show that each of f and g is the inverse of the other. **(05 Marks)**

d. If 5 colours are used to paint 26 doors, prove that at least 6 doors will have the same colour. **(05 Marks)**

6 a. Let A {1, 2, 3, 4, 5}. Define a relation R on A×A by (x_1, y_1) R (x_2, y_2) if and only if $x_1 + y_1 = x_2 + y_2$.
- i) Verify that R is an equivalence relation on A×A.
- ii) Determine the equivalence classes [(1, 3)] and [(2, 4)]. **(06 Marks)**

b. Let A = {1, 2, 3, 4, 6, 8, 12}. On A, define the relation R by aRb if and only if a divides b. Prove that R is a partial order on A. Draw the Hasse diagram for this relation. **(07 Marks)**

c. Consider the Hasse diagram of a poset (A, R) given below in Fig Q6(c).

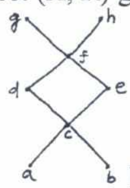

Fig Q6(c)

If B = {c, d, e}, find
- i) All upper bounds of B
- ii) all lower bounds of B
- iii) the LUB of B
- iv) the GLB of B. **(07 Marks)**

7 a. Define abelian group. Prove that a group G is abelian if and only if $(ab)^2 = a^2b^2$ for all $a, b \in G$. **(06 Marks)**

b. Define homomorphism. Let f be a homomorphism from a group G_1 to a group G_2. Prove that

i) If e_1 is the identity in G_1, and e_2 is the identity in G_2, then $f(e_1) = e_2$

ii) $f(a^{-1}) = [f(a)]^{-1}$ for all $a \in G_1$ **(07 Marks)**

c. An encoding function $E : Z_2^2 \to Z_2^5$ is given by the generator matrix

$$G = \begin{bmatrix} 1 & 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 1 & 1 \end{bmatrix}$$

i) Determine all the code words.

ii) Find the associated parity check matrix H. What about its error correction capability? **(07 Marks)**

8 a. Define group code. Consider the encoding function $E : Z_2^2 \to Z_2^6$ of the triple repetition code defined by E (00) = 000000, E(10) = 101010, E(01) = 010101, E(11) = 111111. Prove that $C = E\ (Z_2^2)$ is a group code. **(06 Marks)**

b. Define a Ring. If R is a ring with unity and a, b are units in R, prove that ab is a unit in R and that $(ab)^{-1} = b^{-1}a^{-1}$. **(07 Marks)**

c. Define integral domain. Let R be a commutative ring with unity. Prove that R is an integral domain if an only if, for all a, b, c, $\in$ R where $a \neq 0$, $ab = ac \Rightarrow b = c$. **(07 Marks)**

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10CS35

Third Semester B.E. Degree Examination, Dec.2016/Jan.2017

Data Structures with C

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Define pointer. With examples, explain pointer declaration, pointer initialization and use of the pointer in allocating a block of memory dynamically. **(06 Marks)**

b. What is recursion? What are the various types of recursion? **(05 Marks)**

c. Explain the following: i) Big - Oh ii) Big - Ω iii) Big - θ. **(09 Marks)**

2 a. Define structure and union with suitable example. **(08 Marks)**

b. Write a C program using structures with following fields NAME, ROLLNO, marks in M_1, M_2, M_3 and find Total and average. Read any N records and print all the records and also print the record who is having second highest total with all the fields. **(12 Marks)**

3 a. Define queue. Write a function for both INSERT( ) and DELETE( ) functions. **(08 Marks)**

b. Write an algorithm to convert infix to postfix expression and apply the same to convert following expressions from infix to postfix:

i) a/b – c + d * e - a * c ii) (a – b) + c/d $n e. **(12 Marks)**

4 a. What is a linked list? Explain the different types of linked list with diagram. **(10 Marks)**

b. Write a C-program to implement the insertion and delete operation on queue using linked list. **(10 Marks)**

PART – B

5 a. Define binary tree. For the given tree find the following:

i) Siblings
ii) Leaf nodes
iii) Ancestors
iv) Depth of a tree
v) Level of trees. **(10 Marks)**

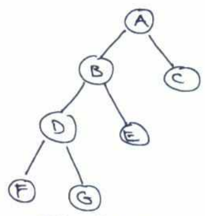

Fig.Q.5(a)

b. Explain the following with suitable example:

i) Strictly binary tree
ii) Complete binary tree
iii) Skewed tree. **(06 Marks)**

c. What is heap? Explain the different types of heaps. **(04 Marks)**

6 a. What is a binary search tree? Draw the binary search tree for the following list 14, 5, 6, 2, 18, 20, 15, 19, -3, 16. **(10 Marks)**

b. What is a forest? Explain the different methods of traversing a tree with following tree. **(10 Marks)**

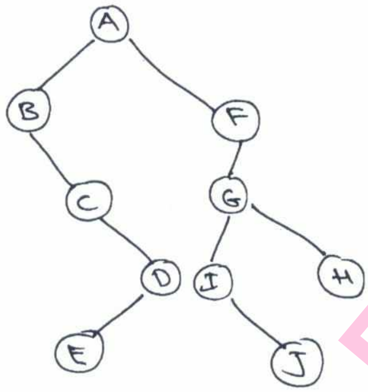

Fig.Q.6(b)

7 a. What is a priority queue? Explain the various types of priority queues. **(08 Marks)**

b. Write a short note on:

i) Binomial heaps

ii) Priority heaps

iii) Fibonacci heaps. **(12 Marks)**

8 a. What is an AVL tree? Write the algorithm to insert an item into AVL tree. **(10 Marks)**

b. Explain the following:

i) Red-black trees

ii) Splay trees. **(10 Marks)**

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10CS36

Third Semester B.E. Degree Examination, June/July 2015
Object Oriented Programming 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. State the important features of object oriented programming. Compare object oriented programming with procedure oriented programming. **(10 Marks)**

b. Define function overloading. Write a C++ program to define three overloaded functions to swap two integers, swap two floats and swap two doubles. **(10 Marks)**

2 a. Differentiate between class and structure. With an example explain the syntax for defining a class. **(10 Marks)**

b. List the characteristics of a constructor. Write a C++ program to define a suitable parameterized constructor with default values for the class distance with data members feet and inches. **(10 Marks)**

3 a. Differentiate between function overloading and function templates. Can we overload a function template? Illustrate with an example. **(08 Marks)**

b. Write a C++ program to create a class called STRING and implement the following operations. Display the results after every operation by overloading the operator <<.

i) STRING S1 = "VTU"
ii) STRING S2 = "BELGAUM"
iii) STRING S3 = S1 + S2 (Use copy constructor). **(08 Marks)**

c. List the characteristics of a friend function. **(04 Marks)**

4 a. Explain the visibility of base class members for the access specifiers : private, protected and public while creating the derived class and also explain the syntax for creating derived class. **(08 Marks)**

b. Write a C++ program to illustrate multiple inheritance. **(06 Marks)**

c. List the types of inheritances. Write a C++ program to implement single inheritance with public access specifier. **(06 Marks)**

PART – B

5 a. With an example, explain the syntax for passing arguments to base class constructors in multiple inheritance. **(10 Marks)**

b. With an example, explain the order of invocation of constructors and destructors in multiple inheritance. **(10 Marks)**

6 a. Differentiate between early binding and late binding. With an example explain how late binding can be achieved in C++. **(08 Marks)**

b. With an example, explain how virtual functions are hierarchical. **(06 Marks)**

c. Define pure virtual functions. Write a C++ program to illustrate pure virtual function. **(06 Marks)**

7 a. Explain the output manipulators : setw( ), setprecision( ) and setfill( ). **(06 Marks)**
b. Explain the use of ifstream and ofstream classes for file input and output. **(08 Marks)**
c. Explain the file operation functions in C++ to manipulate the position of file pointers in a random access file. **(06 Marks)**

8 a. Define exception handling. Explain the use of try, catch and throw for exception handling in C++. **(08 Marks)**
b. Write a C++ program to illustrate catching all exceptions. **(06 Marks)**
c. Explain briefly the three foundational items of standard template library. **(06 Marks)**

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MATDIP301

Third Semester B.E. Degree Examination, Dec.2016/Jan.2017

Advanced Mathematics - I

Time: 3 hrs. Max. Marks:100

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

1 a. Express the $\frac{3}{1+i} - \frac{1}{2-i} + \frac{1}{1-i}$ in the form of a + ib. **(06 Marks)**

b. Find the cube roots of 1 - i. **(07 Marks)**

c. Prove that $\left(\frac{1+\cos\theta+i\sin\theta}{1+\cos\theta-i\sin\theta}\right)^n = \cos n\theta + i\sin n\theta$. **(07 Marks)**

2 a. Find the nth derivative of $e^{ax}\cos(bx+c)$. **(07 Marks)**

b. Find the nth derivative of $\frac{x}{(x-1)(2x+3)}$. **(06 Marks)**

c. 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)**

3 a. With usual notations P.T $\tan\phi = \frac{rd\theta}{dr}$. **(06 Marks)**

b. Find the angle between the pairs of curves

$r = a\log\theta \quad r = \frac{a}{\log\theta}$. **(07 Marks)**

c. Find the Pedal equation to the curve $r = a(1+\sin\theta)$. **(07 Marks)**

4 a. State and prove Euler's theorem of Homogeneous functions. **(06 Marks)**

b. If $u = f(x-y, y-z, z-x)$

P.T $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} + \frac{\partial u}{\partial z} = 0$. **(07 Marks)**

c. If $u = \tan^{-1}x + \tan^{-1}y$, $V = \frac{x+y}{1-xy}$

S.T $\frac{\partial(u,v)}{\partial(x,y)} = 0$. **(07 Marks)**

5 a. Obtain the Reduction formula for $\int \sin^m x \cos^n x\, dx$. Where m, n are positive integers. **(07 Marks)**

b. Evaluate $\int_1^2 \int_0^{2-y} xy\, dx\, dy$. **(06 Marks)**

c. Evaluate $\int_0^3 \int_0^2 \int_0^1 (x+y+z)\, dz\, dx\, dy$. **(07 Marks)**

6 a. Prove that $\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}$. **(06 Marks)**

b. Prove that $\int_0^\infty x^2 e^{-x^4} dx \times \int_0^\infty e^{-x^4} dx = \frac{\pi}{8\sqrt{2}}$. **(07 Marks)**

c. Evaluate the Integral $\int_0^1 x^5(1-x)^6\,dx$. **(07 Marks)**

7 a. Solve $(D^3 - 3D - 2)y = 0$. **(06 Marks)**

b. Solve $(y'' + y) = e^{-x} + \cos x + x^3$. **(07 Marks)**

c. Solve $y'' - 2y' + y = xe^x \sin x$. **(07 Marks)**

8 a. Solve $\frac{dy}{dx} = \frac{x(2\log x + 1)}{\sin y + y\cos y}$. **(06 Marks)**

b. Solve $x \log x \frac{dy}{dx} + y = 2 \log x$. **(07 Marks)**

c. Solve $(2xy + y - \tan y)\,dx + (x^2 - x\tan^2 y + \sec^2 y)\,dy = 0$. **(07 Marks)**

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