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10MAT31

Third Semester B.E. Degree Examination, Dec.2017/Jan.2018
Engineering Mathematics – III

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Find the Fourier series for the function $f(x) = x + x^2$ over the interval $-\pi \le x \le \pi$. Hence deduce that:

i) $\frac{\pi^2}{12} = \frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \ldots\ldots$ ii) $\frac{\pi^2}{6} = \frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \ldots\ldots$ **(07 Marks)**

b. Expand the function $f(x) = x(\pi - x)$ over the interval $(0, \pi)$ in half range Fourier cosine series. **(06 Marks)**

c. Find the constant term and the first two harmonics for the function f(θ) given by the following table: **(07 Marks)**

θ (in degrees)	0	60	120	180	240	300	360
f(θ)	0.8	0.6	0.4	0.7	0.9	1.1	0.8

2 a. Show that the Fourier transform of the function

$$f(x) = \begin{cases} 1 - x^2, & |x| \le 1 \\ 0, & |x| > 1 \end{cases} \text{ is } F(\alpha) = \frac{2\sqrt{2}}{\alpha^3\sqrt{\pi}}(\sin\alpha - \alpha\cos\alpha).$$

Hence deduce that $\int_0^\infty \frac{\sin x - x\cos x}{x^3}\,dx = \frac{\pi}{4}$. **(07 Marks)**

b. Find the Fourier cosine transform of $f(x) = \frac{1}{1+x^2}$. **(06 Marks)**

c. If the Fourier sine transform of f(x) is given by $F_s(u) = \frac{\pi}{2}e^{-2u}$, find the function f(x). **(07 Marks)**

3 a. Find the various possible solutions of two-dimensional Laplace equation by method of separation of variables. **(07 Marks)**

b. 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)**

c. Solve the one-dimensional heat equation $c^2 u_{xx} = u_t$, $0 < x < \pi$ subject to the conditions $u(0, t) = 0$, $u(\pi, t) = 0$, $u(x,0) = u_0 \sin x$ where u_0 is a non-zero constant. **(07 Marks)**

4 a. Find a curve of the best fit of the form $y = ax^b$ to the following data: **(07 Marks)**

x	1	2	3	4	5
y	0.5	2	4.5	8	12.5

b. For conducting a practical examination, the chemistry department of a college requires 10, 12 and 7 units of 3 chemicals x, y and z respectively. The chemicals are available in 2 types of boxes: Box A and Box B. Box A contains 3, 2 and 1 units of x, y, z respectively and cost Rs.300. Box B contains 1, 2 and 2 units of x, y, z respectively and costs Rs.200. Find how many boxes of each type should be bought by the department so that the total cost is minimum. Solve graphically. **(06 Marks)**

c. Solve the following LPP by simplex method:
Maximize $z = 2x_1 + 4x_2 + 3x_3$
Subject to the constraints $3x_1 + 4x_2 + 2x_3 \le 60$ $2x_1 + x_2 + 2x_3 \le 40$
$x_1 + 3x_2 + 2x_3 \le 80$ $x_1, x_2, x_3 \ge 0$ **(07 Marks)**

PART – B

5 a. Use Newton-Raphson method to find an approximate root of the equation $x \log_{10} x = 1.2$ correct to 5 decimal places that is near 2.5. **(07 Marks)**

b. Use Relaxation method to solve the following system of linear equations:
$8x + 3y + 2z = 13$ $x + 5y + z = 7$ $2x + y + 6z = 9$ **(06 Marks)**

c. Find the numerically largest eigen value and the corresponding eigen vector of the matrix $A = \begin{bmatrix} 5 & 0 & 1 \\ 0 & -2 & 0 \\ 1 & 0 & 5 \end{bmatrix}$ by power method taking $X^{(0)} = [1 \quad 0 \quad 0]^T$. Perform 6 iterations. **(07 Marks)**

6 a. Find the interpolating polynomial for the function y = f(x) given by f(0) = 1, f(1) = 2, f(2) = 1, f(3) = 10. Hence evaluate f(0.75) and f(2.5). **(07 Marks)**

b. Apply Lagrange's method to find the value of x corresponding to f(x) = 15 from the following data: **(06 Marks)**

x	5	6	9	11
f(x)	12	13	14	16

c. Evaluate $\int_0^1 \frac{dx}{1+x^2}$ by using Simpson's $\frac{3}{8}^{th}$ rule dividing the interval (0, 1) into 6 equal parts.
Hence deduce the approximate value of π. **(07 Marks)**

7 a. Solve the wave equation $u_{tt} = 4u_{xx}$ subject to the conditions u(0, t) = 0, u(4, t) = 0, $u_t(x, 0) = 0$ and u(x, 0) = x(4 – x) by taking h = 1, k = 0.5 upto four steps. **(07 Marks)**

b. Find the numerical solution of the equation $u_{xx} = u_t$ when u(0, t) = 0, u(1, t) = 0, $t \ge 0$ and $u(x,0) = \sin \pi x$, $0 \le x \le 1$. Carryout computations for two levels taking $h = \frac{1}{3}$ and $k = \frac{1}{36}$. **(07 Marks)**

c. Solve Laplace's equation $u_{xx} + u_{yy} = 0$ for the following square mesh with boundary values as shown in the following Fig.Q7(c).

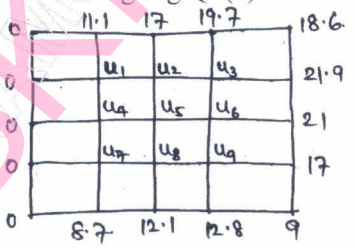

Fig.Q7(c) **(06 Marks)**

8 a. Find the z-transform of $5n^2 + 4\cos\frac{n\pi}{2} - 4^{n+2}$ and $\sinh n\theta$. **(06 Marks)**

b. Obtain in inverse z-transform of $\frac{z(2z+3)}{(z+2)(z-4)}$. **(07 Marks)**

c. Using z-transforms, solve $u_{n+2} + 3u_{n+1} + 2u_n = 3^n$ given $u_0 = 0$, $u_1 = 1$. **(07 Marks)**

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10CS32

Third Semester B.E. Degree Examination, Dec.2017/Jan.2018
Electronic Circuits

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Draw the fixed bias circuit using BJT and derive the expressions for operating point. Mention its advantages and disadvantages. **(08 Marks)**

b. For the circuit shown in Fig. Q1(b) determine the operating point. Given $\beta = 100$, $V_{BE} = 0.7V$ **(04 Marks)**

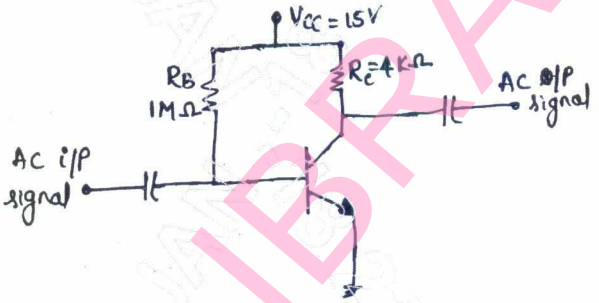

Fig. Q1(b)

c. Explain the working of transistor as a switch and define delay time, rise time, storage time and fall time with respect to transistor switching. **(08 Marks)**

2 a. Explain the construction, operation and characteristics of N-channel E-MOSFET with sketches. **(10 Marks)**

b. Briefly discuss the basic operation of CMOS inverter with a neat diagram. Mention two advantages of CMOS. **(06 Marks)**

c. List the difference between JFET's and MOSFETS (any four). **(04 Marks)**

3 a. What is an optocouplers? Explain the parameters of optocouplers in brief. **(06 Marks)**

b. Explain any six characteristics parameters of photo sensors. **(06 Marks)**

c. Explain the basic operation and construction of LED and also discuss the different LED characteristics. **(08 Marks)**

4 a. Draw the generalized h-parameter model of a transistor based amplifier and derive the expression for :

i) Current gain
ii) Input Impedance
iii) Voltage gain
iv) Output admittance. **(10 Marks)**

b. Discuss the effect of coupling and bypass capacitors on the low frequency response of the voltage divider BJT amplifier with relevant sketches. **(10 Marks)**

PART – B

5 a. Derive the expression for voltage gain, Input resistances and output resistance in case of voltage series feedback with a neat diagram. **(10 Marks)**

b. What are the advantages of negative feedback? **(06 Marks)**

c. An amplifier without feedback has a voltage gain of 100.
   i) Determine the gain of the amplifier with an introduction of 10% negative feedback.
   ii) Also find the feedback factor, if the gain required with feedback is 50. **(04 Marks)**

6 a. Explain the operation of monostable multi-vibrator with a neat diagram. (using BJT). **(08 Marks)**

b. Explain RC low pass circuit and discuss the behavior of this circuit for step and pulse inputs. **(08 Marks)**

c. Write a note on Barkhausen criterion. **(04 Marks)**

7 a. Explain the operation of buck regulator with relevant diagrams. **(10 Marks)**

b. Design mains transformer with the following specifications,
   Assume B = 60,000 lines/sq.inch.
   Primary voltage : 220V, 50Hz
   Secondary voltage : i) 5V at 1 A and efficiency is 90%
   ii) 12 – 0 – 12V at 100mA efficiency is 90% **(06 Marks)**

c. Define line regulation and load regulation for a regulated power supply. **(04 Marks)**

8 a. Define the following as referred to op-amp
   i) Bandwidth
   ii) CMRR
   iii) PSRR
   iv) Slew rate
   v) Open loop gain
   vi) Setting time **(06 Marks)**

b. Give a comparison between ideal op-amp with practical op-amp. **(06 Marks)**

c. With neat figure and relevant waveform, explain the working of relaxation oscillator circuit using op-amp. **(08 Marks)**

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10CS33

Third Semester B.E. Degree Examination, Dec.2017/Jan.2018
Logic Design

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. What is a digital electronic circuit? List the applications of digital circuits and systems. **(04 Marks)**

b. With an aid of a circuit diagram, explain the operation of a 2-input standard TTL NAND gate with totem-pole output. Show that NAND gate is an universal logic gate. **(08 Marks)**

c. Explain sourcing and sinking current, noise immunity, standard loading and output-input profile of standard TTL device. **(08 Marks)**

2 a. Realize a logic circuit using only NAND gates that converts a 4-bit binary input to a Gray-code output. Use Karnaugh maps for simplification of logic expressions. **(12 Marks)**

b. Find the simplified expression of, $Y = f(A,B,C,D) = \sum m(0,3,4,5,6,7,11,14)$ using Quine-Mccluskey method. **(08 Marks)**

3 a. Design a full adder circuit using a 3-to-8 decoder and multi-input OR gates. Write VHDL / verilog code for a 2 to 4 decoder. **(06 Marks)**

b. Explain how a 7446 decoder-driver is ued to drive a common anode seven-segment indicator. **(06 Marks)**

c. Distinguish :
(i) PAL and PROM.
(ii) PLA and PAL.
(iii) Encoder and multiplexer.
(iv) Even parity and odd parity. **(08 Marks)**

4 a. What is a Schmitt trigger? Show how it can be used to ensure rapid switching action. **(04 Marks)**

b. Show how to use a simple RS latch to eliminate switch contact bounce. **(06 Marks)**

c. Show how SR flip-flop is converted into JK flip-flop and explain how racing problem in JK flip-flop is avoided. Write VHDL/verilog code for JK flip-flop. **(10 Marks)**

PART – B

5 a. What is a shift register? How long will it take to shift an 8-bit number into a 74164 shift register if the clock is set at 10 MHz? **(04 Marks)**

b. Explain the working of 4-bit parallel-access shift register 7495. Show how it can be wired for shift left operation. **(08 Marks)**

c. Discuss the advantages and disadvantages of a ring counter. Also write VHDL/verilog code for a twisted tail counter. **(08 Marks)**

6 a. Realize a 3-bit asynchronous binary up-down counter using J-K flip-flops and basic logic gates. **(06 Marks)**

b. Design a modulo-4 synchronous counter using J-K flip flops. **(10 Marks)**

c. Realize a sequence generator circuit using synchronous counter to generate a repetitive sequence of binary word 1011 with minimum number of memory elements. **(04 Marks)**

7 a. Distinguish Moore model and Mealy model of sequential logic system. **(04 Marks)**

b. What is an ASM chart? Draw the ASM chart of a sequence generator that receives binary data stream at its input, X and signals when a combination '011' arrives at the input by making its output, Y high which otherwise remains low. Consider Moore model. **(08 Marks)**

c. Discuss the problems with asynchronous sequential logic circuits. **(08 Marks)**

8 a. What is a binary ladder DAC? Mention its advantages over the resistance divider DAC. Also explain accuracy and resolution of DAC. **(06 Marks)**

b. Explain the working of a 2-bit flash A/D converter. List its applications. **(08 Marks)**

c. Explain the successive approximation technique of A/D conversion. When is it useful? **(06 Marks)**

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10CS36

Third Semester B.E. Degree Examination, Dec.2017/Jan.2018
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. Explain basic data types available in C++, briefly with examples. **(05 Marks)**

b. What is inline function? Mention its advantages and also write a program to find cube of a given number. **(05 Marks)**

c. What is function overloading? Write a C++ program to find area of circle, triangle and rectangle by overloading the function area. **(05 Marks)**

d. Explain reference variable in C++. Also write a program to swap values of two given variables using reference variables. **(05 Marks)**

2 a. Explain how to achieve data hiding and encapsulation in C++, with suitable program. **(08 Marks)**

b. What are constructor and destructor? Can you overload constructor and destructor? Justify with suitable example. **(08 Marks)**

c. Explain static data member of a class. Also write a program to count the number of objects created. **(04 Marks)**

3 a. What is friend function? Write a program using bridge friend function swap to exchange the values of two variables and also display the result before and after swapping. **(10 Marks)**

b. Write a C++ program to add two complex numbers by overloading the operator + using member function. **(05 Marks)**

c. What is template function? Write a program using template function large to find the largest of three ints and three double numbers. **(05 Marks)**

4 a. How to achieve reusability in C++? Illustrate with an example. **(10 Marks)**

b. Explain the differences between the three visibility modes, with suitable example. **(10 Marks)**

PART – B

5 a. Explain how to pass arguments to base class constructors in multiple inheritance, with suitable example. **(10 Marks)**

b. Explain with the suitable diagram and program the virtual base class. **(10 Marks)**

6 a. What is runtime polymorphism? How to achieve it? Illustrate with an example program. **(10 Marks)**

b. Explain pure virtual function and abstract class with suitable programs. **(10 Marks)**

7 a. Explain with the neat diagram, the stream class hierarchy. **(07 Marks)**

b. Explain any five manipulators, with example. **(06 Marks)**

c. Explain briefly various file operations. **(07 Marks)**

8 a. What is exception? Explain briefly exception handling options. **(10 Marks)**

b. What is STL? Explain vector container briefly. **(10 Marks)**

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10CS35

Third Semester B.E. Degree Examination, Dec.2017/Jan.2018
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 the various memory allocation techniques? Explain them with example. **(06 Marks)**

b. What is recursion? What are the various types of recursion explain with example. **(06 Marks)**

c. What is a magic square? What is the procedure given by coxeter to generate the magic square? **(08 Marks)**

2 a. Point out the differences between malloc( ) and calloc( ) **(04 Marks)**

b. Write an algorithm to add two polynomials using abstract data type polynomial. **(08 Marks)**

c. Write an algorithm to search for an element in the sparse matrix represented as a triple. **(08 Marks)**

3 a. Define stack, write an ADT of it. **(04 Marks)**

b. Convert the following infix to postfix notations.

i) ((A + (B – C)*D)^E + F)

ii) X^Y^Z – M + N + P/Q. **(06 Marks)**

c. Write an algorithm to implement queue full and queue empty functions for the non – circular queue. **(10 Marks)**

4 a. What are linked lists? Point out its types and how a linked list is represented in 'C'? **(04 Marks)**

b. Write a 'C' functions to insert an item at the front end of the list. **(04 Marks)**

c. What are double – linked lists. Explain the procedure or a 'C' function how to insert a node at the front end and at the rear end. **(10 Marks)**

d. Point out any two differences between single and double link lists. **(02 Marks)**

PART – B

5 a. Define the following : i) Strictly binary tree ii) Skewed tree
iii) Complete binary tree iv) Binary search tree. **(04 Marks)**

b. Consider a binary tree, given in Fig.Q5(b).
Write the preorder, postorder and inorder traversals of the binary tree of Fig.Q5(b) **(06 Marks)**

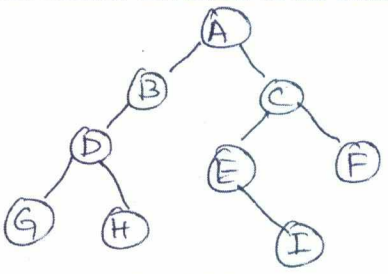

Fig.Q5(b)

c. Write a 'C' functions to traverse the tree in inorder, preorder, and postorder level. **(06 Marks)**

d. What are threaded binary trees? What are its types? How they are different from normal binary trees. **(04 Marks)**

6 a. What is a binary search tree? Explain how to insert an element in it. **(05 Marks)**

b. Consider the following forest given in Fig. 6(b) and convert the forest into a binary tree. **(05 Marks)**

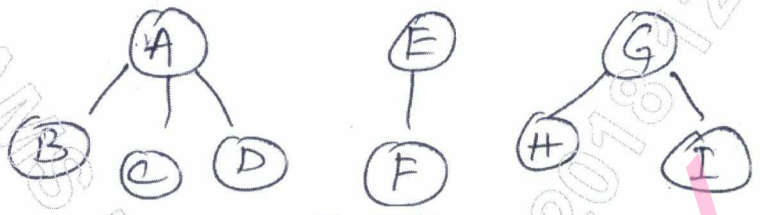

Fig. Q6(b)

c. What is a selection tree? What are its types and explain them briefly. **(04 Marks)**

d. What is an adjacency matrix and adjacency list explain both with an example. **(06 Marks)**

7 a. What is single ended and double ended priority queues? **(03 Marks)**

b. What is a binomial heap? What are the types of binomial heaps? **(06 Marks)**

c. What is a Fibonacci heap? What are the types of Fibonacci heaps? **(06 Marks)**

d. What is a paring heap? What are its types? **(05 Marks)**

8 a. What is an AVL tree? Write an algorithm to create an AVL tree. **(10 Marks)**

b. What is a Red Black tree? What is the rank of a node in a red-black tree? How a red–black tree can be represented? **(10 Marks)**

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MATDIP301

Third Semester B.E. Degree Examination, Dec.2017/Jan.2018
Advanced Mathematics - I

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Find the modulus and amplitude of $\frac{4+2i}{2-3i}$. **(06 Marks)**

b. Express the complex number $2 + 3i + \frac{1}{1-i}$ in the form a + ib. **(07 Marks)**

c. Simplify $\frac{(\cos 3\theta + i\sin 3\theta)^4(\cos 4\theta - i\sin 4\theta)^5}{(\cos 4\theta + i\sin 4\theta)^3(\cos 5\theta + i\sin 5\theta)^{-4}}$. **(07 Marks)**

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

b. Find the n^{th} derivative of $\frac{x^2}{2x^2+7x+6}$. **(07 Marks)**

c. If $y = e^{a\sin^{-1}x}$, prove that $(1-x^2)\,y_{n+2} - (2n+1)xy_{n+1} - (n^2+a^2)y_n = 0$. **(07 Marks)**

3 a. If ϕ is the angle between the tangent and radius vector to the curve $r = f(\theta)$ at any point (r, θ), prove that $\tan\theta = \frac{rd\theta}{dr}$. **(06 Marks)**

b. Find the angle of intersection between the curves $r^n = a^n\cos n\theta$ and $r^n = b^n\sin n\theta$. **(07 Marks)**

c. Using Maclaurin's series, expand tan x up to the term containing x^5. **(07 Marks)**

4 a. If $Z = f(x + ct) + \phi(x - ct)$, prove that $\frac{\partial^2 z}{\partial t^2} = C^2\frac{\partial^2 z}{\partial x^2}$. **(06 Marks)**

b. If $u = \sin^{-1}\left(\frac{x^2+y^2}{x+y}\right)$ prove that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y}$ tan u. **(07 Marks)**

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

PART – B

5 a. Obtain the reduction formula for $\int\cos^n x\,dx$. **(06 Marks)**

b. Using reduction formula evaluate $\int_0^a \frac{x^7}{\sqrt{a^2-x^2}}dx$. **(07 Marks)**

c. Evaluate $\int_0^1\int_0^1 e^{x+y}\,dx\,dy$. **(07 Marks)**

6 a. Evaluate $\int_0^1 \int_0^2 \int_1^2 x^2yz \, dxdydz$. **(07 Marks)**

b. Prove that $\beta(m, n) = \frac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$. **(07 Marks)**

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

7 a. Solve $3e^x \tan y \, dx + (1-e^x) \sec^2 y dy = 0$. **(06 Marks)**

b. Solve $(2x + 3y + 4)dx - (4x + 6y + 5) \, dy = 0$. **(07 Marks)**

c. Solve $\frac{dy}{dx} + y \tan x = \cos x$. **(07 Marks)**

8 a. Solve $\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 5y = -2 \cos hx$. **(06 Marks)**

b. Solve $(D^2 - 4D + 3)y = \sin 3x \cos 2x$. **(07 Marks)**

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

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