

CBCS Scheme

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15MAT41

Fourth Semester B.E. Degree Examination, Dec.2017/Jan.2018 Engineering Mathematics – IV

Time: 3 hrs.

Max. Marks: 80

**Note: 1. Answer any FIVE full questions, choosing one full question from each module.
2. Use of statistical tables is permitted.**

Module-1

- 1 a. Employ Taylor's series method to find y at $x = 0.1$. Correct to four decimal places given $\frac{dy}{dx} = 2y + 3e^x$; $y(0) = 0$. (05 Marks)
- b. Using Runge Kutta method of order 4, find $y(0.2)$ for $\frac{dy}{dx} = \frac{y-x}{y+x}$; $y(0) = 1$, taking $h = 0.2$. (05 Marks)
- c. If $y' = 2e^x - y$; $y(0) = 2$, $y(0.1) = 2.010$, $y(0.2) = 2.040$ and $y(0.3) = 2.090$. Find $y(0.4)$ using Milne's predictor corrector formula. Apply corrector formula twice. (06 Marks)

OR

- 2 a. Use Taylor's series method to find $y(4.1)$ given that $(x^2 + y)y' = 1$ and $y(4) = 4$. (05 Marks)
- b. Using modified Euler's method find y at $x = 0.1$, given $y' = 3x + \frac{y}{2}$ with $y(0) = 1$, $h = 0.1$. Perform two iterations. (05 Marks)
- c. Find y at $x = 0.4$ given $y' + y + xy^2 = 0$ and $y_0 = 1$, $y_1 = 0.9008$, $y_2 = 0.8066$, $y_3 = 0.722$ taking $h = 0.1$ using Adams-Bashforth method. Apply corrector formula twice. (06 Marks)

Module-2

- 3 a. Given $y'' = xy'^2 - y^2$ find y at $x = 0.2$ correct to four decimal places, given $y = 1$ and $y' = 0$ when $x = 0$, using R-K method. (05 Marks)
- b. If α and β are two distinct roots of $J_n(x) = 0$, then prove that $\int_0^1 x J_n(\alpha x) J_n(\beta x) dx = 0$ if $\alpha \neq \beta$. (05 Marks)
- c. If $x^3 + 2x^2 - x + 1 = ap_0(x) + bp_1(x) + cp_2(x) + dp_3(x)$ then, find the values of a, b, c, d . (06 Marks)

OR

- 4 a. Apply Milne's method to compute $y(0.8)$ given that $y'' = 1 - 2yy'$ and the table.

x	0	0.2	0.4	0.6
y	0	0.02	0.0795	0.1762
y'	0	0.1996	0.3937	0.5689

Apply corrector formula twice.

- b. Show that $J_{\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi x}} \sin x$. (05 Marks)
- c. Derive Rodrigue's formula $P_n(x) = \frac{1}{2^n n!} \frac{d^n}{dx^n} [(x^2 - 1)^n]$. (06 Marks)

Module-3

- 5 a. Define analytic function and obtain Cauchy Riemann equation in Cartesian form. (05 Marks)
- b. Evaluate $\int_c \frac{\sin \pi z^2 + \cos \pi z^2}{(z-1)^2(z-2)} dz$; c is the circle $|z| = 3$ by using theorem Cauchy's residue. (05 Marks)
- c. Discuss the transformation $w = e^z$ with respect to straight line parallel to x and y axis. (06 Marks)

OR

- 6 a. Find the analytic function whose real part is $u = \frac{x^4 y^4 - 2x}{x^2 + y^2}$. (05 Marks)
- b. State and prove Cauchy's integral formula. (05 Marks)
- c. Find the bilinear transformation which maps the points $z = 1, i, -1$ into $w = 2, i, -2$. (06 Marks)

Module-4

- 7 a. Find the constant c , such that the function $f(x) = \begin{cases} cx^2, & 0 < x < 3 \\ 0, & \text{otherwise} \end{cases}$ is a p.d.f. Also compute $p(1 < x < 2)$, $p(x \leq 1)$, $p(x > 1)$. (05 Marks)
- b. If the probability of a bad reaction from a certain injection is 0.001, determine the chance that out of 2000 individuals, more than two will get a bad reaction. (05 Marks)
- c. x and y are independent random variables, x take the values 1, 2 with probability 0.7; 0.3 and y take the values -2, 5, 8 with probabilities 0.3, 0.5, 0.2. Find the joint distribution of x and y hence find $\text{cov}(x, y)$. (06 Marks)

OR

- 8 a. Obtain mean and variance of binomial distribution. (05 Marks)
- b. The length of telephone conversation in a booth has been an exponential distribution and found on an average to be 5 minutes. Find the probability that a random call made from this booth (i) ends less than 5 minutes, (ii) between 5 and 10 minutes. (05 Marks)
- c. The joint distribution of two discrete variables x and y is $f(x, y) = k(2x + y)$ where x and y are integers such that $0 \leq x \leq 2$; $0 \leq y \leq 3$. Find: (i) The value of k ; (ii) Marginal distributions of x and y ; (iii) Are x and y independent? (06 Marks)

Module-5

- 9 a. Explain the terms: (i) Null hypothesis; (ii) Type I and type II errors; (iii) Significance level. (05 Marks)
- b. A die thrown 9000 times and a throw of 3 or 4 was observed 3240 times. Is it reasonable to think that the die is an unbiased one? (05 Marks)
- c. Find the unique fixed probability vector for the regular Stochastic matrix:

$$A = \begin{bmatrix} 0 & 1 & 0 \\ 1/6 & 1/2 & 1/3 \\ 0 & 2/3 & 1/3 \end{bmatrix}$$

(06 Marks)

OR

- 10 a. A certain stimulus administered to each of the 12 patients resulted in the following change in blood pressure 5, 2, 8, -1, 3, 0, 6, -2, 1, 5, 0, 4. Can it be concluded that the stimulus will increase the blood pressure. ($t_{0.05}$ for 11 d.f = 2.201) (05 Marks)
- b. It has been found that the mean breaking strength of a particular brand of thread is 275.6 gms with $\sigma = 39.7$ gms. A sample of 36 pieces of thread showed a mean breaking strength of 253.2 gms. Test the claim at 1+ and 5- level of significance. (05 Marks)
- c. A man's smoking habits are as follows. If he smokes filter cigarettes one week, he switches to non filter cigarettes the next week with probability 0.2. One the other hand, if he smokes non filter cigarettes one week there is a probability of 0.7 that he will smoke non filter cigarettes the next week as well. In the long run how often does he smoke filter cigarettes? (06 Marks)

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15CS42

Fourth Semester B.E. Degree Examination, Dec.2017/Jan.2018 Software Engineering

Time: 3 hrs.

Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

Module-1

- 1 a. What is software? List the fundamental software engineering activities. Mention and explain the key challenges or the general issues facing software engineering. (05 Marks)
- b. List and explain any five software engineering code of ethics. (05 Marks)
- c. Write block diagram for illustrating incremental development model. State at least two benefits and the problems in incremental development. (06 Marks)

OR

- 2 a. Explain functional, non-functional and domain requirements with at least one example for each. (03 Marks)
- b. Write the structure of the requirement document as suggested by IEEE standards. (10 Marks)
- c. List out all the stake-holders in Mental Health Care Patient Management System (MHC-PMS). Write a note on interviewing stake-holders for requirements discovery. (03 Marks)

Module-2

- 3 Write short notes on:
 - a. Context models with context diagram for MHC-PMS. (06 Marks)
 - b. Interaction models (05 Marks)
 - c. Behavioral models (05 Marks)

OR

- 4 a. Write a neat block diagram and explain the phases of Rational Unified Process (RUP). (06 Marks)
- b. List out all the activities in an object oriented design process. (02 Marks)
- c. What is a sequence model? Write the diagram for sequence model of operations in collecting data from a weather station and explain. (08 Marks)

Module-3

- 5 a. State and explain development testing and its three levels - unit testing, component testing and system testing. (04 Marks)
- b. List out all the guidelines for testing. (04 Marks)
- c. Explain test-driven development (TDD), with a block diagram. Explain TDD activities and benefits of TDD. (08 Marks)

OR

- 6 a. With appropriate block diagram, explain the software evolution process. (06 Marks)
- b. Define "program evolution dynamics". Discuss Lehman laws for program evolution dynamics. (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.

Module-4

- 7 a. Explain software pricing. List and briefly explain the factors affecting software pricing. (06 Marks)
b. List and explain various COCOMO cost estimation models. (10 Marks)

OR

- 8 a. List out the questions to be answered by the quality management team to decide whether or not the software is fit for its intended purpose. (06 Marks)
b. Explain the various inspection checklists for software inspection process. (06 Marks)
c. What are product metrics? Explain its two classes of metrics. (04 Marks)

Module-5

- 9 a. Draw the block diagram and explain the process of prototype development. What are the benefits of a prototype? Write briefly about throw away prototypes. (10 Marks)
b. List and explain any six extreme programming practices. (06 Marks)

OR

- 10 a. List all the four key features of testing in XP. (02 Marks)
b. What is pair programming? List the advantages of pair programming. (04 Marks)
c. Explain SCRUM. Draw and explain block diagram for the SCRUM process. List all the key characteristics of this process. Mention the advantages of SCRUM. (10 Marks)

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15CS43

Fourth Semester B.E. Degree Examination, Dec.2017/Jan.2018 Design and Analysis of Algorithms

Time: 3 hrs.

Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

Module-1

- 1 a. Define an algorithm. Discuss the criteria of an algorithm with an example. (06 Marks)
b. Prove that : If $t_1(n) \in O(g_1(n))$ and $t_2(n) \in O(g_2(n))$ then
 $t_1(n) + t_2(n) \in O(\max\{g_1(n), g_2(n)\})$ (06 Marks)
c. Explain the two common ways to represent a graph with an example (04 Marks)

OR

- 2 a. Consider the following algorithm
Algorithm GUESS (A[] [])
for i ← 0 to n - 1
 for j ← 0 to i
 A [i] [j] ← 0
 i) What does the algorithm compute?
 ii) What is basic operation?
 iii) What is the efficiency of this algorithm? (03 Marks)
b. List and explain important problem types that are solved by computer. (07 Marks)
c. Design an algorithm for checking whether all elements in a given array are distinct or not.
Derive its worst complexity. (06 Marks)

Module-2

- 3 a. Explain divide and conquer technique. Write a recursive algorithm for finding the maximum and minimum element from a list. (08 Marks)
b. Apply quick sort to sort the list E, X, A, M, P, L, E in alphabetical order. Draw the tree of the recursive calls made. (08 Marks)

OR

- 4 a. Discuss Strassen's matrix multiplication and derive its time complexity. (08 Marks)
b. Design merge sort algorithm and discuss its best-case, average-case and worst-case efficiency. (08 Marks)

Module-3

- 5 a. Solve the greedy knapsack problem where
 $m = 10, n = 4, P = (40, 42, 25, 12), W = (4, 7, 5, 3)$. (06 Marks)
b. What is job sequencing with deadlines problem? Let $n = 5$, profits [10, 3, 33, 11, 40] and deadlines [3, 1, 1, 2, 2] respectively. Find the optimal solution using greedy algorithm. (05 Marks)
c. Define minimum cost spanning tree (MST). Write Prim's algorithm to construct minimum cost spanning tree. (05 Marks)

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OR

- 6 a. Design Dijkstra's algorithm and apply the same to find the single source shortest path for graph taking vertex 'a' as source of Fig. Q6(a). (08 Marks)

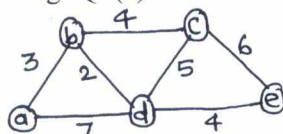


Fig. Q6(a)

- b. Construct a Huffman code for the following data :

Character	A	B	C	D
Probability	0.4	0.1	0.2	0.15

Encode the text ABACABAD and decode the text 100010111001010, using the above code.

(04 Marks)

- c. Construct the heap for the list 2, 9, 7, 6, 5, 8 by the bottom-up algorithm.

(04 Marks)

Module-4

- 7 a. Define transitive closure. Write Warshall's algorithm to compute transitive closure. Find its efficiency. (08 Marks)
- b. Apply Floyd's algorithm to find all pair shortest path for the graph of Fig. Q7(b). (08 Marks)

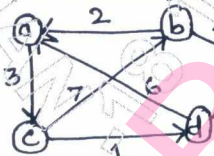
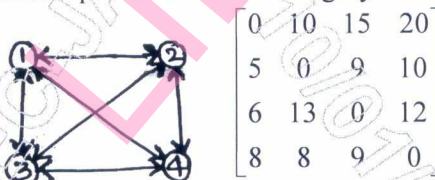


Fig. Q7(b)

OR

- 8 a. For the given cost matrix, obtain optimal cost tour using dynamic programming. (08 Marks)



0	10	15	20
5	0	9	10
6	13	0	12
8	8	9	0

Fig. Q8(a)

- b. Write a pseudocode to find an optimal binary search tree by dynamic programming.

(08 Marks)

Module-5

- 9 a. Write the pseudocode for backtracking algorithm. Let $w = \{3, 5, 6, 7\}$ and $m = 15$. Find all possible subsets of w that sum to m . Draw the state space tree that is generated. (09 Marks)
- b. Draw the portion of the state space tree for m - colorings of a graph when $n = 4$ and $m = 3$. (07 Marks)

OR

- 10 a. With the help of a state space tree, solve the Travelling Salesman Problem (TSP) of Fig. Q10(a), using branch-and-bound algorithm. (08 Marks)

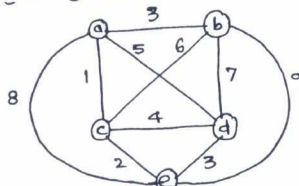


Fig. Q10(a)

- b. Explain the classes of NP - Hard and NP - complete.

(08 Marks)

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15CS44

Fourth Semester B.E. Degree Examination, Dec.2017/Jan.2018

Microprocessor and Microcontroller

Time: 3 hrs.

Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

Module-1

- 1 a. Explain the architecture of 8086 microprocessor with a neat diagram along with functions of various blocks. (06 Marks)
- b. With an example distinguish between physical address, logical address and offset address. If CS = 2000 h, DS = 3000 h, SS = 4000 h, ES = 5000 h, BX = 0020 h, BP = 0030 h. Find physical address for (i) MOV AL, [BP] (ii) MOV CX, [BX]. (04 Marks)
- c. Explain the following addressing modes of 8086:
 - i) Register indirect
 - ii) Based indexed indirect
 - iii) Direct memory.(06 Marks)

OR

- 2 a. What are assembler directives? Explain the following assembler directives (i) PROC, (ii) Assume, (iii) PTR. (04 Marks)
- b. Write assembly language program to add 5 bytes of data stored in data segment. (04 Marks)
- c. With syntax, explain the following control transfer instructions:
 - i) Conditional transfer
 - ii) Unconditional transfer instruction.(08 Marks)

Module-2

- 3 a. Explain the syntax of following instructions with an example:
 - i) DAA
 - ii) MUL
 - iii) AND
 - iv) SHR
 - v) CMP
 - vi) AAM(06 Marks)
- b. Write a program to convert lower case to upper case by reading string from KB and print the converted string at 10th row, 20th column after clearing the screen. (06 Marks)
- c. Write an ALP to count the number of one's and zero's in a given 8 bit data using rotate instructions. (04 Marks)

OR

- 4 a. Explain the syntax of following instructions with example: i) AAA, ii) Shl, iii) DIV, iv) RCR. (04 Marks)
- b. What is an interrupt? Explain various types with an interrupt vector table. (06 Marks)
- c. Write an ALP to sort a given set of 16 bit numbers in ascending order using any sorting method. (06 Marks)

Module-3

- 5 a. With an example, explain how to identify over flow and under flow using flags in a flag register for performing arithmetic operation on 16 bit number. (06 Marks)
- b. Write the syntax of following instruction and explain with an example: (i) CBW, (ii) IDIV, (iii) CMPSB, (iv) Xlat. (04 Marks)
- c. Design a memory system for 8086 with one 64 KB RAM and one 64 KB ROM at address 30000h and F0000h show the complete design along with memory mapping and draw the final diagram with address decoder. (06 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
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OR

- 6 a. With block diagram, explain 8255 and write control word register format for P_A output, P_B input in mode 0. (06 Marks)
- b. Write an ALP to read P_B and check number of one's in a given 8 bit data at P_B and display FFh on P_A if it is even parity else 00h on P_A if it is odd parity. (05 Marks)
- c. Write a program using string instructions to accept a string from keyboard and check for palindrome and accordingly display appropriate message. (05 Marks)

Module-4

- 7 a. Compare microprocessor with microcontroller. (04 Marks)
- b. Explain the programmer's model of ARM processor with complete register sets available. (04 Marks)
- c. With diagram explain the various blocks in a 3 stage pipeline of ARM processor organization. (04 Marks)
- d. Explain registers used under various modes. (04 Marks)

OR

- 8 a. Explain the structure of ARM cross development tool kit. (06 Marks)
- b. Describe the various modes of operation of ARM processor. (05 Marks)
- c. Explain the various fields in Current Program Status Register (CPSR). (05 Marks)

Module-5

- 9 a. Explain the syntax with example the following instructions of ARM processor (i) MVN, (ii) RSB, (iii) ORR, (iv) MLA, (v) LDR. (05 Marks)
- b. Write a program to display message "Hellow world" using ARM7 instructions. (04 Marks)
- c. Explain various formats of add instructions based on operands of ARM7 processor. (04 Marks)
- d. If $r_5 = 5$, $r_7 = 8$ and using the following instruction, write values of r_5 , r_7 after execution $MOV\ r_7, r_5, LSL\ \# 2$. (03 Marks)

OR

- 10 a. Explain software interrupt instruction of ARM processor. (04 Marks)
- b. Explain various types of multiply instructions with syntax and example. (04 Marks)
- c. What are the salient features of ARM instruction set? (05 Marks)
- d. If $r_1 = 0b1111$, $r_2 = 0b0101$, find r_0 after $BIC\ r_0, r_1, r_2$. (03 Marks)

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15CS45

Fourth Semester B.E. Degree Examination, Dec.2017/Jan.2018 Object Oriented Concepts

Time: 3 hrs.

Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

Module-1

- 1 a. List out the difference between procedure oriented program and object oriented program. (05 Marks)
b. Explain function overloading with example. (05 Marks)
c. What is constructor? List the different type of constructors and explain default constructor with example. (06 Marks)

OR

- 2 a. Explain the concept of object oriented program
i) Encapsulation
ii) Polymorphism
iii) Inheritance
iv) Data initialization. (08 Marks)
b. Explain function prototyping with example. (05 Marks)
c. How do namespace help in preventing pollution of the global name space? (03 Marks)

Module-2

- 3 a. Explain how java is robust and interactive. (05 Marks)
b. Write java program to sum only first five elements of the array using for each looping. (05 Marks)
c. Explain the operation of the following operators with example.
i) % ii) >>> iii) && (06 Marks)

OR

- 4 a. Write java program to initialize and display different types of integer and floating point variables. (06 Marks)
b. What is type casting? Illustrate with an example. What is meant by automatic type promotion? (06 Marks)
c. How to declare two dimensional arrays in java? Explain with simple example. (04 Marks)

Module-3

- 5 a. Describe the various levels of access protections available for packages and their implications. (08 Marks)
b. Give the basic form of an exception handling block. (04 Marks)
c. What is the importance of the clause finally? (04 Marks)

OR

- 6 a. Define inheritance. List the different types of inheritance. (05 Marks)
b. Illustrate with example a super class variable can reference a subclass object. (06 Marks)
c. Compare and contrast method overloading and overriding. (05 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
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Module-4

- 7 a. What is Thread? Explain two ways of creation of thread. (05 Marks)
b. What is synchronization? When do we use it? (05 Marks)
c. Explain KeyEvent and MouseEvent class. (06 Marks)

OR

- 8 a. Explain Delegation event model used to handle events in java. (08 Marks)
b. Explain the role of synchronization with producer and consumer problem. (08 Marks)

Module-5

- 9 a. What is an applet? Explain five main methods of applet. (08 Marks)
b. Explain with syntax the following :
i) JLabel
ii) JTextField
iii) JButton
iv) JCheckBox (08 Marks)

OR

- 10 a. Create swing applet that has two buttons named beta and gamma. When either of the buttons pressed, it should display "beta pressed" and "gamma was pressed" respectively. (08 Marks)
b. Explain getDocumentbase and getCodebase in applet class. (08 Marks)

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15CS46

Fourth Semester B.E. Degree Examination, Dec.2017/Jan.2018

Data Communication and Networking

Time: 3 hrs.

Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

Module-1

- 1 a. Define data communication. Explain the fundamental characteristics of a data communication system. With a neat diagram, explain the components of data communication. (06 Marks)
- b. Explain TCP/IP protocol suite of computer networks with a neat diagram. (08 Marks)
- c. Assume that five devices are connected in a mesh topology. How many duplex links are needed? How many ports are needed for each? (02 Marks)

OR

- 2 a. Explain different causes for transmission impairments during signal transmission through media. (06 Marks)
- b. Define line coding. List out its characteristics. Represent the sequence 10100110 using polar and biphase schemes. (08 Marks)
- c. A network with a bandwidth of 10 Mbps can pass only an average of 18000 frames per minute with each frame carrying an average of 10000 bits. What is the throughput of this network? (02 Marks)

Module-2

- 3 a. Explain with suitable diagram PCM encoder used for analog to digital conversion with example. (08 Marks)
- b. Define multiplexing. State and explain the data rate management to handle disparity in input data rates in TDM. (05 Marks)
- c. Four 1 Kbps connections are multiplexed together. A unit is 1 bit. Find:
 - i) Duration of 1 bit before multiplexing.
 - ii) Transmission rate of link.
 - iii) Duration of each time slot. (03 Marks)

OR

- 4 a. Briefly explain with neat diagrams, ASK and FSK modulation techniques and specify the bandwidth requirement. (06 Marks)
- b. We need to send data 3 bits at a time at a bit rate of 3 Mbps. The carrier frequency is 10 MHz. Calculate the number of levels (different frequencies, band rate and band width). (04 Marks)
- c. Explain how message can be sent from one system to another using datagram approach and calculate the total delay with appropriate diagrams. (06 Marks)

Module-3

- 5 a. Find the code word at sender site using CRC given dataword 101001111 and generator 10111. (05 Marks)
- b. Explain different frame types in HDLC. (06 Marks)
- c. Explain transition phases of PPP protocol. (05 Marks)

OR

- 6 a. Explain with neat diagram, simple parity check code. (06 Marks)
b. Explain with examples, computation of internet checksum. List the steps undertaken by sender and receiver for error detection. (05 Marks)
c. Explain stop-and-wait protocol with appropriate diagrams. (05 Marks)

Module-4

- 7 a. Explain working of CSMA/CD with suitable flow diagram. (07 Marks)
b. A network using CSMA/CD has a bandwidth of 10 Mbps. If the propagation time is $25.6 \mu\text{s}$, what is the minimum size of the frame? (03 Marks)
c. Define Bluetooth and explain the architecture of the same. (06 Marks)

OR

- 8 a. Define channelization. Explain CDMA with an example. (06 Marks)
b. A pure ALOHA network transmits 200 bits frames on a shared channel of 200 kbps. What is the throughput if the system produces 1000 frames per second. (04 Marks)
c. Discuss 802.3 MAC frame format. (06 Marks)

Module-5

- 9 a. Explain the operation of cellular telephony. (06 Marks)
b. Explain transition from IPV4 to IPV6. (06 Marks)
c. Discuss special addresses supported by IPV6. (04 Marks)

OR

- 10 a. Explain IP datagram header format with neat diagram and give the description of each field. (08 Marks)
b. Explain the working of mobile IP with diagram. (08 Marks)

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15MATDIP41

Fourth Semester B.E. Degree Examination, Dec.2017/Jan.2018 Additional Mathematics – II

Time: 3 hrs.

Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

Module-1

- 1 a. Find the rank of the matrix $A = \begin{bmatrix} 2 & 3 & -1 & -1 \\ 1 & -1 & -2 & -4 \\ 3 & 1 & 3 & -2 \\ 6 & 3 & 0 & -7 \end{bmatrix}$ by applying elementary row transformations. (06 Marks)
- b. Solve the following system of equations by Gauss-elimination method: $x + y + z = 9$, $x - 2y + 3z = 8$ and $2x + y - z = 3$. (05 Marks)
- c. Find the inverse of the matrix $\begin{bmatrix} 5 & -2 \\ 3 & 1 \end{bmatrix}$ using Cayley-Hamilton theorem. (05 Marks)

OR

- 2 a. Find the rank of the matrix $\begin{bmatrix} 1 & 3 & -1 & 2 \\ 0 & 11 & -5 & 3 \\ 2 & -5 & 3 & 1 \\ 4 & 1 & 1 & 5 \end{bmatrix}$ by reducing it to echelon form. (06 Marks)
- b. Solve the following system of equations by Gauss-elimination method: $x + y + z = 9$, $2x - 3y + 4z = 13$ and $3x + 4y + 5z = 40$. (05 Marks)
- c. Find the eigen values of $A = \begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$. (05 Marks)

Module-2

- 3 a. Solve $(D^4 - 2D^3 + 5D^2 - 8D + 4)y = 0$. (05 Marks)
- b. Solve $\frac{d^2y}{dx^2} - 4y = \cosh(2x - 1) + 3^x$. (05 Marks)
- c. Solve by the method of variation of parameters $y'' + a^2y = \sec ax$. (06 Marks)

OR

- 4 a. Solve $\frac{d^3y}{dx^3} - 3\frac{d^2y}{dx^2} + 4\frac{dy}{dx} - 2y = e^x$. (05 Marks)
- b. Solve $(D^2 + 5D + 6)y = \sin x$. (05 Marks)
- c. Solve by the method of undetermined coefficients $y'' + 2y' + y = x^2 + 2x$ (06 Marks)

Module-3

- 5 a. Find the Laplace transform of $\cos t \cdot \cos 2t \cdot \cos 3t$. (06 Marks)
- b. Find the Laplace transform $f(t) = \frac{Kt}{T}$, $0 < t < \pi$, $f(t+T) = f(t)$. (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.

c. Express $f(t) = \begin{cases} \cos t, & 0 < t < \pi \\ \sin t, & t > \pi \end{cases}$ in terms of unit step function, and hence find $L[f(t)]$.

(05 Marks)

OR

6 a. Find the Laplace transform of (i) $t \cos at$, (ii) $\frac{1 - e^{-at}}{t}$. (06 Marks)

b. Find the Laplace transform of a periodic function a period $2a$, given that

$$f(t) = \begin{cases} t, & 0 \leq t < a \\ 2a - t, & a \leq t < 2a \end{cases} \quad f(t+2a) = f(t).$$

(05 Marks)

c. Express $f(t) = \begin{cases} 1, & 0 < t < 1 \\ t, & 1 < t \leq 2 \\ t^2, & t > 2 \end{cases}$ in terms of unit step function and hence find its Laplace transform. (05 Marks)

Module-4

7 a. Find the inverse Laplace transform of (i) $\frac{(s+2)^3}{s^6}$, (ii) $\frac{s+5}{s^2-6s+13}$. (06 Marks)

b. Find inverse Laplace transform of $\log \left[\frac{s^2+4}{s(s+4)(s-4)} \right]$. (05 Marks)

c. Solve by using Laplace transforms $\frac{d^2y}{dt^2} + k^2y = 0$, given that $y(0) = 2$, $y'(0) = 0$. (05 Marks)

OR

8 a. Find the inverse Laplace transform of $\frac{4s+5}{(s+1)^2(s+2)}$. (06 Marks)

b. Find the inverse Laplace transform of $\cot^{-1} \left(\frac{s+a}{b} \right)$. (05 Marks)

c. Using Laplace transforms solve the differential equation $y'' + 4y' + 3y = e^{-t}$ with $y(0) = 1$, $y'(0) = 1$. (05 Marks)

Module-5

9 a. If A and B are any two events of S, which are not mutually exclusive then $P(A \cup B) = P(A) + P(B) - P(A \cap B)$. (05 Marks)

b. The probability that 3 students A, B, C, solve a problem are $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$ respectively. If the problem is simultaneously assigned to all of them, what is the probability that the problem is solved? (05 Marks)

c. In a class 70% are boys and 30% are girls. 5% of boys, 3% of girls are irregular to the classes. What is the probability of a student selected at random is irregular to the classes and what is the probability that the irregular student is a girl? (06 Marks)

OR

10 a. If A and B are independent events then prove that \bar{A} and \bar{B} are also independent events. (05 Marks)

b. State and prove Baye's theorem. (05 Marks)

c. A Shooter can hit a target in 3 out of 4 shots and another shooter can hit the target in 2 out of 3 shots. Find the probability that the target is being hit:

(i) when both of them try

(ii) by only one shooter. (06 Marks)
