G 1377 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2012

Fourth Semester

Branch : Computer Science and Engineering

COMPUTER ORGANIZATION (R)

(Improvement/Supplementary—2004 admission onwards)

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions briefly.*
Each question carries 4 *marks.*

1. Explain the organization of a computer.
2. Describe the different layers of a computer system.
3. Mention any *four* floating point instructions and their meanings.
4. Using 4 bit version of the divide algorithm, divide 9 by 2 (both are decimal numbers).
5. What is the performance of single-cycle machine ?
6. What is the significance of horizontal and vertical organization of microinstructions ?
7. What is memory hierarchy ? Specify its advantages.
8. State two techniques to reduce Cache miss penalty.
9. Explain the working of an optical mouse.
10. Describe how a dedicated I/O processor communicates with the main processor.

(10 × 4 = 40 marks)

Part B

Answer any **one** *full question from each module.*
Each full question carries 12 *marks.*

Module 1

11. Explain the different steps in breaking instruction execution into block cycles.

Or

12. (a) What are the practical issues to be considered for commercial interconnection structure ? (6 marks)

(b) Give algorithmic steps and explain execution of data movement instruction. (6 marks)

Turn over

Module 2

13. (a) With a flow chart, explain execution of floating divide instruction. (6 marks)

(b) Draw and explain the block diagram of binary multiplier and give flowchart of multiplication algorithm.

(6 marks)

Or

14. Explain any division algorithm which can be implemented as hardware and perform 5 ÷ 2 using the same algorithm.

Module 3

15. Draw and explain in detail a simple data path with the control unit.

Or

16. With a logical block diagram, explain the generation of next address in microprogrammed control unit. What are the different schemes followed in optimising the control memory in microprogram control.

Module 4

17. Draw and describe the static and dynamic RAM cell circuit diagrams and clearly explain the read and write operations. Compare and contrast them.

Or

18. (a) What is virtual memory ? Explain virtual to physical addresses with neat diagrams.

(6 marks)

(b) Design an algorithm to maintain a link list of a set of items stored in an associative memory.

(6 marks)

Module 5

19. With a neat block diagram, describe the components needed to interfcae CRT to a processor. Explain their functions clearly.

Or

20. With neat diagrams, explain the interfacing of a keyboard as a peripheral to a digital computer.

(5 × 12 = 60 marks)

G 1407 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2012

Fourth Semester

Branch : Computer Science and Engineering

DATA STRUCTURES AND PROGRAMMING METHODOLOGY (R)

(Improvement/Supplementary—2004 Admissions onwards)

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*
Each question carry 4 *marks.*

1. Give a recursive algorithm for finding the factorial of a number and derive time complexity.
2. Define Big Oh notation. Give any polynomial and its Big Oh notation.
3. Explain any *two* applications of the data structure Stack.
4. Explain how a linear array is used to implement a circular queue.
5. Let x and y be strings of same length represented as linked lists. Write a function which finds the first character of x which does not match with the corresponding character of y.
6. Compare and contrast array implementation and linked list implementation of stack.
7. Draw a full binary tree of height 2 and perform *inorder, preorder, postorder* and *level order* traversals on it.
8. Prove that the height of a binary tree that contains $n(n >= 0)$ elements is at most n and at least $\log_2(n+1)$.
9. Derive the average case time complexity of sequential search.
10. Explain the sorting technique of Radix Sort. Under what conditions would a Most–Significant–Digit–First Radix sort be more efficient that Least–Significant–Digit–First Radix sort ?

(10 × 4 = 40 marks)

Part B

Each question carries 12 *marks.*

11. Define "Algorithm". Explain the various phases of development of a program.

Or

12. What do you mean by time complexity of an algorithm ? Give the binary search algorithm and derive its time complexity.

Turn over

13. Assuming any efficient representation for a sparse matrix, give a code/pseudo-code for finding the transpose of a sparse matrix, and explain its working.

Or

14. Write a code/pseudo-code for multiplying two polynomials represented using arrays, and explain its working with two polynomials.

15. Write programs for implementing stack and queue using singly linked lists.

Or

16. Write a program/pseudo-code for evaluating a postfix expression. Use a stack implemented using linked list.

17. (a) Write a function/pseudo-code to count the number of leaf nodes in a binary tree, given a pointer to its root node.

    (b) Give a non-recursive code for performing depth first search on a graph.

Or

18. Write and explain a program to implement a binary tree. Also give functions to perform inorder, preorder and post order traversal on it.

19. Give and explain a code each for Insertion Sort, Selection Sort and Bubble Sort.

Or

20. Give the Heap Sort algorithm. Trace its working for the following input and draw all the intermediate heaps formed.

    {26, 5, 77, 1, 61, 11, 59, 15, 48, 19}

(5 × 12 = 60 marks)

G 1415 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2012

Fourth Semester

Branch : Computer Science and Engineering

ADVANCED MICROPROCESSORS AND PERIPHERALS (R)

(Improvement/Supplementary—2004 admission onwards)

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions briefly.*
Each question carries 4 *marks.*

1. Explain the status word format of 8279.
2. Explain bit set-reset mode in 8255.
3. What are the different keyboard modes of operation of 8279 keyboard/display controller ? Explain.
4. Explain the memories in a microcontroller.
5. List any *four* data types processed directly by 8088.
6. List all the addressing modes available in 8088.
7. Name the six groups of instructions in the 8086 instruction set.
8. During a bus cycle that involves an odd-addressed word transfer which byte of data is transferred over the bus during the first bus cycle.
9. How many bytes are there in a descriptor ? Name each of its fields and give their sizes.
10. What four types of SIMD data can be processed by the Pentium processor with MMX technology.

(10 × 4 = 40 marks)

Part B

Answer any **one** *full question from each module.*
Each full question carries 12 *marks.*

Module 1

11. Explain the internal architecture of 8255. Describe the mode 2 operation with port A as bidirectional bus and port B in mode 1 of 8255 using its control word, control signals, timing diagram and status word.

Or

12. Explain the block schematic internal functional blocks of 8251. Explain the sequence of instructions to be used for the initialisation of 8251 in serial asynchronous mode transmission of a byte stored in some general purpose register of 8085.

Turn over

Module 2

13. With neat diagram, explain how a 4 × 4 keyboard can be interfaced with 8085 using 8255 ? Give the control words used in the above design.

Or

14. Draw the internal architecture of any one general purpose microcontroller, emphasising the differences as compared to a microprocessor.

Module 3

15. Give an overview of how a byte of data is read from memory address B0004 of an 8088 based microcomputer, and list the memory control signals along with their active logic levels that occur during the memory read cycle.

Or

16. (a) Explain with suitable examples, the stack memory addressing modes. (6 marks)

(b) Explain any *four* data related addressing modes with appropriate examples. (6 marks)

Module 4

17. (a) Write a 8086 assembly language program to sort a byte array in ascending order using bubble sort.

(6 marks)

(b) Given a number N in the range $0 < N \leq 5$. Write an assembly language program that computes its factorial and saves the result in memory location FACT.

(6 marks)

Or

18. (a) Explain the real mode interrupt address pointer table and protected mode address pointer table of 80286.

(6 marks)

(b) Describe the bus activity that take place as the 80286 writes a byte of data into the memory address B0011.

(6 marks)

Module 5

19. Draw a neat block functional diagrams of the internl architecture of Pentium processor and explain its important features.

Or

20. (a) How is memory organized from a hardware point of view in a protected-mode and in a real mode 80386 microcomputer system ?

(8 marks)

(b) Explain the real mode internal interrupts serviced by 80386. (4 marks)

[5 × 12 = 60 marks]

G 1387 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2012

Fourth Semester

Branch : Computer Science and Engineering

OBJECT-ORIENTED PROGRAMMING (R)

(Improvement/Supplementary—2004 admission onwards)

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*
Each question carries 4 *marks.*

1. Explain classes and objects with appropriate examples.
2. What are member variables ? Explain with an example.
3. With examples, distinguish multiple and multilevel inheritance.
4. Can a derived class get access privilege for a private member of the base class ? Explain how.
5. Discuss various overloading mechanisms in C++.
6. Explain friend functions with the help of a real-life example.
7. What are templates ? Explain its uses.
8. List the important features of virtual destructors.
9. Why is Java known as platform neutral language ?
10. List four major C++ features that were intentionally removed for Java.

(10 × 4 = 40 marks)

Part B

Answer **either** *section (a)* **or** *(b) of each module.*
Each full question carries 12 *marks.*

Module 1

11. (a) (i) Explain, why member functions of a class are declared public. (6 marks)

(ii) What purpose do member functins serve in a class ? List the different types of such functions. (6 marks)

Or

(b) (i) What do you understand by default constructor and copy constructor functions used in classes ? How are these functions different from normal constructors ? Give examples for each. (8 marks)

(ii) What is a parameterized constructor ? How is it useful ? (4 marks)

Turn over

Module 2

12. (a) (i) Discuss various reasons that support the concept of inheritance in object oriented languages. (8 marks)

(ii) Which members of the base class can be accessed from derived classes but not by objects of derived classes ? (4 marks)

Or

(b) (i) Discuss, with examples, a situation in which the private derivation will be more appropriate as compared to public derivation. (7 marks)

(ii) Name the different forms of inheritance. How are they different from one another ? (5 marks)

Module 3

13. (a) A time comprises of three components-hours, minutes and seconds. Define a class to store the components of time with an overloaded operator function to add two times and hence find the result when you add, for example, 1 hr., 34 min. 30 sec. to 3 hrs., 21 min., 45 sec.

Or

(b) Write a C++ program which designs two classes and then calculates the multiplication of first class private data with second class private data. For solving the above problem use the concept of friend function.

Module 4

14. (a) Write a C++ program which calculates area of rectangle for (i) int type data ; (ii) float type data.

For solving the above problem, use function template.

Or

(b) Write a C++ program using overloaded function reciprocal () to find the reciprocal of a number for any type of arguments. Rewrite the same program using a template function to achieve the same objective.

Module 5

15. (a) Implement a program example student data base with name, date of birth and rank in entrance examination, using dynamic object allocation.

Or

(b) Write a program to calculate the mean, variance and standard deviation of N integers using object-oriented programming, in which member functions are defined as inline substitution.

($5 \times 12 = 60$ marks)

G 1397 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2012

Fourth Semester

Branch : Computer Science and Engineering

INTEGRATED CIRCUITS (R)

(Improvement/Supplementary—2004 admission onwards)

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions briefly.*
Each question carries 4 *marks.*

1. Why ECL logic is faster than TTL ? What are its demerits ?
2. What is wired logic ? Why it should not be used with active pull-up outputs ?
3. What is a PLD ? What do a dot and X represent on a PLD diagram ?
4. How many 16 K × 1 RAMs are required to achieve a memory with word capacity of 32 K and a word length of 8 bits ?
5. What are the advantages and disadvantages of counter type ADC ?
6. Define (i) quantization error ; (ii) resolution ; (iii) conversion time ; and (iv) propagation delay of an ADC.
7. A square wave of peak to peak amplitude of 750 mV has to be amplified to a peak to peak amplitude of 3.8 V, with a rise time of 4.5 μsec. or less. Can IC 741 op-amp be used ? Explain, why ?
8. Define CMRR, give its significance. What are the methods to improve CMRR ?
9. Draw the circuit of op-amp open loop comparator and sketch its voltage transfer characteristics.
10. Draw the circuit of a summing amplifier. Is there any limit on the number of inputs to such an amplifier ?

(10 × 4 = 40 marks)

Part B

Answer any **one** *full question from each module.*
Each full question carries 12 *marks.*

Module 1

11. Draw 2-input NAND gate circuits using (i) DTL family and (ii) CMOS family. Explain their working and compare their performances.

Or

12. With suitable circuit diagram, explain the working of 2-input medium speed TTL NAND gate with totem pole output. Compare it with 2-input Schottky TTL NAND gate with totem pole output. List the performance merits and demerits.

Turn over

Module 2

13. (a) Draw the circuit diagram of a 3 to 8 decoder with active low outputs to implement $f_1 = \pi M (0, 1, 3, 5, 6)$.

(6 marks)

(b) The content of a 4 bit register is initially 1101. The register is shifted 6 times to the right with the serial input being 101101. What is the content of the register after each shift ?

(6 marks)

Or

14. With necessary diagrams, explain PLA structure. How it can be used to generate logic functions ? Explain how PLA of $3 \times 4 \times 2$ can be used to realise $f = \Sigma m (0, 1, 3, 4)$.

Module 3

15. With neat diagrams, describe the working of a 3 bit parallel ADC. Discuss its merits and demerits.

Or

16. With neat block diagram and waveforms, describe the principle of working of a counter type ADC. What are its characteristics ?

Module 4

17. (a) A differential amplifier has inputs $V_{s1} = 10$ mV and $V_{s2} = 9$ mV. It has a differential mode gain of 60 dB and CMRR of 80 dB. Calculate the percentage error in the output voltage and the error voltage.

(6 marks)

(b) For an op-amp having a slew rate of 2 volt per microseconds, determine the maximum closed loop voltage gain that can be used when the input signal varies by 0.5 volt in 10 μS.

(6 marks)

Or

18. Explain the following parameters of op-amp :

(i) Input offset.

(ii) Input bias current.

(iii) Slew rate.

Describe circuits and procedure to measure the above parameters of the op-amp.

Module 5

19. With neat circuit diagrams and output expressions, describe how op-amp can be used as

(i) adder. (ii) subtractor.

(iii) differentiator. (iv) integrator.

Or

20. Draw a linear sweep generator circuit using two op-amps. Explain the working with the help of necessary waveforms. Derive expressions for the sweep duration and amplitude.

($5 \times 12 = 60$ marks)

G 1837 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2012

Fourth Semester

Branch : Computer Science and Engineering

CS 010 402—OBJECT ORIENTED PROGRAMMING (CS)

(Regular—2010 Admissions)

Time : Three Hours Maximum : 100 Marks

Answer **all** *questions.*

Part A

Each question carries 3 *marks.*

1. Differentiate Procedure Oriented Programming (POP) and Object Oriented Programming (OOP).
2. What is meant by Friend class ?
3. What is meant by Polymorphism ?
4. What are the blocks used in the Exception handing ?
5. Java is platform independent language. Justify.

(5 × 3 = 15 marks)

Part B

Each question carries 5 *marks.*

6. Describe the advantages of OOPS.
7. Explain about Hybrid inheritance with suitable OOP program.
8. Explain the concept of Abstract class and list its applications.
9. Describe in detail about throwing mechanism.
10. Explain the process of 'Open' files ?

(5 × 5 = 25 marks)

Part C

Each question carries 12 *marks.*

11. Explain nested and local classes with necessary examples.

Or

12. Write a program to implement constructor, copy constructor and destructor.

(12 marks)

13. Explain about Friend function with suitable example.

Or

14. Explain a public, private and protected inheritance.

(12 marks)

Turn over

15. In detail explain about :
    (a) Function overloading.
    (b) Operator overloading.

(6 + 6 = 12 marks)

Or

16. In detail explain the concept of the pure virtual methods.

17. Write a program to use single argument in Function template.

Or

18. Write a program to demonstrate the use of throw within and outside a function.

(12 marks)

19. Explain the process of read and write files.

Or

20. (a) How can we determine errors while dealing with files ?
    (b) How can we open a binary file and write to it ?

(8 + 4 = 12 marks)

[5 × 12 = 60 marks]

G 1843 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2012

Fourth Semester

Branch : Computer Science and Engineering/Information Technology

CS 010 403/IT 010 405—DATA STRUCTURES AND ALGORITHMS (CS, IT)

(Regular—2010 Admissions)

Time : Three Hours Maximum : 100 Marks

Answer **all** *questions.*

Part A

Each question carries 3 *marks.*

1. What is meant by Static Hashing ?
2. Define a Queue.
3. State the applications of linked lists.
4. Define a B Tree.
5. What is meant by sorting ? Mention the various sorting algorithm.

(5 × 3 = 15 marks)

Part B

Each question carries 5 *marks.*

6. Explain Big-Oh notation with an example.
7. Explain in detail the enqueue operation in a queue.
8. Explain the process of polynomial division in linked lists.
9. Define a graph, an undirected, and a directed graph.
10. Explain in merge sort algorithm.

(5 × 5 = 25 marks)

Part C

Each full question carries 12 *marks.*

11. Explain time complexity of an algorithm.

Or

12. Explain space complexity of an algorithm.
13. Explain priority queues in detail.

Or

14. Explain in brief the different ways to check whether the queue is empty or not ?

Turn over

15. Explain in brief insertion of nodes and deletion of nodes in various positions in a doubly linked list.

Or

16. Explain in brief insertion of nodes and deletion of nodes in various positions in a circular doubly linked list.

17. Explain a weakly connected graph and a weighted graph.

Or

18. Explain a complete binary tree and a right skewed binary tree.

19. Compare the sorting algorithms with respect to their best,, average, and worst cases.

Or

20. Explain the radix sort and heap sort algorithm.

(5 × 12 = 60 marks)

G 1861 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2012

Fourth Semester

Branch : Computer Science and Engineering

CS 010 405—MICROPROCESSOR SYSTEMS (CS)

(Regular—2010 Admissions)

Time : Three Hours Maximum : 100 Marks

Answer **all** *questions.*

Part A

Each question carries 3 *marks.*

1. What is the need of ALE and TRAP Pins in 8085 Microprocessor ?
2. What are the different memory mapping scheme ? Give any *one* advantage and disadvantage for each.
3. Explain priority interrupts of 8085.
4. What are the various programmed data transfer methods ?
5. What are the modes of operations used in 8253 ?

(5 × 3 = 15 marks)

Part B

Each question carries 5 *marks.*

6. What are the flags affected by ALU in 8085 ? Explain briefly.
7. Write short notes on subroutine with an example.
8. Explain the working of INTR interrupt.
9. Explain the need and functionality of a DMA controller.
10. Draw the architecture of 8251.

(5 × 5 = 25 marks)

Part C

Each full question carries 12 *marks.*

11. Explain the function of signals and major components in the architecture of 8085 processor.

Or

12. Write the name of the different addressing modes used in 8085 instruction set and explain about each one with suitable example.
13. Write an 8085 microprocessor based assembly language program to sort an array of data in ascending order.

Or

14. Write an assembly language program to convert ASCII Code to 8 bit binary.

Turn over

15. Explain briefly about the different types of interrupts in 8085.

Or

16. Draw the block diagram of programmable interrupt controller and describe its operation.

17. Briefly explain about 8257.

Or

18. Explain in detail about the operation of 8255.

19. Describe the architecture and working of 8253 timer.

Or

20. Explain about the USART 8051.

(5 × 12 = 60 marks)

G 1872 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2012

Fourth Semester

Branch : Computer Science and Engineering / Information Technology

CS 010 406 / IT 010 404—THEORY OF COMPUTATION (CS, IT)

(Regular—2010 Admissions)

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*
Each question carries 3 *marks.*

1. Explain the principle of Mathematical Induction.
2. Differentiate between Deterministic and Non-deterministic Finite automata.
3. Define instantaneous description of push down automata.
4. Design a TM that accepts the language of odd integers written in binary.
5. What is meant by halting problem ?

(5 × 3 = 15 marks)

Part B

Answer **all** *questions.*
Each question carries 5 *marks.*

6. Prove that all natural numbers of the form $n^3 + 3n$ are divisible by 3 using principle of induction.
7. Construct an NFA equivalent to the regular expression (0 + 1) (00 + 11) (0 + 1).
8. State and prove the pumping lemma.
9. Describe the Turing Machine which shifts a string w containing no blanks to one cell to the left.
10. Explain briefly NP hard and NP complete problems.

(5 × 5 = 25 marks)

Part C

Answer **either** (*a*) **or** (*b*) from *each question.*
Each full question carries 12 *marks.*

11. (a) With an example explain Primitive and partial recursive functions.

Or

(b) Define Diagonalization principle. Prove that the set is uncountable.

Turn over

12. (a) Prove that if a language C is accepted by some NFA, iff it is accepted by some DFA.

Or

(b) Show that the language $\{a^n e^n = i^L, i \geq 1\}$ is not regular.

13. (a) Obtain a CFG to generate a language of all non-palindrome over the alphabet $\Sigma = \{a, b\}$. Trace for a string of acceptable and non-acceptance using Left most derivation.

Or

(b) Show that any CFL without ε can be generated by an equivalent grammar in Chomsky Normal Form.

14. (a) Is the language $\alpha(G) = \{abc / n \geq 0\}$ accepted by the Turing machine ? If so, construct the Turing machine for the same and trace for a two strings, one for acceptance and other for rejection.

Or

(b) (i) Explain briefly the church Turing Thesis. (4 marks)

(ii) Explain :

1 A random access TM. (4 marks)

2 Non-deterministic TM. (4 marks)

15. (a) Write the characteristic features of p-completeness. Explain briefly with an example.

Or

(b) (i) Distinguish P, NP, NP-Hard and NP-complete problems. (6 marks)

(ii) Explain any *two* applications of NP-complete problems. (6 marks)

[5 × 12 = 60 marks]

G 1852

(Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2012

Fourth Semester

Branch : Computer Science and Engineering

CS 010 404—COMMUNICATION SYSTEMS (CS)

(Regular—2010 Admissions)

Time : Three Hours Maximum : 100 Marks

Answer **all** *questions.*

Part A

Each question carries 3 *marks.*

1. Define Sampling theorem.
2. Explain basic problems in signal transmissions.
3. What is the need for modulation ?
4. Compare the circuit, packet and message switching schemes.
5. What is ASCII code ?

(5 × 3 = 15 marks)

Part B

Each question carries 5 *marks.*

6. List the properties of continuous time Fourier transform.
7. Draw and explain the Architecture of a typical communication system.
8. Explain Pulse code modulation.
9. Draw the block diagram of Frequency division multiplexing.
10. Explain Baudot and Parity coding.

(5 × 5 = 25 marks)

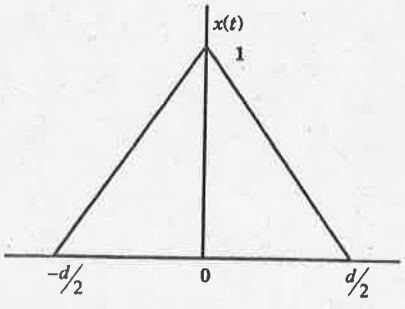
Part C

Each full question carries 12 *marks.*

11. (a) What are the properties of continuous time Fourier series.

Or

(b) Determine the Fourier transform of the signal.



Turn over

12. (a) Explain in detail typical parameters of communication systems.

Or

(b) Explain in detail Shannon Hartley theorem.

13. (a) Explain any *three* types of analog modulation technique.

Or

(b) Explain the following types of modulation schemes. (ASK, FSK)

14. (a) Explain the following : Simplex, Half Duplex an Full Duplex Transmissions.

Or

(b) Explain the basic ideas on SONET.

15. (a) Write the following error correction and detection code with example : Convolution coding. Hamming code. (6 + 6 = 12 marks)

Or

(b) Write short notes on EBCDIC, Bar coding. (6 + 6 = 12 marks)

(5 × 12 = 60 marks)

MODULE 5

19. Two independent sample sizes of 7 and 6 has the following values :

Sample A	:	28	30	32	33	31	29	34
Sample B	:	29	30	30	24	27	28	—

Examine whether the samples have been drawn from normal populations having the same variance.

(12 marks)

Or

20. Records taken of the number of male and female births in 800 families having four children are as follows :

No. of male births	:	0	1	2	3	4
No. of female births	:	4	3	2	1	0
No. of families	:	32	178	290	236	94

Test whether the data are consistent with the hypothesis that the binomial law holds and the chance of male birth is equal to that of the female birth, namely, $p = q = \frac{1}{2}$.

(12 marks)

[5 × 12 = 60 marks]

G 1833 (Pages : 4) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2012

Fourth Semester

EN 010 401—ENGINEERING MATHEMATICS—III

(Regular—2010 Admissions)

[Common to all Branches]

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*
Each question carries 3 *marks.*

1. Expand $\pi x - x^2$ in a half range sine series in the interval $(0, \pi)$ upto the first three terms.

2. Find the Fourier Transform of $f(x) = \begin{cases} 1 \text{ for } |x| < 1 \\ 0 \text{ for } |x| > 1. \end{cases}$

3. Form the partial differential equation by eliminating the arbitrary functions from $f(x + y + z, x^2 + y^2 + z^2) = 0$.

4. During war, one ship out of nine was sunk on an average in a certain voyage. What was the probability that exactly 3 out of a convoy of 6 ships would arrive safely ?

5. A random sample of 900 members has a mean 3.4 cm. Check if it can be reasonably regarded as a sample from a large population of mean 3.2 cm. and SD = 2.3 cm.

(5 × 3 = 15 marks)

Part B

Answer **all** *questions.*
Each question carries 5 *marks.*

6. Obtain Fourier series for the function

$$f(x) = \pi x, \quad 0 \le x \le 1$$
$$= \pi(2 - x) \quad 1 \le x \le 2$$

7. Find the Fourier cosine transform of $f(x) = \frac{1}{1 + x^2}$ and hence derive Fourier sine Transform of $\phi(x) = \frac{x}{1 + x^2}$

8. Solve $\frac{\partial^2 z}{\partial x \partial y} = \sin x \sin y$, given that $\frac{\partial z}{\partial y} = -2 \sin y$, when $x = 0$ and $z = 0$, when y is an odd multiple of $\frac{\pi}{2}$.

9. Assume that the probability of an individual coal-miner being killed in a mine accident during an year is $\frac{1}{2400}$. Use Poisson's distribution to calculate the probability that in a mine employing 200 miners, there will be at least one fatal accident in a year.

10. A coin was tossed 400 times and the head turned up 216 times. Test the hypothesis that the coin is unbiased.

(5 × 5 = 25 marks)

Part C

Answer any **one** *full question from each module.*
Each full question carries 12 *marks.*

Module 1

11. If $f(x) = x, \quad 0 < x < \pi/2$
$= \pi - x, \ \pi/2 < x < \pi$, show that

(a) $f(x) = \frac{4}{\pi}\left[\sin x - \frac{\sin 3x}{3^2} + \frac{\sin 5x}{5^2} - \ldots\ldots\right]$. (5 marks)

(b) $f(x) = \frac{\pi}{4} - \frac{2}{\pi}\left[\frac{\cos 2x}{1^2} + \frac{\cos 6x}{3^2} + \frac{\cos 10x}{5^2} + \ldots\ldots\right]$. (7 marks)

Or

12. Obtain the first three coefficients in the Fourier Cosine series for y from the following data :

x :	0	1	2	3	4	5
y :	4	8	15	7	6	2

(12 marks)

Module 2

13. (a) Using Fourier integral representation, show that $\int_0^\infty \frac{\cos \omega x}{1+\omega^2} d\omega = \frac{\pi}{2} e^{-x} \ (x \geq 0)$. (6 marks)

(b) Solve for F (x) the integral equation $\int_0^\infty F(x) \sin tx \, dx = \begin{cases} 1, & 0 \leq t < 1 \\ 2, & 1 \leq t < 2 \\ 0, & t \geq 2. \end{cases}$ (6 marks)

14. (a) Using Parseval's identity, prove that $\int_0^\infty \frac{dt}{(a^2+t^2)(b^2+t^2)} = \frac{\pi}{2ab(a+b)}$. (5 marks)

(b) Solve the integral equation $\int_0^\infty F(x) \cos px = dx \begin{cases} 1-p, & 0 \leq p \leq 1 \\ 0, & p > 1 \end{cases}$ and hence deduce that $\int_0^\infty \frac{\sin^2 t}{t^2} \, dt = \frac{\pi}{2}$. (7 marks)

Module 3

15. Solve $2zx - px^2 - 2pxy + pq = 0$. (12 marks)

Or

16. Solve :

(a) $(D^2 - 2DD' + D'^2) z = e^{(2x+3y)}$. (6 marks)

(b) $\frac{\partial^2 z}{\partial x^2} + 3\frac{\partial^2 z}{\partial x \partial y} + 2\frac{\partial^2 z}{\partial y^2} = 12xy$. (6 marks)

Module 4

17. A random variable X has the following probability distribution values of X :

x :	0	1	2	3	4	5	6	7	8	9
$p(x)$:	a	$3a$	$5a$	$7a$	$9a$	$11a$	$13a$	$15a$	$17a$	$19a$

(a) Determine the value of a (3 marks)

(b) Find $P(X < 3), P(X \geq 3), P(2 \leq X < 5)$. (6 marks)

(c) What is the smallest value for which $P(X \leq x) > 0.5$? (3 marks)

Or

18. A sample of 100 button cells tested to find the length of life, produced the following results : $\bar{x} = 12$ hours, $\sigma = 3$ hours. Assuming the data to be normally distributed, what percentage of button cells are expected to have life

(a) more than 15 hours ; (4 marks)

(b) less than 6 hours ; and (4 marks)

(c) between 10 and 14 hours ? (4 marks)

G 1372 (Pages : 3) Reg. No.....CS.....

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2012

Fourth Semester

ENGINEERING MATHEMATICS—III

(Common to all Branches)

[Improvement/Supplementary/2004 Admissions onwards]

Time : Three Hours Maximum : 100 Marks

Answer **one** *full question from each module.*
Each full question carries 20 *marks.*
Use of Statistical tables is permitted.

Module I

1. (a) Find the general solution of $p^2 + 2py \cot x = y^2$. (5 marks)

(b) Solve $xdx - xdy + \log xdx = 0$. (5 marks)

(c) Find the orthogonal trajectory of the cardioids

$r = a(1 - \cos\theta)$. (10 marks)

Or

(d) Solve $(D^2 + 2D + 1)\, y = 2 + x^2$. (5 marks)

(e) Solve $(D^2 - 2D + 1)\, y = e^x \log x$ by the method of variation of parameters. (5 marks)

(f) A bullet enters a board of 0.1 m thickness with a velocity of 200 m/s, pierces it and leaves the board with a velocity of 80 m/s. Assuming that the resistance offered by the board to the bullet is proportional to the square of its velocity, find the time taken by the bullet to pierce the board. (10 marks)

Module 2

2. (a) Solve $(pq - p - q)(z - px - qy) = pq$. (5 marks)

(b) Solve by Charpit's method : $q + xp = p^2$. (8 marks)

(c) Solve $\frac{\partial^2 z}{\partial x^2} - 7\frac{\partial^2 z}{\partial x \partial y} + 12\frac{\partial^2 z}{\partial y^2} = e^{x-y}$. (7 marks)

Or

(d) Find the complete solution of

$$\frac{\partial^2 z}{\partial x^2} - 3\frac{\partial^2 z}{\partial x \partial y} + 2\frac{\partial^2 z}{\partial y^2} = e^{(2x-3y)} + \sin(x-2y).$$

(10 marks)

(e) A bar with insulated sides is initially at temperature 0° C throughout. The end $x = 0$ is kept at 0° C and heat is suddenly applied at the end $x = l$ so that $\frac{\partial u}{\partial x} = A$ for $x = l$, where A is a constant. Find the temperature function $u(x, t)$.

(10 marks)

Module 3

3. (a) Using Fourier integrals, show that

$$\int_0^\infty \frac{\lambda \sin \lambda x}{k^2 + \lambda^2} d\lambda = \frac{\pi}{2} e^{-kx}, \; x > 0, k > 0$$

(8 marks)

(b) Solve the integral equation $\int_0^\infty F(x) \cos px dx = \begin{cases} 1-p & 0 \le p \le 1 \\ 0, & p > 1 \end{cases}$ and hence deduce that $\int_0^\infty \frac{\sin t}{t^2} dt = \frac{\pi}{2}$.

(12 marks)

Or

(c) Using Parseval's identity, show that $\int_0^\infty \frac{dx}{(1+x^2)^2} = \frac{\pi}{4}$. (10 marks)

(d) Find the Fourier cosine transform of $f(x) = \frac{1}{(1+x^2)}$ and hence derive Fourier sine transform of $\phi(x) = \frac{x}{1+x^2}$.

(10 marks)

Module 4

4. (a) In 800 families with 5 children each, how many families would be expected to have (i) 3 boys and 2 girls ; (ii) 2 boys and 3 girls ; (iii) no girl ; (iv) at the most two girls ? Assume probabilities for boys and girls to be equal.

(12 marks)

(b) Suppose a book of 585 pages contains 43 typographical errors. If these errors are randomly distributed throughout the book, what is the probability that 10 pages, selected at random, will be free from errors ?

(8 marks)

Or

(c) The probability that a man aged 40 years will die before reaching the age of 45 years is 0.018. Out of a group of 4 men, now aged 40 years, what is the probability that 2 men will die within the next 5 years ?

(10 marks)

(d) Fit a normal curve to the following distribution :

x :	2	4	6	8	10
f :	1	4	6	4	1

(10 marks)

Module 5

5. (a) In a simple sample of 600 men from a certain city, 400 are found smokers. In one of 900 men from another city, 450 are found to smoke. Do the data indicate that the cities are significantly different with respect to the prevalence of smoking among men ?

(10 marks)

(b) Tests for breaking strength were carried out on two lots of 5 and 9 steel wires respectively. The variance of first lot was 250 and that of the second was 482. Is there a significant difference in their variability ?

(10 marks)

Or

(c) Obtain the equation of the normal curve that may be fitted to the data and test the goodness of fit :

x :	4	6	8	10	12	14	16	18	20	22	24	Total
$f(x)$:	1	7	15	22	35	43	38	20	13	5	1	200

(10 marks)

(b) What is the probability that a correlation coefficient of 0.75 or less can arise in a sample of 30 from a normal population in which the true correlation coefficient is 0.9 ?

(10 marks)

[5 × 20 = 100 marks]