

- N. B. : (1) Attempt any **three** questions from **each** section.
 (2) Answers to the **two** sections must be written in **separate** answer books.
 (3) **Figures** to the **right** indicate **full** marks.
 (4) Assume **additional data** if **necessary** but **state** the **same** clearly.
 (5) Symbols have their usual meanings and tables have their usual standard design unless stated otherwise.
 (6) Use of **simple calculator** and **statistical tables** are **allowed**.

Section I

1. (a) Discuss three main aspects of a programming language. 3
 (b) Explain the hierarchy and associativity of various types of operators of a programming language with examples. 5
 (c) State and explain by giving examples various methods of passing parameters. 5
2. (a) Explain the need of lexical analysis. 2
 (b) State and explain algorithm for minimizing number of states of a DFA. 5
 (c) Construct DFA equivalent to NFA, 5

$M = (\{ A, B \}, \{ 0, 1 \}, \delta, A, \{ A \})$, where δ is a transition table given by—

δ	0	1
A	{A,B}	\emptyset
B	{B}	{B}

3. (a) Construct CFG for a language over $\{0, 1\}^*$ which accepts a strings having equal number of 0's and 1's. 3
 (b) Explain with reasons which of the following languages are context free :— 5
 (i) $L1 = \{wcwR | w \text{ is in } (a|b)^*\}$, where wR stands for w reverse.
 (ii) $L2 = \{wcw | w \text{ is in } (a|b)^*\}$
 (iii) $L3 = \{a^n b^m c^n d^m | n \geq 1 \text{ and } m \geq 1\}$
 (iv) $L4 = \{a^n b^n | n \geq 1\}$
 (c) Consider the grammar :— 5
 $S \rightarrow iCtS$
 $S \rightarrow iCtSeS$
 $S \rightarrow a$
 $C \rightarrow b$

Construct a leftmost and rightmost derivation for the sentence $w = ibtibtaea$.

4. (a) What is LR parser ? Why they are important ? 2
 (b) What is handle and handle pruning ? Consider the following grammar :— 5
 $E \rightarrow E+E$
 $E \rightarrow E^*E$
 $E \rightarrow (E)$
 $E \rightarrow id$
 Give sequence of reductions, which reduces $id_1 + id_2^* id_3$ to start symbol E.
 (c) Construct a predictive parsing table for the following grammar : — 5
 $S \rightarrow BC | AB$
 $A \rightarrow aAa | b$
 $B \rightarrow bAa | \epsilon$
 $C \rightarrow \epsilon$

Is above grammar LL(1) ? Why ?

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5. (a) What are conflicts in a parsing table? Can shift-shift conflict occur? Why? 2
- (b) Consider following augmented grammar : — 5
- $$S' \rightarrow S$$
- $$S \rightarrow CC$$
- $$C \rightarrow cC|d$$
- Construct LR(1) parsing table for above grammar.
- (c) Construct LALR parsing table for following grammar 5
- $$S' \rightarrow S$$
- $$S \rightarrow CC$$
- $$C \rightarrow cC|d$$
- What are advantages/disadvantages of LALR (1) grammar over LR(1) grammar constructed in question 5(b)?

Section II

6. (a) Convert the following postfix expression to infix expression : 4
- (i) $ab + df * +$
- (ii) $ab + c*$
- (b) What is syntax directed translation? Explain synthesized translation and inherited translation giving example. 4
- (c) Describe in detail with example any one method of translating Boolean expression. 4
7. (a) What is symbol table management in compilation? What are contents of symbol table? 3
- (b) Explain the storage of k dimensional array in memory. How an address of an element of the array is found? 5
- (c) Differentiate between error recovery and error repair. State and explain different types of errors that a compiler needs to handle. 5
8. (a) Discuss different criteria that can be applied to the selection of optimizing transformations. 4
- (b) What are blocks? How are they managed for their storage allocation? 4
- (c) Describe the use of list and tree data structure for the storage of symbol table. 4
9. (a) What are dominators? State properties of dominators. 3
- (b) What is directed acyclic graph (DAG)? Explain algorithm for constructing a DAG. 5
- (c) Explain loop unrolling and loop jamming optimization techniques. 5
10. (a) Consider a quadruple :— 6
- $A := B + C$ where B and C are simple variables in distinct memory locations. Give three different ways of code generation of the given quadruple. Assume suitable machine model and write your assumption of machine model clearly.
- (b) Assume a target machine is a byte-addressable machine with 2^{16} bytes of memory and have eight general purpose registers R0, R1, ..., R7, each capable of holding 16-bit quantity. Generate code for expression $w := (A - B) + (A - C) + (A - C)$. Assume suitable instructions for the target machine. 6

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RE-3863

(3 Hours)

[Total Marks : 75

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Section I

1. (a) What is Region of convergence (ROC) in Z-transform ? Find ROC for — 3
 $x(n) = a^n u(n)$.
- (b) Determine frequency response, magnitude response and phase response of the 5
 system given by $y(n) - 1/2y(n-1) = x(n)$.
- (c) What is digital filter realization ? Realize the transfer function 5

$$H(z) = \frac{1 + 1/4 z^{-1}}{(1 + 1/2 z^{-1})(1 + 1/2 z^{-1} + 1/4 z^{-2})}$$
 in cascade and parallel form.
2. (a) Explain what do you mean by windowing. Discuss Kaiser window to bring out 7
 the important features.
- (b) State and prove convolution property of DFT. Determine convolution of two 6
 sequences $x(n) = \{2, 1, 0, 0.5\}$, $h(n) = \{2, 2, 1, 1\}$ using convolution property of
 DFT.
3. (a) What are maximal ripple and extra ripple filters ? 2
- (b) Explain in brief the Remez Exchange algorithm in the design of Optimal FIR filters. 5
- (c) Analyze truncation and round-off processes of binary representations while realizing 5
 digital filters.
4. (a) Compare FIR and IIR low pass filters. 2
- (b) Discuss Model of a compensating D/A Converter. 5
- (c) Obtain the mapping differentials for the approximation of derivatives method using 5
 forward difference.
5. (a) Describe the Decimation in Frequency FFT Algorithm. Find $x(k)$ where 6
 $x(n) = \{1, 2, 3, 4\}$.
- (b) Write a note on Chirp Z-transform algorithm. State advantages and disadvantages 6
 of Chirp Z-transform.

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Section II

6. (a) Is the basic convolution theorem valid for linear time invariant for two dimensional systems ? Also illustrate the difficulty of applying it. 3
(b) Write a note on major logic family in Digital Signal Processing. 5
(c) Define causability, separability and stability in a two dimensional system. 5
7. (a) What is pipelining technique ? How does pipeline technique speed up processing ? 3
(b) Draw sketch and explain the working of add-shift multiplier. 5
(c) Explain working of ECL with a circuit diagram. 5
8. (a) State the steps used in design procedures for Digital Signal Processing applications. 2
(b) Explain the working of Cascade FIR Filter. 5
(c) Explain Multiplexed hardware for digital touch-tone receiver. 5
9. (a) Draw the structure of a simplified general purpose computer. 2
(b) Explain FFT indexing with respect to bit reversal and digital reversal of fixed indices. 5
(c) Explain the structure of Lincoln Processor 2. 5
10. (a) Explain any **one** of the following Radar parameters :— 2
(i) Antenna Aperture and Wavelength
(ii) Range and Range Resolution.
(b) Explain Homomorphism Processing of speech. 5
(c) What is the significance of ambiguity function in radar signals ? Explain. 5
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RE-3905

(3 Hours)

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Section I

1. (a) What is inter symbol interference ? 2
 (b) Explain APSK, with the help of QPSK and BPSK. 5
 (c) What are the benefits of reservation schemes ? How are collisions avoided during data transmission ? 5
2. (a) What is Spreading Factor and dwell time ? 3
 (b) Explain mobile services provided by GSM. 5
 (c) Name some key features of GSM, DECT, TETRA and UMTS systems. 5
3. (a) Name basic applications for satellite communication. 2
 (b) How do inclination and elevation determine the use of a satellite ? 5
 (c) Write a short note on : (i) DAB (ii) DVB. 5
4. (a) What does the lifetime field specify in registration replay ? 3
 (b) What is reverse tunneling ? Explain the same in detail. 5
 (c) What are general problems of mobile IP regarding security and support of quality of service ? 5
5. (a) How registration of mobile station is achieved ? 2
 (b) List entities of mobile IP and describe data transfer from a mobile node to a fixed node and vice versa. 5
 (c) What is wireless markup language (WML) ? State various features of WML. 5

Section II

6. (a) State the areas of application of simulation. 5
 (b) The probability distribution of the yields of corn for the current weather conditions is given below :— 8

Yield per acre in kgs	120	140	160	180
Probability	0.18	0.26	0.44	0.12

The probability distribution of per kg. price of corn as follows :—

Price per kg. in Rs.	10	12	14	16	18
Probability	0.20	0.30	0.25	0.15	0.10

Assuming that prices are independent of yields, combine these two into revenue per acre for next 5 years. Also, find the average revenue per acre. Use following Random Numbers.

For Yield : 20, 72, 34, 54, 30

For Price : 82, 95, 15, 96, 23

(Revenue per Acre = Yield per Acre × Price per kg.)

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7. (a) A pair of unbiased dice is rolled once. Find the probability distribution of the sum of the two numbers occurring on the uppermost face of the dice. Also find the cumulative distribution function. 4
- (b) A production process manufacturing computer chips produces on average 2% defective chips. Everyday a random sample of 10 chips is taken from the process. The process will be stopped if the sample contains not more than two defective chips. Determine the probability that the process is stopped by this sampling scheme. 4
- (c) The income of a group of 5000 persons is normally distributed with mean Rs. 7500 and standard deviation Rs. 500. Find the number of persons having income — (i) above Rs. 8500 (ii) between Rs. 7000 and Rs. 8250. 4

Given : the area (A) below the Standard Normal Curve between 0 and x is as follows :—

x	1.00	1.50	2.00
A	0.34134	0.43319	0.47725

8. (a) With reference to the Poisson Process, explain the terms — 4
- (i) Random Splitting
- (ii) Pooled Process.
- (b) With reference to a queuing system, explain the terms — 4
- (i) Calling Population
- (ii) System Capacity.
- (c) A small barber shop, operated by a single barber, has room for at most 2 customers. Potential customers arrive at a Poisson rate of 3 per hour and successive service times are independent exponential random variables with mean 1/4 hours. 4
- (i) What is the probability that the system is empty ?
- (ii) What is the expected number of customers in the system ?

9. (a) Explain the Kolmogorov-Smirnov test to test the uniformity of a set of numbers. 4
- (b) Consider the following sequence of random numbers :— 8

0.12	0.01	0.23	0.28	0.89	0.31	0.64	0.28	0.83	0.93
0.99	0.15	0.33	0.35	0.91	0.41	0.60	0.27	0.75	0.88
0.68	0.49	0.05	0.43	0.95	0.58	0.19	0.36	0.69	0.87

Test whether 3rd, 8th, 13th etc. numbers in the sequence are auto correlated.
[Given : the area below the Standard Normal Curve between ± 1.96 is 0.95]

10. (a) Explain the Convolution method to generate random variates for an Erlang distribution. 5
- (b) Write the algorithm to generate EAR(1) Time series. 4
- (c) Discuss Input-output validation using Turing Test. 4

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RE-3974

(3 Hours)

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SECTION I

1. (a) Define a data warehouse and explain why there is a need to form data warehouse. **5**
 (b) Explain the steps involved in planning data warehouse. **5**
 (c) Explain physical and operational infrastructure related to data warehouse. **3**
2. (a) Explain how to form information package by considering a scenario of toy shop. **5**
 (b) Explain in detail extraction, transformation and loading processes in ETL. **5**
 (c) Differentiate between MOLAP and ROLAP. **3**
3. (a) Explain Discretization process to handle noisy data in preprocessing of data in data mining. **5**
 (b) Define Gini index to measure impurity in CART algorithm in classification. Find Gini index for the following nodes :— **5**

Node N1	Count
class = 0	1
class = 1	5

Node N2	Count
class = 0	3
class = 1	3

- (c) What is data mining ? Explain any one of the application of data mining. **2**
4. (a) Explain k-mean method to divide the set of members into groups in cluster analysis. What are the strengths and weaknesses of this method ? **5**
 (b) Draw dendrogram using single link clustering algorithm for the following adjacency matrix :— **5**

Item	A	B	C	D
A	0	1	4	5
B	1	0	2	6
C	4	2	0	3
D	5	6	3	0

- (c) Define association rule. Write any one of the rule for given items. **2**
5. (a) What do you mean by frequent item set ? Use Apriori algorithm to generate frequent item sets for the following by taking support threshold as 60%: **5**

TID	Items
1	{Bread, Milk}
2	{Bread, Diapers, Beer, Eggs}
3	{Milk, Diapers, Beer, Cola}
4	{Bread, Milk, Diapers, Beer}
5	{Bread, Milk, Diapers, Cola}

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- (b) Create a Markov chain for the following scenario :— 5
 It is predicted today that if it is raining then the chance of raining tomorrow is 40 % and not raining tomorrow is 60%. On the other hand if it is not raining today then the chance of raining tomorrow is 20% and not raining is 80%.
- (c) State "**true or false** : If {c, d, e} is frequent item set then its subsets is also frequent". If true then state the principle by which it is true. 2

SECTION II

6. (a) Describe and differentiate pipelined parallelism and data partitioned parallelism. 5
 (b) Discuss how each of the following operators can be paralyzed using data partitioning : scanning, sorting, join. Illustrate with example. 5
 (c) What are the advantages of distributed databases ? 2
7. (a) Describe and explain any two architectures supported by distributed DBMS. 5
 (b) What are the similarities and differences between parallel and distributed database management systems ? 5
 (c) When can you say that the global history is serializable ? 2
8. (a) How is an object identifier (oid) different from primary key in a relational DBMS ? Define deep and shallow equality and illustrate with an example. 5
 (b) What are the new kinds of data types supported in object database system ? Give an example and discuss how the situation would be handled if only an RDBMS were available. 5
 (c) Show with an example how one can map entities and relationships of E-R diagram to types and tables of object data model. 2
9. (a) How do we index collections of XML documents ? What is the difference between indexing on structure versus indexing on value ? 5
 (b) Write a short note on semi structured data model in XML documents. 5
 (c) Explain Event-Action-Condition paradigm in active database. What are the different types of events that are possible in this paradigm ? 3
10. (a) What are the characteristics of spatial data ? What are the difference between spatial range queries, nearest neighbor queries and spatial join queries ? 5
 (b) Compare conventional database with temporal database by giving suitable example. 5
 (c) Write short note on mobile database. 3
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