(Time: 2½ hours)

Total Marks: 75

N. B.: (1) **All** questions are **compulsory**.
(2) Make **suitable assumptions** wherever necessary and **state the assumptions** made.
(3) Answers to the **same question** must be **written together**.
(4) Numbers to the **right** indicate **marks**.
(5) Draw **neat labeled diagrams** wherever **necessary**.
(6) Use of **Non-programmable** calculators is **allowed**.

1. **Attempt *any three* of the following:** 15
a. What is Python? List and explain feature of Python.
b. Write the steps to install Python and to run Python code.
c. Explain type conversion of variable in Python.
d. Explain if...else statement with example.
e. Explain the use of break statement in a loop with example.
f. What is the difference between interactive mode and script mode in Python?

2. **Attempt *any three* of the following:** 15
a. How function is defined and called in Python?
b. Write a function that takes single character and prints 'character is vowel' if it is vowel, 'character is not vowel' otherwise.
c. Short note on incremental development.
d. What is recursive function? Write a Python program to calculate factorial of a number using recursive function?
e. Explain various string operations that can be performed using operators in Python.
f. Explain str.find() function with suitable example.

3. **Attempt *any three* of the following:** 15
a. What is list? How to create list?
b. Explain try...except blocks for exception handling in Python.
c. Explain various built-in list functions and methods.
d. What is tuple in python? How to create and access it?
e. Explain the properties of dictionary keys.
f. Explain open() and close() methods for opening and closing a file.

4. **Attempt *any three* of the following:** 15
a. What is regular expression? Explain various patterns of regular expression.
b. Explain match() function with suitable example.
c. What is method overriding? Write an example.
d. What is multithreaded programming? Explain _thread module with suitable example.
e. What is module? What are the advantages of using module?
f. Explain various functions of math module.

[TURN OVER]

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5. **Attempt _any three_ of the following:**
a. Explain Checkbutton widget with example.
b. Write short note tkMessageBox module.
c. What is layout management? Explain Grid manager.
d. Explain place geometry manager with example.
e. Write and explain the steps insert a row into MySql database with example.
f. Write short note on cursor object in Python.

COMPUTER NETWORKS

Q.P. Code: 20939

(Time: 2½ hours)

Total Marks: 75

N. B.: (1) **All** questions are **compulsory**.
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(3) Answers to the **same question** must be **written together**.
(4) Numbers to the **right** indicate **marks**.
(5) Draw **neat labeled diagrams** wherever **necessary**.
(6) Use of **Non-programmable** calculators is **allowed**.

1.   Attempt *any three* of the following: 15
a.   Define Data Communication. Explain its various components.
b.   List and explain the functions of ISO's OSI Model Layers.
c.   What do you mean by Transmission line impairments? Explain in detail.
d.   Explain the following terms in relation with Data Communication
           (i)   Half Duplex System.
           (ii)   Full Duplex System.
e.   Define Modulation. Write a short note on Amplitude Modulation.
f.   Explain the following terms of Data Transmission
           (i)   Parallel Transmission.
           (ii)   Serial Transmission.

2.   Attempt *any three* of the following: 15
a.   Differentiate between Frequency Division Multiplexing (FDM) and Time Division Multiplexing (TDM).
b.   Write a short note on Spread Spectrum Modulation (SSM) techniques along with its Application.
c.   Discuss the major classifications of transmission media.
d.   What is Packet Switching? Explain its methods of implementation.
e.   Define *Error* under scope of networking and explain its types.
f.   Explain the following terms
           (i)   Forward Error Correction (FEC).
           (ii)   Automatic request for Retransmission (ARQ).

3.   Attempt *any three* of the following: 15
a.   Explain ALOHA system with its two versions.
b.   Discuss **GO BACK N ARQ** protocol in detail.
c.   Explain Bluetooth Layered Architecture.
d.   Differentiate between satellite communication and optical communication.
e.   Explain the following connecting devices in networking
           (i)   Bridge.
           (ii)   Gateway.
f.   Explain CSMA with collision detection.

[TURN OVER]

b. Given the following relational schemas: $R = (A, B, C)$ $S = (D, E, F)$
Suppose the relations r(R) and s(S) are defined. Write the expressions in tuple relational calculus equivalent to each of the following:
   i. $\Pi_A(r)$ ii. $\sigma_{B=17}(r)$ iii. $r \times s$ iv. $\Pi_{A,F}(\sigma_{C=D}(r \times s))$

c. Consider the relational database below, where primary keys are underlined.
   employee (_person name_, street, city)
   works (_person name_, _company name_, salary)
   company (_company name_, city)
   manages (_person name_, manager name)
   Give an expression in tuple relational calculus for each of the following queries:
   i.   Find all employees who work directly for "Jones."
   ii.   Find all cities of residence of all employees who work directly for "Jones."
   iii. Find the name of the manager of the manager of "Jones."
   iv.   Find those employees who earn more than all employees living in the city "Mumbai."

d. What is normalization? What is its objective? Give a distinguishing characteristic of 1NF, 2NF, 3NF, 4NF and BCNF.

e. i. Using the INVOICE table structure shown in table below, write the relational schema, draw its dependency diagram and identify all dependencies (including all partial and transitive dependencies). You can assume that the table does not contain repeating groups and that any invoice number may reference more than one product. (Hint: This table uses a composite primary key.)

Attribute Name	Sample Value	Sample Value	Sample Value	Sample Value	Sample Value
INV_NUM	211347	211347	211347	211348	211349
PROD_NUM	AA-E3422QW	QD-300932X	RU-995748G	AA-E3422QW	GH-778345P
SALE_DATE	15-Jan-2016	15-Jan-2016	15-Jan-2016	15-Jan-2016	16-Jan-2016
PROD_LABEL	Rotary sander	0.25-in. drill bit	Band saw	Rotary sander	Power drill
VEND_CODE	211	211	309	211	157
VEND_NAME	NeverFail, Inc.	NeverFail, Inc.	BeGood, Inc.	NeverFail, Inc.	ToughGo, Inc.
QUANT_SOLD	1	8	1	2	1
PROD_PRICE	?4995	?345	?3999	?4995	?8775

   ii. Using the initial dependency diagram drawn in question i, remove all partial dependencies, draw the new dependency diagrams, and identify the normal forms for each table structure you created.
   iii. Using the table structures you created in question ii, remove all transitive dependencies and draw the new dependency diagrams. Also identify the normal forms for each table structure you created.

f. Explain the phases of database design.

3. **Attempt _any three_ of the following:**
a. What are constraints? What are the different types of constraints? Explain.
b. What is a view? What are its advantages?
c. State the rules for performing DML operations on a view.
d. Explain GROUP BY and ORDER BY clauses with examples.
e. What are NULL values? Explain.

15

[TURN OVER]

f.   What are joins? What are different types of joins? Explain.

15

4.   **Attempt _any three_ of the following:**

a   The lost update anomaly is said to occur if a transaction T_j reads a data item, then another transaction T_k writes the data item (possibly based on a previous read), after which T_j writes the data item. The update performed by T_k has been lost, since the update done by T_j ignored the value written by T_k.

    i.   Give an example of a schedule showing the lost update anomaly.

    ii.   Give an example schedule to show that the lost update anomaly is possible with the read committed isolation level.

    iii.   Explain why the lost update anomaly is not possible with the repeatable read isolation level.

b   State and explain the ACID properties of transactions.

c   i.   Consider a database for a bank where the database system uses snapshot isolation. Describe a particular scenario in which a nonserializable execution occurs that would present a problem for the bank.

    ii.   Consider a database for an airline where the database system uses snapshot isolation. Describe a particular scenario in which a nonserializable execution occurs, but the airline may be willing to accept it in order to gain better overall performance.

d   Show that the two-phase locking protocol ensures conflict serializability, and that transactions can be serialized according to their lock points.

e   Consider the following two transactions:

    T_{34}:   read(A);
            read(B);
            if $A = 0$ then $B := B + 1$;
            write(B).

    T_{35}:   read(B);
            read(A);
            if $B = 0$ then $A := A + 1$;
            write(A).

    Add lock and unlock instructions to transactions T_{34} and T_{35}, so that they observe the two-phase locking protocol. Can the execution of these transactions result in a deadlock?

f   Explain the different ways to handle deadlocks.

5.   **Attempt _any three_ of the following:**

15

a.   What are triggers? What are different types of triggers? How are they created? Give the syntax and examples of the same.

b.   What are packages? What are the components of packages? How are packages developed? Explain with syntax and example.

c.   What are functions? What are procedures? How do they differ from each other? What are the benefits of stored procedures and functions?

d.   What is a cursor? Explain implicit and explicit cursors. How are explicit cursors controlled?

e.   What are hierarchical queries? Explain the syntax of hierarchical queries.

f.   What are composite data types? Explain the PL/SQL records. How is a PL/SQL record created?

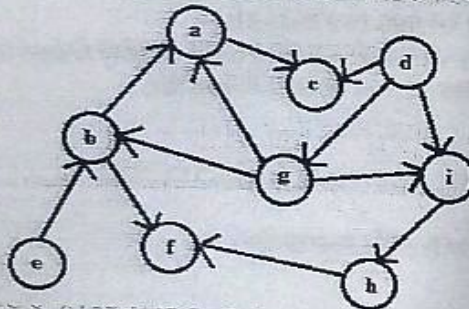-----------------------------------

S.Y.B.Sc.I.T. (Sem-III) Semester End Exam Nov-2017

Q. P. Code: 20936

Sub :-Data Structures

(2½ hours)

Total Marks: 75

N. B.: (1) **All** questions are **compulsory**.
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(4) Numbers to the **right** indicate **marks**.
(5) Draw **neat labeled diagrams** wherever **necessary**.
(6) Use of **Non-programmable** calculators is **allowed**.

1. Attempt *any three* of the following: 15
   a. What is data structure? Explain different categories of data structure.
   b. List and explain different operations that can be performed on a data structure.
   c. Define different asymptotic notations used to measure the complexity of an algorithm.
   d. Discuss memory representation of one dimensional array.
      Differentiate between linear search and binary search.
   e. Consider a two dimensional array D[3:7,-2:6]. If the base address of D is 5639 and each element takes 2 memory cells then find the address of D4,0 element assuming that
      i. Array D is sorted in column major order.
      ii. Array D is sorted in row major order.
   f. What is sparse matrix? Explain different ways of representing sparse matrix into memory.

2. Attempt *any three* of the following: 15
   a. Explain how memory is allocated and deallocated for linked list.
   b. Write and explain an algorithm to insert a new element into sorted linked list.
   c. Write and explain an algorithm to split a linked list into two linked lists.
   d. Write and explain an algorithm to delete a node containing item from a doubly linked list.
   e. What is header linked list? Explain different categories of header linked list.
   f. Write algorithm to subtract two polynomials.

3. Attempt *any three* of the following: 15
   a. Write and explain syntax verification algorithm.
   b. Convert following infix expression into prefix and postfix expressions.
      i. $a \times b \times (c-d) - (e \wedge 3 \times f) + g / h$
      ii. $(a \times b \times c \wedge 2) + d - (c / d + e)$
   c. What is recursion? What are disadvantages of recursion?
   d. Write an algorithm to evaluate an arithmetic postfix expression and calculate the result of the expression. Give suitable example.
   e. What is queue? How queue is represented in memory? Write and explain an algorithm to insert element into circular queue.
   f. Explain with example priority queue.

4. Attempt *any three* of the following: 15
   a. Sort the following elements using merge sort.
      23 56 13 34 78 62 98 53 49 82

[TURN OVER]

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b. Explain with example the following terms:
   i. Degree of a node
   ii. Path
   iii. Internal node
   iv. Similar binary trees
   v. Complete binary tree

c. Draw the binary tree whose inorder and preorder traversals are:
   In-order : g d b h e i a f c
   Pre-order : a b d g e h i c f

d. Make a binary search tree by inserting the following numbers in sequence
   52 36 98 29 123 39 15 56 31 365 278 45 72

e. Draw max and min heap with the following elements
   80 59 25 30 100 45 62 89 51 23 11 27 323

f. What is AVL tree? How balancing is done in AVL tree? Explain with example.

5. Attempt *any three* of the following:

a. Find the adjacency matrix and list representation of the following graph   15

b. List graph traversal technique. Write and explain algorithm for any one. Give suitable example.

c. Explain with example Dijkstra shortest path algorithm.

d. Explain with example Prim's algorithm to find the Minimum Spanning Tree (MST).

e. List different hashing methods. Explain with example any two of them.

f. List different techniques of open addressing. Explain any one.

S.Y. B. SC. I.T. (Sem -III) Semester End November-2017

Q. P. Code: 20945

Sub:- Applied mathematics.

(Time: 2½ hours)

Total Marks: 75

N. B.: (1) **All** questions are **compulsory**.
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(5) Draw **neat labeled diagrams** wherever **necessary**.
(6) Use of **Non-programmable** calculators is **allowed**.

1. Attempt *any three* of the following: 15

a. Find the Adjoint of the given matrix and hence find Inverse if exist

$$\begin{bmatrix} 2 & -1 & 3 \\ 4 & 6 & -2 \\ 5 & 1 & 8 \end{bmatrix}$$

b. Find the Characteristic values and characteristic vectors of the given matrix.

$$\begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$$

c. Verify Caley-Hamilton theorem for the given matrix, also find inverse if exists.

$$\begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$$

d. Expand $(1 + \cos x + i\sin x)^n$
e. Evaluate $(1 + i\sqrt{3})^{16} / (\sqrt{3} - i)^{17}$
f. Express $\sec(x + iy)$ in $a + ib$ form

2. Attempt *any three* of the following: 15
a. Solve the Differential Equation $(x - 4xy - 2y^2) dx + (y^2 - 4xy - 2x^2) dy = 0$
b. Solve the Differential Equation $dy/dx + x^2y = x^5$
c. Solve the following Equation $x^2p^2 - 2xpy + (2y^2 - x^2) = 0$
d. Solve the following Equation $p(p + y) = x(x + y)$
e. Find the Complementary and Particular Solution of the equation $(D^3 + D^2 + D + 1)y = \sin 2x$
f. Find the General Solution of the equation $(D^2 + 4)y = \sin 3x + e^x + x^2$

3. Attempt *any three* of the following: 15
a. Evaluate $\int_0^\infty e^{-2t} \sin^2 t \, dt$
b. Find the inverse Laplace transform for the function

$$F(s) = \frac{21 - s^2}{s(s^2 + 4s + 13)}$$

c. Find Laplace transformation of the function

$$f(t) = te^{2t} \cos 3t$$

[TURN OVER]

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d. Obtain the Inverse Laplace transform of each of the given function

$$\frac{(s+1)}{s^3(s-3)^2}$$

e. Find Inverse Laplace Transformation by convolution theorem for

$$F(s) = \frac{s}{(s^2+1)(s^2+4)}$$

f. By using fundamental definition, find laplace transform of f(t)

$$F(t) = t, \ 0 < t < 4$$
$$= 5, \ t > 4$$

4. Attempt *any three* of the following: 15

a.

$$Evaluate \int_0^1 \int_0^2 e^{x+y} dxdy$$

b.

$$Evaluate \int_0^3 \int_0^{\sqrt{4-y}} \frac{dxdy}{(1+x^2+y^2)}$$

c.

$$Evaluate \int_0^{log2} \int_0^x \int_0^{x+logy} e^{x+y+z} \, dxdydz$$

d.

$$Evaluate \int_0^1 \int_0^{1-x} \int_0^{x+y} e^z \, dxdydz$$

e. Change the order of integration and evaluate $\int_0^2 \int_0^{x^2/4} xydxdy$

f. Solve $\iint r^3 \, drd\theta$ over the area included between the circles r = 2sinθ and r = 4 sinθ

5. Attempt *any three* of the following: 15

a. Evaluate $\int_0^{\pi/2} \sin^6 x \cos^7 x \, dx$

b. Evaluate i) erfc(-x) + erfc(x)
ii) erfc(x) + erf(x)

c.

Evaluate $\int_0^{2a} x(2ax - x^2)^{1/2} dx$

[TURN OVER]

d.   Evaluate $\int_0^{\pi/2} \sin^5 2x\, dx$

e.

   Evaluate $\int_0^1 \frac{x^7}{(1-x^4)^{1/2}}\, dx$

f.   Evaluate $\int_0^1 \frac{(x^a - x^b)}{\log x}\, dx$

———————

d.   Evaluate $\int_0^{\pi/2} \sin^5 2x\, dx$

e.

   Evaluate $\int_0^1 \frac{x^7}{(1-x^4)^{1/2}}\, dx$