

JALPAIGURI GOVERNMENT ENGINEERING COLLEGE
 [A GOVERNMENT AUTONOMOUS COLLEGE]
JGEC/B.TECH / IT / PAPERCODE: BS-M(IT)301/2022-23
2022
PAPER NAME: Mathematics - III

Full Marks: 70

Times: 3 Hours

The figures in the margin indicate full marks.
Candidates are instructed to write the answers in their own words as far as practicable.

GROUP-A
[OBJECTIVE TYPE QUESTIONS]

Answer *all* questions

5x2=10

1. Find an integrating factor of $xydx + (2x^2 + 3y^2 - 20)dy = 0$. 2
2. Evaluate $\int_C \vec{A} \cdot d\vec{r}$, where $\vec{A} = (xy)^2\hat{i} + y\hat{j}$ and the curve C is $y^2 = 4x$ in the xy-plane from (0,0) to (4,4). 2
3. Change the order of integration of $\int_0^1 dy \int_y^1 e^{x^2} dx$. 2
4. Give an example of a graph which is Hamiltonian but not Eulerian and an example of a graph which is Eulerian but not Hamiltonian. 2
5. Examine the convergence of the series $\sum_{n=1}^{\infty} \frac{n^n}{n!}$. 2

GROUP-B
[LONG ANSWER TYPE QUESTIONS]

Answer any *five* questions

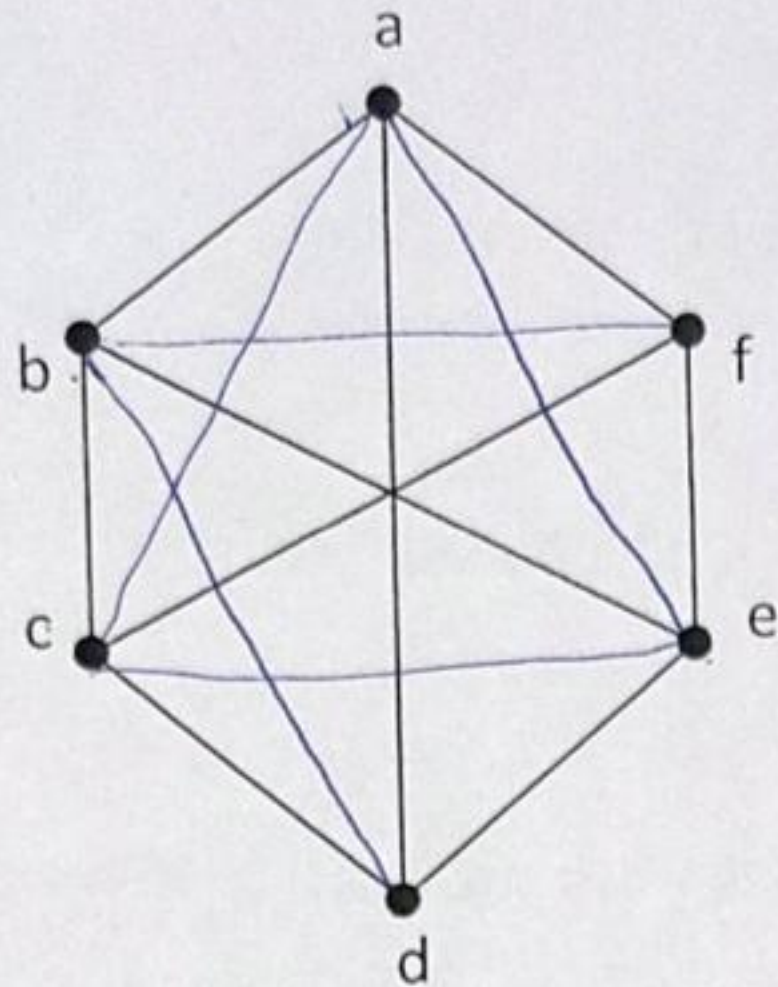
12x5=60

6. (a) Solve $\frac{dy}{dx} - \frac{tany}{1+x} = (1+x)e^x \sec y$. 6
- (b) Solve $p^3x - p^2y - 1 = 0$. 6
7. (a) Solve $(D^2 - 4D + 4)y = 12(1+x)^2 e^{2x}$. 6
- (b) Solve: $x^2 \frac{d^2y}{dx^2} - 2x \frac{dy}{dx} + 2y = (\log x)^2 - \log x^2$. 6
8. a) Solve by method of variation of parameters: $\frac{d^2y}{dx^2} + y = x \sin x$ 6
- (b) Given the function $f(x,y) = \begin{cases} \frac{xy(x^2-y^2)}{x^2+y^2}, & (x,y) \neq (0,0) \\ 0, & (x,y) = (0,0) \end{cases}$ 6
- Show that $f_{xy}(0,0) \neq f_{yx}(0,0)$.
9. (a) If $u = \tan^{-1} \frac{x^3+y^3}{x-y}$, show that $x^2 \frac{\partial^2 u}{\partial x^2} + 2xy \frac{\partial^2 u}{\partial x \partial y} + y^2 \frac{\partial^2 u}{\partial y^2} = (1 - 4\sin^2 u) \sin 2u$. 6
- (b) If $z = (1 - 2xy + y^2)^{-\frac{1}{2}}$, show that $\frac{\partial}{\partial x} \left\{ (1 - x^2) \frac{\partial z}{\partial x} \right\} + \frac{\partial}{\partial y} \left\{ y^2 \frac{\partial z}{\partial y} \right\} = 0$. 6
10. (a) Determine $\iint_R (x^2 + y^2) dx dy$ where R is the region bounded by $y = x^2, x = 2, y = 1$. 6
- Evaluate**
- b) Verify by Green's theorem $\oint_C \{(\cos x \sin y - xy)dx + \sin x \cos y dy\}$ where C is the circle $x^2 + y^2 = 1$. 6
11. (a) Check the convergence of the sequence $\{a_n\}$ where 3
- $$a_n = \frac{n+1}{2n+1}$$
- (b) Find whether the series $\frac{x}{1} + \frac{1}{2} \cdot \frac{x^3}{3} + \frac{1.3}{2.4} \cdot \frac{x^5}{5} + \frac{1.3.5}{2.4.6} \cdot \frac{x^7}{7} + \dots \dots \dots (x > 0)$ is convergent or 5
- divergent.

(e) Prove that the series $x - \frac{x^2}{2} + \frac{x^3}{3} - \dots$ is absolutely convergent when $|x| < 1$ and conditionally convergent when $x = 1$.

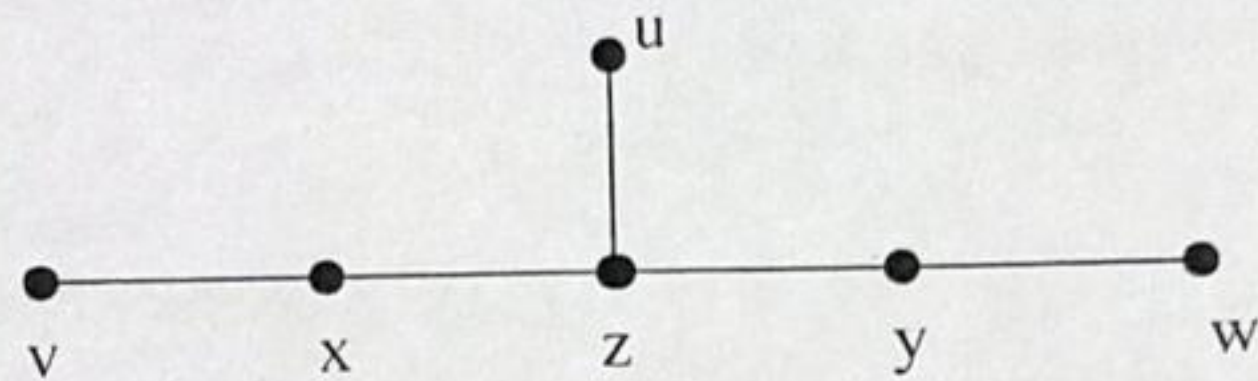
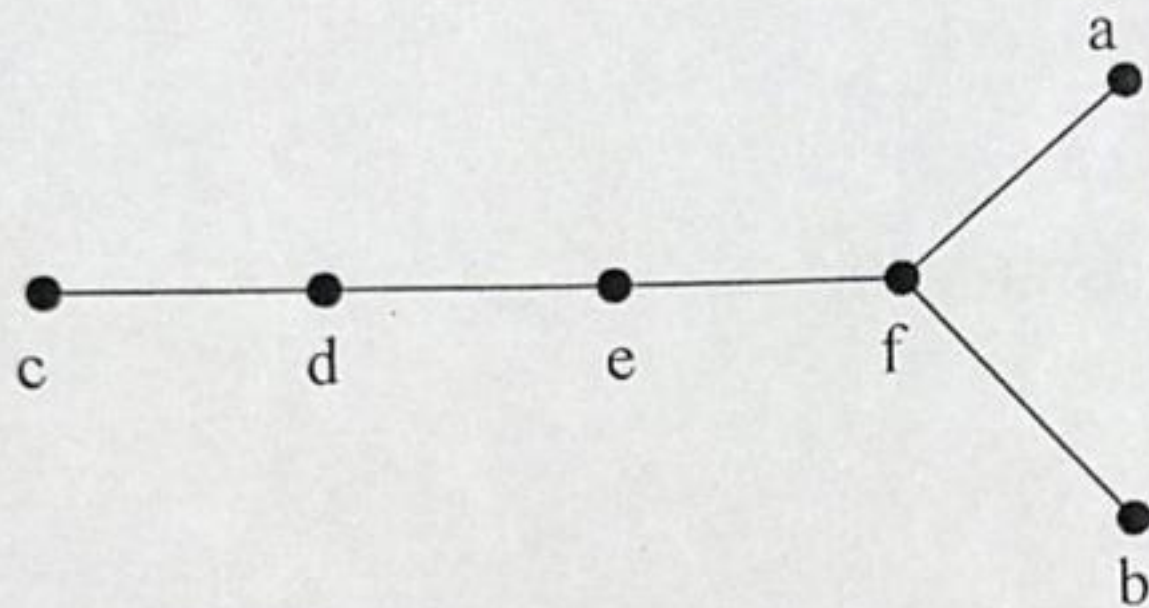
4

12. (a) Define complement \bar{G} of a simple graph G . Draw the complement of a graph G with vertices a, b, c, d, e, f as given below:



- (b) Examine whether the graphs G_1 and G_2 (given below) are isomorphic or not:

4



G

G'

- (c) If a graph G has exactly two vertices of odd degree, show that there must be a path joining these two vertices.

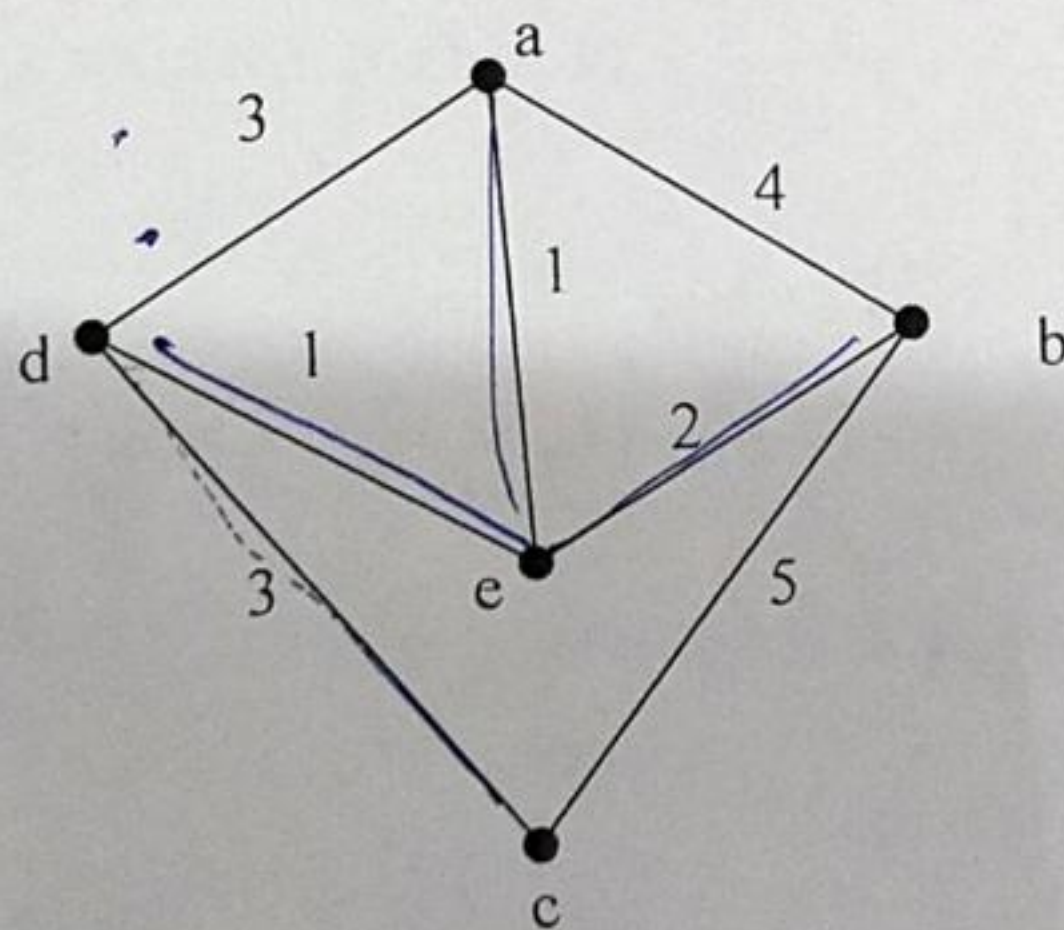
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13. (a) Define a spanning tree of a connected graph. Prove that a graph G has a spanning tree iff G is connected.

1+(2+2)

- (b) Use Prim's algorithm to find the minimal spanning tree in the graph G given below:

4



- (c) Find the number of pendent vertices in a binary tree.

3

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JGEC/B.TECH/IT/ES-IT301/2022-23
2022

Full Marks: 70

ANALOG & DIGITAL ELECTRONICS

Times: 3 Hours

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Candidates are instructed to write the answers in their own words as far as practicable.

GROUP-A
[OBJECTIVE TYPE QUESTIONS]

Answer **all** questions

5x2=10

1. Write the generalized property of XOR gate. 2
2. $\sqrt{(224)_r} = (13)_r$, what is the value of radix r ? 2
3. $A = 11111010$, $B = 00001010$ be the 8bit 2's complement no. Find their product in 2's complement form. 2
4. What is the difference between latch and flip-flop? 2
5. Design $F = B + \bar{A}C$ using two input NAND gate. 2

GROUP-B
[LONG ANSWER TYPE QUESTIONS]

Answer any **four** questions

4 x15=60

6. A) Solve 19-26 using 1's complement arithmetic 5
 B) $F = AD + BE + CD + BD + AE + CE$ 5
 What is the minimum no. Of 2 input NOR gates required to implement the above boolean function. 5
 C) $f(w,x,y,z) = m\sum(0,1,2,3,7,8,10) + d\sum(5,6,11,15)$
 Find minimal POS form using K- map.
7. A) Find the characteristic equation of the J-K- flip-flop. 5
 B) What is meant by edge triggering? Write the difference between positive and negative edge triggering. 5
 C) Explain how a S-R flip-flop can be converted into D flip-flop. 5
8. A) Find the minimum number of 2.input NAND gates to implement XOR function. 5
 B) Define consensus law. Write the conditions for consensus law. 5
 C) Let $*$ be defined as $X * Y = X + Y$ 5
 Let $Z = X * Y$ then the value of $Z * X = ?$
9. A) Write the difference between synchronous counter and asynchronous counter. 5
 B) Write the algorithm to construct MOD-N ripple counter. 5
 C) Describe serial in parallel out shift register with neat logic diagram. 5
10. A) Explain the parameters used to characterize logic families. 5
 B) Write the characteristics of the RTL family. 5
 C) Write a brief note on interfacing TTL with CMOS. 5
11. A) $F(a,b,c) = a'c + a c' + b'c$ find all the prime implicants and find all essential prime implicants. 5
 B) Explain race around condition of J-K flip-flop. 5
 C) Describe the operation of ring counter. 5

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COE/B.TECH./ IT/ PCC-IT301/2022-23

2022

Data Structure & Algorithm

Full Marks: 70

Times: 3 Hours

The figures in the margin indicate full marks.

Candidates are requested to write their answers in their own words as far as practicable.

GROUP-A
[OBJECTIVE TYPE QUESTIONS]

Answer *all* questions

5x2=10

1. Why we need to study the asymptotic notations? 2
2. What is the worst case time complexity of bubble sort? 2
3. What do you mean by internal and external sorting? 2
4. What is the difference between Binary Search Tree (BST) and AVL? 2
5. What is difference between Tree and Graph data structure? 2

GROUP-B
[LONG ANSWER TYPE QUESTIONS]

Answer any *four* questions

4x15=60

6. i) What is ADT (Abstract Data Types) in data structure explain with example? 3
- ii) What is sparse matrix? Give an example of sparse matrix, how it can be represented. 3
- iii) Let $X = (X_1, X_2, X_3, \dots, X_n)$ and $Y = (Y_1, Y_2, Y_3, \dots, Y_m)$ are two single linked lists where n & m are the length of linked lists X & Y . Write an algorithm to merge the lists together to obtain the linked list Z such that $Z = (X_1, Y_1, X_2, Y_2, \dots, X_m, Y_m, X_{m+1}, \dots, X_n)$ if $m \leq n$ or $Z = (X_1, Y_1, X_2, Y_2, \dots, X_n, Y_{n+1}, \dots, Y_m)$ if $m > n$ 7
- iv) Is it possible to apply the binary search algorithm to sorted link list? Justify your answer 2
- i) Write a function `insert()` to insert an integer x into sorted array $A[]$ (sorted in ascending order) containing n integer so that the array remains sorted after insertion. Return the length of the new array. The function like `int insert (int x , int A[] , int n)` 5
- ii) Write a function `void insertion_sort(int A[] , int n)` that takes an array $A[]$ containing n integers as input and uses insertion sort to sort the array by making call the function `insert()`. 5
Note : To get credit you must use calls to `insert()` function appropriately
- iii) You are sorting the following array in ascending order using Insertion Sort. 3

6	2	7	1	3
---	---	---	---	---

Show the contents of the array after every iteration of the sort (Iteration 0 is the input array) like

Iteration	Index				
	0	1	2	3	4
0	6	2	7	1	3
1					
2					

- iv) What is a Threaded Binary Tree? Explain with example. What is the need of it? 2

8. i) Define the node structure of a single linked list & write down an efficient procedure/algorithm to break up the singly linked list in two equal parts. 1+3
- ii) What is hashing? What are the properties a good hash function should possess? Write down the different approaches for resolving collision in Hashing. 1+1+2
- iii) Calculate the time complexity of quick sort **when the input to be sorted is in decreasing order or increasing order** (if the first element is the pivot element) . Sort the following array using quick sort method showing each pass data. 2+2
24 56 47 12 35 10 90 82 31.
- iv) Compare the Array Data structure and Link List data structure. 3
9. i) What is meant by circular queue and priority queue. write a function to insert and delete an element from a circular queue 3+4
- ii) Construct a max heap stepwise with the following elements: 3+2
32, 14, 36, 50, 10, 20, 45, 26, 17, 18, 4. Now delete the element 45 and reconstruct the heap.
- iii) Convert the following infix expression to equivalent postfix expression using stack showing all the steps. $((A+(B*C))/(D-E)+F)$ 3
10. i) Construct a Binary Search tree with the following elements: B D H I F G A K E J C where $A < B < C < \dots < Z$. Show the steps clearly 4
- ii) Write down the recursive definition of In-order traversal of a tree and explain with a suitable example. 5
- iii) Consider the following array in C language `int B[15][8]`.
Find out the address of the `B[8][6]` where the base address of the array a is 2050.
Note: Assume integer take 4 bytes of memory. 3
- iv) Determine the frequency counts for all statements in the following C program segment & find out the time complexity of a segment. 3
- ```

for (i=1; i <=n; i++)
 for (j = 1; j <=i; j++)
 for (k =1; k <= j; k++)
 y++;

```
11. Write short notes on any **three** of the followings: 5X3
- i) Stack
- ii) B-Tree
- iii) Radix Sort
- iv) BST
- v) Linear Search
- vi) Recursion



**JALPAIGURI GOVERNMENT ENGINEERING COLLEGE**  
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**JGEC/B.TECH/ IT/ PC-1T302/ 2022-23**  
**2022**  
**COMPUTER ARCHITECTURE**

Full Marks: 70

Times: 3 Hours

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**GROUP-A**  
**[OBJECTIVE TYPE QUESTIONS]**

Answer *all* questions

5x2=10

1. What is pipeline technique?
2. What is meant by logical address?
3. What is meant by branching?
4. Name four vector instruction types?
5. What is race condition?

2  
2  
2  
2  
2

**GROUP-B**  
**[LONG ANSWER TYPE QUESTIONS]**

Answer any *four* questions

4x15 = 60

6. Explain associative cache memory management along with its architecture.

15

7. For the reservation table below find

|    | T0 | T1 | T2 | T3 | T4 | T5 | T6 | T7 | T8 |
|----|----|----|----|----|----|----|----|----|----|
| S1 | X  |    |    |    |    |    |    |    | X  |
| S2 |    | X  | X  |    |    |    |    | X  |    |
| S3 |    |    |    | X  |    |    |    |    |    |
| S4 |    |    |    |    | X  | X  |    |    |    |
| S5 |    |    |    |    |    |    | X  | X  |    |

- a) Latency sequence
- b) Forbidden latency set
- c) Collision vector
- d) Simple cycle
- e) Greedy cycle

3  
3  
3  
3  
3

8. a) Draw a typical pipelined vector computer
- b) Compare scalar and vector operation with the help of diagrams.
- c) Write down the properties of vector processor.

5  
5

9. Write short notes on

- a) Strip mining
- b) Multistage network
- c) SIMD

5  
5  
5

10. a) Draw the diagram of Burroughs scientific processor.
- b) Why do we need to take care of logical/modular structure of a user program?
- c) Consider the execution of a program of 20000 instructions by a linear pipeline processor with a clock rate of 40 MHz. Assume that the instruction pipeline has 5 stages and that one instruction is issued per clock cycle. The penalties due to branch instruction and out of order instruction are ignored. Calculate the speedup of the pipeline over its equivalent non-pipelined processor, the efficiency and throughput.

5  
5  
5

11. a) Briefly describe Omega network.
- b) What parameters are used to measure performance of a CPU ?
- c) What do you understand by reservation table ?

5  
5  
5



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**JGEC/B.TECH/IT/HM –HU(IT)301 /2022-23**

**2022**

**Values and Ethics in Profession**

Full Marks: 70

Times: 3 Hours

*The figures in the margin indicate full marks.*

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**GROUP-A**

**[OBJECTIVE TYPE QUESTIONS]**

Answer *all* questions

5x2=10

1. What do you mean by Amendment ?
2. What is Article in Indian Constitution ?
- ✓ 3. Spencer said, No one can be perfectly happy till all are \_\_\_\_\_ (Happy/Sad)
- ✓ 4. In \_\_\_\_\_ (English/Greek) language we may call Ethics as Moral Philosophy.
5. What is Ethics of Responsibility .

**GROUP-B**

**[LONG ANSWER TYPE QUESTIONS]**

Answer any *five* questions

5x12=60

- ✓ 6. Write a short note on Industrial revolution. What are the immediate and long term effects of the Industrial revolution on society 5+7=12
- ✓ 7. Write a short note on Democracy 12
- ✓ 8. What is the difference between right and Fundamental rights? Write a short note of Right to Freedom of Religion? 6+6=12
- ✓ 9. Write a short note of Goodlife ? 12
- ✓ 10. Explain the concept of Trusteeship ? 12
11. Write a short note of Aesthetic Values and the concept of Beauty in Art ? 6+6=12
12. Write a short note of Professional Ethics ? What is Profession ? 8+4=12



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**JGEC/B.TECH./ IT/ MC-IT301/ 2022-23**  
**2022**

**Essence of Traditional Knowledge**

Full Marks: 70

Times: 3 Hours

*The figures in the margin indicate full marks.*  
*Candidates are instructed to write the answers in their own words as far as practicable.*

**GROUP-A**  
**[OBJECTIVE TYPE QUESTIONS]**

Answer *all* questions

- |                                                                      |               |
|----------------------------------------------------------------------|---------------|
|                                                                      | <b>5x2=10</b> |
| 1. Define 'Traditional Knowledge (TK)'.                              | 2             |
| 2. Describe different aspects of TK.                                 | 2             |
| 3. Categorize TK based on its nature and types.                      | 2             |
| 4. Differentiate between western knowledge and indigenous knowledge. | 2             |
| 5. Write down few TK system-based practices.                         | 2             |

**GROUP-B**  
**[LONG ANSWER TYPE QUESTIONS]**

Answer any *four* questions

- |                                                                                                              |                  |
|--------------------------------------------------------------------------------------------------------------|------------------|
|                                                                                                              | <b>4x15 = 60</b> |
| 6. (i) Why should we protect TK?                                                                             | 5                |
| (ii) Why do you think environmental, social, and economic sustainability are related to TK system?           | 5                |
| (iii) Write a short note on the "The Basmati Rice Case (2000)".                                              | 5                |
| 7. (i) Write a short note on various factors affecting the transmission, preservation, and protection of TK. | 5                |
| (ii) Briefly state the abuses of TK                                                                          | 5                |
| (iii) Explain OCAP in detail.                                                                                | 5                |
| 8. (i) Why was TKDL set up?                                                                                  | 5                |
| (ii) What are the goals of TKDL?                                                                             | 5                |
| (iii) Name various international organizations that can access TKDL?                                         | 5                |
| 9. (i) What is biopiracy                                                                                     | 5                |
| (ii) How does it happen?                                                                                     | 5                |
| (iii) Is biopiracy illegal? explain.                                                                         | 5                |
| 10. (i) Why there is a need to stop biopiracy?                                                               | 5                |
| (ii) Elaborate the various actions taken against biopiracy?                                                  | 5                |
| (iii) Write a short note on the "The Turmeric Patent Dispute Case (1998)".                                   | 5                |
| 11. (i) Write a short note on "Convention on Biodiversity (CBD)".                                            | 5                |
| (ii) Write a short note on "Bio prospecting Contracts".                                                      | 5                |
| (iii) Write a short note on "Patent Law".                                                                    | 5                |
| 12. (i) Write a short note on the "Neem Patent Void Case (2000)".                                            | 5                |
| (ii) How is Traditional Knowledge protected in India?                                                        | 5                |
| (iii) Why companies choose Biopiracy instead of Bioprospecting?                                              | 5                |