

# CBCS SCHEME

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18AI52

## Fifth Semester B.E. Degree Examination, Jan./Feb. 2023 Python Programming

Time: 3 hrs.

Max. Marks: 100

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

### Module-1

- 1 a. Explain elif, for, which, break and continue statements in python with examples for each. (10 Marks)
- b. Write a python program to calculate the area of square rectangle and circle. Point the results. Take input from user. (05 Marks)
- c. How can we pass parameters in user defined functions? Explain with suitable example. (05 Marks)

### OR

- 2 a. Demonstrate with example print( ), input( ) and string replication. (06 Marks)
- b. Explain local and global scope with local and global variables. (06 Marks)
- c. Demonstrate the concept of exception. Implement a code which prompts the user for Celsius temperature, convert the temperature to Fahrenheit, and print out the converted temperature by handling the exception. (08 Marks)

### Module-2

- 3 a. What is List? Explain append( ), insert( ) and remove( ) methods with examples. (08 Marks)
- b. How is tuple different from a list and which function is used to convert list to tuple. (05 Marks)
- c. Create a function to print out a blank tic-tac-toe based. (07 Marks)

### OR

- 4 a. Discuss get( ), item( ), keys( ) and values( ) dictionary methods in python with examples. (08 Marks)
- b. With example code explain join( ) and split( ) string methods. (06 Marks)
- c. Develop a program to accept a sentence from the user and display a longest word of that sentence along with its length. (06 Marks)

### Module-3

- 5 a. What are regular expression? Describe question mark, star, plus-and dot Regex symbols with suitable python code snippet. (09 Marks)
- b. With example code explain re.IGNORECASE, re.DOTALL with suitable example. (06 Marks)
- c. Write a program that reads a string with five characters which starts with 'a' and ends with 'z'. Print search successful if pattern matches string. (05 Marks)

### OR

- 6 a. With a code snippet, explain saving variables using the shelve module and PPrint Pformat( ) functions. (06 Marks)
- b. Explain the steps involved in file reading and writing process with suitable examples. (08 Marks)
- c. Write a python program to count the number of occurrences of a given word in a file. (06 Marks)

**Module-4**

- 7 a. What is class, object, attributes? Explain copy.copy( ) with an example. (06 Marks)  
b. Demonstrate pure functions and modifiers with examples. (08 Marks)  
c. Use the date time module to write a program that gets the current date and prints that day of the week. (06 Marks)

**OR**

- 8 a. Explain operator overloading and polymorphism with examples. (08 Marks)  
b. Illustrate the concepts of inheritance and class diagrams with examples. (08 Marks)  
c. Write a function called print time that takes a time object and print it in the form hour:minute:second. (04 Marks)

**Module-5**

- 9 a. Explain parsing HTML with the beautiful soup module with code snippet for creating finding an element and getting data. (09 Marks)  
b. What methods do selenium's web element object have for simulating mouse clicks and keyboard keys. Explain with python code snippet. (06 Marks)  
c. Write a python program to access cell in a worksheet. (05 Marks)

**OR**

- 10 a. Write a program to get a list of all files with the pdf extension in the current working directory and sort them. (06 Marks)  
b. Demonstrate the json module with python program. (06 Marks)  
c. What are the advantages of CSV files? Explain the reader objects and writes objects with python code. (08 Marks)

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18AI55

## Fifth Semester B.E. Degree Examination, Jan./Feb. 2023 Principles of Artificial Intelligence

Time: 3 hrs.

Max. Marks: 100

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

### Module-1

- 1 a. List out the applications of Artificial Intelligence. Explain in detail how tic tac toe game is played using magic square of order 3. (10 Marks)
- b. Explain in brief the components of AI program and categorization of Intelligent Systems. (10 Marks)

OR

- 2 a. Define State Space. State Space Search. List the rules for water jug problem and use the production rules for solving water jug problem taking 5-gallon and 3 gallon water jug. (10 Marks)
- b. What is constraint satisfaction problem? Solve the below cryptarithmic problem  
BASE + BALLS → GAMES (10 Marks)

### Module-2

- 3 a. What is problem reduction and AND-OR graph? Solve tower of Hanoi considering 3 discs problem. (10 Marks)
- b. Discuss and develop AO\* algorithm by taking an example. (10 Marks)

OR

- 4 a. Develop MINIMAX algorithm. Explain with an example. (10 Marks)
- b. Explain in detail  $\alpha - \beta$  pruning with examples. (10 Marks)

### Module-3

- 5 a. Explain in detail the steps for conversion of a formula into a set of clauses. (10 Marks)
- b. Show that  $\alpha : (A \cap B) \cap (B \rightarrow \sim A)$  is unstable using the Tablean method. (10 Marks)

OR

- 6 a. Discuss satisfiability and unsatisfiability. (10 Marks)
- b. Discuss semantic Tablean system in propositional logic. (10 Marks)

### Module-4

- 7 a. Discuss types of planning system. (10 Marks)
- b. Discuss in detail block world problem and logic based planning. (10 Marks)

OR

- 8 a. What is Means-Ends Analysis? Explain with example. (10 Marks)
- b. Discuss non-linear planning strategies and learning plans. (10 Marks)

### Module-5

- 9 a. Discuss different approaches to knowledge representation. (10 Marks)
- b. Explain in detail knowledge representation using semantic network. (10 Marks)

OR

- 10 a. Define Expert System. Discuss introduction phases in detail. (10 Marks)
- b. Discuss and differentiate architecture of Expert System vs Traditional System. (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.

# CBCS SCHEME

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18AI56

## Fifth Semester B.E. Degree Examination, Jan./Feb. 2023 Mathematics for Machine Learning

Time: 3 hrs.

Max. Marks: 100

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

### Module-1

- 1 a. Find the general and particular solution of the system of equations :
- $$\begin{aligned} -2x_1 + 4x_2 - 2x_3 - x_4 + 4x_5 &= -3 \\ 4x_1 - 8x_2 + 8x_3 - 3x_4 + x_5 &= 2 \\ x_1 - 2x_2 + x_3 - x_4 + x_5 &= 0 \\ x_1 - 2x_2 - 3x_4 + 4x_5 &= a. \end{aligned}$$
- (10 Marks)
- b. Define a basis, rank and inner product space with an example. (06 Marks)
- c. Determine a basis for a vector subspace  $U \subseteq \mathbb{R}^5$ , spanned by the vectors  $\{x_1, x_2, x_3, x_4\} \in \mathbb{R}^5$ , where  $x_1 = [1, 2, -1, -1, -1]^T$ ,  $x_2 = [2, -1, 1, 2, -2]^T$ ,  $x_3 = [3, -4, 3, 5, -3]^T$ ,  $x_4 = [-1, 8, -5, -6, 1]^T$ . (04 Marks)

OR

- 2 a. If  $u = [2, -5, -1]^T$  and  $v = [-7, -4, 6]^T$  then :
- i)  $u \cdot v$     ii)  $u + v$     iii)  $\|u\|$     iv)  $\|v\|$     v)  $\|u + v\|$ . (10 Marks)
- b. For  $x, y \in v$  where  $v$  is a inner product space then define distance between  $x$  and  $y$ . Also find the distance between  $(7, 1)$  and  $(3, 2)$ . (05 Marks)
- c. Define angle between two vectors form Cauchy – Schwartz inequality. Hence compute angle between  $[1, 1]^T$  and  $[1, 2]^T$ . (05 Marks)

### Module-2

- 3 a. For the matrix  $A = \begin{bmatrix} 2 & 6 & 1 \\ 0 & 1 & 4 \\ -8 & 0 & -1 \end{bmatrix}$ . Find  $|A|$  and trace  $(A)$ . (05 Marks)
- b. Find the Eigen values, Eigen vectors, and Eigen spaces for the matrix  $A = \begin{bmatrix} 4 & 2 \\ 1 & 3 \end{bmatrix}$ . (06 Marks)
- c. Find the singular value decomposition of  $A = \begin{bmatrix} 0 & 1 & 0 \\ -2 & 1 & 0 \end{bmatrix}$ . (09 Marks)

OR

- 4 a. Explain the terms orthogonal and orthonormal vectors. (04 Marks)
- b. If  $a = [-2, 1]^T$ ,  $b = [-3, 1]^T$ ,  $c = \left[\frac{4}{3}, -1, \frac{2}{3}\right]^T$  and  $d = [5, 6, -1]^T$ , then compute.
- i)  $\left(\frac{a \cdot b}{a \cdot a}\right) \cdot a$
- ii) Find a unit vector 'u' in the direction c
- iii) Show that 'd' is orthogonal to 'c'. (06 Marks)
- c. Compute the singular value decomposition of a matrix  $A = \begin{bmatrix} 4 & 11 & 14 \\ 8 & 7 & -2 \end{bmatrix}$ . (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-3**

- 5 a. Obtain the Maclaurin's series of  $f(x) = \sqrt{1 + \sin 2x}$ . Draw the graphs of  $f(x) = f(0)$ ,  
 $f(x) = f(0) + \frac{x}{1!} f'(0)$  and  $f(x) = f(0) + \frac{x}{1!} f'(0) + \frac{x^2}{2!} f''(0)$ . (07 Marks)
- b. Define gradient of the vector valued functions  $f(x_1, x_2)$  and hence find gradient of  
 $f(x_1, x_2) = x_1^2 x_2 + x_1 x_2^3$ . (07 Marks)
- c. Compute the derivative of the function  $h(x) = g[f(x)]$  where  $g[f(x)] = [f(x)]^4$  and  
 $f(x) = 2x + 1$ . (06 Marks)

**OR**

- 6 a. If  $f(x, y) = x^2 + 2y$ ; where  $x_1 = \sin t$  and  $x_2 = \cos t$ , then find  $\frac{df}{dt}$ . (06 Marks)
- b. Compute the gradient of  $h$  with respect to  $t$ , for the function  $h: \mathbb{R} \rightarrow \mathbb{R}$ ,  $h(t) = (f \circ g)(t)$  with  
 $f: \mathbb{R}^2 \rightarrow \mathbb{R}$ ,  $g: \mathbb{R} \rightarrow \mathbb{R}^2$  defined by  $f(x) = e^{xy}$   $x = \begin{bmatrix} x \\ y \end{bmatrix} = g(t) = \begin{bmatrix} t \cos t \\ t \sin t \end{bmatrix}$ . (06 Marks)
- c. For the linear regression model  $f(x) = \sqrt{x^2 + e^{x^2}} + \cos(x^2 + e^{x^2})$ . Compute the gradient and  
 $\frac{\partial f}{\partial x}$  by working backward. (08 Marks)

**Module-4**

- 7 a. Let  $x$  and  $y$  are two independent variables. If variance of  $(2x - y) = 6$  and variance of  
 $(x + 2y) = 9$ . Find the variance of  $x$  and variance of  $y$ . (06 Marks)
- b. A joint probability distribution is given by the following table.

X \ Y	-3	2	4
1	0.1	0.2	0.2
3	0.3	0.1	0.1

- Find variance of  $x$  and  $y$  and write the marginal distributions  $p(x)$  and  $p(y)$ . (07 Marks)
- c. State the following :
- Sum rule for discrete and continuous random variables
  - Product rule which relates the joint distribution to the conditional distribution.
  - Baye's theorem
  - Likelihood  $P\left(\frac{y}{x}\right)$
  - Posterior  $P\left(\frac{x}{y}\right)$ . (07 Marks)

**OR**

- 8 a. A bag contain 2 mango and 3 apples and a bag B contains 4 mango and 5 apples. One fruit is  
drawn at random from one of the bags and it is found to be apple. Find the probability that  
the apple fruit is drawn from bag B. (06 Marks)
- b. Given a real valued function  $f(x) = a g(x) + b h(x)$  where  $a, b \in \mathbb{R}$  and  $x \in \mathbb{R}^D$ , then prove that  
 $E_x[f(x)] = a E_x[g(x)] + b E_x[h(x)]$ . (04 Marks)
- c. For any two random variable, prove that
- $E(X + Y) = E(X) + E(Y)$
  - $E(X - Y) = E(X) - E(Y)$
  - $V(X + Y) = V(X) + V(Y) + 2 \text{COV}(X, Y)$
  - $V(X - Y) = V(X) + V(Y) - 2 \text{COV}(X, Y)$ . (10 Marks)

**Module-5**

- 9 a. Distress for the function  $f(x) = x^4 + 7x^3 + 5x^2 - 17x + 3$ , the convexity and concavity in the interval  $(-6, 2)$ . Further graphically represent the negative gradients and global minimum. (10 Marks)
- b. For a quadratic function in two dimensions  $f\left(\begin{bmatrix} x \\ y \end{bmatrix}\right) = \frac{1}{2}\begin{bmatrix} x \\ y \end{bmatrix}^T \begin{bmatrix} 2 & 1 \\ 1 & 20 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} - \begin{bmatrix} 5 \\ 3 \end{bmatrix}^T \begin{bmatrix} x \\ y \end{bmatrix}$  with gradient  $\begin{bmatrix} x \\ y \end{bmatrix}^T \begin{bmatrix} 2 & 1 \\ 1 & 20 \end{bmatrix} - \begin{bmatrix} 5 \\ 3 \end{bmatrix}^T$  initial location,  $x_0 = [-3, -1]^T$  and  $r = 0.085$ . Apply gradient descent algorithm which converges to minimal value perform two iterations. (10 Marks)

**OR**

- 10 a. Define convex optimization problem, further discuss the convexity of  $x \log_2 x$  between the points  $x = 2$  and  $x = 4$ . Also plot the function and tangent at  $x = 2$ . (10 Marks)
- b. Write a brief note on concavity and convexity with suitable examples. Further discuss the convexity of  $y = 3x^2 - 5x + 2$  with graph. (10 Marks)

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