B.Tech. (CSE-AI & MLE) 3rd Semester

(G-Scheme) Examination, December–2024

MATHEMATICS FOR AI

Paper–BSC-MATH-271-G

Time allowed : 3 hours] *[Maximum marks : 75*

Before answering the questions, candidate should ensure that they have been supplied the correct and complete questions paper. No complaint in this regard, will be entertained after the examination.

Note : *Attempt **five** questions in all, selecting **one** question from each unit. **Question No. 1 is compulsory.** All questions carry equal marks.*

1. (a) Let f (x, y) = $\sqrt{|xy|}$. Show that f (x, y) is continuous at the origin.

(b) If u = log $(x^3 + y^3 + z^3 - 3xyz)$, prove that

$$\left(\frac{\partial}{\partial x}+\frac{\partial}{\partial y}+\frac{\partial}{\partial z}\right)^2 u=\frac{-9}{(x+y+z)^2}$$

(c) Evaluate : $\int_0^3 \int_0^1 (x^2+3y^2)\, dy\, dx$

(d) Solve $\frac{dy}{dx} - x^3 y^3 + xy = 0$.

(e) If $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$, show that $\text{div}(r^n \vec{r}) = (n+3) r^n$

(f) State Gauss divergence theorem. $2.5 \times 6 = 15$

Unit–I

2. (a) If $x^y = y^x$, show that $\frac{dy}{dx} = \frac{y(y - x \log y)}{x(x - y \log x)}$ using partial derivative method.

(b) If $u = \sin^{-1}\left(\frac{x+y}{\sqrt{x}+\sqrt{y}}\right)$, then prove that

$$x^2 \frac{\partial^2 u}{\partial x^2} + 2xy \frac{\partial^2 u}{\partial x \partial y} + y^2 \frac{\partial^2 u}{\partial y^2} = -\frac{\sin u \cos 2u}{4 \cos^3 u}$$

15

3. (a) Discuss the maxima and minima of function $x^4 + y^4 - 2x^2 + 4xy - 2y^2$.

(b) Find the volume of the greatest rectangular parallelepiped that can be inscribed in the ellipsoid $\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$ using method of Lagrange's undetermined multiplier. 15

Unit–II

4. (a) Evaluate $\iint y^2 \, dx \, dy$ over the area outside the circle $x^2 + y^2 - ax = 0$ and inside the circle $x^2 + y^2 - 2ax = 0$.

(b) Evaluate $\int \int_R (x^2 + y^2 + z^2) \, dx \, dy \, dz$, where R denotes the region bounded by $x = 0, y = 0, z = 0$ and $x + y + z = a, (a > 0)$. 15

5. (a) Find by triple integration, the volume in the positive octant bounded by the co-ordinate planes and the plane $x + 2y + 3z = 4$.

(b) Find, by double integration, the area lying inside the circle $r = a \sin \theta$ and outside the cardioids $r = a(1 - \cos \theta)$. 15

Unit–III

6. (a) Solve $xe^x (dx - dy) + e^x \, dx + ye^y \, dy = 0$

(b) A pipe 20 cm in diameter contains steam at 160°C and is protected with a Covering 5 cm thick for which k, the coefficient of thermal conductivity = 10025. If the temperature of the outer surface of the covering is 50°C, find the temperature at half way through the covering under steady conditions. 15

7. (a) Solve $(2x+3)^2 \frac{d^2y}{dx^2} - (2x+3)\frac{dy}{dx} - 12y = 6x$

(b) Solve simultaneous differential equations :

$$2\frac{dx}{dt} - \frac{dy}{dt} + 2x + y = 11t$$

$$2\frac{dx}{dt} + 3\frac{dy}{dt} + 5x - 3y = 2$$ 15

Unit–IV

8. (a) Show that the vector field

$$\vec{F} = 2x(y^2 + z^3)\hat{i} + 2x^2y\hat{j} + 3x^2z^2\hat{k}$$

is irrotational and find its scalar potential.

(b) Evaluate $\int\int_S \vec{A} \cdot \hat{n}\, dS$, where

$\vec{A} = 18z\hat{i} - 12\hat{j} + 3y\hat{k}$ and S is the surface of the plane $2x + 3y + 6z = 12$ in the first octant. 15

9. Verify Gauss divergence theorem for $\vec{F} = 2x^2y\hat{i} - y^2\hat{j} + 4xz^2\hat{k}$ taken over the region first octant bounded by $y^2 + x^2 = 9$ and $x = 2$. 15

B.Tech. (CSE) 3rd Semester (G-Scheme) Examination,

December–2024

PYTHON PROGRAMMING (w.e.f. March-2021)

Paper–PCC-CSE-207-G(A)

Time allowed : 3 hours] *[Maximum marks : 75*

Note : *Attempt **five** questions in all, selecting **one** question from each unit. **Question No. 1 is compulsory.** All questions carry equal marks.*

1. (a) What are the different ways to sort the dictionaries in python ?

(b) Why python is called a strongly typed programming language ?

(c) What are mutable and immutable types in python ? Give an example of each.

(d) Differentiate between the terminal-based user interfaces and GUIs.

(e) What is time slicing ?

(f) Explain what a constructor does ? 6×2.5=15

Unit–I

2. (a) Write a python program to print the following star pattern : 8

```
*
* *
* * *
* * * *
* * * * *
* * * *
* * *
* *
*
```

(b) Write a python program to check whether the string is a palindrome ? 7

3. (a) Assume that the variable **data** refers to the string **"Python rocks !"**. 8

Use a string method perform the following tasks :

(i) Obtain a list of the words in the string.

(ii) Convert the string to uppercase.

(iii) Locate the position of the string **"rocks"**.

(iv) Replace the exclamation point with a question mark.

(b) Write a python program that reads a text file and changes the file by capitalizing each character of the file. 7

Unit–II

4. Define list data structure in python. Assume that the variable **data** refers to the list [18, 15, 20]. Write the expressions that perform the following tasks : 15

(a) Replace the value at position 0 in the **data** with that value's negation.

(b) Add the value 10 to the end of the **data**.

(c) Insert the value 22 at position 2 in the **data**.

(d) Remove the value at position 1 in the **data**.

(e) Add the values in the list **newData** to the end of **data**.

(f) Locate the index of the value 20 in the **data**.

(g) Sort the values in the **data**.

5. (a) Write the difference between lists and dictionaries in python. 7

(b) Write a python program to perform a binary search using recursion. 8

Unit–III

6. (a) Describe turtle operations in detail with the help of examples. 8

(b) Write a python program to draw a regular polygon using a turtle. 7

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7. (a) Why does the blur function need to work with a copy of the original image ? 6

(b) Explain the python libraries used to create a graphical user interface. 9

Unit–IV

8. (a) What is a class variable ? When should the programmer define a class variable rather than an instance variable ? 4

(b) Describe how the arithmetic operators can be overloaded to work with a new class of numbers ? 4

(c) How is the lifetime of an object determined ? What happens to an object when it dies ? 4

(d) Explain what the __str__ method does and why it is a useful method to include in a class. 3

9. (a) What is the difference between a sleeping thread and a waiting thread ? 4

(b) What does a thread's run method do ? 4

(c) State two ways in which the readers and writers problem is different from the producer-consumer problem. 4

(d) What is a synchronization problem ? 3

B.Tech. (CSE–AI & ML) 3rd Semester (G-Scheme)

Examination, December–2024

DISCRETE MATHEMATICS

Paper–PCC-CSE-202-G

Time allowed : 3 hours] *[Maximum marks : 75*

Note : ***Question No. 1 is compulsory.*** *Attempt* ***five*** *questions in total by selecting* ***one*** *question from each unit. All questions carry equal marks.*

1. (a) Let $f : R \to R$ be given by $f(x) = -x^2$ and $g : R^+ \to R^+$ be given by $g(x) = \sqrt{x}$ where R^+ is the set of all non negative real numbers and R is the set of all real numbers. Compute f o g. Can g o f be defined ?

(b) State the fundamental theorem of Arithmetic.

(c) Define identity element with an example.

(d) Define cyclic group with an example.

(e) What is the chromatic number of K_3 and $K_{2,3}$?

(f) Is there a simple graph with degree sequence (2, 1, 4, 4) ? $6 \times 2.5 = 15$

Unit–I

2. (a) State and prove De Morgan's Law of algebra of sets. 7.5

(b) Show that the relation "congruence modulo m" given by

$$R = \{(x, y) : x - y \text{ is divisible by } m\}$$

over the set of integers is an equivalence relation. 7.5

3. (a) Classify the following propositions into tautology, contradiction or contingency : 7.5

(i) $(p \rightarrow q) \leftrightarrow (\sim q \rightarrow \sim p)$

(ii) $((p \vee q) \wedge (\sim q)) \rightarrow p$

(b) Prove that the set of real numbers is uncountable. 7.5

Unit–II

4. (a) Using generating function solve the recurrence relation $a_r = 4\ a_{r-1} - 4\ a_{r-2} + r^2$, with initial conditions $a_0 = 2$ and $a_1 = 5$. 7.5

(b) How many different bit strings contain exactly five 0's and fourteen 1's if every 0 must be immediately followed by two 1's. 7.5

5. (a) Solve the recurrence relation :

$$a_r - a_{r-1} - a_{r-2} = 2r^2.$$ 7.5

(b) Find the minimum number of persons selected so that at least nine of them will have birthday on the same day of the week. 7.5

Unit–III

6. Define the following terms with suitable examples :

(i) Permutation group

(ii) Field

(iii) Abelian group

(iv) Homomorphism of groups

(v) Normal Subgroup 15

7. (a) Define Boolean algebra. Write down the axioms of Boolean algebra. 7.5

(b) Find the conjunctive normal form for the Boolean function $f(x, y, z) = (x + y)\ \bar{z}$. 7.5

Unit–IV

8. Define the following terms with examples :

   (i) Regular Graph

   (ii) Cut point

   (iii) Bipartite graph

   (iv) Minimal Spanning tree

   (v) Planar graph 15

9. (a) Differentiate between the following with suitable examples :

   (i) Eulerian graph and Hamiltonian graph

   (ii) Connected graph and Complete graph 7.5

   (b) Explain homomorphism and isomorphism of graphs with examples. 7.5

B.Tech. (CSE-AI & MLE) 3rd Semester

(G-Scheme) Examination, December–2024

MATHEMATICS FOR AI

Paper–BSC-MATH-271-G

Time allowed : 3 hours] *[Maximum marks : 75*

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(c) Evaluate : $\int_0^3 \int_0^1 (x^2+3y^2)\, dy\, dx$

(d) Solve $\frac{dy}{dx} - x^3 y^3 + xy = 0$.

(e) If $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$, show that $\text{div}(r^n \vec{r}) = (n+3) r^n$

(f) State Gauss divergence theorem. $2.5 \times 6 = 15$

Unit–I

2. (a) If $x^y = y^x$, show that $\frac{dy}{dx} = \frac{y(y - x \log y)}{x(x - y \log x)}$ using partial derivative method.

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15

3. (a) Discuss the maxima and minima of function $x^4 + y^4 - 2x^2 + 4xy - 2y^2$.

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Unit–II

4. (a) Evaluate $\iint y^2 \, dx \, dy$ over the area outside the circle $x^2 + y^2 - ax = 0$ and inside the circle $x^2 + y^2 - 2ax = 0$.

(b) Evaluate $\int \int_R (x^2 + y^2 + z^2) \, dx \, dy \, dz$, where R denotes the region bounded by $x = 0, y = 0, z = 0$ and $x + y + z = a, (a > 0)$. 15

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Unit–III

6. (a) Solve $xe^x (dx - dy) + e^x \, dx + ye^y \, dy = 0$

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Unit–IV

8. (a) Show that the vector field

$$\vec{F} = 2x(y^2 + z^3)\,\hat{i} + 2x^2y\,\hat{j} + 3x^2z^2\,\hat{k}$$

is irrotational and find its scalar potential.

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B.Tech. 3rd Semester (CSE-AI & MLE) G. Scheme

Examination, December-2024

ARTIFICIAL INTELLIGENCE

Paper : PCC-CSE-304-G

Time allowed : 3 hours] *[Maximum marks : 75*

Note : Question No. 1 is compulsory. *Answer any* ***one*** *question from each of the remaining four units. All questions carry equal marks.*

1. (a) What is Artificial Intelligence?

(b) Differentiate between informed and uninformed search.

(c) What is forward and backward reasoning?

(d) What is abduction?

(e) What is transformational Analogy? 5×3=15

Unit–I

2. (a) What is problem decomposition and solution steps can be ignored? Explain with example. 7

   (b) Explain hill climbing algorithm. What are the disadvantages of Hill Climbing? 8

3. (a) Explain Alpha-Beta Pruning. 7

   (b) Explain the state space search for water jug problem. 8

Unit–II

4. (a) Differentiate between propositional logic and predicate logic. 8

   (b) What is frame? How knowledge is represented using frame? 7

5. Explain the concept of knowledge Acquisition. Write down the properties of a knowledge representation system. 15

Unit–III

6. (a) Explain non-monotonic reasoning with the help of example. 8

   (b) What is partial order planning? Explain. 7

7. Define probability. Differentiate between conditional and unconditional probability with the help of example. 15

Unit–IV

8. (a) What do you mean by learning from example? Explain. 8

   (b) Differentiate between supervised and unsupervised learning. 7

9. What is version space? How it is used for candidate elimination? Explain. 15

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B.Tech. (CSE) 3rd Semester (G-Scheme) Examination,

December–2024

DATABASE MANAGEMENT SYSTEMS

Paper–PCC-CSE-201 G

Time allowed : 3 hours] *[Maximum marks : 75*

Note : ***Question No. 1 is compulsory****. Attempt* ***five*** *questions in total, selecting* ***one*** *question from each unit.*

1. (a) What is Data independence ? 2.5

(b) What is Data Abstraction ? Explain by taking suitable example. 2.5

(c) Define Armstrong's axioms. 2.5

(d) What is Hashing ? 2.5

(e) What is Object Relational Database ? 2.5

(f) Write short note on Web Database. 2.5

Unit–I

2. What is Database system ? Explain its architecture, its advantages and disadvantages in detail. 15

3. Write short note on the following : 2×7.5=15

   (i) Entity Relationship Model

   (ii) Network Model

Unit–II

4. What are Normal forms ? Explain the different Normal Forms in details with the help of example. 15

5. What is Query Processing ? How we optimize a query ? Explain its algorithms. 15

Unit–III

6. What is B-Tree ? How we insert and delete elements in a B-Tree ? 15

7. What is Concurrency Control ? Describe Multi-version and optimistic Concurrency Control schemes in detail by taking suitable example. 15

Unit–IV

8. Write short note on the following : 2×7.5=15

   (a) Data Security

   (b) Intrusion Detection

9. Define data warehousing. Explain data warehouse architecture and characteristics in detail. 15

B.Tech. (CSE) 3rd Semester (G-Scheme)

Examination, December-2024

DATA STRUCTURES & ALGORITHMS

(w.e.f. March-2021)

Paper -PCC-CSE-203-G(A)

Time allowed : 3 hours] *[Maximum marks : 75*

Note : *Attempt any **five** questions in total, selecting **one** question from each unit. **Question No. 1 is compulsory.** All questions carry equal marks.*

1. (a) What is the length of the path in a tree?

(b) Why do we use Big O notation to compare algorithms?

(c) What are the advantages of the array over a linked list?

(d) Why Stack is a recursive data structure?

(e) How do you test for empty Queues in 'C'?

(f) How does bubble sort get its name?

(g) Write applications of a doubly linked list.

(h) What is the need for a header in the header-linked list?

(i) What do you mean by external and internal sorting?

(j) What is an almost complete binary tree?

(k) What is a balance factor in the AVL tree?

(l) What is the use of Kruskal's algorithm?

(m) What is visiting and traversing in a graph?

(n) What are the characteristics of an algorithm?

(o) How priority queues are represented in 'C'?

15×1=15

Unit-I

2. (a) Define Data Structure. Why do we need Data Structure? 7

(b) Differentiate between the following: 8

(i) Primitive Data Structure and Non-Primitive Data Structure.

(ii) Linear Data Structure and Non-Linear Data Structure.

(iii) Static Data Structure and Dynamic Data Structure.

(iv) Homogeneous Data Structure and Non-Homogeneous Data Structure.

3. (a) Recursive or iterative Binary Search: which one is more efficient and why? 7

(b) Write a program for Recursive Binary Search. 8

Unit-II

4. (a) Why and when Stack or Queue data structure should be used instead of Array or lists. 7

(b) Convert the following prefix expression into an infix expression by using Stack: 8

*– P/QR– /PST

5. (a) Define Priority Queues. What are the characteristics of Priority Queues? 6

(b) What are the implementation strategies for Priority Queues? Explain with a suitable example. 9

Unit-III

6. What are the advantages, disadvantages and applications of circular linked list? 15

7. What are the differences between B–tree and B+tree? Construct a Binary Search Tree for the following:

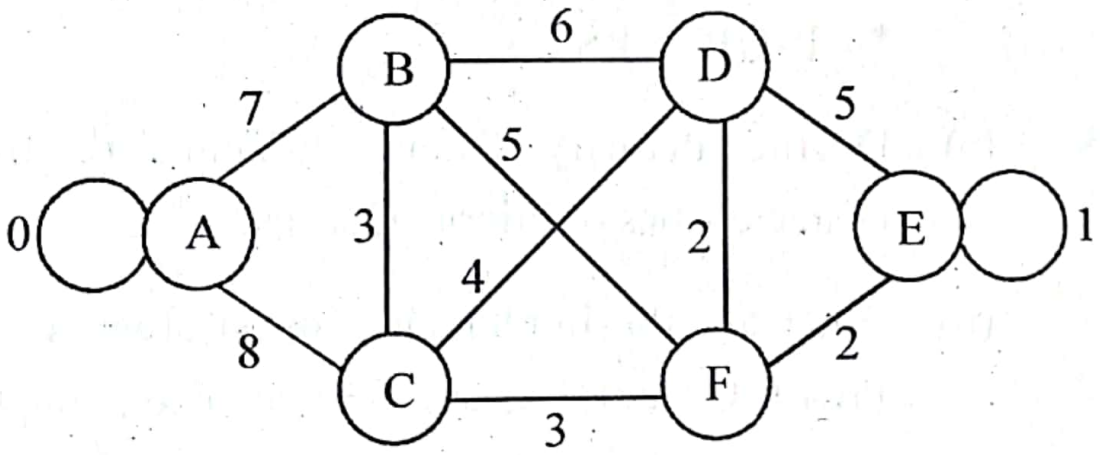
52, 17, 60, 5, 20, 58, 91, 3, 8, 37, 59, 24. 15

Unit-IV

8. What are the steps of the heap sort algorithm? Sort the following list of unsorted numbers by using heap sort:

85, 95, 10, 15, 20, 75, 55, 25. 15

9. How does Kruskal's algorithm work? Construct the Minimum Spanning Tree for the given graph using Kruskal's algorithm. 15



B.Tech. (CSE) 3rd Semester (G-Scheme)

Examination, December-2024

DIGITAL ELECTRONICS

Paper -PCC-CSE-205-G

Time allowed : 3 hours] *[Maximum marks : 75*

Note : *Attempt any* ***five*** *questions in all, selecting* ***one*** *question from each Unit.* ***Question No. 1 is compulsory.*** *All questions carry equal marks.*

1. (a) What do you mean by digital signal?

(b) Define various applications of flip-flop.

(c) What do you mean by multiplexer?

(d) Define ROM.

(e) Differentiate between Latch and flip flop.

(f) Define Quantization. 6×2.5=15

Unit-I

2. (a) State and explain Universal property of gates. 10

   (b) Convert $(ABC43)_{16}$ into $()_8$ 2

   (c) Convert $(4634)_8$ into $()_2$ 2

   (d) Convert $(264)_{10}$ into $()_8$ 1

3. Explain various Error detecting and correcting codes in detail. 15

Unit-II

4. Realize a function with the help of NAND gates:

   $F(A,B,C,D) = \sum(0,2,3,9,12,15) + d(1,4,6)$ 15

5. Write short note on: 15

   (a) De-Multiplexer

   (b) Priority encoder

Unit-III

6. Explain the working of J-K flip flop with truth table. 15

7. Differentiate between synchronous and asynchronous counter. 15

Unit-IV

8. Explain various types of digital to analog converters in detail. 15

9. Explain the following: 15

   (a) FPGA

   (b) CPLD

B.Tech. (CSE-AI&ML) 3rd Semester G-Scheme

Examination, December–2024

APPLIED COMPUTATIONAL STATISTICS

Paper-BSC-MATH-253-G

Time allowed : 3 hours] *[Maximum marks : 75*

Note : *The students have to attempt **five** questions in total, **first being compulsory** and selecting **one** question from each unit. All questions carry equal marks.*

1. (a) Write the axioms of probability.

(b) Explain :

(i) Null Hypothesis

(ii) Alternative Hypothesis

(iii) Level of significance

(c) Define a Markov Chain. Give an example.

(d) Define Multivariate distribution along with suitable example.

(e) Define covariance and coefficient of correlation between two random variables.

(f) Define measure of Skewness and Kurtosis.

6×2.5=15

Unit-I

2. Write short note on the following : 15

   (i) Normal distribution

   (ii) Large sample test for single proportion

   (iii) Test for single mean

3. (a) What is Hypothesis? What are the procedures of hypothesis testing ? 7

   (b) Below are given the gain in weights (in kgs) of pigs fed on two diets A and B. Gain in weight is given followings : 8

   Diet A: 25, 32, 30, 34, 24, 14, 32, 24, 30, 31, 35, 25

   Diet B: 44, 34, 22, 10, 47, 31, 40, 30, 32, 35, 18, 21, 35, 29, 22

   Test, if the two diets differ significantly as regards their effect on increase in weight.

Unit-II

4. (a) Explain the meaning of analysis of variance. Describe briefly the technique of variance for one-way and two-way classifications. 8

   (b) Define Multivariate distribution. Also discuss the multivariate normal distribution and its properties in details. 7

5. Write brief notes on the following : 15

   (i) Correlation and Regression coefficients

   (ii) MANOVA

Unit-III

6. Explain the principal component analysis and factor analysis in brief. 15

7. Write short notes : 15

   (i) Cluster Analysis

   (ii) Canonical Correlation Analysis

Unit-IV

8. (a) Find the nature of the state of the Markov Chain with three states 0, 1, 2 and with one step transition probability matrix $P = \begin{bmatrix} 0 & 1 & 0 \\ \frac{1}{2} & 0 & \frac{1}{2} \\ 0 & 1 & 0 \end{bmatrix}$. 8

   (b) Classify different types of random processes with suitable example. 7

9. Discuss in detail of Queuing process and Branching processes. 15

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B.Tech. (Electronics & Communication Engg.)
3rd Semester G-Scheme

Examination, December–2024

ECONOMICS FOR ENGINEERS

Paper-HSMC-01-G

Time allowed : 3 hours] *[Maximum marks : 75*

Note : *Attempt **five** questions in all, selecting **one** question from each unit. **Question No. 1 is compulsory.** All questions carry equal marks.*

1. (a) Define Micro Economics.

(b) Define Marginal Cost.

(c) What is Economic Problem?

(d) Define Monopoly.

(e) What is Law of Demand?

(f) What is Globalization?

6×2.5=15

Unit-I

2. What is Economics? Explain the nature of Economic Problem also discuss the significance of production possibility curve. 15

3. Explain the term Demand. Discuss the nature and importance of Law of Demand. 15

Unit-II

4. What is Production? Explain various factors of production and their significance. 15

5. Discuss the Law of Production. Illustrate the various cost in short run and in long run. 15

Unit-III

6. Define Market and its characteristics. Differentiate between Perfect Competition, Monopoly, Monopolistic and Oligopoly. 15

7. What is Law of Supply? Explain the various factors that affect the supply of the product. 15

Unit-IV

8. What do you understand by Privatization? Explain its merits and demerits. 15

9. What are Commercial Banks? Explain various functions of commerical banks. 15