



स्वामी रामानंद तीर्थ
मराठवाडा विद्यापीठ, नांदेड

शैक्षणिक वर्ष २०२४-२५ पासून राष्ट्रीय
॥ सा विद्या या विमुक्तये ॥
स्वामी रामानंद तीर्थ मराठवाडा विद्यापीठ, नांदेड
'ज्ञानतीर्थ', विष्णुपुरी, नांदेड - ४३१ ६०६ (महाराष्ट्र राज्य) भारत
SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

'Dnyanteerth', Vishnupuri, Nanded - 431 606 (Maharashtra State) INDIA
Established on 17th September, 1994, Recognized By the UGC U/s 2(f) and 12(B), NAAC Re-accredited with 'B++' grade

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विज्ञान व तंत्रज्ञान विद्याशाखेतील
CBCS पॅटर्न नुसारच्या पदवी
स्तरावरील तृतीय वर्षाच्या सुधारित
(दुरुस्ती) अभ्यासक्रमा बाबत....

प रि प त्र क

या परिपत्रकान्वये सर्व संबंधितांना कळविण्यात येते की, विज्ञान व तंत्रज्ञान विद्याशाखेतील शैक्षणिक वर्ष २०२१-२२ मध्ये **CBCS** पॅटर्न नुसार लागू केलेल्या पदवी स्तरावरील तृतीय वर्षाचे अभ्यासक्रम दुरुस्ती करण्यास मा. विद्यापरिषदेच्या दिनांक ३१ जुलै २०२५ रोजीच्या बैठकीतील विषय क्रमांक ०३/६२-२०२५ अन्वये मान्यता प्रदान केली आहे. त्यानुसार दुरुस्तीसह खालील अभ्यासक्रम शैक्षणिक वर्ष २०२५-२६ पासून लागू करण्यात येत आहेत.

01	B.Sc. III rd Year Computer Science
02	B.Sc. III rd Year Software Engineering
03	B.Sc. III rd Year Information Technology
04	B.Sc. III rd Year Computer Management
05	B.Sc. III rd Year Network Technology
06	B.C.A. (Bachelor of Computer Application) III rd Year

सदरील परिपत्रक व अभ्यासक्रम प्रस्तुत विद्यापीठाच्या www.srtmun.ac.in या संकेतस्थळावर उपलब्ध आहेत. तरी सदरील बाब ही सर्व संबंधितांच्या निदर्शनास आणून द्यावी, ही विनंती.

'ज्ञानतीर्थ' परिसर,

विष्णुपुरी, नांदेड - ४३१ ६०६.

जा.क्र.:शैक्षणिक-१/परिपत्रक/बी.एस्सी/ दुरुस्ती/S&T/

२०२५-२६/ 222

दिनांक : ०८.०९.२०२५



सहाय्यक कुलसचिव

शैक्षणिक अभ्यासमंडळ विभाग

प्रत माहिती व पुढील कार्यवाहीस्तव.

०१. मा. अधिष्ठाता, विज्ञान व तंत्रज्ञान विद्याशाखा, प्रस्तुत विद्यापीठ.
०२. मा. संचालक, परीक्षा व मूल्यमापन मंडळ यांचे कार्यालय, प्रस्तुत विद्यापीठ.
०३. मा. संचालक, सर्व संबंधित संकुले, प्रस्तुत विद्यापीठ.
०४. मा. प्राचार्य, सर्व संबंधित महाविद्यालये, प्रस्तुत विद्यापीठ.
०५. सिस्टम एक्सपर्ट, शैक्षणिक विभाग, प्रस्तुत विद्यापीठ. यानां देवून कळविण्यात येते की, सदरील परिपत्रक विद्यापीठाच्या संकेतस्थळावर प्रसिध्द करण्यात यावे.



॥ सा विद्या या विमुक्तये ॥



स्वामी रामानंद तीर्थ मराठवाडा विद्यापीठ, नांदेड

“ज्ञानतीर्थ” परिसर, विष्णुपुरी, नांदेड - ४३१६०६ (महाराष्ट्र)

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY NANDED

“Dnyanteerth”, Vishnupuri, Nanded - 431606 Maharashtra State (INDIA)

Established on 17th September 1994 – Recognized by the UGC U/s 2(f) and 12(B), NAAC Re-accredited with 'A' Grade

ACADEMIC (1-BOARD OF STUDIES) SECTION

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संलग्नित महाविद्यालयांतील विज्ञान व तंत्रज्ञान विद्याशाखेतील पदवी स्तरावरील तृतीय वर्षाचे CBCS Pattern नुसारचे अभ्यासक्रम शैक्षणिक वर्ष २०२१-२२ पासून लागू करण्याबाबत.

परिपत्रक

या परिपत्रकान्वये सर्व संबंधितांना कळविण्यात येते की, मा. विद्याशाखेने दिनांक ३१ मे २०२१ रोजीच्या बैठकीतील केलेल्या शिफारशीप्रमाणे व दिनांक १२ जून २०२१ रोजी संपन्न झालेल्या ५१ व्या मा. विद्या परिषद बैठकीतील विषय क्र. २६/५१-२०२१च्या ठरावानुसार प्रस्तुत विद्यापीठाच्या संलग्नित महाविद्यालयांतील विज्ञान व तंत्रज्ञान विद्याशाखेतील पदवी स्तरावरील तृतीय वर्षाचे खालील विषयांचे C.B.C.S. (Choice Based Credit System) Pattern नुसारचे अभ्यासक्रम शैक्षणिक वर्ष २०२१-२२ पासून लागू करण्यात येत आहेत.

1. B.Sc.-III Year-Biophysics
2. B.Sc.-III Year-Bioinformatics
3. B.Sc.-III Year-Biotechnology
4. B.Sc.-III Year-Biotechnology (Vocational)
5. B.Sc.-III Year-Botany
6. B.Sc.-III Year-Horticulture
7. B.Sc.-III Year-Agro Chemical Fertilizers
8. B.Sc.-III Year-Analytical Chemistry
9. B.Sc.-III Year-Biochemistry
10. B.Sc.-III Year-Chemistry
11. B.Sc.-III Year-Dyes & Drugs Chemistry
12. B.Sc.-III Year-Industrial Chemistry
13. B.C.A. (Bachelor of Computer Application)-III Year
14. B.I.T. (Bachelor of Information Technology)-III Year
15. B.Sc.-III Year-Computer Science
16. B.Sc.-III Year-Network Technology
17. B.Sc.-III Year-Computer Application (Optional)
18. B.Sc.-III Year-Computer Science (Optional)
19. B.Sc.-III Year-Information Technology (Optional)
20. B.Sc.-III Year-Software Engineering
21. B.Sc.-III Year-Dairy Science
22. B.Sc.-III Year-Electronics
23. B.Sc.-III Year-Environmental Science
24. B.Sc.-III Year-Fishery Science
25. B.Sc.-III Year-Geology
26. B. A./B.Sc.-III Year-Mathematics
27. B.Sc.-III Year-Microbiology
28. B.Sc.-III year Agricultural Microbiology
29. B.Sc.-III Year-Physics
30. B. A./B.Sc.-III Year Statistics
31. B.Sc.-III Year-Zoology

सदरील परिपत्रक व अभ्यासक्रम प्रस्तुत विद्यापीठाच्या www.srtmun.ac.in या संकेतस्थळावर उपलब्ध आहेत. तरी सदरील बाब ही सर्व संबंधितांच्या निदर्शनास आणून द्यावी, ही विनंती.

‘ज्ञानतीर्थ’ परिसर,

विष्णुपुरी, नांदेड - ४३१ ६०६.

जा.क्र.: शैक्षणिक-१/परिपत्रक/पदवी-सीबीसीएस अभ्यासक्रम/
२०२१-२२/७५

दिनांक : १२.०७.२०२१.

प्रत माहिती व पुढील कार्यवाहीस्तव :

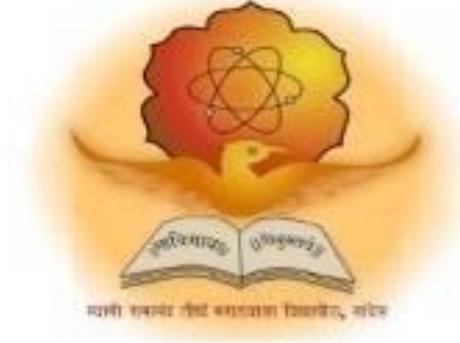
- १) मा. कुलसचिव यांचे कार्यालय, प्रस्तुत विद्यापीठ.
- २) मा. संचालक, परीक्षा व मूल्यमापन मंडळ यांचे कार्यालय, प्रस्तुत विद्यापीठ.
- ३) प्राचार्य, सर्व संबंधित संलग्नित महाविद्यालये, प्रस्तुत विद्यापीठ.
- ४) साहाय्यक कुलसचिव, पदव्युत्तर विभाग, प्रस्तुत विद्यापीठ.
- ५) उपकुलसचिव, पात्रता विभाग, प्रस्तुत विद्यापीठ.
- ६) सिस्टम एक्सपर्ट, शैक्षणिक विभाग, प्रस्तुत विद्यापीठ.
- ७) अधीक्षक, परीक्षा विभाग विज्ञान व तंत्रज्ञान विद्याशाखा प्रस्तुत विद्यापीठ.

स्वाक्षरित

सहा.कुलसचिव

शैक्षणिक (१-अभ्यासमंडळ) विभाग

**Swami Ramanand Teerth Marathwada
University, Nanded**



Syllabus of Third Year

B.Sc.(Computer Science)
(Revised CBCS pattern)

Introduced from Academic Year 2021-2022

B.Sc. Computer Science

B.Sc. Computer Science (3years) program / degree is a specialized program in computer sciences. It builds the student on studies in Computer Science and to become competent in the current race and development of new computational sciences. The duration of the study is of six semesters, which is normally completed in three years.

CBCS pattern

The B.Sc. Computer Science program as per CBCS (Choice based credit system) pattern, in which choices are given to the students under open electives and subject electives. The students can choose open electives from the wide range of options to them.

Eligibility and Fees

The eligibility of a candidate to take admission to **B.Sc. Computer Science** program is as per the eligibility criteria fixed by the University. More details on admission procedure and fee structure can be seen from the prospectus of the college / institution as well as on website of the University.

Credit Pattern

Every course has corresponding grades marked in the syllabus structure. There are 24 credits per semester. A total of 144 credits are essential to complete this program successfully. The Grading pattern to evaluate the performance of a student is as per the University rules.

Every semester has a combination of Theory (core or elective) courses and Lab courses. Each theory course has 04 credits which are split as 03 external credits and 01 internal credit. The university shall conduct the end semester examination for 03 external credits. For theory internal credit, student has to appear for 01 class test (15 marks) and 01 assignment (10 marks). Every lab course has 02 credits which are split as 01 external credit and 01 internal credit. For lab internal credit, the student has to submit Laboratory Book (05 marks) and remaining 20 marks are for the Lab activities carried out by the student throughout the semester. For lab external credit, 20 marks are reserved for the examinational experiment and 05 marks are for the oral / viva examinations.

The open elective has 04 credits which are purely internal. If students are opting for MOOCs as open elective, then, there must be a Faculty designed as MOOCs course coordinator who shall supervise learning through MOOCs. This is intentionally needed as the MOOCs course coordinator shall verify the MOOC details including its duration, starting date, ending date, syllabus contents, mode of conduction, infrastructure feasibility, and financial feasibility during start of each semester. This is precautionary as the offering of the MOOCs through online platforms are time specific and there must be proper synchronization of semester duration with the MOOCs duration. Students must opt for either institutional / college level open elective or a course from University recognized MOOCs platforms as open electives.

The number of hours needed for completion of theory and practical courses as well as the passing rules, grading patterns, question paper pattern, number of students in practical batches, etc shall be as per the recommendations, norms, guidelines and policies of the UGC, State Government and the SRTM University currently operational. The course structure is supplemented with split up in units and minimum numbers of hours needed for completion of the course, wherever possible.

Under the CBCS pattern, students would graduate **B.Sc. Computer Science** with a minimum number of required credits which includes compulsory credits from core courses, open electives and program specific elective course. All students have to undergo lab / practical activities leading to specific credits and project development activity as a part of professional UG program.

1. **B.Sc. Computer Science** Degree / program would be of 144 Credits. Total credits per semester= 24
2. Each semester shall consist of three core courses, one elective course, one open elective course and two practical courses. Four theory courses (core+elective) = 16 Credits
3. Two practical / Lab courses= 4 Credits in total (02 credits each) , One Open elective= 4 credit
4. One Credit = 25 marks , Two Credits = 50 Marks, Four Credits = 100 Marks

PEO, PO and CO Mappings

1. **Program Name** : B.Sc.(Computer Science)
2. **Program Educational Objectives:** After completion of this program, the graduates / students would

PEO I :Technical Expertise	Implement fundamental domain knowledge of core courses for developing effective computing solutions by incorporating creativity and logical reasoning.
PEO II : Successful Career	Deliver professional services with updated technologies in Computer Science based career.
PEO III :Hands on Technology and Professional experience	Develop leadership skills and incorporate ethics, team work with effective communication & time management in the profession.
PEO IV :Interdisciplinary and Life Long Learning	Undergo higher studies, certifications and research programs as per market needs.

3. **Program Outcome(s):** Students / graduates will be able to

PO1: Apply knowledge of mathematics, science and algorithm in solving Computer problems.

PO2: Generate solutions by conducting experiments and applying techniques to analyze and interpret data

PO3: Design component, or processes to meet the needs within realistic constraints.

- PO4:** Identify, formulate, and solve problems using computational temperaments.
- PO5:** Comprehend professional and ethical responsibility in computing profession.
- PO6:** Express effective communication skills.
- PO7:** Recognize the need for interdisciplinary, and an ability to engage in life-long learning.
- PO8:** Actual hands on technology to understand it's working.
- PO9:** Knowledge of contemporary issues and emerging developments in computing profession.
- PO10:** Utilize the techniques, skills and modern tools, for actual development process
- PO11:** Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary settings in actual development work
- PO12:** Research insights and conduct research in computing environment.

4. **Course Outcome(s):** Every individual course under this program has course objectives and course outcomes (CO). The course objectives rationally match with program educational objectives. The mapping of PEO, PO and CO is as illustrated below

5. **Mapping of PEO& PO and CO**

Program Educational Objectives	Thrust Area	Program Outcome	Course Outcome
PEO I	Technical Expertise	PO1,PO2,PO3,PO6	All core courses
PEO II	Successful Career	PO4,PO5,PO11,	All discipline specific electives courses
PEO III	Hands on Technology and Professional experience	PO8,PO10	All Lab courses
PEO IV	Interdisciplinary and Life Long Learning	PO7,PO9,PO12	All open electives and discipline specific electives

**Third Year B.Sc. Computer Science (Revised
CBCS pattern)
Introduced from Academic Year 2021-2022**

Year	Semester	Course category	Course Code	Course Title	credits		
Third	Fifth	Core Course	BCS-501	Windows Programming	04		
		Core Course	BCS-502	Python	04		
		Core Course	BCS-503	Data Science	04		
		Chose any one from the below Elective courses					
		Elective Subject	BCS- 504A	Software Testing (Elective)	04		
			BCS-504 B	Basics of Linux (Elective)			
			BCS-504 C	Enterprise Infrastructure and Cloud Technologies Part I (Additional Elective)			
		Chose any one Open Elective courses					
		Open Elective	BCS-505 A	University recognized MOOC (NPTEL / SWAYAM / others) OR Intra / Inter Departmental courses OR	04		
			BCS-505 B	System Analysis and Design(SAD)— (Open elective)			
		Lab / Practical	BCS-506	Windows Programming	02		
			BCS-507	Python	02		
Total					24		
Third	Sixth	Core Course	BCS-601	Mobile Application Development	04		
		Core Course	BCS-602	Fundamentals of Image Processing	04		
		Core Course	BCS-603	Project Development activity and Seminar	04		
		Chose any one from the below Elective courses					
		Elective Subject	BCS-604A	Software Process Management (Elective)	04		
			BCS-604B	Linux Administration (Elective)			
			BCS-604C	Enterprise Infrastructure and Cloud Technologies Part II (Additional Elective)			
		Chose any one Open Elective courses					
		Open Elective	BCS-605A	University recognized MOOC (NPTEL / SWAYAM / others) OR Intra / Inter Departmental courses OR	04		
			BCS-605B	Networking Essentials (Open elective)			
		Lab / Practical	BCS-606	RDBMS	02		
			BCS-607	JAVA Programming	02		
Total					24		

Name of Course	B.Sc. Computer Science (Third Year)
Semester	V Semester
Name of Subject	Windows Programming
Subject code	BCS-501

Course Objectives:

1. To learn and understand basic concepts of Windows Programming.
2. To learn basic C# programming.
3. To understand and work on desktop application development using C#.Net.
4. To expose students to current applications C#.Net.

Course Outcome:

1. Review the fundamental concepts of Windows Programming in C#.Net
2. Evaluate the logic of different programming concepts.
3. Evaluate the techniques of application development in windows environment.
4. To develop database connectivity application.
5. To evaluate different techniques to develop windows applications.

UNIT I

Sr. No.	Introduction	Lectures Required
1	Introduction to .Net Technology & Framework	1
2	Net Architecture	1
3	Common Language Runtime(CLR)	2
4	Visual Studio and IDE Components	1
5	Intellisense	1
6	Project Types	1
7	Java vs C#	1

UNIT II

Sr. No.	Windows Applications and Windows Controls	Lectures Required
1	Important Classes Used in Windows Application	1
2	Creating and Customizing Windows Form	2
3	TextBox and Label Control	1
4	Button, CheckBox and RadioButton	1
5	ListBox and ComboBox control	1
6	Menus and Dialog Boxes	2

UNIT III

Sr. No.	Functions, Arrays and Strings	Lectures Required
1	C# Function	1
2	Parameter Passing - Call by Value & Call by Reference	2
3	Out Parameter	1
4	Array and ArrayList class	2
5	Jagged Array	1
6	String Class	1
7	StringBuffer class	1

UNIT IV

Sr. No.	Properties, Indexers, Delegates & Events	Lectures Required
1	Properties	1
2	Indexers	2
3	Delegates	1
4	Multicast Delegates	2
5	Custom Events	1

UNIT V

Sr. No.	Namespace, interface & Exception handling	Lectures Required
1	Creating & using Namespace(DLL library)	1
2	Creating & using interface	2
3	Exception Handling using Try and Catch Block	1
4	Using Finally Block	2
5	Custom Exception	1

UNIT VI

Sr. No.	Database Connectivity	Lectures Required
1	Introduction ADO.Net	1
2	Advantages of ADO.Net	2
3	Developing a Simple ADO.NET Based Application	1
4	Retrieving & Updating Data From Tables	2
5	Disconnected Data Access Through Dataset Objects	2

Reference books:-

- 1 Programming in C# E Balagurusamy Mc Graw Hill
- 2 Visual C#.Net C Muthu Mc Graw Hill

Name of Course	B.Sc. (Computer Science) Third Year
Semester	V Semester
Name of Subject	Python
Subject code	BCS-502

Course objective:

1. To understand why Python is a useful scripting language for developers.
2. To define the structure and components of a Python program.
3. To understand programming constructs in Python.
4. To acquire Object Oriented Skills in Python
5. To develop the ability to write database applications in Python

Course Outcome:

After successful completion of this course, learner will be able to-

1. Write programs using Python programming constructs.
2. Design and Develop applications using Python programming.
3. Design object oriented programs with Python classes.
4. Use exception handling in Python applications for error handling.
5. Design and Develop applications connecting with database.

UNIT-I

Sr. No.	Introduction	Lectures Required
1	Getting Started - Introducing python,	1
2	Features of python	1
3	Python Interpreter , Installing python on windows	2
4	Meeting the interpreter, Writing your first program.	2

UNIT-II

Sr. No.	Data types, variables, expressions, statements and Control Structures	Lectures Required
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1	Employing variables, Obtaining user input, Correcting Errors.	2
2	Performing operations-Doing arithmetic,	1
3	Assignment statements Assigning values, Comparing Values, Assessing logic.	2
4	Examining Conditions, Setting precedence, casting data types.	2
5	Branching with if, Looping while true, Looping over items, Breaking out of loops.	2
6	Working with List, Tuple, Set, Dictionary.	2

UNIT-III

Sr. No.	Strings and string operations, Modularization and Classes	Lectures Required
1	Manipulating strings, Formatting strings, Modifying strings Operators (unary, arithmetic, etc.)	2
2	Accessing files, Reading and writing files, Updating file strings	2
3	Pickling data, Reading data from CSV/EXCEL file in python	1
4	Standard modules , Packages, Defining Classes	1
5	Defining functions ,Functions and arguments (signature)	1
6	Mathematical functions and constants (import math)	1

UNIT-IV

Sr. No.	Exceptions and data structures	Lectures Required
1	Data Structures (array, List, Dictionary)	1

2	Exception Raising ,Exception Handling ,Error processing.	2
3	Making statements - Writing lists, Manipulating lists, Restricting lists, associating list elements,	2

UNIT-V

Sr. No.	Object Oriented Design	Lectures Required
1	Programming types , Object Oriented Programming,	1
2	Inheritance and types of inheritance,	2
3	Polymorphism.	2

UNIT-VI

Sr. No.	Database Connectivity and Web	Lectures Required
1	Getting MySQL for python	1
2	Connecting with database	1
3	Passing Query to MySQL	1
4	Design and Implement any Database Application using Python	1
5	Introduction to web using flask.	1

Reference Books:

1. Learning Python Mark Lutz O'Reilly 5th edition
2. Starting Out with Python plus MyProgramming Lab Tony Gaddis Pearson eText --Access Card Package 3rd edition
3. MySQL for Python Albert Lukaszewski Packt publication 1st edition

Name of Course	B.Sc. Computer Science (Third Year)
Semester	VI Semester
Name of Subject	Data Science
Subject code	BCS-503

Course Objectives:

1. To learn and understand fundamental concepts of Data Science
2. To learn basic Data Science operations.
3. To understand and work on different algorithms for Data Science
4. To expose students to current applications and opportunities in Data Science emerging field.

Course Outcome:

1. Review the fundamental concepts of Data Science
2. Evaluate the techniques for better Data Science understanding.
3. Evaluate the techniques for perfect Data Analysis
4. To develop applications/algorithms in the field of Data Science
5. To evaluate different Data Science techniques & tools

UNIT I

Sr. No.	Introduction to Data Science	Lectures Required
1	Data Mining, classification, regression	1
2	Essential of algorithms and data structure	1
3	Data Visualization	2
4	Software Engineering trends and technique.	2

UNIT II

Sr. No.		Lectures Required
1	Data base & Data Warehousing	1
2	AI & ANN basic, Non-Scalable & Scalable data	2
3	Use of Statistics Methods & technique, Descriptive and Inferential statistics	2
4	Data Analysis, Hypothesis techniques	2

UNIT III

Sr. No.		Lectures Required
1	Introduction to data computational techniques conventional & modern	2
2	Artificial Intelligence, Machine learning big data, parallel Computing and algorithms	1
3	Managing Big Data and different techniques	2
4	Research Methodology basics and importance	2

UNIT IV

Sr. No.		Lectures Required
1	Basic introduction to Data Science	2
2	Various Applications of data Science	2
3	Importance of Data Science in Future	2
4	Data Analysis, techniques, Programming paradigm & algorithms, data structures	2

UNIT V

Sr. No.		Lectures Required
1	Data Mining V/S Data Science	1
2	Experimentation, Evaluation and Project Deployment Tools	2
3	Predictive Analytics and Segmentation using Clustering	2
4	Applied Mathematics and Informatics, Exploratory Data Analysis	1

UNIT VI

Sr. No.		Lectures Required
1	Optimization for Data Science, Data scientist roles and responsibilities,	1
2	Data acquisition and data science life cycle	2
3	Big Data Fundamentals and Hadoop Integration with R	1
4	Experimentation, Evaluation and Project Deployment Tools	2

Reference books:-

1. Foreman, Data Smart: Using Data Science to Transform Information into Insight, John Wiley
2. Fundamentals of mathematical statistics by Gupta and Kapoor
3. Database Design and Relational Theory: Normal Forms and All That Jazz by C.J. Date
4. Dunham, Data Mining: Introductory and Advanced Topics, Pearson

Name of Course	B.Sc. Computer Science (Third Year)
Semester	VI Semester
Name of Subject	Software Testing (Elective)
Subject code	BCS- 504A

Course Objectives:

- i. To develop software testing skills and test plans execution skills.
- ii. To understand software testing techniques and its application in Software development.
- iii. To enhance skills of designing and testing software.
- iv. To learn technical skills required for quality assurance of software.

Course Outcomes:

- i. Ability to learn various methods of software development.
- ii. Ability to apply various software testing techniques.
- iii. Ability to evaluate cost of software testing.
- iv. Ability to implement different software testing according to types of software.

UNIT I

Sr. No.	Quality concepts	Lectures Required
1	Concept of Quality	1
2	Software Quality	1
3	McCall's Quality Factors	1
4	ISO 9126 Quality Factors	1
5	Targeted Quality Factors	1
6	Cost of Quality , Quality and Security	1
8	Quality Control , Quality Assurance	1

UNIT II

Sr. No.	Software Quality Assurance	Lectures Required
1	Software Quality Assurance	1
2	Software Reviews and its type	2
3	Formal Technical Reviews	1
4	Software Reliability	1
5	Software Quality Assurance Plan	1

UNIT III

Sr. No.	SOFTWARE TESTING STRATEGIES	Lectures Required
1	A Strategic Approach to Software Testing	1
2	Unit Testing	1
3	Integration Testing	1
4	Validation Testing	1
5	System Testing	1
6	The Art Of Debugging	1

UNIT IV

Sr. No.	TESTING APPLICATION	Lectures Required
1	Software Testing Fundamentals	1
2	Internal and External Views of Testing	2
3	White-Box Testing	2
4	Basic Path Testing	1
5	Control Structural Testing	1
6	Black Box Testing	1

UNIT V

Sr. No.	WEBAPPS FOR TESTING	Lectures Required
1	Testing Concepts for WebApps	1
2	An Overview-The Testing Process	1
3	Content Testing	1

4	User interface Testing	1
5	Navigation Testing	1
6	Security Testing	1

UNIT VI

Sr. No.	PRODUCT METRICS	Lectures Required
1	A frame work for product metrics	1
2	Metrics for the requirements mode	2
3	Metrics for design mode	1
4	Metrics for source code	2
5	Metrics for testing	1

Reference books:-

1. Software Engineering –A Practitioner's approach, Sixth Edition, Roger S. Pressman, McGraw-Hill Higher Education; (1 August 2007),ISBN-10: 0077227808
2. Software Engineering –A Practitioner's approach, Fifth Edition, Roger S. Pressman, McGraw-Hill Higher Education; (1 August 2005)
3. Software Testing Concepts and Tools NageswaraRoo Dreamtech Publication

Name of Course	B.Sc. Computer Science (Third Year)
Semester	V Semester
Name of Subject	Basics of Linux (Elective)
Subject code	BCS-504 B

Course Objectives:

- This course shall build a platform for students to start their own enterprise
- For Making Student Job Ready
- To become familiar with open source software and user interface.
- To securely handle OS without any viruses and malwares.
- For easily use free software available on internet.
- To understand the basic operating system command.
- To understand the basic concept of Linux operating system

Course Outcomes:

- Awareness of existing demanding trends in IT industry in order to get placement & research in open source market.
- Understand the Linux OS architecture.
- Install and use different types of distributions available in market.
- Understand the different Linux basic commands.

UNIT I

Sr. No.	Introduction to Linux	Lectures Required
1	Operating system,What is Linux, Advantages of Linux, Disadvantages of Linux,Distributions of Linux	2
2	Functions of Operating system ,History and development of of Linux, Features of Linux	2
3	Installation steps of Linux	2
4	Difference between Linux and Windows, Difference between Linux and Unix	2

UNIT II

Sr. No.	Handling Linux Environment	Lectures Required
1	Basic Commands, Linux standard directories,Hardware requirement for linux	2
2	Commands for files and directories,File processing commands,Mathematical Commands	2
3	Login,Logout and Remote Login,different GPU (cal,date,wc,who)	1
4	Basic filters –head,tail,sort,grep,different options and expressions for grep	2

UNIT III

Sr. No.	Linux boot process	Lectures Required
1	Boot Loaders (LILO and GRUB),System Initiazation	2
2	inittab	1
3	rc.sysinit,rc	1
4	Printing files: Print Spool directory,sending files to Printer	1

UNIT IV

Sr. No.	VI Editors	Lectures Required
1	Editors,use of VI,features of Vi	2
2	VI basics,Different modes and working with VI	1
3	Command mode-Curser movements(k,j,h,l),delete(character,line,word),Screen up,down use of repeat factor,Joining lines(J)	1
4	Input Mode-switching with (I,o,r,s,a,I,O,R,S) Ex mode-saving(w,x,q),writing selecting lines to another	2

UNIT V

Sr. No.	Sharing Files with Other users	Lectures Required
1	Maintaining User accounts,changing password,creating group Accounts,Granting access to files,Changing file ownership	2
2	Protecting files,making a file readonly,	1
3	Free command and top utility	2
4	working with processes: types of process,ps Command,Creating process,killing process	2

UNIT VI

Sr. No.	Managing Disk space	Lectures Required
1	Df,du commands,creating Additional free disk space,Locating unused files,Setting system clock	2
2	Communication utility:who,who am I,finger,mesg,write,wall,talk	1
3	Creating a message of the day,X windows System	2
4	Graphical user interface: KDE and GNOME Desktop Environment	2

Reference book:-

- 1) LINUX complete reference by Richard Peterson
- 2) RedHalt Linux 718 by billball,David Pitts
- 3) Unix concept and applications by Sumitabha Das
- 4) Fedora 7 Unleashed by Andrew Hudson and Paul Hudson (SAMS publication)

Name of Course	B.Sc. Computer Science (Third Year)
Semester	V Semester
Name of Subject	Enterprise Infrastructure and Cloud Technologies Part I (Additional Elective)
Subject code	BCS-504 C

UNIT I

Sr. No.	Networking and Server Infrastructure	Lectures Required
1	Introduction to Networking Devices and LAN/WAN - IPv4 and IPv6.	2
2	Routers and Switches Overview.	2
3	Datacenter Overview and Server Form Factors - Server	2
4	Management Portals (IPMI/iLO/iDrac) and Events -	2
5	Introduction to Storage: NAS, DAS, SAN - RAID Levels and Comparisons (Fibre Channel, iSCSI, FCoE)	2

UNIT II

Sr. No.	Operating Systems Overview (Server & Client)	Lectures Required
1	Operating Systems Overview (Server & Client),	2
2	Domain vs. Workgroup - File Systems: FAT, NTFS, ReFS, EXT3, EXT4 -	2
3	Installing and Managing OS (Windows Server, Linux) - Firewall	1
4	Fundamentals (Hardware/Software)	2

UNIT III

Sr. No.	Windows Server Administration	Lectures Required
1	Windows Server Core Installation, Upgrades, Patch	2
2	Management & Migrations - Storage Spaces, iSNS, DCB, and MPIO - Data Deduplication and Disk Management -	2
3	High Availability: Failover Clustering,	2
4	NLB - Deployment Images using MDT and WSUS -	2
5	PowerShell DSC and Monitoring Tools - Performance Monitoring and Event Logs	2

UNIT IV

Sr. No.	Active Directory & Security	Lectures Required
1	AD DS DNS Server Role, Zones, and Transfers	2
2	AD DS Replication and Sites	1
3	Group Policy Management and Templates	1
4	Securing Domain Controllers and Accounts	2
5	Audit Authentication and Managed Service Accounts	2
6	Certificate Services (CAs, Templates, Revocation, Recovery)	2
7	AD FS, AD RMS, and Smart Cards - Backup & Restore of Active Directory	2

Core Practical: Enterprise Infrastructure and Cloud Technologies Lab Part I

Course Code: BCA-504-C (Elective)

1. **Windows Server Installation & Configuration**, Install Windows Server (GUI).
2. Install Windows Server Core
3. **Install & Configure Active Directory Domain Services (AD DS)**
 - Promote server to DC, join clients to the domain.
4. Enforce password policy,
5. Restrict drives,
6. desktop configuration.
7. **Implement Failover Cluster and Network Load Balancing (NLB)**
 - Build a high-availability cluster for file share service.
8. **PowerShell Scripting for Automation Tasks**
 - Write scripts for backup, log rotation, monitoring, Patching, Checking Stale Records

Reference book:-

Textbooks

1. Sara Perrott, "**Windows Server 2019 & PowerShell All-in-One For Dummies**", Wiley, 2021.
2. Sander van Vugt, "**Red Hat RHCSA 8 Cert Guide: EX200**", Pearson IT Certification, 2021.
3. Computer Networks" by Andrew S. Tanenbaum and David J. Wetherall, 5th Edition, Pearson Education, **2011**

Name of Course	B.Sc. Computer Science (Third Year)
Semester	VI Semester
Name of Subject	System Analysis and Design(SAD)—Open elective
Subject code	BCS-505 B

Course Objective :-

1. System analysis helps in discovering means to design systems.
2. System analysis helps in discovering sub-system may have apparently conflicting objectives.
3. It helps in achieving inter compatibility and unity of purpose of sub-systems.
4. It offers a means to create understanding of the complex structures
5. It helps to understand writing system proposals, system development scheduling, and cost-benefits analysis etc. also dealing with quality assurance

Course Outcome :-

1. To learn basic things of systems, System development Life cycle, and System Analyst.
2. To determine specific needs of system.
3. Discuss approaches and tasks of system. Planning for developing system
4. Evaluate tools and techniques.
5. Use appropriate methods and techniques to design software.
6. Implementation of Developed System, Evaluation and Testing of system.

UNIT I

Sr. No.	Introduction	Lectures Required
1	System Definition, Characteristics.	2
2	Elements and Types of system, Need of System Analysis and design.	2
3	Role and Qualities of System Analyst	2
4	System Development Life Cycle.	1

UNIT II

Sr. No.	Feasibility Study	Lectures Required
1	Project Initiation, Feasibility study	2
2	Ascertaining HW/SW needs, Criteria for HW/SW selection	2
3	Make v/s Buy Decision	2
4	Cost Benefit Analysis.	1

UNIT III

Sr. No.	Decision Modules & Scheduling	Lectures Required
1	Structured Analysis tools- DFD, Data Dictionary	2
2	Decision Tree, Decision Table, Structured English, Activity planning control	2
3	Activity Diagrams, Case modeling, UML, Class Diagram. System Proposal	2
4	Project Scheduling, Information Gathering Tools- Interviews, Questionnaire, JAD, Prototyping.	2

UNIT IV

Sr. No.	Tools for System Analysis	Lectures Required
1	Data Flow Diagram (DFD), Logical and Physical DFDs	2
2	Developing DFD; System Flowcharts and Structured charts	2
3	Structured English, Decision trees and Decision tables.	2

UNIT V

Sr. No.	Design & Implementation	Lectures Required
1	System Design, Input/output Design, From Design	2
2	From Design, Database Design, File organization, System Implementation Plan	2
3	Activity Network for Conversion, Combating Resistance to Change, System Testing,	2
4	Test Plan AND test data, Types of System Test, Quality Assurance, Documentation.	2

UNIT VI

Sr. No.	System Security and Audit	Lectures Required
1	System Security, Security Threats	2
2	Risk Analysis, Control measures	2
3	System Audit, Disaster Recovery Planning	2

Reference Books :-

- 1. System Analysis and Design- Kendall and Kendall, Pearson Education, Inc., Prentice Hall.
 2. System Analysis and Design- E. M. Awad, Galgotia Publications Pvt. Ltd
 3. Modern System Analysis and Design - Jeffrey A. Hoffer, Prentice-Hall, Inc.
 4. System Analysis & design -Perry Edwards, Mc Graw Hill

Name of Course	B.Sc. CS Third Year
Semester	VI
Name of Subject	Mobile Application Development
Subject Code	BCS-601

Course Objectives:

- This course shall build a platform for students to start their own enterprise
- For Making Student Job Ready
- To gain an understanding of the processes that are involved in an Android developed application
- To become familiar with Android development tools and user interface.
- To understand Activity and Intends
- To understand SQLite Database.
- To Understand Web view control
- Ability to build Many simple apps that you can share with your friends

Course Outcome:

- Awareness of existing demanding trends in IT industry in order to get placement & research
- Understand the Android OS architecture.
- Install and use appropriate tools for Android development, including IDE, device emulator, and profiling tools.
- Understand the Android application architecture, including the roles of the task stack, activities, & services.
- Build user interfaces with fragments, views, form widgets, text input, lists, tables, and more.

UNIT I

I	FUNDAMENTALS MOBILE PROGRAMMING	Lectures Required
1.1	Introduction to Mobile Programming	1
1.2	Android: An Open Platform for Mobile Development	1
1.3	Overview of the Operating Systems used on different mobile devices	1
1.4	Android Operating System, Its Features and Versions	1
1.5	Android Development Tools	1
1.6	Introducing the Development Framework	1
1.7	Installing Android Studio	2

UNIT II

II	ANDROID ARCHITECTURE		Lectures Required
	2.1	Android Stack	1
	2.2	Android applications structure	2
	2.3	Creating a project	1
	2.4	Configuring the Android Manifest File	1
	2.5	Understanding Activities	1
	2.6	Understanding the Components or layouts of a Screen	2

UNIT III

III	ACTIVITIES, FRAGMENTS, AND INTENTS		Lectures Required
	3.1	Understanding Activities	1
	3.2	Intents	2
	3.3	Linking Activities Using Intents	1
	3.4	Activity life cycle	1
	3.5	Fragments	1

UNIT IV

IV	BUILDING USER INTERFACES		Lectures Required
	4.1	Text controls	1
	4.2	Button controls	2
	4.3	Toggle buttons	1
	4.4	ImageButton, RadioButton, and RadioGroup Views, ProgressBar View, AutoCompleteTextView View	1
	4.5	TimePicker View, DatePicker View	1
	4.6	AnalogClock and DigitalClock Views	1
	4.7	WebView	1
	4.8	Toast notifications	1

UNIT V

V	MENUS, SMS & LOCATION-BASED SERVICES		Lectures Required
	5.1	Localization	1

	5.5	Creating the Helper Methods, Options menu and Context menu	1
	5.3	Dialogs- Alert dialog	1
	5.4	SMS Messaging	1
	5.5	Using a Content Provider	1
	5.6	Lists view	1
	5.7	Displaying Maps , Getting Location Data	2
	5.8	Monitoring a Location using GPS	1

UNIT VI

VI	WORKING WITH INTERNET, DATABASES AND PUBLISHING APPS	Lectures Required
	6.1 Shared preferences	1
	6.2 Downloading and Parsing Internet Resources, Using the Download Manager.	1
	6.3 Files access	2
	6.4 Introducing Android Databases, Introducing SQLite, Content Values and Cursors, Working with SQLite Databases.	3
	6.5 Preparing for publishing	1
	6.6 Publishing to the Android Market	2

Reference Books:-

- 1 Professional Android 4 Application Development, Edition 3 Reto Meier Wrox Publication
- 2 Beginning Android 4 Application Development, Edition illustrated Wei-Meng Lee, John Wiley & Sons WroxPublication
- 3 Sams Teach Yourself Android Application Development in 24 Hours, Edition illustrated Darcey& Shane Conder Sams Publishing

Name of Course	B.Sc. Computer Science (Third Year)
Semester	VI Semester
Name of Subject	Fundamentals of Image Processing
Subject code	BCS-602

Course Objectives:

- 1 To learn and understand fundamental concepts of digital image processing.
- 2 To learn basic image processing operations.
- 3 To understand and work on different image analysis algorithms
- 4 To expose students to current applications of digital image processing system.

Course Outcome:

- 1 Review the fundamental concepts of digital image processing system.
- 2 Evaluate the techniques for image enhancement.
- 3 Evaluate the techniques for Image restoration.
- 4 To develop color based image processing applications.
- 5 To evaluate different filtering method.

UNIT I

Sr. No.	Introduction	Lectures Required
1	Introduction to Digital image processing	1
2	Applications of image processing	1
3	Fundamental steps in digital image processing	2
4	Elements of visual perception, Brightness, Discrimination and adaptation	2

UNIT II

Sr. No.	Introduction to Digital Image Representation	Lectures Required
1	Components of an image processing system	1
2	Representing digital images, co-ordinate convention system,	2

	Matrix representation,	
3	Reading, displaying and writing of images	2
4	Data class, Image types, sampling and quantization	2

UNIT III

Sr. No.	Color Image Processing	Lectures Required
1	Color fundamentals, Basics of full color image processing,	2
2	Color models and color spaces,	1
3	RGB color model, HSV color model, CMY color model,	2
4	Pseudo color image processing, Color image representation, MATLAB functions for color model conversions.	2

UNIT IV

Sr. No.	Intensity Transformation and spatial filtering techniques	Lectures Required
1	Background, basic intensity transformation function using imadust()	2
2	Histogram processing and function plotting, histogram equalization, histogram type	2
3	Fundamentals of filtering, neighbourhood,	2
4	Linear spatial filtering, Non linear spatial filtering, fspecial() and imfilter().	2

UNIT V

Sr. No.	Image Restoration	Lectures Required
1	A model of image degradation and restoration process	1
2	Noise models	2
3	Geometric transformation function, image registration.	2
4	Restoration techniques.	1

UNIT VI

Sr. No.	Introduction to MATLAB	Lectures Required
1	Advantages and disadvantages of MATLAB	1
2	Using MATLAB scratch pad, MATLAB environment	2
3	Variables and arrays, scalar and array operation,	1
4	MATLAB operator, Multidimensional array, Introduction to M function programming.	2

Reference books:-

1. Digital Image Processing using MATLAB R.C. Gonzalez, R.E.Woods and S.L.Eddins Second Edition, Pearson Education.
2. Fundamentals of Image Processing A.K. Jain PHI publication.
3. MATLAB Programming for Engineers Stephen J. Chapman Third Edition, Thomson Learning.

Name of Course	B.Sc. Computer Science (Third Year)
Semester	VI Semester
Name of Subject	Software Process Management (Elective)
Subject code	BCS-604 A

Course Objectives:

1. To acquire knowledge on software process management
2. To acquire managerial skills for software project development.
3. To understand software economics

Course Outcomes:

1. Analyze software process maturity, its framework and the reference models .
2. Understand the Capability Maturity Model and learn about conventional software management.
3. Understand how to manage software projects and project planning.
4. Analyze project tracking and control.
5. Understand the role of project closure analysis.

UNIT I

Sr. No.	Introduction to Software Engineering	Lectures Required
1	Introduction to Software .	1
2	Nature of software – Defining Software, Software Application Domain, Legacy Software	2
3	The Evolving Role of Software	1
4	The Software Myths	2
5	Software Process	1

UNIT II

Sr. No.	Software Process Structure	Lectures Required
1	A Generic Process Model	1
2	Defining a Framework Activity	2
3	Identifying a Task Set	1
4	Process Patterns	1
5	Process Assessment and Improvement	2

UNIT III

Sr. No.	Process Models	Lectures Required
1	Waterfall Model	1
2	Specialized Process model- Component based development, The formal method model , Aspect-Oriented Software Development	3
3	Evolutionary Process Model	1
4	Prototype Model	1

UNIT IV

Sr. No.	Process Activities	Lectures Required
1	Software Process Maturity	1
2	Software maturity Framework	1
3	Principles of Software Process Change	1
4	Software Process Assessment	1
5	The Initial Process	1
6	The Repeatable Process	1

UNIT V

Sr. No.	Process Management & Models	Lectures Required
1	The Defined Process	1
2	The Managed Process	1
3	The Optimizing Process	1
4	Process Reference Models Capability Maturity Model (CMM), CMMI, PCMM, PSP, TSP).	3

UNIT VI

Sr. No.	Process Metrics	Lectures Required
1	Process metrics	1
2	Software process management	1
3	Software Measurements – Size oriented metrics	1
4	Function Oriented	1
5	FP Metrics	1
6	Metrics for software quality- Measuring quality	2
7	Defect removal efficiency	1

Reference book:-

1. Software Engineering –A Practitioner's approach, Sixth Edition, Roger S. Pressman, McGraw-Hill Higher Education; (1 August 2007),ISBN-10: 0077227808
2. Software Engineering –A Practitioner's approach, Fifth Edition, Roger S. Pressman, McGraw-Hill Higher Education; (1 August 2005)
3. Software Engineering 7th / 8th Edition, IAN Sommerville Pearson Edition
4. Watts S. Humphrey, An Introduction to the Team Software Process, 1st Edition, Addison-Wesley International Publications, 2000.

Name of Course	B.Sc. Computer Science (Third Year)
Semester	VI Semester
Name of Subject	Linux Administration (Elective)
Subject code	BCS-604 B

Course Objectives:

- This course shall build a platform for students to start their own enterprise
- For Making Student Job Ready
- To become familiar with open source software and user interface.
- To securely handle OS without any viruses and malwares.
- For easily use free software available on internet.
- To understand the basic operating system command.
- To understand the basic concept of Linux operating system administration

Course Outcomes:

- Awareness of existing demanding trends in IT industry in order to get placement & research in open source market.
- Understand the Linux OS architecture.
- Install and use different types of distributions available in market.
- Understand the different Linux administration commands.

UNIT I

Sr. No.	System Administration	Lectures Required
1	Managing User Accounts, Managing Groups.	2
2	Managing Users, Managing Permissions	2
3	Managing Passwords	1
4	Granting System Administrator Privileges to Regular Users , Disk Quotas	2

UNIT II

Sr. No.	Automating Tasks	Lectures Required
1	Running Services at Bootup:- Beginning the Boot Loading Process, Booting into the Default Run level,	2
2	Understanding init Scripts and the Final Stage of Initialization, Controlling Services at Boot with Administrative Tools	2
3	Starting and Stopping Services Manually	1
4	Scheduling Tasks	2

UNIT III

Sr. No.	System-Monitoring Tools	Lectures Required
1	Console-Based Monitoring, Using the kill Command to Control Processes	2
2	Using Priority Scheduling and Control.	1
3	Graphical Process and System Management Tools	1
4	KDE Process- and System-Monitoring Tools	1

UNIT IV

Sr. No.	Backing Up	Lectures Required
1	Choosing a Backup Strategy ,	2
2	Choosing Backup Hardware and Media	1
3	Using Backup Software	1
4	Copying Files.	1

UNIT V

Sr. No.	Networking and TC/IP	Lectures Required
1	Using Network Configuration Tools	2
2	Advanced Wireless Networking	1
3	Dynamic Host Configuration Protocol . .	2
4	Setting Up a Telnet Server, Setting Up an SSH Server	2

UNIT VI

Sr.	Server & Printer Management	Lectures
No.		Required
1	Installing the Apache Server, Starting and Stopping Apache	2
2	Using the Network File System	1
3	Putting Samba to Work:- Configuring Samba with system-config-samba, Configuring Samba with SWAT,	2
4	Configuring and Managing Print Services, Creating Network Printers ,Creating and Configuring Local Printers ,	2

Reference book:-

- 5) Fedora 7 Unleashed by Andrew Hudson and Paul Hudson (SAMS publication)

Name of Course	B.Sc. Computer Science (Third Year)
Semester	VI Semester
Name of Subject	Enterprise Infrastructure and Cloud Technologies Part II (Additional Elective)
Subject code	BCS-604 C

UNIT I

Sr. No.	Linux Server Administration	Lectures Required
1	RHEL/ Cent OS Overview, Boot Process, and GRUB2	2
2	File system Hierarchy, Shell Environment, Text Editors	2
3	User and Group Management, File Permissions, ACLs	2
4	RPM, YUM, Dependency Management, Patching	2
5	System Logging, Snapshots, Backup/Restore.	2
6	Basic Linux Command, Linux Administration command	2

UNIT II

Sr. No.	Virtualization	Lectures Required
1	Hypervisors, Hyper-V, VMware vSphere/v Center	2
2	Configuring VMs, Networking, Storage, HA/DRS	2
3	vMotion, Templates, Resource Pools, dvSwitches	2

UNIT III

Sr. No.	Cloud Computing	Lectures Required
1	Cloud Computing Fundamentals, Deployment Models -	2
2	SaaS, PaaS, IaaS and Key Providers (AWS, Azure, GCP) -	2
3	Cloud Security, Navigation, and Resource Management- AWS EC2, S3, VPC, IAM; Azure VM, Storage.	2
4	Networking	2

UNIT IV

Sr. No.	Backup, and Monitoring	Lectures Required
1	Backup Technologies: Disk, Tape, Veeam, TSM, NetBackup -	2
2	VM Backups, Restoration, Deduplication, Troubleshooting-	2
3	Infra Monitoring Tools: Nagios.	3

Reference book:-

1. Sander van Vugt, "Red Hat RHCSA 8 Cert Guide: EX200", Pearson IT Certification, 2021.
2. Nick Marshall, "Mastering VMware vSphere 7", Wiley, 2021.
3. Mustafa Toroman , "Hands-On Cloud Administration in Azure" , Packt, 2020.

Core Practical: Enterprise Infrastructure and Cloud Technologies Lab Part II

Course Code: BCA-604-C (Elective)

1. **Install Linux (RHEL/CentOS) and Set Up Users & ACLs**
 - o Partitioning, user creation, chmod, setfacl, etc.
 - o Patching
 - o Configuring Network interfaces – NUMTUI/NUMCLI
 - o Server Troubleshooting- Boot, Package, Services, Discover Services
2. **Service Monitoring and Patch Management using YUM**
 - o Enable repo, install updates, monitor with top, systemctl.
3. **Create and Manage VMs in VMware vSphere or Hyper-V**
 - o Install hypervisor, create VM, snapshot, clone
4. **Launch and Access EC2 Instances on AWS**
 - o Key pair creation, EC2 instance launch, inbound rules, remote access.
5. **Configure S3 Bucket and Lifecycle Policies**
 - o Create bucket, enable versioning, lifecycle rule to archive/delete.
6. **Create and Manage VPC with Subnets and Security Groups (AWS)**
 - o Design private/public subnets, attach IGW, and route tables.
7. **Azure VM Deployment and Storage Blob Configuration**
 - o Create VM, configure VNet, attach a blob container for backup.
8. **IAM Role and Policy Creation in AWS**
 - o Create custom IAM roles and attach to EC2 instance for access control.
9. **Configure Cloud Backup using AWS/Azure Services**
 - o Snapshot of EC2 instance / Azure VM backup vault.

Name of Course	B.Sc. Computer Science (Third Year)
Semester	VI Semester
Name of Subject	Networking Essentials
Subject code	BCS-605 B (Open elective)

Course Objectives:

- To understand the basics of wireless voice and data communication technologies.
- To study about the wireless communication Techniques.
- To understand different routing algorithms.
- To understand security and privacy issues in wireless environments.

Course Outcomes:

- Evaluate the usability of mobile devices such as smart phones.
- Select appropriate network technologies in commercial and enterprise applications.
- Assess the capabilities of next generation networks and role of network technologies.

UNIT-I

Sr. No.	Review of Basic Concepts		Lectures Required
1	1.1	What is Network, Benefits of Networking	1
	1.2	Network Architecture – Protocol Hierarchies	2
	1.3	Reference Model	2
	1.4	Connection oriented & Connectionless Services	1
	1.5	Underlying Technologies- IP Address, LAN & WAN	2

UNIT-II

Sr. No.	LAN Hardware		Lectures Required
2)	2.1	Network Interface card	1
	2.2	Ethernet Technology 10 Base 2 & 10Base 5, 10 Base T	2
	2.3	Network Device Router & Switch	1
	2.4	Repeaters	2
	2.5	Wireless LAN	1

UNIT-III

Sr. No.	The Internet Layer & Routing Protocols		Lectures Required
3)	3.1	IP-Datagram	1
	3.2	ICMP - Types of Messages	2
	3.3	BOOTP and DHCP	2
	3.4	Routing Protocol	2
	3.5	RIP, OSPF, BGP	2

UNIT-IV

Sr. No.	The Transport Layer		Lectures Required
4)	4.1	The transport service- services primitives	2
	4.2	Sockets	2
	4.3	Elements of transport protocols	2
	4.4	TCP Frame Format	2
	4.5	UDP Protocol	1

UNIT-V

Sr. No.	Introduction to Network Security		Lectures Required
5)	5.1	Network Security Overview and Policies .	2
	5.2	Network Security Devices	1
	5.3	Protecting Networks with Firewalls, Using Intrusion Detection and Prevention Systems	2
	5.3	Protecting a Network from Malware- Viruse, Worms	2
	5.5	Spyware and Spam, Malware Protection	2

UNIT-VI

Sr. No.	Wide Area Networking and Cloud Computing		Lectures Required
6)	6.1	Wide Area Network Fundamentals-WAN Devices	1
	6.2	WAN Connection methods- Circuit-Switched WANs	1
	6.3	Leased Lines, Packet-Switched WANs	2
	6.4	WANs over the Internet	2
	6.5	Cloud Computing	1

References Books :

1. Computer Networks Andrew S. Tanenbaum Prentice Hall
2. Guide to Networking Essentials (Seventh Edition) Greg Tomsho Cengage Learning
3. CCNA ICND2 (Third Edition) Wendell Odom Cisco Press
4. Data and Computer Communications Stallings Pearson Education