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

Phone: (02462)215541 **Academic-1 (BOS) Section** website: srtmun.ac.in

E-mail: bos@srtmun.ac.in

विज्ञान व तंत्रज्ञान विद्याशाखेतील **CBCS** पॅटर्न नुसारच्या पदवी स्तरावरील तृतीय वर्षाच्या सुधारित (दुरूस्ती) 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 ३१जुलै २०२५ रोजीच्या बैठकीतील विषय क्रमांक ०३/६२–२०२५ अन्वये मान्यता प्रदान केली आहे. त्यानुसार दुरुस्तीसह खालील अभ्यासक्रम शैक्षणिक वर्ष २०२५–२६ पासुन 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/ दुरूस्ती/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 संबधित संकुले, प्रस्तुत विद्यापीठ.
०४. मा. प्राचार्य, सर्व संबधित 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, विष्णुपूरी, 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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E-mail: bos.srtmun@gmail.com

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

प रि प त्र क

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. २६/५१–२०२१**च्या 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.

स्वाक्षरित
सहा.कुलसचिव
शैक्षणिक (१–अभ्यासमंडळ) विभाग

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, परिक्षा विभाग विज्ञान व तंत्रज्ञान विद्याशाखा प्रस्तुत विद्यापीठ.

Swami Ramanand Teerth Marathwada University, Nanded
(NAAC Re-accredited with 'A' Grade)

Syllabus of

Third Year B.Sc. Software Engineering
(Revised CBCS pattern)

Introduced from Academic Year 2021-2022

B.Sc. Software Engineering

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

CBCS pattern

The B.Sc. Software Engineeringprogram 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 tothem.

Eligibility and Fees

The eligibility of a candidate to take admission to **B.Sc. Software Engineering**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, staring 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. Software Engineering**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. Software Engineering 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= 4credit
4. One Credit = 25 marks , Two Credits = 50 Marks, Four Credits = 100Marks

PEO,POand CO Mappings

1. **Program Name** : B.Sc.(SoftwareEngineering)

2. **Program Educational Objectives**: After completion of this program, the graduates / studentswould

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 Software Engineering based career.
PEO III :Hands on Technology and Professionalexperience	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 ableto

PO1: Apply knowledge of mathematics, science and algorithm in solving software development processes.
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 illustratedbelow

5. Mapping of PEO& PO andCO

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

Swami RamanandTeerthMarathwadaUniversity,Nanded

CBCS Revised Syllabus w.e.f. TY: 2021-22

Program: B.Sc. (Software Engineering) – AffiliatedColleges

Year	Semester	Course category	Course Code	Course Title	Credits * *(split up willbe givenseparately)
Third	**Fifth**	Core Course	BSE-501	Data Science	04
		Core Course	BSE-502	Python	04
		Core Course	BSE-503	RDBMS	04
		Chose any one from the below Elective courses			
		Elective Subject	BSE-504 A	Cloud Computing	04
			BSE-504 B	C#.NET Programming	
			BSE-504 C	Enterprise Infrastructure and Cloud Technologies Part I	
		Chose any one Open Elective courses			
		Open Elective	BSE-505 A	University recognized MOOC (NPTEL / SWAYAM / others) OR Intra / Inter Departmental courses OR	04
			BSE-505 B	Linux and Shell Programming	
		Lab / Practical	BSE-506	Python	02
			BSE-507	RDBMS through PL/SQL	02
				Total	**24**
Third	**Sixth**	Core Course	BSE-601	Software Testing	04
		Core Course	BSE-602	Mobile Application Development	04
		Core Course	BSE-603	Project Development Activity and Seminar	04
		Chose any one from the below Elective courses			
		Elective Subject	BSE-604A	Image Processing Concepts	04
			BSE-604B	Cyber Security	
			BSE-604C	Enterprise Infrastructure and Cloud Technologies Part II	
		Chose any one Open Elective courses			
		Open Elective	BSE-605A	University recognized MOOC (NPTEL / SWAYAM / others) OR Intra / Inter Departmental courses OR	04
			BSE-605B	Introduction to R language	
		Lab / Practical	BSE-606	Software Testing	02
			BSE-606	Mobile Application Development	02
				Total	**24**

BSE-501	B.Sc.(SE) TY Fifth Semester	Data Science	Credits:04

Course Objectives:

1. To learn data collection and preprocessing techniques for data science
2. To Understand and practice analytical methods for solving real life problems.
3. To study data exploration techniques
4. To learn different types of data and its visualization
5. To study different data visualization techniques and tools

Course Outcomes:

1. Apply data preprocessing methods on open access data and generate quality data for analysis
2. Apply and analyze classification and regression data analytical methods for real life problems.
3. Implement analytical methods using Python/R/Excel/Data Studio
4. Apply different data visualization techniques to understand the data.
5. Analyze the data using suitable method; visualize using the open source tool.
6. Model multidimensional data and visualize it using appropriate tool

UNIT I	Introduction to Data Science

Defining data science, Data Science Jobs, Recognizing the different types of data, Gaining insight into the data science process, Data Science Process: Overview, Different steps, Machine Learning Definition and Relation with Data Science. Data Preparation, Model Planning, Model Building, Communicating Results, Operationalization.

UNIT II	Introduction to DBMS and Big Data Science

Introduction to Database Management Systems its Purpose and Application, Introduction to NoSQL Database, Types and examples of NoSQL Database- Key value store, document store, graph, Performance, Structured verses unstructured data, Comparative study of SQL and NoSQL., Definition of Big Data, Big data characteristics & considerations, Data repositories- analyst perspective, Business drivers for analytics, Typical analytical architecture, Business Intelligence Vs Data science, Drivers of Big data analytics, Role of data scientist in Big data ecosystem, Applications of Big data analytics.

UNIT III	Basics of Data Visualization

Introduction to data visualization, challenges of data visualization, Definition of Dashboard, Their type, Evolution of dashboard, dashboard design and principles, display media for dashboard. Types of Data visualization: Basic charts scatter plots, Histogram, advanced visualization Techniques like streamline and statistical measures, Plots, Graphs, Networks, Hierarchies, Reports. Data Science with MS-Excel, Data Science with Google Data Studio.

UNIT IV	Basic Data Analytics methods using R

Introduction to R: GUI of R, Getting data into & out of R, Data types in R, Basic operations, Basic statistics, Generic functions, Data visualization using R, Data exploration & presentation, Statistics for model building & evaluation

UNIT V	Data Science with Python

Data Science & Python, Python Environment set-up Jupyter and Spyder overview, Data Science in Python, Python Numpy, DataFrame, Python SciPy, Python Pandas, Python Matplotlib

Unit VI	Advanced Analytics- Theory & Methods

Introduction to Artificial Intelligence and Machine Learning, Machine Learning Algorithms, Supervised and Unsupervised Learning K-means Clustering, Association Rules, Apriori algorithm, Linear Regression, Logistics Regression, Naïve Bayesian classifiers, Decision Trees, Time series analysis, Text analysis

References:			
Sr. No	**Title**	**Author**	**Publication**
1	Data Mining: Concepts and Techniques	Jiawei Han, MichelineKamber, Jian Pei	
2	Data Science from Scratch	Joel Grus	O'Reilly Media Inc
3	Information visualization perception for design	Colin ware	MK publication
4	Data Science & Big Data Analytics, EMC education services,	David Dietrich, Barry Hiller	Wiley publications

Code BSE-502	Fifth Semester	**Python Programming**	Credits:04

Course Objectives:

- -. To understand why Python is a useful scripting language for developers.
- To learn how to design and program Python applications.
- To learn how to use lists, tuples, and dictionaries in Python programs.
- To learn how to identify Python object types.
- To learn how to use indexing and slicing to access data in Python programs.
- To define the structure and components of a Python program.
- To learn how to write loops and decision statements in Python.
- To learn how to write functions and pass arguments in Python.
- To learn how to build and package Python modules for reusability.
- To learn how to design object□oriented programs with Python classes.
- To learn how to use exception handling in Python applications for error handling.

Course Outcomes:

- Write, Test and Debug Python Programs
- Implement Conditionals and Loops for Python Programs
- Use functions and represent Compound data using Lists, Tuples and Dictionaries.
- Express proficiency in the handling of strings and functions.
- Use regular expression to find the matching string.

Unit I	**GETTING STARTED:-**

History & need of Python Application of Python, Advantages and disadvantages of Python, Installing Python., Program structure, User Interface or IDE

Unit II	**PYTHON FUNDAMENTALS:-**

Python Character Set, Python Tokens, Keywords, Identifiers, Literals, Operators, Variables and Assignments, Conditional statement:- if, if-else,if-elif statements, Looping statement: for loop, while loop, nested loop, Break and continue statement.

Unit III	**Python Data Structure**

Introduction to Python List:- Creating List, access list element, join list, List slicing, Introduction to Python Tuple:-Creating Tuple, access Tuple, Join Tuple, Tuple Slicing, DICTIONARIES:- What is dictionary, Accessing values in dictionaries, What is mean by Module how to create it?, String operation and inbuilt function of string

Unit IV	**CLASSES AND OBJECTS AND EXCEPTION HANDLING**

Creating Class and Objects, Creating Objects By Passing Values, Variables & Methods in a Class, How to create constructor in python, Inheritance in python, Exception handling: Try ....except statement, Raise, Assert, Finally blocks, User defined Exception.

Unit V	**Python Regular Expressions**

What are regular expressions? The match Function, The search Function, Search and Replace.

Unit VI	**Using Databases in Python**

What is mean by Database and Data? How to establish database connection using pymysql, CREATE, INSERT, READ Operation.

Reference Books:

Sr.No.	Name ofthe Book	Author	Publication
Core Python Applications Programming		**Wesley J Chun**	**3rd Edition, Pearson EducationIndia,**
2	**Learning Python, 5th Edition**	**Mark Lutz**	
3.	**Think Python**	**Allen Downey**	**Green Tea Press**

Code BSE-503	B.Sc(SE) TY Sixth Semester	**RDBMS**	Credits:04

Prerequisites:

- Adequate knowledge of Database.
- Adequate knowledge of RDBMS concepts.

Course Objectives:

- To develop RDBMS Queries.
- To understand Database concepts.

Course Outcomes:

- Ability to learn various commands of RDBMS.
- Ability to learn Database concepts & PL/SQL Language.

Salient Features:

- Improve your skills & build Confidence
- Ability to understand the Database and functions in SQL.

Unit I	**Introduction and Basic concepts**

What is DBMS ?, What is RDBMS ?,Advantages of RDBMS, Diadvantages of RDBMS, Data Model, Object Oriented Data Model.

Unit II	**SQL Statements and working with tables**

SQL, Datatypes in SQL, Creating and Managing tables, Where Clause , Distinsct Clause , Column Alises , Data constraints

Unit III	**Operators, SQL Functions and Views**

What are Operators and types of Operators , Single Row Functions, Multiple Row Functions, Working With Views.

Unit IV	**Sorting, Grouping Data in SQL and Joining Tables, Subqueries**

Order by Clause, Group by Clause , Having Clause , What is join? , Types of join, SQL Subqueries

Unit V	**Introduction to PL/SQL**

Introduction to PL/SQL Block, System defined exception , User defined exception.

Unit VI	**Database Triggers and Cursors**

What are Triggers?, Types of Triggers, Enabling and Disabling Triggers, Woking With Cursor: Implicit Cursor, Explicit cursor

References:

1.	"Oracle Database 10g PL/SQL Programming" by Scott Urman , Ron Hardman, MichaleMc Laughlin, Oracle Press, TMH, ISBN-0-07-059779-0.
2.	"Oracle Database 10g The Complete Reference" By Kevin Loney, Bob Bryla Oracle Press (TATA McGraw Hill Edition) ISBN-13:978-0-07-059425-8, ISBN-10: 0-07-059425-2
3.	SQL, PL/SQL the programming language of ORACLE 4th Edition by Ivan Bayross ISBN-81- 7656964-X

Code BSE-504 A	Fifth Semester	**Cloud Computing**	Credits:04

Course Objectives:

- To provide students with the fundamentals and essentials of Cloud Computing.
- To provide students a sound foundation of the Cloud Computing so that they are able to start using and adopting Cloud Computing services and tools in their real life scenarios.
- To enable students exploring some important cloud computing driven commercial systems and applications.
- To expose the students to frontier areas of Cloud Computing and information systems, while providing sufficient foundations to enable further study and research.

Course Outcomes:

- -After successful completion of this course, student will be able to
- Explain the core concepts of the cloud computing paradigm: how and why this paradigm shift came, the characteristics, advantages and challenges brought about by the various models and services in cloud computing.
- Apply the fundamental concepts in datacenters
- Identify resource management fundamentals and outline their role in managing infrastructure in cloud computing.
- Analyze various cloud programming models and apply them to solve problems on the cloud.

Unit I	**Enterprise computing: a retrospective**

a) Introduction
b) Mainframe architecture
c) Client-server architecture
d) 3-tier architectures with TP monitors

Unit II	**Internet as a platform and Software as a service**

a) Internet technology and web-enabled applications
b) Web application servers
c) Internet of services
d) Emergence of software as a service
e) Successful SaaS architectures
f) Dev 2.0 platforms
g) Cloud computing
h) Dev 2.0 in the Cloud for Enterprises

Unit III	**Cloud computing platforms**

a) Infrastructure as a service: Amazon EC2
b) Platform as a service: Google App Engine
c) Microsoft Azure

Unit IV	**Web services, AJAX and mashups**

a) Web services: SOAP and REST
b) SOAP versus REST
c) AJAX: asynchronous ‘rich’ interfaces
d) Mashups: user interface services

Unit V	**Data in the cloud**

a) Relational databases
b) Cloud file systems: GFS and HDFS
c) BigTable, HBase and Dynamo
d) Cloud data stores: Datastore and SimpleDB

Unit VI	**Dev 2.0 Platforms**

a) Salesforce.com's Force.Com Platform
b) TCS InstantApps on Amzon Cloud
c) More Dev 2.0 platforms & related efforts
d) Advantages , applicability and limits of Dev 2.0

Reference Books:

Sr.No.	Name ofthe Book	Author	Publication
1.	Enterprise Cloud Computing: Technology, Architecture, Application	Gautam Shroff	Cambridge University Press

Code Elective BSE-504 B	B.Sc.(SE) TY Fifth Semester	**C#.NET Programming**	Credits:04

Course Objectives:

- To learn fundamental concepts of Windows Programming.
- To develop background knowledge as well as core expertise in C#.
- To understand the windows form creation and provide knowledge for creating windows applications.
- To learn the object oriented concepts.

Course Outcomes:

- To impart the knowledge on basics concepts of object oriented programming
- To outline the various characteristics of C#.
- To provide the familiarity in the concept of developing window application.
- To converse an idea of creating application using ADO.Net.
- To convey the idea of CLR and .Net framework.

Unit I	**Introduction to .Net Technology & Framework**

History of .Net Technology, Versions of .Net Framework, .Net Architecture, Common Language Runtime(CLR), IDE Components, Intellisense, Project Types, Java vs. C#

Unit II	**Windows Applications and Windows Controls**

Creating and Customizing Windows Form, TextBox and Label Control, Button, CheckBox and RadioButton, ListBox and ComboBox control, Menus and Common Dialog Boxes

Unit III	**Functions, Arrays and Strings**

C# Function, Call by Value & Call by Reference, Out Parameter, Array and ArrayList class, Jagged Array, String Class

Unit IV	**Properties, Indexers, Delegates & Events**

Properties, Indexers, Delegates, Multicast Delegates, Custom Events

Unit V	**Namespace, Interface & Exception handling**

Creating & Using Namespace(DLL Library), Creating & Using Interface, Try Catch Block, Using Finally Block, Custom Exception

Unit VI	**Database Connectivity**

Introduction ADO.Net, Advantages of ADO.Net, Developing a Simple ADO.NET Based Application, Retrieving & Updating Data From Tables, Disconnected Data Access Through Dataset Objects, Accessing Data from XML files

References:

Sr. No.	Name of Book	Writer	Publication
1	Programming in C#	E Balagurusamy	Mc Graw Hill
2	Visual C#.Net	C Muthu	Mc Graw Hill

Code Elective BSE-504 C	B.Sc.(SE) TY Fifth Semester	**Enterprise Infrastructure and Cloud Technologies Part I**	Credits:04

Course Objectives

- To provide a foundational understanding of networking devices, data centers, and enterprise storage technologies.
- To introduce various server and client operating systems and their configuration and security.
- To impart practical knowledge on Windows Server administration, storage management, and deployment techniques.
- To enable learners to work with Active Directory, domain services, and secure authentication mechanisms.
- To equip students with the ability to monitor, troubleshoot, and manage enterprise-level infrastructure.

Course Outcomes

After completing this course, the student will be able to:

1. Understand the structure and functioning of networking devices, server form factors, and RAID-based storage solutions.
2. Install and configure client and server operating systems, including handling file systems and firewall settings.
3. Manage and administer Windows Server environments, perform patching, clustering, and automated deployment.
4. Implement and secure Active Directory services, group policies, and authentication mechanisms.
5. Demonstrate the ability to monitor system performance and use tools to ensure availability and fault tolerance in enterprise IT infrastructure.

Unit I	**Unit I: Networking and Server Infrastructure**

Introduction to Networking Devices and LAN/WAN - IPv4 and IPv6. Routers and Switches Overview. Datacenter Overview and Server Form Factors - Server Management Portals (IPMI/iLO/iDrac) and Events - Introduction to Storage: NAS, DAS, SAN - RAID Levels and Comparisons (Fibre Channel, iSCSI, FCoE)

Unit II	**Operating Systems Overview (Server & Client**

Operating Systems Overview (Server & Client), Domain vs. Workgroup - File Systems: FAT, NTFS, ReFS, EXT3, EXT4 - Installing and Managing OS (Windows Server, Linux) - Firewall Fundamentals (Hardware/Software)

Unit III	**Windows Server Administration**

Windows Server Core Installation, Upgrades, Patch Management & Migrations - Storage Spaces, iSNS, DCB, and MPIO - Data Deduplication and Disk Management - High Availability: Failover Clustering, NLB - Deployment Images using MDT and WSUS - PowerShell DSC and Monitoring Tools - Performance Monitoring and Event Logs

Unit IV	**Active Directory & Security**

AD DS DNS Server Role, Zones, and Transfers - AD DS Replication and Sites - Group Policy Management and Templates - Securing Domain Controllers and Accounts - Audit Authentication and Managed Service Accounts - Certificate Services (CAs, Templates, Revocation, Recovery) - AD FS, AD RMS, and Smart Cards - Backup & Restore of Active Directory

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**

Core Practical: Enterprise Infrastructure and Cloud Technologies Lab Part I

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

Code Elective BSE-505 B	B.Sc(SE) TY Fifth Semester	**Linux & Shell Programming**	Credits:04

Course Objectives:

- To understand the basic operating system command.
- 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 concept of shell programming

Course Outcomes:

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

Unit I	**Introduction**

Features of Linux OS, Installation steps of Linux, Linux kernel, Linux boot loader, Booting process of Linux OS

Unit II	**Working with Linux OS**

Working with the Linux File System, Changing User Information, Linux Shell, Text Editors in Linux Working with permissions

Unit III	**Linux Commands and Utilities**

adduser , alias, at ,cat , cd, chmod , chown ,cp, cpio, dd,df,
dir,du,find,finger,grep,zip,unzip,gzip,halt,hostname,ifconfig,kill,login,look, lpc, lpd ,lpr, lprm, ls, mail, man,mde, mkdir,mor,mount, mv,netstat,passwd,ping, ps,pwd,rm, rmdir,shutdown,sort, su,tar,tree,moun, umount,unzip,vi,wc, who,whoami,zip

Unit IV	**Basic Shell Scripting**

Types of shells, Shell functionality and Environment, Writing First Scritpt and executing basic script, Variables, Mathematical Expressions

Unit V	**Shell Programming in Linux**

Conditional Statements in shell Scripting, Looping Statements in shell Scripting-While, For, Until
Break and Continue, Logical operators-AND, OR, NOT

Unit VI	**Functions and File Manipulations**

Functions in Shell scripting, Command line Arguments in shell Scripting, Grep command and patterns

References:

Sr. No	Name of Book	Writer	Publication
1	Red Hat Linux 7 Unleashed	Bill Ball ,David Pitts	Techmedia SAMS publication
2	UNIX System Administration Handbook	EviNemeth,GarthSnyder,ScottSeebass	Person Education Asia (LPE)(III Edition)
3	Red Hat Linux and Fedora Unleashed	Bill Ball and Hoyt Duff	Techmedia SAMS publication
4	UNIX Shell programming	Y.C. Kanetkar	BPB Publication

Code BSE-506	Fifth Semester	**Python Programming Lab**	Credits:04

Course Objectives:

- -. To understand why Python is a useful scripting language for developers.
- To learn how to design and program Python applications.
- To learn how to use lists, tuples, and dictionaries in Python programs.
- To learn how to identify Python object types.
- To learn how to use indexing and slicing to access data in Python programs.
- To define the structure and components of a Python program.
- To learn how to write loops and decision statements in Python.
- To learn how to write functions and pass arguments in Python.
- To learn how to build and package Python modules for reusability.
- To learn how to design object□oriented programs with Python classes.
- To learn how to use exception handling in Python applications for error handling.

Course Outcomes:

- Write, Test and Debug Python Programs
- Implement Conditionals and Loops for Python Programs
- Use functions and represent Compound data using Lists, Tuples and Dictionaries.
- Express proficiency in the handling of strings and functions.
- Use regular expression to find the matching string.

List of Practical

1) Program to demonstrate Constant Variable.

2) Program to demonstrate scope of Variable

3) Program to demonstrate branching statement

4) Program to demonstrate Looping statement

5) Program to demonstrate simple class

6) Program to demonstrate String class and it‟s method.

7) Program to demonstrate exception handling.

8) Program to demonstrate inheritance and its Types

9) Program to demonstrate package (Module)

10) Program to demonstrate regular expression

11) Program to demonstrate database connectivity

12) Program to demonstrate networking.

Code BSE-507	B.Sc(SE) TY Sixth Semester	**RDBMS through PL/SQLLab/practical**	Credits:02

Course Objectives:

- To develop RDBMS Queries.
- To understand Database concepts.

Course Outcomes:

- Ability to learn various commands of RDBMS.
- Ability to learn Database concepts & PL/SQL Language.

SR.NO.	Practical List
1.	Introduction to Structured Query Language (SQL).
2.	Creating and Managing table.
3.	Where Clause and Distinct Clause.
4.	Working with Data Contraints.
5.	Study of Operators.
6.	Study of SQL Funcion.
7.	Working with Views.
8.	Sorting, Grouping Data and Joining Tables.
9.	Subqueries in SQL.
10.	To Study of Triggers Program.
11.	Program on System defined and User defined exception.
12.	Program on Implicit and Explicit Cursor.

Code Elective BSE-601	B.Sc(SE) TY Sixth Semester	**Software Testing**	Credits:04

Prerequisites:

- Adequate knowledge of programming languages.
- Adequate knowledge of Software engineering concepts.

Course Objectives:

- To develop software engineering skills and testing plans.
- To understand system concepts and its application in Software development.
- To enhance skills of designing and testing software.
- To expose students to learn technical skills to assure production of quality software.

Course Outcomes:

- Ability to learn various methods of software development.
- Ability to apply various software testing techniques

Salient Features:

- Improve your skills & build Confidence
- Ability to understand the problem and write test cases for software testing
- Lifelong learning and readily adapt to new software testing environments.

Unit I	**Quality concepts**

Quality, Software Quality, Software Quality Factors, The Cost of Quality , Quality and Security , Quality Control , Software Quality Assurance, Software Reviews , Formal Technical Reviews, Software Reliability , The SQA Plan

Unit II	**SOFTWARE TESTING STRATEGIES**

A Strategic Approach to Software Testing, Unit Testing, Integration Testing, Validation Testing , System Testing , The Art Of Debugging

Unit III	**TESTING Tactics**

Software Testing Fundamentals, Black Box Testing and White-Box Testing , Basic Path Testing , Control Structural Testing ,

Unit IV	**O-O Testing Methods**

O-O Testing Methods, Testing Methods applicable on the Class Level, Inter-Class Test Case Design, Testing for Specialized Environments, Architectures and Applications, Testing Patterns.

Unit V	**Testing Concepts for WebApps**

The Testing Process-An Overview, Content Testing, User interface Testing, Navigation Testing, Security Testing

Unit VI	**PRODUCT METRICS**

A frame work for product metrics, Metrics for the requirements model, Metrics for design model, Metrics for source code, Metrics for testing,Metrics for Maintenance.

References:

Sr. No	Name of Book	Writer	Publication
1	Software Engineering: A Practitioner's Approach, 7th Edition	Roger S. Pressman	McGraw Hill, 2009
2	Software Engineering	R.Pressmen	M C Graw Hill
3	Software Testing Concepts and Tools	NageswaraRoo	Dreamtech Publication
4	An Integrated Approach to Software Engineering,	Pankaj Jalote	Narosa Publishing House,2008
5.	Software Engineering Fundamentals	Ali Behforooz and Frederick J. Hudson	Oxford University Press, 1996

BSE-602	B.Sc.(SE) TY Sixth Semester	Mobile Application Development	Credits:04

Course Objectives:

6. To learn fundamental concepts of mobile application development
7. To quickly get you up to speed with writing apps for Android devices.
8. The student will learn the basics of Android platform and get to understand the application lifecycle
9. For Making Student Job Ready

Course Outcomes:

7. Student will be able to write simple GUI applications.
8. Students will be also able to use built-in widgets and components
9. This course shall build a platform for students to start their own enterprise
10. To gain an understanding of the processes that are involved in an Android developed application
11. Students will become familiar with Android development tools and user interface.
12. Will able to understand Activity and Intends
13. Will able to understand SQLite Database.
14. Will able to build Many simple apps that you can share with your friends

UNIT I	Introduction to Mobile Application Development

Introduction to Mobile Programming and Smartphones future, Overview of the Operating Systems used on different mobile devices, Android Operating System Features and Versions, Overview of the development languages available on different mobile devices, Explore mobile device features not available on PCs such as accelerometer and GPS etc., Android Architecture, Installing Android Studio and Android Virtual Device, Creating First Android Project, Android Project Structure.

UNIT II	Android Studio And User Interface Design

Android Studio and its Features, Introduction to Activities and Activity Lifecycle, Working with the, AndroidManifest.xml, Using the log system, Views and ViewGroups, LinearLayout, RelativeLayout, TableLayout, ConstraintLayout, FrameLayout, ScrollLayout, ScrollView

UNIT III	Designing Your User Interface with Views

TextView , Button, ImageButton, EditText, CheckBox, ToggleButton, RadioButton, and RadioGroup Views ProgressBar View ,AutoCompleteTextView, ImageView, Image Switcher, Using the Spinner View, TimePicker View, DatePicker View, Using List Views to Display Long Lists-ListView, Using the Spinner View

UNIT IV	Intents, Fragments, Toast and Alert Dialogs

Application context , Intents and its Types, Starting new Activity Using Intents, Example on Intents, Notifications, Pending Intents, Introduction to Fragments, Creating and Adding Fragments, Lifecycle of Fragment, Interaction between Fragments, Toast, Custom Toast, Alert Dialog, Creating Custom Alert Dialog,

Unit V	Localization, Menus and shared preference

Localization, Options menu, Context menu, Shared preferences, Files access, Sending Email, Sending SMS

Unit VI	Working with Database and Publishing the Apps

Introduction to SQLite, SQLiteOpenHelper and SQLiteDatabase, Creating , opening and closing database, Working with cursors, Insert, Update, Delete, Building and executing queries, Preparing for publishing the App, Publishing to the Play Store

References:

Sr. No	Name of Book	Author	Publication
1	Professional Android 4 Application Development, Edition 3	Reto Meier	Wrox Publication
2	Beginning Android 4 Application Development, Editionillustrated	Wei-Meng Lee, John Wiley & Sons	Wrox Publication
3	Sams Teach Yourself Android Application Development in 24 Hours, Edition illustrated	Darcey& Shane Conder	Sams Publishing
4	https://developer.android.com/		

Code Elective BSE-604 A	B.Sc(SE) TY Sixth Semester	**Image Processing Concepts**	Credits:04

Course Objectives:

- To learn fundamental concepts of Digital ImageProcessing
- To study basic image processingoperations
- To understand image analysis algorithms
- To expose students to current applications in the field of digital imageprocessing

Course Outcomes:

- Review the fundamental concepts of a digital image processingsystem.
- Analyze images in the frequency domain using varioustransforms.
- Evaluate the techniques for image enhancement and image restoration.
- Categorize various compressiontechniques.
- Interpret Image compressionstandards.
- Interpret image segmentation and representationtechniques.

Unit I	**Introduction to MATLAB**

Introduction, Advantages and Disadvantages of MATLAB, MATLAB Environment, Using MATLAB Scratch Pad, Variables and Arrays, Multidimensional Arrays, Scalar and Array Operations

Unit II	**Introduction to Digital Image Representation**

Elements of Digital Image Processing System, Digital Image Representation, Coordinate Conventions, Reading, displaying and writing images, Data classes and Image types, Converting between data classes and image types, Array Indexing, Introduction to M-function Programming

Unit III	**Intensity Transformation and Spatial Filtering**

Background, Intensity Transformation Functions Using imadjust( ), Using log( ), Histogram Processing and function plotting, Spatial filtering Linear spatial filtering, Non-Linear spatial filtering

Unit IV	**Frequency Domain Processing**

Introduction to Discrete Fourier, Transformation(DFT), Computing and visualizing 1D-DFT, Computing and visualizing 2D-DFT, Filtering in frequency domain

Unit V	**Image Restoration**

A model of image Degradation/Restoration Process, Noise models, Restoration Techniques, Geometric Transformation, Image Registration.

Unit VI	**Color Image Processing**

Color Image Representation, Color Characteristics, Color Models, Converting to their color spaces, The Basics of full color image processing, Color Transformation.

References:

Sr. No	Name of Book	Writer	Publication
1	Digital Image Processing	R.C. Gonzalez, R.E. Woods and S.L.Eddins	Second Edition, Pearson Education
2	Digital Image Processing using MATLAB	R.C. Gonzalez, R.E. Woods and S.L.Eddins	Second Edition, Pearson Education
3	Fundamentals of Image Processing	A.K. Jain	PHI publication
4	MATLAB Programming for Engineers	Stephen J. Chapman	Third Edition, Thomson Learning

BSE-604B	B.Sc.(SE) TY VI Semester	**Cyber Security**	Credits:04

Course Objectives:

- To understand the fundamentals of Cryptography
- To acquire knowledge on standard algorithms used to provide confidentiality, integrity and authenticity
- To understand the various key distribution and management schemes
- To understand how to deploy encryption techniques to secure data in transit across data networks
- To design security applications in the field of Information technology

Course Outcomes:

- Identify the security issues in the network and resolve it.
- To be able to secure a message over insecure channel by various means.
- Provide security of the data over the network.
- Protect any network from the threats in the world

Unit I	**Introduction**

Introduction, The Need for Security, Principles of Security, Types of Attacks, OSI Security Architecture, A Model for network security.

Unit II	**Cryptography: Concepts and Techniques**

Plain text and Cipher Text, Substitution Techniques, Transportation Techniques, .Encryption and Decryption, Symmetric and Asymmetric Key Cryptography, Steganography

Unit III	**Cyber Crimes & Domain Name Disputes**

Concept of Domain Names, Cybersquatting, Reverse, hijacking, Meta tags, tampering with Computer Source Documents, Hacking with Computer System, Digital Signature.

Unit IV	**Introduction of Ethical Hacking**

Information gathering, Foot printing - Active / Passive, Scanning ,Sniffers, Hacking by stealth, Virus, Trojans, Binders , Key loggers

Unit V	**Firewall & Network Security**

Introduction of Firewall, Types of Firewall, Configuring of Firewall, Open source Firewall, Importance of Firewall, Modem/Router Configuration, WI-FI Configuration, V-LAN Configuration, Proxy Server Configuration.

Unit VI	**The Cyber Crimes**

Tampering with Computer Source Documents, Hacking with Computer System, Publishing of Information, Which is Obscene in Electronic Form, Offences: Breach of Confidentiality & Privacy, Offences: Related to Digital Signature Certificate

References:

Sr. No	Name of Book	Writer	Publication
1	Ethical Hacking	Ankit Fadia	

Code Elective BSE-604 C	B.Sc.(SE) TY Fifth Semester	**Enterprise Infrastructure and Cloud Technologies Part II**	Credits:04

Course Objectives

- To develop hands-on skills in Linux server administration, including file systems, package management, and backup.
- To introduce virtualization concepts and tools like Hyper-V, VMware vSphere/vCenter, and resource management.
- To provide in-depth knowledge of cloud computing models, services (IaaS, PaaS, SaaS), and platforms like AWS and Azure.
- To enable learners to understand and apply cloud security principles and resource provisioning techniques.
- To familiarize students with enterprise backup solutions and infrastructure monitoring tools.

Course Outcomes

After completing this course, the student will be able to:

- Configure and manage Linux servers, handle user permissions, backups, and system logging.
- Deploy and operate virtual machines and manage virtual infrastructure using Hyper-V and VMware.
- Understand and differentiate between various cloud service models and providers, and utilize core services on AWS and Azure.
- Implement basic cloud security practices, manage virtual resources, and perform cloud-based deployments.
- Use backup technologies and monitoring tools to ensure system availability and troubleshoot issues effectively

Unit I:	**Linux Server Administration**

RHEL/ Cent OS Overview, Boot Process, and GRUB2 - Filesystem Hierarchy, Shell Environment, Text Editors - User and Group Management, File Permissions, ACLs - RPM, YUM, Dependency Management, Patching - System Logging, Snapshots, Backup/Restore. Basic Linux Command, Linux Administration command

UNIT II	**Virtualization**

Hypervisors, Hyper-V, VMware vSphere/vCenter - Configuring VMs, Networking, Storage, HA/DRS - vMotion, Templates, Resource Pools, dvSwitches

Unit III	**Cloud Computing**

Cloud Computing Fundamentals, Deployment Models - SaaS, PaaS, IaaS and Key Providers (AWS, Azure, GCP) - Cloud Security, Navigation, and Resource Management- AWS EC2, S3, VPC, IAM; Azure VM, Storage, Networking

Unit IV	**Backup, and Monitoring**

Backup Technologies: Disk, Tape, Veeam, TSM, NetBackup - VM Backups, Restoration, Deduplication, Troubleshooting- Infra Monitoring Tools: Nagios.

Textbooks

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

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

BSE-605B	B.Sc.(SE) TY Sixth Semester	Introduction to R language (Open Elective)	Credits:04

Course Objectives:

10. To learn fundamental concepts of R Programming
11. To quickly get you up to speed performing data Science operation with R.
12. The student will learn the basics of R Programming for Data Science and Data

Course Outcomes:

15. Student will be able to write simple R Applications.
16. Students will be also able to use built-in Library function of R language
17. This course shall build a platform for students to start their own enterprise
18. To gain an understanding of the processes that are involved in anData Science and Statistical Analysis
19. Students will become familiar with R Studio.
20. Will able to perform Many Data Science tasks.

UNIT I	Introduction to R Programming

Introduction to R, R features and Application Area, Installing R and RStudio, RStudio Overview , Working in the Console, Arithmetic Operators ,Logical Operations, Using Functions , Getting Help in R and Quitting RStudio, Creating Variables, Numeric, Character and Logical Data

UNIT II	Data Structure and Control Structures

Vectors , Data Frames, Factors , Sorting Numeric, Character, and Factor Vectors, Special Values, If / else, Boolean logical operators while loops, for loop

UNIT III	R packages, scripts and Descriptive statistics in R

Installing and loading packages • Setting up your working directory • Downloading and importing data • Working with missing data • Extracting a subset of a data frame • Writing R scripts • Adding comments and documentation • Creating reports, Measures of central tendency • Measures of variability • Skewness and kurtosis • Summary functions, describe functions, and descriptive statistics by group • Correlations

UNIT IV	Statistical graphs and Working with messy data

Scatter Plots, Box Plots, Scatter Plots and Boxand-Whisker Plots Together, Histogram Messy Data, Renaming Columns (Variable Names) , Attaching / Detaching, Tabulating Data: Constructing Simple Frequency Tables, Ordering Factor Variables

Unit V	Data exploration and visualization, Data querying: SQL and R

Using the ggplot2 package to visualize data • Applying themes from ggthemes to refine and customize charts and graphs • Building data graphics for dynamic reporting, Writing SQL statements in R • Using the Select, From, Where, Is, Like, Order By, Limit, Max, Min SQL functions

Unit VI	Writing functions Reporting and Interactive reporting with Rmarkdown

Creating functions • Calling functions, RMarkdown basics • Text formatting • Code chunks • YAML header • Preview of notebooks, presentations ,websites, and dashboards

References:

Sr. No.	Name of Book	Author	Publication
1	R IN ACTIONLATEST EDITION - SECOND	Robert L. Kabacoff	Dreamtech Press
2	R FOR DATA SCIENCE	Hadley Wickham and Garrett Gorlemund	O'Reilly
3	THE ART OF R PROGRAMMING - A TOUR OF STATISTICAL SOFTWARE DESIGN	Norman Matloff	No Starch Press
4	HANDS-ON PROGRAMMING WITH R: WRITE YOUR OWN FUNCTIONS AND SIMULATIONSLATEST EDITION - FIRST	Garrett Grolemund	Shroff/O'Reilly

Code Elective BSE-606	B.Sc(SE) TY Sixth Semester	**Software Testing** Lab / Practical	Credits:02

Prerequisites:

- Adequate knowledge of programming languages.
- Adequate knowledge of Software engineering concepts.

Course Objectives:

- To develop software engineering skills and testing plans.
- To understand system concepts and its application in Software development.
- To enhance skills of designing and testing software.
- To expose students to learn technical skills to assure production of quality software.

Course Outcomes:

- Ability to learn various methods of software development.
- Ability to apply various software testing techniques

Salient Features:

- Improve your skills & build Confidence
- Ability to understand the problem and write test cases for software testing
- Lifelong learning and readily adapt to new software testing environments.

1. To study what is software testing.
2. To study Verification method.
3. To study validation method
4. To study Defect management process.
5. To study defect life cycle.
6. To study introduction to winrunner.
7. To study synchronization in Winrunner.
8. To study checkpoints in Winrunner.
9. To Study batch File mode in Winrunner .

Or

1. To study introduction to QTP.
2. To study synchronization in QTP.
3. To study checkpoints in QTP.
4. To Study working with regular Expression.
5. To study test director.

BSE-606 Lab/ Practical	B.Sc.(SE) TY Sixth Semester	Mobile Application Development- Lab2	Credits:02

Course Objectives:

13. To learn fundamental concepts of mobile application development
14. To quickly get you up to speed with writing apps for Android devices.
15. The student will learn the basics of Android platform and get to understand the application lifecycle
16. For Making Student Job Ready

Course Outcomes:

21. Student will be able to write simple GUI applications.
22. Students will be also able to use built-in widgets and components
23. This course shall build a platform for students to start their own enterprise
24. To gain an understanding of the processes that are involved in an Android developed application
25. Students will become familiar with Android development tools and user interface.
26. Will able to understand Activity and Intends
27. Will able to understand SQLite Database.
28. Will able to build Many simple apps that you can share with your friends

Lab/ Practical Assignment/ List of Programs

1. Study of Android Studio and Project Structure
2. Study of Hello World Sample Android Application
3. Simple Android Application to Calculate the Square of the given no
4. Interest Calculator android Application
5. Android Application for Demonstration of Layouts
6. Android Application for Demonstration of ImageView and ImageSwitcher
7. Android Application for Demonstration of Creating and using Spinner
8. Android Application for Demonstration of creating and using Listview
9. Android Application for Demonstration of Date Picker and Time Picker ,and progress Bar
10. Android Application for Demonstration of Checkbox, RadioGroup, RadioButton, And ToggleButton
11. Android Application for Demonstration Creating and Sending Notifcations
12. Android Application for Demonstration of Pending Intents
13. Android Application for demonstration of Intents to start Activity, send email, Open a url, Search for Query String
14. Android Application for Demonstration of creating and using Fragments
15. Android Application for Demonstration of creating and using Custom Toast and Custom AlertDialog.
16. Android Application for Demonstration of Localizations
17. Android Application for Demonstration of creating and using Option Menu and Context Menu
18. Android Application for Demonstration of Shared Preferences
19. Android Application for Demonstration of File Access
20. Android Application for Demonstration of Sending SMS and Email
21. Android Application for Demonstration of Creating and using SqLite Database
22. Android Application for Demonstration of Insert, Update, Delete Operation SqLite
23. Android Application for creating contact application using SqLite
24. Study of Publishing the App in Play Store.

References:

Sr. No	Name of Book	Author	Publication
1	Professional Android 4 Application Development, Edition 3	Reto Meier	Wrox Publication
2	Beginning Android 4 Application Development, Editionillustrated	Wei-Meng Lee, John Wiley & Sons	Wrox Publication
3	Sams Teach Yourself Android Application Development in 24 Hours, Edition illustrated	Darcey& Shane Conder	Sams Publishing
4	https://developer.android.com/		