॥ 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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शैक्षणिक वर्ष २०२४–२५ पासून राष्ट्रीय शैक्षणिक धोरणानुसार लागू केलेल्या विज्ञान व तंत्रज्ञान विद्याशाखेतील पदव्युत्तर स्तरावरील द्वितीय वर्षाच्या सुधारित (दुरूस्ती) अभ्यासक्रमा बाबत....

प रि प त्र क

संदर्भ:– १. जा.क्र.शै–१/एनईपी/विवत्रंविपदवी/२०२४–२५/११३ दिनांक १३/०६/२०२४

या परिपत्रकान्वये सर्व संबंधितांना कळविण्यात येते की, संदर्भीय परिपत्रकान्वये दिनांक १५ मे २०२४ रोजी संपन्न झालेल्या मा. विद्यापरिषदेच्या बैठकीतील विषय क्र. १५/५९–२०२४ अन्वये मान्यता दिल्यानुसार विज्ञान व तंत्रज्ञान विद्याशाखे अंतर्गत राष्ट्रीय शैक्षणिक धोरणानुसार पदव्युत्तर द्वितीय वर्षाचे अभ्यासक्रम शैक्षणिक वर्ष २०२४–२५ पासून लागू करण्यात आलेले आहेत. तथापि वरील संदर्भीय परिपत्रका अन्वये प्रकाशित केलेल्या अभ्यासक्रमामध्ये अभ्यासमंडळानी किरकोळ दुरूस्ती करून अभ्यासक्रम सादर केला असून मा. अधिष्ठाता, विज्ञान व तंत्रज्ञान विद्याशाखा यांच्या मान्यतेने दुरूस्ती केलेले खालील अभ्यासक्रम लागू करण्यात येत आहेत.

01	M. Sc. II year Computer Science (Campus)
02	M. Sc. II year Computer Application (Campus)

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,

डॉ. सरिता लोसरवार
सहाय्यक.कुलसचिव
शैक्षणिक अभ्यासमंडळ विभाग

विष्णुपुरी, नांदेड – ४३१ ६०६.
जा.क्र.:शैक्षणिक–१/परिपत्रक/एनईपीपीजीदुरूस्ती/S&T/
२०२४–२५/ 271
दिनांक : १४.०९.२०२४

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. यांना देवून कळविण्यात येते की, सदरील परिपत्रक विद्यापीठाच्या संकेतस्थळावर प्रसिध्द करण्यात यावे.

Swami Ramanand Teerth Marathwada University, Nanded

(NAAC Re-accredited with 'B++' Grade)

Syllabus of Second Year

M.Sc. (Computer Application)

(Campus)*
(2 years) (NEP-2020 pattern)

To be introduced from AY 2024-2025

Program code: SCS-S-MSCA-PG (13-2-1-01)

*(BoS deserves the rights for minor corrections, typographical errors in this syllabus with due approval of Administrations)

M.Sc. Computer Application (Campus)

M.Sc. Computer Application (2years) program / degree is a specialized program in latest advances in computer application issues. It builds the student on higher studies and research awareness in overall computational application fields so as to become competent in the current race and development of new computational sciences. The duration of the study is of four semesters, which is normally completed in two years.

CBCS pattern : The M.Sc. Computer Application 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 **M.Sc. Computer Application 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 25 credits per semester. A total of 100 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 02 external credits and 02 internal credits. The university shall conduct the end semester examination for 02 external credits. For theory internal credits, student has to appear for 02 class test (15 marks) and 01 assignment (20 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. There is a special skill based activity of 01 internal credits per semester which shall inculcate awareness regarding the domain of computers, IT, and ICT.

The open elective has 02 credits which are split as 01 external credit and 01 internal credit. Students are encouraged to opt for online courses / MOOCs /etc. The credit transfer shall be done as per the University policy. 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 / departmental/school 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. The new Question paper pattern as per the suggestion of Hon'ble Vice Chancellor sir which will be communicated later after due approval. Under the CBCS pattern, students would graduate **M.Sc. Computer Application** 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 PG program. The M.Sc. Computer Application Degree / program would be of 100 Credits and total credits per semester are 25. As per the guidelines, One Credit = 25 marks, Two Credits = 50 Marks, Four Credits = 100 Marks. Minimum four hours teaching per week is compulsory for 04 credit course and likewise for other variations in the credits. There must be minimum 60 lectures per semester for a theory course.

PEO, PO and CO Mappings

1. **Program Name** : M.Sc.(CA) Campus { SCS-S-MSCA-PG (13-2-1-01)}

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 computational 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.

1. **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 understanding underlying computer application environment
   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.

2. **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

3. **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

The detailed syllabus is as below,

Third Semester

Sr#	Course category	Course Code	Course Title	Total credits
1	**Core Subjects**	SCCAC-501	Digital Image Processing	04
2	**Theory**	SCCAC-502	Visual Programing Tools	04
3		SCCAC-503	Software Engineering	04
4	**Lab / Practical**	SCCACP-501	Lab 7: DIP Lab	01
5		SCCACP-502	Lab 8: Visual Prog. Lab	01
Elective Subjects : Choose any one Theory(Corresponding elective lab)				
6	**Theory**	SCCAE- 501-		
		A	Advanced Python Programing	
		B	Network and Linux Administration	
		C	DBMS Programing	
		D	Advanced Computer Networks	
		E	Internet of Things	
		F	Subject relevant MOOC (NPTEL / SWAYAM / RUSA sponsored Future Oriented Courses / other recognized courses$$ ($$ - with prior consultation with the Director of the School in order to determine relevancy, CREDIT TRANSFER POLICY WILL BE ADOPTED)	03
7	**Lab / Practical**	SCCAEP-501	Lab-9: Elective Lab	01
8	**Research Project**	SCCAR-551	Research Project	04

Forth Semester

Sr. No	Course category	Course Code	Course Title	Total credits
1	**Core Subjects**	SCCAC-551	Mobile Application Development	04
2	**Theory**	SCCAC-552	Introduction to Data Science	04
3	**Lab / Practical**	SCCACP-551	Lab 10: MAD Lab	01
4		SCCACP-552	Lab 11: DS Lab	01
Elective Subjects : Choose any one Theory(Corresponding elective lab)				
5	Theory	SCCAE-551-		03
		A	Introduction to Cyber Security	
		B	Database Administration	
		C	Software Quality Assurance and Testing	
		D	Principles of User Interface Design	
		E	Cloud Computing Tools and Techniques	
		F	AI and Machine Learning	
		G	Management Information System	
6	Lab / Practical	SCCAEP-551	Lab-12: Elective Lab	01
7	Publication Ethics	SVECP-551	Publication Ethics	02
8	Research Project	SCCAR-552	Research Project	06

M. Sc. CA Second Year, Semester III and IV *(Level 6.5) : Teaching Scheme*

Course	Course Code	Course Name	Credits Assigned per course			Teaching Scheme (Hrs/ week) per course	
			Theory	Practical	Total	Theory	Practical
Major	SCCAC-501 to SCCAC-503 and SCCAC-551 to SCCAC-552	All Core Course	04	--	04	04	--
Elective	SCCAE-501 and SCCAE-551	All Elective Courses	03	--	03	03	--
Major Practical	SCCACP-501 to SCCACP-502 & SCCACP-551 to SCCACP-552	All Core labs	--	01	01	--	02
Elective Practical	SCCAEP-501 and SCCAEP-551	Elective lab	--	01	01	--	02
Research Project	SCCAR-551	Research Project	--	04	--	--	04/08#
Research Project	SCCAR-552	Research Project	--	06	--	--	06/12#
Publication Ethics	SVECP-551	Publication Ethics	02	--		02	--
Total Credits per semester			--	--	**22**	--	--
Total credits per year			--	--	**44**	--	--

 # 01 Credit Lab has 02 hours practical duration so depending upon university policy, the number of hours per week shall be counted

M. Sc. CA Second Year , Semester III and IV   (Level 6.5) :Examination Scheme

Course Code (2)	Course Name (3)	Theory				Practical		Total
		Continuous Assessment (CA)			ESA			Col (6+7) / Col (8+9)
		Test I (4)	Test II (5)	Avg of (T1+T2)/2 (6)	Total (7)	CA (8)	ESA (9)	(10)
SCCAC-501 to SCCAC-503 and SCCAC-551 to SCCAC-552	All core courses	20	20	`20	80	--	--	100
SCCAE-501 and SCCAE-551	All elective courses	15	15	15	60	--	--	75
SCCACP-501 to SCCACP-502 & SCCACP-551 to SCCACP-552	All Core Labs	--	--	--	--	05	20	25
SCCAEP-501 and SCCAEP-551	All Elective labs	--	--	--	--	05	20	25
*SVECP-551	Publication Ethics	As per University Policy						
*SCCAR-551	Research Project	As per University Policy						
*SCCAR-552	Research Project	As per University Policy						

*Note : Teaching scheme and Examination scheme for these courses will be elaborated later

Guidelines for Course Assessment: M.Sc. CA

    A. Continuous Assessment (CA) (20% of the Maximum Marks): This will form 20% of the Maximum Marks and will be carried out throughout the semester. It may be done by conducting **Two Tests** (Test I on 40% curriculum) and **Test II** (remaining 40% syllabus). Average of the marks scored by a student in these two tests of the theory paper will make his **CA** score (col. 6).

    B. End Semester Assessment (80% of the Maximum Marks): *(For illustration we have considered a paper of 04 credits, 100 marks and need to be modified depending upon credits of an individual paper)*

        1. **ESA Question paper will consists of 6 questions, each of 20 marks.**
        2. **Students are required to solve a total of 4 Questions.**
        3. **Question No.1 will be compulsory and shall be based on entire syllabus.**
        4. Students need to solve **ANY THREE** of the remaining Five Questions (Q.2 to Q.6) and shall be based on entire syllabus.

    C. Question paper of campus and affiliated colleges shall be different

Note: **Number of lectures required to cover syllabus of a course depends on the number of credits assigned to a particular course. One credit of theory corresponds to 15 Hours lecturing and for practical course one credit corresponds to 30 Hours. For example, for a course of two credits 30 lectures of one hour duration are assigned, while that for a three credit course 45 lectures.**

%%%%%

Course Code:	SCCAC-501	Digital Image Programming	Credits: 04

Course Objectives:

This course is to study the image fundamentals and mathematical transforms necessary for image processing. This course elaborates the concepts of the image enhancement techniques and image restoration procedures. It is to study the image compression procedures with the study of image segmentation and representation techniques.

Course Outcome:

This course made students to learn digital image fundamentals, exposed to simple image processing techniques, be familiar with image compression and segmentation techniques, to learn to represent image in form of features

Unit-1:	**Digital Image Fundamentals**	
	What is Digital Image Processing?, Origins of Digital Image Processing, Examples of fields that use DIP, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Elements of Visual Perception, Image Sensing and Acquisition.	15 Lectures
Unit-2:	**Image Enhancement in the Spatial Domain**	
	Image Sampling and Quantization, Some Basic Relationships Between Pixels, Linear and Nonlinear Operations. Some Basic Intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters	15 Lectures
Unit-3:	**Frequency Domain**	
	Preliminary Concepts, The Discrete Fourier Transform (DFT) of Two Variables, Properties of the 2-DDFT, Filtering in the Frequency Domain, Image Smoothing and Image Sharpening Using Frequency Domain Filters, Selective Filtering.	10 Lectures
Unit-4:	**Restoration and Morphological Image Processing**	
	Noise models, Restoration in the Presence of Noise Only using Spatial Filtering and Frequency Domain Filtering, Linear, Position-Invariant degradations Estimating the Degradation Function, Inverse Filtering, Minimum Mean Square Error(Wiener) Filtering, Constrained Least Squares Filtering. Preliminaries, Erosion and Dilation, Opening and Closing. Color Fundamentals, Color Models, Pseudo color Image processing.	20Lectures

Prescribed Book

1.	Digital Image Processing- Rafel C Gonzalez and Richard E. Woods, PHI 3rd Edition

Reference Books

1.	Digital Image Proce&< ing- S.Jayaraman, S. Esakkirajan,T. Veerakumar, Tata McGraw Hill 2014.
2.	Fundamentals of Digital Image Processing- A K. Jain, Pearson 2004.

Course Code:	SCCAC-501	Visual Programming Tools	Credits: 04

Course Objectives:

This course introduces students to visual programming using Visual Basic, focusing on creating graphical user interfaces (GUIs) for Windows applications. Students will learn to design, code, and test user-friendly applications using various Visual Basic controls and techniques.

Course Outcome:

- Students will be able to develop independent applications

Unit-1:	**Fundamentals of Visual Basic and Visual Studio**	
	Introduction to Visual Programming, Importance of Visual Programming, Visual Basic and Visual Programming, Setting Up the Development Environment, Basic Syntax and Structure of Visual Basic Programs, Variables, Constants, and Data Types, Operators and Expressions, Creating basic GUI Application	15 Lectures
Unit-2:	**Working with Controls and Events**	
	Concept of Form, Common Controls (Labels, TextBoxes, Buttons, CheckBoxes, RadioButtons, etc), Setting Properties of Controls (Text, Font, Color, Size, etc.), Aligning and Arranging Controls on a Form, Event Handling (Understanding Events and Event Handlers, Writing Event Handlers for Controls, Common Event Handlers), User Input Validation, Enhancing User Interfaces - Best Practices for UI Design	15 Lectures
Unit-3:	**Advanced Controls and Customization**	
	Working with ListBoxes, ComboBoxes, and PictureBoxes, Standard DialogBoxes, Menus and Toolbars, Creating Menus with the MenuStrip Control, Adding Toolbars with the ToolStrip Control, Multi-Form Applications	15 Lectures
Unit-4:	**File Handling in Visual Basic**	
	Introduction to File Handling, File Input and Output Operations, Working with Binary Files, Advanced File Handling Techniques :- OpenFileDialog and SaveFileDialog, Working with File Paths and Directories, Using the My.Computer.FileSystem Object	15 Lectures

Prescribed Book

1.	The Complete Reference Visual basic .NET, Jeffrey R. Shaprio

Reference Books

1.	Mastering Visual Basic 2010, Evangelos Petroutsos, Sybex
2.	Programming Windows, Charles Petzold, Microsoft Press

Course Code:	SCCAC-503	Software Engineering	Credits: 4

Course Objectives:

- To aware the software Engineering principles
- To understand the software development and testing process, verification and validation of software product

Course Outcome:

- Students are able to develop software using software engineering principles
- Students are able to test the software as well as quality of software product

Unit-1:	**Introduction**	
	Introduction: Software, Software Characteristics, Software Applications, Software Myths, Software Engineering, Generic View of Software, Software Paradigms: Linear Sequential Model or Classic Life Cycle, Prototyping, Evolutionary Software Process Model, 4 GT, RAD	15Lectures
Unit-2:	**Software process and project metrics**	
	Measures, metric and indicators, Software Measurement, Reconciling different metric approaches, Metrics for software quality, Integrating metrics within the software Engineering process.	15 Lectures
Unit-3:	**Design Engineering and User Interface Design**	
	Design process and design quality, design concepts, design models, The Golden rules, User interface analysis and design, interface design activities	15 Lectures
Unit-4:	**Risk Analysis AND Software Testing Techniques**	
	Definition of Risk, Types of Risk, Reactive Vs. proactive risk, Risk Analysis: risk identification, projection, Assessment and Management. Testing-Introduction to Testing, Testing Objectives, white box: Basis path Testing, Control Structure Testing, black box: Equivalence Partitioning, Boundary Value Analysis, Comparison Testing, Orthogonal Array, Testing Strategies: Validation and Verification.	15 Lectures

Prescribed Book

1.	Software Engineering a Practitioner's Approach Roger S. Pressman 5e	

Reference Books

1.	Software Engineering Richard Fairley Tata McGraw Hill
2.	Software Engineering David Gustafson
3.	Practical Guide in Structured System Design Meilier Page
4.	Software Project Management - Jalote

Course Code:	SCCAE-501-A	Advanced Python Programming	Credits: 03 Theory and 01 Lab	Hours required

Course pre-requisite:
1. Basic knowledge of Python Programming

Course Objectives:
1. Understanding of the Python language and explore advanced concepts and techniques.
2. To master Python and dedicated to pursuing careers as data analysts or data scientists.
3. Providing students with a strong foundation in programming and data analysis, focusing on data analysis, visualization, and machine learning.

Course Outcome:
1. Students will be able to use different python modules.
2. Students will be able to perform basic data analytics operations.
3. Student wiil be able to implement Machine Learning algorithms.

Unit -1	**Advanced Data Structures and Algorithms**	
1.1	Review of basic data structures: lists,dictionaries,sets,tuples , Advanced data structures: trees,graphs, heaps, queues	6
1.2	Algorithms for searching, sorting, and graph traversal, Big O notation and algorithmic complexity analysis	6
Unit-2	**Data analysis using Python**	
2.1	Introduction to Data Analysis,NumPy:Arrays and Array Operations, Array Indexing,Slicing, Broadcasting,Vectorization,ArrayManipulation,Reshaping	6
2.2	Introduction to Pandas, Pandas data structures, Data wrangling using pandas,Loading a dataset into a dataframe,	6
2.3	Selecting Columns from a dataframe,Selecting Rows from a dataframe, Adding new data in a dataframe,Deleting data from a dataframe, Handling Missing Data	6
Unit-3	**Data Exporation and visualization unsing Python**	
3.1	Exporatory Data Analysis (EDA),Introduction to Matplotlib,Scatter plot, Line plot, Bar chart, Histogram,Box plot	10
3.2	Web Scrapping, Beautiful Soup	4
Unit-4	**Machine learning with scikit-learn**	
4.1	Basic of Machine Learning,Linear Regression,Logistic Regression	6
4.2	Unsupervised Learning,Model Evaluation parameters	6
4.3	Hyperparameter Tuning and Model Selection	4

Text Book:
1. Fluent Python" by Luciano Ramalho
2. Python for Data Analysis by Wes McKinney
3. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow by Aurelien Geron

Reference Books:
1. Data Structures and Algorithms in Python by Michael T. , Roberto T, and Michael H. G.
2. Python data science handbook by Jake Vanderplas

Course Code:	SCCAE-501-B	Network and Linux Administration	Credits: 03 Theory and 01 Lab

Course Objectives:
1. To understand File formats and data standard used in Multimedia
2. To acquire the skill of animation of an object
3. To study the Input output technology of Multimedia

Course Outcome:
1. Students will be able to Concept of File formats
2. Students will be able to do the animation
3. Students will able to compress the data used in multimedia without losing the properties

Unit-1:	**Introduction**	
	Basics of Client and Server model, basic networking topologies , Installation of Linux, System recovery, File system, system calls, internal commands of Linux: Date, Time,cp, cal, rd, md, cd	15 Lectures
Unit-2:	**Component of Process AND File System**	
	PID, PPID, UID, EUID, GID, EGID, The lifecycle of Process, The /Proc file system, The working of commands top, nice ,renice, ps, dig File system mounting and unmounting, File types: regular files, directories, character and block device files, names pipes. File attributes: permission bits, setuid and set gid bits,	15 Lectures
Unit-3:	**Linux administration**	
	Adding user, removing user, disable login, allocating permissions to user, managing user with system specific tools. Software Configuration Management: diskless client, Package management, Localization and configuration, configuration management tools. Linux commands: grep, man, kill, whereis, service,df,du,passwd,lpr,ifconfig,netstat,nslookup,wall, talk,free, cat, tar,	15 Lectures
Unit-4:	**Domain Name System (DNS) in Linux**	
	DNS namespace, How DNS works, DNS database: Resource record, SOA record, NS record, Mx record, PTR record, Cname record, IPV6 resource record. BIND client issues, BIND server configuration,	15 Lectures needed

Prescribed Book		
1.	Evi Nemeth , Garth Snyder, Trent R. Hein, Ben Whaley "Unix and Linux administration handbook" 4th Ed. ,PHI	

Reference Books	
1.	Evi Nemeth , Garth Snyder, Trent R. Hein "Unix and Linux administration handbook" 2th Ed. ,PHI

Course Code:	SCCAE-501-C	DBMS PROGRAMMING	Credits: 03 Theory and 01 Lab

Course Objectives:

1. Make students familiar with triggers, procedures, stored procedures in SQL

Course Outcome:

1. Students will able to understand the use of programming in DBMS
2. Students will able to develop their own procedures in SQL

Unit-1:	**Introduction AND Basics of PL/SQL**	
	Overview of PL/SQL and its features , Differences between SQL and PL/SQL, PL/SQL architecture and components (blocks, procedures, functions, packages), PL/SQL block structure (declarative, executable, exception handling), Variables and data types, Operators and expressions	15 Lectures
Unit-2:	**Control Structures and Cursors in PL/SQL**	
	Iterative control: LOOP, WHILE, FOR loops, Implicit vs. Explicit cursors, Cursor attributes (%ROWCOUNT, %FOUND, %NOTFOUND, %ISOPEN), Cursor FOR loops and cursor parameters	15 Lectures
Unit-3:	**PL/SQL Subprograms and Exception Handling**	
	Exception types (predefined and user-defined), Handling exceptions with EXCEPTION and RAISE statements , Exception propagation and nested blocks, - Procedures and functions: creation, parameters (IN, OUT, IN OUT), Invoking subprograms from SQL and PL/SQL, Overloading subprograms	15 Lectures
Unit-4:	**Packages and Triggers in PL/SQL**	
	Introduction to packages: specification and body, Advantages of using packages, Using package variables and procedures /functions, Introduction to triggers, Types of triggers (BEFORE, AFTER, INSTEAD OF), Trigger timing and event-based triggers	15 Lectures

Prescribed Book

	1.	Oracle PL/SQL Programming" by Steven Feuerstein	

Reference Books

1.	Oracle Database PL/SQL Language Reference
2.	Online resources: Oracle documentation, PL/SQL tutorials, SQL*Plus guides

Course Code:	SCCAE-501-D	Advanced Computer Networks	Credits: 4

Course Objectives:

To understand the basic concepts of computer network and firm foundation for understanding how data communication occurring using computer network. It is based around the OSI Reference Model which deals with the major issues and related protocol studies in the various layers (Physical, Data Link, Network, Transport, Session, Presentation and Application) of the model.

Course Outcome:

1. Analyse the requirements for a given organizational structure and select the most appropriate networking architecture and technologies;
2. Specify and identify deficiencies in existing protocols, and then go onto formulate new and better protocols;
3. Analyse, specify and design the topological and routing strategies for an IP based networking infrastructure
4. To have a working knowledge of datagram and internet socket programming

Unit-1:	Foundations of Computer Network	15 Lectures
	o Introduction to Computer Networks: Definition, History, and Evolution o Network Models: OSI and TCP/IP Models o Physical Layer: Transmission Media, Signal Encoding Techniques o Data Link Layer: Error Detection and Correction, MAC Protocols (Ethernet, Wi-Fi) o Network Layer: IP Addressing, Subnetting, Routing Protocols (RIP, OSPF, BGP) o Transport Layer: TCP/UDP, Flow Control, Congestion Control o Application Layer: DNS, HTTP, SMTP, FTP o Network Devices: Routers, Switches, Gateways, Hubs	

Unit-2:	Advanced Networking Concepts	15 Lectures
	o Network Design and Architecture: LAN, WAN, MAN, PAN o Wireless Networks: Wi-Fi, Bluetooth, Zigbee, LTE, 5G o Network Security: Firewalls, VPNs, IDS/IPS o Cryptographic Techniques: Symmetric and Asymmetric Encryption, PKI o Software-Defined Networking (SDN): Architecture, OpenFlow, Network Virtualization o Network Function Virtualization (NFV): Concepts, Benefits, Use Cases o Internet of Things (IoT) Networks: Protocols, Architecture, Security Challenges o Edge and Fog Computing: Concepts, Architectures, Applications	

Unit-3:	Emerging Technologies and Trends	15 Lectures
	o 5G and Beyond: Architecture, Key Technologies, Use Cases o Next-Generation Wi-Fi: Wi-Fi 6, Wi-Fi 6E, Wi-Fi 7 o Quantum Networking: Concepts, Quantum Key Distribution, Challenges o Blockchain in Networking: Use Cases, Benefits, Challenges o Cybersecurity Trends: Zero Trust Architecture, SASE o Cloud Networking: Multi-Cloud Strategies, Cloud Security	

Unit-4:	Practical Applications and Case Studies	15 Lectures
	o Network Design and Implementation: Case Studies of Enterprise Networks o Performance Analysis and Troubleshooting: Tools and Techniques o Smart City Networking: IoT Integration, Network Infrastructure o Industrial Networks: Industry 4.0, IIoT, Smart Manufacturing o Network Management: Monitoring, Configuration, Automation o Disaster Recovery and Business Continuity Planning: Strategies, Best Practices	

Text Books:	
1.	Computer Networking-A Top-Down approach, 5thedition, Kurose and Ross, Pearson

Reference Books	
1.	Computer Networks (4th edition), Andrew Tanenbaum, Prentice Hall
2.	Computer Networking and the Internet (5thedition),Fred Halsall, Addison Wesley
3.	Data Communications and Networking (4th edition), Behrouz Forouzan, McGraw Hill

Course Code:	SCCAE-501-E	Internet of Things	Credits: 03 Theory and 01 Lab

Course Objectives:

- Understanding IoT details and technology needed to build IoT applications

Course Outcome:

- Students will be able to design their own IoT solutions

Unit-1:	Introduction to IoT	
	1. Overview of IoT: Definition, History, and Evolution , IoT Architecture: Layers and Design Principles, IoT Ecosystem: Devices, Gateways, and Cloud 2. Key Technologies: Sensors, Actuators, and Communication Protocols, IoT Network Protocols: IPv6, 6LoWPAN, RPL, CoAP, MQTT 3. Connectivity Technologies: WiFi, Bluetooth, Zigbee, LoRaWAN, NB-IoT, IoT Standards and Frameworks: IEEE, IETF, ITU-T, OneM2M, Case Studies: Smart Homes, Wearables, Industrial IoT	15 Lectures
Unit-2:	IoT Software and Hardware	
	1. Introduction to IoT Hardware Platforms: Arduino, Raspberry Pi, ESP8266/ESP32, Sensors and Actuators: Types, Selection Criteria, and Interfacing, IoT Software Platforms and Operating Systems: FreeRTOS, Contiki, RIOT 2. IoT Programming Languages: Python, C/C++, JavaScript, Data Collection and Processing: Edge vs Cloud Computing, IoT Data Storage: Time Series Databases, NoSQL, SQL 3. Introduction to IoT Analytics: Descriptive, Predictive, and Prescriptive Analytics, Visualization Tools and Techniques: Dashboards, Reports, and Alerts	15 Lectures
Unit-3:	IoT communication and Security	
	1. IoT Communication Models: Device-to-Device, Device-to-Gateway, Device-to-Cloud, Network Topologies: Star, Mesh, Hybrid 2. IoT Security Fundamentals: Threats, Vulnerabilities, and Attack Surfaces, Cryptographic Techniques for IoT Security: Symmetric and Asymmetric Cryptography, PKI, Secure Communication Protocols: TLS/SSL, DTLS, IPsec, Authentication and Authorization in IoT: OAuth, JWT, X.509 Certificates 3. Privacy Considerations in IoT: Data Privacy Laws, GDPR, CCPA 4. Security Best Practices: Device Hardening, Network Security, Incident Response	15 Lectures
Unit-4:	IoT application and Future Trends	
	1. IoT in Smart Cities: Smart Grid, Smart Transportation, Smart Healthcare, Industrial IoT (IIoT): Industry 4.0, Predictive Maintenance, Asset Tracking, IoT in Agriculture: Precision Farming, Smart Irrigation, Livestock Monitoring 2. Emerging Technologies in IoT: Edge Computing, Fog Computing, Blockchain, Artificial Intelligence and Machine Learning in IoT: Use Cases and Techniques 3. Future Trends in IoT: 5G and Beyond, Autonomous Systems, Ethical and Social Implications, Course Review and Capstone Project Presentation	15 Lectures
Prescribed Book		
1.	Internet of Things: A Hands-On Approach by Arshdeep Bahga and Vijay Madisetti	
Reference Books		
1.	Building the Internet of Things by Maciej Kranz	

Course Code:	SCCAE-501-F	Subject relevant MOOC	Credits: 03 Theory and 01 Lab
Subject relevant MOOC (NPTEL / SWAYAM / RUSA sponsored Future Oriented Courses / other recognized courses$^{\$\$}$ ($\$\$$ - with prior consultation with the Director of the School in order to determine relevancy, credit transfer policy will be adopted)			

Course Code:	SCCACP-501	LAB 7: CN LAB	Credits: 01
Course Objectives: As per the Lab Manual circulated to students by the concerned Teacher			
Course Outcome: As per the Lab Manual circulated to students by the concerned Teacher			
Experiments: As per the Lab Manual circulated to students by the concerned Teacher			

Course Code:	SCCACP-502	LAB 8: CD LAB	Credits: 01
Course Objectives: As per the Lab Manual circulated to students by the concerned Teacher			
Course Outcome: As per the Lab Manual circulated to students by the concerned Teacher			
Experiments: As per the Lab Manual circulated to students by the concerned Teacher			

Course Code:	SCCAEP-501	LAB 9: ELECTIVE LAB	Credits: 01
Course Objectives: As per the Lab Manual circulated to students by the concerned Teacher			
Course Outcome: As per the Lab Manual circulated to students by the concerned Teacher			
Experiments: As per the Lab Manual circulated to students by the concerned Teacher			

Course Code: SCCAR-551: RESEARCH PROJECT

Course Objectives: To provide postgraduate level research knowledge in computer science, including understanding, analysis, management, and handling of real-life information technology problems in workplace. Students are encouraged to problems from real life / NGO/ state-central govt projects/ hackathon/ etc

Course Outcome: Project based learning will increase their capacity and learning through shared cognition. Students will have an ability to identify, formulate and implement computing solutions. Students will be able to design a system, component or process as per needs and specification.

Guidelines for Project Development:

1. A single student or a group of maximum three students should be formed at the beginning of the semester. University policy will be adopted for number of students in a project group.
2. Each project will be allotted one project guide.

3. Students must submit the project topic and synopsis to the project guide.
4. Students will be given a project approval letter signed by the head of department and the project guide.
5. After receiving a project approval letter, students must submit at least three progress reports of their development in project to the guide, one per month.
6. After completion of project students have to give pre-exam demo to his guide.
7. After finalization of the project, students must prepare minimum 03 copies of the project reports, out of which one copy is for the college and one copy is for the university records. University/College copy must be bind with black covering with golden embossment and it should contain
   i. First Page
   ii. Certificate
   iii. Declaration
   iv. Acknowledgement
   v. Project Approval letter
   vi. Pre- Mid and Final Progress reports (03)
   vii. Objectives, Hypothesis, Methodology and System Flow Diagram/DFD
   viii. Chapter wise briefing, results, conclusions, snapshots, code, etc
   ix. Bibliography
   x. Selected publications as research papers or book chapters or case studies / etc