॥ 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

स्वामी रामानंद तीर्थ मराठवाडा विद्यापीठ, नांदेड

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विज्ञान व तंत्रज्ञान विद्याशाखे अंतर्गत राष्ट्रीय शैक्षणिक धोरण २०२० च्या अनुषंगाने शैक्षणिक वर्ष २०२३–२४ पासून संलग्न महाविद्यालये व विद्यापीठ संकुलांत पदव्युत्तर पदवी प्रथम वर्ष आणि विद्यापीठ संकुले व न्यू मॉडेल डिग्री कॉलेज मध्ये पदवी प्रथमवर्ष अभ्यासक्रम लागू करण्याबाबत.

प रि प त्र क

या परिपत्रकान्वये सर्व संबंधितांना कळविण्यात येते की, शासन निर्णय क्र. एनईपी २०२०/प. क्र. ०९/विशि–३/शिकाना, दिनांक २० एप्रिल २०२३ व शासन पत्र. क्र एनईपी २०२०/प. क्र. ०९/विशि–३, दिनांक १६ जून २०२३ अन्वये सूचित केल्यानुसार राष्ट्रीय शैक्षणिक धोरण २०२०च्या अनुषंगाने दिलेल्या आराखडया नुसार दिनांक १६ जून २०२३ रोजी संपन्न झालेल्या मा. विद्यापरिषदेच्या बैठकीत ऐनवेळचा विषय क्र. ०५/५६–२०२३ अन्वये मान्यता दिल्यानुसार प्रस्तुत विद्यापीठाच्या विज्ञान व तंत्रज्ञान विद्याशाखा अंतर्गत खालील पदव्युत्तर पदवी अभ्यासक्रम (AICTE, PCL, BCI, CoA, NCTE इ. सारख्या नियमक संस्थाची मान्यता आवश्यक असलेले अभ्यासक्रम वगळून) संलग्न महाविद्यालये, विद्यापीठ परिसर व उपपरिसर संकुलांमध्ये आणि पदवी प्रथम वर्ष अभ्यासक्रम विद्यापीठ परिसर व उपपरिसर संकुले व विद्यापीठ संचलित न्यू मॉडेल डिग्री कॉलेज, हिंगोली येथे शैक्षणिक वर्ष २०२३–२४ पासून लागू करण्यात येत आहे.

1) M.Sc. Biotechnology (1st Year) - Campus School
2) M.Sc. Biotechnology (1st Year) – Affiliated colleges
3) B.Sc. Biotechnology (1st Year) – New Model Degree College, Hingoli
4) M.Sc. Botany (1st Year) - Campus School
5) M.Sc. Botany (1st Year) – Affiliated colleges
6) M.Sc. Herbal Medicine (1st Year) - Affiliated colleges
7) M.Sc. Chemistry (1st Year) - Campus School
8) M.Sc. Chemistry (1st Year) - Affiliated colleges
9) M.Sc. Computer Science / Computer Network / Computer Applications (1st Year) University campus, sub campus Latur
10) M.Sc. System Administration & Networking (1st Year) – Affiliated colleges
11) M.Sc. Computer Management (1st Year) – Affiliated Colleges
12) M.Sc. Computer Science (1st Year) – Affiliated Colleges
13) M.Sc. Dairy Science (1st Year) - Affiliated colleges
14) M.Sc. Electronic (1st Year) - Affiliated colleges
15) M.Sc. Geology (1st Year) – University Campus
16) M.Sc. Geography (1st Year) – University Campus
17) M.Sc. Applied Mathematics (1st Year) – Affiliated Colleges
18) M.Sc. Mathematics (1st Year) – Affiliated Colleges
19) M.Sc. Microbiology (1st Year) - University Campus
20) M.Sc. Microbiology (1st Year) – Affiliated colleges

21) M.Sc. Physics (1st Year) - University Campus
22) M.Sc. Physics (1st Year) – Affiliated Colleges
23) M.Sc. Statistics (1st Year) - University Campus
24) M.Sc. Statistics (1st Year) – Affiliated colleges
25) M.Sc. Biochemistry (1st Year) – Affiliated Colleges
26) M.Sc. Zoology (1st Year) – Affiliated Colleges

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.:शै–१/एनइपी२०२०/S&T/अक/२०२३–२४/ 130

सहा.कुलसचिव
शैक्षणिक (१–अभ्यासमंडळ) विभाग

दिनांक : ३०.०६.२०२३.

प्रत : १) मा. प्राचार्य, सर्व संलग्नित महाविद्यालये, प्रस्तुत विद्यापीठ.
२) मा. संचालक, सर्व संकुले परिसर व उपपरिसर, प्रस्तुत विद्यापीठ
३) मा. प्राचार्य, न्यु मॉडेल डिग्री कॉलेज हिंगोली.
४) मा. समन्यवक, कै. श्री उत्तमराव राठोड आदिवासी विकास व संशोधन केंद्र, किनवट.

प्रत माहितीस्तव :
१) मा. कुलगुरू महोदयांचे कार्यालय, प्रस्तुत विद्यापीठ.
२) मा. कुलसचिव, प्रस्तुत विद्यापीठ.
३) मा. सर्व आधिष्ठाता, प्रस्तुत विद्यापीठ.
४) सर्व प्रशासकीय विभाग प्रमुख साहाय्यक, प्रस्तुत विद्यापीठ.
५) सिस्टीम एक्सपर्ट, शैक्षणिक विभाग, प्रस्तुत विद्यापीठ.

SWAMI RAMANAND TEERTH

MARATHWADA UNIVERSITY, NANDED - 431 606

(**Structure and Syllabus of Two Years PG Degree Program with Multiple Entry and Exit Option**)

TWO YEAR MASTERS PROGRAMME IN MASTER of SCIENCE

Subject: Computer Science and Applications

Under the Faculty of

Science and Technology

Effective from Academic year 2023 – 2024

(As per NEP-2020)

Swami Ramanand Teerth Marathwada University

Nanded

Faculty of Science and Technology

NEP-2020 Oriented Structure of Post Graduate Programs

(as per Govt of Maharashtra GR dated 16-05-2023)

M.Sc. Computer Science (Campus) (Sub Centre)

(2 years full time PG Programs)

Introduced from Academic Year 2023-2024

Program code:

From the Desk of the Dean, Faculty of Science and Technology

Swami Ramanand Teerth Marathwada University, Nanded, enduring to its vision statement "***Enlightened Student: A Source of Immense Power",*** is trying hard consistently to enrich the quality of science education in its jurisdiction by implementing several quality initiatives. Revision and updating curriculum to meet the standard of the courses at national and international level, implementing innovative methods of teaching-learning, improvisation in the examination and evaluation processes are some of the important measures that enabled the University to achieve the **3Es, the *equity, the efficiency and the excellence*** in higher education of this region. To overcome the difficulty of comparing the performances of the graduating students and also to provide mobility to them to join other institutions the University has adopted the *cumulative grade point average* (CGPA) system in the year 2014-2015. Further, following the suggestions by the UGC and looking at the better employability, entrepreneurship possibilities and to enhance the latent skills of the stakeholders the University has adopted the *Choice Based Credit System* (CBCS) in the year 2018-2019 at graduate and post-graduate level. This provided flexibility to the students to choose courses of their own interests. To encourage the students to opt the world-class courses offered on the online platforms like, NPTEL, SWAYM, and other MOOCS platforms the University has implemented the credit transfer policy approved by its Academic Council and also has made a provision of reimbursing registration fees of the successful students completing such courses.

SRTM University has been producing a good number of high caliber graduates; however, it is necessary to ensure that our aspiring students are able to pursue the right education. Like the engineering students, the youngsters pursuing science education need to be equipped and trained as per the requirements of the R&D institutes and industries. This would become possible only when the students undergo studies with an updated and evolving curriculum to match global scenario.

Higher education is a dynamic process and in the present era the stakeholders need to be educated and trained in view of the self-employment and self-sustaining skills like start-ups. Revision of the curriculum alone is not the measure for bringing reforms in the higher education, but invite several other initiatives. Establishing industry-institute linkages and initiating internship, on job training for the graduates in reputed industries are some of the important steps that the University would like to take in the coming time. As a result, revision of the curriculum was the need of the hour and such an opportunity was provided by the New Education Policy 2020. National Education Policy 2020 (NEP 2020) aims at equipping students with knowledge, skills, values, leadership qualities and initiates them for lifelong learning. As a result the students will acquire expertise in specialized areas of interest, kindle their intellectual curiosity and scientific temper, and create imaginative individuals.

The curriculum given in this document has been developed following the guidelines of NEP-2020 and is crucial as well as challenging due to the reason that it is a transition from general science-based to the discipline-specific-based curriculum. All the recommendations of the ***Sukanu Samiti*** given in the **NEP Curriculum Framework-2023** have been followed, keeping the disciplinary approach with rigor and depth, appropriate to the comprehension level of learners. All the Board of Studies (BoS) under the Faculty of Science and Technology of this university have put in their tremendous efforts in making this curriculum of international standard. They have taken care of maintaining logical sequencing of the subject matter with proper placement of concepts with their linkages for better understanding of the students. We take this opportunity to congratulate the Chairman(s) and all the members of various Boards of Studies for their immense contributions in preparing the revised curriculum for the benefits of the stakeholders in line with the guidelines of the Government of Maharashtra regarding NEP-2020. We also acknowledge the suggestions and contributions of the academic and industry experts of various disciplines.

We are sure that the adoption of the revised curriculum will be advantageous for the students to enhance their skills and employability. Introduction of the mandatory ***On Job Training, Internship*** program for science background students is praise worthy and certainly help the students to imbibe first-hand work experience, team work management. These initiatives will also help the students to inculcate the workmanship spirit and explore the possibilities of setting up of their own enterprises.

Dr. L. M. Waghmare
Dean, *Faculty of Sci & Tech.*

Dr. M. K. Patil,
Associate Dean, *Faculty of Sci & Tech.*

From Desk of Chairman, Board of Studies of the Subject Computer Science and Application

The School of Computational Sciences, SRTMUN exists since inception of the University and offers Masters, M.Phil. and Ph.D. programs. The Master's Degree Programs, M.Sc.(CS), M.Sc.(CN) and M.Sc.(CA), being officered are two years full time post graduate programs revised with industry expectations. The School of Technology, Sub Centre, Latur offers M.Sc.(CS) since last one decade. These all programs have four semesters, which are normally completed in two years. These programs as per NEP-2020 guidelines are flexible enough so that within discipline and cross discipline migration choices of relevant courses are given to the students under electives courses. There are program specific core subjects. The students can choose relevant electives from the same program or from other programs of the same school. The Evaluation of performance of a student for the course is based on principle of continuous assessment through internal and external evaluation mechanisms. NEP-2020 policy had emphasis given on imparting skills to students. The eligibility criteria and fees structure shall be same as that of Campus Prospectus.

In compliance with the NEP -2020 guidelines, various resolutions passed by the UGC, Government of Maharashtra, directions of the *SUKANU SAMITEE*, Hon'ble Vice Chancellor's directions, Pro Vice Chancellor's timely guidance, rigorous exercise taken by the Dean and Associate Dean, (Science and Technology), resolution passed by the apex bodies , all faculties in the school have assisted BoS for preparing 2 years full time M.Sc. Computer Application, M.Sc. Computer Network and M.Sc. Computer Science programs being taught by the school in the light of NEP-2020. In Doing so, all members agreed unanimously to adhere the UGC guidelines, guidelines of the Government of Maharashtra, guidelines of the *SUKANU SAMITEE* as well as SRTMUN policy draft on NEP-2020 being circulated to the school for all M.Sc. programs. The model NEP-2020 syllabus framed by Prof R.D. Kulkarni committee was also reviewed. It was decided to have first year common for all M.Sc. programs under school which will help students to have minimum common skills leading to PG Diploma in Computer Science and Application, under first year exist option. While framing program specific core and electives courses, the interdisciplinary applications of Computers, IT, Scientific computing allied courses were found out across the various disciplines and relevant courses have been put.

While framing syllabus as per NEP-2020 pattern, care has been taken to consider local needs placed in a national context so as to fulfill global demands. Due care is taken to introduce application oriented interdisciplinary learning. Therefore, students pursuing post graduation degrees over here, in specific courses are encouraged to imbibe knowledge and skills which enable all round personality development, skill enhancement and in-depth learning of technology platforms. Under the NEP-2020 pattern, students would post graduate M.Sc. programs with a total number of 88 credits which includes compulsory, program specific core, program specific elective and relevant electives across from the choices available in the each semester. The directions given by Hon'ble Vice Chancellor sir reading *intra school* and *inter school* electives was specifically accepted by the committee and due care is taken to embed subject relevant courses. Accordingly, horizontal and vertical migration among all M.Sc. and MCA programs with other programs offered by other schools in the campus is allowed. However, Model MCA syllabus as per NEP-2020 has to come yet. The discussions with Hon'ble Pro Vice Chancellor sir lead to following specific agenda of the syllabi

1. To provide mobility and flexibility for students within and outside the Computational Science School as well as to migrate between institutions
2. To help students to learn at their own pace
3. To have provision for relevant elective courses
4. To impart more job oriented skills to students
5. To make any course multi-disciplinary in approach

In order to move ahead on the agenda, the BoS committee members continuously sat together 04 times in last two months. This activity started in April 2023 and finally ended on 25th May 2023. There were discussions on a uniform structure per semester, as per the Govt. of Maharashtra GR dated 16-05-2023, which is likewise to be extended across all semesters so as to make a M.Sc. program worth of 88 credits. All the semesters have 22 credits each. Accordingly, first two semesters are common. The third and fourth semesters have major and elective courses to be completed, as per the rationale of the program. The major courses have been designed as per the perspective of CA/CN and CS programs. These are program specific courses which enable in depth learning in the allied programs. The electives are designed as per the relevant demand of a course in IT industry / Research area. The project development activity was intentionally introduced in third and fourth semesters of every program so as give a real time feel of industry activities to the students. An unified course numbering system was used for proper numbering of all courses was adopted as suggested in common template/ daft guidelines of the university.

The definition of credit in is finally taken as per the NEP-2020, SRTMUN policy, as a weightage to a course, to be given in relation to the hours assigned for the course. Generally one hour per week has one credit. For viability and conformity to the guidelines credits are awarded irrespective of the teaching hours.

A core course is the course offered by the parent program, totally related to the major subject, components.

An Elective Course is also offered by the parent program whose objective is to provide choice and flexibility within the program.

The student can choose his/her elective paper. Elective is related to the major subject. The difference between core course and elective course is that there is choice for the student. The program is at liberty to offer certain number of elective courses any semester. The objective of elective is to provide mobility and flexibility outside the parent program. This is introduced to make every course multi-disciplinary in nature. It is to be chosen from a list of courses offered by various programs in the school. The list is given in the syllabus copy. All faculties were told to outline the specific courses of their interest and elaborate them further with objectives and outcome. The final version of syllabi is outcome oriented which smoothes the understanding of students regarding the skills he/she will be getting after the completion of the program. This has also made faculties to be specialized of the courses being drafted by them.

In order to see the employability of the skills being imparted through these syllabi, the syllabi gist was telephonically consulted with Industry experts. Due care is taken to incorporate suggestions and modifications given by these experts. These experts are 1) Dr. Parvin Pawar, Philips Research Lab, Bangalore, 2) Mr. Sanjay Kurundkar, Creve Info Tech Ltd, Pune, 3) Mr. Ashish Tendulakr, Google Inc, Pune

M.Sc. Computer Science (Campus)(Sub Centre)

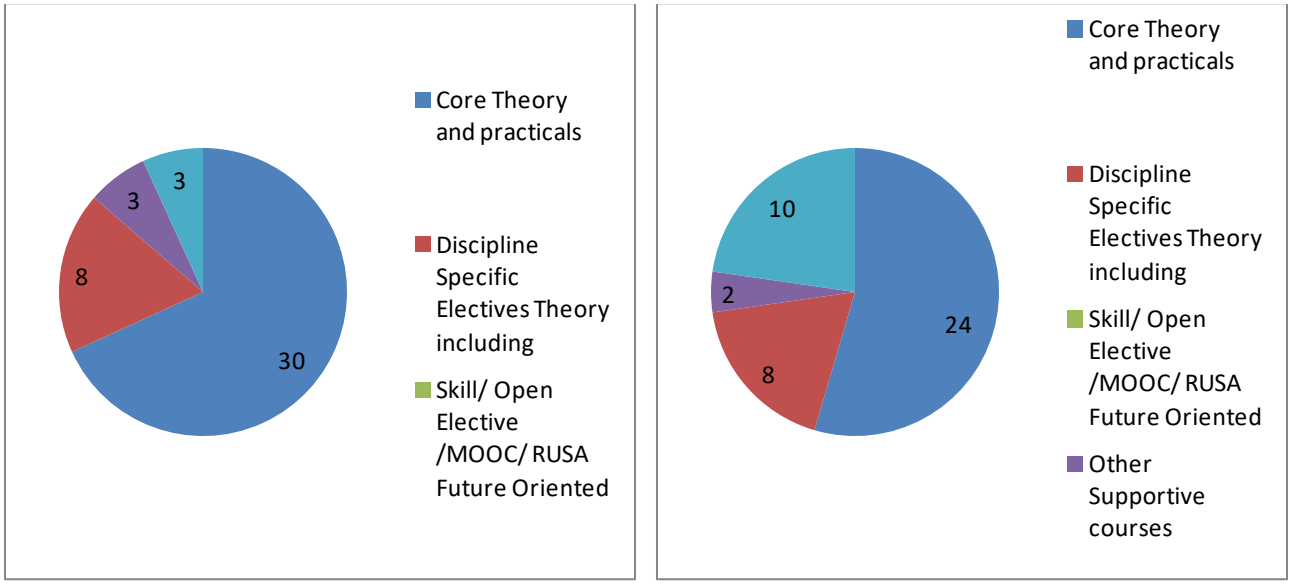
M.Sc. Computer Science (2years) program / degree is a specialized program in latest advances in computer science issues. It builds the student on higher studies and research awareness in overall computational science fields so as to become competent in the current race and development of new computational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

NEP-2020 pattern: The M.Sc. Computer Science program as per NEP-2020 and CBCS (Choice based credit system) pattern, in which choices are given to the students under 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 this 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 22 credits per semester. A total of 88 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, internship, other relevant courses, major project and Lab courses. 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 NEP-2020, 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 M.Sc. Computer Science with a minimum number of required credits which includes compulsory credits from core courses, open electives and program specific elective course. All students have to undergo lab / practical activities leading to specific credits and project development activity as a part of professional UG program.



FY and SY credit patterns

PEO, PO and CO Mappings

1. **Program Name** : M.Sc.(CS) Campus , Sub Centre

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.

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

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

PO2: Generate solutions by 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.

4. **Course Outcome(s):** Every individual course under this program has course objectives and course outcomes (CO). The course objectives rationally match with program educational objectives.

The mapping of PEO, PO and CO is as illustrated below

5. Mapping of PEO& PO and CO

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

The detailed syllabus is as below,

Swami Ramanand Teerth Marathwada University, Nanded

Faculty of Science and Technology

NEP-2020 oriented Structure of Two years Post Graduate Program

Subject : Computer Science (CAMPUS) (Sub Centre)

Introduced from Academic Year 2023-2024 **(as per Govt of Maha GR dated 16-05-2023)**

Program Year and Sem	**Level**	**Semester**		**Faculty**			**Other courses**				
First year common for all PG programs in the School			**Major / Mandatory /**		**Electives/**		**RM**	**OJT/FP/**	**RP**	**Total Sem. credits**	**Cumu. Credits**
			Theory	**Practical**	**Theory**	**Practical**					
			(04 credits)	**(01credits)**	**(04 credits) (03+01)**		**(03credits)**	**(03 Credits)**	**(04 Credits)**		
			SCCS		**SCCS**						
M.Sc. CS	6.0	First Semester	SCCSC-401 SCCSC-402 SCCSC-403	SCCSCP-401 SCCSCP-402 SCCSCP-403	SCCSE-401	---------	SVECR-401 Research Methodology Compulsory	---------	---------	**22**	**22**
M.Sc. CS		Second Semester	SCCSC-451 SCCSC-452 SCCSC-453	SCCSCP-451 SCCSCP-452 SCCSCP-453	SCCSE -451	---------	---------	SCCSOJ-451	----------	**22**	**44**
PG Diploma			24credits + 06 Credits		06 credits +02 Credits		03credits	03credits	----------	**44 credits**	

Exit Option: After completion of First year as above with 44 credits, student will be awarded PG Diploma in Computer Science and Applications**

****(for students who have done 03 years UG program)**

****(available from AY 2024-2025)**

1. Abbreviations : **S- Science, CCS- COMPUTER SCIENCE, D**iscipline **S**pecific **C**ore course (C- Core Course)
2. Abbreviations : **SCCSE- D**iscipline supportive **E**lective **C**ourse (E- Elective Course)
3. Abbreviations : SVECR: Research Methodology course
4. Abbreviations : SCCSOJ : On Job Training , Internship/ Apprenticeship or Field Project
5. Abbreviations : SCCSR : Research Project

Swami Ramanand Teerth Marathwada University, Nanded

Faculty of Science and Technology

NEP-2020 oriented Structure of Two years Post Graduate Program

Subject: Computer Science (CAMPUS) (Sub Centre)

Introduced from Academic Year 2023-2024 **(as per Govt of Maha GR dated 16-05-2023)**

Program Year and Sem	**Level**	**Semester**		**Faculty**			**Other courses**				
Second Year is program specific for all PG programs in the School			**Major / Mandatory / SDSC**		**Electives / SDSC**		**RM /others**	**OJT/FP/**	**RP**	**Total Sem. credits**	**Cumu. Credits**
			Theory	**Practical**	**Theory**	**Practical**					
			(04 credits)	**(01credits)**	**(04 credits) (03+01)**		**(02 credits)**	**(04 credits)**	**(04 credits)**		
M.Sc. CS	6.5	Third Semester	SCCSC-501 SCCSC-502 SCCSC-503	SCCSCP-501 SCCSCP-502	SCCSE-501 (FROM SAME SCHOOL/DEPT)	---------	---------	---------	SCCSR-551 (04 credits)	**2 2**	**66**
M.Sc. CS	6.5	Fourth Semester	SCCSC-551 SCCSC-552	SCCSCP-551 SCCSCP-552	SCCSE-551 (FROM SAME SCHOOL/DEPT)	--------	SVECP -A551 Publication ethics	---------	SCCSR-552 (06 credits)	**22**	**88**
Exit Option: After completion of Second year as above with cumulative 88 credits, student will be awarded M.Sc. in Computer Science Degree depending upon enrollment and completion of program specific core and electives courses ** **(for students who have done 03 years UG program)											

Swami Ramanand Teerth Marathwada University, Nanded

Faculty of Science and Technology

NEP-4545 oriented Structure of One year Post Graduate Program

For students who have completed 04 years UG

Subject: Computer Science, Computer Application, Computer Network (CAMPUS)

Introduced from Academic Year 2027-2028 **(as per Govt of Maha GR dated 16-05-2023)**

Program Year and Sem	**Level**	**Semester**		**Faculty**			**Other courses**				
			Major / Mandatory / SDSC		**Electives / SDSC**		**RM**	**OJT/FP/**	**RP**	**Total Sem. credits**	**Cumu. Credits**
			Theory	**Practical**	**Theory**	**Practical**					
			22-26 credits		08 credits		-------	------	40 credits	---	40-44 credits
One Year program specific courses			Contents will be announced later		Contents will be announced later		----------	----------	Contents will be announced later	-------	

M.Sc. Computer Science
Common Syllabus First Semester

Core Courses Code	Title	Remarks Credits
SCCSC-401	Advanced Computer System Architectures	04
SCCSC-402	Advanced Operating System Concepts	04
SCCSC-403	Advanced Programming Language Concepts	04
SCCSCP-401	Lab 1: ACSA Lab	01
SCCSCP-402	Lab 2: Windows & Linux Lab	01
SCCSCP-403	Lab 3: APLC Lab	01
SCCSE-401	**Chose any one** A. Data Analysis using Spreadsheet B. Mathematical Foundations for Computer Science C. Advanced Web Technology	03 Theory and 01 Lab
SVECR-401	Research Methodology	03

M.Sc. Computer Science
Common Syllabus Second Semester

Core Courses Code	Title	Remarks Credits
SCCSC-451	Computer Graphics and Multimedia	04
SCCSC-452	Database Essentials	04
SCCSC-453	Programming in C and Python	04
SCCSCP-451	Lab 4: CG Lab	01
SCCSCP-452	Lab 5: SQL Lab	01
SCCSCP-453	Lab 6: C & Python Lab	01
SCCSE-451	Chose any one A. Core and Advanced Java Programming B. Design and Analysis of Algorithms C. Information System Security	03 Theory and 01 Lab
SCCSOJ-451	On Job Training , Internship/ Apprenticeship or Field Project	03

Note [$$]: Contents of the common courses in campus and affiliated colleges shall be different

Program Specific Syllabus: Third Semester
M.Sc. Computer Science

Core Courses Code	Title	Remarks Credits
SCCSC-C501	Advanced Computer Networks	04
SCCSC-C502	Compiler Designing	04
SCCSC-C503	Software Engineering	04
SCCSCP-C501	Lab 7: CN Lab	01
SCCSCP-C502	Lab 8: CD Lab	01
SCCSE-C501	**Chose any one** A. Advanced Python Programming B. Network and Linux Administration C. DBMS Programming D. Theory of Computation E. Internet of Things F. Subject relevant MOOC (NPTEL / SWAYAM / RUSA sponsored Future Oriented Courses / Other recognized [$$] G. Visual Programming Tools H. Digital Image Processing	03 Theory and 01 Lab **Note:** [$$] with prior consultation with the Director of the School in order to determine relevancy
SCCSR-C551	Research Project	04

Program Specific Syllabus: Fourth Semester
M.Sc. Computer Science

Core Courses Code	Title	Remarks Credits
SCCSC-C551	AI and Machine Learning	04
SCCSC-C552	Introduction to Data Science	04
SCCSCP-C551	Lab 9: AI-ML Lab	01
SCCSCP-C552	Lab 10: DS Lab	01
SCCSE-C551	**Chose any one** 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. Distributed Computing G. Natural Language Processing	03 Theory and 01 Lab
SVECP -C551	Publication Ethics	02
SCCSR-C552	Research Project	06

Syllabus Analysis

List of Supportive Courses

Title	Semester
Mathematical Foundations of Computer Science	First Semester

Skill enhancement Courses

Title	Semester
1. Data Analysis using Spreadsheet 2. Advanced Web Technology	First Semester

Domain Specific Streams (one or more courses)

Stream	Title	Semester
Application oriented Programmer	1. Advanced Programming Language Concepts 2. Programming in C and Python 3. Core and Advanced Java Programming 4. Advanced Python Programming 5. Visual Programming Tools 6. Principles of User Interface Design	First Semester to Fourth Semester
Databases and Data Analytics, Data Consultant	1. Data Analysis using Spreadsheet 2. Database Essentials 3. DBMS Programming 4. Database Administration 5. Introduction to Data Science	First Semester to Fourth Semester
Advanced trends in Computer application	1. Mobile Application Development 2. Cloud Computing Tools and Techniques 3. AI and Machine Learning 4. Natural Language Processing 5. Internet of Things 6. Introduction to Cyber Security	First Semester to Fourth Semester
Network Security	1. Information Security System 2. Network vulnerabilities and Risk Mgmt. 3. Web Applications and Security 4. Cryptography and Network Security	First Semester to Fourth Semester
Network Administration and Management	1. Network Analysis and Synthesis 2. Network and Linux Administration 3. Windows Server Administration 4. Advanced Computer Networks	First Semester to Fourth Semester

M. Sc. CS First Year, Semester I and II *(Level 6.0)* : *Teaching Scheme*

Coures	Course Code	Course Name	Credits Assigned per course			Teaching Scheme (Hrs/ week) per course	
			Theory	Practical	Total	Theory	Practical
Major	SCCSC-401 to SCCSC-403 and SCCSC-451 to SCCSC-453	All Core Course	04	--	**04**	**04**	--
Elective	SCCSE-401 and SCCSE-451	All Elective Courses	03	--	**03**	**03**	--
Special Courses	SVECR-401 and SCCSOJ-451	Research Methodology and On Job Training	03	--	**03**	**03**	
Major Practical	SCCSCP-401 to SCCSCP-403 and SCCSCP-451 to SCCSCP-453	All Core labs	--	01	**01**	--	**02**
Elective Practical	SCCSEP-401 and SCCSEP-451	Elective lab	--	01	**01**	--	**02**
Total Credits per semester			**18**	**04**	**22**	**18**	**04**
Total credits per year			**36**	**08**	**44**	**36**	**08**

M. Sc. CS First Year , Semester I and II (Level 6.0) :Examination Scheme

Course Code (2)	Course Name (3)	Theory				Practical		Total Col (6+7) / Col (8+9) (10)
		Continuous Assessment (CA)			ESA			
		Test I (4)	Test II (5)	Avg of (T1+T2)/2 (6)	Total (7)	CA (8)	ESA (9)	
SCCSC401 to SCCSC-403 and SCCSC-451 to SCCSC-453	All core courses	20	20	`20	80	--	--	100
SCCSE-401 and SCCSE-451	All elective courses	15	15	15	60	--	--	75
SVECR-401 and SCCSOJ-451	Research Methodology	15	15	15	60	--	--	75
SCCSCP-401 to SCCSCP-403 and SCCSCP-451 to SCCSCP-451	All Core Labs	--	--	--	--	05	20	25
SCCSEP-401 and SCCSEP-451	All Elective labs	--	--	--	--	05	20	25

Note : Teaching scheme and Examination scheme for Second year will be elaborated later, along with detailed syllabus of Second Year

Guidelines for Course Assessment: M.Sc. CS

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.

%%%%%

M.Sc. CS First Semester w.e.f AY 2023-2024

Course Code:	SCCSC-401	Advanced Computer System Architecture	Credits: 4	Hours required
Course pre-requisite:				
1. Basic knowledge of computer Hardware and digital electronics				
Course Objectives:				
2. To aware Computer System architecture 3. To learn data processing 4. To understand digital circuits and its use				
Course Outcome:				
1. Students will be able to handle the digital circuits 2. Students will be able to perform micro operations				
Unit-1:	**Register Transfer and Micro operations**			
1.1	Basic computer organization and design: instruction codes, computer registers, computer instructions, timing and control, instruction cycle, memory reference instructions, input-output and interrupt, design of accumulator logic.			08
1.2	Introduction to basic and advanced architecture of computers, basics of 8086 and advanced microprocessors, register transfer language, register transfer, bus and memory transfers, arithmetic micro operations, logic micro operations, and shift micro operations.			08
1.3	Programming the Basic Computer: Machine Language, Assembly Language, The Assembler Program Loops, Programming Arithmetic and Logic Operations, Subroutines, Input-Output Programming.			08
Unit-2:	**Central Processing Unit**			
2.1	Introduction to CPU logic, general register organization, stack organization, instruction formats, Complete computer description & design of basic computer.			08
2.2	Addressing modes, data transfer and manipulation, program control, reduced instruction set computer (RISC).			08
2.3	Pipeline and vector processing, parallel processing, pipelining, arithmetic pipelines, instruction pipelines			04
Unit-3:	**Input-Output Organization**			
3.1	Peripheral Devices, Input-Output Interface, Input-Output Processor, Serial Communication.			04
3.2	Asynchronous Data Transfer, Modes of Transfer, Priority Interrupt, Direct Memory Access (DMA),			04
Unit-4:	**Memory Organization**			
4.1	Memory Hierarchy, Main Memory, RAM and ROM, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory, Memory Management Hardware.			04
4.2	Case studies of some contemporary advanced architecture for processors of families like Intel, AMD, IBM etc.			04
Text Book				
1.	William Stallings, Computer Organization and Architecture			
Reference Books				
1.	Andrew S. Tanenbaum, Structured Computer Organization,			

Course Code	SCCSC-402	Advanced Operating System	Credits: 4	Hours required
Course Prerequisite				
1. General understanding of software				
Course Objectives				
1. To learn the mechanisms of OS to handle processes and threads and their communication 2. To learn the advanced mechanisms involved in process , file and memory management in contemporary OS				
Course Outcome				
1. Students will be able to understand architectural components involved in OS design 2. Students will be able to configure existing operating systems				
Unit No.	**Unit Title**			
Unit-1:	**Operating systems overview**			
1.1	Introduction, operating system operations, process management, memory management, storage management, protection and security, distributed systems.			08
1.2	Operating system services and systems calls, system programs, operating system structure, operating systems generations.			08
Unit-2:	**Process management:**			
2.1	Process concepts, process state, process control block, scheduling queues, process scheduling, multithreaded programming, threads in UNIX, comparison of UNIX and windows.			08
2.2	Process synchronization, critical section problem, Peterson's solution, synchronization hardware, semaphores, classic problems of synchronization,			08
2.3	Readers and writers problem, dining philosophers' problem, monitors, synchronization examples (Solaris), atomic transactions. Comparison of UNIX and windows.			04
Unit-3:	**Memory management & file system:**			
3.1	Swapping, contiguous memory allocation, paging, structure of the page table, segmentation, virtual memory, demand paging, page-replacement algorithms, allocation of frames, thrashing, case study – WINDOWS, LINUX			08
3.2	Concept of a file, access methods, directory structure, file system mounting, file sharing, protection.			04
3.3	File system implementation: file system structure, file system implementation, directory implementation, allocation methods, free-space management, efficiency and performance, comparison of LINUX and windows.			04

Unit-4:	**I/O system:**	
4.1	Mass storage structure - overview of mass storage structure, disk structure, disk attachment, disk scheduling algorithms, swap space management, stable storage implementation, tertiary storage structure.	04
4.2	I/O: Hardware, application I/O interface, kernel I/O subsystem, transforming I/O requests to hardware operations, streams, performance.	04
Text Books:		
1.	Abraham Silberschatz, Peter Baer Galvin, Greg Gagne (2006), Operating System Principles, 7th edition, Wiley India Private Limited, New Delhi.	
Reference Books:		
1.	Stallings (2006), Operating Systems, Internals and Design Principles, 5th edition, Pearson Education, India.	
2.	Andrew S. Tanenbaum (2007), Modern Operating Systems, 2nd edition, Prentice Hall of India, India.	
3.	Deitel & Deitel (2008), Operating systems, 3rd edition, Pearson Education, India	

Course Code	SCCSC-403	Advanced Programming Language Concepts	Credits: 4	Hours required
Course Prerequisite				
1. Some knowledge of computer programming languages				
Course Objectives:				
1. To help to understand the fundamental concepts of programming Languages. 2. To prepare students about the need and use of data structures 3. To prepare students to identify and apply data structures for problem solving				
Course Outcome:				
1. Understanding the evolution of programming languages. 2. Understanding object oriented languages, functional and logical programming languages				
Unit-1:	**The role of Programming Languages**			
1.1	Introduction to Languages, Basic types of languages (Machine, Assembly, High level Languages),			**08**
1.2	Toward Higher-Level Languages, Programming Paradigms, Language Implementation: Bridge the Gap.			**08**
Unit-2:	**Language Description: Syntactic Structure**			**08**
2.1	Expression Notations, Abstract Syntax Trees, Lexical Syntax: Tokens and Spellings			**08**
2.2	Context-Free Grammars, Grammars for Expressions, Handling Associativity and Precedence.			**04**
Unit-3:	**Structured Programming and Data representation**			
3.1	Need for Structured Programming, Syntax-directed Control Flow (conditional, Looping Construct, for, Selection Case) Design considerations: Syntax, Programming with Invariants.			**08**
3.2	The role of types, Basic types, Arrays: Sequence of elements, Records: Name Fields, Union and Variant Records, Sets, Pointers.			**02**
Unit-4:	**Procedure Activations and Logic Programming**			
4.1	Introduction to Procedures, Parameter-Passing Methods, Scope Rules for Names, Nested Scopes in the Source Text, Activation Records, Lexical Scope., Computing with relations,			**04**
4.2	Introduction to Prolog, Data Structure in Prolog, Programming Techniques, Control in Prolog, cuts.			**02**
4.3	Case studies of C, C++ and Java languages			**04**
Text Books:				
1.	Programming Languages Concepts and constructs- Ravi Sethi, Pearson Education.			
2.	Programming Language Design Concepts- D. A. Watt, Wiley Dream Tech.			
Reference Books				
1.	Programming Languages- A. B. Tucker, R. E. Noonan, 2nd Edition, TMH.			
2.	Programming Languages- K. C. Louden, 2nd Edition, Thomson Press.			

Course Code:	SCCSE-401 A Elective	Data Analysis using spreadsheets	Credits: 3 Theory and 01 Lab	Hours required
Pre requisite				
1. Knowledge of Use of computers for storing and retrieving data				
Course Objectives:				
1. Making students habitual of using computers for data storing and data analysis				
Course Outcome:				
1. Learn how to use spreadsheets built-in data analysis features, create charts and visualizations, and discover multiple ways to tell the stories hidden in the numbers				
Unit-1:	**Introduction to MS Excel**			
1.1	About Excel & Microsoft, Uses of Excel, Excel software, Spreadsheet window pane, Title Bar, Menu Bar, Standard Toolbar, Formatting Toolbar, the Ribbon, File Tab and Backstage View, Formula Bar, Workbook Window, Status Bar, Task Pane, Workbook & sheets			**08**
1.2	Selecting Columns & Rows, Changing Column Width & Row Height, Autofitting Columns & Rows, Hiding/Unhiding Columns & Rows, Inserting & Deleting Columns & Rows, Cell, Address of a cell, Components of a cell – Format, value, formula, Use of paste and paste special			**08**
Unit-2:	**Using Ranges and Formulas**			
2.1	Using Ranges, Selecting Ranges, Entering Information Into a Range, Using AutoFill			**08**
2.2	Using Formulas, Formula Functions – Sum, Average, if, Count, max, min, Proper, Upper, Lower, Using AutoSum, Advanced formulas			**08**
Unit-3:	**Spreadsheet Charts and Data Analysis**			
3.1	Creating Charts, Different types of chart, Formatting Chart Objects, Changing the Chart Type, Showing and Hiding the Legend, Showing and Hiding the Data Table			**04**
3.2	Sorting, Filter, Text to Column, Data Validation Creating PivotTables, Manipulating a PivotTable, Using the PivotTable Toolbar, Changing Data Field, Properties, Displaying a PivotChart, Setting PivotTable Options, . Adding Subtotals to PivotTables			**04**
Unit-4:	**Advanced operations for data analysis**			
4.1	Moving between Spreadsheets, Selecting Multiple Spreadsheets, Inserting and Deleting Spreadsheets Renaming Spreadsheets, Splitting the Screen, Freezing Panes, Copying and Pasting Data between Spreadsheets, Hiding , Protecting worksheets			**04**
4.2	Recording Macros, Running Macros, Deleting Macros			**04**
Lab	**Actual hands on for data analysis**			**12**
01 Credit Lab	Data analysis case studies leading to independent projects where students collect data, use Excel for recording data and create their own individual data analysis reports			
Reference Books				
1.	Excel Data Analysis For Dummies, 5th Edition, Paul McFedries			

Course Code:	SCCSE-401 B Elective	Mathematical Foundations for Computer Science	Credits: 3 Theory and 01 Lab	Hours required
Pre requisite				
1. Basic knowledge of mathematical concepts				
Course Objectives:				
1. Cultivate clear thinking and creative problem solving. 2. Thoroughly train in the construction and understanding of mathematical proofs. 3. Exercise common mathematical arguments and proof strategies.				
Course Outcome:				
1. At the end of the course student will be able to understand the notion of mathematical thinking, mathematical proofs and to apply them in problem solving.				
Unit-1:	**Introduction**			
1.1	Sets, Venn diagrams, Operations on Sets, Laws of set theory, Power set and Products, Partitions of sets, The Principle of Inclusion and Exclusion.			**08**
Unit-2:	**Propositions and Logical Operations**			
2.1	Propositions &logical operations, Truth tables , Equivalence, Implications , Laws of logic, Normal Forms, Predicates & Quantifiers, Math.Induction.			**08**
Unit-3:	**Relations, Paths and Digraphs**			
3.1	Relations, Paths and Digraphs, Properties and types of binary relations , Operations on relations, Closures, Warshalls algorithm, Equivalence and partial ordered relations, Poset, Hasse diagram and Lattice			**08**
3.2	Functions: Types of functions – Injective, Surjective and Bijective Composition of functions , Identity and Inverse function, Pigeon-hole principle.			**08**
Unit-4:	**Permutations and Combinations**			
4.1	Permutations, Combinations, Elements of Probability, Discrete Probability and Conditional Probability,			**04**
4.2	Generating Functions and Recurrence Relations, Recursive Functions, Introduction to Functional Programming,			**04**
4.3	Graphs Definitions, Paths and circuits: Eulerian and Hamiltonian, Types of graphs, Sub Graphs Isomorphism of graphs.			**08**
Lab	**Use of Programming language / Packages for actual hands on**			
01 Credit Lab	Case studies leading to independent projects where students implement above mathematical concepts using a programming language or a package leading to a Lab Book			**12**
Text Book				
1	Discrete Mathematical Structures- C. L. Liu, Second Edition, McGraw-Hill			
Reference Books				
1.	Discrete Mathematical Structures- Y N Singh, Wiley-India Press.			
2.	Discrete Mathematics for Computer Scientists and Mathematicians- J. L. Mott, A.Kandel, Prentice Hall of India.			
3.	Discrete Mathematical Structures with Applications to Computer Science- Discrete Mathematics for Computer Scientists and Mathematicians, Tata Mcgraw-Hill.			

Course Code:	SCCSE-401 C Elective	Advanced Web Technology	Credits: 3 Theory and 01 Lab	Hours required
Pre requisite				
1. Basic knowledge of web sites and internet				
Course Objectives:				
1. Students must be able to understand art of programming a website				
Course Outcome:				
1. Students will understand basics of web development and will be in a position to independently develop a website				
Unit-1:	**Introduction to HTML**			
1.1	Introduction to basic concept, Internet domains, Client IP address, web client and server, The Phases of Web Site Development Creating Internet World Wide Web pages- HTML - Hypertext Markup Language , Basic HTML Concepts, Lists, Tables, linking documents frames, adding Graphics and multimedia. HTML Forms.			**08**
Unit-2:	**Introduction to CSS**			
2.1	Introduction To Style sheet, types of style sheets- Inline, External, Embedded CSS, color and background, text formatting attributes, CSS Border, margin properties, Positioning Use of classes in CSS, Div and span tag, Classes, use of external style sheets.			**08**
Unit-3:	**Introduction to Javascripts and XML**			
3.1	Intro to script, types, intro of JavaScript, JavaScript identifiers, operators, control & Looping structure, Intro of Array, Array with methods, form object, Math, String and Date Objects with methods User defined & Predefined functions, DOM objects, Window Navigator, , Event handling, Validations On Forms, introduction to cookies.			**08**
3.2	Intro & features of XML, XML writing elements, attributes etc. XML with CSS, DSO, XML Namespaces XML DTD, XML Schemas, Writing Simple sheets using XSLT, SAX & DOM Parsers, SOAP Introduction.			**08**
Unit-4:	**Introduction to PHP**			
4.1	Introduction, apache/IIS installation, setting and configuration PHP to work under apache/IIS, writing PHP, data types, variables, constants operators, arrays, loops, functions PHP Server variables, working with forms			**16**
Lab	**Use of Programming language / Packages for actual hands on**			
01 Credit Lab	Students must independently use a programming language / package / software to implement above concepts leading to design and development of a website			**12**
Text Book				
1.	Ivan Bayross, "Web enabled commercial application development using HTML, DHTML, JavaScript, PERL-CGI", BPB pub., 2nd Ed., 2000			
Reference Books				
1.	Hofstetter fred , "Internet Technology at work", Osborne pub. , 2004			
2.	Ivan Bayross , "HTML, DHTML, JavaScript, Perl & CGI" ,BPB pub. 3rd Ed.,2004			

Course Code:	SVECR-401 compulsory	Research Methodology	Credits: 3 Theory	Hours required
Pre requisite				
1. Knowledge of research studies				
Course Objectives:				
1. To impart knowledge and skills needed for research methodology				
Course Outcome:				
1. Students will be able to scientifically undertake a research project				
Unit-1:	**Foundations of Research:**			
1.1	Meaning, Objectives, Motivation, Utility. Concept of theory, empiricism, deductive and inductive theory. Characteristics of scientific method – Understanding the language of research – Concept, Construct, Definition, Variable. Research Process			**04**
	Problem Identification & Formulation – Research Question – Investigation Question Measurement Issues – Hypothesis – Qualities of a good Hypothesis –Null Hypothesis & Alternative Hypothesis. Hypothesis Testing – Logic & Importance			**04**
Unit-2:	**Research Design**			
2.1	Concept and Importance in Research – Features of a good research design – Exploratory Research Design – concept, types and uses, Descriptive Research Designs – concept, types and uses. Experimental Design: Concept of Independent & Dependent variables.			**04**
Unit-3:	**Research Types and Measurements**			
3.1	Qualitative and Quantitative Research: Qualitative research – Quantitative research – Concept of measurement, causality, generalization, replication. Merging the two approaches.			**04**
3.2	Measurement: Concept of measurement–Problems in measurement in research – Validity and Reliability. Levels of measurement – Nominal, Ordinal, Interval, Ratio			**04**
Unit-4:	**Core Research Concepts**			
4.1	Sampling methods and Practical considerations in sampling and sample size			**04**
4.2	Data analysis and data Preparation including standard methods of testing hypothesis of association			**04**
4.3	Interpretation of Data and Paper Writing –Journals, Impact factor of Journals, Ethical issues related to publishing, Plagiarism			**04**
4.4	Use of Encyclopedias, Research Guides, Handbook etc., Academic Databases for Computer Science Discipline.			**04**
4.5	Use of tools / techniques for Research: methods to search required information effectively, Reference Management Software, Software for paper formatting like LaTeX/MS Office, Software for detection of Plagiarism			**05**
Text Book				
1.	Research Methodology – C.R.Kothari			
Reference Books				
1.	Business Research Methods – Donald Cooper & Pamela Schindler, TMGH, 9th edition			
2.	Business Research Methods – Alan Bryman & Emma Bell, Oxford University Press			

Course Code:	SCCSCP-401	Course Name: Lab-1	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:	SCCSCP-402	Course Name: Lab-2	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:	SCCSCP-403	Course Name: Lab 3	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			

Second Semester

Course Code:	SCCSC-451	Computer Graphics and Multimedia	Credits: 4	Hours required
Course pre-requisite:				
Knowledge of Computer graphics				
Course Objectives:				
1. To develop an understanding and awareness how issues such as content, information architecture, motion, sound, design, and technology merge to form effective and compelling interactive experiences for a wide range of audiences and end users.				
Course Outcome:				
1. Design two dimensional graphics. 2. Apply two dimensional transformations. 3. Understood Different types of Multimedia File Format				
Unit-1:	**Basics of Graphics**			
1.1	Light sources - basic illumination models – halftone patterns and dithering techniques; Properties of light - Standard primaries and chromaticity diagram; Intuitive colour concepts - RGB YIQ CMY HSV HLS colour model; Colour selection. Output primitives – points and lines, line drawing algorithms, loading the frame buffer, line function; circle and ellipse generating algorithms; Pixel addressing and object geometry, filled area primitives			08
Unit-2:	**2D and 3D Graphics**			
2.1	Two dimensional geometric transformations – Matrix representations and homogeneous coordinates, composite transformations; Two dimensional viewing – viewing pipeline, viewing coordinate reference frame; window-to-viewport coordinate transformation, Two dimensional viewing functions; clipping operations – point, line, and polygon clipping algorithms.			08
2.2	Three dimensional concepts; Three dimensional object representations – Polygon surfacesPolygon tables- Plane equations - Polygon meshes; Curved Lines and surfaces, Quadratic surfaces; Blobby objects; Spline representations – Bezier curves and surfaces -BSpline curves and surfaces.			08
2.3	Three dimensional geometric and modeling transformations – Translation, Rotation, Scaling, composite transformations; Three dimensional viewing – viewing pipeline, viewing coordinates, Projections, Clipping; Visible surface detection methods.			08
Unit-3:	**Multimedia basics**			
3.1	Multimedia applications, Multimedia system architecture, Evolving technologies for multimedia − Defining objects for multimedia systems − Multimedia data interface standards − Multimedia databases.			08
3.2	Compression and decompression − Data and file format standards − Multimedia I/O technologies − Digital voice and audio − Video image and animation − Full motion video − Storage and retrieval technologies.			08
Unit-4:	**Hypermedia**			
4.1	Multimedia authoring and user interface - Hypermedia messaging -Mobile messaging − Hypermedia message component − Creating hypermedia message − Integrated multimedia message standards − Integrated document management − Distributed multimedia systems.			08
4.2	CASE STUDY: BLENDER GRAPHICS Blender Fundamentals – Drawing Basic Shapes – Modelling – Shading & Textures			04
	Text Book			
1.	Donald Hearn and Pauline Baker M, —Computer Graphics", Prentice Hall, New Delhi, 2007			

Course Code:	SCCSC-452	Database Essentials	Credits: 4	Hours required
Course pre-requisite:				
Understanding of data storages in computers				
Course Objectives:				
1. To understand the features of Relational database. 2. To describe data models and schemas in DBMS. 3. To use SQL- the standard language of relational databases for database				
Course Outcome:				
1. Confidence in creating own dataset and modeling their applications				
Unit-1:	**Basics of Databases**			
1.1	General Architecture of DBMS, Roles of DBA, Data Dictionary, Advantages and Disadvantages of DBMS.			08
1.2	Data modeling using Entity Relationship model, Discussions on data modeling using Relational Model, E-R to Relational Conversion.			08
1.3	Basics of Relational Algebra, selection, projection, division, cross product Operators Set Operators, Join and its types, writing Relational Algebra notations for user queries.			08
Unit-2:	**Normalization**			
2.1	Introduction to attributes, Keys, relationships and their types, Anomalies in databases, understanding Functional Dependencies(Determinant, partial, full, transitive, multi valued, etc),			08
2.2	Normalization process, First Normal form, Second Normal Form, Third Normal Form etc. , Boyce-Codd Normal Form, Fourth Normal Form, Fifth Normal Form.			08
Unit-3:	**SQL Essentials**			
3.1	Introduction to data retrieval languages, Discussions on SQL, Table , building blocks of SQL including data types, operators, expressions			04
3.2	DDL Statements, DML Statements, DCL Statements , TCL statements , SQL Functions ,			04
Unit-4:	**Advanced SQL**			
4.1	Introduction to Views, writing basic PL/SQL codes, table partitions,			04
4.2	Introduction to constraints, types of constrains, Integrity constraints, Data administration issues			04
Text Book				
1.	Database System Concepts- Silber Schatz Korth, Tata McGraw Hill.			
Reference Books				
1.	Introduction to Database management System- Bipin Desai, Galgotia P			

Course Code:	SCCSC-453	Programming in C and Python	Credits: 4	Hours required
Course pre-requisite:				
Knowledge of computer languages				
Course Objectives:				
To give skills for computer programming				
Course Outcome:				
Students will be able to solve problems using C and Python programming languages				
Unit-1:	**Introduction to programming paradigms**			
1.1	Applications of C Language, Structure of C program, C programming building blocks including Data Types , operators, expressions, evaluation of expressions, Input / Output statements, use of Assignment statements, Decision making statements, Looping statements in programming, Preprocessor directives and Compilation process			08
1.2	Introduction to Arrays, 1D and 2 D array concepts and their use in programming as well as in searching and sorting operations, various string operations			08
Unit-2:	**Advanced concepts in C**			
2.1	Understanding modular programming, dealing with some standard string and mathematical functions in programming, use of recursion using recursive functions , dealing with pointers, understanding parameter passing concept			08
2.2	Use of abastract data types, understanding use of structures and pointers typedef , dynamic memory allocation concepts, understanding storage classes and visibility.			08
Unit-3:	**Introduction to Python**			
3.1	Python installation and working of it, get familiar with python variables and data types, operator understanding and its usage, detail study of python blocks			08
3.2	Hands on with conditional blocks using if, else and elseif, hands on examples and study of looping with range, list and dictionaries, hands on to organize python code with function, modular approach in python, knowledge of various libraries in python with their research uses			08
Unit-4:	**Advanced concepts in Python**			
4.1	Handling if exceptions to handle the code cracks, handling and helping file operations, coding with the exceptional handling and testing Anonymous method, Properties, Indexers, Exception Handling			08
4.2	Procedural and Object-Oriented Programming, classes and working with instances, method overloading, polymorphism, importing internal module as well as external modules in the code packages understanding and their usage, hands on with lambda function in python coding with the use of functions, modules and external packages			04
Text Book				
2.	Kernighan, B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education,			
Reference Books				
1.	Starting Out with Python (2009) Pearson , Tonny Gaddis			

Course Code:	SCCSE-451 A Elective	Core and Advanced Java Programming	Credits: 3 Theory and 01 Lab	Hours required
Pre requisite				
1. Basic knowledge of computer programming				
Course Objectives:				
1. Cultivate clear thinking and creative problem solving using Java language .				
Course Outcome:				
1. At the end of the course student will be able to understand basics of core Java and advanced Java and to apply them in problem solving.				
Unit-1:	**Introduction to Java**			
1.1	Programming language types and paradigms, computer programming hierarchy, how computer architecture affects a language? , why java? ,flavors of java, java designing goal, role of java programmer in industry, features of java language, jvm –the heart of java , java's magic bytecode.			**08**
1.2	Installing java, java program development, java source file structure, compilation, executions.			
1.3	Lexical tokens, identifiers, keywords, literals, comments, primitive data types, operators assignments.			
Unit-2:	**Basic Java Programming**			
2.1	Class and object fundamentals , creating and operating classes and objects , understanding types of classes, code blocks, access control constructor, interfaces defining methods argument passing mechanism , method overloading, recursion, dealing with static members, use of "this " reference, other aspects related with complete understanding of classes and objects			**08**
Unit-3:	**Core Java**			
3.1	Inheritance in JAVA, types of inheritance in java, inheriting data members and methods , role of constructors in inheritance , overriding super class methods ,use of "super" , polymorphism in inheritance ,type compatibility and conversion implementing interfaces.			**08**
3.2	Organizing classes and interfaces in packages , package as access protection , defining package ,classpath setting for packages , making jar files for library packages import and static import naming convention for packages.			**08**
3.3	Introduction to threads , exceptions and event handling in Java			
Unit-4:	**Advanced Java**			
4.1	Utility methods for arrays ,observable and observer objects , date & times ,using scanner regular expression, input/output operation in java(java.io package),streams and the new i/o capabilities ,understanding streams, the classes for input and output, the standard streams, working with file object, file i/o basics, reading and writing to files, buffer and buffer management, read/write operations with file channel, serializing objects .			**04**
4.2	Introduction to jdbc,jdbc drivers & architecture, curd operation using jdbc,			**04**

	connecting to non-conventional databases.	
4.3	Web application basics, architecture and challenges of web application, introduction to servlet, servlet life cycle, developing and deploying servlets, exploring deployment , descriptor (web.xml), handling request and response.	**08**
Lab	**Use of Programming language / Packages for actual hands on**	
01 Credit Lab	Case studies / experiments leading to independent projects / work out where students implement above core and advanced Java concepts leading to a Lab Book	**12**
Text Book		
1	Discrete Mathematical Structures- C. L. Liu, Second Edition, McGraw-Hill Book	
Reference Books		
1.	Discrete Mathematical Structures- Y N Singh, Wiley-India Press.	
2.	Discrete Mathematics for Computer Scientists and Mathematicians- J. L. Mott, A.Kandel, Prentice Hall of India.	
3.	Discrete Mathematical Structures with Applications to Computer Science- Discrete Mathematics for Computer Scientists and Mathematicians, Tata Mcgraw-Hill.	

Course Code:	SCCSE-451 B Elective	Design and Analysis of Algorithms	Credits: 3 Theory and 01 Lab	Hours required
Pre requisite				
1. Knowledge of Data structures				
Course Objectives:				
1. Reinforce basic design concepts (e.g., pseudo code, specifications, top-down) 2. Knowledge of algorithm design strategies 3. Familiarity with an assortment of important algorithms 4. Ability to analyze time and space complexity				
Course Outcome:				
1. Ability to analyze algorithm 2. Ability to propose efficient algorithms 3. Ability to think on complexity issues				
Unit-1:	**Review of Algorithms and elementary data structures**			
1.1	Understanding basic data structures and their applications with more emphasis on graphs and trees, knowledge of algorithm and their complexity notations, emphasis on asymptotic notations			**08**
1.2	Complexity analysis for algorithms on graphs including DFS,BFS , shortest path algorithms like, the Bellman-ford algorithm, the Dijkstra algorithm ,the Floyd-Warshall algorithm, the Johnsons algorithm.			
1.3	Complexity analysis for algorithms on trees including, tree searching, inseartion of node / deletion of nodes in trees, traversing trees, binary search trees trees, AVL trees			
Unit-2:	**Divide and conquer mechanism**			
2.1	Introduction, general method, algorithm complexity analysis for binary search, merger sort, quick sort, Strassen s matrix multiplication.			**08**
Unit-3:	**Advanced algorithm design methods-1**			
3.1	Greedy method, general method, container loading knapsack problem, job sequence, introduction to spanning trees , minimum spanning trees ,growing a minimum spanning tree, the algorithms of Kruskal and Prim.			**08**
3.2	Dynamic programming, general method, applications 0/1 knapsack problem, travelling sales person problem			**08**
Unit-4:	**Advanced algorithm design methods-2**			
4.1	General Backtracking method, Applications- n-queen problem, Sum of subsets problem, Graph coloring and Hamiltonian cycles			**04**
4.2	Introduction to String matching, Robin – Karp algorithm, Knuth – Morris Pratt algorithm,			**04**
4.3	Introduction to NP completeness , polynomial time , polynomial time verification , reducibility, NP completeness proofs ,NP completeness problems			**08**
Lab	**Use of Programming language / Packages for actual hands on**			
01 Credit Lab	Case studies / experiments leading to independent projects / work out where students implement above analysis of algorithm concepts leading to a Lab Book			**12**

Text Book		
1	Introduction to Algorithms, Corman , Leiserson and others , 2nd edition , PHI	
Reference Books		
1.	Data Structures, Lipschutz , Tata McGraw Hills	
2.	Design Methods and Analysis of Algorithms , S.K.Basu , PHI.	
3.	The Art of Computer Programming, Vol 1,2,3 , Dr.Kunth , Addison Wesley	

Course Code:	SCCSE-451 C Elective	Information System Security	Credits: 3 Theory and 01 Lab	Hours required
Pre requisite				
1. understanding of computer technology, including software, hardware, telecommunications and basics of internet				
Course Objectives:				
1. Identify and prioritize information assets. 2. Identify and prioritize threats to information assets. 3. Define an information security strategy and architecture.				
Course Outcome:				
1. Students will be able to plan for and respond to intruders in an information system. 2. Ability to describe legal and public relations implications of security and privacy issues. 3. Ability to present a disaster recovery plan for recovery of information assets after an incident.				
Unit-1:	**Understanding Attacks and Introduction to Security Mechanisms**			
1.1	Active attacks, passive attacks, social engineering, denial of service attacks, buffer overflow attacks, malware (viruses, trojan horses, worms)			**04**
1.2	Cryptosystems, authentication ("who you are, what you have, what you know"), intrusion detection, redundancy, disaster recover, security services, availability integrity, confidentiality authentication, non-repudiation			**04**
Unit-2:	**Terminology and Background of Cryptosystems**			
2.1	Cryptosystems, encryption, decryption, plain text and cipher text, encryption algorithms			**04**
2.2	Hash algorithms, hash concept, description of hash algorithms, message digest algorithms, secure secret key (symmetric) systems			**04**
2.3	The data encryption standard (DES), advance encryption standard (AES), block cipher operational modes, public key (asymmetric key) encryption systems concept and characteristics of public key encryption system, Rivest-Shamir-Adelman (RSA)			**04**
2.4	Introduction to digital signature algorithms, the digital signature standard (DSA), introduction to elliptic curve (EC,) cryptography			**04**
Unit-3:	**Key Management issues in security**			
3.1	Solving key distribution problem, diffie-hellman algorithm, key exchange with public key cryptography, public key infrastructure (PKI), concept of digital certificate, certificate authorities and it's roles, digital certificates types			**06**
3.2	Understanding important network security protocols and authentication protocols , knowledge of secure shell (SSH), IP security (IPSec) protocol, VPN, securing wireless networks, intruder detection and prevention, understanding malicious code (virus, worms, zombies etc.), preventing malware attacks, firewalls			**06**
Unit-4:	**The Internet Security**			

4.1	Web security, solving privacy problems ,solving authentication problems, secure socket layer (SSL) protocol secure payment protocols, secure electronic mail, pretty good privacy (PGP), secure/multipurpose internet mail extensions, handling spams (hoax, phishing, chain mails, financial) detection and prevention.	**06**
4.2	Security policy creation of policies (password, internet, e-mail and social network access policies etc.), threat analysis model, security auditing, enforcement legal issues, security awareness issues	**06**
Lab	**Use of Programming language / Packages for actual hands on**	
01 Credit Lab	Case studies / experiments leading to independent projects / work out where students implement above information system security concepts leading to a Lab Book / project report	**12**
Text Book		
1	Security in Computing (Fourth Edition)", Charles P. Pfleeger, Prentice-Hall International,	
Reference Books		
1.	Applied Cryptography Protocols, Algorithms, and Source Code in C (Second edition)", Bruce Schneier, John Wiley & Sons, Inc	
2.	Computer Security: Art and Science, Matt Bishop	

Course Code:	**SCCSCP-451**	**Course Name: Lab-4**	**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:	**SCCSCP-452**	**Course Name: Lab-5**	**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:	SCCSCP-453	Course Name: Lab 6	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:	SCCSOJ-451	On Job Training , Internship/ Apprenticeship or Field Project	Credits: 03
Course Objectives: As per the University rules and policy			
Course Outcome: As per the University rules and policy			
Experiments As per the University rules and policy			

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