



स्वामी रामानंद तीर्थ मराठवाडा विद्यापीठ

नांदेड— ४३१६०६ (महाराष्ट्र)

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY

NANDED-431606, MAHARASHTRA STATE, INDIA.



स्वामी रामानंद तीर्थ
मराठवाडा विद्यापीठ, नांदेड.

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

ACADEMIC (1-BOARD OF STUDIES) SECTION

Phone: (02462) 229542

Website: www.srtmun.ac.in

E-mail: bos.srtmun@gmail.com

Fax : (02462) 229574

संलग्नित महाविद्यालयांतील विज्ञान व तंत्रज्ञान विद्याशाखेतील पदव्युत्तर स्तरावरील प्रथम वर्षाचे CBCS Pattern नुसारचे अभ्यासक्रम शैक्षणिक वर्ष २०१९-२० पासून लागू करण्याबाबत.

प रि प त्र क

(संदर्भ : शैक्षणिक-१/परिपत्रक/पदव्युत्तर-सीबीसीएस अभ्यासक्रम/२०१९-२०/४६४, दि. ११.०७.२०१९.)

या परिपत्रकान्वये सर्व संबंधितांना कळविण्यात येते की, दिनांक ०८ जून २०१९ रोजी संपन्न झालेल्या ४४व्या मा. विद्या परिषद बैठकीतील ऐनवेळचा विषय क्र.११/४४-२०१९ च्या ठरावानुसार प्रस्तुत विद्यापीठाच्या संलग्नित महाविद्यालयांतील विज्ञान व तंत्रज्ञान विद्याशाखेतील पदव्युत्तर स्तरावरील प्रथम वर्षाचे खालील विषयांसह एकूण सतरा विषयांचे C.B.C.S. (Choice Based Credit System) Pattern नुसारचे अभ्यासक्रम संदर्भाय परिपत्रकान्वये शैक्षणिक वर्ष २०१९-२० पासून लागू करण्यात आले होते.

तथापि, त्यापैकी खालील पाच विषयांच्या अभ्यासक्रमांत काही सुधारणा करण्यात आल्या असून, त्या शैक्षणिक वर्ष २०१९-२० पासून लागू करण्यात येत आहेत.

1. Computer Management
2. Computer Science
3. Information Technology
4. Software Engineering
5. System Administration & Networking

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

‘ज्ञानतीर्थ’ परिसर,

विष्णुपुरी, नांदेड - ४३१ ६०६.

जा.क्र.: शैक्षणिक-१/परिपत्रक/पदव्युत्तर-सीबीसीएस

अभ्यासक्रम/२०१९-२०/१८१०

दिनांक : २६.१०.२०१९.

प्रत माहिती व पुढील कार्यवाहीस्तव :

- १) मा. कुलसचिव यांचे कार्यालय, प्रस्तुत विद्यापीठ.
- २) मा. संचालक, परीक्षा व मूल्यमापन मंडळ यांचे कार्यालय, प्रस्तुत विद्यापीठ.
- ३) प्राचार्य, सर्व संबंधित संलग्नित महाविद्यालये, प्रस्तुत विद्यापीठ.
- ४) साहाय्यक कुलसचिव, पदव्युत्तर विभाग, प्रस्तुत विद्यापीठ.
- ५) उपकुलसचिव, पात्रता विभाग, प्रस्तुत विद्यापीठ.
- ६) सीनिअर प्रोग्रामर, शैक्षणिक विभाग, प्रस्तुत विद्यापीठ.



स्वाक्षरित/—

उपकुलसचिव

शैक्षणिक (१-अभ्यासमंडळ) विभाग

Resolutions passed in the BoS in Computer Science and Application dated 16/09/2019

1. Revised Credit arrangements for following programs - M.Sc. programs in Affiliated colleges including Computer Science, Software Engineering, System Administration and Networking, Computer Management, Information Technology

New Resolution: There is no change in the total credits per semester or total credits per program. All above M.Sc. Degrees / programs in affiliated colleges would be of 100 Credits even now after changes. Total credits per semester are still 25. **However the credit pattern is changed in order to keep informality with other PG programs of other BoS in the faculty. These changes are as follows**

Earlier	Revised and effective from 16-09-2019
Each theory course has 04 credits which are split as 02 external credits and 02 internal credits. (50+ 50 pattern)	Each theory course has 04 credits which are split as 03 external credits and 01 internal credit. (75+25 pattern)
The university shall conduct the end semester examination for 02 external credits (50 marks).	The university shall conduct the end semester examination for 03 external credits (75 marks).
For theory internal credit, student has to appear for 02 class test (15 marks) and 01 assignment (20 marks).	For theory internal credit, student has to appear for 02 class test (10 marks each) and 01 assignment (05 marks).
Semester wise Practical / Lab examinations	--- same --- no changes
Every lab course has 02 credits which are split as 01 external credit and 01 internal credit.	--- same --- no changes
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.	--- same --- no changes
For lab external credit, 20 marks are reserved for the examinational experiment and 05 marks are for the oral / viva examinations.	--- same --- no changes
For open elective (also applicable to Open elective in professional UG programs also)	The Open elective shall have 04 credits and its assessment shall be totally internally. Any University recognized MOOC courses can be availed for this. Such courses must be of minimum 16 weeks duration in order to claim 04 credits. The credit transfer policy shall be as per the rules and regulations of the University. The MOOC course coordinator of the college shall verify the contents, validity and time duration of the MOOC course chosen by the student and the semester duration. Failure of which, students must undergo in-house open elective. More weightage for MOOC courses (above 08 credits) in campus and affiliated colleges is intentionally given by the BoS with a view that students will undergo skills based advanced courses in Computer science and allied subject discipline from reputed and recognized agencies. This will also help in wide range of elective subjects for students
Credits for Major Project development activity in Last semester	Major Project development activity is one of the core subjects in fourth semester. There will be no theory examination conducted by the university for it. The external examiner shall conduct the examination for 04 credits. The 04 credits are together for actual project demonstration, project report and project viva

Resolutions passed in the BoS in Computer Science and Application dated 16/09/2019

Contd...

Resolutions:

2. The end semester examination duration of these M.Sc. programs in the affiliated colleges, namely, Computer Science, Software Engineering, System Administration and Networking, Computer Management, Information Technology, shall be of 03 hours and a common question paper pattern shall be followed for all these PG programs. This pattern is attached below.
3. For this academic year, AY 2019-2020, for PG programs, while setting theory question papers or conducting practical examinations, related to first year, the new question paper pattern has to be followed.
4. For setting theory question papers or conducting practical examinations, related to current second year (third and fourth semesters) belonging to old syllabi and for backlog students, belonging to PG programs, the previous concerned question paper pattern for corresponding syllabi must be followed .
5. For M.Sc. programs being offered by Campus School and Latur Sub centre (namely Computer Science, Computer Application and Computer Network), there is no change in the credit pattern, total credits per semester, total credits per program and the question paper pattern.
6. For MCA programs, being offered by Campus School and affiliated colleges, there is no change in the credit pattern, total credits per semester, total credits per program and the question paper pattern.

Revised Credit pattern for M.Sc. programs in affiliated colleges (Computer Science, Software

Sr. No	Course category	Course Code	Course Title	Internal credits	External credits	Total credits
First Semester to Third Semester						
1.	Core Subjects	Same	Same	1	3	4
2		Same	Same	1	3	4
3		Same	Same	1	3	4
Choose any one from below elective subjects						
4	Elective Subject	Same	Same	1	3	4
		Same	Same			
Practical /Lab						
5	Lab / Practical	Same	Lab	1	1	2
		Same	Lab	1	1	2
6	Open Elective	Same	Same	4	0	4
		Same	Same			
7	Skill based Activity	Same	same	1	0	1
	Total credits			11	14	25

Engineering, System Administration and Networking, Computer Management, Information Technology)

Sr. No	Course category	Course Code	Course Title	Internal credits	External credits	Total credits
Fourth Semester						
1.	Core Subjects			1	3	4
2				1	3	4
3			Major Project development Activity		0	4
Choose any one from below elective subjects						
4	Elective Subject			1	3	4
Practical /Lab						
5	Lab / Practical		Lab-7	1	1	2
				Lab-8	1	1
6	Open Elective	A	University recognized MOOC (NPTEL / SWAYAM / others) OR Intra / Inter Departmental OR Intra / Inter School OR	4	0	4
		B				
7	Skill based Activity		same	1	0	1
			Total credits	10	15	25

Common Question paper pattern for M.Sc. programs (Not for Campus)

Swami Ramanand Teerth Marathwada University, Nanded
Faculty of Science and Technology
Question Paper Pattern w.e.f Academic Year 2019-2020
**M.Sc. (Computer Science /Computer Management/Information Technology/
Software Engineering/System Administration & Networking)**
First Semester & Second Semester
(CBCS Pattern- Affiliated Colleges)

Time: 03 Hrs.

Max Marks = 75

Note:

- i) All questions are Compulsory
- ii) Assume your own data if necessary
- iii) Draw well labeled diagram wherever necessary to illustrate your answers.

Q1. Attempt the Following questions.

- | | | |
|----|----|----|
| A. | | 15 |
| | OR | |
| B. | | 7 |
| C. | | 8 |

Q2. Attempt the Following Questions.

- | | | |
|----|----|----|
| A. | | 15 |
| | OR | |
| B. | | 7 |
| C. | | 8 |

Q3. Attempt the Following Questions.

- | | | |
|----|----|----|
| A. | | 15 |
| | OR | |
| B. | | 7 |
| C. | | 8 |

Q4. Attempt any one of the following

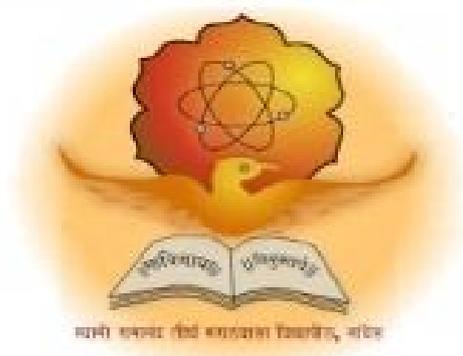
- | | | |
|----|----|----|
| A. | | 15 |
| | OR | |
| B. | | 7 |
| C. | | 8 |

Q5. Write a Short note on following (any three)

- | | | |
|----|--|----|
| A. | | 15 |
| B. | | |
| C. | | |
| D. | | |
| E. | | |

NOTE: The Questions are based on the all units in the syllabus

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



Syllabus of
M.Sc. (Computer Science)
(Affiliated colleges)
(2 years) (Revised CBCS pattern)

Introduced from Academic Year 2019-2020

M.Sc. Computer Science (Affiliated Colleges)

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

Eligibility and Fees

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

Credit Pattern

Every course has corresponding grades marked in the syllabus structure. There are 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 03 external credits and 01 internal credits. The university shall conduct the end semester examination for 03 external credits. For theory internal credit, student has to appear for 02 class test (10 marks each) and 01 assignment (05 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 04 credits which are purely internal. If students are opting for MOOCs as open elective, then, there must be a Faculty designed as MOOCs course coordinator who shall supervise learning through MOOCs. This is intentionally needed as the MOOCs course coordinator shall verify the MOOC details including its duration, starting date, ending date, syllabus contents, mode of conduction, infrastructure feasibility, and financial feasibility during start of each semester. This is precautionary as the offering of the MOOCs through online platforms are time specific and there must be proper synchronization of semester duration with the MOOCs duration. Students must opt for either institutional / college level open elective or a course from University recognized MOOCs platforms as open electives.

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

Under the CBCS pattern, students would graduate **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.

1. M.Sc. Computer Science Degree / program would be of 100 Credits. Total credits per semester= 25
2. Each semester shall consist of three core courses, one elective course, one open elective course and two practical courses. Four theory courses (core+elective) = 16 Credits. Two practical / Lab courses= 4 Credits in total (02 credits each) , One Open elective= 4 credit, One skill enhancement activity of 01 credits.
3. One Credit = 25 marks , Two Credits = 50 Marks, Four Credits = 100 Marks

PEO, PO and CO Mappings

1. **Program Name** : M.Sc.(CS) Affiliated Colleges
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 science 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,

CBCS Revised Syllabus w.e.f AY: 2019-2020
Program: M.Sc.(Computer Science) – Affiliated Colleges

Sr. No	Course category	Course Code	Course Title	Internal credits	External credits	Total credits
First Semester						
1.	Core Subjects	CS-101	Computer Architecture and Microprocessor	1	3	4
2		CS-102	OOP concepts using C++	1	3	4
3		CS-103	Mathematical Foundation for Computer Science	1	3	4
Choose any one from below elective subjects						
4	Elective Subject	CS-104 A	Relational Database Management System	1	3	4
		CS-104 B	Computer Network			
Practical /Lab						
5	Lab / Practical	CS-105	Lab -1 : C++ Programming	1	1	2
		CS-106	Lab-2: ALP using 8086 Microprocessor	1	1	2
6	Open Elective	CS-107A	University recognized MOOC (NPTEL / SWAYAM / others) OR Intra / Inter Departmental OR Intra / Inter School OR	4	0	4
		CS-107 B	Introduction to E-commerce			
7	Skill based Activity	CS-108	SK-01	1	0	1
	Total credits					25

CBCS Revised Syllabus w.e.f AY: 2019-2020
Program: M.Sc.(Computer Science) – Affiliated Colleges

Sr. No	Course category	Course Code	Course Title	Internal credits	External credits	Total credits
Second Semester						
1.	Core Subjects	CS-201	Design and Analysis of Algorithms	1	3	4
2		CS-202	Software Engineering	1	3	4
3		CS-203	Programming with VB.NET	1	3	4
Choose any one from below elective subjects						
4	Elective Subject	CS-204 A	Advanced Operating System	1	3	4
		CS-204 B	Compiler Designing			
Practical /Lab						
5	Lab / Practical	CS-205	Lab-3: VB.NET Programming	1	1	2
		CS-206	Lab-4: Based on Elective Subjects	1	1	2
6	Open Elective	CS-207A	University recognized MOOC (NPTEL / SWAYAM / others) OR Intra / Inter Departmental OR Intra / Inter School OR	4	0	4
		CS-207 B	Information Technology			
7	Skill based Activity	CS-208	SK-02	1	0	1
	Total credits					25

CS-101	Semester : I	Computer Architecture and Microprocessor	Credits: 4
Course Objectives :			
1. To develop Understanding of Internal Architecture of Computer 2. To aware students about Basics of Microprocessor & Assembly Language Programming			
Course Outcome :			
3. 1. Students will acquire skill of Assembly Language programming using 8086 Microprocessor 4. 2. Student will be familiar with Internal Processing of Computers			
Unit No.	Unit Title		No. Of Lectures
Unit-1:	Design Methodology		10
	Evolution of Computers, Introduction to system modeling, Design Methodology of Combinational and Sequential circuits-Gate level, Register level and Processor level.		
Unit-2:	Unit Title Binary Arithmetic		10
	Fixed point arithmetic's and algorithms for addition, subtraction, multiplication and division, Floating point arithmetic's and algorithms for addition, subtraction.		
Unit-3:	Unit Title Processors Design & Control Units		10
	CPU organization, Data representation, Instruction Sets –Format, types, Implementation, CICS and RISC, Control Unit-Hardwired control and design examples, Micro programmed control unit, pipeline control, Interrupt and their types and Branch Instruction processing.		
Unit-4:	Unit Title Memory Organization		10
	Memory Technologies, Memory System, Virtual memory, Memory hierarchies, Main memory -allocation, Segmentation, High speed-Cache Memory, interleaved and associative memories.		
Unit-5:	Unit Title 8085 & 8086 Microprocessor		10
	8085 Microprocessor: Architecture of 8085 Microprocessor, Features of 8085, Timing diagram of Memory read , memory write, Op code fetch and execute cycle. 8086 Microprocessor: Architecture of 8086 Microprocessor-EU and BIU, Features of 8086, Pin diagram of 8086, Addressing modes, Instruction set classification, Assembly language programming of 8086.		
Text Books			
1.	Computer Architecture & Organization by J.P Hays.		
Reference Books			
1.	Fundamentals of Microprocessors by Gaonkar		
2.	Computer System Architecture by M. Morris Mano (PHI)		
3.	Microprocessor and Interfacing: Programming and Hardware by Douglas Hall (McGraw-Hill/Glencoe)		

CS-102	Semester I	OOP Concepts using C++	Credits: 4
Course Objectives :			
<ol style="list-style-type: none"> To aware the students with the concept of Object oriented concepts To master students in advanced programming languages faster which is useful for foundation of software development. 			
Course Outcome :			
<ol style="list-style-type: none"> Students will have the conceptual knowledge of Object Oriented programming. This course will create foundation for student to learn other Object Oriented Programming Languages such as JAVA. 			
Unit No.	Unit Title	No. Of Lectures	
Unit-1:	Introduction and basic concepts of C++	10	
	Procedure Oriented Programming, Object Oriented Programming Paradigm, Basic concepts of OOP's, Benefits and Applications, Structure of C++ program.		
Unit-2:	Tokens, Operators and Functions in C++	10	
	Keywords, Identifiers, Data-types, Operators in C++, Operator precedence and associativity, Control structures, branching and looping statements, Function, function prototype, default arguments, Reference variable, call by reference, return by reference, Inline function, function overloading .		
Unit-3:	Class and object, Constructor and destructor	10	
	Class and object: Specifying a class and object, Nesting of member function, Memory allocation for objects, Static data member, static function, Friend function. Constructor and destructor: Introduction to Constructor, Types of constructor, Destructor		
Unit-4:	Inheritance and polymorphism		
	Types of inheritance, Virtual base class, Operator overloading (Unary and binary), Virtual function and there rules, Pure virtual function, Abstract class, Pointer to object, This pointer.	10	
Unit-5:	Input / Output Operation	10	
	Console I/O operation, formatted I/O, unformatted I/O, C++ classes for console I/O, C++ stream classes for file I/O, Opening and closing file, sequential and random access, Error handling during a file operation, command line arguments, Introduction to Templates.		
Text Books:			
1.	Object-Oriented Programming with C++ -E-Balgurusamy		
Reference Books:			
1.	The C++ Complete Reference -TMH Publication		
2.	Programming with C++, D Ravichandran, TMH		
3.	Let us C++ -Yashwantkanetkar		

CS-103	Mathematical Foundations for Computer Science	Credits: 4
Course Objectives:		
Cultivate clear thinking and creative problem solving. Thoroughly train in the construction and understanding of mathematical proofs. Exercise common mathematical arguments and proof strategies.		
Course Outcome:		
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. Ability to understand use of functions, graphs and their use in programming applications. Apply discrete structures into computing problems, formal specification, artificial intelligence, cryptography, Data Analysis.		
Unit-1:		
Sets, Venn diagrams, Operations on Sets, Laws of set theory, Power set and Products, Partitions of sets, The Principle of Inclusion and Exclusion.		
Unit-2:		
Propositions and logical operations, Truth tables , Equivalence, Implications ,Laws of logic, Normal Forms, Predicates and Quantifiers, Mathematical Induction.		
Unit-3:		
Relations, Paths and Digraphs, Properties and types of binary relations , Operations on relations, Closures, Warshall's algorithm, Equivalence and partial ordered relations, Poset, Hasse diagram and Lattice ,Functions: Types of functions - Injective, Surjective and Bijective Composition of functions , Identity and Inverse function, Pigeon-hole principle.		
Unit-4:		
Permutations, Combinations, Elements of Probability, Discrete Probability and Conditional Probability, Generating Functions and Recurrence Relations, Recursive Functions, Introduction to Functional Programming.		
Unit-5:		
Graphs Definitions, Paths and circuits: Eulerian and Hamiltonian, Types of graphs, Sub Graphs Isomorphism of graphs.		
Unit-6:		
Algebraic structures with one binary operation: semigroup, monoid and group, Abelian group Isomorphism, Homomorphism and Automorphism, Cyclic groups, Normal subgroups, Codes and group codes.		
Text Books:		
1.	Discrete Mathematical Structures- Bernad Kolman, Robert Busby, Pearson Education.	
2.	Discrete Mathematical Structures- C. L. Liu, Second Edition, McGraw-Hill Book	
3.	Discrete Mathematics and applications- K. H. Rosen, Tata McGraw Hill publishing	
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.	

CS-104 A Elective	Relational Database Management System	Credits: 4
Course Objectives:		
<ol style="list-style-type: none"> 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 operations. 4. To understand the functional dependencies and design of the databases. 		
Course Outcome:		
<ol style="list-style-type: none"> 1. To study the basic concepts of relational databases 2. Learn and practice data modelling using the entity-relationship and developing database designs. 3. Understand the use of Structured Query Language (SQL) and learn SQL syntax for writing queries. 4. Apply normalization techniques to normalize the databases. 		
Unit-1:	Introduction	
Problems in Traditional file oriented approach, Three level architecture of DBMS, basic database components like schema, views, instances, General Architecture of DBMS, Roles of DBA, Data Dictionary, Advantages and Disadvantages of DBMS.		
Unit-2:	DATA Models	
Concepts of Abstraction and Data Model, Discussions on data modeling using Entity Relationship model, Discussions on data modeling using Relational Model, E-R to Relational Conversion.		
Unit-3:	Relational Algebra	
Basics of Relational Algebra, selection, projection, division, cross product Operators Set Operators, Join and its types, writing Relational Algebra notations for user queries.		
Unit-4:	Basic Normalization	
Introduction to attributes, Keys, relationships and their types, Anomalies in databases, understanding Functional Dependencies(Determinant, partial, full, transitive, multi valued, etc), normalization process, First Normal form, Second Normal Form, Third Normal Form etc.		
Unit-5:	Advance Normalization	
Boyce-Codd Normal Form, Fourth Normal Form, Fifth Normal Form.		
Unit-6:	SQL	
Introduction to data retrieval languages like QBE, QUEL, SQL Discussions on SQL, Table , View Definitions ,DDL Statements, DML Statements, DCL Statements , TCL statements , SQL Functions ,Introduction to PL/SQL , Cursors.		
Text Books:		
1.	Database Management Systems- Raghuram Ramakrishnan, Johannes, Gehrke, Tata McGraw Hill.	
2.	Database System Concepts- Silber Schatz Korth, Tata McGraw Hill.	
Reference Books		
1.	Fundamental of Database System- Sham Kanth B. Navathe, Pearson Education.	
2.	Introduction to Database management System- Bipin Desai, Galgotia Publications.	
3.	Oracle Development Language Oracle PL/SQL Programming, Steven Feuerstein , O'Reilly	
4.	ORACLE documentations on ORACLE PRESS / Internet.	

CS-104 B Elective	Computer Network	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.analyze 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.analyze,specify and design the topological and routing strategies for an IP based networking infrastructure 4.Have a working knowledge of datagram and internet socket programming		
Unit-1:	Introduction to computer networks and Internet	
	Understanding of network and Internet, The network edge, The network core, Understanding of Delay, Loss and Throughput in the packet-switching network, protocols layers and their service model, History of the computer network	
Unit-2:	Application Layer	
	Principles of computer applications, Web and HTTP, E-mail, DNS, Socket programming with TCP and UDP	
Unit-3:	Transport Layer	
	Introduction and transport layer services, Multiplexing and Demultiplexing, Connection less transport (UDP), Principles of reliable data transfer, Connection oriented transport (TCP), Congestion control.	
Unit-4:	Network Layer	
	Introduction, Virtual and Datagram networks, study of router, IP protocol and addressing in the Internet, Routing algorithms, Broadcast and Multicast routing	
Unit-5:	The Link layer and Local area networks	
	Introduction and link layer services, error-detection and correction techniques, Multiple access protocols, addressing, Ethernet, switches.	
Unit-6:	Introduction to LAN	
	Devices, Topologies, Tools, Cables, Configuration	
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	

CS-105	Semester: I	Lab-1 : C++ Programming	Credits: 2
Course Objectives :			
<ol style="list-style-type: none"> 1. Get hands on experience with C++ Programming. 2. Write and execute program logic in C++ 			
Course Outcome :			
<ol style="list-style-type: none"> 1. Confidence in C++. 2. Students will be skilled to learn fundamentals of advanced internet programming languages 			
At least 15 C++ programs			

CS-106	Semester: I	Lab-2 : ALP using 8086 Microprocessor	Credits: 2
Course Objectives :			
<ol style="list-style-type: none"> 1. Get hands on experience with Assembly Language Programming. 2. Write and debug programs in TASM/MASM/hardware kits 			
Course Outcome :			
<ol style="list-style-type: none"> 1. Lab work will skill to apply the fundamentals of assembly level programming of microprocessors. 2. Students will be skilled to learn fundamentals of designing embedded systems 			
At least 15 Assembly language programs using 8086 Microprocessor			

CS- 107 A	First semester	Open Elective	Credits: 04
Open Elective : University recognized MOOC (NPTEL / SWAYAM / others) OR Intra / Inter Departmental courses			

OR

CS-107 B Introduction to E-Commerce

Unit	Title	Details of Topic
Unit I	Introduction to E-Commerce	E-commerce: The revolution is just beginning, E-commerce : A Brief History, Understanding E-commerce: organizing Themes
Unit II	E-commerce business models and concepts, The internet and World Wide Web: E-commerce infrastructure	E-commerce Business Models, Major Business to Consumer (B2C) business models, Major Business to Business (B2B) business models, Business models in emerging E-commerce areas, How the Internet and the web change business: strategy, structure and process. The Internet: Technology Background, The Internet Today, Internet II- The Future Infrastructure, The World Wide Web, The Internet and the Web : Features
Unit III	Building an e-commerce web site, Security and payment	Building an E-commerce Web Site: A systematic Approach, The e-commerce security environment, Security threats in the e-commerce environment, Technology solution, Management policies, Business procedures, and public laws, Payment system, E-commerce payment system, Electronic billing presentment and payment
Unit IV	E commerce marketing concepts, Online retailing and services	Consumer online: The Internet Audience and Consumer Behaviour, Basic Marketing Concepts, Internet Marketing Technologies, B2C and B2B E-commerce marketing and business strategies, The Retail sector, Analyzing the viability of online firms, E-commerce in action: E-tailing Business Models, Common Themes in online retailing, The service sector: offline and online, Online financial services, Online Travel Services, Online career services
Unit V	Social networks, auctions, and portals	Social networks and online communities, Online auctions, E-commerce portals

Books Recommended:

1. Kenneth C. Laudon, E-Commerce : Business, Technology, Society, 4th Edition, Pearson
2. S. J. Joseph, E-Commerce: an Indian perspective, PHI

CS-108	First semester	Skill based Activity	Credits: 01
		SK-01: PC Assembly and Maintenance	
Scope : Practically understand the PC and surrounding peripherals. The student will assemble / setup and upgrade personal computer systems; install OS and other application software, diagnose and isolate faulty components; optimize system performance and install / connect peripherals.			

Second Semester

CS-201	Semester: II	Design and Analysis of Algorithms	Credits: 4
Course Objectives :			
<ol style="list-style-type: none"> To understand the concept of designing an algorithm. To learn advance algorithm techniques that are related to real life problem. 			
Course Outcome :			
<ol style="list-style-type: none"> This course will aware the implementation of various advance algorithms to solve real world problem Students will be skilled to select appropriate design techniques to solve various problems problems. 			
Unit No.	Unit Title	No. Of Lectures	
Unit-1:	Introduction to data structure	10	
	Concepts of data and algorithm, Time and space Complexity of a given algorithm		
Unit-2:	Divide and Conquer	10	
	General Method, Binary search, Merge sort, Quick sort, Strassen's matrix multiplication		
Unit-3:	Greedy method	10	
	General method, Knapsack problem, Optimal storage on tapes, Job sequencing with deadlines, Optimal merge pattern, Minimum spanning tree, Shortest path		
Unit-4:	Dynamic Programming	10	
	The general method, Multistage graphs, Optimal binary search tree, Reliability Design, Travelling sales person problem		
Unit-5:	Basic search, traversal techniques and Backtracking	10	
	Binary tree traversal Preorder, Inorder and Postorder Traversal, Breadth first search(BFS), Depth first search(DFS), Backtracking: The general method, 8-Queens problem, Sum of subsets, Graph coloring, Hamiltonian cycle.		
Text Books:			
1.	Fundamentals of computer algorithm by Horowitz Sahani,Galgotial Publication		

CS-202	Semester: II	Software Engineering	Credits: 4
Course Objectives :			
<ol style="list-style-type: none"> To develop software engineering skills and testing plans. To understand system concepts and its application in Software development 			
Course Outcome : After completion of this course students will be able to			
<ol style="list-style-type: none"> Learn various methods of software development. Apply various software testing techniques. 			
Unit No.	Unit Title		No. Of Lectures
Unit-1:	Software and Software Engineering		10
	The Evolving Role of Software, Software Characteristics, Categories of Computer Software, The Software Myths, Software Engineering – A layered Technology, The software process, The nature of Software, Legacy Software.		
Unit-2:	Process models		10
	A generic process model, A Process Framework, The capability Maturity Model Integration (CMMI), Process Patterns ,Process Assessment, The Waterfall Model, Prototyping Model, Spiral Model, Fourth generation techniques, Personal software process, Team software process, Process Assessment and improvement.		
Unit-3:	Requirements Engineering & Design concepts		10
	Requirements Engineering, Initiating the Requirements Engineering Process, Eliciting Requirements, Negotiating Requirements, Validating Requirements, Developing use cases, Design Process and Design Quality, Design Concepts, The Design Model, Pattern Based Software Design, Web App Design Quality, Design Goals, Web App Engineering Layers, The Web Engineering Process, Web Engineering Best Practices.		
Unit-4:	Software Testing Strategies		10
	Software Testing fundamentals, A strategic Approach to software Testing, Strategic Issues, Test Strategies for Conventional Software, Validation Testing, System Testing, Debugging, White Box Testing, Black Box Testing, Control Structure Testing, System Testing, Model based Testing, Debugging Process, Debugging Strategies, Correcting the errors.		
Reference Books:			
1.	Software Engineering –A Practitioner's approach, Sixth Edition, Roger S. Pressman, McGraw-Hill Higher Education; (1 August 2007),ISBN-10: 0077227808		
2.	Software Engineering –A Practitioner's approach, Fifth Edition, Roger S. Pressman, McGraw-Hill Higher Education; (1 August 2005)		
3.	Fundamentals of Software Engineering Second Edition, Rajib Mall, Prentic-Hall India.		

CS-203	Semester: II	Programming with VB .NET	Credits: 4
Course Objectives :			
<ol style="list-style-type: none"> 1. To provide the knowledge of .Net framework along with VB.Net language 2. To skill the students for developing windows base applications. 			
Course Outcome :			
<ol style="list-style-type: none"> 1. Students will able to develop simple as well as complex applications using .Net framework 2. Students will learn to use web applications for creating GUI based programs. 			
Unit No.	Unit Title		No. Of Lectures
Unit-1:	Introduction to Visual Programming using VB.Net		10
	Event-Driven Programming , Installing Visual Basic 2010, The Visual Studio 2010 IDE 6, The Profile Setup Page, The Menu, The Toolbars, Creating a Simple Application, Windows in the Visual Studio 2010 IDE, The Toolbox, Modified Hungarian Notation, The Code Editor		
Unit-2:	Variables and Dates		10
	Comments and Whitespace: Comments, Whitespace, Data Types: Numbers, Common Integer Math Operations, Integer Math Shorthand, The Problem with Integer Math, Floating-Point Math, Other States, Single-Precision Floating-Point Numbers, Working with Strings: Concatenation, Using the Concatenation Operator Inline, More String Operations, Substrings, Formatting Strings, Localized Formatting, Replacing Substrings, Using Dates: Formatting Date Strings, Extracting Date Properties, Date Constants, Defining Date Literals, Manipulating Dates, Boolean		
Unit-3:	Storing Variables and Methods		10
	Binary, Bits and Bytes, Representing Values, Converting Values Methods: Why Use Methods?		
Unit-4:	Controlling the flow, Array and Data Structure		10
	The If Statement: The Else Statement, Allowing Multiple Alternatives with Elseif, Nested If Statements, Single-Line If Statement, Comparison Operators, Using Not Equal To, Using the Numeric Operators, The And and Or Operators, Using the And Operator, More on And and Or String Comparison, Select Case: Case-Insensitive Select Case, Multiple Selections, the Case Else Statement, Different Data Types with Select Case Loops: The For ... Next Loop, Using the Step Keyword, Looping Backwards, the For Each ... Next Loop, The Do ... Loop Loops, Do While ... Loop, Acceptable Expressions for a Do ... Loop, Other Versions of the Do ... Loop, Nested Loops, Quitting Early, Quitting Do ... Loops, Infinite Loops Data Structure Arrays: Defining and Using Arrays, Using For Each ... Next, Passing Arrays As Parameters, Sorting Arrays, Going Backwards, Initializing Arrays with Values		
Unit-5:	Building Windows Applications and Menus		10

	<p>The If Statement: The Else Statement, Allowing Multiple Alternatives with ElseIf, Nested If Statements, Single-Line If Statement, Comparison Operators, Using Not Equal To, Using the Numeric Operators, The And and Or Operators, Using the And Operator, More on And and Or String Comparison,</p> <p>Select Case: Case-Insensitive Select Case, Multiple Selections, the Case Else Statement, Different Data Types with Select Case</p> <p>Loops: The For ... Next Loop, Using the Step Keyword, Looping Backwards, the For Each ... Next Loop, The Do ... Loop Loops, Do While ... Loop, Acceptable Expressions for a Do ... Loop, Other Versions of the Do ... Loop, Nested Loops, Quitting Early, Quitting Do ... Loops, Infinite Loops</p> <p>Data Structure Arrays: Defining and Using Arrays, Using For Each ... Next, Passing Arrays As Parameters, Sorting Arrays, Going Backwards, Initializing Arrays with Values</p> <p>Understanding Menu Features: Images, Access Keys, Shortcut Keys, Check Marks, The Properties Window, Creating Menus: Designing the Menus, Adding Toolbars and Controls, Coding Menus, Coding the View Menu and Toolbars</p>	
Text Books:		
1.	Visual Basic.Net Paperback – 2004 by Shirish Chavan (Author), pearson publications	
Reference Books:		
1.	.NET 4.5 Programming 6-in-1, Black Book Paperback – 2013 by Kogent Learning Solutions Inc. (Author)	
2.	Programming VB .NET (English, Paperback, Morrison Jonathan)	

CS-204 A Elective	Semester: II	Advanced Operating System	Credits: 4
Course Objectives :			
<ol style="list-style-type: none"> To learn the mechanisms of OS to handle processes and threads and their communication To learn the advanced mechanisms involved in process , file and memory management in contemporary OS 			
Course Outcome :			
<ol style="list-style-type: none"> Students will be able to Analyze the structure of OS and basic architectural components involved in OS design Students will be able to Conceptualize the components involved in designing a contemporary OS 			
Unit No.	Unit Title	No. Of Lectures	
Unit-1:	Introduction to UNIX/Linux Kernel	10	
	System Structure, User Perspective, Assumptions about Hardware, Architecture of UNIX Operating System, Concepts of Linux Programming-Files and the File system, Processes, Users and Groups, Permissions, Signals, Inter-process Communication		
Unit-2:	File and Directory I/O	10	
	Buffer headers, structure of the buffer pool, scenarios for retrieval of a buffer, reading and writing disk blocks, inodes, structure of regular file,		

	open, read, write, lseek, close, pipes, dup, open, creat, file sharing, atomic operations, dup2, sync, fsync, and fdatasync, fcntl, /dev/fd, stat, fstat, lstat, file types, Set-User-ID and Set-Group-ID, file access permissions, ownership of new files and directories, access function, umask function, chmod and fchmod, sticky bit, chown, fchown, and lchown, file size, file truncation, file systems, link, unlink, remove, and rename functions, symbolic links, symlink and readlink functions, file times, utime, mkdir and rmdir, reading directories, chdir, fchdir, and getcwd, device special files	
Unit-3:	Process Environment, Process Control and Process Relationships	10
	Process states and transitions, layout of system memory, the context of a process, saving the context of a process, sleep, process creation, signals, process termination, awaiting process termination, invoking other programs, the user id of a process, changing the size of the process, The Shell, Process Scheduling	
Unit-4:	Memory Management	10
	The Process Address Space, Allocating Dynamic Memory, Managing Data Segment, Anonymous Memory Mappings, Advanced Memory Allocation, Debugging Memory Allocations, Stack-Based Allocations, Choosing a Memory Allocation Mechanism, Manipulating Memory, Locking Memory, Opportunistic Allocation (TextBook-1: Chapter 8) Swapping, Demand Paging	
Unit-5:	Signal Handling	10
	Signal concepts, signal function, unreliable signals, interrupted system calls, reentrant functions, SIGCLD semantics, reliable-signal technology, kill and raise, alarm and pause, signal sets, sigprocmask, sigpending, sigsetjmp and siglongjmp, sigsuspend, abort, system function revisited, sleep	
Text Books:		
1.	Linux System Programming, O'Reilly, by Robert Love.	
Reference Books:		
1.	Windows Internals, Microsoft Press, by Mark E. Russinovich and David A. Soloman.	
2.	The Design of the UNIX Operating System, PHI, by Maurice J. Bach.	
3.	Advanced Programming in the UNIX Environment, Addison-Wesley, by Richard Steve	

CS-204 B Elective	Semester: II	Compiler Designing	Credits: 4
Course Objectives :			
<ol style="list-style-type: none"> 1. Describe the design of a compiler including its phases and components. 2. To explore the students step by step conversion of Source program into Object code 			
Course Outcome :			
<ol style="list-style-type: none"> 1. To realize the students basics of compiler design and apply for real time applications. 2. Students will get knowledge about compiler generation tools and techniques 			
Unit No.	Unit Title		No. Of

		Lectures
Unit-1:	Introduction to Compilers and Programming Languages	10
	Compilers and translators, The structure of compiler, Compiler writing tools, High level programming languages, Definitions of programming languages, A lexical and syntactic structure of a language, Data structures, Operators, Statements	
Unit-2:	Lexical Analysis & Syntax Analysis	10
	Lexical analysis, Role of a Lexical analyzer, A simple approach to the design of lexical analyzer, regular expressions, Syntax analysis, Finite automata, Minimizing number of states of a DFA, Implementation of a lexical analyzer, Context free grammars	
Unit-3:	Basic parsing techniques	10
	Introduction to parsers, Shift reduce parsing, Top-down parsing, Operator Precedence parsing, Predictive parsers, LR, SLR and LALR parsers.	
Unit-4:	Syntax Directed Translation and Symbol tables	10
	Introduction, Syntax directed Schemes5.3 Implementation of Syntax directed translators, Intermediate code, Postfix notation and evaluation of postfix expressions, Parse trees and syntax trees Symbol Tables -The contents of a symbol table, Data structures for a symbol table	
Unit-5:	Error detection and recovery and Code Optimization	10
	Errors, Lexical-phase errors, Syntactic phase errors, Semantic errors. Introduction to Code Optimization: Sources of optimization, Loop optimization	
Text Books:		
1.	Principals of Compiler Design By Alfred V. Aho, Jeffrey D. Ullman	
Reference Books:		
1.	Compilers - Principles, Techniques and Tools - A.V. Aho, R. Shethi and J.D.	
2.	Introduction to System Software By D. M. Dhamdhere	
3.		

CS-205	Semester: II	Lab-3 : Vb.Net Programming	Credits: 2
At least 15 programs covering all theoretical aspects. Concerned teacher shall frame these experiments well in advance, before commencement of the semester			

CS-206	Semester: II	Lab-4 : Based on Elective Subject CS-204 A or CS-204 B	Credits: 2
At least 15 programs covering all theoretical aspects. Concerned teacher shall frame these experiments well in advance, before commencement of the semester			

CS- 207 A	Second semester	Open Elective	Credits: 04
Open Elective : University recognized MOOC (NPTEL / SWAYAM / others) OR Intra / Inter Departmental courses			

OR

Course Code: CS-207 B
Paper Title: Information Technology

Course Objectives:

1. Introduce students to foundation of Information technology

Course outcome: After completion of this course student will be able to:

1. Understand basic concepts in IT and their use in actual working

Unit 1: Computer Organization, Memory and Storage

Introduction, Basic Computer Organization, Input Devices, Output Devices, Central Processing Unit, The System Bus Architecture, Memory or Storage Unit

Unit 2: Information Technology Basics

Introduction, Need for Information Storage and Processing, Information Technology Components, Role of Information Technology, Information Technology and the Internet

Unit 3: Internet and its Tools

Introduction, Internet Evolution, Basic Internet Terminology, Data over Internet, Modes of Data Transmission, Types of Networks, Types of Topologies, Protocols used in the Internet, Getting Connected to Internet Applications, Internet Applications, Computer Ethics,

Unit 4: Emerging Trends in IT

Introduction, Electronic Commerce (E-Commerce), Electronic Data Interchange (EDI) Smart Cards, Mobile Communication, Internet Protocol TV

Unit 5: Computer Programming and Languages

Introduction, Planning a Computer Program, Steps for Program Development ,Problem Solving Tools, Program Control Structures, Generations of Computer Languages, Program Methodology, Programming Models

Reference books

Fundamentals of Information Technology, Wiley India Editorial Team, ISBN: 9788126543557

CS- 208	Second semester	Skill based Activity SK-02: Networking Essentials	Credits: 01
Scope : Networking Essentials deals with knowing what is a network, how to install, configure, and troubleshoot a computer network It includes knowledge of the fundamental building blocks that form a modern network, such as various cables, switches, routers, connectors, LAN-NIC cards and network operating systems. It then provides in-depth coverage of the most important concepts in contemporary networking like connecting computers/ peripherals, servers and clients, Wi-Fi connectivity, etc. Students are expected to have the skills to build a network / LAN from scratch and maintain, upgrade, and troubleshoot an existing network.			

The Question paper pattern is as below

Common Question paper pattern for M.Sc. programs (Not for Campus)

Swami Ramanand Teerth Marathwada University, Nanded
Faculty of Science and Technology
Question Paper Pattern w.e.f Academic Year 2019-2020
**M.Sc. (Computer Science /Computer Management/Information Technology/
Software Engineering/System Administration & Networking)**
First Semester & Second Semester
(CBCS Pattern- Affiliated Colleges)

Time: 03 Hrs.

Max Marks = 75

Note:

- i) All questions are Compulsory
- ii) Assume your own data if necessary
- iii) Draw well labeled diagram wherever necessary to illustrate your answers.

Q1. Attempt the Following questions.

- | | | |
|----|----|----|
| A. | | 15 |
| | OR | |
| B. | | 7 |
| C. | | 8 |

Q2. Attempt the Following Questions.

- | | | |
|----|----|----|
| A. | | 15 |
| | OR | |
| B. | | 7 |
| C. | | 8 |

Q3. Attempt the Following Questions.

- | | | |
|----|----|----|
| A. | | 15 |
| | OR | |
| B. | | 7 |
| C. | | 8 |

Q4. Attempt any one of the following

- | | | |
|----|----|----|
| A. | | 15 |
| | OR | |
| B. | | 7 |
| C. | | 8 |

Q5. Write a Short note on following (any three)

- | | | |
|----|--|----|
| A. | | 15 |
| B. | | |
| C. | | |
| D. | | |
| E. | | |

NOTE: The Questions are based on the all units in the syllabus