



स्वामी रामानंद तीर्थ मराठवाडा विद्यापीठ

नांदेड— ४३१६०६ (महाराष्ट्र)

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY

NANDED-431606, MAHARASHTRA STATE, INDIA.

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



## ACADEMIC (1-BOARD OF STUDIES) SECTION

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संलग्नित महाविद्यालयांतील विज्ञान व तंत्रज्ञान विद्याशाखेतील 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](http://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	<b>--- same --- no changes</b>
Every lab course has 02 credits which are split as 01 external credit and 01 internal credit.	<b>--- same --- no changes</b>
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.	<b>--- same --- no changes</b>
For lab external credit, 20 marks are reserved for the examinational experiment and 05 marks are for the oral / viva examinations.	<b>--- same --- no changes</b>
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. <b>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</b>
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**

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### **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
<b>First Semester to Third Semester</b>						
1.	<b>Core Subjects</b>	Same	Same	1	3	4
2		Same	Same	1	3	4
3		Same	Same	1	3	4
<b>Choose any one from below elective subjects</b>						
4	<b>Elective Subject</b>	Same	Same	1	3	4
		Same	Same			
<b>Practical /Lab</b>						
5	<b>Lab / Practical</b>	Same	Lab	1	1	2
		Same	Lab	1	1	2
6	<b>Open Elective</b>	Same	Same	4	0	4
		Same	Same			
7	<b>Skill based Activity</b>	Same	same	1	0	1
<b>Total credits</b>				<b>11</b>	<b>14</b>	<b>25</b>

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

Sr. No	Course category	Course Code	Course Title	Internal credits	External credits	Total credits
<b>Fourth Semester</b>						
1.	Core Subjects			1	3	4
2				1	3	4
3			Major Project development Activity		0	4
<b>Choose any one from below elective subjects</b>						
4	Elective Subject			1	3	4
<b>Practical /Lab</b>						
5	Lab / Practical		Lab-7	1	1	2
			Lab-8	1	1	2
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
<b>Total credits</b>				<b>10</b>	<b>15</b>	<b>25</b>

**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**

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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 Management) (2**  
**years)**  
(Revised CBCS pattern)

**Introduced from Academic Year 2019-2020**

# M.Sc. Computer Management

**M.Sc. Computer Management** (2years) program / degree is a specialized program in Computer Management and software development processes issues. It builds the student on higher studies and research awareness in overall designing and development of software 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 Management** 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 Management** 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 Management** 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 Management** 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. enhancement activity of 01 credits.
4. One Credit = 25 marks , Two Credits = 50 Marks, Four Credits = 100 Marks

### PEO, PO and CO Mappings

1. **Program Name** : M.Sc.( CM)
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 software engineer 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 Management 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

1. **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



## 2. 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,

<b>Sr. No</b>	<b>Course category</b>	<b>Course Code</b>	<b>Course Title</b>	<b>Internal credits</b>	<b>External credits</b>	<b>Total credits</b>
<b>First Semester</b>						
1.	<b>Core Subjects</b>	CM-101	Computer Organization and Architecture	1	3	4
2		CM-102	Relational Database Management System	1	3	4
3		CM-103	Programming in Java	1	3	4
<b>Choose one from below elective subjects</b>						
4	<b>Elective Subject</b>	CM-104 A	Data Structure and Algorithms	1	3	4
		CM-104 B	Mathematical Foundations for Computer Science			
<b>Practical /Lab</b>						
5	<b>Lab / Practical</b>	CM-105	Lab-1: Relational Database Management System	1	1	2
		CM-106	Lab-2: Programming in Java	1	1	2
6	<b>Open Elective</b>	CM-107A	University recognized MOOC (NPTEL / SWAYAM / others) OR Intra / Inter Departmental OR Intra / Inter School OR	4	0	4
		CM-107 B	Communication Skills-1			
7	<b>Skill based Activity</b>	CM-108	SK-01	1	0	1
	Total credits					<b>25</b>

<b>Sr. No</b>	<b>Course category</b>	<b>Course Code</b>	<b>Course Title</b>	<b>Internal credits</b>	<b>External credits</b>	<b>Total credits</b>
<b>Second Semester</b>						
1.	<b>Core Subjects</b>	CM-201	Operating Systems Concepts	1	3	4
2		CM-202	Technical Help Desk	1	3	4
3		CM-203	Web Designing and Content Management	1	3	4
<b>Choose any one from below elective subjects</b>						
4	<b>Elective Subject</b>	CM-204 A	Advanced Relational Database Management System	1	3	4
		CM-204 B	Computer Networks			
<b>Practical /Lab</b>						
5	<b>Lab / Practical</b>	CM-205	Lab-3: CM-203	1	1	2
		CM-206	Lab-4: Based on Elective Subjects	1	1	2
6	<b>Open Elective</b>	CM-207 A	University recognized MOOC (NPTEL / SWAYAM / others) OR Intra / Inter Departmental OR Intra / Inter School OR	4	0	4
		CM-207 B	Communication Skills-2			
7	<b>Skill based Activity</b>	CM-208	SK-02	1	0	1
	Total credits					<b>25</b>

<b>Sr. No</b>	<b>Course category</b>	<b>Course Code</b>	<b>Course Title</b>	<b>Internal credits</b>	<b>External credits</b>	<b>Total credits</b>
<b>Third Semester</b>						
1.	<b>Core Subjects</b>	CM-301	Advanced Java Programming	1	3	4
2		CM-302	Software Engineering	1	3	4
3		CM-303	Information Security and Audit	1	3	4
<b>Choose any one from below elective subjects</b>						
4	<b>Elective Subject</b>	CM-304 A	System Administration and Server Integration	1	3	4
		CM-304 B	Server and Desktop Technologies			
<b>Practical /Lab</b>						
5	<b>Lab / Practical</b>	CM-305	Lab-5: Based on CM-301	1	1	2
		CM-306	Lab-6: Based on Elective Subjects	1	1	2
6	<b>Open Elective</b>	CM-307A	University recognized MOOC (NPTEL / SWAYAM / others) OR Intra / Inter Departmental OR Intra / Inter School OR	4	0	4
		CM-307 B	Technical Writings			
7	<b>Skill based Activity</b>	CM-308	SK-03: Seminar Presentation Activity	1	0	1
	Total credits					<b>25</b>

<b>Sr. No</b>	<b>Course category</b>	<b>Course Code</b>	<b>Course Title</b>	<b>Internal credits</b>	<b>External credits</b>	<b>Total credits</b>
<b>Fourth Semester</b>						
1.	<b>Core Subjects</b>	CM-401	Software Testing	1	3	4
2		CM-402	ASP.NET using VB.NET	1	3	4
3		CM-403	Major Project development Activity	0	4	4
<b>Choose any one from below elective subjects</b>						
4	<b>Elective Subject</b>	CM-404 A	Software Project Management	1	3	4
		CM-404 B	Mobile Application Development			
<b>Practical /Lab</b>						
5	<b>Lab / Practical</b>	CM-405	Lab-7: Based on CM-402	1	1	2
		CM-406	Lab-8: Based on Elective Subjects	1	1	2
6	<b>Open Elective</b>	CM-407A	University recognized MOOC (NPTEL / SWAYAM / others) OR Intra / Inter Departmental OR Intra / Inter School OR	4	0	4
		CM-407 B	Information Communication Technology			
7	<b>Skill based Activity</b>	CM-408	SK-04	1	0	1
Total credits						<b>25</b>

**Course Code: CM-101**  
**Course Title: Computer Organization and Architecture**

**Course Objectives:**

To understand the structure, function and characteristics of computer systems. To understand the design of the various functional units and components of digital computers. To identify the elements of modern instructions sets and explain their impact on processor design. To explain the function of each element of a memory hierarchy, identify and compare different methods for computer I/O. To compare simple computer architectures and organizations based on established performance metrics.

**Course Outcomes:**

On completion of the course, student will be able to demonstrate computer architecture concepts related to design of modern processors, memories and I/Os. Analyze the principles of computer architecture using examples drawn from commercially available computers. Evaluate various design alternatives in processor organization.

**Unit I Computer Evolution and Performance**

Computer Organization and Architecture, Structure and Function, Evolution (a brief history) of computers, Designing for Performance, Evolution of Intel processor architecture- 4 bit to 64 bit, performance assessment. A top level view of Computer function and interconnection Computer Components, Computer Function, Interconnection structure, bus interconnection, Computer Arithmetic- The Arithmetic and Logic Unit, addition and subtraction of signed numbers, design of adder and fast adder, carry look ahead addition, multiplication of positive numbers, signed operand multiplication, booths algorithm, fast multiplication, integer division.

**Unit II Computer Memory System**

Characteristics of memory system, The memory hierarchy. Cache Memory- Cache memory principles, Elements of cache design- cache address, size, mapping functions, replacement algorithms, write policy, line size, number of cache, one level and two level cache, performance characteristics of two level cache- locality & operations.

**Unit III Input and Output System**

External devices, I/O modules- Module function and I/O module structure, Programmed I/O overview, I/O commands, I/O instructions, Interrupt driven I/O- interrupt processing, design issues. Case Study- Study of Programmable Interrupt Controller Intel 82C59A in brief.

**Unit IV Instruction Sets**

Characteristics and Functions- machine instruction characteristics, types of operands, Case Study-Intel 8086, Types of operations- data transfer, arithmetic, logical, conversion, input-output, system control, and transfer of control, Case Study-Intel 8086 operation types.

### **Unit V Processor Organization**

Processor organization, Register organization- user visible registers, control and status registers, Case Study- register organization of microprocessor 8086. Instruction Cycle- The machine cycle and Data flow. Instruction Pipelining- Pipelining Strategy, pipeline performance, pipeline hazards, dealing with branches.

### **References:**

1. John P Hays, —Computer Architecture and Organization, McGraw-Hill Publication, 1998, ISBN:978-1-25-902856-4, 3rd Edition.
2. Miles Murdocca and Vincent Heuring, —Computer Architecture and Organization- an integrated approach, Wiley India Pvt. Ltd, ISBN:978-81-265-1198-3, 2nd Edition
3. A. Tanenbaum, —Structured Computer Organization, Prentice Hall of India, 1991 ISBN: 81 – 203 – 1553 – 7, 4th Edition

**Course Code: CM-102**  
**Course Title: Relational database Management System**

**Course Objective:-**

To teach fundamental concepts of RDBMS (MySQL) To teach principles of databases To teach database management operations To teach data security and its importance To teach client server architecture

**Course Outcome:**

Able to Create database Tables, Able to design database

**Unit I: MySQL**

Creating a Database and Tables, Inserting, Selecting, Ordering, Limiting, Grouping, Analyzing and Manipulating Data, Changing, Deleting, Searching, Importing Data, Command Line Interface, Database and Table Schema Statements, Data Manipulation Statements and Functions, Table Statements and Functions, Replication Statements and Functions, Stored Routine Statements, Aggregate Clauses, Aggregate Functions, String Functions, Date and Time Functions, Mathematical Functions Unit

**Unit II: Transaction Concepts**

Describe a transaction, properties of transaction, state of the transaction. Executing transactions concurrently associated problem in concurrent execution. Schedules, types of schedules, concept of serializability, precedence graph for Serializability. Ensuring Serializability by locks, different lock modes, 2PL and its variations. Basic timestamp method for concurrency, Thomas Write Rule. Locks with multiple granularity, dynamic database concurrency (Phantom Problem), Timestamps versus locking. Deadlock handling methods

**Unit III: Database Security Concepts**

Introduction to database security concepts , Methods for database security, Discretionary access control method, Mandatory access control and role base access control for multilevel security, Use of views in security enforcement, Overview of encryption technique for security, Statistical db security.

**Unit IV: Crash Recovery**

Failure classification, Recovery concepts, Log base recovery techniques (Deferred and Immediate update) Checkpoints, Recovery with concurrent transactions (Rollback, checkpoints, commit), Database backup and recovery from catastrophic failure, Client-Server Technology



## **Unit V: Describe client-server computing**

Evolution of Client - Server information systems. Client – Server Architecture benefits, Client Server Architecture - Components, Principles, Client Components - Communication middleware components - Database middleware components - Client Server Databases

### **References:-**

1. Fundamentals of Database Systems (4th Ed) By: Elmasri and Navathe
2. Database System Concepts (4th Ed) By: Korth, Sudarshan, Silberschatz
3. MySQL The Complete Reference By Vikram Vaswani
4. Learning MySQL by O'reilly 5. MySQL in Nut Shell by Dyer 2nd Edition

**Course Code: CM-103**  
**Course Title: Programming in Java**

**Objective:**

1. Core java introduces object oriented concepts like abstraction, inheritance, polymorphism
2. Better utilization Classes and objects, Function prototyping, Array of objects, Constructors, Operator overloading, Inheritance, Templates, Streams
3. Also covers RMI, database connectivity and web based application development

**Outcome:**

1. Students will be able to use concepts of Object Oriented Programming using java
2. Students will be able to establish the connectivity between database and Java program

**Unit I: Introduction to Core Java**

Class and Object, Object Oriented concepts with respect to Java, Interfaces, Packages and Exception Handling, Applets

**Unit II: Abstract Window Toolkit and Swing**

Components and Graphics, Containers, Frames and Panels, Layout Managers Border layout, Flow layout Grid layout, Card layout, AWT all components, Swing & Its Features ,JApplet ,Icons & Labels Button & Label, Text Field & Toggle Buttons, checkboxes , Radio buttons ,Combo Box & Lists ,Scroll panes ,Trees ,Tables ,Menu Bars & Menus ,Tool Bars ,Dialog Boxes, File Dialog , Progress Bar, Choosers

**Unit III: Multithreading and I/O**

Multithreading concepts, Thread Life cycle, Creating multithreaded application, Thread priorities, Thread synchronization. Java Input Output: Java IO package, Byte/Character Stream, Buffered reader / writer, File reader / writer, Print writer, File Sequential / Random

**Unit IV: JDBC**

Java Database Connectivity (JDBC): Introduction to JDBC, Types of JDBC Connectivity, Types of statement objects (Statement, PreparedStatement and CallableStatement), Types of resultset, ResultSetMetadata, Inserting and updating records, JDBC and AWT Connection pooling.

**Unit V: RMI and Servlet**

Introduction & Architecture of RMI, Java rmi classes and interfaces, Writing simple RMI application, Parameter passing in remote methods (marshalling and unmarshalling).

Servlet Overview & Architecture, Setting up Apache Tomcat Server, Handling HTTP Get Request, Handling HTTP Get Request Containing Data Handling HTTP Post Request

**Reference Books:**

1. Herbert Schildt, Java “The Complete Reference”, Tata McGraw-Hill
2. John Zukowski , “Mastering Java2 J2SE1.4”, PBP Publication
3. H.M Deitel, P.J. Deitel , “Java™ How to Program”, sixth Edition
4. E. Balagurusamy, “Programming With JAVA A Primer” 3rd Edition , TH.

**Course Code: CM-104 A (Elective)**  
**Course Title: Data Structure and Algorithms**

**Course Objective:**

Master the implementation of linked data structures such as linked lists and binary trees. Be familiar with advanced data structures such as balanced search trees, hash tables, priority queues and the disjoint set union/find data structure.

**Course Outcome:**

Data structures include: arrays, linked lists, binary trees, heaps, and hash tables. Students develop knowledge of applications of data structures including the ability to implement algorithms for the creation, insertion, deletion, searching, and sorting of each data structure.

**Unit I: Data Structure Concepts**

Definition of Data Structure, precondition, Examples of data structures. Kinds of data structures, logical Implementation and Application levels of data structures. Node and Representative node of data structure, Empty data structure. Mathematical Structure, hardware Structure and Storage structure. Abstract Data Type (ADT)

**Unit II: Algorithm Concepts**

Algorithm, Concept of a well posed problem, Definition of Algorithm. Recursive and iterative algorithms, Objectives of algorithms. Quality of an algorithm, Space complexity and Time complexity of algorithm, Frequency Analysis and Problem complexity.

**Unit III: Arrays**

Characteristics of an array. Definition of an Array, Positional value of a member, Base address of array, indexing of an array, Index variable, Index type. Implementation of 1-D arrays, Row and Column Major Implementations of 2-D, 3-D and n-D arrays. Simple examples illustrating address computations. Feature restricting the number of array implementations to two.

**Unit-IV: Stacks**

Stack as a data structure, Relationship component (LIFO) in stacks. Representative node for stack, uses of stack. Static and Dynamic stack. PUSH and POP operations for stack. ANSI 'C' implementations of PUSH and POP operations for stacks implemented as array and linked list. Algorithm for comparing static and dynamic stacks. Polish and reverse Polish notations. ANSI 'C' implementations of PUSH and POP operations for stacks implemented as array and linked list. Algorithm for comparing static and dynamic stacks.

**Unit V: Queues**

Queue as data structure, Relationship component (FIFO) Queue. Representative nodes Classification of queue as Linear Queue, (b) Circular Queue (c) Priority Queue. ANSI 'C' Implementations of algorithms for (a) Adding a node in queue, (b) Deleting a Node form queue Finding size of queue and (d) printing a queue, for linear And circular queues expressed as array and list.

**Reference Books:**

1. Data Structures Using "C" by Tanenbaum.
2. Data Structures and Program Design in "C" by Robert L. Kruse.
3. Fundamentals of Data Structures by Horowitz and Sahani.
4. Data Structures : An Advanced Approach Using 'C' by Esakov and Weises.
5. Data Structures and 'C' Programming by Cristopher J. Vanwyk.

**Course Code: CM-104 B (Elective)**

**Course Title: Mathematical Foundations for Computer Science**

**Course Objectives:**

To introduce the concepts of mathematical logic. To introduce the concepts of sets, relations, and functions. To perform the operations associated with sets, functions, and relations. To relate practical examples to the appropriate set, function, or relation model, and interpret the associated operations and terminology in context. To introduce generating functions and recurrence relations. To use Graph Theory for solving problems.

**Course Outcomes:**

Ability to apply mathematical logic to solve problems. Understand sets, relations, functions, and discrete structures. Able to use logical notation to define and reason about fundamental mathematical concepts such as sets, relations, and functions. Able to formulate problems and solve recurrence relations. Able to model and solve real-world problems using graphs and trees.

**Unit I: Mathematical logic:**

Introduction, Statements and Notation, Connectives, Normal Forms, Theory of Inference for the Statement Calculus, The Predicate Calculus, Inference Theory of the Predicate Calculus.

**Unit II: Set theory:**

Introduction, Basic Concepts of Set Theory, Representation of Discrete Structures, Relations and Ordering, Functions. Algebraic Structures: Introduction, Algebraic Systems, Semi groups and Monoids, Groups, Lattices as Partially Ordered Sets, Boolean algebra.

**Unit III: Elementary Combinatorics:**

Basics of Counting, Combinations and Permutations, Enumeration of Combinations and Permutations, Enumerating Combinations and Permutations with Repetitions, Enumerating Permutations with Constrained Repetitions, Binomial Coefficients, The Binomial and Multinomial Theorems, The Principle of Inclusion Exclusion.

**Unit IV: Recurrence Relations:**

Generating Functions of Sequences, Calculating Coefficients of generating functions, Recurrence relations, Solving recurrence relations by substitution and Generating functions, The method of Characteristic roots, Solutions of Inhomogeneous Recurrence Relations.

**Unit V: Graphs:**

Basic Concepts, Isomorphisms and Subgraphs, Trees and their Properties, Spanning Trees, Directed Trees, Binary Trees, Planar Graphs, Euler's Formula, Multigraphs and Euler Circuits, Hamiltonian Graphs, Chromatic Numbers, The Four-Color Problem.

## Reference Books

1. Discrete Mathematical Structures with Applications to Computer Science, J.P. Tremblay, R. Manohar, McGraw Hill education (India) Private Limited. (UNITS – I,II )
2. Discrete Mathematics and its Applications, Kenneth H. Rosen, 7th Edition, McGraw Hill education (India) Private Limited.
3. Discrete Mathematics, D.S. Malik & M.K. Sen, Revised edition Cengage Learning.
4. Elements of Discrete Mathematics, C. L. Liu and D.P.Mohapatra, 4th edition, McGraw Hill education (India) Private Limited.
5. Discrete Mathematics with Applications, Thomas Koshy, Elsevier.
6. Discrete and Combinatorial Mathematics, R. P. Grimaldi, Pearson.

**Course Code: CM-105**

**Lab-1: Relational Database Management System**

Practical's Based on RDBMS

**Course Code: CM-106**

**Lab-2: Programming in Java**

Practical's Based on Java Programming

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

OR

**Course Code: CM-107 B**  
**Course Title: Communication Skills- I**

**Objectives of the Course:**

1. To make a comprehensive use of English in day-to-day life.
2. To help Students develop the ability to learn and contribute critically.

**Course outcome:**

**By the end of this course students should be able to:**

1. Understand and demonstrate Basic English usages for their different purposes.
2. Clear entrance examination and aptitude tests.

**Unit One: Basic English Grammar,**

1. Word classes: Open Word Classes & Close Word Classes
2. Word Formation Process; Word analysis
3. Phrases: NP, VP, AdjP, AdvP, PrepP
4. Clauses: Clause Elements, Basic Structure
5. Sentences: Complex & Compound

**Unit Two: Grammar- it's Usage**

1. Tenses: Present, Past, Future
2. Voice: Active & Passive
3. Speech: Direct & Indirect
4. Common Errors in English
5. Transformation of Sentences

**Unit Two: Communication Skill & Soft Skills**

1. Communication Skills: Definition & Concept
2. Process /cycle of Communication,
3. Types/Methods of Communication,
4. Barriers of Communication
5. Soft Skills: Concept, Negotiation skills, Empathy, Manners & Etiquettes.

**Unit Three: Language Skills**

1. Language: Definition & its Characteristics.
2. Listening Skill: Process and types.
3. Speaking Skill: Process, style.
4. Reading skill : Process , Reading comprehension passage.
5. Writing Skill : Process & importance

**Unit Four: Presentation skills**

1. Seminars
2. Conference
3. Anchoring & Vote of Thanks
4. Narrating Incidents



**References:-**

1. Practical English Grammar by – A.J. Thomson
2. Mac Millan Foundation English by - R. K. Dwivedi, A. Kumar.
3. Soft Skills by - K Alex.

Group Discussion for Admissions & Jobs by – Anand Ganguly

Code: CM-108	First semester	<b>Skill based Activity</b> <b>SK- 01: PC Assembly and Maintenance</b>	Credits: 01
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.			

**Course Code: CM 201**  
**Course Title: Operating Systems Concepts**

**Course Objectives:**

To learn and understand the Concepts of operating system. To Learn and understand operating system services. The core structure, functions and design principles of operating system

**Course Outcome:**

Students will be having understanding of following concepts of Operating System Process Management, Memory Management File & I/O Management.

**Unit I: Introduction**

Architecture, Goals & Structures of O.S, Basic functions, Interaction of O. S.& hardware architecture, System calls, Batch, multiprogramming. Multitasking, time sharing, parallel, distributed & real-time O.S.

**Unit II: Process Management Process**

Concept, Process states, Process control, Threads, Uni-processor Scheduling: Types of scheduling: Preemptive, Non preemptive, Scheduling algorithms: FCFS, SJF, RR, Priority, Thread Scheduling, Real Time Scheduling. System calls like ps, fork, join, exec family, wait.

**Unit III: Concurrency control**

Concurrency: Principles of Concurrency, Mutual Exclusion: S/W approaches, H/W Support, Semaphores, pipes, Message Passing, signals, Monitors, Classical Problems of Synchronization: Readers-Writers, Producer Consumer, and Dining Philosopher problem. Deadlock: Principles of deadlock, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, System calls like signal, kill

**Unit IV: Memory Management**

Memory Management requirements, Memory partitioning: Fixed and Variable Partitioning, Memory Allocation: Allocation Strategies (First Fit, Best Fit, and Worst Fit), Fragmentation, Swapping, and Paging. Segmentation, Demand paging Virtual Memory: Concepts, management of VM, Page Replacement Policies (FIFO, LRU, Optimal, Other Strategies), Thrashing

**Unit V: I/O management & Disk scheduling:**

I/O Devices, Organization of I/O functions, Operating System Design issues, I/O Buffering, Disk Scheduling (FCFS, SCAN, C-SCAN, SSTF), RAID, Disk Cache.

**Reference Books:**

1. Operating System Concepts, 9th edition Peter B. Galvin, Greg Gagne, Abraham Silberschatz, John Wiley & Sons, Inc.
2. Modern Operating Systems-By Andrew S. Tanenbaum (PHI)
3. Operating Systems 5th Edition, William Stallings, Pearson Education India

**Course Code: CM 202**  
**Course Title: Technical Help Desk**

**Course Objectives:**

Students are prepared for entry-level employment in a variety of positions including Computer Repair/Support Technicians, Desktop Support Technicians, Help Desk Technicians, and Networking Support. Demonstrate expertise in the resolution of end user incident requests involving troubleshooting and configuration of hardware, software and network settings. Graduates can communicate effectively, either independently or in a team, to solve problems using computers and computer repair principles.

**Course Outcome:** Upon Completion of this course, the student can, Define the role of help desk and customer service in an organization I. Introduction to Help Desk Service Tools, technology, and Techniques. Evaluate help desk technology, tools and techniques.

**Unit I: Introduction to Computer User Support**

Identify how changes in computer technology over time have affected computer use. Classify end users. Identify resources computer users need and major categories of end-user software. Identify common problems encountered by users. Identify job market demand for user support workers. List common ways to organize and provide support services. Identify typical position descriptions for user support staff. Identify knowledge, skills, and abilities required for an entry-level support position. Identify career paths for user support workers.

**Unit II: Customer Service Skills for User Support Agents**

Name important communication and interpersonal skills and customer service relationships for support agents. Specify reasons support agents must listen and read carefully. Demonstrate how agents build and communicate understanding. Identify important aspects of effective speaking and nonverbal communication. List how support agents develop a personal communication style. Identify strategies support agents use for telephone communications. Identify how support agents develop an incident management strategy. Identify how developing an understanding of different personality types and work styles can help an agent. Formulate strategies support agents use to handle difficult clients.

**Unit III: Skills for Troubleshooting Computer Problems**

Identify the troubleshooting process and the thinking skills required for successful troubleshooting. Identify communication skills for troubleshooting. Identify information resources to help solve computer problems. Identify diagnostic and repair tools used to

troubleshoot computer problems. Formulate strategies for troubleshooting. Identify how to develop your own approach to problem solving.

#### **Unit IV: Help Desk Operation**

Identify Help desk operational procedures. Analyze a multilevel support model. Describe the incident management process. Describe best practices in help desk operation. Describe the physical layout of help desk work areas. List types of job stress in help desk work. Identify hardware and software tools used by support agents, managers, and end users. Describe help desk industry trends.

#### **Unit V: Product Evaluation Strategies and Support Standards**

Describe how product and support standards emerged. Identify common tools and methods for evaluating and selecting computer products. Identify information resources and decision-making tools for evaluating and selecting computer products. Describe typical product support standards. How organizations develop and implement support standards.

#### **Reference Books:**

1. Computer User Support for Help Desk and Support Specialists, 6th Edition. ISBN-10: 1-285-85268-0 ISBN-13: 978-1-285-85268-3 Author: Fred Beisse Publisher: Cengage Learning Copyright: 2015, 2013, 2010

**Course Code: CM-203**

**Course Title: Web Designing and Content Management**

**Course Objective:**

Web Design course, students will use a variety of design software to organize, create, publish, and manage a web site. Course content includes creating a variety of graphic elements including video, animations, rollover effects, backgrounds, and page images.

**Course Outcome:**

The course activities will encourage you to practice and be used to assess your success in achieving these outcomes. Understand the various platforms, devices, display resolutions, viewports, and browsers that render websites. Recognize the various tools to plan, design, code, and share projects/documents. Understanding key terms about semantic web, knowledge management and content management technologies

**Unit I: Web Design Principles**

Basic principles involved in developing a web site. Planning process. Five Golden rules of web designing. Designing navigation bar, Page design, Home Page Layout, Design Concept.

**Unit II: Basics in Web Design**

Brief History of Internet, What is World Wide Web, Why create a web site, Web Standards, Audience requirement.

**Unit III: Introduction to HTML**

What is HTML, HTML Documents, Basic structure of an HTML document, creating an HTML document, Mark up Tags, Heading-Paragraphs, Line Breaks, HTML Tags. Introduction to elements of HTML, Working with Text, Working with Lists, Tables and Frames, Working with Hyperlinks, Images and Multimedia

**Unit IV: Introduction to Web Publishing or Hosting**

Creating the Web Site, Saving the site, Working on the web site, Creating web site structure, Creating Titles for web pages , Themes-Publishing web sites.

**Unit V: Content Management Systems**

Introduction to CMS, advantages using CMS, CMS development tools: Word press, Drupal, Joomla. Wordpress: content and conversion, directory, file structure, local working, component administration, core, loop, data management, Wordpress as CMS, Wordpress in enterprise.

Website Deployment: Domain registration, Domain hosting, parking websites, uploading data using FTP, email configuration. AJAX

**Reference book:**

1. Joomla! 3: Beginner's Guide (2013). Eric Tiggeler. Packt Publishing, ISBN-13: 978-1-78216-434-0
2. (SPHT) SharePoint 2013 How To (2013). Ishai Sagi. Sams, ISBN-13: 978-0-672-33447-3.
3. (SPIO) Microsoft SharePoint 2013 Inside Out (2013). Shadravan D., Coventry P., Resing T., Wheeler C. Microsoft Press, ISBN-13: 978-0-7356-6699-3.
4. Ivan Bayross, "Web Enabled Commercial Application Development Using HTML, JavaScript, DHTML and PHP", 4th Edition, BPB Publications.
5. Jason Hunter, "Java Servlet Programming", 2nd Edition, O'reilly Publications

**Course Code: CM-204 A (Elective)**

**Course Title: Advanced Relational Database Management System**

**Course Objective:**

The objective of the course is to present an introduction to database management systems, with an emphasis on how to organize, maintain and retrieve - efficiently, and effectively - information from a DBMS.

**Course Outcome:**

Describe the fundamental elements of relational database management systems Explain the basic concepts of relational data model, entity-relationship model, relational database design, relational algebra and SQL. Design ER-models to represent simple database application scenarios

**Unit-1: Comparison between different databases:**

Significance of Databases, Database System Applications, Advantages and Disadvantages of different Database Management systems, Comparison between DBMS, RDBMS, Distributed and Centralized DB.

**Unit-2: RDBMS and SQL:**

Relational Query Languages, The SQL Query Language, Querying Multiple Relations, Creating Relations in SQL, Destroying and Altering Relations, Adding and Deleting Tuples, Integrity Constraints (ICs), Primary and Candidate Keys in SQL, Foreign Keys, Referential Integrity in SQL, Enforcing Referential Integrity, Categories of SQL Commands, Data Definition, Data Manipulation Statements: SELECT - The Basic Form Subqueries, Functions, GROUP BY Feature, Updating the Database, Data Definition Facilities, Views, Embedded SQL \*, Declaring Variables and Exceptions, Embedding SQL Statements, Transaction Processing, Consistency and Isolation, Atomicity and Durability, Dynamic SQL.

**Unit-3: Normalization:**

Functional Dependency, Anomalies in a Database, The normalization process: Conversion to first normal form, Conversion to second normal form, Conversion to third normal form, The boyce-code normal form(BCNF), Fourth Normal form and fifth normal form, normalization and database design, Denormalization

**Unit-4: Query Optimization:**

Algorithm for Executing Query Operations: External sorting, Select operation, Join operation, PROJECT and set operation, Aggregate operations, Outer join, Heuristics in Query Optimization, Semantic Query Optimization, Converting Query Tree to Query Evaluation Plan, multiquery optimization and application, Efficient and extensible algorithms for multi-query optimization, execution strategies for SQL sub queries, Query Processing for SQL Updates



**Unit-5: Query Execution:**

Introduction to Physical-Query-Plan Operators, One-Pass Algorithms for Database, Operations, Nested-Loop Joins, Two-Pass Algorithms Based on Sorting, Two-Pass, Algorithms Based on Hashing, Index-Based Algorithms, Buffer Management, Parallel Algorithms for Relational Operations, Using Heuristics in Query Optimization, Basic Algorithms for Executing Query Operations.

**Reference Books:**

1. Database Systems Concepts, design and Applications Singh, S. K. Pearson Education, New Delhi, 2012.
2. Sql/ Pl/SQL Bayross, Ivan BPB.
3. An Introduction to Database Systems Date, C. J. Pearson Education, New Delhi, 2012

**Course Code: CM-204 B (Elective)**

**Course Title: Computer Networks**

### **Course Objective**

To educate concepts, vocabulary and techniques currently used in the area of computer networks. To master the terminology and concepts of the OSI model and the TCP/IP model. To be familiar with wireless networking concepts. To be familiar with contemporary issues in networking technologies.

### **Course Outcome**

To understand the organization of computer networks, factors influencing computer network development and the reasons for having variety of different types of networks. To apply knowledge of different techniques of error detection and correction to detect and solve error bit during data transmission. To design a network routing for IP networks. To explain how a collision occurs and how to solve it. To demonstrate proper placement of different layers of ISO model and illuminate its function. To learn Internet structure and can see how standard problems are solved in that context. To determine proper usage of the IP address.

### **Unit I: Introduction To Computer Networks:**

Introduction: Definition of a Computer Network; What is a Network?, Components of a computer network: Use of Computer networks; Networks for companies, Networks for people, Social Issues: Classification of networks; Based on transmission technology, Based on their scale, Local area networks, Metropolitan area networks, Wide area networks, Wireless networks:

### **Unit II: Network Software & Network Standardization:**

Introduction: Networks Software; Protocol hierarchy, Design issues for the layers, Merits and De-merits of Layered Architecture, Service Primitives: Reference models; The OSI Reference Model, The TCP/IP Reference Model, Comparison of the OSI & the TCP/IP Reference Models: Network standardization; Who's who in the telecommunication world?, Who's who in the standards world, Who's who in the Internet standards world?:

### **Unit III: Data Communications:**

Introduction: Theoretical basis for communication; Fourier analysis, Band limited signals, Maximum data rate of a channel: Transmission impairments; Attenuation distortion, Delay distortion, Dispersion, Noise: Data transmission modes; Serial & Parallel, Simplex, Half duplex & full duplex, Synchronous & Asynchronous transmission:

#### **Unit IV: Physical Layer:**

Introduction: Network topologies; Linear Bus Topology, Ring Topology, Star Topology, Hierarchical or Tree Topology, Topology Comparison, Considerations when choosing a Topology: Switching; Circuit switching, Message switching, Packet switching, Implementation of packet switching, Relationship between Packet Size and Transmission time, Comparison of switching techniques: Multiplexing; FDM – Frequency division multiplexing, WDM – Wavelength division multiplexing, TDM – Time division multiplexing:

#### **Unit V: Transmission Medium:**

Introduction: Transmission medium; Guided & Unguided Transmission medium, Twisted pair, Coaxial cable, Optical fiber, Comparison of fiber optics and copper wire: Wireless transmission; Electromagnetic spectrum, Radio transmission, Microwave transmission:

#### **Reference Book:**

1. Computer Networking- A Top-Down approach, 5th edition, Kurose and Ross, Pearson
2. Computer Networks- A Top-Down approach, Behrouz Forouzan, McGraw Hill
3. Computer Networks (4th edition), Andrew Tanenbaum, Prentice Hall
4. Computer Networking and the Internet (5th edition), Fred Halsall, Addison Wesley
5. Data Communications and Networking (4th edition), Behrouz Forouzan, McGraw Hill 6.  
TCP/IP Protocol Suite (3rd edition), Behrouz Forouzan, McGraw Hill

**Course Code: CM-205**

**Course Title:** Lab-3: Web Design and Content Management

Practical's based on Web Design and content Management

**Course Code: CM-206**

**Course Title:** Lab-4: Based on Elective Subjects

Code: CM- 207 A	First semester	<b>Open Elective</b>	Credits: 04
<b>Open Elective : University recognized MOOC (NPTEL / SWAYAM / others) OR Intra / Inter Departmental courses</b>			

OR

**Course Code: CM-207 B**  
**Course Title: Communication Skills-2**

**Objectives of the Course:**

1. A comprehensive use of English in day-to-day life.
2. To help Students develop the ability to learn and contribute critically.

**Course outcome:**

By the end of this course students should be able to:

1. Understand and demonstrate Basic English usages for their different purposes.
2. Clear entrance examination and aptitude tests. life.

**Unit one: Phonetics: Study of Speech Sounds**

1. Phonemes: Consonants (24) Vowels (20),
2. Stress; Three Term Label,
3. Intonation,
4. Word Transcription,
5. Sentence Transcription.

**Unit two: Soft Skills**

1. Soft Skills: Leadership Skills,
2. Soft Skills: Time management,
3. Soft Skills: Stress management,
4. Conflict Management,
5. Meditation.

**Unit Three : Career Skills**

1. Group Discussion,
2. Personal Employment Interview,
3. Telephonic Etiquettes & Interview,
4. Report Writing: Formal & Informal Report Writing,
5. Meetings.

**Unit Four: Creative Writing & Situational English**

1. Creative writing: Narrating a situation,
2. Situational English: Greetings, Introducing, Inviting, Thanking, Enquiring, Complimenting, Complaining etc.
3. Note Making & Note Taking ,
4. Dialogue writing,
5. Formal Letters Writing: Job Application, Curriculum Vitae, Supply Orders, Complaint letters.

**Reference Books:**

1. Mac Millan Foundation English by - R. K. Dwivedi, A. Kumar.
2. Developing communication Skills by - Krishna Mohan, Meera Banerji
3. Soft Skills by - K Alex.
4. Spoken English- Level one by - G Radhakrishana Pillai, K Rajeevan
5. Personality Development & Communicative English by - Dr. T. Bharti

**Course Code: CM-208**

**Course Title: SK-02**

Code: CM- 208	Second semester	<b>Skill based Activity</b> <b>SK-02: Network Essentials</b>	Credits: 01
<p><b>Scope :</b> 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. Technology like 4G, 5G etc</p>			

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**

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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**  
**Choice Based Course Credit System (distribution and details of CBCS System)**

**M.Sc. (CM) First Year (Two Semester)**

<b>Semester-I</b>					
<b>Course Code</b>	<b>Title of the Paper</b>	<b>External credit</b>	<b>Internal credit</b>	<b>Total credit</b>	<b>No. of Classes</b>
M.SC. CM-101	Elements of Information Technology	3	1	4	40hrs
M.SC. CM-102	Introduction to Programming in “C”	3	1	4	40hrs
M.SC. CM-103	Operating System	3	1	4	40hrs
M.SC. CM-104	Management Information System	3	1	4	40hrs
M.SC. CM-105	Lab-1 ( EIT+OS)	1	1	2	60hrs
M.SC. CM-106	Lab-2 ( Programming in C )	1	1	2	60hrs
<b>Total Credits</b>		<b>14</b>	<b>6</b>	<b>20</b>	<b>280 hrs</b>

<b>Semester-II</b>					
<b>Course Code</b>	<b>Title of the Paper</b>	<b>External credit</b>	<b>Internal credit</b>	<b>Total Credits</b>	<b>No. of Classes</b>
M.SC. CM-201	RDBMS AND Oracle PL/SQL	3	1	4	40hrs
M.SC. CM-202	Programing in C++	3	1	4	40hrs
M.SC. CM-203	Software Engineering	3	1	4	40hrs
M.SC. CM-204	Programing with Visual Basic 6.0	3	1	4	40hrs
M.SC. CM-205	<b>Elective-II</b>	3	1	4	40hrs
	1: Next Generation Networks				
	2: ADHOC & Sensor Networks				
	3: System & Network Administration				
M.SC. CM-206	Lab-3(Oracle PL/SQL+ C++)	1	1	2	60hrs
M.SC. CM-207	Lab-4(Visual Basic 6.0)	1	1	2	60hrs
M.SC. CM-208	Seminar	1	0	1	40hrs
<b>Total Credits</b>		<b>18</b>	<b>7</b>	<b>25</b>	<b>360hrs</b>





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**M.Sc. CM-101**

**Elements of Information Technology**

**(4 Credits)**

**UNIT I: Introduction to Computers**

What is Computer? Definition, Characteristics, Basic Building blocks, History & Generations  
Hardware Devices & Storage Devices, Input device - keyboard, Mouse, Web Camera, Scanner  
Output Device - Monitor, Printer, Plotter, and Memory devices - primary & secondary memory devices (FDD, HDD, CD, Tape and DVD)

**UNIT II: Data Representation**

Need for binary system, Conversion, Conversions from binary to others, Conversions from others to binary, Fraction Conversions, Binary Arithmetic's - Addition, Substation, Multiplication, and Division  
Representation of characters- ASCII, EBCDIC, Logic Gates (AND, OR, NOT), Flip Flop

**UNIT III: Computer Software & Operating System (DOS)**

What is software?, Relationship between Hardware & Software, Types of software & examples, Compilers & interpreter, Definition, Commands, Internal Commands, External Commands

**UNIT IV: Networking concepts**

LAN, WAN, MAN, Classification- serial, simplex, duplex, half duplex, Topologies, OSI Model

**UNIT V: Introduction of Database**

What is Database?, Simple & Relational Database, Defining Structure of Database file, Saving a database file, Opening & closing Database file, Modifying Database Structure ,

**UNIT VI: Database Commands using FoxPro**

Appending data, Editing & Changing Data, Viewing a database, List Command (All Options)  
Display Command, Browse option, searching the information with Locate Command, Record Pointer Deleting Records, Global Replacement with Replace Command

**REFERENCE BOOKS –**

1. FoxPro 2.5 Made Simple For Dos & Windows - By R.K. Taxali, BPB Publication, 2003, ISBN-8170296897
2. Computer Fundamentals - By Sinha, P. K. BPB Publications 2004 ISBN – 8176567523
3. Computer Networks - By Andrew S. Tanenbaum, David J. Wetherall, 5th Edition , 2010 ISBN - 978-0132126953 ISBN-10: 0132126958
4. MS- DOS - By Peter Norton, Sams Publishing, 1994, ISBN 067230614X, 9780672306143



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5. Introduction to computer -By Peter Norton, Fifth Edition, McGraw-Hill, 2002 , ISBN 0078454484, 9780078454486
6. Elements of Digital Computers - By Thomas Barteet, Second Edition, McGraw-Hill, 1966.



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**M.Sc. (CM) First Year (Two Semester)**

**M.Sc. CM-102                      Introduction to Programming in “C”                      (4 Credits)**

**UNIT I: Getting Started With C:**

History, Importance of C, Basic Structure of C program, Pre-processor, C Character set, C Tokens, Identifiers & Keywords, Constants, Variables, Data Types, Strings, Operators, Type Casting.

**UNIT II: Decision making, branching, & looping statements:**

Introduction, Decision making with, If statement, If-Else statements, Nested If-Else statements, Else If ladder, switch statement, Looping statements, WHILE statement, DO – while statement, For Statement.

**UNIT III: Storage Classes & Arrays:**

Storage class, types, what is Array? Array Types, Bounds checking, Passing array elements to a function.

**UNIT IV: Functions & pointers:**

What is a function?, Advanced Features of Functions, Call by Value & Call by References, Recursion, Introduction to pointers, Pointers & Arrays, Arrays of Pointers, Function Returning Pointers, Pointers to functions.

**UNIT V: Structures & Unions:**

Introduction to structures, Structure variables, Arrays within structure, Structure within structure, Introduction to Union

**UNIT VI: Input Output Functions in C:**

Console I/O Functions, Disk I/ O Functions, What are strings? String functions, Dynamic Memory Allocation

**Reference Books:**

1. Programming in ANSI C – By E. Balagurusamy, Tata McGraw-Hill Education, 2004 ISBN 0070534772, 9780070534773
2. Let Us C - By Yeshwant Kanetkar Infinity Science Press, 8th edition, 2008, ISBN - 1934015253
3. Pointers in C - By Yeshwant Kanetkar, 4th Edition, BPB Publications 2009 ISBN -9788176563581



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**M.Sc. (CM) First Year (Two Semester)**

**M.Sc. CM-103**

**Operating System**

**(4 Credits)**

**UNIT I: Introduction to Operating System:**

Definition of Operating System, Importance of Operating System, Basic Concept & Terminology, Extended Machine Concept, Hierarchical Machine Concept, Multi-User, Multiprocessor, Multiprogramming, Multi-Tasking.

**UNIT II: Memory Management:**

Single Contiguous memory management, Partition Memory Management, Relocatable Partition Memory Management, Paged Memory Management, Demand Page Memory Management, Segmented Memory Management Technique.

**UNIT III: Processor Management:**

What is Process? Process State model, Context Switching, Job Scheduling, Process Control Block, Process Scheduling, Multiprocessor System

**UNIT IV: Process Synchronization:**

Race Condition, Synchronization Mechanism, Deadlock- techniques for handling deadlock.

**UNIT V: Device Management:**

Techniques of device Management, Device Characteristics, Channels & Control Units, Modules of Device Management- I/O Traffic Controller, I/O Scheduler, Device Handler

**UNIT VI: Information Management**

Simple File System, General Model of file System

**Reference Books:**

- 1) Operating System – By Stuart E. Madnick, John J. Donovan, Tata McGraw-Hill Education, 1997, ISBN - 0074632736
- 2) Operating System Concepts- By Abraham Silberschatz, Greg Gagne, Peter B. Galvin, 9<sup>th</sup> Edition, Wiley Publication, 2012, ISBN - 1118063333, 9781118063330



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**M.Sc. (CM) First Year (Two Semester)**

**M.Sc. CM-104**

**Management Information System**

**(4 Credits)**

**UNIT I: Introduction to MIS:**

Introduction, Definition of MIS, Objectives of MIS, Characteristics of MIS, Role of MIS in business organization.

**UNIT II: Management, Organization and MIS:**

Introduction, Function Concept, Managerial functions, Organization structure, Fitting MIS to Management / Organization, MIS design, Control and feedback, Law of requisite variety.

**UNIT III: Information requirements analysis:**

Definition, Information Process, Source of information, Types of information, Attributes of Information, Human as information processor, Techniques for assessing information requirements, Levels of information requirement..

**UNIT IV: Sales Budgeting & Financial Account:**

Introduction to market segmentation, Segmenting the consumer market, Product, Sales Routine, General Ledger, Profit and loss account, Balance sheet, Trial balance, Account receivables and Account payable.

**UNIT V: Manufacturing:**

Bill of Material, Capacity requirement planning-Long term, Short term planning, Material requirement planning, Production planning, Material procurement-Purchase requisition, Scrutiny, Collect Quotation from vendor, Vendor analysis and selection of them, Order preparation, Follow up, Receiving and inspection, Storage and record keeping, Invoicing and payment.

**UNIT VI: Human Resources:**

Employee database, Recruitment, Employee Appraisal, Employee Training, Leave accounting.

**Reference Books:**

- 1) **Management Information System** – By Rajlaxmi kendurkar, Vision publication, Pune.
- 2) **Management Information System** - By Dr. Milind oka, Everest publishing house, ISBN - 8176600210



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**M.Sc. (CM) First Year (Two Semester)**

**M.Sc. CM-201**

**RDBMS AND Oracle PL/SQL**

**(4 Credits)**

**UNIT I: Introduction and Basic Concepts**

Structure of DBMS, Advantages & Disadvantages of DBMS, **Relational Database** :*Attribute & Domains, Tuple , relations and their schemes*, **Relational Algebra**: *Basic Operations, additional relational algebraic Operations*, **Relational Calculus**: *Tuple Calculus, Domain Calculus*, Introduction to data constraints, Types of data constraints, Integrity rules

**UNIT II: Introductions to Tools to Oracle**

Introduction to SQL, DDL, DML commands, Data types, LOB Data type, CLOB, BLOB, BFILE SQL \*Plus, Checking the SQLPLUS Environment, Oracle & Client - Server Technology, Create Table, Alter Table, Drop Table, Insert, Update, Delete with 'where' clause Commands, Select command with all Options. SQL Queries and Function, Database views, Operation and Operator Arithmetic, Comparison, Logical

**UNIT III: Numbers and SQL Functions**

Oracle Dual Table, Query Expression Operators, Union, Minus Operator Precedence

**Character functions** - *initcap, lower, upper, trim, translate, length, Char*,

**Date functions** - *Sys\_date, now\_time, next\_date, Add\_months, Last\_day, months\_Between*

**Numeric functions** - *round, trunk, abs, cell, cos, exp, floor*,

**Conversion functions** - *To\_Char, To\_date, To\_number-*

**Group Functions** - *Avg, max, min, sum, count.* , Group by Clause, Having Clause, Expression Set operations Sub queries.

**UNIT IV: Introduction to PL/SQL**

Structure of PL/SQL Block, Condition logic, Loops, Exception Handling, Database Triggers, Introduction to Cursor & Locks PL/SQL Forms, Reports

**UNIT V: Transactions**

Transaction Concept, Transaction State, ACID Properties of Database Implementations of Atomicity and Durability, Concurrent Executions, Serializability, Recoverability

**UNIT VI: Security & Database Triggers**

Creating User, Working with Privileges (System Level Privileges, Object Level Privileges), Granting Privileges, Revoking Privileges, Working With Roles (Study of default roles, Creating roles), Granting and Revoking roles



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**Reference Books -**

1. Oracle by Ivan N. Bayross, BPB Publications (December 1, 2010), ISBN- 817656964
2. Understanding oracle by James T. Perry , Joseph G. Lateer, Sybex Inc, 1989, ISBN- 0895885344
3. Oracle Database Pl/Sql Programming By Scott Urman, Tata McGraw-Hill Education, 2004, ISBN=0070597790.
4. Oracle 9i: The Complete Reference Edition First By Kevin Loney, George Koch, McGraw-Hill Companies, 2002, ISBN-: 9780072225211



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**M.Sc. (CM) First Year (Two Semester)**

**M.Sc. CM-202**

**Programming in C++**

**(4 Credits)**

**Unit I: Introduction to OOP's**

Introduction to OOP's, Object oriented programming, Basic concept of OOP's, Benefits of OOP's, Tokens, keywords, Identifiers and constants, Basic data types, Operators in C++, Operator precedence and associativity, Structure of C++ programming Type casting, Control Structure Sequential, Branching, Looping .

**Unit II: Functions, Class, objects in C++**

Function, Function prototype, Call by value, Call by reference, Inline function , Default arguments, Function overloading, Specifying a class and object, Nesting of member function, Memory allocation for objects, Visibility modes, Static data member and member function, Friend functions, Pointer to member, Pointer to object.

**Unit III: Constructor and destructor**

Constructor, Types of constructor, Default constructor, Parameterized constructor, Copy constructor, Dynamic constructor, Destructor, operator overloading and type conversions, Concept of operator overloading, Unary and binary operator overloading, Rules for overloading, Type conversions Basic to class, Class to basic ,Class to class

**Unit IV: Inheritance and Polymorphism**

Concept of inheritance, Types of inheritance, Polymorphism ,Virtual base class, Pointer to derived class, Virtual functions, Rules for virtual functions, Pure virtual functions,

**Unit V: C++ I/O system**

C++ streams, Stream classes, Unformatted I/O, Overloading <<, Formatted console I/O operations, User define manipulator, Classes for file stream operations, Opening and closing a file, Sequential and Random access, Error Handling During file operations, Command line arguments,

**Unit VI: Templates & string manipulation**

Class Templates, Class templates with multiple Parameters, Function templates, Function templates with multiple parameters, Basic of Exception Handling, Exception handling mechanism, Creating string objects, Manipulating string objects, Relational operations, String Characteristics, Accessing characters in string.

**Reference Books:-**

1. The C++ Complete Reference - By Herbert Schildt, Tata McGraw-Hill Education, 2003, ISBN- 9780070532465





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2. Object-Oriented Programming with C++ - By E- Balagurusamy, Tata McGraw-Hill Education, 2008, ISBN- 9780070669079
3. Let us C++ - By Yashwant Kanetkar, Galgotia Publications, ISBN- 9788175153929



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**M.Sc. (CM) First Year (Two Semester)**

**M.Sc. CM-203**

**Software Engineering**

**(4 Credits)**

**UNIT I: The Product & Process**

The Evolving Role of Software, Software Characteristics, Applications of Computer Software, The Software Myths, Software Engineering – A layered Technology, Software Process Model, The Capability Maturity Model Integration (CMMI) , The Waterfall Model , Prototyping Model, Spiral Model, Fourth generation techniques

**UNIT II: Management Concepts**

Management Spectrum, The People, The Product, The Process, The Project, Players, Leaders & software team, Software scope

**UNIT III: Software process and Project Metrics**

Measures Metrics and Indicators, Metrics in the process and project domains  
Software Measurement:-  
- Size-Oriented Metrics  
- Function-Oriented Metrics  
- Extended Function Point Metrics

**UNIT IV: Software Project Planning**

Observations on Estimating, Project Planning Objectives, Software Scope, Resources, Software Project Estimation

**UNIT V: Risk Analysis and & Software Quality Assurance**

Software Risks, Risk Identification, Risk Projection, Quality Concepts, Software Quality Assurance, Software Reviews, Formal Technical Reviews

**UNIT VI: Software Testing Technique & Strategies**

Software Testing Fundamentals, White Box Testing, Basic Path Testing, Control Structure Testing, Black Box Testing, A Strategic Approach to Software Testing, Unit Testing, Integration Testing, Top-down Integration, Bottom-up Integration, Validation Testing, System Testing

**References Book -**

1. Software Engineering: A Practitioner's Approach, 7<sup>th</sup> Edition, Roger S. Pressman, McGraw-Hill, 2010 ISBN- 9780071267823.



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**M.Sc. (CM) First Year (Two Semester)**

**M.Sc. CM-204**

**Programming with Visual Basic 6.0**

**(4 Credits)**

**UNIT I: INTRODUCTION TO VISUAL BASIC-**

Event Driven Programming, Understanding VB Environment, Project explorer, Properties window, Tool Box, Form Lay Out window, Property Pages, Saving and printing pages, Running application, Code window, Naming conventions, Variables( All data types) , Scope (Global/local/static) , Constants

**UNIT II: VISUAL BASIC CONTROLS-**

Label controls, Textbox controls, Command controls, Picture Box, Image Box, Frame controls, Checkbox controls, Option Box controls, List Box controls, Combo Box, Directory, File, Drive List Box controls , Formatting controls, Control Array, Tab Order

**UNIT III: WORKING WITH FUNCTION AND CONTROL STATEMENTS**

String function, Mathematical function, Date function, Data type conversion function, If and IF-else statements, Select case statements, Do statements, For statements, Exit statements

**UNIT IV: DIALOG BOXES AND MENUS**

MSG Box, Input box, Common dialog box, Creating Menus, Adding code to menus, Other common controls (MS windows common controls 6.0, 3.6.0)

**UNIT V: ACCESSING DATA**

Reading and writing files, Data from wizard, Data control, Data grid control, DB combo box, DB List Box, SQL queries in VB, JET DAO, ADO, Error Handling

**UNIT VI: ACTIVE X CONTROL AND WINDOWS API**

Creating your own Active X control, Adding active X Control to project, Introduction to Windows API, DLL,s, Declare statements, Calling API Routine, Reports.

**Reference Books: -**

1. Mastering Visual Basic 6 – By Evangelos Petroustos, Wiley, 1998, SBN- 9780782122725
2. Programming with Visual Basic 6.0, By M Azam, Vikas Publishing House Pvt Ltd, 2001 ISBN-9788125909323
3. Peter Norton's Guide to Visual Basic 6, By Peter Norton, Michael Groh, 5<sup>th</sup> Edition, Sams, 1998, ISBN- 9780672310546
4. Visual Basic 6 Complete Guide, Greg M. Perry, Apogeo Editore, 1998, ISBN 9788873034568



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**M.Sc. (CM) First Year (Two Semester)**

**M.Sc. CM-205 (Elective -1)                      Next Generation Networks                      (4 Credits)**

**UNIT I: Converged Services for Next Generation Networks**

GSM/UMTS Network protocols: SS7 and Standard basics, Supplementary Services: UMTS procedures. Intelligent Network: IN principles, CAMEL, Services: what are the challenges? , Integration, deployment issues.

**UNIT II: Introduction to Next Generation Networks**

IMS: the convergence. NGN architecture, NGN control architectures and protocols, Multi-access to the services: 3G, Wi-Fi, DSL, Cable. TISPAN, SIP, Service architectures, Transition of networks (PSTN, IP-based) to NGN, Ipv6-based NGN, MEGACO, H.248, P2P systems, P2P SIP, Social Networks: Web-NGN convergence, Telco 2.0, IPTV, RCS. UMTS standardized on at 3GPP: Standardization process and principles in ETSI and 3GPP, Functionalities standardized in UMTS from Release 99 to Release 9. Latest 3GPP updates: what happened in 2010?

**UNIT III: Wireless Access and Transport Technologies**

RAN architecture : Radio Access Network Architecture for GSM, GPRS and UMTS, network devices, interfaces and protocols , QoS definition and management in GPRS and UMTS, Access methods and radio resource management in mobile networks, mainly for: TDMA systems

**UNIT IV: CDMA systems and OFDMA systems.**

Scheduling issues for GPRS, UMTS and WiMAX : downlink, uplink Physical to logical channel mapping: for GSM , for UMTS Procedure and protocol used for resource allocation ,PDP Context and TBF allocation.

**UNIT V: WPAN, WLAN, WMAN and Broadcast technologies**

WLAN, WPAN, WMAN, DVB-H: Introduction ,WiFi: Standards, performance, usage and applications, new evolutions ,WiMAX, DVB-H :Usage and standard, Security :Basics, architectures, algorithms, Bluetooth: Standard, performance, usage and applications , Zigbee, UWB: Standards and usage, Service discovery in wireless Networks (jxta, UPnP,...) , Security in Wireless Networks: PANs, LANs and cellular Wireless Networks Simulation (tools and methods)

**UNIT VI: Optimization: Theory and Network applications**

Graph algorithms, linear programming basics, Introduction to Integer programming, Traffic engineering, Network topology calculus, Network optimal routing and dimensioning, Frequency assignment, Pricing, Game theory.



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**Reference Books:**

1. Next Generation Network Services: Technologies & Strategies by Neill Wilkinson, Publication, Edition: 1, ISBN: 978-0-471-48667-1
2. Next Generation Networks: Perspectives and Potentials by Jingming Li Salina, Pascal Salina, Publisher: John Wiley & Sons, 2008, ISBN=0470724471
3. Next-Generation Network Services: By Robert Wood, Published Nov 1, 2005 by Cisco Press. Part of the Networking Technology series ISBN-13: 978-1-58705-159-3
4. Best Practices for Implementing Next Generation Networks (NGN) in the Asia and Pacific Region, International Telecommunication Union, Telecommunication Development Bureau, June 2012.



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**M.Sc. CM-205 (Elective -2)                      ADHOC and Sensor Networks                      (4 Credits)**

**UNIT I: Ad Hoc Wireless Networks**

Introduction. Issues in Ad Hoc Wireless Networks. Ad Hoc Wireless Internet.

**MAC Protocols for Ad Hoc Wireless Networks:**

Introduction, Issues in Designing a MAC Protocol for Ad Hoc Wireless Networks. Design Goals of a MAC Protocol for Ad Hoc Wireless Networks. Classifications of MAC Protocols. Contention-Based Protocols. Contention-Based Protocols with Reservation Mechanisms. Contention-Based MAC Protocols with Scheduling Mechanisms. MAC Protocols in Directional Antennas. Other MAC Protocols

**UNIT II: Routing Protocols for Ad Hoc Wireless Networks:**

Introduction to Routing algorithm, Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks. Classifications of Routing Protocols. Table-Driven Routing Protocols. On-Demand Routing Protocols. Hybrid Routing Protocols. Routing Protocols with Efficient Flooding Mechanisms. Hierarchical Routing Protocols. Power-Aware Routing Protocols.

**UNIT III: Transport Layer and Security Protocols for Ad Hoc Wireless Networks:**

Introduction. Issues in Designing a Transport Layer Protocol for Ad Hoc Wireless Networks. Design Goals of a Transport Layer Protocol for Ad Hoc Wireless Networks. Classification of Transport Layer Solutions. TCP Over Ad Hoc Wireless Networks. Other Transport Layer Protocols for Ad Hoc Wireless Networks. Security in Ad Hoc Wireless Networks. Network Security Requirements. Issues and Challenges in Security Provisioning. Network Security Attacks. Key Management. Secure Routing in Ad Hoc Wireless Networks.

**UNIT IV: Wireless Sensor Networks:**

Introduction. Sensor Network Architecture. Data Dissemination. Data Gathering. MAC Protocols for Sensor Networks. Location Discovery. Quality of a Sensor Network. Evolving Standards. Other Issues.

**UNIT V: Hybrid wireless Networks:**

Introduction. Next-Generation Hybrid Wireless Architectures. Routing in Hybrid Wireless Networks. Pricing in Multi-Hop Wireless Networks. Power Control Schemes in Hybrid Wireless Networks. Load Balancing in Hybrid Wireless Networks.



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**UNIT VI: Wireless Geolocation Systems:**

Introduction. What is wireless Geolocation? Wireless Geolocation System Architecture. Technologies for Wireless Geolocation. Geolocation Standards for E-911 Services. Performance Measures for Geolocation Systems. Questions. Problems.

**Recent Advances in Wireless Networks:**

Introduction. Ultra-Wide-Band Radio Communication. Wireless Fidelity Systems. Optical Wireless Networks. The Multimode 802.11 -IEEE 802.11a/b/g. The Meghadoot Architecture, introduction to vehicular sensor networks.

**Reference Books**

1. Toh, C. K., Ad hoc Mobile Wireless Networks Protocols and Systems, Prentice Hall, PTR, (2001) 3rd Edition, ISBN-0132442043
2. Principles of Wireless Networks, - A united approach - Pahlavan, Kaveh., Krishnamoorthy, Prashant., Pearson Education, (2002) 2nd ed. ISBN-13: 9780130930033
3. Wang X. and Poor H.V., Wireless Communication Systems, Pearson education, (2004) 3rd ed.
4. Mobile Communications, 2 Edition, Jochen Schiller, Pearson Education India, 2008 ISBN-9788131724262
5. Carlos De Moraes Cordeiro and Dharam P Agrawal, "Adhoc and Sensor Networks- Theory & Applications", 2nd Ed, Cambridge Univ Press India Ltd



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**M.Sc. (CM) First Year (Two Semester)**

**M.Sc. CM-205 (Elective -3) System and Network Administration (4 Credits)**

**UNIT I: System Hardware**

PC and Server Hardware Architecture, Operating System Administration: UNIX, Windows, MAC OS.

**Centralization and Decentralization:** Centralized Authentication, Active Directories; LDAP;  
**Storage:** RAID, Storage Area Network (SAN), Direct Attached Storage (DAS), Network Attached Storage (NAS); Data Integrity Backup and Recovery.

**UNIT II: System Configuration**

Cloning, Monitoring and administering them; workstations, server, Data center, Data Center Management: Administering, Surveillance, Access Control, High Performance Computing, Virtualization and Cloud Computing.

**UNIT III: Network Administration:**

**Network administrator** (definition and functions), Network Planning, Routine system maintenance

**Computer Networks:** OSI & TCP/IP Model, clean architecture;

**UNIT IV: Switching & Routing**

Layer 2 & Layer 3 switching; Routing; VLAN; Cisco L2 and L3 Switch Configuration; DHCP Configuration; IPv6, Wireless LAN: 802.11 a/b/g/n/ac WiFi; Access Point and Wireless Router configuration.

**UNIT V: Internet Architecture**

ISP Architecture; DNS Resolution; Content Mirroring, Internet Applications: DNS, Web, Mail, Proxy, NTP; **Perimeter Security:** Firewall, UTM,

**UNIT VI: Network Security**

LAN and WLAN Security issues; IP Spoofing; Dictionary Attack; DoS and DDoS Attack; Rogue/Misconfigured/External APs; Network Troubleshooting: ping, traceroute, nslookup, dig, tcpdump; Network Monitoring: SNMP; MRTG.





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**References Books:**

- [1] Thomas A Limoli, Christina J. Hogan , Strata R. Chalup " Theory and Practise of System and Network administration " Addison-Wesley Professional; 2 edition 2007
- [2] Subramaniam Mani, Subramanian " Network Management: Principles and Practice" Pearson Education India, 2006
- [3] Evi Nemeth, Garth Snyder, Trent R. Hein , Ben Whaley "UNIX and Linux System Administration Handbook" (4th Edition), 2010
- [4] Craig Hunt, "TCP/IP Network Administration" "O'Reilly Media, Inc.", 2002



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

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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](http://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. <b>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</b>
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
<b>First Semester to Third Semester</b>						
1.	<b>Core Subjects</b>	Same	Same	1	3	4
2		Same	Same	1	3	4
3		Same	Same	1	3	4
<b>Choose any one from below elective subjects</b>						
4	<b>Elective Subject</b>	Same	Same	1	3	4
		Same	Same			
<b>Practical /Lab</b>						
5	<b>Lab / Practical</b>	Same	Lab	1	1	2
		Same	Lab	1	1	2
6	<b>Open Elective</b>	Same	Same	4	0	4
		Same	Same			
7	<b>Skill based Activity</b>	Same	same	1	0	1
<b>Total credits</b>				<b>11</b>	<b>14</b>	<b>25</b>

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

Sr. No	Course category	Course Code	Course Title	Internal credits	External credits	Total credits
<b>Fourth Semester</b>						
1.	Core Subjects			1	3	4
2				1	3	4
3			Major Project development Activity		0	4
<b>Choose any one from below elective subjects</b>						
4	Elective Subject			1	3	4
<b>Practical /Lab</b>						
5	Lab / Practical		Lab-7	1	1	2
			Lab-8	1	1	2
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
<b>Total credits</b>				<b>10</b>	<b>15</b>	<b>25</b>

**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**

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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**

<b>Sr. No</b>	<b>Course category</b>	<b>Course Code</b>	<b>Course Title</b>	<b>Internal credits</b>	<b>External credits</b>	<b>Total credits</b>
<b>First Semester</b>						
1.	<b>Core Subjects</b>	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
<b>Choose any one from below elective subjects</b>						
4	<b>Elective Subject</b>	CS-104 A	Relational Database Management System	1	3	4
		CS-104 B	Computer Network			
<b>Practical /Lab</b>						
5	<b>Lab / Practical</b>	CS-105	Lab -1 : C++ Programming	1	1	2
		CS-106	Lab-2: ALP using 8086 Microprocessor	1	1	2
6	<b>Open Elective</b>	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	<b>Skill based Activity</b>	CS-108	SK-01	1	0	1
	Total credits					<b>25</b>

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

<b>Sr. No</b>	<b>Course category</b>	<b>Course Code</b>	<b>Course Title</b>	<b>Internal credits</b>	<b>External credits</b>	<b>Total credits</b>
<b>Second Semester</b>						
1.	<b>Core Subjects</b>	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
<b>Choose any one from below elective subjects</b>						
4	<b>Elective Subject</b>	CS-204 A	Advanced Operating System	1	3	4
		CS-204 B	Compiler Designing			
<b>Practical /Lab</b>						
5	<b>Lab / Practical</b>	CS-205	Lab-3: VB.NET Programming	1	1	2
		CS-206	Lab-4: Based on Elective Subjects	1	1	2
6	<b>Open Elective</b>	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	<b>Skill based Activity</b>	CS-208	SK-02	1	0	1
	<b>Total credits</b>					<b>25</b>

<b>CS-101</b>	<b>Semester : I</b>	<b>Computer Architecture and Microprocessor</b>	<b>Credits: 4</b>
<b>Course Objectives :</b>			
1. To develop Understanding of Internal Architecture of Computer 2. To aware students about Basics of Microprocessor & Assembly Language Programming			
<b>Course Outcome :</b>			
3. 1. Students will acquire skill of Assembly Language programming using 8086 Microprocessor 4. 2. Student will be familiar with Internal Processing of Computers			
<b>Unit No.</b>	<b>Unit Title</b>	<b>No. Of Lectures</b>	
<b>Unit-1:</b>	<b>Design Methodology</b>	10	
	Evolution of Computers, Introduction to system modeling, Design Methodology of Combinational and Sequential circuits-Gate level, Register level and Processor level.		
<b>Unit-2:</b>	<b>Unit Title Binary Arithmetic</b>	10	
	Fixed point arithmetic's and algorithms for addition, subtraction, multiplication and division, Floating point arithmetic's and algorithms for addition, subtraction.		
<b>Unit-3:</b>	<b>Unit Title Processors Design &amp; Control Units</b>	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.		
<b>Unit-4:</b>	<b>Unit Title Memory Organization</b>	10	
	Memory Technologies, Memory System, Virtual memory, Memory hierarchies, Main memory -allocation, Segmentation, High speed-Cache Memory, interleaved and associative memories.		
<b>Unit-5:</b>	<b>Unit Title 8085 &amp; 8086 Microprocessor</b>	<b>10</b>	
	<b>8085 Microprocessor:</b> Architecture of 8085 Microprocessor, Features of 8085, Timing diagram of Memory read , memory write, Op code fetch and execute cycle. <b>8086 Microprocessor:</b> Architecture of 8086 Microprocessor-EU and BIU, Features of 8086, Pin diagram of 8086, Addressing modes, Instruction set classification, Assembly language programming of 8086.		
<b>Text Books</b>			
1.	Computer Architecture & Organization by J.P Hays.		
<b>Reference Books</b>			
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 )		

<b>CS-102</b>	<b>Semester</b> <b>I</b>	<b>OOP Concepts using C++</b>	<b>Credits:</b> <b>4</b>
<b>Course Objectives :</b>			
<ol style="list-style-type: none"> <li>To aware the students with the concept of Object oriented concepts</li> <li>To master students in advanced programming languages faster which is useful for foundation of software development.</li> </ol>			
<b>Course Outcome :</b>			
<ol style="list-style-type: none"> <li>Students will have the conceptual knowledge of Object Oriented programming.</li> <li>This course will create foundation for student to learn other Object Oriented Programming Languages such as JAVA.</li> </ol>			
<b>Unit No.</b>	<b>Unit Title</b>	<b>No. Of Lectures</b>	
<b>Unit-1:</b>	<b>Introduction and basic concepts of C++</b>	10	
	Procedure Oriented Programming, Object Oriented Programming Paradigm, Basic concepts of OOP's, Benefits and Applications, Structure of C++ program.		
<b>Unit-2:</b>	<b>Tokens, Operators and Functions in C++</b>	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 .		
<b>Unit-3:</b>	<b>Class and object, Constructor and destructor</b>	10	
	<b>Class and object:</b> Specifying a class and object, Nesting of member function, Memory allocation for objects, Static data member, static function, Friend function. <b>Constructor and destructor:</b> Introduction to Constructor, Types of constructor, Destructor		
<b>Unit-4:</b>	<b>Inheritance and polymorphism</b>		
	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	
<b>Unit-5:</b>	<b>Input / Output Operation</b>	<b>10</b>	
	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.		
<b>Text Books:</b>			
1.	Object-Oriented Programming with C++ -E-Balgurusamy		
<b>Reference Books:</b>			
1.	The C++ Complete Reference -TMH Publication		
2.	Programming with C++, D Ravichandran, TMH		
3.	Let us C++ -Yashwantkanetkar		

<b>CS-103</b>	<b>Mathematical Foundations for Computer Science</b>	<b>Credits: 4</b>
<b>Course Objectives:</b>		
Cultivate clear thinking and creative problem solving. Thoroughly train in the construction and understanding of mathematical proofs. Exercise common mathematical arguments and proof strategies.		
<b>Course Outcome:</b>		
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.		
<b>Unit-1:</b>		
Sets, Venn diagrams, Operations on Sets, Laws of set theory, Power set and Products, Partitions of sets, The Principle of Inclusion and Exclusion.		
<b>Unit-2:</b>		
Propositions and logical operations, Truth tables , Equivalence, Implications ,Laws of logic, Normal Forms, Predicates and Quantifiers, Mathematical Induction.		
<b>Unit-3:</b>		
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.		
<b>Unit-4:</b>		
Permutations, Combinations, Elements of Probability, Discrete Probability and Conditional Probability, Generating Functions and Recurrence Relations, Recursive Functions, Introduction to Functional Programming.		
<b>Unit-5:</b>		
Graphs Definitions, Paths and circuits: Eulerian and Hamiltonian, Types of graphs, Sub Graphs Isomorphism of graphs.		
<b>Unit-6:</b>		
Algebraic structures with one binary operation: semigroup, monoid and group, Abelian group Isomorphism, Homomorphism and Automorphism, Cyclic groups, Normal subgroups, Codes and group codes.		
<b>Text Books:</b>		
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	
<b>Reference Books</b>		
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.	

<b>CS-104 A Elective</b>	<b>Relational Database Management System</b>	<b>Credits: 4</b>
<b>Course Objectives:</b>		
<ol style="list-style-type: none"> <li>1. To understand the features of Relational database.</li> <li>2. To describe data models and schemas in DBMS.</li> <li>3. To use SQL- the standard language of relational databases for database operations.</li> <li>4. To understand the functional dependencies and design of the databases.</li> </ol>		
<b>Course Outcome:</b>		
<ol style="list-style-type: none"> <li>1. To study the basic concepts of relational databases</li> <li>2. Learn and practice data modelling using the entity-relationship and developing database designs.</li> <li>3. Understand the use of Structured Query Language (SQL) and learn SQL syntax for writing queries.</li> <li>4. Apply normalization techniques to normalize the databases.</li> </ol>		
<b>Unit-1:</b>	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.		
<b>Unit-2:</b>	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.		
<b>Unit-3:</b>	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.		
<b>Unit-4:</b>	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.		
<b>Unit-5:</b>	Advance Normalization	
Boyce-Codd Normal Form, Fourth Normal Form, Fifth Normal Form.		
<b>Unit-6:</b>	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.		
<b>Text Books:</b>		
1.	Database Management Systems- Raghuram Ramakrishnan, Johannes, Gehrke, Tata McGraw Hill.	
2.	Database System Concepts- Silber Schatz Korth, Tata McGraw Hill.	
<b>Reference Books</b>		
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.	

<b>CS-104 B Elective</b>	<b>Computer Network</b>	<b>Credits: 4</b>
<b>Course Objectives:</b>		
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.		
<b>Course Outcome:</b>		
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		
<b>Unit-1:</b>	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	
<b>Unit-2:</b>	Application Layer	
	Principles of computer applications, Web and HTTP, E-mail, DNS, Socket programming with TCP and UDP	
<b>Unit-3:</b>	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.	
<b>Unit-4:</b>	Network Layer	
	Introduction, Virtual and Datagram networks, study of router, IP protocol and addressing in the Internet, Routing algorithms, Broadcast and Multicast routing	
<b>Unit-5:</b>	The Link layer and Local area networks	
	Introduction and link layer services, error-detection and correction techniques, Multiple access protocols, addressing, Ethernet, switches.	
<b>Unit-6:</b>	Introduction to LAN	
	Devices, Topologies, Tools, Cables, Configuration	
<b>Text Books:</b>		
1.	Computer Networking-A Top-Down approach, 5thedition, Kurose and Ross, Pearson	
<b>Reference Books</b>		
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	



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

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

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

**OR**

### CS-107 B Introduction to E-Commerce

Unit	Title	Details of Topic
Unit I	<b>Introduction to E-Commerce</b>	E-commerce: The revolution is just beginning, E-commerce : A Brief History, Understanding E-commerce: organizing Themes
Unit II	<b>E-commerce business models and concepts, The internet and World Wide Web: E-commerce infrastructure</b>	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	<b>Building an e-commerce web site, Security and payment</b>	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	<b>E commerce marketing concepts, Online retailing and services</b>	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	<b>Social networks, auctions, and portals</b>	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
		<b>SK-01: PC Assembly and Maintenance</b>	
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	<b>Semester:</b> <b>II</b>	<b>Design and Analysis of Algorithms</b>	<b>Credits: 4</b>
<b>Course Objectives :</b>			
<ol style="list-style-type: none"> <li>To understand the concept of designing an algorithm.</li> <li>To learn advance algorithm techniques that are related to real life problem.</li> </ol>			
<b>Course Outcome :</b>			
<ol style="list-style-type: none"> <li>This course will aware the implementation of various advance algorithms to solve real world problem</li> <li>Students will be skilled to select appropriate design techniques to solve various problems problems.</li> </ol>			
<b>Unit No.</b>	<b>Unit Title</b>		<b>No. Of Lectures</b>
<b>Unit-1:</b>	<b>Introduction to data structure</b>		10
	Concepts of data and algorithm, Time and space Complexity of a given algorithm		
<b>Unit-2:</b>	<b>Divide and Conquer</b>		10
	General Method, Binary search, Merge sort, Quick sort, Strassen's matrix multiplication		
<b>Unit-3:</b>	<b>Greedy method</b>		10
	General method, Knapsack problem, Optimal storage on tapes, Job sequencing with deadlines, Optimal merge pattern, Minimum spanning tree, Shortest path		
<b>Unit-4:</b>	<b>Dynamic Programming</b>		10
	The general method, Multistage graphs, Optimal binary search tree, Reliability Design, Travelling sales person problem		
<b>Unit-5:</b>	<b>Basic search, traversal techniques and Backtracking</b>		<b>10</b>
	Binary tree traversal Preorder, Inorder and Postorder Traversal, Breadth first search(BFS), Depth first search(DFS), <b>Backtracking:</b> The general method, 8-Queens problem, Sum of subsets, Graph coloring, Hamiltonian cycle.		
<b>Text Books:</b>			
1.	Fundamentals of computer algorithm by Horowitz Sahani, Galgotia Publication		

<b>CS-202</b>	<b>Semester:</b> <b>II</b>	<b>Software Engineering</b>	<b>Credits: 4</b>
<b>Course Objectives :</b>			
<ol style="list-style-type: none"> <li>To develop software engineering skills and testing plans.</li> <li>To understand system concepts and its application in Software development</li> </ol>			
<b>Course Outcome :</b> After completion of this course students will be able to			
<ol style="list-style-type: none"> <li>Learn various methods of software development.</li> <li>Apply various software testing techniques.</li> </ol>			
<b>Unit No.</b>	<b>Unit Title</b>	<b>No. Of Lectures</b>	
<b>Unit-1:</b>	<b>Software and Software Engineering</b>	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.		
<b>Unit-2:</b>	<b>Process models</b>	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.		
<b>Unit-3:</b>	<b>Requirements Engineering &amp; Design concepts</b>	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.		
<b>Unit-4:</b>	<b>Software Testing Strategies</b>	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.		
<b>Reference Books:</b>			
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	<b>Semester:</b> <b>II</b>	<b>Programming with VB .NET</b>	<b>Credits: 4</b>
<b>Course Objectives :</b>			
<ol style="list-style-type: none"> <li>1. To provide the knowledge of .Net framework along with VB.Net language</li> <li>2. To skill the students for developing windows base applications.</li> </ol>			
<b>Course Outcome :</b>			
<ol style="list-style-type: none"> <li>1. Students will able to develop simple as well as complex applications using .Net framework</li> <li>2. Students will learn to use web applications for creating GUI based programs.</li> </ol>			
<b>Unit No.</b>	<b>Unit Title</b>		<b>No. Of Lectures</b>
<b>Unit-1:</b>	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		
<b>Unit-2:</b>	Variables and Dates		10
	<b>Comments and Whitespace:</b> Comments, Whitespace, <b>Data Types:</b> Numbers, Common Integer Math Operations, Integer Math Shorthand, The Problem with Integer Math, Floating-Point Math, Other States, Single-Precision Floating-Point Numbers, <b>Working with Strings:</b> Concatenation, Using the Concatenation Operator Inline, More String Operations, Substrings, Formatting Strings, Localized Formatting, Replacing Substrings, <b>Using Dates:</b> Formatting Date Strings, Extracting Date Properties, Date Constants, Defining Date Literals, Manipulating Dates, Boolean		
<b>Unit-3:</b>	Storing Variables and Methods		10
	Binary, Bits and Bytes, Representing Values, Converting Values <b>Methods:</b> Why Use Methods?		
<b>Unit-4:</b>	Controlling the flow, Array and Data Structure		10
	<b>The If Statement:</b> 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, <b>Select Case:</b> Case-Insensitive Select Case, Multiple Selections, the Case Else Statement, Different Data Types with Select Case  <b>Loops:</b> 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 <b>Data Structure Arrays:</b> Defining and Using Arrays, Using For Each ... Next, Passing Arrays As Parameters, Sorting Arrays, Going Backwards, Initializing Arrays with Values		
<b>Unit-5:</b>	Building Windows Applications <b>and Menus</b>		<b>10</b>

	<p><b>The If Statement:</b> 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><b>Select Case:</b> Case-Insensitive Select Case, Multiple Selections, the Case Else Statement, Different Data Types with Select Case</p> <p><b>Loops:</b> 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><b>Data Structure Arrays:</b> Defining and Using Arrays, Using For Each ... Next, Passing Arrays As Parameters, Sorting Arrays, Going Backwards, Initializing Arrays with Values</p> <p><b>Understanding Menu Features:</b> Images, Access Keys, Shortcut Keys, Check Marks, The Properties Window, Creating <b>Menus:</b> Designing the Menus, Adding Toolbars and Controls, Coding Menus, Coding the View Menu and Toolbars</p>	
<b>Text Books:</b>		
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)	

<b>CS-204 A Elective</b>	<b>Semester:</b> <b>II</b>	<b>Advanced Operating System</b>	<b>Credits: 4</b>
<b>Course Objectives :</b>			
<ol style="list-style-type: none"> <li>To learn the mechanisms of OS to handle processes and threads and their communication</li> <li>To learn the advanced mechanisms involved in process , file and memory management in contemporary OS</li> </ol>			
<b>Course Outcome :</b>			
<ol style="list-style-type: none"> <li>Students will be able to Analyze the structure of OS and basic architectural components involved in OS design</li> <li>Students will be able to Conceptualize the components involved in designing a contemporary OS</li> </ol>			
<b>Unit No.</b>	<b>Unit Title</b>	<b>No. Of Lectures</b>	
<b>Unit-1:</b>	<b>Introduction to UNIX/Linux Kernel</b>	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		
<b>Unit-2:</b>	<b>File and Directory I/O</b>	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	
<b>Unit-3:</b>	<b>Process Environment, Process Control and Process Relationships</b>	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	
<b>Unit-4:</b>	<b>Memory Management</b>	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	
<b>Unit-5:</b>	<b>Signal Handling</b>	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	
<b>Text Books:</b>		
1.	Linux System Programming, O'Reilly, by Robert Love.	
<b>Reference Books:</b>		
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	

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

		<b>Lectures</b>
<b>Unit-1:</b>	<b>Introduction to Compilers and Programming Languages</b>	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	
<b>Unit-2:</b>	<b>Lexical Analysis &amp; Syntax Analysis</b>	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	
<b>Unit-3:</b>	<b>Basic parsing techniques</b>	10
	Introduction to parsers, Shift reduce parsing, Top-down parsing, Operator Precedence parsing, Predictive parsers, LR, SLR and LALR parsers.	
<b>Unit-4:</b>	<b>Syntax Directed Translation and Symbol tables</b>	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	
<b>Unit-5:</b>	<b>Error detection and recovery and Code Optimization</b>	<b>10</b>
	Errors, Lexical-phase errors, Syntactic phase errors, Semantic errors. Introduction to Code Optimization: Sources of optimization, Loop optimization	
<b>Text Books:</b>		
1.	Principals of Compiler Design By Alfred V. Aho, Jeffrey D. Ullman	
<b>Reference Books:</b>		
1.	Compilers - Principles, Techniques and Tools - A.V. Aho, R. Shethi and J.D.	
2.	Introduction to System Software By D. M. Dhamdhare	
3.		

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



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

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

**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

<b>CS- 208</b>	<b>Second semester</b>	<b>Skill based Activity</b> <b>SK-02: Networking Essentials</b>	<b>Credits: 01</b>
<b>Scope :</b> 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**

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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

Choice Based Course Credit System (distribution and details of CBCS)

## M.Sc. (Computer Science)

### First Year (Two Semesters)

Semester-I					
course code	Title of the paper	External credit	Internal credit	Total Credits	Total Nor of Classes
CS-101	Computer Architecture & Microprocessor	3	1	4	40hrs
CS-102	Programming in C++	3	1	4	40hrs
CS-103	Design Analysis of Algorithm	3	1	4	40hrs
CS-104	Distributed Database Concepts	3	1	4	40hrs
CS-105	Lab-1 ( Programming in C++)	1	1	2	60hrs
CS-106	Lab-2 (Computer Architecture)	1	1	2	60hrs
<b>Total Credits</b>		<b>14</b>	<b>6</b>	<b>20</b>	280hrs

Semester-II					
course code	Title of the paper	External credit	Internal credit	Total Credits	Total Nor of Classes
CS-201	Advance Networking Concepts	3	1	4	40hrs
CS-202	Mobile Computing	3	1	4	40hrs
CS-203	C#.NET	3	1	4	40hrs
CS-204	Compiler Design	3	1	4	40hrs
CS-205	Elective-II	3	1	4	40hrs
	1. Discrete Event System simulation				
	2. Distributed Computing				
	3. Network Programming				
CS-206	Lab-3(Advance N/W Concepts)	1	1	2	60hrs
CS-207	Lab-4(C#.NET )	1	1	2	60hrs
CS-208	Seminar	1	0	1	40hrs
<b>Total Credits</b>		<b>18</b>	<b>7</b>	<b>25</b>	360Hrs



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**CS-101 Advanced Computer Architecture & Microprocessors(4-Credits)**

**Unit 1: Design Methodology**

Introduction to system modeling, Design levels of Combinational and Sequential circuits- Gate level, Register level and Processor level, Queuing Model, Simulation.

**Unit 2: Binary Arithmetic**

Fixed point arithmetic's and algorithms for addition, subtraction, multiplication and division, Floating point arithmetic's and algorithms for addition, subtraction, multiplication and division.

**Unit 3: Processors Design & Control Units**

Processor organization, Information representation, Instruction –Format, types, Implementation, CICS and RISC, Vector Concepts, Control Unit-Hardwired and Micro programmed control unit, Interrupt and Branch Instruction processing.

**Unit 5: Memory Organization**

Virtual memory, Memoryhierarchies, Main memory -allocation, Segmentation, High speed-interleaved and associative memories.

**Unit 5: 8085 Microprocessor**

Architecture of 8085 Microprocessor, Features of 8085, Pin diagram of 8085, Timing diagram of Memory read , memory write, Opcode fetch and execute cycle, Addressing modes, DE multiplexing of address and data bus, Instruction set –classification, Instruction timing ,Assembly language programming of 8085.

**Unit 6:8086 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.

Reference Books:-

- 1) Computer Architecture & Organization by J.P Hays.
- 2) Fundamentals of Microprocessors by B.Ram.
- 3) Fundamentals of Microprocessors by Gaonkar



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**(CS) - 102    Programming with C++    (4-Credits)**

**Unit – 1 Introduction and basic concepts of C++**

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++**

Keywords, Identifiers, Data-types, Operators in C++, Operator precedence and associativity, Function, function prototype, default arguments, Reference variable, call by reference, return by reference, Inline function, function overloading

**Unit – 3 Class and object**

Specifying a class and object, Nesting of member function, Memory allocation for objects, Static data member, static function, Friend function, Returning objects

**Unit – 4 Constructor and destructor**

Constructor, Types of constructor, Destructor

**Unit – 5 Inheritance and polymorphism**

Types of inheritance, Virtual base class, Operator overloading (Unary and binary), Virtual function and their rules, Pure virtual function, Abstract class, Pointer to object, This pointer

**Unit – 6 Input / Output Operation**

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, Templates, template function, template class.

**Reference Books:-**

- 1) The C++ Complete Reference            -TMH Publication
- 2) Object-Oriented Programming with C++    -E-Balgurusamy
- 3) Let us C++            -Yashwantkanetkar



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**(CS) – 103 Design and analysis of an algorithm (4-Credits)**

**Unit-I Introduction to data structure**

Concepts of data and algorithm, Time and space Complexity of a given algorithm

**Unit-II Divide and Conquer**

General Method, Binary search, Merge sort, Quick sort, Strassen's matrix multiplication

**Unit-III The Greedy method**

The general method, Knapsack problem, Optimal storage on tapes, Job sequencing with deadlines, Optimal merge pattern, Minimum spanning tree, Shortest path

**Unit-IV Dynamic Programming**

The general method, Multistage graphs, Optimal binary search tree, Reliability Design, Travelling sales person problem

**Unit-V Basic search and traversal techniques**

Binary tree traversal, Breadth first search(BFS), Depth first search(DFS), Bi-connected components and DFS

**Unit-VI Backtracking**

The general method, The 8-Queens problem, Sum of subsets, Graph coloring, Hamiltonian cycle, Knapsack problem, Efficiency consideration

**Reference Books :**

1. Fundamentals of computer algorithm by Horowitz Sahani, Galgotia Publication



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**CS 104 Distributed Database System (4-Credits)**

**Unit 1 :Database System Architectures**

Centralized Architectures, client server Architecture, Server System Architecture , Parallel System Distributed System , Network Types

**Unit 2 :Distributed Database**

Homogeneous and Heterogeneous Databases , Distributed Database storage, Transaction Concept ,Distributed Transactions, Commit Protocols, Concurrency control in distributed databases, Availability, Serializability, Distributed Query Processing , Heterogeneous Distributed Databases , Distributed Database in Oracle

**Unit 3 :Parallel Database**

Introduction, I/O Parallism, InterqueryParallism, IntraqueryParallism, Interoperation Parallism, IntraoperationParallism, Design of Parallel system,

**Unit 4 :Decision Support System & Indexing and Hashing**

Introduction, Aspects of decision support, Database design for Decision support, Data Preparation

Data warehouses and Data marts, Online Transaction Processing (OLTP) ,

Basic Concepts, Ordered indices, B tree index files, B+ tree index files, Multiple key access, Static Hashing, Dynamic Hashing, Comparison of Ordered indexing and Hashing, Bitmap indices

**Unit 5 :Advanced Data types and New Applications & Advanced Transaction Processing**

Motivation, Time in Database, Spatial and Geographic data, Multimedia Databases, Mobility and Personal Databases. Transaction Processing Monitors, Transactional Workflows, Main memory databases, Real time transaction system, Long duration transactions, Transaction Management in Multidatabases

**Unit 6 :Recovery System**

Failure classification, Storage structure, Recovery and Atomicity, Log based recovery, Shadow Paging, Recovery With concurrent Transactions, Failure with loss of Non-volatile storage, Advanced recovery technique, Remote backup system





# Swami Ramanand Teerth Marathwada University, Nanded

Choice Based Course Credit System (distribution and details of CBCS)

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## Reference Books –

1. Database System Concepts - (Abraham, Korth and Sudarshan (4th edition) Tata McGraw-Hill)
2. An Introduction to Database systems - C. J. Date (3rd Edition) Pearson Education



## **CS-201 Advanced Networking Concepts(4-Credits)**

### **Unit-I :Review of Basic Concepts**

Network Architecture – Protocol Hierarchies, Layered model, services, interface , Reference Models, Underlying Technologies

### **Unit-II :LAN Hardware**

Network Interface card , Transmission Media , Topologies , Active hub and passive hub , Repeaters Wireless LAN.

### **Unit- III :The Internet Layer & Routing Protocols**

IP-Datagram , fragmentation and reassembly, ICMP –types of messages, error reporting, ICMP package, BOOTP and DHCP, Interior and Exterior routing – RIP, OSPF, BGP, Multicast Routing- Unicast, Multicast and Broadcast, Multicasting, Multicast trees.

### **Unit-IV :The Transport Layer**

The transport service –Services provided, services primitives, Sockets, Process-to-process communication, Elements of transport protocols – addressing, connection establishment, connection release, flow control and buffering , multiplexing, crash recovery, UDP-Introduction, Remote Procedure Call , TCP –service model, protocol, frame format , connection establishment, release, connection management, error control, congestion control.

### **Unit- V :Client –server Model & The Application Layer**

Client-Server Model- Concurrency , Processes, Socket Interface –sockets, byte Ordering, Socket system calls, connectionless and connection Oriented applications , DNS Telnet and Rlogin, FTP, TFTP, SNMP, SMTP, World Wide Web(Client and server side, cookies, wireless web), Java and the internet

### **Unit-VI :Introduction to Network security**

Cryptography, symmetric key algorithm, Public key algorithms, Digital signatures, Certificates, IPSec, Firewalls, Virtual Private Networks, Network Address Translation, Authentication protocols, Social Issues .



# Swami Ramanand Teerth Marathwada University, Nanded

Choice Based Course Credit System (distribution and details of CBCS)

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## Reference Books:

1. BeehrouzForouzan , TCP/IP protocol suit , second edition, Tata McGraw Hill
2. Andrew S. Tanenbaum, Computer Networks , Fourth Edition, Prentice Hall
3. Douglas E. Comer, Internetworking with TCP/IP , vol 1,
4. William Stallings, Data and Computer Communications , Seventh edition , Pearson Edition

## Lab Assignment

1. Assigning an IP-address to client and server
2. Design a LAN with a given set of requirement.
3. Configuration of DHCP
4. Configuration of DNS
5. Active Directory Configuration
6. Creating an Network Users
7. Creating an Shared folders
8. Interconnecting client and server



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**CS – 202 Mobile Communications (4 – Credits)**

**Unit-I :Introduction**

Applications, Vehicles, Emergencies, Business, Replacement of wired networks , Infotainment and more, Location dependent services, Mobile and wireless devices A short History of wireless communication, A market for mobile communication Some open research topics, A simplified reference model,

**Unit –II :Cellular System**

Basic Cellular System Performance Criteria, Operation of Cellular System ,Planning a Cellular System.

**Unit-III :Wireless transmission**

Frequencies for radio transmission, Regulations , Signals, Antennas, Multiplexing Modulation, Cellular Systems.

**Unit-IV :Medium Access Control**

Motivation for specialized MAC, SDMA,TDMA ,Fixed TDM, Classical Aloha Slotted Aloha, CSMA , Multiple Access with collision avoidance , CDMA .

**Unit-V :Telecommunication and Satellite Systems**

GSM, Mobile services , System architecture , Applications of satellite systems.

**Unit-VI :Wireless LAN**

Infra redVs Wireless LAN, Infrastructure and Ad-hoc network , IEEE 802.11 System Architecture , Protocol Architecture, HIPERLAN, HIPERLAN 1 WATM, Bluetooth , Architecture .

**References**

1. Mobile Communications Second Edition – By Jochen Schiller (Pearson Education)
2. Mobile Cellular Telecommunications Second Edition-By William C.Y.Lee (Mc-Graw-Hill)



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**(CS) - 203 C#.NET (4 - Credits)**

**Unit I :Introducing C#**

What is c#, Why C# & Evolution of C#, Character tics of C#, How C# differs from C++ & Java, Introduction to .Net Technology & Framework, The Common language Runtime(CLR)Visual Studio .Net & .Net languages

**Features in Visual Studio.net**

Integrated Development environment, Start page, Solution explorer window, Class view window, Object browser, Code window, Intellisense, Heap facility, Code Debugging, Project types

**Unit II :Arrays, String, Operators Properties, Indexers, Delegates & Events**

Jagged Arrays, Array &ArrayList class, string class, Boxing & Unboxing variable, Short circuiting operators

**Properties, Indexers, Delegates & Events**

Properties, Indexers, Delegates, Multicast Delegates, Events

**Unit III :Namespace, interface & Exception handling**

Creating & using Namespace(DLL library), Creating & using interface, Exception

**Unit IV :Multithreading**

Understanding System. Threading Namespace, Creating & starting Thread, Threading synchronization & Pooling

**Unit V : Windows Application**

Event Driven Programming Model, Important classes used in windows application, TextBox& Label Control, Button, CheckBox, RadioButton&GroupBox Control, ListBox&ComboBox control, Month Calendar Control, Docking Control, Tree View Control, Menu & Toolbar control, Dialog Boxes

**Unit VI :Database Connectivity, XML & Web Services**

Advantages of ADO.NET, Managed Data providers, Developing a Simple ADO.NET Based Application, Retrieving & Updating Data From Tables., Disconnected Data Access Through Dataset Objects



### **Working with XML**

Support for XML in .NET, System.Xml namespace, Working with streamed XML, Implementing document object model in .NET, XPath XSLT in .NET, Using XML with ADO.NET

### **Web Services**

Introduction to web services, Simple object access protocol, Web service description language, UDDI, Creating a web service, Deploying a web service, Using the Web service class, Using the Web service

### **Reference Books :**

1. Programming in C# A Primer - Second Edition By - E Balagurusamy
2. Visual C#.Net By – C Muthu
3. C# 2005 Programming Black Book By Matt Telles&Kogenet Solution Inc.
4. C#.Net Programming Wrox Publication



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**CS – 204 Compiler Design (4 – Credits)**

**Unit-I :Introduction to Compilers and Programming Languages**

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-II :Lexical Analysis & Syntax Analysis**

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-III :Basic parsing techniques**

Introduction to parsers, Shift reduce parsing, Top-down parsing, Operator Precedence parsing, Predictive parsers, LR, SLR and LALR parsers.

**Unit-IV :Syntax Directed Translation and Symbol tables**

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-V :Error detection and recovery**

Errors, Lexical-phase errors, Syntactic phase errors, Semantic errors

**Unit VI :Introduction to Code Optimization**

Sources of optimization, Loop optimization

**Recommended books :**

1. Principals of Compiler Design By Alfred V. Aho, Jeffrey D. Ullman
2. Compilers - Principles, Techniques and Tools - A.V. Aho, R. Shethi and J.D.
3. Introduction to system software By D. M. Dhamdhare



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**CS – 205 Elective 1 :Elective Discrete Event System simulation (4 – Credits)**

**Unit I: Introduction to Simulation**

System and System environment, Components of system, Type of systems, Type of models, Steps in simulation study, Advantages and Disadvantages of simulation.

**Unit II :Simulation Principles, Examples and Softwares**

Simulation Examples- Simulation of Queuing systems, Other examples of simulation.  
General Principles- Concepts of discrete event simulation, List processing, Simulation Software-History of simulation software, An Example Simulation, Simulation Packages, Trends in simulation software.

**Unit III :Statistical Models in Simulation**

Useful statistical model, Discrete distribution, Continuous distribution, Poisson process , Empirical distribution.

**Unit IV ;Queueing Models**

Characteristics of Queueing systems, Queueing notations, Long run measures of performance of Queueing systems, Network of Queues.

**Unit V : Random Number Generation**

Properties of random numbers, Generation of pseudo random numbers, Techniques for generating random numbers, Tests for random numbers.

**Unit VI : Input Modeling**

Data Collection, Identifying the Distribution of data, Parameter estimation, Goodness of fit tests, Selection input model without data, Multivariate and Time series input models.

**Text Books:**

1. Jerry Banks, John Carson, Barry Nelson, David Nicol, [Discrete Event System Simulation](#)
2. Averill Law, W. David Kelton, [Simulation Modeling and Analysis](#), McGRAWHILL





# Swami Ramanand Teerth Marathwada University, Nanded

Choice Based Course Credit System (distribution and details of CBCS)

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## References Books:

1. Geffery Gordon, [System Simulation], PHI
2. Bernard Zeigler, Herbert Praehofer, Tag Gon Kim, [Theory of Modeling and Simulation], Academic Press
3. NarsingDeo, [System Simulation with Digital Computer], PHI
4. Donald W. Body, [System Analysis and Modeling], Academic Press Harcourt India
5. W David Kelton, Randall Sadowski, Deborah Sadowski, [Simulation with Arena], McGRAW-HILL.



**CS – 205 Elective 2 : Distributed Computing (4 – Credits)**

**Unit I: Introduction to Distributed System**

Goals, Hardware concepts, Software concepts, and Client-Server model. Examples of distributed systems.

**Unit II :Communication**

Layered protocols, Remote procedures call, Remote object invocation, Message oriented communication, Stream-oriented communication.

**Unit III: Processes**

Threads, Clients, Servers, Code Migration, Software agent.

**Unit IV: Naming**

Naming entities, Locating mobile entities, Removing un-referenced entities.

**Unit V :Synchronization**

Clock synchronization, Logical clocks, Global state, Election algorithms, Mutual exclusion, Distributed transactions.

**Unit VI: Consistency and Replication**

Introduction, Data centric consistency models, Client centric consistency models, Distribution protocols, Consistency protocols.

**Text Books:**

1. A. Taunenbaum, “*Distributed Systems: Principles and Paradigms*”
2. G. Coulouris, J. Dollimore, and T. Kindberg, “*Distributed Systems: Concepts and Design*”, Pearson Education

**References:**

1. M. Singhal, N. Shivaratri, “*Advanced Concepts in Operating Systems*”, TMH



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**CS – 205 Elective 3 :Network Programming (4 - Credits)**

**Unit I :Introduction**

A Simple Daytime Client, Protocol Independence, Error Handling: Wrapper Functions, A SimpleDaytime Server [Book-1]

**Sockets Introduction**

Socket Address Structures, Value-Result Arguments, Byte Ordering Functions, Byte ManipulationFunctions, inet\_aton, inet\_addr, and inet\_ntoa Functions, inet\_pton and inet\_ntop Functions,sock\_ntop and Related Functions, readn, writen, and readline Functions, isfdtype Function[Book-1] What is a Socket? Using Sockets [Book-2]

**Unit II :Elementary TCP Sockets**

Socket Function, connect Function, bind Function, listen Function, accept Function, fork andexec Functions, Concurrent Servers, close Function, getsockname and getpeername Functions[Book-1]

**Unit III :TCP Client-Server Example**

TCP Echo Server: main Function, TCP Echo Server: str\_echo Function, TCP Echo Client: mainFunction, TCP Echo Client: str\_cli Function, Normal Startup, Normal Termination, ConnectionAbort before accept Returns, Termination of Server Process, SIGPIPE Signal, Crashing of Server Host, Crashing and Rebooting of Server Host, Shutdown of Server Host [Book-1]

**Unit IV :I/O Multiplexing: The select and poll Functions**

I/O Models, select Function, str\_cli Function (Revisited), Batch Input, shutdown Function, str\_cli Function (Revisited Again), TCP Echo Server (Revisited), pselect Function, poll Function, TCP Echo Server (Revisited Again) [Book-1]

**Socket Options**

getsockopt and setsockopt Functions, Checking If an Option Is Supported and Obtaining theDefault, Socket States, Generic Socket Options, IPv4 Socket Options, ICMPv6 Socket Option, IPv6 Socket Options, TCP Socket Options



### **Unit V :Elementary UDP Sockets**

recvfrom and sendto Functions, UDP Echo Server: main Function, UDP Echo Server: dg\_echoFunction, UDP Echo Client: main Function, UDP Echo Client: dg\_cli Function, Lost Datagrams, Verifying Received Response, Server Not Running, Summary of UDP example, connect Function with UDP, dg\_cli Function (Revisited), Lack of Flow Control with UDP, Determining Outgoing Interface with UDP, TCP and UDP Echo Server Using select [Book-1]. User Datagram Protocol, File Transfer, Error Handling [Book-2]

### **Unit VI :Protocols, Sessions, State, and Implementing Custom Protocols**

State vs. Stateless, Methods for Maintaining State, What Is a Protocol? Designing a Custom Protocol, Our Chat Protocol, Protocol Registration [Book-2].

### **Referencebooks :**

1. Unix Network Programming, Volume 1: The Sockets Networking API, 3/E by W. Richard Stevens, Bill Fenner, Andrew M. Rudoff, PHI
2. The Definitive Guide to Linux Network Programming by KEIR DAVIS, JOHN W. TURNER, AND NATHAN YOCOM, Apress.

॥ सा विद्या या विमुक्तये ॥



# स्वामी रामानंद तीर्थ मराठवाडा विद्यापीठ, नांदेड

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

**SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY NANDED**

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

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

## ACADEMIC (1-BOARD OF STUDIES) SECTION

Phone: (02462) 229542

Website: [www.srtmun.ac.in](http://www.srtmun.ac.in)

E-mail: [bos.srtmun@gmail.com](mailto:bos.srtmun@gmail.com)

Fax : (02462) 229574

संलग्नित महाविद्यालयांतील विज्ञान व तंत्रज्ञान विद्याशाखेतील पदव्युत्तर स्तरावरील द्वितीय वर्षाचे CBCS Pattern नुसारचे अभ्यासक्रम शैक्षणिक वर्ष २०२०-२१ पासून लागू करण्याबाबत.

### प रि प त्र क

या परिपत्रकान्वये सर्व संबंधितांना कळविण्यात येते की, दिनांक २० जून २०२० रोजी संपन्न झालेल्या ४७व्या मा. विद्या परिषद बैठकीतील विषय क्र.११/४७-२०२०च्या ठरावानुसार प्रस्तुत विद्यापीठाच्या संलग्नित महाविद्यालयांतील विज्ञान व तंत्रज्ञान विद्याशाखेतील पदव्युत्तर स्तरावरील द्वितीय वर्षाचे खालील विषयांचे C.B.C.S. (Choice Based Credit System) Pattern नुसारचे अभ्यासक्रम शैक्षणिक वर्ष २०२०-२१ पासून लागू करण्यात येत आहेत.

- |   |  |
|---|--|
| 1. M.Sc.-II Year-Botany                 | 2. M.Sc.-II Year-Herbal Medicine                     |
| 3. M.Sc.-II Year-Analytical Chemistry   | 4. M.Sc.-II Year-Biochemistry                        |
| 5. M.Sc.-II Year-Organic Chemistry      | 6. M.Sc.-II Year-Physical Chemistry                  |
| 7. M.Sc.-II Year-Computer Management    | 8. M.Sc.-II Year-Computer Science                    |
| 9. M.Sc.-II Year-Information Technology | 10. M.C.A. (Master of Computer Applications)-II Year |
| 11. M.Sc.-II Year-Software Engineering  | 12. M.Sc.-II Year-System Administration & Networking |
| 13. M.Sc.-II Year-Dairy Science         | 14. M.Sc.-II Year-Environmental Science              |
| 15. M.Sc.-II Year-Applied Mathematics   | 16. M.Sc.-II Year-Mathematics                        |
| 17. M.Sc.-II Year-Microbiology          | 18. M.Sc.-II Year-Physics                            |
| 19. M.Sc.-II Year-Zoology               | 20. M.Sc.-II Year-Biotechnology                      |
| 21. M.Sc.-II Year-Bioinformatics        |  |

सदरील परिपत्रक व अभ्यासक्रम प्रस्तुत विद्यापीठाच्या [www.srtmun.ac.in](http://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/  
२०२०-२१/३३५

दिनांक : १६.०७.२०२०.

प्रत माहिती व पुढील कार्यवाहीस्तव :

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

स्वाक्षरित / -

**उपकुलसचिव**

शैक्षणिक (१-अभ्यासमंडळ) विभाग

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



**Syllabus of  
Second Year M.Sc. (Computer Management)  
(Revised CBCS pattern)**

**Introduced from Academic Year 2020-2021**

# M.Sc. Computer Management

**M.Sc. Computer Management** (2years) program / degree is a specialized program in Computer Management and software development processes issues. It builds the student on higher studies and research awareness in overall designing and development of software 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 Management** 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 Management** program is as per the eligibility criteria fixed by the University. More details on admission procedure and fee structure can be seen from the prospectus of the college / institution as well as on website of the University.

## Credit Pattern

Every course has corresponding grades marked in the syllabus structure. There are 25 credits per semester. A total of 100 credits are essential to complete this program successfully. The Grading pattern to evaluate the performance of a student is as per the University rules.

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

The open elective has 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 Management** 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 Management** 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. enhancement activity of 01 credits.
4. One Credit = 25 marks , Two Credits = 50 Marks, Four Credits = 100 Marks

### PEO, PO and CO Mappings

1. **Program Name** : M.Sc.( CM)
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 software engineer 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 Management 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

1. **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



## 2. 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,

M.Sc.(CM)

Sr. No	Course category	Course Code	Course Title	Internal credits	External credits	Total credits
<b>Third Semester</b>						
1.	<b>Core Subjects</b>	CM-301	Advanced Java Programming	2	2	4
2		CM-302	Software Engineering	2	2	4
3		CM-303	Information Security and Audit	2	2	4
<b>Choose any one from below elective subjects</b>						
4	<b>Elective Subject</b>	CM-304 A	System Administration and Server Integration	2	2	4
		CM-304 B	Server and Desktop Technologies			
<b>Practical /Lab</b>						
5	<b>Lab / Practical</b>	CM-305	Lab-5: Based on CM-301	1	1	2
		CM-306	Lab-6: Based on Elective Subjects	1	1	2
6	<b>Open Elective</b>	CM-307A	University recognized MOOC (NPTEL / SWAYAM / others) OR Intra / Inter Departmental OR Intra / Inter School OR	4	0	4
		CM-307 B	Technical Writings			
7	<b>Skill based Activity</b>	CM-308	SK-03: Seminar Presentation Activity	1	0	1
	Total credits					<b>25</b>

M.Sc.(CM)

Sr. No	Course category	Course Code	Course Title	Internal credits	External credits	Total credits
<b>Fourth Semester</b>						
1.	<b>Core Subjects</b>	CM-401	Software Testing	2	2	4
2		CM-402	ASP.NET using VB.NET	2	2	4
3		CM-403	Major Project development Activity	0	4	4
<b>Choose any one from below elective subjects</b>						
4	<b>Elective Subject</b>	CM-404 A	Software Project Management	2	2	4
		CM-404 B	Mobile Application Development			
<b>Practical /Lab</b>						
5	<b>Lab / Practical</b>	CM-405	Lab-7: Based on CM-402	1	1	2
		CM-406	Lab-8: Based on Elective Subjects	1	1	2
6	<b>Open Elective</b>	CM-407A	University recognized MOOC (NPTEL / SWAYAM / others) OR Intra / Inter Departmental OR Intra / Inter School OR	4	0	4
		CM-407 B	Information Communication Technology			
7	<b>Skill based Activity</b>	CM-408	SK-04	1	0	1
	Total credits					<b>25</b>

## **CM-301 : Advanced Java Programming**

### **Course Objectives**

Objective of this course is to introduce the students to some concepts of advanced programming and practice on reusing components. It focuses on Graphical User Interface (GUI), networking, and database manipulation. Discuss the principles of inheritance and polymorphism and demonstrate through problem analysis assignments how they relate to the design of methods, abstract classes and interfaces.

### **Course Outcomes**

With this course Students should be able to Learn the Internet Programming, using JApplets. Create a full set of UI widgets and other components, including windows, menus, buttons, checkboxes, text fields, scrollbars and scrolling lists, using Abstract Windowing Toolkit (AWT) and Swings. Learn to access database through Java programs, using Java Data Base Connectivity (JDBC). Create dynamic web pages, using Servlets and JSP. Understand the multi-tier architecture of web-based enterprise applications using Enterprise JavaBeans (EJB).

### **Course Contents**

#### **Unit-1** Introduction to java:

History, Features, Java program structure, Java tokens, Java Statements, Java virtual machine, Command line arguments, Constants, Variable, Data types, Decision making and branching, looping, Class, Methods, Objects, Method overloading, Nesting of methods

#### **Unit-2** Inheritance and System packages

Overriding methods, Final variables, Final methods, Final Classes, Abstract methods, Abstract Classes, Visibility Control, Arrays, Strings, Vectors, Naming conventions, Creating and accessing packages, Introduction to multithreaded programming, Creating and extending threads, Life cycle of thread, Thread exception, Thread priority, Synchronization, Exception handling, Multiple catch statements, finally statement, Throwing our own exceptions, Exception for debugging

#### **Unit-3:** Applets and Graphics

Applet code, Applet life cycle, creating an executable applet, designing a web page, Applet tag, passing parameter to applet, Lines, Rectangles, Circles, Ellipses, Arcs, Polygons, Line graphs, Bar charts, Control loops in applet

#### **Unit-4:** Java Database Connectivity:

The design of JDBC, JDBC driver types, Basic JDBC programming, concept.

#### **Unit –5** Java Beans and Swing:

Introduction to Java Bean, Advantages of Java beans, Application Builder tools, Using BDk, JAR Files, JApplet, JIcons and Labels, Textfields, Buttons, Combo Boxes, Scrollpanes, Trees, Tables, Menu, Bars and Menus, Tool Bars, Dialog Boxes, File dialog, Progress Bar.

#### **Unit 6**

Servlets and Java Server Pages : The life cycle of a servlets, Using Tomcat for server development, A simple servlet, Using cookies, Session Tracking, Introduction to java server pages, A simple JSP, example, Scripting.

### **Text Books**

1. Programming with Java A Primer – E.Balaguruswamy, McGrawhill
2. Java 7 Programming Black Book - Kogent Learning Solutions Inc, Dream Tech press

### **Reference Books**

1. Java Fundamentals A comprehensive introduction- Herbert Schildt, Dale Skrien, McGraw Hill.
2. The Complete Reference, Java 2 – Herbert Schild, Fourth Edition, - TMH.
3. Core Java Volume-I Fundamentals- Horstmann and Cornell, - Pearson Education.

## **CM-302: Software Engineering**

### **Course Objectives**

This course introduces the concepts and methods required for the construction of large software intensive systems. It aims to develop a broad understanding of the discipline of software engineering. It seeks to complement this with a detailed knowledge of techniques for the analysis and design of complex software intensive systems. It aims to set these techniques in an appropriate engineering and management context. It provides a brief account of associated professional and legal issues.

### **Course Outcomes**

After completing the course students will be able to understand the issues affecting the organization, planning and control of software based systems development, complete the analysis and design of a small software intensive system, read and understand the professional and technical literature on software engineering.

### **Course Contents**

#### **Unit 1: Product and Process**

Evolving role of Software(SDLC), Software Characteristics, Software Applications, Crisis on the Horizon, Software Myths, A layered Technology, software process model, Evolutionary software process models, Component based development, fourth generation techniques, process and product.

#### **Unit 2: Managing Software Project:**

Introduction, Project Management Concepts, Software Process and Project Metrics.

#### **Unit 3: Conventional Methods for Software Engineering**

Introduction, System Engineering, Analysis Concepts and Principles, Analysis Modeling.

#### **Unit 4: Design Concepts and Principles**

Architectural Design, User Interface Design, Component-level Design.

#### **Unit 5: Software Testing Techniques**

Software testing Strategies, Testing tactics.

#### **Unit 6: Object- Oriented Software Engineering**

Introduction, Object-Oriented Concepts and principles, Objected-Oriented Analysis, Object-Oriented Design, Object-Oriented Testing, Technical Metrics for Object-Oriented Systems.

Text Books:

1. Software Engineering a Practitioners Approach- Pressman, 5<sup>th</sup> Edition, TMH.
2. An integrated approach to software Engineering- Pankaj Jalota, Narosa Publication.

### **Reference Books:**

1. Software Engineering- Jawadekar, TMH Pub.
2. Software Engineering - Sommerville, Pearson Education.

## **CM-303 : Information Security and Audit**

### **Course Objectives**

The student should be made to Learn the security issues network layer and transport layer, Be exposed to security issues of the application layer, Learn computer forensics Be familiar with forensics tools, Learn to analyze and validate forensics data, audit trials

### **Course Outcomes**

Upon completion of the course, the student should be able to discuss the security issues network layer and transport layer. Apply security principles in the application layer. Explain computer forensics. Use forensics tools. Analyze and validate forensics data.

### **Course Contents**

#### **Unit 1**

IPSec Protocol - IP Authentication Header - IP ESP - Key Management Protocol for IPSec Transport layer, Security: SSL protocol, Cryptographic Computations – TLS Protocol.

#### **Unit 2**

PGP - S/MIME - Internet Firewalls for Trusted System: Roles of Firewalls – Firewall related terminology- Types of Firewalls - Firewall designs - SET for E-Commerce Transactions.

#### **Unit 3**

Introduction to Traditional Computer Crime, Traditional problems associated with Computer Crime. Introduction to Identity Theft and Identity Fraud. Types of CF techniques - Incident and incident response methodology – Forensic duplication and investigation.

#### **Unit 4**

Preparation for IR: Creating response tool kit and IR team. - Forensics Technology and Systems - Understanding Computer Investigation – Data Acquisition.

#### **Unit 5**

Processing Crime and Incident Scenes–Working with Windows and DOS Systems. Current Computer Forensics Tools: Software/ Hardware Tools.

#### **Unit 6**

Validating Forensics Data – Data Hiding Techniques – Performing Remote Acquisition – Network Forensics – Email Investigations – Cell Phone and Mobile Devices Forensics

### **Text Books**

1. Internet Security: Cryptographic Principles, Algorithms and Protocols- Man Young Rhee, Wiley Publications.
2. Computer Forensics and Investigations- Nelson, Phillips, Enfinger, Steuart, Cengage Learning, India Edition.

### **Reference Books**

1. Computer Forensics- John R.Vacca, Cengage Learning.
2. Internet Cryptography- Richard E.Smith, 3 rd Edition Pearson Education.
3. Computer Forensics and Cyber Crime: An Introduction- MarjieT.Britz, 3 rd Edition, Prentice Hall

## **CM-304 A : System Administration and Server Integration**

### **Course Objectives**

This course introduces the UNIX/Linux family of operating systems. Basic commands, utilities, System structures, scripting and tools are explored. Elements of system administration are presented. This course is primarily oriented for would-be users of UNIX -- in the words of the course text, p. iv, for those "primarily interested in it as a tool". It is not a course in UNIX system programming (it is not a course in UNIX internals), nor is it a course in UNIX system administration, although I hope we will brush up against a few aspects of UNIX system administration during the course of the semester.

### **Course Outcome**

Students who complete the course will have demonstrated the ability to do the use of basic UNIX/Linux commands from the command line (from a terminal window); organize and manage their files within the UNIX/Linux file system; organize and manage their processes within UNIX/Linux; usefully combine UNIX/Linux tools using features such as filters, pipes, redirection, and regular expressions; customize their UNIX/Linux working environment; be knowledgeable enough about basic UNIX/Linux shell scripting to be able to successfully read and write bash shell scripts; know how to use UNIX/Linux resources to find additional information about UNIX/Linux commands.

### **Course Contents**

#### **Unit- 1:**

Definition of Operating System, Types of Operating System, features of Linux, Basic Architecture of Unix/Linux system, features of Kernel and Shell.

#### **Unit-2:**

Linux/Unix File system - Boot block, super block, Inode table, data blocks, How Unix/Linux kernel access files, Unix/Linux standard file system.

#### **Unit 3:**

Structure of file system, Essential Linux commands - Commands for files and directories creating and viewing files using cat, cd, ls, cp, md, rm, mkdir, rmdir, pwd, file, more, less, file comparisons – cmpandcomm, View files, disk related commands, checking disk free spaces, chmod with its options, cal,date,who,tty, lp, stty.

#### **Unit 4:**

Filters and pipes: head, tail ,wc, pr, cut, paste, sort, unique, grep, egrep, fgrep ,tee,  
The process: shell process, parent and children, process status, system process, multiple jobs in background and foreground, changing process priority with nice, premature termination of process, Mathematical commands- bc, expr, factor, units.

#### **Unit 5:**

Creating and editing files with VI editor with their command options, Operators, text deletion, text movement, changing text, yanking text, filtering text, the ex mode, moving text from one file to another. Communication: The bulletin board –news, write, mesg, talk, mail, elm, pine, finger, vacation and connecting to remote machine.

#### **Unit 6:**

System administration Common administrative tasks, identifying administrative files configuration and log files, Role of system administrator, Managing user accounts-adding and deleting users, changing permissions and ownerships, Installation of Unix/Linux system– Unix/Linux Installation requirement, complete Procedure steps, Partitioning the Hard drive, System startup and shut-down process, init and run levels. File system mounting, lpstat, backup strategy, installing software on Unix/Linux.

### **Text Books**

1. Unix – Syed Mansoor Sarwar, Robert kortskey - Pearson Education.

**Reference Books:**

1. Unix concepts and Application- Sumitabha Das, Tata McHill
2. Using Linux – David Bandel and Napier, Pearson Education.

**CM-304 B : Server and Desktop Technologies**

**Course Objectives:** Configure and Troubleshoot Domain Name System, Maintain Active Directory Domain Services, Manage User and Service Accounts, Implement Group Policy Infrastructure

**Course Outcomes:** Best Practices for domain configuration Best Practices for group policy.

Units

1. Install servers, Configure servers, Configure local storage (Emphasis on windows server 2012)
2. Configure file and share access, Configure print and document services, Configure servers for remote management
3. Create and configure virtual machine settings Create and configure virtual machine storage, Create and configure virtual networks
4. Configure IPv4 and IPv6 addressing, Configure servers, Deploy and configure the DNS service
5. Install domain controllers, Create and manage Active Directory users, Create and manage Active Directory groups
6. Create Group Policy Objects, Configure security policies, Configure application restriction policies, Configure Windows Firewall

**References**

1. MCTS Self-Paced Training Kit (Exam 70-410): Installing and Configuring Windows Server 2012



<b>Course Code:</b>	<b>CM-305</b>	<b>Based on CM-301</b>	<b>Credits: 02</b>
<b>Course Objectives:</b> As per the Lab Manual circulated to students by the concerned Teacher			
<b>Course Outcome:</b> As per the Lab Manual circulated to students by the concerned Teacher			
<b>Experiments</b> As per the Lab Manual circulated to students by the concerned Teacher			

<b>Course Code:</b>	<b>CM-306</b>	<b>Based on Elective Subject</b>	<b>Credits: 02</b>
<b>Course Objectives:</b> As per the Lab Manual circulated to students by the concerned Teacher			
<b>Course Outcome:</b> As per the Lab Manual circulated to students by the concerned Teacher			
<b>Experiments</b> As per the Lab Manual circulated to students by the concerned Teacher			

<b>Course Code:</b>	<b>CM- 307A</b>	<b>Open Elective</b>	<b>Credits: 02</b>
<b>Open Elective : University recognized MOOC (NPTEL / SWAYAM / others) OR Intra / Inter Departmental courses OR RUSA sponsored Future Oriented Courses</b>			

**OR**

### **CM- 307 B : Technical Writings**

**Objectives :** To acquaint students with a variety of forms of writing in science and technology; develop research skills; discuss and apply writing and formatting techniques; review grammar and revision.

#### **Topics**

1. Discussion of types of technical writing, audience analysis, and persuasion.
2. Discussion of definition writing and analysis of material.
3. Discussion of description of mechanisms and processes.
4. Discussion of library resources, research techniques, and proposal writing.
5. Discussion of collecting notes, writing outlines, and writing rough drafts.
6. Discussion of the elements of the formal research report.
7. Discussion of graphic aids in technical reports.
8. Discussion of grammar, technical writing style, and paper revision.
9. Discussion of the job application procedure, including application letters and resumes.
10. Discussion of plagiarism and professional ethics.

Course Code:CM-308

Course Title: **Seminar Presentation Activity**  
(**SK-03 Skill Based Activity**)

**Objectives :**

1. To enable a student to be familiar with Communication skills
2. Student is expected to Learn – how to deliver a seminar
3. Every student must deliver a seminar on recent topic and one seminar report has to be submitted

## **CM-401: Software Testing**

### **Course Objectives**

To understand the testing concepts with software quality measures and quality assurance. To understand the defect management and improve software quality. To understand the testing tools.

### **Course Outcomes**

This course will give deep knowledge about software testing concepts with various kinds of software tools and techniques. This course also guides students to learn software quality measures and quality improvement strategies.

### **Course Contents**

#### **Unit 1** Introduction

Introduction, Nature of errors, an example for Testing, Definition of Quality, QA, QC, QM and SQA, Software Development Life Cycle, Software Quality Factors Verification and Validation Definition of V andV, Different types of V and V Mechanisms, Concepts of Software Reviews, Inspection and Walkthrough.

#### **Unit 2** Software Testing Methods and strategies

Testing Fundamentals, Test Case Design, White Box Testing and its types, Black Box Testing and its types, Strategic Approach to Software Testing, Unit Testing, Integration Testing, Validation Testing, system Testing.

#### **Unit 3** Software Metrics and Defect Management

Concept and Developing Metrics, Different types of Metrics, complexity metrics, Definition of Defects, Defect Management Process, Defect Reporting, Metrics Related to Defects, Using Defects for Process Improvement.

#### **Unit 4** Quality Improvement

Introduction, Pareto Diagrams, Cause-effect Diagrams, Scatter Diagrams, Run charts.

#### **Unit 5** Software Quality Assurance and Quality Costs

Concepts, Quality Movement, Background issues and SQA activities Software Reviews, Formal Technical Reviews, Formal approaches to SQA Statistical Quality Assurance, Software Reliability, SQA Plan, The ISO 9001 Quality Standard, Six sigma, Informal Reviews, Quality Cost Measurement, Utilizing Quality Costs for Decision-Making .

#### **Unit 6** Testing Tools

Testing Tools, Introduction to Junit, Apache Jmeter, Winrunner, Loadrunner, Rational Robot

### **Text Books**

1. Software Engineering A Practitioners Approach-, Roger S. Pressman, Tata McGraw Hill
2. Software Engineering for Students- A Programming Approach - Douglas Bell, Pearson.
3. Software engineering: An Engineering approach- J.F.Peters, W.Pedrycz, Wiley Press.

### **Reference Books:**

1. Quality Management- Donna C. S. Summers, 5th ed., Prentice-Hall.
2. Total Quality Management- Dale H. Besterfield, Prentice Hall.
3. Software testing- Yogesh Singh, Cambridge publication
4. Software Testing and Quality Assurance Theory and Practice- Kshirsagar Naik, Priyadarshi Tripathy, Nirali Prakashan.

## **CM-402: ASP.NET using VB.NET**

### **Course Objectives**

This course will cover the practical aspects of multi-tier application development using the .NET framework. This course is to introduce the basics of distributed application development.

Technologies covered include the Common Language Runtime (CLR), .NET framework classes, VB, ASP.NET, and ADO.NET. It also cover service oriented architecture, design, performance, security, content managements and deployment issues building multi-tier applications.

### **Course Outcomes**

Upon completion of this course, the student will be able apply technical knowledge and perform specific technical skills, including design web applications using ASP.NET.

### **Course Contents**

#### **Unit 1** Web Components

Introduction to Internet, Web Client/Server Model, Protocols for Web Client/Server Communication, Understanding Web Server IIS.

#### **Unit 2** Introduction to ASP.NET

DOT NET Framework, CLR, Framework Class Library, Garbage Collection, MSIL, Web Services, COM+ Component Services, Intro to ASP.NET, ASP.NET and HTML Controls, ASP.NET Events and Events Handler.

#### **Unit 3** Web Programming with VB.

Data Types, Variables, Expressions, Flow Control, Operators, Conditional Statements, Looping Structures, Arrays, OOP Concepts, Objects, Properties, Methods, Classes, Scope, Events

#### **Unit 4** Essentials ASP.NET

Working with Web forms, Directory Structure in ASP.NET, ASP.NET Compilation Model, Code behind Model, Working with Web form Controls, Navigation Controls, Validation Controls, Validation Groups, Client/Server Side Validation.

#### **Unit 5** ASP.NET Master Page

ASP.NET Master Page Overview, Master Page Layout with CSS, Master Page Directive and Content Place Holder, Creating and Applying Themes, Cookies, ASP.NET Session State, Application State

#### **Unit 6** Data Access with ADO.NET

Working with ADO.NET, Overview of ADO.NET Objects, Working with Connection Object, Command Object, Data Adapter Object, Data Set Object, Data Reader Object, Data Table Object.

### **Text Books**

1. ASP.NET and VB.NET Web Programming - Coruch Matt J, Addison Wesley.
2. ASP.net – The Complete Reference- Matthew MacDonald, Tata McGraw Hill
3. Beginning ASP.NET 2.0- John Wiley and Sons, Wrox Publication.

### **Reference Books:**

1. ASP.NET3.5 in C# and VB- Bill Evjen, S. Hanselman, Devin Rader, Wrox Publication
2. Pro ADO.NET 2.0- Sahil Malik, A-Press.
3. Ado.Net: The Complete Reference- Michael Otey, Tata McGraw-Hill Education

Course Code: CM-403  
Course Title: Major Project development Activity

**Course Objectives:**

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

**Course Outcome:**

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

**Guidelines for Project Development:**

1. A group of maximum three students should be formed at the beginning of the semester
2. Each project will be allotted one project guide.
3. Students must submit the project topic and synopsis to the project guide.
4. Students will be given a project approval letter signed by the head of department and the project guide.
5. After receiving a project approval letter, students must submit at least three progress reports of their development in project to the guide, one per month.
6. After completion of project students have to give pre-exam demo to his guide.
7. After finalization of the project, students must prepare minimum 03 copies of the project reports, out of which one copy is for the college and one copy is for the university records. University/College copy must be bind with black covering with golden embossment and it should contain
  - i. First Page
  - ii. Certificate
  - iii. Declaration
  - iv. Acknowledgement
  - v. Project Approval letter
  - vi. Three Progress reports
  - vii. System Flow Diagram/DFD
  - viii. Chapter wise briefing, results, conclusions, snapshots, code, etc
  - ix. Bibliography

## **CM-404 A : Software Project Management**

### **Course Objectives**

Software Project Management covers details about handling the project activities, principals and modern software project management practices. The five process groups and nine knowledge areas of the Project Management Institute Body of Knowledge (PMI BOK) are examined in the context of the systems development lifecycle. Portfolio management and the use and application of software project management tools are also discussed

### **Course Outcome**

Students will Understand the five process groups and nine knowledge areas of the PMI Book, Understand approaches for managing and optimizing the software development process, Understand efficient techniques for managing each phase of the systems development lifecycle, Use and application of tools to facilitate the software project management process.

### **Course Contents**

#### **Unit-1** Fundamentals of Project Management

Definition, Characteristics of Project, Types of Project, Project Phases, Project management Process, Project life cycle, Project Life Cycle Models

#### **Unit-2** Project formulation

Significance of project formulation, Step-Wise Approach to Project formulation, Feasibility analysis, Cost Benefit Analysis, Cash flow forecasting, Return on Investment.

#### **Unit-3** Software project Approach Selection

Project Vs Activity, Activity Planning, Planning Approaches, Process models, Waterfall model, V Model, Spiral model, Software prototyping, appropriate model selection

#### **Unit-4** Software Effort Estimation

Software estimation techniques, Estimation Approaches, Definition of Project scheduling, Project controls and importance, Network techniques of Project Management: Gantt chart, CPM, PERT, COCOMO

#### **Unit-5** Risk and Uncertainty Decisions

Project Risk, Types of Project Risk, Identification of Risk, Risk Prioritization, Project risk Analysis, Qualitative analysis and Quantitative analysis, Sensitivity Analysis, Break Even analysis, Risk Planning

#### **Unit-6** Resource Allocation

Resources, Burman's Priority list, Cost Schedules, Software quality assurance, relation between software quality and software productivity, Role of project manager in software development

### **Text Books**

1. Project Management, S. Chaudhary, Tata McGraw Hill.
2. Project-Preparation, Appraisal, Budgeting and Implementation, Prassna Chandra, Tata McGraw Hill.

### **Reference Books:**

1. Software Project Management, Bob Hughes and Mike Cotterell, Tata McGraw Hill.
2. Software Project Management: A real-world Guide to Success, Joel Henry, Pearson education.

## **CM-404 B: Mobile Application Development**

### **Course Objectives**

Today's applications are increasingly mobile. This course teaches students how to build mobile apps for Android that is today's mobile operating platforms. Students learn to write both web apps and native apps for Android using Eclipse and the Android SDK platforms.

### **Course Outcomes**

At the conclusion of the course, students should be able to understand the basic concepts of mobile computing, Learn the basics of mobile telecommunication system, Be exposed to Ad-Hoc networks and Gain knowledge about different mobile platforms and application development

### **Course Contents**

#### **Unit 1** Introduction

Introduction to Mobile Computing, Introduction to Android Development Environment, Factors in Developing Mobile Applications, Mobile Software Engineering, Frameworks and Tools, Generic UI Development, Android User Understanding B4A for Android: Installing Basic4Android and Android SDK, Install and configure Basic4Android, Installing Android Emulator, My first program (MyFirstProgram.b4a), Second program (SecondProgram.b4a)

#### **Unit 2** Understanding Android Mobiles and the IDE of B4A

Screen sizes and resolutions (Special functions like 50%x, 50dip, PerXToCurrent, PerYToCurrent - 50%x, DipToCurrent - 50dip), Understanding various Android Emulators for B4A, Understanding B4A bridge (The Designer, Tools, General Setting)

Menu and Toolbar, Toolbar, File menu, Edit menu, Project menu, Tools menu, Code area, tabs

#### **Unit 3** Process and Activity life cycle

Variables and objects, Variable Types, Names of variables, declaring variables, Simple variables, Array variables, Array of views (objects), Type variables, Casting, Scope( Process variables, Activity variables, Local variables), Tips and Modules(Activity modules, Code modules, Service modules)

#### **Unit 4** Understanding Basic Language

Program flow, Process Globals routine, Globals routine, Activity Create (First Time As Boolean) routine, Activity Resume routine, Activity Pause (User Closed As Boolean) routine, Expressions (Mathematical expressions, Relational expressions, Boolean expressions), Conditional statements (If – Then – End If, Select – Case) Loop structures (For – Next, Do – Loop), Subs (Declaring, Calling a Sub, Naming, Parameters, Returned value), Events, Libraries (Standard libraries, Additional libraries folder)

#### **Unit 5** Creating User Interface,

Menu example, TabHost example, Button toolbox example, Scroll View examples, SQLite Database (SQLite Database basics, SQLite Database example program), GPS (GPS Library, GPS Objects)

#### **Unit 6:**

String manipulations, Files (File object, Text Writer, Text Reader, Text encoding), Graphics and Drawing

### **Text Books**

1. Fundamentals of Mobile Computing- Prasant Kumar Pattnaik, Rajib Mall, PHI Learning Pvt.Ltd, New Delhi.

### **Reference Books**

1. Java: A Beginner's Guide- Herbert Schildt, Oracle Press.
2. Learning Java by Building Android Games- John Horton, Packt Publishing.
3. Android Programming for Beginners- John Horton, Packt Publishing.

<b>Course Code:</b>	<b>CM-405</b>	<b>Lab 7: Based on CM-402</b>	<b>Credits: 02</b>
<b>Course Objectives:</b> As per the Lab Manual circulated to students by the concerned Teacher			
<b>Course Outcome:</b> As per the Lab Manual circulated to students by the concerned Teacher			
<b>Experiments</b> As per the Lab Manual circulated to students by the concerned Teacher			

<b>Course Code:</b>	<b>CM-406</b>	<b>Lab 8: Based on Elective Subject</b>	<b>Credits: 02</b>
<b>Course Objectives:</b> As per the Lab Manual circulated to students by the concerned Teacher			
<b>Course Outcome:</b> As per the Lab Manual circulated to students by the concerned Teacher			
<b>Experiments</b> As per the Lab Manual circulated to students by the concerned Teacher			

<b>Course Code:</b>	<b>CM- 407A</b>	<b>Open Elective</b>	<b>Credits: 02</b>
<b>Open Elective : University recognized MOOC (NPTEL / SWAYAM / others) OR Intra / Inter Departmental courses OR RUSA sponsored Future Oriented Courses</b>			

OR

### **CM- 407 B : Information Communication Technology (ICT)**

#### **Course Objectives:**

The Information and Communication Technology is Open elective course. This syllabus is developed according to the concepts of skills required in all most all domains. This course offers deep understanding of ICT usage and its applications, which enable students to meet their individual needs.

#### **Course Outcomes:**

This course will developed technical, practical, personal and organizational skills in students. This course benefits students to meet their personal as well as global needs according to ever growing challenges in ICT.

#### **Course Contents**

##### **Unit 1** Computer Fundamentals

Information processing Cycle, Brief History of Computers, Environmental, social and ethical issues, laws of ICT, Organizations of Computer System, Introduction to Operating Systems, measures to protect data and systems

##### **Unit 2** Application Software



Advance Word Processing, working with styles, templates, forms, Advance Spreadsheets, working with multiple worksheets and workbooks, advance functions, Making presentations, working with multimedia presentations

**Unit 3 Database**

Working with data, tables, and relationships, creating and customising queries, customising forms, creating reports

**Unit 4 Information and Communication systems**

Information systems, networking concepts, functions of network devices, cabling standards, firewall, networking protocols, network security

**Unit 5 Internet Terminology**

Web Fundamentals, Web Security, Communication protocols, creating web pages, working with images and multimedia, working with special effects

**Unit 6 Applications of ICT**

Career options in ICT, Job search on Internet and other media, Formatting Resume or CVs, Formatting Application Letters, working with publications

**Text Books**

1. Computer Fundamentals, Ms Office and Internet and Web Technology- Dinesh Maidasani, Firewall Media.
2. Computer Fundamentals- Anita Goel, Person Education.
3. Computer Fundamentals- P. K. Sinha, EduTech Learners.

**Reference Books:**

1. MS Office for Dummies- Wallace Wang, Wiley Publishing, Inc.
2. Ms Office Step by Step- John Lambert, Microsoft Press.
3. Access Bible - Michael Alexander, Wiley Press.
4. Fundamentals of Computer Networking - Sanjay Sharma, Katson Press.

Course Code:CM-408  
Course Title:**Skill Based Activity**  
**(SK-04 Soft Skills)**

- Soft skill Necessary for IT recruitment and further studies
- Strong technical skills are essential for any IT (information technology) position. However, IT employees also need soft skills, sometimes known as interpersonal skills. IT professionals need to be able to interact successfully with others, as well as manage projects and teams.
- Employers have found that many IT professionals possess as many interpersonal skills as anyone else. Technology experts suffering from more severe social handicaps (such as functional forms of autism) are able to practice and learn interpersonal and other soft skills to help them integrate well within a team.



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**M.Sc. (CM) Second Year (Two Semesters)**

<b>Semester-III</b>					
<b>Course Code</b>	<b>Title of the paper</b>	<b>External credit</b>	<b>Internal credit</b>	<b>Total Credits</b>	<b>Total Nor of Classes</b>
M.SC. CM-301	Java Programming	3	1	4	40hrs
M.SC. CM-302	Operation Research	3	1	4	40hrs
M.SC. CM-303	Visual Basic.Net	3	1	4	40hrs
M.SC. CM-304	Software Testing Tools	3	1	4	40hrs
M.SC. CM-305	<b>Elective - III</b> 1. Advanced Operating System 2. JavaScript 3. PHP & My SQL	3	1	4	40hrs
M.SC. CM-306	Lab-1(Java Prog. VB.Net)	1	1	2	60hrs
M.SC. CM-307	Lab-2(Software Testing Tools)	1	1	2	60hrs
M.SC. CM-308	Seminar	0	1	1	
<b>Total Credits</b>		<b>18</b>	<b>7</b>	<b>25</b>	

<b>Semester-IV</b>					
<b>Course Code</b>	<b>Title of the paper</b>	<b>External credit</b>	<b>Internal credit</b>	<b>Total Credits</b>	<b>Total Nor of Classes</b>
M.SC. CM-401	Linux Operating System & Administration	3	1	4	40hrs
M.SC. CM-402	Web Page Design & Active Server Pages 3.0	3	1	4	40hrs
M.SC. CM-403	Network Management	3	1	4	
M.SC. CM-404	Software Project Management	3	1	4	40hrs
M.SC. CM-405	<b>Elective-IV</b> 1. ORACLE DBA 2. Distributed Database Concepts 3. Data Mining	3	1	4	40hrs
M.SC. CM-406	Lab-1(Linux OS & Adm.+WPD&ASP)	1	1	2	60hrs
M.SC. CM-407	Lab-2(Project Work)	1	1	2	
M.SC. CM-408	Open Elective	0	1	1	
<b>Total Credits</b>		<b>18</b>	<b>7</b>	<b>25</b>	



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**M.Sc. (Computer Management) Second Year (Two Semester)**

**M.Sc. CM-301**

**JAVA Programming**

**(4 Credits)**

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**UNIT I: Introduction to Java,**

An Overview of Java, Java Applets and Application, Difference between Java and Java Script , Object Oriented Programming Features, Data Types , Java Token and Keywords , Declaring a variable, dynamic initialization, The scope and Life time of Variable, Type Conversion and Casting, Arrays: One-Two-Multidimensional Arrays.

**UNIT II: Operators and Control Statements**

Arithmetic Operators , The Bitwise Operators , Relational Operators , The Assignment Operators, the ?: Operator , Operator Precedence , Selection Statements , Iteration Statements , Jump Statements

**UNIT III: Introduction to Classes and Objects, Inheritance, package and interface**

Class Fundamental , Declaring Object, Assigning Object Reference Variable, Introducing Methods, Constructors , Garbage Collection, The finalize () method , Stack Class, Overloading Constructors, Using Object as Parameter, Argument Passing , Inheritance Basics, Member Access and Inheritance, Using Super Class, Creating a Multilevel Hierarchy , Using Abstract Classes, Using Final with Inheritance , The object class , Defining a package, Understanding Class path , Importing packages , Defining an Interface, implementing Interfaces , Applying Interfaces, Variable in Interfaces

**UNIT IV: Exception Handling and String Handling**

Exception Handling Fundamentals, Exception Types, Uncaught Exceptions, Using Try and catch , Java Built in Exceptions, User defined Exceptions Sub classes , The String class, The String constructor, Special String Operations , Characters extraction, String searching and Comparison, Data Conversion using valueof () , The String Buffer Class

**UNIT V: Exploring JAVA Lang and Input/output- Exploring JAVA I/O**



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Simple type wrappers, Runtime Memory Management, Array Copy, Object Clone and Clone-able Interface, Class and Class Loader, Security Manager, The java I/O Classes and Interfaces, File name-filter and Directories, I/O Stream classes: File input string, File Output Stream, Byte Stream, Byte Array Input Stream, Byte Array Output Stream, Filtered Stream, and Buffered Streams: Buffered input stream, Buffered Output stream

**UNIT VI: Networking, The Applet class, Swing and JAVA Database Connectivity (JDBC)**

Socket Overview, Reserved Socket, Proxy Servers , Internet addressing, Domain naming services (DNS) Java and the Net, the Networking Classes and Interfaces , The applet class, applet architecture, An applet Skeleton: Initialization and termination , Overriding Update (), Status windows , Handling Event: The Event class, Processing mouse Events , Handling Keyboard Events , HTML Applet tag, passing parameter to Applets , Applet context and show Document () , The Audio Clip and Applet Stub Interface , Swing and its features, Text fields, Buttons, Toggle Buttons, Check Boxes, Radio Buttons, View ports, Scrolling, Sliders and Lists , Combo Boxes, Progress bars, Tool Tips, Separators and Choosers, Layered Panes, Tabbed Panes, Split Panes and Layouts ,Introduction to JDBC, Type of JDBC Connectivity , Accessing Relational Database from Java Programs , Establishing Database Connections

**Reference Books:**

1. The Complete Reference- Java2 by H. Schildt, Fourth Edition, 2001, Tata McGraw Hill, ISBN -0072130849
2. Java : How to Program Java2 by -Dietel and Dietel, Second Edition, 2001, Pearson Education, ISBN- 0138993947
3. Java Example in Nutshell by D.Flanagan, Third Edition, 2001, 'O' Reilly, ISBN- 0596006209

A Programmers Guide to Java Certification by K.Mughal and R.W.Rasmussen First Edition, 1999 , Pearson Education ISBN- 0201596148

1. Java Foundation Classes by M.T.Nelson, Tata McGraw Hill ISBN: 007913758X



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**UNIT I: Basics of Operations Research**

Definition of Operations Research, Characteristics of operations Research, Scientific Methods in operations Research, Necessity of operations Research, Scope of operations Research, Objective of operations Research, Phases of operations Research.

**UNIT II: Linear Programming**

Introduction, Formulation of LP Programming, Graphical solution of LP programming, Development of SIMPLEX Method, Advantages of linear programming method.

**UNIT III: Transportation Models**

Introduction to model, Matrix terminology, Definition of transportation, Formulation and solution of transportation Model.

**UNIT IV: Assignment Models**

Definition of assignment models, Comparison with Transportation Model, Mathematical representation of Assignment model, Formulation and solution of Assignment model.

**UNIT V: Theory of Game**

Introduction, Characteristics of Game Theory, Basics definitions, MaxMin (MinMax) criteria and optimal strategy, Saddle point, Optimal strategies and value of game, Solution of game with saddle point.

**UNIT VI: Project Management by PERT /C PM**

Introduction, Historical development of PERT/CPM Technique, Application of PERT/CPM, Basics steps In PERT/CPM Technique, Network diagram representation, Rules for drawing Network diagram, Project evaluation and review technique, Application areas of PERT/CPM,

**References Books:**



**Swami Ramanand Teerth Marathwada University, Nanded**  
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**M.Sc. (Computer Management) Second Year (Two Semester)**

1. Operation Research, Edition IV, Premkumar Gupta and D. S. Hira, S. Chand and Co. Ltd Publication, 2002, ISBN-81-219-0218-9
2. Operation Research, Edition IV, , Premkumar Gupta and D. S. Hira, S. Chand and Co. Ltd Publication, 2009, ISBN-81-219-0281-9
3. Operations Research, 2005-06, S.D. Sharma, Kedar Nath Ram Nath and CO publishers. ISBN: 935059336X



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**UNIT I: Getting Started With VB.Net and Visual Basic: The Language**

The integrated Development Environment, The Start Page. Project types, The IDE Components, Building Console Application. Variables, Constants, Arrays, Flow Control Statements.

**UNIT II: Writing And using procedure and Working with Forms**

Subroutine Function, Arguments passing Mechanisms, Event handler Arguments, Passing an unknown number of Arguments, Overloading function. The Appearance of the Form, Properties of the form, Anchoring & Docking, The Form Events, Loading & Showing forms, Controlling one Form from within another, Forms vs Dialog Boxes Designing Menus, The Menu Editor, The Menu item Object Properties, Manipulating menus Run Times. Iterating a menu Item, Building Dynamic Form at Run Time, Creating Event handler At Run Time

**UNIT III: Basic and More Windows Controls AND Building Custom Class & Windows Control**

The Text Box. Control, Basic Properties, Text manipulation properties, Text selection properties, TextSelectionMethod, Undoing Edits, Capturing keystrokes, The ListBox, CheckedListBox, & ComboBox Control, Basic properties, The Item Collection, Searching, The Scrollbar & Trackbar Control, The Common Dialog Control, Color Dialog Box, The font Dialog Box. The Open & save As Dialog Box, The Prim Dialog Box, The Rich Text Control, The Rich textbox Properties, Methods, Advanced Edition Feature, Cutting & Pasting, Searching in Rich Textbox, Formatting URL, Print Document, PrintDialog, PageSetupDialog, PrintPreviewDialog Controls, printer & Page Properties, ImageListControl, The TreeView Control, Adding new Items at Design Time, Adding New Item at Run time, Assigning images to Node Scanning the Tree View Control, The ListView Control, The Column Collection, The ListViewItem Objects, The Item Collection, The Sub ItemCollection. Building & using Custom class, Properties in custom class, Inheritance, Polymorphism, MyBase & MyClass Keywords, Building & using CustomControl, designing Irregular Shaped Control, Designing Owner Drawn Menus

**UNIT IV: Handling Strings, Charters, Dates and Working with Files & Folders**

The Char & String Class, The DateTime Class. Directory, File, DirectoryInfo, FileInfo & Path Classes, FileStream, StreamReader, StreamWriter Objects, Sending Data to a File, The File System watcher Components

**UNIT V: Drawing & Painting with Visual Basic and Error Handling & Debugging, Tilt Multiple Documents Interface**



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Displaying lineage, Exchanging Images through the clipboard, Drawing with GDI+, The Basic Drawing Objects, Drawing Shapes, Drawing Methods. Types of Error, Exception & Structured Exception handling, Debugging. MDI Application, Building MDI Application Built In capabilities of MDI Application. Accessing Child Forms.

**UNIT VI: Building Database Application with ADO.NET and Introduction to web Programming**

The architecture of ADO .NET, Creating Dataset, DataGrid Control, Data binding, DataAdapter Object, The Command & DataReader Objects 12.0, The Structure of Dataset, The DataForm Wizard, Transaction. Building web Application, Interacting with web Application, The Web Control, The ASP.NET Objects, The Page Object, The Response Objects, The Request Objects, the Server Objects, Handling Multiple Forms In web Application.

**Reference Books**

1. Mastering Visual Basic.Net By Evangelos Patroutsos (BPB Publication)
2. Visual Basic. Net Programming By Billy Hollis, Rockford Thotlog (Wrox Publication)
3. Visual Basic.Net Programming Black Book By Steven Holzner
4. Beginning VB.Net (2<sup>nd</sup> Edition)





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**M.Sc. (Computer Management) Second Year (Two Semester)**

**UNIT I: Introduction to Software Testing**

Quality, Quality Culture, Customer View, Characteristic of Software, SDLC Life cycle, Definition of Software testing, Principles of Software testing, Economics of testing, Testing policy, Structured approach to testing. Testing Process, Test objects, Test Methods, Black Box testing, White box testing, Configuration Management

**UNIT II: Defect Management**

Defect, Software Verification and Validation, Defect Techniques for Finding defect, Static technique, Dynamic technique, Categories of testing, Defect Management Process, Defect Management Risks, Retesting, Defect Life Cycle, Defect Tracking Tools, Severity, Priority, Defect Reporting, Defect Density

**UNIT III: Levels of Testing**

‘V’ Model, Stub, Driver, Integration Testing, Bottom-Up Testing, Top-down testing Sub-System testing, System testing, Execution Testing, Usability Testing, Compatibility testing, Operation testing, Acceptance Testing, Alpha Testing, Beta Testing. Regression testing Error-handling testing, Manual-Support testing, Smoke testing, Ad-hoc testing, Parallel Testing, Stress testing, Load testing.

**UNIT IV: Writing and Tracking Test Cases**

Test plan, Test plan Benefits, Test Plan Template, Test Scope, Test Objectives, Assumptions, Risk, Risk Analysis, Risk management, Test Schedule and Planned Resources, Test case planning overview, Test Design, Test Cases, Test Procedures, Building Test Data, Equivalence Partitioning, Boundary Value analysis, Test case Organization and Tracking

**UNIT V: Automated Testing and Test Tools**



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Benefits of Automation, Introduction to Winrunner7.01 , Recording and Playback, GUI Map File and GUI map per Test , Creating Checkpoints, Virtual Object wizard, Programmed macros, Recording Tests, Synchronizing Test, checking bitmaps , Creating Data Driven Tests, Reading Text, Creating Batch Tests.

**UNIT VI: Test Director Software and Quick Test Professional**

Server and Client System configuration, Applications of Test Director, Creating Users in the project, Assigning Rights, Writing Test Cases in Test Director, Automation of test cases, Bug reporting, Customization of Fields, Introduction to QTP, Record and Play back, Active Screen , Running and analyzing Tests, Creating Checkpoints , Parameterizing Tests, Creating Output Values, Working with regular Expression, Dividing Tests into Multiple Actions

**Reference Books:-**

1. Software Engineering by Roger S. Pressman, Sixth Edition, McGraw Hill International Pub, ISBN- 0077227808.
2. Software Testing in the Real World by Edward Kit, Addition – Wesley Pub, ISBN-0201877562
3. Software Testing by Ron Patton, Second Edition, BPB Publication, ISBN-9780672327988
4. The Art of Software Testing by G. J. Myers, Third Edition, Wiley-InterScience Pub, ISBN: 9781118031964

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**M. Sc. CM-305 Elective III (1)Advanced Operating System (4 Credits)**

**UNIT I Introduction to UNIX/Linux Kernel**



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**Choice Based Course Credit System (distribution and details of CBCS System)**  
**M.Sc. (Computer Management) Second Year (Two Semester)**

System Structure, User Perspective, Assumptions about Hardware, Architecture of UNIX Operating System (TextBook-3: Chapter Topics: 1.2, 1.3, 1.5, 2.1), Concepts of Linux Programming-Files and the File system, Processes, Users and Groups, Permissions, Signals, Inter-process Communication (TextBook-1: Chapter 1- relevant topics)

### **UNIT II File and Directory I/O**

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 (TextBook- 3: Chapter Topics: 3.1-3.4, 4.1, 4.2, 5.1-5.3, 5.5-5.7, 5.12, 5.13) 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 (TextBook-4: Chapter Topics: 3.3, 3.4, 3.10 3.14, 3.16, 4.2-4.23)

### **UNIT III: Process Environment, Process Control and Process Relationships**

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 (TextBook-3: Chapter Topics: 6.1-6.4, 6.6, 7.1-7.8, 8.1)

### **UNIT IV: Memory Management**

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 (TextBook-3: Chapter Topics: 9.1, 9.2)

### **UNIT V. Signal Handling**

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 (TextBook-4: Topics: 10.2-10.13, 10.15-10.19)

### **Unit VI: Windows Thread Management**

Thread Internals Data Structures, Kernel Variables, Performance Counters, Relevant Functions, Birth of a Thread Examining Thread Activity: Limitations on Protected Process Threads, Worker Factories (Thread Pools) Thread Scheduling Overview of Windows Scheduling, Priority Levels, (TextBook-2: Chapter 5 [relevant topics])



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**References:**

1. Linux System Programming, O'Reilly, by Robert Love.
2. Windows Internals, Microsoft Press, by Mark E. Russinovich and David A. Solomon.
3. The Design of the UNIX Operating System, PHI, by Maurice J. Bach.
4. Advanced Programming in the UNIX Environment, Addison-Wesley, by Richard Steve

**M.Sc. CM-305 Elective III (2)**

**JavaScript**

**(4 Credits)**

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**UNIT I: Introduction to JavaScript**



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### Choice Based Course Credit System (distribution and details of CBCS System) M.Sc. (Computer Management) Second Year (Two Semester)

First look at JavaScript, Adding JavaScript to XHTML Documents, History & Use of JavaScript, JavaScript's Primitives Types – Numbers, Strings, Booleans, Undefined and Null, Composites Types – Objects, Arrays, Functions and The typeof Operator, Variables – Identifiers, Variable Declaration

#### **UNIT II: Operators & Statements**

Operators – Assignment, Arithmetic, Bitwise, Bitwise Shift, Comparison, Logical, typeof, void, Increment, Decrement and ?: Operator, Core JavaScript Statements – if Statements, switch Statement, while loop, do-while loop, for loop, continue and break Statement

#### **UNIT III: Functions and Objects**

Function Basics –Parameter-Passing Basics, return Statement and Parameter Passing: In and Out, Recursive Functions, Objects in JavaScript, Object Fundamentals – Object Creation, Object Destruction, Properties, Objects Are Reference Types and Passing Objects to Functions

#### **UNIT IV: Array, Date, Math's & Type Related Objects**

Array – Accessing Array Elements, Adding, Changing and Removing Array Elements, Array as Stacks and Queues and Manipulating Arrays, Date – Creating Dates and Manipulating Dates, Math – Constants and Methods Provided by the Math Object, Type Related Objects – Number and String

#### **UNIT V: Regular Expression**

The Need for Regular Expressions, The Concept of Regular Expressions, Introduction to JavaScript Regular Expressions – Creating Patterns, RegExp Object – test, compile and exec, String Methods for Regular Expressions – search, split, replace and match

#### **UNIT VI: Form Handling**

The Need for JavaScript Form Checking, Form Basics – Accessing Forms and Accessing Form Fields, Form Fields – Common Input Element Properties, Buttons, Text Fields, Checkboxes, Radio Buttons, Hidden Fields, File Upload Fields, Select Menus, Label, Fieldset and Legend, Form Validation – Abstracting Form Validation and Drop-in Form Validation

#### **REFERENCE BOOKS –**

1. The Complete Reference, JavaScript – By Thomas Powell, Fritz Schneider, TATA McGRAW-HILL Edition, 2004, ISBN – 0-07-0590027-3
2. Pure JavaScript – By R. Allen Wyke Jason D. Gilliam, Charlton Ting, Sean Michaels, SAMS Publishing, 2001, ISBN – 0-672-32141-6

**M.Sc. CM-305 Elective III (3)**

**PHP & My SQL**

**(4 Credits)**

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**M.Sc. (Computer Management) Second Year (Two Semester)**

**UNIT I: Introduction to PHP**

Basic Syntax, Sending Data to the Web Browser, Understanding PHP and HTML and White Space, Writing Comments, What Are Variables? , About Numbers, About Strings, About Constants, Operators, What Are Arrays, Conditionals statements, looping statements.

**UNIT II: Creating Dynamic Web Sites**

Creating an HTML Form, Handling an HTML Form, Validating Form Data, Handling HTML Forms with PHP Redux, Making Sticky Forms, Including Multiple File, Creating and Calling Your Own Functions, Variable Scope, Date and Time Functions, Sending Email

**UNIT III: Introduction and Advanced SQL and MySQL**

Choosing Your Column Types, Choosing Other Column Properties, Creating Databases and Tables, Inserting Records, Selecting Data, Using Conditionals, Using LIKE and NOT LIKE, Sorting Query Results, Limiting Query Results, Updating Data, Deleting Data, Using Functions, Database Design, Performing Joins, Grouping ,Creating Indexes, Using Different Table Types, Performing FULLTEXT Searches, Database Optimization

**UNIT IV: Error Handling and Debugging**

General Error Types and Debugging, Displaying PHP Errors, Adjusting Error Reporting in PHP, Creating Custom Error Handlers, Logging PHP Errors, Debugging Techniques, SQL and MySQL Debugging Techniques

**UNIT V: Using PHP with MySQL**

Modifying the Template, Connecting to MySQL and Selecting the Database, Executing Simple Queries, Retrieving Query Results, Ensuring Secure SQL, Counting Returned Records, Updating Records with PHP

**UNIT VI: Web Application Security**

Using Cookies, Using Sessions, Sessions and Cookies, Improving Session Security, More Secure Form Validation, Handling HTML, Validating Data by Type, Form Validation with JavaScript

**References**

1. PHP and MySQL for Dynamic Web Sites: Visual Quickpro Guide, Second Edition, Larry Edward Ullman, Peachpit Press, 2003, ISBN 0321186486, 9780321186485.



**Swami Ramanand Teerth Marathwada University, Nanded**  
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**M.Sc. (Computer Management) Second Year (Two Semester)**

2. Programming PHP, II Edition, "Rasmus Lerdorf, Kevin Tatroe, Peter MacIntyre", "O'Reilly Media, Inc.", 2013, ISBN 1449365833, 9781449365837

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**M. Sc. CM-401 Linux Operating System and Administration (4-Credits)**

**UNIT I: Introduction to Fedora**



**Swami Ramanand Teerth Marathwada University, Nanded**  
**Choice Based Course Credit System (distribution and details of CBCS System)**  
**M.Sc. (Computer Management) Second Year (Two Semester)**

Features of Fedora, Hardware Requirements, Fedora Installation, Working with Linux file system, Logging to & working with Linux, Changing User Information, Reading Documentation, Using the shell, Using the text editors, Working with File Permissions

**UNIT II: The X Window System**

Basic X concept, Using XFree86, Starting X, Selecting & using X window manager

**UNIT III: Managing Users & Services**

User Accounts, Managing users, Managing Groups, Managing passwords, Granting System administrative privileges to regular users, User login process, Fedora core Linux Boot Process, System services and run levels, Controlling services at boot with administrative tools, Starting and stopping services manually

**UNIT IV: Managing Software & System Resources**

Using RPM for software management, controlling software from source, System monitoring tools

**UNIT V: Backing up, Restoring & recovery**

Choosing Backup strategy, Choosing backup hardware & media, Using Backup software, Copying files

**UNIT VI: Printing and Network Connectivity with Linux**

Configuring & managing print services, Creating & configuring Local printers, Creating Network printers, Using network configuration tools, Using DHCP [Dynamic Host Configuration Protocol], Using the network file system, Putting SAMBA to work, Introduction to DNS & Apache web server

**Reference Books:-**

1. Red Hat Linux 7 Unleashed by Bill Ball, David Pitts. Publisher: Sams 2000. ISBN-13: 9780672319853
2. Fedora Unleashed by Bill Ball ISBN: 8129705087

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**M. Sc. CM-402 Web Page Design and Active Server Pages 3.0(4 –Credits)**

**UNIT I: Web Publishing and HTML Documents**





**Swami Ramanand Teerth Marathwada University, Nanded**  
**Choice Based Course Credit System (distribution and details of CBCS System)**  
**M.Sc. (Computer Management) Second Year (Two Semester)**

Basic HTML Concepts, HTML: Structured Language, Overview of HTML, web Browser, WWW, Web Server, The Phases of Web Site Development-Implementation, Maintenance, Testing, What are Links or URLs? Structure of HTML Documents-HTML, Head, Title, Body tags, The Mark up tags Heading Styles, Formatting Text, List styles, Line Breaks, Paragraphs, Div, Including images in the Documents, Introduction to Hyper linking, The Anchor tag, Anchor tags and Images, Formatting table, Table, Table rows, Table data tags, Table Header and Footer tags, Frames The Form tag, Action and Method Attributes, Controls: Text fields, checkboxes, Option Buttons, Submit Buttons, Listboxes, Password Fields.

**UNIT II: Getting Started with ASP and Client side scripting and Server side scripting**

What is Dynamic Web Page?, Using dynamic web page, Installing and Configuring IIS 5.0 The Microsoft Management Console(MMC), Testing Web Server, Virtual Directories, How do Web Server Works, Client Side Scripting, Writing Client Side Scripts, A Client Side Script using VB script, A Client Side Script using Javascript, Advantage & Disadvantage of Client Side scripting, Server Side script-Writing Server Side Scripts.

**UNIT III: Basic ASP Technique, Variables, ASP control Structure and Object, Properties, Methods and Events**

Getting Information from the User, Using the Information Obtained from the User, A Simple Example. Creating Variables, Data Types in VB Script, Declaring Variable, Option Explicit arithmetic & Comparison Operator, Constant & String Manipulation, Arrays. Branching Structure-If.....Then, Select Case, Looping structure-For.....Next, For Each Next, Do.....While, Do loop while, Jumping Statement- Procedures, Functions. Object Terms- Programming with Object, Object Model Structure.

**UNIT IV: The Request & Response Objects and Application, Session and Cookies**

Sending Information to the Server, Sending Information Back to the Client Write Method The Request Object Collection: Query Strings, Forms, Server Variable, Client Certificate The Response object -1. Controlling information 2.Content expiration 3.Redirection Server. Execute & Server. Transfer. Using Cookies- Making & Deleting Cookies, The Application object, Application variable, Application object collection, Application object method, Global.asa, The Session Object, Session Object collection, Session Object, Properties, Session Object Method, Session & Global.asa.

**UNIT V: Error Handling and Server Pages Components**

Types of Error, Debugging ASP Script, Client Side versus Server Side Debugging, Get Last Error method, The Server Object, The Add Rotator Component, The Content linking Component, The Browser capabilities Component.

**UNIT VI: ASP & Data Store Access And Using Recordsets**



**Swami Ramanand Teerth Marathwada University, Nanded**  
**Choice Based Course Credit System (distribution and details of CBCS System)**  
**M.Sc. (Computer Management) Second Year (Two Semester)**

Universal Data Access, ODBC, OLE- DB , ADO. Getting data, Microsoft Access(.mdb)files, Microsoft SQL Server/ MSDE(.mdf) files, What is connection? connection String Data Link file, Data Source Names, Connection Object, Opening a Connection, Closing a connection, The Recordset object, Creating a Recordset using Explicit connection object ADO Constants, Active Connection, Cursor Type, ADO Cursor Type, Locking, Using Recordset Object, BOF and EOF properties, Moving through Records, Finding Records, Filtering

**Reference Book's**

1. Beginning ASP 3.0 by David Buser, John Kauffman, wrox publication ISBN: 978-0-7645-4363-0
2. Mastering Active Server pages 3 By Russell Jones (BPB publication) ISBN-10: 0782126197
3. Complete Reference – HTML – Powell ISBN-10: 0071496297



**Swami Ramanand Teerth Marathwada University, Nanded**  
**Choice Based Course Credit System (distribution and details of CBCS System)**  
**M.Sc. (Computer Management) Second Year (Two Semester)**

**UNIT I: Introduction to Networks & LAN Hardware**

Uses of Computer Networks., Network Hardware- LAN,MAN,WAN, Wireless Networks, Network Software - Protocol Hierarchy, Design and issues for layer, Network Interface Card, Drivers, Magnetic Media, Twisted Pair Cable, Coaxial Cable, Fiber Optic Cable, Network Topologies-Bus Ring, Star, Tree and other Topologies, Networking Devices-Repeaters, Bridges, Routers, Gateways, Hub and Switch

**UNIT II: LAN Software**

Client-Server Model, File Server, Database Server, Print Server, DHCP Server, DNS Server, Peer-TO-Peer Networks

**UNIT III: Multiplexing and Switching**

Concept of modulation and their application, Multiplexing-Time division and Frequency division, Switching, Circuit Switching, Packet Switching, Message Switching

**UNIT IV: Network Standards and Network Protocols**

OSI Reference Model, TCP/IP reference model, IP Protocol , SMTP,PPP, FTP ,HTTP, SNMP,IP addresses

**UNIT V: Introduction to ISDN,PBX,FDDI and Internet**

ISDN Architecture, USE of PBX, FDDI, Token ring architecture, Definition, Internet Verses Intranet, Internet Service Providers, E-mail- Architecture and Services, WWW- Client side and Server Side, URL, Messengers, Search Engine

**UNIT VI: Ethernet Technology(802.3)**

Overview of Ethernet, 10 Mbps IEEE Standards, 100 Mbps IEEE Standards, Windows 2003 Server Overview, Understanding and using Active Directory managing and creating User Accounts, Creating and managing Shared Folders – Managing permissions

**Reference Books:-**

1. Local Area Network - Gerd E. Keiser Tata McGraw Hill ISBN: 0072393432
2. Local Area Network - Peter Holdson BPB Publication Fifth Edition ISBN: 0826454097
3. Data and Computer Communication -William Stallings Fifth Edition ISBN: 9332518866
4. Windows 2003 Server - Mark Minasi ISBN: 0782141307

**M. Sc. CM-404 Software Project Management (4 - Credits)**

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**Swami Ramanand Teerth Marathwada University, Nanded**  
**Choice Based Course Credit System (distribution and details of CBCS System)**  
**M.Sc. (Computer Management) Second Year (Two Semester)**

**UNIT I: Introduction to Software Project and Project Management**

Project, Software Project v/s other types of Project, Activities covered by Software Project, Management, The Project as a System, Problem with Software, Project Stakeholders. Introduction to Project Management, Phases of Project Management, Project Management life cycle.

**UNIT II: Resources Planning and Estimation Technique and Project Planning**

Resource Introduction, Resource Planning Delphi Techniques, COCOMO Model, Function Point Analysis, Basic concept, Project Scheduling defining a task set for the Software Project, Defining a task network, Scheduling.

**UNIT III: Change Management**

Software Configuration Management, Software Configuration Management Repository, Software Configuration Management Process.

**UNIT IV: Reengineering**

Business process reengineering, Software reengineering, Reverse engineering, Forward engineering.

**UNIT V: Small Projects**

Introduction, Some problem with student projects, Content of project plan.

**UNIT VI: ISO / 2207 an overview**

The ISO /2207 approach to software life cycle data, The ISO /2207 approach to software life processes, The acquisition process, The supply process.

**Reference Books**

1. Software Engineering. - BY Pressman- Sixth Edition ISBN-10: 0077227808
2. Software Engineering - BY Richard Fairly ISBN-10: 0074631217



**Swami Ramanand Teerth Marathwada University, Nanded**  
**Choice Based Course Credit System (distribution and details of CBCS System)**  
**M.Sc. (Computer Management) Second Year (Two Semester)**

**UNIT I: Database Architecture**

Overview of database, pfile, spfile, Instance, Tablespaces, Datafiles, Other files, Oracle managed Files, Users, Schemas, Indexes, View, Sequences, Synonyms, Privileges, Roles, Clusters, Hash Clusters, Internal memory structure, SGA, PGA, Background processes, External structure, Redo logs, Control files, Trace files, Alert logs, Creating database manually

**UNIT II: Hardware configuration and consideration**

Architectural overview, Standalone hosts, Standalone hosts with disk array, Standalone, Hosts with disk shadowing, Multiple databases, Networked hosts, Networks of databases, Remote updates, Remote application options, Real application, Clusters, Multiple processors, The parallel query and parallel load options, Client/server databases application, Standby databases

**UNIT III: Physical databases layouts**

Database file layouts, I/O connections among data files, I/O bottlenecks among all data files, Concurrent I/O among background processes, Defining recoverability and performance goals for the system, Defining the system hardware and mirroring architecture, Database space using overview, Implementation of the storage clause, Locally managed Tablespaces, Dictionary managed Tablespaces, Table segments, Index segments, Rollback segments, Temporary, Free space, Resizing Datafiles, Control files, Online redo log Files Deallocate space from segments, Shrinking Datafiles, Shrinking Tables, Clusters and indexes, Oracle managed files(OFA)

**UNIT IV: Logical Database Layouts**

Describe logical structure of a database, Different types of Tablespaces, Changing the Tablespaces size, Allocating segments for temporary segments, Temporary segments in permanent Tablespaces, Changing tablespace status, changing tablespace storage settings, Oracle Managed Files (OMFs), Oracle Flexible Architecture(OFA), Different segments types and relationships, Extent usages, Block space utilization

**UNIT V. Backup –Recovery& Networked ORACLE**

Types of Logical and Physical backups, Implementations, Integrations of backup procedures, NOARCHIVELOG Mode, ARCHIVELOG Mode, Backup Methods –Closed Database Backup, Open Database Backup, Recovery in NOARCHIVELOG Mode, Recovery in ARCHIVELOG Mode, Recovery manager architecture, Recovery Manager Features, Using Recovery manager & RMAN, Using OEM backup manager, Generating lists and reports. **Networked Oracle** - Overview of SQL \*Net and Net8, Connect descriptors, Service names and Listeners, Net8 assistants, The multi-protocol interchange, Dedicated Server Processes, Oracle Shared Server, Benefits of Oracle Shared Server, Client Server application, Database links

**UNIT VI: .Database Security, Auditing& Database Tuning**



**Swami Ramanand Teerth Marathwada University, Nanded**  
**Choice Based Course Credit System (distribution and details of CBCS System)**  
**M.Sc. (Computer Management) Second Year (Two Semester)**

Security capabilities-Account security, Object privileges, System level roles and privileges, Implementing security-operating system security, Create user, Drop user, User profiles, and Password managements, Preventing password reuse, setting password complexity, Using password file for authentication, Auditing, Login audits, Action audits, Object audits, Protecting the audit trail. **Tuning Databases** -Tuning application design, Tuning SQL,Memory usage, Data storage, Data manipulation,Physical storage, Logical storage,Reducing net traffic using OEM

**Reference Books –**

1. Oracle 9i DBA Handbook,Eighth Reprint - Kevin Lonely, Marlene TheriaultOracle Press, Tata McGraw Hill PublicationISBN-0- 07-048674-3
2. OCA Oracle 9i Associate DBA Certification Exam Guide,Sixth Reprint, Jason Couchman, Sudheer N. MarishettiOraclePress,Tata McGraw Hill Publication,2005 ISBN-0-07-049893-8



**Swami Ramanand Teerth Marathwada University, Nanded**  
**Choice Based Course Credit System (distribution and details of CBCS System)**  
**M.Sc. (Computer Management) Second Year (Two Semester)**

**UNIT I: Database System Architectures**

Centralized Architectures, client server Architecture, Server System Architecture , Parallel System Distributed System , Network Types

**UNIT II: Distributed Database**

Homogeneous and Heterogeneous Databases , Distributed Database storage, Transaction Concept ,Distributed Transactions, Commit Protocols, Concurrency control in distributed databases, Availability, Serializability, Distributed Query Processing , Heterogeneous Distributed Databases , Distributed Database in Oracle

**UNIT III: Parallel Database**

Introduction, I/O Parallism, InterqueryParallism, IntraqueryParallism, Interoperation Parallism, IntraoperationParallism, Design of Parallel system,

**UNIT IV: Decision Support System & Indexing and Hashing**

Introduction, Aspects of decision support, Database design for Decision support, Data PreparationData warehouses and Data marts, Online Transaction Processing (OLTP),Basic Concepts, Ordered indices, B tree index files, B+ tree index files, Multiple key access, Static Hashing, Dynamic Hashing, Comparison of Ordered indexing and Hashing, Bitmap indices

**UNIT V: Advanced Data types and New Applications & Advanced Transaction Processing**

Motivation, Time in Database, Spatial and Geographic data, Multimedia Databases, Mobility and Personal Databases. Transaction Processing Monitors, Transactional Workflows, Main memory databases, Real time transaction system, Long duration transactions, Transaction Management in Multidatabases

**UNIT VI: Recovery System**

Failure classification, Storage structure, Recovery and Atomicity, Log based recovery, Shadow Paging, Recovery With concurrent Transactions, Failure with loss of Non-volatile storage, Advanced recovery technique, Remote backup system

**Reference Books –**

1. Database System Concepts - (Abraham, Korth and Sudarshan (4th edition) Tata McGraw-Hill) ISBN: 007044756X
2. An Introduction to Database systems - C. J. Date (3rd Edition) Pearson Education



**Swami Ramanand Teerth Marathwada University, Nanded**  
**Choice Based Course Credit System (distribution and details of CBCS System)**  
**M.Sc. (Computer Management) Second Year (Two Semester)**

**UNIT I: Introduction**

Basic Data Mining Tasks, Data Mining Versus Knowledge Discovery in Databases, Data Mining Issues, Data Mining Metrics

**UNIT II: Related Concepts**

Database/OLTP Systems, Fuzzy sets & Fuzzy Logic, Information Retrieval, Data Ware housing

**UNIT III: Data Mining Techniques**

Introduction, A Statistical Perspective on Data Mining

**UNIT IV: Classification**

Introduction, Statistical-Based Algorithms, Distance –Based Algorithms

**UNIT V: Clustering**

Introduction, Similarity and Distance Measures, Outliers, Hierarchical Algorithms, Partition Algorithms, Minimum Spanning Tree, Squared Error Clustering Algorithm, K-Means clustering, Clustering Large Database

**UNIT VI: Web mining**

Introduction, Web Content Mining, Web Structure Mining, Web Usage Mining

**Reference Books**

1. Data Mining Introductory and Advanced Topics, 2008, Margaret H.
2. Dunham and S.Sridhar, Pearson Education, ISBN 81-7758-785-4

**M.Sc.CM-408 Open Elective I**

**Language Aptitude**

**(1 Credits)**

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**UNIT I: Professional Skills**





**Swami Ramanand Teerth Marathwada University, Nanded**  
**Choice Based Course Credit System (distribution and details of CBCS System)**  
**M.Sc. (Computer Management) Second Year (Two Semester)**

Interview Techniques, HR Interview Questions, Getting Prepared for the interview, Telephonic Interview

**UNIT II: Group Discussion**

Meaning, nature and purpose, Do's & Don'ts of Group Discussion, Topics of the GD, Practical Sessions on GD

**UNIT III: Personality Development**

Interpersonal Skills, Empathy Skills, Negotiation Skills, Problem Solving, Leadership Skills

**UNIT IV: Basics of English**

Tense: mood, aspect, usage, Prepositions, Basic Sentence Structure, Framing Questions, Model Auxiliary Verbs & usage, Synonyms & Antonyms, Idioms & Phrases

**UNIT V: Writing Skills**

Resume Building, Curriculum Vita, Email Drafting; Do's & Don'ts, Essay Writing, Covering Letter

**UNIT VI: Presentation Skills and English Aptitude**

Body language, eye contact, facial expressions, Opening of Presentation, Public Speaking: Do's & Don'ts, Topics for the presentation, Seminars: Practical Sessions, **English Aptitude**: Spotting Errors, Closet Test, Sentence Correction, Ordering of Sentences, Comprehension, Sentence Formation, Sentence Improvement

**References:**

1. English Grammar & Composition, First Edition, Rajendra Pal & Prem
2. LataSuri, Sutan Chand & Sons Delhi, 2012, ISBN:978- 81-8050-868-0
3. Personality Development & Communicative English, Fifth Edition, Dr. T. Bharathi, Neelkamal Publication Private Limited, 2004, ISBN: 81-8316-007-7
4. R. Gupta's Group Discussion & Interviews, First Edition, AnandGanguly, Ramesh Publication House Delhi, ISBN:81-7812-050-X.
5. Practical English Grammar, Fourth Edition, A.J.Thomson & A.V. Martinet, Oxford India, 1986, ISBN-13:978-0-19-562053-5.
6. Developing Communication Skill, First Edition, Krishana Mohan & Meera Banerji, Macnillan India, 1990, ISBN-0333929195.



**Swami Ramanand Teerth Marathwada University, Nanded**  
**Choice Based Course Credit System (distribution and details of CBCS System)**  
**M.Sc. (Computer Management) Second Year (Two Semester)**

7. Essential English Grammar, Second Edition, Raymond Murphy Cambridge University Press, 1998, ISBN- 13:978-81-7596-029-9.

**M.Sc.CM-408 Open Elective II Logical Reasoning and Quantitative Aptitude**

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**(1 Credits)**



**Swami Ramanand Teerth Marathwada University, Nanded**  
**Choice Based Course Credit System (distribution and details of CBCS System)**  
**M.Sc. (Computer Management) Second Year (Two Semester)**

**UNIT I: General Mental Ability-I**

Series Completion, Coding and Decoding, Blood relations, Seating Arrangement, Comparison type questions.

**UNIT II: General Mental Ability-II**

Directions sense test, logical venn diagrams, Inserting the missing character, data sufficiency.

**UNIT III: Logical Deduction**

Logic, statement arguments, statement assumptions, statement conclusion.

**UNIT IV: Arithmetical Ability-I**

Numbers, Simplification, Average, Problems on ages, Percentage, Probability.

**UNIT V: Arithmetical Ability-II**

Profit and loss, ratio and proportion, time and work, simple interest compound interest, calendar.

**UNIT VI: Data Interpretation**

**Tabulation, Bar graphs, Pie charts, line graphs**

**Reference books:**

1. Quantitative Aptitude by Dr. R S Aggarwal, Revised edition, ISBN 81-219-2498-7
2. A Modern Approach to Verbal Reasoning by Dr. R S Aggarwal, S. Chand and Company pvt. Ltd., ISBN 81-219-0552-4

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**M.Sc.CM-408 Open Elective III: DBMS Administration (1 Credits)**

**UNIT I: Client/Server Concepts**



**Swami Ramanand Teerth Marathwada University, Nanded**  
**Choice Based Course Credit System (distribution and details of CBCS System)**  
**M.Sc. (Computer Management) Second Year (Two Semester)**

Client server Architecture, Invoking Client Programs, MySQL Client Program-Using MySQL interactively, Statement Terminators, Using Script Files with MySQL, MySQL Output Formats, Client Commands and SQL Statements, Using Server-Side Help, Using the – safeupdates Option,

**UNIT II: MySQL Architecture**

Client/Server Overview, Communication Protocols, the SQL Parser and Storage Engine Tiers, How MySQL Uses Disk Space, How MySQL Uses Memory, Types of MySQL Distributions, Starting and Stopping MySQL Server on Windows, Starting and Stopping MySQL Server on UNIX, Runtime MySQL Configuration, Log and Status Files, Loading Time Zone Tables, Security-Related Configuration, Setting the Default SQL mode, Upgrading MySQL

**UNIT III: Locking**

Locking Concepts, Explicit Table Locking, Advisory Locking

**UNIT IV: Storage Engines**

MySQL Storage Engines, The MyISAM Engine, The MERGE Engine, The InnoDB Engine, The MEMORY Engine, The FEDERATED Engine, The Cluster Storage Engine, Other Storage engines,

**UNIT V: Data (Table) Maintenance**

Types of Table Maintenance Operations, SQL Statements for Table Maintenance, Client and Utility Programs for Table Maintenance, Repairing, InnoDB Tables, Enabling MyISAM Auto-Repair

**UNIT VI: Data Backup and Recovery Methods**

Introduction, Binary Versus Textual Backups, Making Binary Backups, Making Text Backups, Backing Up Log and Status Files, Replication as an Aid to Backup, MySQL Cluster as Disaster Prevention, Data Recovery



**Swami Ramanand Teerth Marathwada University, Nanded**  
**Choice Based Course Credit System (distribution and details of CBCS System)**  
**M.Sc. (Computer Management) Second Year (Two Semester)**

Why Learn About Cyber Crime.

Introduction to Cyber Crime.

Types of Cyber Crime.

Hacking passwords of MS-Office Files & Email for ethical use.

Sending Fake Emails/SMS.

Email Tracing.

Chatting In LAN/ Transferring Files in LAN. Sharing Desktop.

Preventing Credit/Debit card Fraud.

Screen Recording.

Introduction to Cyber Security.

Online Safety Tips.

Protecting Password.

Stenography/Hiding Information.

Encrypting Decrypting Information.

Identifying secure websites.

Cyber Laws.

**M.Sc.CM-408 Open Elective V: Internet Programming**

**(1Credits)**

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**UNIT I: BASIC NETWORK AND WEB CONCEPTS**



**Swami Ramanand Teerth Marathwada University, Nanded**  
**Choice Based Course Credit System (distribution and details of CBCS System)**  
**M.Sc. (Computer Management) Second Year (Two Semester)**

Internet standards - TCP and UDP protocols - URLs - MIME - CGI - Introduction to SGML.

### **UNIT II: JAVA PROGRAMMING**

Java basics - I/O streaming - files - Looking up Internet Address - Socket programming - client/server programs - E-mail client - SMTP - POP3 programs - web page retrieval - protocol handlers - content handlers - applets - image handling - Remote Method Invocation.

### **UNIT III: SCRIPTING LANGUAGES**

HTML - forms - frames - tables - web page design - JavaScript introduction - control structures - functions - arrays - objects - simple web applications.

### **UNIT IV: DYNAMIC HTML**

Dynamic HTML - introduction - cascading style sheets - object model and collections - event model - filters and transition - data binding - data control - ActiveX control - handling of multimedia data

### **UNIT V: SERVER SIDE PROGRAMMING**

Servlets - deployment of simple servlets - web server (Java web server / Tomcat / Web logic) - HTTP GET and POST requests - session tracking - cookies - JDBC - simple web applications - multi-tier applications.

### **REFERENCES**

1. Deitel, Deitel and Nieto, "Internet and World Wide Web - How to program", Pearson Education Publishers, 2000.
2. Elliotte Rusty Harold, "Java Network Programming", O'Reilly Publishers, 2002
3. R. Krishnamoorthy & S. Prabhu, "Internet and Java Programming", New Age International Publishers, 2004.
4. Thomno A. Powell, "The Complete Reference HTML and XHTML", fourth edition, Tata McGraw Hill, 2003.

Naughton, "The Complete Reference - Java2", Tata McGraw-Hill,

॥ सा विद्या या विमुक्तये ॥



# स्वामी रामानंद तीर्थ मराठवाडा विद्यापीठ, नांदेड

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

**SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY NANDED**

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

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

## ACADEMIC (1-BOARD OF STUDIES) SECTION

Phone: (02462) 229542

Website: [www.srtmun.ac.in](http://www.srtmun.ac.in)

E-mail: [bos.srtmun@gmail.com](mailto:bos.srtmun@gmail.com)

Fax : (02462) 229574

संलग्नित महाविद्यालयांतील विज्ञान व तंत्रज्ञान विद्याशाखेतील पदव्युत्तर स्तरावरील द्वितीय वर्षाचे CBCS Pattern नुसारचे अभ्यासक्रम शैक्षणिक वर्ष २०२०-२१ पासून लागू करण्याबाबत.

### प रि प त्र क

या परिपत्रकान्वये सर्व संबंधितांना कळविण्यात येते की, दिनांक २० जून २०२० रोजी संपन्न झालेल्या ४७व्या मा. विद्या परिषद बैठकीतील विषय क्र.११/४७-२०२०च्या ठरावानुसार प्रस्तुत विद्यापीठाच्या संलग्नित महाविद्यालयांतील विज्ञान व तंत्रज्ञान विद्याशाखेतील पदव्युत्तर स्तरावरील द्वितीय वर्षाचे खालील विषयांचे C.B.C.S. (Choice Based Credit System) Pattern नुसारचे अभ्यासक्रम शैक्षणिक वर्ष २०२०-२१ पासून लागू करण्यात येत आहेत.

- |   |  |
|---|--|
| 1. M.Sc.-II Year-Botany                 | 2. M.Sc.-II Year-Herbal Medicine                     |
| 3. M.Sc.-II Year-Analytical Chemistry   | 4. M.Sc.-II Year-Biochemistry                        |
| 5. M.Sc.-II Year-Organic Chemistry      | 6. M.Sc.-II Year-Physical Chemistry                  |
| 7. M.Sc.-II Year-Computer Management    | 8. M.Sc.-II Year-Computer Science                    |
| 9. M.Sc.-II Year-Information Technology | 10. M.C.A. (Master of Computer Applications)-II Year |
| 11. M.Sc.-II Year-Software Engineering  | 12. M.Sc.-II Year-System Administration & Networking |
| 13. M.Sc.-II Year-Dairy Science         | 14. M.Sc.-II Year-Environmental Science              |
| 15. M.Sc.-II Year-Applied Mathematics   | 16. M.Sc.-II Year-Mathematics                        |
| 17. M.Sc.-II Year-Microbiology          | 18. M.Sc.-II Year-Physics                            |
| 19. M.Sc.-II Year-Zoology               | 20. M.Sc.-II Year-Biotechnology                      |
| 21. M.Sc.-II Year-Bioinformatics        |  |

सदरील परिपत्रक व अभ्यासक्रम प्रस्तुत विद्यापीठाच्या [www.srtmun.ac.in](http://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/  
२०२०-२१/३३५

दिनांक : १६.०७.२०२०.

प्रत माहिती व पुढील कार्यवाहीस्तव :

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

स्वाक्षरित / -

**उपकुलसचिव**

शैक्षणिक (१-अभ्यासमंडळ) विभाग

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University, Nanded**  
(NAAC Re-accredited with 'A' Grade)



**Syllabus of**  
**Second Year M.Sc. (Computer Science)\***  
**(Revised CBCS pattern)**  
**Introduced from Academic Year 2020-2021**



## **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 02 external credits and 02 internal credits. The university shall conduct the end semester examination for 02 external credits. For theory internal credit, student has to appear for 02 class test (15 marks) and 01 assignment (20 marks). Every lab course has 02 credits which are split as 01 external credit and 01 internal credit. For lab internal credit, the student has to submit Laboratory Book (05 marks) and remaining 20 marks are for the Lab activities carried out by the student throughout the semester. For lab external credit, 20 marks are reserved for the examinational experiment and 05 marks are for the oral / viva examinations. There is a special skill based activity of 01 internal credits per semester which shall inculcate awareness regarding the domain of computers, IT, and ICT.

The open elective has 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.

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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. enhancement activity of 01 credits.
4. 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

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**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,**

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Sr. No	Course category	Course Code	Course Title	Internal credits	External credits	Total credits
<b>Third Semester</b>						
1.	<b>Core Subjects</b>	CS-301	Advance Database Administration	1	3	4
2		CS-302	Web Technologies	1	3	4
3		CS-303	Data Mining and Data Warehousing	1	3	4
<b>Choose any one from below elective subjects</b>						
4	<b>Elective Subject</b>	CS-304 A	Artificial Intelligence	1	3	4
		CS-304 B	Mobile Application Development			
		CS-304 C	Research Methodology			
<b>Practical /Lab</b>						
5	<b>Lab / Practical</b>	CS-305	Lab-5: Adv Database Admin	1	1	2
		CS-306	Lab-6: Web Technologies	1	1	2
6	<b>Open Elective</b>	CS-307A	University recognized MOOC (NPTEL / SWAYAM / others) OR Intra / Inter Departmental OR Intra / Inter School	4	0	4
		CS-307 B	Cyber Security			
7	<b>Skill based Activity</b>	CS-308	SK-03: Seminar Presentation Activity	1	0	1
	Total credits					<b>25</b>

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Sr. No	Course category	Course Code	Course Title	Internal credits	External credits	Total credits
<b>FourthSemester</b>						
1.	<b>Core Subjects</b>	CS-401	Digital Image Processing	1	3	4
2		CS-402	Linux Administration	1	3	4
3		CS-403	Major Project development Activity	1	3	4
<b>Choose any one from below elective subjects</b>						
4	<b>Elective Subject</b>	CS-404 A	Client Server Technology	1	3	4
		CS-404 B	Software Testing Tools			
<b>Practical /Lab</b>						
5	<b>Lab / Practical</b>	CS-405	Lab-7: DIP	1	1	2
		CS-406	Lab-8: Based on Elective Subject	1	1	2
6	<b>Open Elective</b>	CS-407A	University recognized MOOC (NPTEL / SWAYAM / others) OR Intra / Inter Departmental OR Intra / Inter School OR	4	0	4
		CS-407 B	Logical Reasoning and Quantitative Aptitude			
7	<b>Skill based Activity</b>	CS-408	SK-04 : Soft Skills	1	0	1
	Total credits					<b>25</b>

**Course Code: CS-301**  
**Course Title: Advance Database Administration**

**Course Objectives:**

To Introduce the students physical and Logical Structure of database  
To aware the students the role of the database administrator

**Course Outcomes:**

Students Will be able to explain and evaluate the fundamental theories and requirements that influence the design of modern database systems. Students can analyze the background processes involved in queries and transactions, and explain how these impact on database operation and design

**Unit I: Database Architecture**

Overview of database, pfile, spfile, Instance, Tablespaces, Datafiles, Other files, Oracle managed Files, Users, Schemas, Indexes, View, Sequences, Synonyms, Privileges, Roles, Clusters, Hash Clusters, Internal memory structure, SGA, PGA ,Background processes, External structure, Redo logs, Control files, Trace files, Alert logs, Creating database manually.

**Unit II: Hardware configuration and consideration**

Architectural overview, Standalone hosts, Standalone hosts with disk array, Standalone, Hosts with disk shadowing, Multiple databases, Networked hosts, Networks of databases, Remote updates, Remote application options, Real application, Clusters, Multiple processors, The parallel query and parallel load options, Client/server databases application, Standby databases

**Unit-III: Physical databases layouts**

Database file layouts, I/O connections among data files, I/O bottlenecks among all data files, Concurrent I/O among background processes, Defining recoverability and performance goals for the system, Defining the system hardware and mirroring architecture, Database space using overview, Implementation of the storage clause, Locally managed Tablespaces, Dictionary managed Tablespaces, Table segments, Index segments, Rollback segments, Temporary, Free space, Resizing Datafiles, Control files, Online redo log Files Deallocate space from segments, Shrinking Datafiles, Shrinking Tables, Clusters and indexes, Oracle managed files(OFA)

**Unit-IV: Logical Database Layouts**

Describe logical structure of a database, Different types of Tablespaces, Changing the Tablespaces size, allocating segments for temporary segments, Temporary segments in permanent Tablespaces, changing tablespace status, changing tablespace storage settings,

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Oracle Managed Files (OMFs), Oracle Flexible Architecture (OFA), Different segments types and relationships, Extent usages, Block space utilization.

**Unit-V: Backup, Recovery & Networked ORACLE**

Types of Logical and Physical backups, Implementations, Integrations of backup procedures, NOARCHIVELOG Mode, ARCHIVELOG Mode, Backup Methods –Closed Database Backup, Open Database Backup, Recovery in NOARCHIVELOG Mode, Recovery in ARCHIVELOG Mode, Recovery manager architecture, Recovery Manager Features, Using Recovery manager & RMAN, Using OEM backup manager, Generating lists and reports. Networked Oracle - Overview of SQL \*Net and Net8, Connect descriptors, Service names and Listeners, Net8 assistants, The multi-protocol interchange, Dedicated Server Processes, Oracle Shared Server, Benefits of Oracle Shared Server, Client Server application, Database links.

**Reference Books:**

- 1.Oracle 9i DBA Handbook, Eighth Reprint - Kevin Lonely, Marlene Theriault Oracle Press, Tata McGraw Hill Publication ISBN-0- 07-048674-3.
- 2.OCA Oracle 9i Associate DBA Certification Exam Guide, Sixth Reprint, Jason Couchman, Sudheer N. Marish Oracle Press, Tata McGraw Hill Publication,2005, ISBN-0-07-049893-8

**Course Code: CS-302**  
**Course Title:Web-Technologies**

**Course Objectives**

To aware the Students with advanced web technology  
To develop a skill to write applications using PHP and Java Script

**Course Outcome**

Students Will be Students are able to develop a dynamic webpage by the use of PHP and java script. On completion of this course, a student will be able to develop a web application using PHP and java script.

**Unit-I: Introduction**

Web Technology & XML Internet – current state, hardware and software requirement, ISP, an internet account, web home page, URL, browser, security on web, searching tools, search engines, FTP, Gopher, Telnet, emails, TFTP Web browser architecture, web page and multimedia, static dynamic and active web page, simple mail transfer protocol, simple network management protocol, hypertext transfer protocol

**Unit-II: Basics of PHP**

Introduction to PHP, what does PHP do? history of PHP, language basics, datatypes,variables, expressions and operators, flow control statements, including code, embedding PHP in web pages.

**Unit-III: Functions & Strings**

Calling a function, defining a function, variable scope, function parameters, return values, variable functions, anonymous functions. Strings: Accessing individual characters, cleaning strings, encoding and escaping, comparing strings, manipulating and searching strings, regular expressions.

**Unit-IV: Arrays & Objects**

Indexed vs. associative arrays, identifying elements of an array, storing data in arrays, multidimensional arrays, extracting multiple values, converting between arrays and variables, traversing arrays, sorting. Objects: Creating an object, accessing properties and methods, declaring a class, introspection.

**Unit-V: MySQL Overview**

Introduction, connecting to and disconnecting from the server , Entering queries , Creating and using a database , Creating and selecting a database , creating a table , loading data into a table , Retrieving information from a table , selecting all data , selecting particular rows , selecting particular columns , sorting rows , date calculations , working with NULL values , pattern matching , counting rows , using more than one tables. MySQL databases in PHP:



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Introduction, connecting to a MySQL database, querying the database, Retrieving and displaying the results, modifying data, deleting data.

**Reference Books:**

1. Elizabeth Castro, “HTML for the World Wide Web”, Peachpit Press Pearson Education.
2. Lehnert Wendy, “Web 101, Making the network for you”, Pearson Education, Asia.
3. Naughton Patrick, “The JAVA Handbook”, TataMcgraw Hill 1996. 12.
4. Winston PH &Narsimhan, “On to JAVA 1.2”, Addison Wesley.

**Course Code: CS-303**  
**Course Title:Data Mining & Data Warehousing**

**Course Objectives:**

To identify the scope and essentiality of Data Warehousing and Mining.  
To analyze data, choose relevant models and algorithms for respective applications.

**Course Outcome:**

Students Will be Understand Data Warehouse fundamentals, Data Mining Principles.  
Identify appropriate data mining algorithms to solve real world problems

**Unit-I: Introduction**

Basic Data Mining task, Data Mining Vs Knowledge discovery in databases, Data mining metrics, Social Implication of Data Mining.

**Unit-II:Related Concepts and Data Mining Techniques**

Database/OLTP systems, Information Retrieval, Decision Support Systems, Dimensional Modeling, OLAP, Web Search Engines, Statistical perspective on Data Mining, Decision Tree, Neural networks

**Unit-III:Classification**

Introduction, Statistical based algorithms, Distance based algorithms, Decision tree-based algorithms, Neural network-based algorithm.

**Unit-IV:Clustering andAssociation Rules**

Introduction, Hierarchical algorithms, Partitioned algorithms, Clustering large databases, Basic algorithms, Parallel and distributed algorithms

**Unit-V:Web Mining&Data Warehousing**

Introduction, Web content mining, Web structure mining, Web usage mining. Data Warehousing – the only viable solution, Data Warehouse defined

**Reference Books:**

1. Data Mining Introductory and Advanced Topics, 2008, Margaret H.Dunham and S. Sridhar, Pearson Education, ISBN 81-7758-785-4
2. Data Warehousing Fundamentals, 2009, PaulrajPonniah, Wiley India Publication, ISBN 978-81-265-0919-5

**Course Code: CS-304(A)**  
**Course Title:Artificial Intelligence**

**Course Objectives:**

To provide students of with comprehensive and in-depth knowledge of AI principles and techniques by introducing AI's fundamental problems  
To expose students to the frontiers of AI-intensive computing and information systems

**Course Outcome:**

Students will be able to compare AI with human intelligence and traditional information processing and discuss its strengths and limitations as well as its application to complex and human-centered problems.

Students Will be able to apply the basic principles, models, and algorithms of AI to recognize, model, and solve problems in the analysis and design of information systems.

**Unit-I: Introduction**

Intelligent Agents, Agents and environments, Good behavior, the nature of environments, Structure of agents, Problem Solving, Problem solving agents, Example problems, searching for solutions, Uniformed search strategies, avoiding repeated states, Searching with partial information.

**Unit-II: SEARCHING TECHNIQUES**

Informed search and exploration, informed search strategies, Heuristic function, Local search algorithms and optimistic problems, Local search in continuous spaces, Online search agents and unknown environments, Constraint satisfaction problems (CSP)

**Unit-III: Backtracking search and Local search for CSP**

Structure of problems, Adversarial Search, Games, Optimal decisions in games, Alpha Beta Pruning, Imperfect real-time decision, Games that include an element of chance.

**Unit-IV: KNOWLEDGE REPRESENTATION and Ontological Engineering**

First order logic, Representation revisited, Syntax and semantics for first order logic, Using first order logic, Knowledge engineering in first order logic, Inference in First order logic, Propositional versus first order logic, Unification and lifting, Forward chaining, Backward chaining, Resolution, Knowledge representation, Ontological Engineering-Categories and objects, Actions, Simulation and events, Mental events and mental objects

**Unit-V: LEARNING**

Learning from observations - forms of learning, Inductive learning - Learning decision trees, Ensemble learning - Knowledge in learning , Logical formulation of learning, Explanation based learning, Learning using relevant information, Inductive logic programming, Statistical learning methods, Learning with complete data, Learning with hidden variable, EM algorithm

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- Instance based learning, Neural networks - Reinforcement learning, Passive reinforcement learning, Active reinforcement learning, Generalization in reinforcement learning.  
Introduction to Communications

**Reference Books:**

1. “Artificial Intelligence – A Modern Approach” by Stuart Russell, Peter Norvig, 2nd Edition, Pearson Education / Prentice Hall of India, 2004, ISBN 978-0137903955
2. “Artificial Intelligence: A new Synthesis”, by Nils J. Nilsson, Harcourt Asia Pvt.Ltd., 2000, ISBN: 9814033 464
3. “Artificial Intelligence” by Elaine Rich and Kevin Knight, 2nd Edition, Tata McGraw-Hill, 2003, ISBN: 0-07-008770-9
4. “Artificial Intelligence-Structures and Strategies For Complex Problem Solving” by George F. Luger, Pearson Education / PHI, 2002, ISBN 9780201648669

**Course Code: CS-304(B)**  
**Course Title:Mobile Application Development**

**Course Objectives:**

To quickly get you up to speed with writing apps for Android devices.  
The student will learn the basics of Android platform and get to understand the application lifecycle

**Course Outcome:**

Student will be able to write simple GUI applications.  
Students will be also able to use built-in widgets and components, work with the database to store data locally.

**Unit-I: Introduction**

About Mobile Programming & Android, Smartphones future, preparing the Environment- Installing the SDK, Creating Android Emulator, Installing Eclipse, Installing Android Development Tools, choosing which Android version to use, Android Stack, Android applications structure

**Unit-II: Android Architecture**

Android Stack, Android applications structure, creating a project, working with the, AndroidManifest.xml, Using the log system, Activities

**Unit-III: UI Architecture**

Application context, Intents, Activity life cycle, supporting multiple screen sizes

**Unit-IV: User Interface Widgets**

Text controls, Button controls, Toggle buttons, Images, Notification and Toast- Parameters on Intents, Pending intents, Status bar notifications, Toast notifications

**Unit-V: Menus, Dialogs & Animation**

Localization, Options menu, Context menu, Dialogs- Alert dialog, Custom dialog, Dialog as Activity, Animation -View animation, Drawable animation

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**Reference Books:**

1. Professional Android 4 Application Development, Edition 3, Reto Meier, Wrox John Wiley & Sons, 2012, ISBN 1118237226, 9781118237229.
2. Beginning Android 4 Application Development, Edition illustrated, Wei-Meng Lee, John Wiley & Sons, 2012, ISBN 1118240677, 9781118240670.
3. Sams Teach Yourself Android Application Development in 24 Hours, Edition illustrated, Lauren Darcey & Shane Conder, Sams Publishing, 2012, ISBN 0672335697, 9780672335693

**Course Code: CS-304(C)**  
**Course Title: Research Methodology**

**Course Objectives:**

To introduce research and research methodologies in CS to students going to peruse research in CS. To understand the strengths and weakness of each of different research methods.

**Course Outcome:**

Students Will be demonstrate knowledge of research processes (reading, evaluating, and developing), Perform literature reviews using print and online databases.

**Unit-I: Introduction, the Purpose and Product of Research**

What is research? Evaluating Research, the 6Ps of research, Reasons for doing Research, possible products, Finding and choosing research topics, evaluating the purpose and product of research.

**Unit-II: Overview of the Research Process, Internet Research**

A model of the research process, Alternative models of the research process, evaluating the research process, Background of the Internet and WWW, Internet research topics, The Internet and a literature review, The Internet and research strategies and methods, Internet research, the law and ethics.

**Unit-III: Reviewing the literature, Surveys and Design Creation**

Purpose of literature review, literature resources, The Internet and literature reviews, conducting literature reviews, evaluating literature reviews, Define Surveys, Planning and Designing surveys, the internet and surveys, Example of Surveys, defining design and creation, Planning and conducting design and creation research, Creative computing and digital art.

**Unit-IV: Experiments, Case studies, Action Research**

Defining experiments, Planning and conducting experiments, the internet and experiments, defining case studies, Planning and conducting case studies, the internet case studies, Defining Action research, Planning and conducting Action research, The internet and Action research

**Unit-V: Interviews, Observations, Questionnaires**

Defining Interviews, Planning and conducting Interviews, Group Interviews Internet based Interviews, Defining Observations, Planning and conducting systematic Observations, Planning and conducting participant Observations, The internet and Observations. Introduction to Quantitative data analysis, Qualitative data analysis and Presentation of Research

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**Reference Books:**

1. Researching Information System and Computing by Briony J Oates, SAGE Publications, ISBN 978-81-7829-759-0
2. Research Design. Qualitative, Quantitative, and Mixed Methods Approaches. By John W. Creswell, Fourth Edition. SAGE Publication, 2014
3. The Craft of Research, By Wayne C. Booth, Gregory G. Colomb, Joseph M. Williams, Joseph Bizup, William T. FitzGerald, Third Edition, The University of Chicago Press, 2008



**Course Code: CS-305**

**Course Title:Lab-5: Adv. Database Admin**

- Advance Database Admin At least 15 practical's which covers all Adv. Database Administration Concepts. All commands

**Course Code: CS-306**

**Course Title:Lab-6: Web Technologies**

- At least 15 Practical Based Programs on Web Technologies.

**Course Code: CS-307-A**

**Course Title:University recognized MOOC**

- **Open Elective:** University recognized MOOC (NPTEL / SWAYAM / others) OR Intra /Inter Departmental courses.

**Course Code: CS-307-B**  
**Course Title: Cyber Security**

**Course Objectives:**

To get knowledge about securing both clean and corrupted systems, protect personal data, and secure computer networks.

To understand key terms and concepts in cyber law, intellectual

**Course Outcome:**

Students will understand principles of web security.

Students will understand key terms and concepts in cyber law, intellectual property and cybercrimes, trademarks and domain theft.

**Unit I:**

Why Learn About Cyber Crime. Introduction to Cyber Crime. Types of Cyber Crime.

**Unit II:**

Hacking passwords of MS-Office Files & Email for ethical use. Sending Fake Emails/SMS. Email Tracing.

**Unit III:**

Chatting In LAN/ Transferring Files in LAN. Sharing Desktop. Preventing Credit/Debit card Fraud. Screen Recording.

**Unit IV:**

Introduction to Cyber Security. Online Safety Tips. Protecting Password.

**Unit V:**

Stenography/Hiding Information. Encrypting Decrypting Information. Identifying secure websites, Introduction to Cyber Laws.

**Reference Books:**

1. Network Security and Cryptography, Atul Kahate, McGraw Hill, 2003.
2. Cryptography and Network Security: Principles and Practices, William Stallings, Fourth Edition, Prentice Hall, 2013.
3. Introduction to Cryptography with coding theory, second edition, Wade Trappe, Lawrence C. Washington, Pearson, 2005.

**Course Code: CS-308**  
**Course Title:SK-03 Seminar Presentation Activity**

**Course Objectives:**

To help the student increase self-motivation, personal responsibility, and understanding of his or her role in being an informed participant in the educational process.

To develop a Stage Courage for putting his concepts strongly in front of the audience.

**Course Outcome:**

Help the student increase self-motivation, personal responsibility, and understanding of his or her role in being an informed participant in the educational process.

Create an environment that helps the student establish healthy relationships and support networks.

**Guidelines for Seminar Presentation Activity**

1. Each student has to give seminar individually
2. The topic should be Unique for each student
3. Students must approve seminar topic from seminar incharge faculty.
4. Student must prepare at least Ten Power point slides seminar presentation.
5. Students have to give at least two seminars on the selected topic throughout the semester.

Students must prepare a seminar report. The signed seminar report from Head of department and Seminar Incharge must be submitted during final seminar.

**Course Code: CS-401**  
**Course Title:Digital Image Processing**

**Course Objectives:**

To study the image fundamentals and mathematical transforms necessary for image processing.

To study the image enhancement, image restoration procedures and image compression techniques.

**Course Outcome:**

Students will be Analyze images in the frequency domain using various transforms.

Evaluate the techniques for image enhancement and image restoration and also categorize various compression techniques.

**Unit-I: Digital Image Processing Systems**

What is DIP? Fundamental steps in DIP, Components of an Image Processing System, Elements of Visual Perception, Lights and Electromagnetic Spectrum, Image sensing and acquisition, Image sampling and quantization

**Unit-II:Introduction to Digital Image Representation**

Digital Image Representation, Read & Displaying Images, Data Classes & Image types, Converting between Data Classes and Image types

**Unit-III:Intensity transformation &Spatial filtering**

Intensity Transformation function, Histogram processing & Function plotting, Spatial filtering

**Unit-IV:Frequency Domain Processing**

2D –discrete Fourier transform, Filtering in frequency domain, Obtaining Frequency Domain Filters from spatial filters

**Unit-V:Image Restoration**

A Model of the Image Degradation /Restoration Process, Noise Models, Restoration in presence of Noise only –spatial filtering, Periodic Noise Reduction by Frequency domain Filtering, introduction Color Image Processing and Introduction to Wavelets.

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**Reference Books:**

1. Digital Image Processing by R.C. Gonsales R. E. Woods, Second Edition, Pearson Education,ISBN: 978-0201180756.
2. Fundamentals of Image Processing by Anil K. Jain, First Edition, PHI, ISBN 9788120309296.
3. Digital Image Processing using MATLAB by R.C. Gonsales R. E. Woods,Second Edition, Pearson Education,ISBN 9780130085191

**Course Code: CS-402**  
**Course Title:Linux Administration**

**Course Objectives:**

To describe the relationship between GNU and Linux

To describe various operating system concepts such as multitasking, virtual memory and multiuser environments as they apply to Linux.

**Course Outcome:**

Students will be able carry the duties of a Unix system administer.

Students will learn to do file processing, process management, IO management, queues management, networking, storage backup, account management, proper system start-up and shutting down, as well as other tasks.

**Unit-I:Introduction to RED Hat LINUX**

Hardware Requirements, Red Hat LINUX Installation, Advantages of LINUX, Other LINUX distributions, Concept of Linux loader

**Unit-II:Working with Linux**

LINUX file system, Shells, Text editors, Changing User Information, File Permissions, Virtual Consoles

**Unit-III:The X Window System**

Basic X window system, Configuring X window systems, Starting X, Selecting & using X window.

**Unit-IV:Managing Services, Software & System Resources**

LINUX Boot Process, System services and run levels, controlling services at boot with administrative tools, Starting and stopping services manually, Using RPM for software management, Using RPM on the command line, extracting a single file from & RPM file, Graphical Package Management, System monitoring tools

**Unit-V:Printing with Linux**

Configuring & managing print services, Local printer installation, Network printer installation, LINUX printing commands, Using the Common UNIX Printing System (CUPS), Console print control, Introduction to Network Connectivity Networking with TCP/IP

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**Reference Books:**

1. Red Hat Linux Unleashed, Edition illustrated reprint, “Bill Ball, David Pitts”, Sams, 2001, ISBN 0672319853, 9780672319853.
2. Red Hat Fedora 2 Unleashed, Edition illustrated, “Bill Ball, David Pitts”, Sams, 2005, ISBN 067232721X, 9780672327216.

**Course Code: CS-403**  
**Course Title: Major Project development Activity**

**Course Objectives:**

To provide a postgraduate level knowledge in computer science, including understanding, analysis, management, and handling of real-life information technology problems in workplace.

**Course Outcome:**

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

**Guidelines for Project Development:**

1. A group of maximum three students should be formed at the beginning of the semester
2. Each project will be allotted one project guide.
3. Students must submit the project topic and synopsis to the project guide.
4. Students will be given a project approval letter signed by the head of department and the project guide.
5. After receiving a project approval letter, students must submit at least three progress reports of their development in project to the guide, one per month.
6. After completion of project students have to give pre-exam demo to his guide.
7. After finalization of the project, students must prepare minimum 03 copies of the project reports, out of which one copy is for the college and one copy is for the university records. University/College copy must be bind with black covering with golden embossment and it should contain
  - i. First Page
  - ii. Certificate
  - iii. Declaration
  - iv. Acknowledgement
  - v. Project Approval letter
  - vi. Three Progress reports
  - vii. System Flow Diagram/DFD
  - viii. Chapter wise briefing, results, conclusions, snapshots, code, etc
  - ix. Bibliography



**Course Code: CS-404-A**  
**Course Title:Client Server Technology**

**Course Objectives:**

To understand the different components for developing client/server applications.  
To understand the enabling technologies for building Internet and Web database applications.

**Course Outcome:**

Gain Exposure on most common used servers.  
Understand the concept of client-server development and learn problem solving skills through design scenarios for network environment.

**Unit-I: Client/Server Computing**

DBMS concept and architecture, Single system image, Client Server architecture, mainframe-centric client server computing, downsizing and client server computing, preserving mainframe applications investment through porting, client server development tools, advantages of client server computing.

**Unit-II: Components of Client/Server application**

The client: services, request for services, RPC, windows services, fax, print services, remote boot services, other remote services, Utility Services & Other Services, Dynamic Data Exchange (DDE), Object Linking and Embedding (OLE), Common Object Request Broker Architecture (CORBA). The server: Detailed server functionality, the network operating system, available platforms, the network operating system, available platform, the server operating system.

**Unit-III: Client/Server Network**

connectivity, communication interface technology, Interposes communication, wide area network technologies, network topologies (Token Ring, Ethernet, FDDI, CDDI) network management, Client-server system development: Software, Client–Server System Hardware: Network Acquisition, PC-level processing unit, Macintosh, notebooks, pen, UNIX workstation, x-terminals, server hardware.

**Unit-IV: Client Server Systems Development**

Services and Support, system administration, Availability, Reliability, Serviceability, Software Distribution, Performance, Network management, Help Disk, Remote Systems Management Security, LAN and Network Management issues. Training, Training advantages of GUI Application, System Administrator training, Database Administrator training, End-user training.

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**Unit-V: Data Storage**

Magnetic disk, magnetic tape, CD-ROM, WORM, Optical disk, mirrored disk, fault tolerance, RAID, RAID-Disk network interface cards. Network protection devices, Power Protection Devices, UPS, Surge protectors. The future of client server Computing Enabling Technologies, The transformational system.

**Reference Books:**

1. Patrick Smith & Steve Guengerich, "Client / Server Computing", PHI
2. Dawna Travis Dewire, "Client/Server Computing", TMH
3. Majumdar & Bhattacharya, "Database management System", TMH

**Course Code: CS-404-B**  
**Course Title:Software Testing Tools**

**Course Objectives:**

The student should be made to expose the criteria for test cases.

Learn the design of test cases and be familiar with test management and test automation techniques.

**Course Outcome:**

At the end of the course the students will be able to Design test cases suitable for a software development for different domains. Identify suitable tests to be carried out and prepare test planning based on the document. Document test plans and test cases designed and Use of automatic testing tools.

**Unit-I: Introduction**

Testing as an Engineering Activity, testing as a Process, Testing axioms, Basic definitions: Software Testing Principles, The Testers Role in a Software Development Organization Origins of Defects, Cost of defects, Defect Classes, The Defect Repository and Test Design, Defect Examples, Developer/Tester Support of Developing a Defect Repository, Defect Prevention strategies.

**Unit-II: Test Case Design**

Test case Design Strategies, Using Black Box Approach to Test Case Design, Random Testing, Requirements based testing, Boundary Value Analysis, Equivalence Class Partitioning, Statebased testing, Cause-effect graphing, Compatibility testing, user documentation testing, domain testing, Using White Box Approach to Test design, Test Adequacy Criteria, static testing vs. structural testing code functional testing Coverage and Control Flow Graphs Covering Code Logic Paths code complexity testing Evaluating Test Adequacy Criteria

**Unit-III: Levels Of Testing**

The need for Levers of Testing Unit Test, Unit Test Planning, Designing the Unit Tests, The Test Harness, Running the Unit tests and Recording results, Integration tests, Designing Integration Tests, Integration Test Planning, Scenario testing, Defect bash elimination System Testing, Acceptance testing, Performance testing, Regression Testing, Internationalization testing Ad-hoc testing, Alpha, Beta Tests, Testing OO systems, Usability and Accessibility testing, Configuration testing, Compatibility testing, Testing the documentation, Website testing.

**Unit-IV: Test Management**

People and organizational issues in testing, Organization structures for testing teams testing services, Test Planning, Test Plan Components, Test Plan Attachments, Locating Test Items, test management, test process, Reporting Test Results, The role of three groups in Test

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Planning and Policy Development, Introducing the test specialist, Skills needed by a test specialist, Building a Testing Group.

**Unit-V: Test Automation**

Software test automation, skill needed for automation, scope of automation, design and architecture for automation, requirements for a test tool, challenges in automation, Test metrics and measurements, project, progress and productivity metrics.

**Reference Books:**

1. Srinivasan Desikan and Gopaldaswamy Ramesh, “Software Testing – Principles and Practices”, Pearson Education, 2006.
2. Ron Patton, “Software Testing”, Second Edition, Sams Publishing, Pearson Education, 2007.

**Course Code: CS-405**  
**Course Title:Lab-7: DIP(Digital Image Processing)**

- At least 15 programs on Digital Image Processing using MATLAB

**Course Code: CS-406**  
**Course Title:Lab-8: Based on Elective Subject**

- At least 15 Practical Based on Elective Subject.

**Course Code: CS-407-A**  
**Course Title:University recognized MOOC**

- **Open Elective:** University recognized MOOC (NPTEL / SWAYAM / others) OR Intra /Inter Departmental courses.

**Course Code: CS-407-B**  
**Course Title:Logical Reasoning and Quantitative Aptitude**

**Course Objectives:**

To acquire the skill to solve the problems on Logical Reasoning  
To acquire the skill to solve the problems on Quantitative Aptitude

**Course Outcome:**

Understand the basic concepts of QUANTITATIVE ABILITY and LOGICAL REASONING Skills, acquire satisfactory competency in use of VERBAL REASONING and Solve campus placements aptitude papers covering Quantitative Ability, Logical Reasoning and Verbal Ability

**Unit-I:General Mental Ability-I**

Series Completion, Coding and Decoding, Blood relations, Seating Arrangement, Comparison type questions.

**Unit-II:General Mental Ability-II**

Directions sense test, logical ven diagrams, Inserting the missing character, data sufficiency.

**Unit-III:Logical Deduction**

Logic, statement arguments, statement assumptions, statement conclusion.

**Unit-IV:Arithmetical Ability-I**

Numbers, Simplification, Average, Problems on ages, Percentage, Probability.

**Unit-V:Arithmetical Ability-II**

Profit and loss, ratio and proportion, time and work, simple interest compound interest, calendar. Data Interpretation Tabulation, Bar graphs, Pie charts, line graphs

**Reference Books:**

1. Quantitative Aptitude by Dr. R S Aggarwal, Revised edition, ISBN 81-219-2498-7
2. A Modern Approach to Verbal Reasoning by Dr. R S Aggarwal, S. Chand and Company pvt. Ltd., ISBN 81-219-0552-4

**Course Code: CS-408**

**Course Title:SK-04 Soft Skills**

- Soft skill Necessary for IT recruitment and further studies
- Strong technical skills are essential for any IT (information technology) position. However, IT employees also need soft skills, sometimes known as interpersonal skills. IT professionals need to be able to interact successfully with others, as well as manage projects and teams.
- Employers have found that many IT professionals possess as many interpersonal skills as anyone else. Technology experts suffering from more severe social handicaps (such as functional forms of autism) are able to practice and learn interpersonal and other soft skills to help them integrate well within a team.



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स्वामी रामानंद तीर्थ मराठवाडा विद्यापीठ, नांदेड.

### M.Sc. (Computer Science) Second Year (Two Semester)

#### M.Sc. (CS) Second Year (Two Semesters)

Semester-III					
course code	Title of the paper	External credit	Internal credit	Total Credits	Total Nor of Classes
CS-301	Advance Database Administration	3	1	4	40hrs
CS-302	Java Server Pages, Servlets & Struts	3	1	4	40hrs
CS-303	Data Mining and Data Warehousing	3	1	4	40hrs
CS-304	Digital Image Processing Using MATLAB	3	1	4	
CS-305	Elective-III 1. Advanced Operating System 2. Mobile Programming 3. Research Methodology	3	1	4	40hrs
CS-306	Computer laboratory 1 (Adv Database Admin + D.I.P)	1	1	2	60hrs
CS-307	Computer laboratory 2 (JSP & Servlet + DM & DW	1	1	2	60hrs
CS-108	Seminar	0	1	1	40hrs
<b>Total Credits</b>		<b>17</b>	<b>8</b>	<b>25</b>	

Semester-IV					
course code	Title of the paper	External credit	Internal credit	Total Credits	Total Nor of Classes
CS-401	Fuzzy System and ANN	3	1	4	40hrs
CS-402	Linux Administration	3	1	4	40hrs
CS-403	Elective : 1. Embedded system Design through C & C++ 2. Artificial Intelligence 3. Introduction to Bioinformatics	3	1	4	40hrs
CS-404	Cloud Computing	3	1	4	40hrs
CS-405	Project	3	1	4	40hrs
CS-405	Computer Laboratory 3 ( FS&ANN) +Linux	3	1	4	40hrs
CS-407	Computer Laboratory 4 (Elective)	2	1	4	60hrs
CS-408	Open Elective	0	1	1	40hrs
<b>Total Credits</b>		<b>18</b>	<b>7</b>	<b>25</b>	





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**CS- 301                      Advance Database Administration                      (4 Credits)**

**UNIT I: Database Architecture**

Overview of database, pfile, spfile, Instance, Tablespaces, Datafiles, Other files, Oracle managed Files, Users, Schemas, Indexes, View, Sequences, Synonyms, Privileges, Roles, Clusters, Hash Clusters, Internal memory structure, SGA, PGA ,Background processes, External structure, Redo logs, Control files, Trace files, Alert logs, Creating database manually

**UNIT II: Hardware configuration and consideration**

Architectural overview, Standalone hosts, Standalone hosts with disk array, Standalone, Hosts with disk shadowing, Multiple databases, Networked hosts, Networks of databases, Remote updates, Remote application options, Real application, Clusters, Multiple processors, The parallel query and parallel load options, Client/server databases application, Standby databases

**UNIT III: Physical databases layouts**

Database file layouts, I/O connections among data files, I/O bottlenecks among all data files, Concurrent I/O among background processes, Defining recoverability and performance goals for the system, Defining the system hardware and mirroring architecture, Database space using overview, Implementation of the storage clause, Locally managed Tablespaces, Dictionary managed Tablespaces, Table segments, Index segments, Rollback segments, Temporary, Free space, Resizing Datafiles, Control files, Online redo log Files Deallocate space from segments, Shrinking Datafiles, Shrinking Tables, Clusters and indexes, Oracle managed files(OFA)

**UNIT IV: Logical Database Layouts**

Describe logical structure of a database, Different types of Tablespaces, Changing the Tablespaces size, Allocating segments for temporary segments, Temporary segments in permanent Tablespaces, Changing tablespace status, changing tablespace storage settings, Oracle Managed Files (OMFs), Oracle Flexible Architecture (OFA), Different segments types and relationships, Extent usages, Block space utilization

**UNIT V: Backup –Recovery & Networked ORACLE**

Types of Logical and Physical backups, Implementations , Integrations of backup procedures, NOARCHIVELOG Mode, ARCHIVELOG Mode, Backup Methods –Closed Database Backup, Open Database Backup, Recovery in NOARCHIVELOG Mode, Recovery in ARCHIVELOG Mode, Recovery manager architecture, Recovery Manager Features, Using Recovery manager & RMAN, Using OEM backup manager, Generating lists and reports. Networked Oracle - Overview of SQL \*Net and Net8 , Connect descriptors, Service names and Listeners, Net8 assistants, The multi-protocol interchange, Dedicated Server Processes,



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Oracle Shared Server, Benefits of Oracle Shared Server, Client Server application, Database links.

#### **UNIT VI: Database Security, Auditing & Database Tuning**

Security capabilities-Account security, Object privileges, System level roles and privileges, Implementing security-operating system security, Create user, Drop user, User profiles, and Password managements, Preventing password reuse, setting password complexity, Using password file for authentication, Auditing, Login audits, Action audits, Object audits, Protecting the audit trail. Tuning Databases -Tuning application design, Tuning SQL,Memory usage, Data storage, Data manipulation,Physical storage, Logical storage,reducing net traffic using OEM

#### **Reference Books –**

1. Oracle 9i DBA Handbook, Eighth Reprint - Kevin Lonely, Marlene Theriault Oracle Press, Tata McGraw Hill Publication ISBN-0- 07-048674-3
2. OCA Oracle 9i Associate DBA Certification Exam Guide, Sixth Reprint, Jason Couchman, Sudheer N. Marishetti Oracle Press,Tata McGraw Hill Publication,2005, ISBN-0-07-049893-8



**CS-302                      Java Server Pages, Servlets & Struts                      (4 Credits)**

**UNIT I: An Overview of Servlets, JSP terminology and Servlet Basics**

A Servlets jobs, Why build web pages dynamically?, Advantages of Servlets over traditional CGI, The Role of JSP, Installing & Configuring the JDK & Apache Tomcat, Testing your setup, Web application – A Preview, Basic Servlet structure, A Servlet that generate plain text, A Servlet that generate HTML text, A Servlet package, The Servlet life cycle, The Single Thread model interface, Servlet debugging

**UNIT II: Handling Client Request: Form DATA,cookies and session tracking**

Reading Form Data from Servlet, Example: Reading three parameter, Example: Reading all parameter, Filtering String for HTML –specific character, Benefits of cookies, Some problem with cookies, Sending and receiving cookies, Using cooking to detect first time visitors, Using cookies attributes, The need for session tracking, Session tracking basics, Session tracking API, Browser session Vs server sessions, A Servlets that shows per client access counts

**UNIT III: Overview of JSP technology and Invoking Java code with JSP scripting elements & The JSP page directives**

The Need for JSP, Benefits of JSP, Installation of JSP, Basic syntax, Invoking Java code from JSP, Using JSP Expression, Using Scriptlets to make parts of the JSP page conditional, The *Import* attribute, The *contentType* and *pageEncoding* attribute, Generating Excel Spreadsheet, The *session* attribute, The *isELIgnored* attribute, The *errorPage* and *isErrorPage* attribute

**UNIT IV: Including files and applets in JSP pages and Using Java Beans components in JSP documents**

Including pages at request time: the *jsp:include* action, Including pages at page translation time: the *include* directive, Forwarding request with *jsp:Forward*, Including applets for java plug-in, Why use Beans?, What are Beans?, Using Beans: basic task, Example: *StrignBean*.

**UNIT IV: Integrating Servlets and JSP, Accessing database with JDBC**

Understaning the need for Model View Controller, MVC Framework, Architecture of approach, Implementing MVC with *RequestDispathcher*., Summarizing MVC code, Using JDBC in General, Basic JDBC Examples, Simplifying Database Access with JDBC Utilities, Using Prepared Statements.



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### **UINT VI: Introduction to Struts & Model, View and Controller Layer**

Two Development Models, Struts & Evolution of Struts, Basic Components of Struts, Building simple Struts Application, What is model?, Struts & Model, Struts & View Layer, Struts & the controller Layer, The ActionServlet Class, The Request Processing Engine, The Action Class.

#### **Reference Books:-**

1. Core Servlets and Java Server Pages-By- Marty Hall & Larry Brown vol-1 Low price edition
2. The Complete reference Struts-By James Holmes



## **CS-303      Data Mining & Data Warehousing    (4 Credits)**

### **UNIT I: Introduction**

Basic Data Mining task, Data Mining Vs Knowledge discovery in databases, Data mining metrics, Social Implication of Data Mining

### **UNIT II: Related Concepts and Data Mining Techniques**

Database/OLTP systems, Information Retrieval, Decision Support Systems, Dimensional Modeling, OLAP, Web Search Engines, Statistical perspective on Data Mining, Decision Tree, Neural networks

### **UNIT III: Classification**

Introduction, Statistical based algorithms, Distance based algorithms, Decision tree based algorithms, Neural network based algorithm.

### **UNIT IV: Clustering and Association Rules**

Introduction, Hierarchical algorithms, Partitioned algorithms, Clustering large databases, Basic algorithms, Parallel and distributed algorithms

### **UNIT V: Web Mining**

Introduction, Web content mining, Web structure mining, Web usage mining.

### **UNIT VI: Data Warehousing**

Data Warehousing – the only viable solution, Data Warehouse defined

### **Reference Books**

1. Data Mining Introductory and Advanced Topics, 2008, Margaret H. Dunham and S. Sridhar, Pearson Education, ISBN 81-7758-785-4
2. Data Warehousing Fundamentals, 2009, Paulraj Ponniah, Wiley India Publication, ISBN 978-81-265-0919-5



## **CS-304      Digital Image Processing Using MATLAB      (4 Credits)**

### **UNIT I: Digital Image Processing Systems**

What is DIP?, Fundamental steps in DIP, Components of an Image Processing System, Elements of Visual Perception, Lights and Electromagnetic Spectrum, Image sensing and acquisition, Image sampling and quantization

### **UNIT II: Introduction to Digital Image Representation**

Digital Image Representation, Read & Displaying Images, Data Classes & Image types, Converting between Data Classes and Image types

### **UNIT III: Intensity transformation & Spatial filtering**

Intensity Transformation function, Histogram processing & Function plotting, Spatial filtering

### **UNIT IV: Frequency Domain Processing**

2D –discrete Fourier transform, Filtering in frequency domain, Obtaining Frequency Domain Filters from spatial filters

### **UNIT V: Image Restoration**

A Model of the Image Degradation /Restoration Process, Noise Models, Restoration in presence of Noise only –spatial filtering, Periodic Noise Reduction by Frequency domain Filtering

### **UNIT VI: Color Image Processing and Introduction to Wavelets**

Color Image Representation in MATLAB, Converting to other Color Space, Introduction to Wavelets - Fast wavelet transform, Working with Wavelet Decomposition structures, Inverse Fast Wavelet transform

### **References:**

1. Digital Image Processing by R.C. Gonsales R. E. Woods, Second Edition, Pearson Education ,ISBN: 978-0201180756.
2. Fundamentals of Image Processing by Anil K. Jain, First Edition, PHI, ISBN 9788120309296.
3. Digital Image Processing using MATLAB by R.C. Gonsales R. E. Woods, Second Edition, Pearson Education, ISBN 9780130085191

Practical List: 15 Programs from the above syllabus



## **CS-305 Elective III (1)                      Advanced Operating System (4 Credits)**

### **UNIT I Introduction to UNIX/Linux Kernel**

System Structure, User Perspective, Assumptions about Hardware, Architecture of UNIX Operating System (TextBook-3: Chapter Topics: 1.2, 1.3, 1.5, 2.1), Concepts of Linux Programming-Files and the File system, Processes, Users and Groups, Permissions, Signals, Inter-process Communication (TextBook-1: Chapter 1- relevant topics)

### **UNIT II File and Directory I/O**

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 (TextBook- 3: Chapter Topics: 3.1-3.4, 4.1, 4.2, 5.1-5.3, 5.5-5.7, 5.12, 5.13) open, creat, file sharing, atomic operations, dup2, sync, fsync, and fdatsync, 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 (TextBook-4: Chapter Topics: 3.3, 3.4, 3.10 3.14, 3.16, 4.2-4.23)

### **UNIT III: Process Environment, Process Control and Process Relationships**

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 (TextBook-3: Chapter Topics: 6.1-6.4, 6.6, 7.1-7.8, 8.1)

### **UNIT IV: Memory Management**

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 (TextBook-3: Chapter Topics: 9.1, 9.2)

### **UNIT V. Signal Handling**

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 (TextBook-4: Topics: 10.2-10.13, 10.15-10.19)

### **Unit VI: Windows Thread Management**

Thread Internals Data Structures, Kernel Variables, Performance Counters, Relevant Functions, Birth of a Thread Examining Thread Activity: Limitations on Protected Process



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Threads, Worker Factories (Thread Pools) Thread Scheduling Overview of Windows Scheduling, Priority Levels, (TextBook-2: Chapter 5 [relevant topics])

#### References:

1. Linux System Programming, O'Reilly, by Robert Love.
2. Windows Internals, Microsoft Press, by Mark E. Russinovich and David A. Solomon.
3. The Design of the UNIX Operating System, PHI, by Maurice J. Bach.
4. Advanced Programming in the UNIX Environment, Addison-Wesley, by Richard Steve





**CS -305 Elective III (2)                      Mobile Programming                      (4 Credits)**

**UNIT I: Introduction**

About Mobile Programming & Android, Smartphones future, preparing the Environment- Installing the SDK, Creating Android Emulator, Installing Eclipse, Installing Android Development Tools, Choosing which Android version to use, Android Stack, Android applications structure

**UNIT II: Android Architecture**

Android Stack, Android applications structure, creating a project, Working with the, AndroidManifest.xml, Using the log system, Activities

**UNIT III: UI Architecture**

Application context, Intents, Activity life cycle, supporting multiple screen sizes

**UNIT IV: User Interface Widgets**

Text controls, Button controls, Toggle buttons, Images, **Notification and Toast**- Parameters on Intents, Pending intents, Status bar notifications, Toast notifications

**UNIT V: Menus, Dialogs & Animation**

Localization, Options menu, Context menu, Dialogs- Alert dialog, Custom dialog, Dialog as Activity, Animation -View animation, Drawable animation

**UNIT VI: Working with data storage**

Shared preferences, Preferences activity, Files access, SQLite database

**References:**

1. Professional Android 4 Application Development, Edition 3, Reto Meier, Wrox John Wiley & Sons, 2012, ISBN 1118237226, 9781118237229.
2. Beginning Android 4 Application Development, Edition illustrated, Wei-Meng Lee, John Wiley & Sons, 2012, ISBN 1118240677, 9781118240670.
3. Sams Teach Yourself Android Application Development in 24 Hours, Edition illustrated, Lauren Darcey & Shane Conder, Sams Publishing, 2012, ISBN 0672335697, 9780672335693



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**CS-305 Elective III (3) Research methodology (4 Credits)**

**UNIT I: Introduction, the Purpose and Product of Research**

What is research?, Evaluating Research, The 6Ps of research, Reasons for doing Research, possible products, Finding and choosing research topics, evaluating the purpose and product of research.

**UNIT II: Overview of the Research Process, Internet Research**

A model of the research process, Alternative models of the research process, evaluating the research process, Background of the Internet and WWW, Internet research topics, The Internet and a literature review, The Internet and research strategies and methods, Internet research, the law and ethics.

**UNIT III: Reviewing the literature, Surveys and Design Creation**

Purpose of literature review, literature resources, The Internet and literature reviews, conducting literature reviews, evaluating literature reviews, Define Surveys, Planning and Designing surveys, the internet and surveys, Example of Surveys, Defining design and creation, Planning and conducting design and creation research, Creative computing and digital art.

**UNIT IV: Experiments, Case studies, Action Research**

Defining experiments, Planning and conducting experiments, The internet and experiments, Defining case studies, Planning and conducting case studies, The internet case studies, Defining Action research, Planning and conducting Action research, The internet and Action research

**UNIT V: Interviews, Observations, Questionnaires**

Defining Interviews, Planning and conducting Interviews, Group Interviews Internet based Interviews, Defining Observations, Planning and conducting systematic Observations, Planning and conducting participant Observations, The internet and Observations.

**UNIT VI: Quantitative data analysis, Qualitative data analysis and Presentation of Research**

Defining Quantitative data analysis, Types of Quantitative data analysis, Data coding, Visual aids for Quantitative data analysis, Using statistics for Quantitative data analysis, Qualitative data analysis-Introduction, Analysis textual data, Analyzing non-textual qualitative data, Grounded theory, Presentation of Research- writing up the research, conference paper presentations, Posters and exhibitions, software demonstrations, Presenting yourself, PhD vivas.



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**References:**

1. Researching Information System and Computing by Briony J Oates, SAGE Publications, ISBN 978-81-7829-759-0



## **CS-401 Fuzzy System and Artificial Neural Network (4 Credits)**

### **UNIT I: Introduction to Fuzzy Logic**

Crisp Sets: an Overview ,Fuzzy Sets: Basic Types, Fuzzy Sets: Basic Concepts, Fuzzy Sets Vs Crisp Sets, Additional Properties of alpha cuts, Presentation of fuzzy sets, Extension principle for fuzzy sets.

### **UNIT II: Operations on fuzzy sets**

Fuzzy complements, Fuzzy Union, Fuzzy Intersections, Crisp & Fuzzy Relation , Binary Fuzzy Relation, Binary Relation on single set, Fuzzy Equivalence Relations, Fuzzy Compatibility Relation.

### **UNIT III: Introduction to Neural Networks**

Biological Neuron and their Artificial Neuron, McCulloch-Pits Neuron Model, Perceptron Classification-Linearly Separability-NOR Problem, Overview of Neural Network Architecture, Learning Rules-Supervised Learning-Unsupervised Learning-Perceptron Learning-Reinforcement Learning-Delta Learning Rule

### **UNIT IV: Multilayer Feed forward Network**

Generalized Delta Learning, Back propagations training algorithm and derivation of weight, Variant in Back propagations, Radial Basis Function (RBF), Application of BP and RBF N/W

### **UNIT V: Recurrent Network and Unsupervised Learning**

Hopfield Network, Counter propagation networks, Boltzmann Machine, Adaptive Resonance theory(ART).

### **UNIT VI: Fuzzy System, Neuro Fuzzy System and Applications**

Fuzzy neurons, Fuzzy Neural Network, Fuzzy associative memory, Application in Pattern Recognition, Character, Face, Finger, Palm, Iris Recognitions, Application in Expert System

### **Reference Books:**

1. “Fuzzy Sets and Fuzzy Logic Theory and Application” by George J. Klir, Bo Yuan, Seventh Edition, Prentice Hall PTR, ISBN 0-13-101171-5.
2. “Fuzzy Sets Uncertainty and Information”, George J. Klir, Tina A. Floger, Pearson education, First Edition, ISBN 978-0133459845
3. “ Introduction to the Theory of Neural Competition” by John hertz, Krogh and Richard AddisonWesely, , ISBN 978-0201515602.



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4. “ Introduction to Artificial Neural Network” by Jaeck M. Zurada,Jaico publishing house, ISBN 81-7224-650-1
5. Neural Network and Fuzzy System -A Dynamic SystemBy- Koska PHI Edition.
6. Programming Matlab by E. Herniter Thomson Brooks ISBN 981-240-230-6.



**CS- 402**

**Linux Administration**

**(4 Credits)**

**UNIT I : Introduction to RED Hat LINUX**

Hardware Requirements, Red Hat LINUX Installation, Advantages of LINUX, Other LINUX distributions, Concept of Linux loader

**UNIT II: Working with Linux**

LINUX file system, Shells, Text editors, Changing User Information, File Permissions, Virtual Consoles

**UNIT III: The X Window System**

Basic X window system, Configuring X window systems, Starting X, Selecting & using X window.

**UNIT IV: Managing Services, Software & System Resources**

LINUX Boot Process, System services and run levels, controlling services at boot with administrative tools, Starting and stopping services manually, Using RPM for software management, Using RPM on the command line, Extracting a single file from & RPM file, Graphical Package Management, System monitoring tools

**UNIT V: Printing with Linux**

Configuring & managing print services, Local printer installation, Network printer installation, LINUX printing commands, Using the Common UNIX Printing System (CUPS), Console print control

**UNIT VI: Network Connectivity**

Networking with TCP/IP, Hardware devices for networking, Using RED HAT Linux network, configuration tools, Using DHCP [Dynamic Host Configuration Protocol], Using the network file system, Wireless networking, Introduction to DNS, Essential DNS concepts, Configuring namespaces with DNS, Installing Samba, Configuring Samba, Running the Samba Server

**Reference Books**

1. Red Hat Linux Unleashed, Edition illustrated reprint, “Bill Ball, David Pitts”, Sams, 2001, ISBN 0672319853, 9780672319853.
2. Red Hat Fedora 2 Unleashed, Edition illustrated, “Bill Ball, David Pitts”, Sams, 2005, ISBN 067232721X, 9780672327216.



## **CS-403 Elective IV (1) Embedded Systems Design through C & C++**

**(4 Credits)**

### **UNIT I: Introduction to Embedded System and Hardware Requirement for the Software Engineer**

Embedded Systems, Processor Embedded into as System, Embedded Hardware units & Devices in system, Embedded Software in System, Examples of Embedded system, Hardware Requirement for the Software Engineer – Terminology, Gates, A Few other basic Consideration, Timing diagram, Memory

### **UNIT II: Advanced Hardware Fundamentals and Interrupts**

Microprocessors, Buses, Direct Memory Access, Interrupts, Other Common Parts, Built-ins on the Microprocessor, Conventions used in Schematics, A simple Schematics,. A Last Word about Hardware, Interrupts-Microprocessor Architecture, Interrupts Basics, The Shared Data Problem, Interrupt Latency

### **UNIT III: Survey of Software Architecture and Introduction to Real-Time Operating System**

Round Robin, Round Robin with Interrupts, Functions Queue Scheduling Architecture, Real Time Operating System Architecture, Selecting an Architecture, Introduction to Real-Time Operating System -Task and Task States, Tasks and Data, Semaphores and Shared Data

### **UNIT IV: More Operating System Services**

Message Queue, Mailboxes and Pipes, Timer Functions, Events, Memory Management, Interrupt routines in an RTOS Environment

### **UNIT V: Embedded Software Developments and Debugging Techniques**

Host and Target Machines, Linker, Locators for Embedded Software, Getting Embedded Software into the Target System, Debugging Techniques -Testing Your Host Machines, Instruction set Simulator , The Assert Macro, Using Laboratory Tools

### **UNIT VI: An Example System**

What the program does?, Environment in which program operates, A guide to the source code

### **Reference Books:**

1. Embedded System – Architecture, Programming & Design By - Raj Kamal, 2nd Edition edition (March 9, 2009), McGraw-Hill Education (India), ISBN 978-0070151253



# Swami Ramanand Teerth Marathwada University, Nanded

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### M.Sc. (Computer Science) Second Year (Two Semester)

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2. An Embedded Software Primer By - David E. Simen –Low Price Edition, First Edition, ISBN 078-5342615692
3. Programming Embedded System in C & C++ By – Michael Barr, 1 edition (January 30, 1999), O'Reilly Media;ISBN 978-1565923546.
4. Programming for Embedded System By – DreamtechSoftwate Team, ISBN 978-0764549540 .





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**CS-403 Elective IV (2) Artificial Intelligence (4 Credits)**

**UNIT I: INTRODUCTION**

Intelligent Agents, Agents and environments, Good behavior, The nature of environments, Structure of agents, Problem Solving, Problem solving agents, Example problems, Searching for solutions, Uniformed search strategies, Avoiding repeated states, Searching with partial information.

**UNIT II: SEARCHING TECHNIQUES**

Informed search and exploration, informed search strategies, Heuristic function, Local search algorithms and optimistic problems, Local search in continuous spaces, Online search agents and unknown environments, Constraint satisfaction problems (CSP)

**UNIT III: Backtracking search and Local search for CSP**

Structure of problems, Adversarial Search, Games, Optimal decisions in games, Alpha Beta Pruning, Imperfect real-time decision, Games that include an element of chance.

**UNIT IV: KNOWLEDGE REPRESENTATION and Ontological Engineering**

First order logic, Representation revisited, Syntax and semantics for first order logic, Using first order logic, Knowledge engineering in first order logic, Inference in First order logic, Propositional versus first order logic, Unification and lifting, Forward chaining, Backward chaining, Resolution, Knowledge representation, Ontological Engineering-Categories and objects, Actions, Simulation and events, Mental events and mental objects

**UNIT V: LEARNING**

Learning from observations - forms of learning, Inductive learning - Learning decision trees, Ensemble learning - Knowledge in learning , Logical formulation of learning, Explanation based learning, Learning using relevant information, Inductive logic programming, Statistical learning methods, Learning with complete data, Learning with hidden variable, EM algorithm - Instance based learning, Neural networks - Reinforcement learning, Passive reinforcement learning, Active reinforcement learning, Generalization in reinforcement learning.

**UNIT VI: APPLICATIONS**

Communication – Communication as action, Formal grammar for a fragment of English, Syntactic analysis – Augmented grammars, Semantic interpretation – Ambiguity and disambiguation , Discourse understanding – Grammar induction, Probabilistic language processing, Probabilistic language models –, Information retrieval – Information Extraction, Machine translation.



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Text Book:

1. “Artificial Intelligence – A Modern Approach” by Stuart Russell, Peter Norvig, 2nd Edition, Pearson Education / Prentice Hall of India, 2004, ISBN 978-0137903955

#### REFERENCES

1. “Artificial Intelligence: A new Synthesis”, by Nils J. Nilsson, Harcourt Asia Pvt.Ltd., 2000, ISBN: 981 4033 464

2. “Artificial Intelligence” by Elaine Rich and Kevin Knight, 2nd Edition, Tata McGraw-Hill, 2003, ISBN: 0-07-008770-9

3. “Artificial Intelligence-Structures And Strategies For Complex Problem Solving” by George F. Luger, Pearson Education / PHI, 2002, ISBN 9780201648669



**CS-403 Elective IV (3) Bioinformatics (4 Credits)**

**UNIT I: Bioinformatics: An Introduction**

Introduction, Historical Overview & Definition, Applications, Major Databases

**UNIT II: Information Search & Data Retrieval**

Introduction, Tools for Web Search, Data retrieval tools, Data mining of Biological Databases

**UNIT III: Genome Analysis & Gene Mapping**

Introduction, Genome Analysis, Genome Mapping, the Sequence Assembly Problem, Physical Maps, Applications of Genetic Maps, the Human Genome Project (HGP)

**UNIT IV: Alignments of Pairs of sequences and Tools for Similarity Search & Sequence Alignment**

Introduction, Biological Motivations of Alignment Problems, Methods of sequence Alignments, Using Scoring Matrices, Tools for Similarity Search & Sequence Alignment – Introduction, Working with FASTA, Working with Blast, FASTA& BALSTA Algorithms Comparison

**UNIT V: Introduction to Drug Discovery and Drug Discovery: Technology & Strategies**

Introduction, Areas Influencing Drug Discovery, Pharmacokinetics &, Pharmacogenomics Applications, Important parameters in Drug Discovery, Drug Discovery: Technology & Strategies-Introduction, Drug Discovery Technologies, Target Discovery Strategy, Strategy to identify possible Drug Targets, Target Validation

**UNIT VI: Computer- Aided Drug Design**

Introduction, Introduction to Drug Design, Drug Design Approach, Computer Aided Drug Designing Method

**Reference Books:-**

1. Bioinformatics Methods & Applications S.C. Rastogi, Edition III, PHI Learning Pvt. Ltd., 2008, ISBN 8120335953, 9788120335950
2. An Introduction to Bioinformatics V. Kothekar& T. Nandi, Edition I, Duckworth Press, ISBN 9788190469906



**CS-404**

**Cloud Computing**

**(4 Credits)**

**UNIT I: Enterprise computing: a retrospective**

Introduction, Mainframe architecture, Client-server architecture, 3-tier architectures with TP monitors

**UNIT II: The internet as a platform and Software as a service and cloud computing**

Internet technology and web-enabled applications, Web application servers, Internet of services, Software as a service and cloud computing-Emergence of software as a service, Successful SaaS architectures, Dev 2.0 platforms, Cloud computing, Dev 2.0 in the cloud for enterprises

**UNIT III: Cloud computing platforms and Web services, AJAX and mashups**

Infrastructure as a service: Amazon EC2, Platform as a service: Google App Engine, Microsoft Azure, Web services, AJAX and mashups-Web services: SOAP and REST, SOAP versus REST, AJAX: asynchronous 'rich' interfaces, Mashups: user interface services

**UNIT IV: Data in the cloud**

Relational databases, Cloud file systems: GFS and HDFS, BigTable, HBase and Dynamo, Cloud data stores: Datastore and SimpleDB

**UNIT V: MapReduce and extensions**

Parallel computing, The MapReduce model, Parallel efficiency of MapReduce, Relational operations using MapReduce, Enterprise batch processing using MapReduce

**UNIT VI: Dev 2.0 platforms**

Salesforce.com's Force.com platform, TCS InstantApps on Amazon cloud, More Dev 2.0 platforms and related efforts, Advantages, applicability and limits of Dev 2.0

**Reference Book:**

Enterprise Cloud Computing: Technology, Architecture, ApplicationByGautamShroff, Cambridge University Press,ISBN 978-0521137355.



## CS-408 Open Elective I

## Language Aptitude

(1 Credits)

### UNIT I: Professional Skills

Interview Techniques, HR Interview Questions, Getting Prepared for the interview, Telephonic Interview

### UNIT II: Group Discussion

Meaning, nature and purpose, Do's & Don'ts of Group Discussion, Topics of the GD, Practical Sessions on GD

### UNIT III: Personality Development

Interpersonal Skills, Empathy Skills, Negotiation Skills, Problem Solving, Leadership Skills

### UNIT IV: Basics of English

Tense: mood, aspect, usage, Prepositions, Basic Sentence Structure, Framing Questions, Model Auxiliary Verbs & usage, Synonyms & Antonyms, Idioms & Phrases

### UNIT V: Writing Skills

Resume Building, Curriculum Vita, Email Drafting; Do's & Don'ts, Essay Writing, Covering Letter

### UNIT VI: Presentation Skills and English Aptitude

Body language, eye contact, facial expressions, Opening of Presentation, Public Speaking: Do's & Don'ts, Topics for the presentation, Seminars: Practical Sessions, **English Aptitude:** Spotting Errors, Closet Test, Sentence Correction, Ordering of Sentences, Comprehension, Sentence Formation, Sentence Improvement

### References:

1. English Grammar & Composition, First Edition, Rajendra Pal & Prem
2. Lata Suri, Sutan Chand & Sons Delhi, 2012, ISBN:978- 81-8050-868-0
3. Personality Development & Communicative English, Fifth Edition, Dr. T. Bharathi, Neelkamal Publication Private Limited, 2004, ISBN: 81-8316-007-7
4. R. Gupta's Group Discussion & Interviews, First Edition, Anand Ganguly, Ramesh Publication House Delhi, ISBN:81-7812-050-X.
5. Practical English Grammar, Fourth Edition, A.J.Thomson & A.V. Martinet, Oxford India, 1986 , ISBN-13:978-0-19-562053-5.
6. Developing Communication Skill, First Edition, Krishana Mohan & Meera Banerji, Macmillan India, 1990, ISBN-0333929195.
7. Essential English Grammar, Second Edition, Raymond Murphy Cambridge University Press, 1998, ISBN- 13:978-81-7596-029-9.



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## **CS -408 Open Elective II Logical Reasoning and Quantitative Aptitude**

**(1 Credits Internal)**

### **UNIT I: General Mental Ability-I**

Series Completion, Coding and Decoding, Blood relations, Seating Arrangement, Comparison type questions.

### **UNIT II: General Mental Ability-II**

Directions sense test, logical venn diagrams, Inserting the missing character, data sufficiency.

### **UNIT III: Logical Deduction**

Logic, statement arguments, statement assumptions, statement conclusion.

### **UNIT IV: Arithmetical Ability-I**

Numbers, Simplification, Average, Problems on ages, Percentage, Probability.

### **UNIT V: Arithmetical Ability-II**

Profit and loss, ratio and proportion, time and work, simple interest compound interest, calendar.

### **UNIT VI: Data Interpretation**

**Tabulation, Bar graphs, Pie charts, line graphs**

### **Reference books:**

1. Quantitative Aptitude by Dr. R S Aggarwal, Revised edition, ISBN 81-219-2498-7
2. A Modern Approach to Verbal Reasoning by Dr. R S Aggarwal, S. Chand and Company pvt. Ltd., ISBN 81-219-0552-4



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**CS -408 Open Elective III: DBMS Administration**

**(1 Credits)**

**UNIT I: Client/Server Concepts**

Client server Architecture, Invoking Client Programs, MySQL Client Program-Using MySQL interactively, Statement Terminators, Using Script Files with MySQL, MySQL Output Formats, Client Commands and SQL Statements, Using Server-Side Help, Using the – safeupdates Option,

**UNIT II: MySQL Architecture**

Client/Server Overview, Communication Protocols, the SQL Parser and Storage Engine Tiers, How MySQL Uses Disk Space, How MySQL Uses Memory, Types of MySQL Distributions, Starting and Stopping MySQL Server on Windows, Starting and Stopping MySQL Server on UNIX, Runtime MySQL Configuration, Log and Status Files, Loading Time Zone Tables, Security-Related Configuration, Setting the Default SQL mode , Upgrading MySQL

**UNIT III: Locking**

Locking Concepts, Explicit Table Locking, Advisory Locking

**UNIT IV: Storage Engines**

MySQL Storage Engines, The MyISAM Engine, The MERGE Engine, The InnoDB Engine, The MEMORY Engine, The FEDERATED Engine, The Cluster Storage Engine, Other Storage engines,

**UNIT V: Data (Table) Maintenance**

Types of Table Maintenance Operations, SQL Statements for Table Maintenance, Client and Utility Programs for Table Maintenance, Repairing, InnoDB Tables, Enabling MyISAM Auto-Repair

**UNIT VI: Data Backup and Recovery Methods**

Introduction, Binary Versus Textual Backups, Making Binary Backups, Making Text Backups, Backing Up Log and Status Files, Replication as an Aid to Backup, MySQL Cluster as Disaster Prevention, Data Recovery



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**CS-408 Open Elective IV: Cyber Crime & Cyber Security (1 Credits)**

Why Learn About Cyber Crime.

Introduction to Cyber Crime.

Types of Cyber Crime.

Hacking passwords of MS-Office Files & Email for ethical use.

Sending Fake Emails/SMS.

Email Tracing.

Chatting In LAN/ Transferring Files in LAN. Sharing Desktop.

Preventing Credit/Debit card Fraud.

Screen Recording.

Introduction to Cyber Security.

Online Safety Tips.

Protecting Password.

Stenography/Hiding Information.

Encrypting Decrypting Information.

Identifying secure websites.

Cyber Laws.





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**CS-408 Open Elective V: Internet Programming (1 Credits)**

**UNIT I: BASIC NETWORK AND WEB CONCEPTS**

Internet standards - TCP and UDP protocols - URLs - MIME - CGI - Introduction to SGML.

**UNIT II: JAVA PROGRAMMING**

Java basics - I/O streaming - files - Looking up Internet Address - Socket programming - client/server programs - E-mail client - SMTP - POP3 programs - web page retrieval - protocol handlers - content handlers - applets - image handling - Remote Method Invocation.

**UNIT III: SCRIPTING LANGUAGES**

HTML - forms - frames - tables - web page design - JavaScript introduction - control structures - functions - arrays - objects - simple web applications.

**UNIT IV: DYNAMIC HTML**

Dynamic HTML - introduction - cascading style sheets - object model and collections - event model - filters and transition - data binding - data control - ActiveX control - handling of multimedia data

**UNIT V: SERVER SIDE PROGRAMMING**

Servlets - deployment of simple servlets - web server (Java web server / Tomcat / Web logic) - HTTP GET and POST requests - session tracking - cookies - JDBC - simple web applications - multi-tier applications.

**REFERENCES**

1. Deitel, Deitel and Nieto, "Internet and World Wide Web - How to program", Pearson Education Publishers, 2000.
2. Elliotte Rusty Harold, "Java Network Programming", O'Reilly Publishers, 2002
3. R. Krishnamoorthy & S. Prabhu, "Internet and Java Programming", New Age International Publishers, 2004.
4. Thomno A. Powell, "The Complete Reference HTML and XHTML", fourth edition, Tata McGraw Hill, 2003.
5. Naughton, "The Complete Reference - Java2", Tata McGraw-Hill, 3rd edition, 1999.