

**B.Sc.,
COMPUTER SCIENCE**

MODEL SYLLABUS

AUGUST : 2022

**TAMILNADU STATE COUNCIL FOR HIGHER EDUCATION,
CHENNAI – 600 005**

1. Introduction

B.Sc. Computer Science

Education is the key to development of any society. Role of higher education is crucial for securing right kind of employment and also to pursue further studies in best available world class institutes elsewhere within and outside India. Quality education in general and higher education in particular deserves high priority to enable the young and future generation of students to acquire skill, training and knowledge in order to enhance their thinking, creativity, comprehension and application abilities and prepare them to compete, succeed and excel globally. Learning Outcomes-based Curriculum Framework (LOCF) which makes it student-centric, interactive and outcome-oriented with well-defined aims, objectives and goals to achieve. LOCF also aims at ensuring uniform education standard and content delivery across the state which will help the students to ensure similar quality of education irrespective of the institute and location.

Computer Science is the study of quantity, structure, space and change, focusing on problem solving, application development with wider scope of application in science, engineering, technology, social sciences etc. throughout the world in last couple of decades and it has carved out a space for itself like any other disciplines of basic science and engineering. Computer science is a discipline that spans theory and practice and it requires thinking both in abstract terms and in concrete terms. Nowadays, practically everyone is a computer user, and many people are even computer programmers. Computer Science can be seen on a higher level, as a science of problem solving and problem solving requires precision, creativity, and careful reasoning. The ever-evolving discipline of computer science also has strong connections to other disciplines. Many problems in science, engineering, health care, business, and other areas can be solved effectively with computers, but finding a solution requires both computer science expertise and knowledge of the particular application domain. Computer science has a wide range of specialties. These include Computer Architecture, Software Systems, Graphics, Artificial Intelligence, Computational Science, and Software Engineering. Drawing from a common core of computer science knowledge, each specialty area focuses on specific challenges. Computer Science is practiced by mathematicians, scientists and engineers.

Mathematics, the origins of Computer Science, provides reason and logic. Science provides the methodology for learning and refinement. Engineering provides the techniques for building hardware and software.

Programme Outcome, Programme Specific Outcome and Course Outcome

Computer Science is the study of quantity, structure, space and change, focusing on problem solving, application development with wider scope of application in science, engineering, technology, social sciences etc. The key core areas of study in Mathematics include Algebra, Analysis (Real & Complex), Differential Equations, Geometry, and Mechanics. The

Students completing this programme will be able to present Software application clearly and precisely, make abstract ideas precise by formulating them in the Computer languages. Completion of this programme will also enable the learners to join teaching profession, enhance their employability for government jobs, jobs in software industry, banking, insurance and investment sectors, data analyst jobs and jobs in various other public and private enterprises.

2. Programme Outcomes (PO) of B.Sc. degree programme in Computer Science

- Scientific aptitude will be developed in Students
- Students will acquire basic Practical skills & Technical knowledge along with domain knowledge of different subjects in the Computer Science & humanities stream.
- Students will become employable; Students will be eligible for career opportunities in education field, Industry, or will be able to opt for entrepreneurship.
- Students will possess basic subject knowledge required for higher studies, professional and applied courses.
- Students will be aware of and able to develop solution oriented approach towards various Social and Environmental issues.
- Ability to acquire in-depth knowledge of several branches of Computer Science and aligned areas. This Programme helps learners in building a solid foundation for higher studies in Computer Science and applications.
- The skills and knowledge gained leads to proficiency in analytical reasoning, which can be utilized in modelling and solving real life problems.

- Utilize computer programming skills to solve theoretical and applied problems by critical understanding, analysis and synthesis.
- To recognize patterns and to identify essential and relevant aspects of problems.
- Ability to share ideas and insights while seeking and benefitting from knowledge and insight of others.
- Mould the students into responsible citizens in a rapidly changing interdependent society.

The above expectations generally can be pooled into 6 broad categories and can be modified according to institutional requirements:

PO1: Knowledge

PO2: Problem Analysis

PO3: Design / Development of Solutions

PO4: Conduct investigations of complex problems

PO5: Modern tool usage

PO6: Applying to society

3. Programme Specific Outcomes of B.Sc. Degree Programme in Computer Science

PSO1: Think in a critical and logical based manner

PSO2: Familiarize the students with suitable software tools of computer science and industrial applications to handle issues and solve problems in mathematics or statistics and realtime application related sciences.

PSO3: Know when there is a need for information, to be able to identify, locate, evaluate, and effectively use that information for the issue or problem at hand.

PSO4: Understand, formulate, develop programming model with logical approaches to a Address issues arising in social science, business and other contexts.

PSO5: Acquire good knowledge and understanding to solve specific theoretical and applied problems in advanced areas of Computer science and Industrial statistics.

PO6: Provide students/learners sufficient knowledge and skills enabling them to undertake further studies in Computer Science or Applications or Information Technology and its allied areas on multiple disciplines linked with Computer Science.

PO7: Equip with Computer science technical ability, problem solving skills, creative talent and power of communication necessary for various forms of employment.

PO8: Develop a range of generic skills helpful in employment, internships& societal activities.

PO9: Get adequate exposure to global and local concerns that provides platform for further exploration into multi-dimensional aspects of Computing sciences.

Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs) and Programme Specific Outcomes (PSOs) can be carried out accordingly, assigning the appropriate level in the grids: (put tick mark in each row)

	POs							PSOs		
	1	2	3	4	5	6	...	1	2	...
CLO1										
CLO2										
CLO3										
CLO4										
CLO5										
CLO6										
...										

5. Highlights of the Revamped Curriculum

- Student-centric, meeting the demands of industry & society, incorporating industrial components, hands-on training, skill enhancement modules, industrial project, project with viva-voce, exposure to entrepreneurial skills, training for competitive examinations, sustaining the quality of the core components and incorporating application oriented content wherever required.
- The Core subjects include latest developments in the education and scientific front, advanced programming packages allied with the discipline topics, practical training, devising mathematical models and algorithms for providing solutions to industry / real life situations. The curriculum also facilitates peer learning with advanced mathematical topics in the final semester, catering to the needs of stakeholders with research aptitude.

- The General Studies and Computer Science based problem solving skills are included as mandatory components in the ‘Training for Competitive Examinations’ course at the final semester, a first of its kind.
- The curriculum is designed so as to strengthen the Industry-Academia interface and provide more job opportunities for the students.
- The Industrial Statistics course is newly introduced in the fourth semester, to expose the students to real life problems and train the students on designing a mathematical model to provide solutions to the industrial problems.
- The Internship during the second year vacation will help the students gain valuable work experience that connects classroom knowledge to real world experience and to narrow down and focus on the career path.
- Project with viva-voce component in the fifth semester enables the student, application of conceptual knowledge to practical situations. The state of art technologies in conducting a Explain in a scientific and systematic way and arriving at a precise solution is ensured. Such innovative provisions of the industrial training, project and internships will give students an edge over the counterparts in the job market.
- State-of Art techniques from the streams of multi-disciplinary, cross disciplinary and inter disciplinary nature are incorporated as Elective courses, covering conventional topics to the latest – Statistics with R Programming, Data Science, Machine learning. Internet of Things and Artificial Intelligence etc..

6. Value additions in the Revamped Curriculum:

Semester	Newly introduced Components	Outcome / Benefits
I	<p>Foundation Course To ease the transition of learning from higher secondary to higher education, providing an overview of the pedagogy of learning abstract Mathematics and simulating mathematical concepts to real world.</p>	<ul style="list-style-type: none"> • Instil confidence among students • Create interest for the subject
I, II, III, IV	<p>Skill Enhancement papers (Discipline centric / Generic / Entrepreneurial)</p>	<ul style="list-style-type: none"> • Industry ready graduates • Skilled human resource • Students are equipped with essential skills to make them employable • Training on Computing / Computational skills enable the students gain knowledge and exposure on latest computational aspects • Data analytical skills will enable students gain internships, apprenticeships, field work involving data collection, compilation, analysis etc. • Entrepreneurial skill training will provide an opportunity for independent livelihood • Generates self – employment • Create small scale entrepreneurs • Training to girls leads to women empowerment • Discipline centric skill will improve the Technical knowhow of solving real life problems using ICT tools
III, IV, V & VI	<p>Elective papers- An open choice of topics categorized under Generic and Discipline Centric</p>	<ul style="list-style-type: none"> • Strengthening the domain knowledge • Introducing the stakeholders to the State-of Art techniques from the streams of multi-disciplinary, cross disciplinary and inter disciplinary nature • Students are exposed to Latest topics on Computer Science / IT, that require strong mathematical background • Emerging topics in higher education / industry /

		communication network / health sector etc. are introduced with hands-on-training, facilitates designing of mathematical models in the respective sectors
IV	Industrial Statistics	<ul style="list-style-type: none"> • Exposure to industry moulds students into solution providers • Generates Industry ready graduates • Employment opportunities enhanced
II year Vacation activity	Internship / Industrial Training	<ul style="list-style-type: none"> • Practical training at the Industry/ Banking Sector / Private/ Public sector organizations / Educational institutions, enable the students gain professional experience and also become responsible citizens.
V Semester	Project with Viva – voce	<ul style="list-style-type: none"> • Self-learning is enhanced • Application of the concept to real situation is conceived resulting in tangible outcome
VI Semester	Introduction of Professional Competency component	<ul style="list-style-type: none"> • Curriculum design accommodates all category of learners; ‘Mathematics for Advanced Explain’ component will comprise of advanced topics in Mathematics and allied fields, for those in the peer group / aspiring researchers; • ‘Training for Competitive Examinations’ –caters to the needs of the aspirants towards most sought - after services of the nation viz, UPSC, CDS, NDA, Banking Services, CAT, TNPSC group services, etc.
Extra Credits: For Advanced Learners / Honors degree		<ul style="list-style-type: none"> • To cater to the needs of peer learners / research aspirants

Skills acquired from the Courses	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
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7. Template for Curriculum Design for UG Programme in Computer Science
Credit Distribution for UG Programme in Computer Science

B.Sc. Computer Science
First Year
Semester-I

Part	List of Courses	Credit	Hours per week (L/T/P)
Part-I	Language	3	6
Part-II	English	3	4
Part-III	Core Courses 2 (CC1, CC2)	8	10
	Elective Course 1 (Generic / Discipline Specific)EC1	3	4
Part-IV	Skill Enhancement Course SEC-1 (Non Major Elective)	2	2
	Foundation Course FC	2	2
	Ability Enhancement Compulsory Course(AECC 1) Soft Skill-1	2	2
		23	30

Semester-II

Part	List of Courses	Credit	Hours per week (L/T/P)
Part-I	Language	3	6
Part-II	English	3	4
Part-III	Core Courses 2 (CC3, CC4)	8	10
	Elective Course 1 (Generic / Discipline Specific) EC2	3	4
Part-IV	Skill Enhancement Course -SEC-2 (Non Major Elective)	2	2
	Skill Enhancement Course -SEC-3 (Discipline Specific / Generic)	2	2
	Ability Enhancement Compulsory Course(AECC 2) Soft Skill-2	2	2
		23	30

Second Year
Semester-III

Part	List of Courses	Credit	Hours per week (L/T/P)
Part-I	Language	3	6
Part-II	English	3	4
Part-III	Core Courses 2 (CC5, CC6)	8	10
	Elective Course 1 (Generic / Discipline Specific)EC3	3	4
Part-IV	Skill Enhancement Course -SEC-4 (Entrepreneurial Based)	1	1
	Skill Enhancement Course -SEC-5 (Discipline Specific/ Generic)	2	2
	Ability Enhancement Compulsory Course(AECC 3) Soft Skill-3	2	2
	Environmental Studies(EVS)	-	1
		22	30

Semester-IV

Part	List of Courses	Credit	Hours per week (L/T/P)
Part-I	Language	3	6
Part-II	English	3	4
Part-III	Core Courses 2 (CC7, CC8)	8	8
	CC7: Core Industry Module -1 - Industrial Statistics		
	CC8 : Any Core paper		
	Elective Course 1 (Generic / Discipline Specific)EC4	3	4
Part-IV	Skill Enhancement Course -SEC7	2	2
	Skill Enhancement Course -SEC-8 (Discipline Specific / Generic)	2	2
	Ability Enhancement Compulsory Course(AECC 4) Soft Skill-4	2	2
	Environmental Studies EVS	2	2
		25	30

Third Year**Semester-V**

Part	List of Courses	Credit	Hours per week (L/T/P)
Part-III	Core Courses 3(CC9, CC10, CC11)	12	15
	Elective Courses 2 (Generic / Discipline Specific) EC5, EC6	6	9
	Core /Project with Viva voce CC12	4	4
Part-IV	Value Education	2	2
	Internship / Industrial Training (Carried out in II Year Summer vacation) (30 hours)	2	
		26	30

Semester-VI

Part	List of Courses	Credit	Hours per week (L/T/P)
Part-III	Core Courses 3 (CC13, CC14, CC15)	12	15
	Elective Courses 2 (Generic / Discipline Specific) EC7, EC8	6	11
Part IV	Professional Competency Skill Enhancement Course SE8	2	4
Part-V	Extension Activity (Outside college hours)	1	-
		21	30

Total Credits: 140

8. Credit Distribution for UG Programme

Sem I	Credit	Sem II	Credit	Sem III	Credit	Sem IV	Credit	Sem V	Credit	Sem VI	Credit
1.1. Language	3	2.1. Language	3	3.1. Language	3	4.1. Language	3	5.1 Core Course – \CC IX	4	6.1 Core Course – CC XIII	4
1.2 English	3	2.2 English	3	3.2 English	3	4.2 English	3	5.2 Core Course – CC X	4	6.2 Core Course – CC XIV	4
1.3 Core Course – CC I	4	2.3 Core Course – CC III	4	3.3 Core Course – CC V	4	4.3 Core Course – CC VII Core Industry Module	4	5. 3.Core Course – CC -XI	4	6.3 Core Course – CC XV	4
1.4 Core Course – CC II	4	2.4 Core Course – CC IV	4	3.4 Core Course – CC VI	4	4.4 Core Course – CC VIII	4	5. 3.Core Course –/ Project with viva- voce CC -XII	4	6.4 Elective - VII Generic/ Discipline Specific	3
1.5 Elective I Generic/ Discipline Specific	3	2.5 Elective II Generic/ Discipline Specific	3	3.5 Elective III Generic/ Discipline Specific	3	4.5 Elective IV Generic/ Discipline Specific	3	5.4 Elective V Generic/ Discipline Specific	3	6.5 Elective VIII Generic/ Discipline Specific	3
1.6 Skill Enhancement Course SEC-1 (NME)	2	2.6 Skill Enhancement Course SEC-2 (NME)	2	3.6 Skill Enhancement Course SEC-4, (Entrepreneurial Skill)	1	4.6 Skill Enhancement Course SEC-6	2	5.5 Elective VI Generic/ Discipline Specific	3	6.6 Extension Activity	1
		2.7 Skill Enhancement Course –SEC-3	2	3.7 Skill Enhancement Course SEC-5	2	4.7 Skill Enhancement Course SEC-7	2	5.6 Value Education	2	6.7 Professional Competency Skill	2
1.7 Ability Enhancement Compulsory Course (AECC) Soft Skill-1	2	2.8 Ability Enhancement Compulsory Course (AECC) Soft Skill-2	2	3.7 Ability Enhancement Compulsory Course (AECC) Soft Skill-3	2	4.7 Ability Enhancement Compulsory Course (AECC) Soft Skill-4	2	5.5 Summer Internship /Industrial Training	2		
1.8 Skill Enhancement - (Foundation Course)	2			3.8 E.V.S	-	4.8 E.V.S	2				
	23		23		22		25		26		21
	Total Credit Points										140

9. Consolidated Semester wise and Component wise Credit distribution

Parts	Sem I	Sem II	Sem III	Sem IV	Sem V	Sem VI	Total Credits
Part I	3	3	3	3	-	-	12
Part II	3	3	3	3	-	-	12
Part III	11	11	11	11	22	18	84
Part IV	6	6	5	8	4	2	31
Part V	-	-	-	-	-	1	1
Total	23	23	22	25	26	21	140

***Part I, II, and Part III components will be separately taken into account for CGPA calculation and classification for the under graduate programme and the other components. IV, V have to be completed during the duration of the programme as per the norms, to be eligible for obtaining the UG degree**

10. Illustration for B.Sc. Computer Science Curriculum Design

First Year

Semester-I

Part	List of Courses	Credit	Hours per week (L/T/P)
Part-I	Language	3	6
Part-II	English	3	4
Part-III	CC1 - Python Programming	4	4
	CC2 - Practical : Python Programming	4	5
	Elective Course 1 (Generic / Discipline Specific) – Numerical Methods	3	5
Part-IV	Skill Enhancement Course- SEC-1 (Non Major Elective)- Office Automation	2	2
	Foundation Course FC - Problem Solving Techniques	2	2
	Ability Enhancement Compulsory Course(AECC 1) Soft Skill-1	2	2
		23	30

Semester-II

Part	List of Courses	Credit	Hours per week(L/T/P)
Part-I	Language	3	6
Part-II	English	3	4
Part-III	CC3 - Python Programming	4	4
	CC4 - Practical: Data Structure and Algorithms	4	5
	Elective Course 2 (Generic / Discipline Specific) – Graph Theory and its applications	3	5
Part-IV	Skill Enhancement Course- SEC-2 (Non Major Elective) - Quantitative Aptitude	2	2
	Skill Enhancement Course – SEC-3 (Discipline / Subject Specific) – Advanced Excel	2	2
	Ability Enhancement Compulsory Course(AECC 2) Soft Skill-2	2	2
		23	30

**Second Year
Semester-III**

Part	List of Courses	Credit	Hours per week(L/T/P)
Part-I	Language	3	6
Part-II	English	3	4
Part-III	CC5- Microprocessor and Microcontroller	4	5
	CC6 - Practical: Microprocessor and Microcontroller	4	4
	Elective Course 3 (Generic / Discipline Specific) - EC3 - Discrete Mathematical Structures	3	4
Part-IV	Skill Enhancement Course -SEC-4 (Entrepreneurial Based) – PHP Programming	1	2
	Skill Enhancement Course -SEC-5 (Discipline Specific/ Generic) – Cloud Computing	2	2
	Ability Enhancement Compulsory Course (AECC 3) Soft Skill-3	2	2
	Environmental Studies	-	1
		22	30

Semester-IV

Part	List of Courses	Credit	Hours per week (L/T/P)
Part-I	Language	3	6
Part-II	English	3	4
Part-III	CC7 - Industry Module –Java Programming	4	4
	CC8 - Practical: Java Programming	4	4
	Elective Course - EC4 (Generic / Discipline Specific) – Statistics Analysis using R	3	4
Part-IV	Skill Enhancement Course – SEC-6 - PHP Programming	2	2
	Skill Enhancement Course - SEC-7 -Big Data Analytics	2	2
	Ability Enhancement Compulsory Course(AECC 4) Soft Skill-4	2	2
	Environmental Studies	2	2
		25	30

**Third Year
Semester-V**

Part	List of Courses	Credit	Hours per week (L/T/P)
Part-III	CC9 - Computer Networks	4	5
	CC10 - Advanced Database Management System	4	5
	CC11 - Practical: Advanced Database Management System	4	5
	Elective Course – EC5 (Generic / Discipline Specific) – Operating Systems	3	5
	Elective Course – EC6 (Generic / Discipline Specific) – Data Mining and Warehousing	3	4
	CC12 - Core /Project with Viva voce	4	4
Part-IV	Value Education	2	2
	Internship / Industrial Training (Summer vacation at the end of IV semester activity)	2	
		26	30

Semester-VI

Part	List of Courses	Credit	Hours per week (L/T/P)
Part-III	CC13 - Software Engineering	4	5
	CC14 - .NET Programming	4	5
	CC15 - Practical: .NET Programming	4	5
	Elective Course – EC7 (Generic / Discipline Specific) – Introduction to Data Science	3	6
	Elective Course – EC8 (Generic / Discipline Specific) – Cyber security	3	5
Part-IV	Professional Competency Skill Enhancement Course SE8	2	4
Part -V	Extension Activity	1	
		21	30

Total Credits : 140

Method of Evaluation:

Test I	Test II	Assignment	End Semester Examination	Total	Grade
10	10	5	75	100	

SYLLABUS**First Year (Semester – I)**

Course Code-1	Python Programming		Credits 4
Lecture Hours: (L) per week - 4	Tutorial Hours :75 (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week: 4
Course Category : Core	Year & Semester: I Year I Semester	Admission Year:	
Pre-requisite	Basic Knowledge of Programming concept		
Learning Objectives: (for teachers: what they have to do in the class/lab/field) <ul style="list-style-type: none"> • Describe the core syntax and semantics of Python programming language. • Discover the need for working with the strings and functions. • Illustrate the process of structuring the data using lists, dictionaries, tuples and sets. • Understand the usage of packages and Dictionaries 			
Course Outcomes: (for students: To know what they are going to learn) <p>CO1:Develop and execute simple Python programs</p> <p>CO2:Write simple Python programs using conditionals and looping for solving problems</p> <p>CO3:Decompose a Python program into functions</p> <p>CO4: Represent compound data using Python lists, tuples, dictionaries etc.</p> <p>CO5: Read and write data from/to files in Python programs</p>			
Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)			
Units	Contents	Required Hours	
I	Introduction: The essence of computational problem solving – Limits of computational problem solving-Computer algorithms-Computer Hardware-Computer Software-The process of computational problem solving-Python programming language - Literals - Variables and Identifiers - Operators - Expressions and Data types, Input / output	15	

II	Control Structures: Boolean Expressions - Selection Control - If Statement- Indentation in Python- Multi-Way Selection -- Iterative Control- While Statement- Infinite loops- Definite vs. Indefinite Loops- Boolean Flag. String, List and Dictionary, Manipulations Building blocks of python programs, Understanding and using ranges.	15
III	Functions: Program Routines- Defining Functions- More on Functions: Calling Value-Returning Functions- Calling Non- Value-Returning Functions- Parameter Passing - Keyword Arguments in Python - Default Arguments in Python- Variable Scope. Recursion: Recursive Functions	15
IV	Objects and their use: Software Objects - Turtle Graphics – Turtle attributes-Modular Design: Modules - Top-Down Design - Python Modules - Text Files: Opening, reading and writing text files – Database Programming: Connecting to a database, Creating Tables, INSERT, UPDATE, DELETE and READ operations, Transaction Control, Disconnecting from a database, String Processing - Exception Handling	15
V	Dictionaries and Sets: Dictionary type in Python - Set Data type. Object Oriented Programming using Python: Encapsulation - Inheritance – Polymorphism. Python packages: Simple programs using the built-in functions of packages matplotlib, numpy, pandas etc.	15
Extended Professional Component (is a part of internal component only, Not to	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	

be included in the External Examination question paper)		
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	

Learning Resources:

- **Recommended Texts**

1. Charles Dierbach, “Introduction to Computer Science using Python - A computational Problem solving Focus”, Wiley India Edition, 2015.
2. Wesley J. Chun, “Core Python Applications Programming”, 3rd Edition , Pearson Education, 2016

- **Reference Books**

1. Mark Lutz, “Learning Python Powerful Object Oriented Programming”, O’reilly Media 2018, 5th Edition.
2. Timothy A. Budd, “Exploring Python”, Tata MCGraw Hill Education Private Limited 2011, 1 st Edition.
3. John Zelle, “Python Programming: An Introduction to Computer Science”, Second edition, Course Technology Cengage Learning Publications, 2013, ISBN 978- 1590282410
4. Michel Dawson, “Python Programming for Absolute Beginners” , Third Edition, Course Technology Cengage Learning Publications, 2013, ISBN 978-1435455009

- **Web resources**

1. https://onlinecourses.swyam2.ac.in/cec22_cs20/preview

Course Code: CC2	Python Programming Lab		Credits : 5
Lecture Hours: (L) per week:	Tutorial Hours : (T) per week	Lab Practice Hours: 5 per week	Total: (L+T+P) per week: 5
Course Category :Core	Year & Semester: I Year I Semester	Admission Year:	
Pre-requisite	Basic of programming skill		
<p>Learning Objectives: (for teachers: what they have to do in the class/lab/field)</p> <ul style="list-style-type: none"> • Acquire programming skills in core Python. • Acquire Object-oriented programming skills in Python. • Develop the skill of designing graphical-user interfaces (GUI) in Python. • Develop the ability to write database applications in Python. • Acquire Python programming skills to move into specific branches 			
<p>Course Outcomes: (for students: To know what they are going to learn)</p> <p>CO1:To understand the problem solving approaches</p> <p>CO2:To learn the basic programming constructs in Python</p> <p>CO3:To practice various computing strategies for Python-based solutions to real world problems</p> <p>CO4: To use Python data structures - lists, tuples, dictionaries.</p> <p>CO5: To do input/output with files in Python.</p>			
Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)			
	List of Exercises:	Required Hours	
	<ol style="list-style-type: none"> 1. Program to convert the given temperature from Fahrenheit to Celsius and vice versa depending upon user's choice. 2. Program to calculate total marks, percentage and grade of a student. Marks obtained in each of the five subjects are to be input by user. Assign grades 		

	<p>according to the following criteria:</p> <p>Grade A: Percentage ≥ 80 Grade B: Percentage ≥ 70 and < 80</p> <p>Grade C: Percentage ≥ 60 and < 70 Grade D: Percentage ≥ 40 and < 60</p> <p>Grade E: Percentage < 40</p> <p>3. Program, to find the area of rectangle, square, circle and triangle by accepting suitable input parameters from user.</p> <p>4. Write a Python script that prints prime numbers less than 20.</p> <p>5. Program to find factorial of the given number using recursive function.</p> <p>6. Write a Python program to count the number of even and odd numbers from array of N numbers.</p> <p>7. Write a Python class to reverse a string word by word.</p> <p>8. Given a tuple and a list as input, write a program to count the occurrences of all items of the list in the tuple. (Input : tuple = ('a', 'a', 'c', 'b', 'd'), list = ['a', 'b'], Output : 3)</p> <p>9. Create a Savings Account class that behaves just like a BankAccount, but also has an interest rate and a method that increases the balance by the appropriate amount of interest (Hint:use Inheritance).</p> <p>10. Write a Python program to construct the following pattern, using a nested loop</p> <pre style="text-align: center;">* ** *** ****</pre>	
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	<p style="text-align: center;">***** **** *** ** *</p> <ol style="list-style-type: none"> 11. Read a file content and copy only the contents at odd lines into a new file. 12. Create a Turtle graphics window with specific size. 13. Write a Python program for Towers of Hanoi using recursion 14. Create a menu driven Python program with a dictionary for words and their meanings. 15. Devise a Python program to implement the Hangman Game. 	
<p>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</p>	<p>Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)</p>	
<p>Skills acquired from the course</p>	<p>Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</p>	

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4. Michel Dawson, “Python Programming for Absolute Beginners” , Third Edition, Course Technology Cengage Learning Publications, 2013, ISBN 978-1435455009

Course Code-SEC-1	NUMERICAL METHODS		Credits 3
Lecture Hours: (L) per week - 5	Tutorial Hours :75 (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week: 5
Course Category : Core	Year & Semester: I Year I Smester	Admission Year:	
Pre-requisite	Basic Knowledge of Programming concept		
<p>The main objectives of this course are:</p> <ol style="list-style-type: none"> 1. To introduce the various topics in Numerical methods. 2. To make understand the fundamentals of algebraic equations. 3. To apply interpolation and approximation on examples. 4. To solve problems using numerical differentiation and integration. 5. To solve linear systems, numerical solution of ordinary differential equations. 			
<p>Course Outcomes: (for students: To know what they are going to learn)</p> <p>CO1:Know how to solve various problems on numerical methods</p> <p>CO2:Use approximation to solve problems</p> <p>CO3:Differentiation and integration concept are applied</p> <p>CO4: Apply , direct methods for solving linear systems</p> <p>CO5: Numerical solution of ordinary differential equations</p>			
<p>Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)</p>			
Units	Contents		Required Hours
I	<p>FUNDAMENTALS OF ALGEBRAIC EQUATION:</p> <p>Solution of algebraic and transcendental equations-Bisection method – Fixed point iteration method – Newton Raphson method –linear system of equations – Gauss elimination method – Gauss Jordan method .</p>		15
II	<p>ITERATIVE, INTERPOLATION AND APPROXIMATION: Iterative methods - Gauss Jacobi and Gauss Seidel – Eigen values of a matrix by Power method and Jacobi’s method for symmetric matrices. Interpolation</p>		15

	with unequal intervals – Lagrange’s interpolation – Newton’s divided difference interpolation	
III	INTERPOLATION WITH EQUAL INTERVAL: Difference operators and relations. -Interpolation with equal intervals – Newton’s forward and backward difference formulae.	15
IV	NUMERICAL DIFFERENTIATION AND INTEGRATION: Approximation of derivatives using interpolation polynomials – Numerical integration using Trapezoidal, Simpson’s 1/3 rule	15
V	INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS: Single step methods – Taylor’s series method – Euler’s method – Modified Euler’s method - Runge Kutta method for solving(first, second , Third and 4th) order equations – Multi step methods	15
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	

Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	
<p>Learning Resources:</p> <ul style="list-style-type: none"> • Recommended Texts <ol style="list-style-type: none"> 1. Charles Dierbach, “Introduction to Computer Science using Python - A computational Problem solving Focus”, Wiley India Edition, 2015. 2. Wesley J. Chun, “Core Python Applications Programming”, 3rd Edition , Pearson Education, 2016 • Reference Books <ol style="list-style-type: none"> 5. Mark Lutz, “Learning Python Powerful Object Oriented Programming”, O’reilly Media 2018, 5th Edition. 6. Timothy A. Budd, “Exploring Python”, Tata MCGraw Hill Education Private Limited 2011, 1 st Edition. 7. John Zelle, “Python Programming: An Introduction to Computer Science”, Second edition, Course Technology Cengage Learning Publications, 2013, ISBN 978- 1590282410 8. Michel Dawson, “Python Programming for Absolute Beginners” , Third Edition, Course Technology Cengage Learning Publications, 2013, ISBN 978- 1435455009 • Web resources <ol style="list-style-type: none"> 1. https://onlinecourses.swayam2.ac.in/cec22_cs20/preview 		

Course Code: SEC-1	Office Automation		Credits: 2
Lecture Hours: (L) per week: 2	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week: 2
Course Category : SEC-1	Year & Semester: I Year I Semester	Admission Year:	
Pre-requisite	Basic skills in Computer operations		
<p>Learning Objectives: (for teachers: what they have to do in the class/lab/field)</p> <ul style="list-style-type: none"> • The major objective in introducing the Computer Skills course is to impart training for students in Microsoft Office which has different components like MS Word, MS Excel and Power point. • The course is highly practice oriented rather than regular class room teaching. • To acquire knowledge on editor, spread sheet and presentation software. 			
<p>Course Outcomes: (for students: To know what they are going to learn)</p> <p>CO1: Understand the basics of computer systems and its components.</p> <p>CO2: Understand and apply the basic concepts of a word processing package.</p> <p>CO3: Understand and apply the basic concepts of electronic spreadsheet software.</p> <p>CO4: Understand and apply the basic concepts of database management system.</p> <p>CO5: Understand and create a presentation using PowerPoint tool.</p>			
<p>Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)</p>			
Units	Contents		Required Hours
I	<p>Introductory concepts: Memory unit – CPU-Input Devices: Key board, Mouse and Scanner. Output devices: Monitor, Printer. Introduction to Operating systems & its features: DOS – UNIX– Windows. Introduction to Programming Languages.</p>		17

II	Word Processing: Open, Save and close word document; Editing text – tools, formatting, bullets; Spell Checker - Document formatting – Paragraph alignment, indentation, headers and footers, numbering; printing – Preview, options, merge.	17
III	Spreadsheets: Excel – opening, entering text and data, formatting, navigating; Formulas – entering, handling and copying; Charts – creating, formatting and printing, analysis tables, preparation of financial statements, introduction to data analytics.	17
IV	Database Concepts: The concept of data base management system; Data field, records, and files, Sorting and indexing data; Searching records. Designing queries, and reports; Linking of data files; Understanding Programming environment in DBMS; Developing menu drive applications in query language (MS – Access).	17
V	Power point: Introduction to Power point - Features – Understanding slide typecasting & viewing slides – creating slide shows. Applying special object – including objects & pictures – Slide transition – Animation effects, audio inclusion, timers.	17
Extended Professional Component (is a part of internal	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	

component only, Not to be included in the External Examination question paper)		
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	
<p>Learning Resources:</p> <ul style="list-style-type: none"> • Recommended Texts <ol style="list-style-type: none"> 1. Peter Norton, “Introduction to Computers” –Tata McGraw-Hill. • Reference Books <ol style="list-style-type: none"> 1. Jennifer Ackerman Kettel, Guy Hat-Davis, Curt Simmons, “Microsoft 2003”, Tata McGraw-Hill. • Web resources : Web content from NDL / SWAYAM or open source web resources 		

Course Code: FC1	Problem Solving Techniques		Credits: 2
Lecture Hours: (L) per week: 2	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week: 2
Course Category : FC	Year & Semester:I Year I Semester	Admission Year:	
Pre-requisite	Basic of Problem-solving skills		
<p>Learning Objectives:</p> <ul style="list-style-type: none"> • To understand the importance of algorithms and programs, and to know of the basic problem solving strategies. • To learn efficient strategies and algorithms to solve standard problems, thus laying a firm foundation for designing algorithmic solutions to problems. 			
<p>Course Outcomes: (for students: To know what they are going to learn)</p> <p>CO1:Understand the systematic approach to problem solving.</p> <p>CO2:Know the approach and algorithms to solve specific fundamental problems.</p> <p>CO3:Understand the efficient approach to solve specific factoring-related problems.</p> <p>CO4: Understand the efficient array-related techniques to solve specific problems.</p> <p>CO5: Understand the efficient methods to solve specific problems related to text processing. Understand how recursion works.</p>			
<p>Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)</p>			
Units	Contents	Required Hours	
I	<p>Introduction: Notion of algorithms and programs – Requirements for solving problems by computer – The problem-solving aspect: Problem definition phase, Getting started on a problem, The use of specific examples, Similarities among problems, Working backwards from the solution – General problem-solving strategies - Problem solving using top-down design – Implementation of algorithms – The concept of Recursion.</p>	17	

II	<p>Fundamental Algorithms: Exchanging the values of two variables – Counting - Summation of a set of numbers - Factorial computation - Sine function computation - Fibonacci Series generation - Reversing the digits of an integer – Base Conversion.</p>	17
III	<p>Factoring Methods: Finding the square root of a number – The smallest divisor of an integer – Greatest common divisor of two integers - Generating prime numbers – Computing the prime factors of an integer – Generation of pseudo-random numbers - Raising a number to a large power – Computing the nth Fibonacci number.</p>	17
IV	<p>Array Techniques: Array order reversal – Array counting or histogramming – Finding the maximum number in a set - Removal of duplicates from an ordered array - Partitioning an array – Finding the k^{th} smallest element – Longest monotone subsequence.</p>	17
V	<p>Text Processing and Pattern Searching: Text line length adjustment – Left and right justification of text – Keyword searching in text – Text line editing – Linear pattern search.</p> <p>Recursive algorithms: Towers of Hanoi – Permutation generation.</p>	17
Extended Professional Component (is a part of internal component only, Not to be included	<p>Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)</p>	

in the External Examination question paper)		
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	
<p>Learning Resources:</p> <ul style="list-style-type: none"> • Recommended Texts 1. R. G. Dromey, <i>How to Solve it by Computer</i>, Pearson India, 2007. <ul style="list-style-type: none"> • Reference Books 1. George Polya, Jeremy Kilpatrick, <i>The Stanford Mathematics Problem Book: With Hints and Solutions</i>, Dover Publications, 2009 (Kindle Edition 2013). 2. Greg W. Scragg, <i>Problem Solving with Computers</i>, Jones & Bartlett 1st edition, 1996. <ul style="list-style-type: none"> • Web resources 		

First Year (Semester – II)

Course Code: CC3	Data Structures & Algorithms		Credits: 4
Lecture Hours: (L) per week: 4	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week: 4
Course Category : CC3	Year & Semester: I Year II Semester		Admission Year:

Pre-requisite	Basic knowledge in data and representations	
Links to other Courses		
Learning Objectives: (for teachers: what they have to do in the class/lab/field)		
<ul style="list-style-type: none"> • To impart the basic concepts of data structures and algorithms. • To acquaint the student with the basics of the various data structures and make the students knowledgeable in the area of data structures. • This course also gives insight into the various algorithm design techniques 		
Course Outcomes: (for students: To know what they are going to learn)		
CO1: To introduce the concepts of Data structures and to understand simple linear data structures.		
CO2: Learn the basics of stack data structure, its implementation and application		
CO3: Use the appropriate data structure in context of solution of given problem and demonstrate a familiarity with major data structures.		
CO4: To introduce the basic concepts of algorithms		
CO5: To give clear idea on algorithmic design paradigms like Dynamic Programming, Backtracking, Branch and Bound		
Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)		
Units	Contents	Required Hours
I	INTRODUCTION TO DATA STRUCTURES: <ul style="list-style-type: none"> • Data Structures: Definition- Time & Space Complexity, • Arrays: Representation of arrays, Applications of arrays, sparse matrix and its representation, • Linear list: Singly linked list implementation, insertion, deletion and searching operations on linear list • Circular linked list: implementation, Double linked list implementation, insertion, deletion and searching 	17

	operations. Applications of linked lists- Dynamic Storage management.	
II	<p>STACKS:</p> <ul style="list-style-type: none"> • Operations, array and linked representations of stack, • stack applications, infix to postfix conversion, postfix expression evaluation, recursion implementation 	17
III	<p>QUEUES, TREES & GRAPHS:</p> <ul style="list-style-type: none"> • Queues: operations on queues, array and linked representations. • Circular Queue: operations,, applications of queues. • Trees: Definitions and Concepts- Representation of binary tree, Binary tree traversals (Inorder, Postorder , preorder), • Binary search trees • Graphs : Representation of Graphs- Types of graphs -Breadth first traversal – Depth first traversal- - Applications of graphs – 	17
IV	<p>INTRODUCTION TO ALGORITHMS:</p> <ul style="list-style-type: none"> • INTRODUCTION: Definition of Algorithms- Overview and importance of algorithms- pseudocode conventions, Asymptotic notations, practical complexities. • Divide-and-Conquer: : General Method – Binary Search- Quick Sort- Merge Sort. • Greedy Method: General method- Knapsack problem- Tree vertex splitting- Job sequencing with deadlines 	17

V	<p>DYNAMIC PROGRAMMING, BACKTRACKING & BRANCH & BOUND</p> <ul style="list-style-type: none"> • Dynamic programming: General method, Multistage Graphs, All pairs shortest path, Single source shortest path. • Backtracking: General method, 8 Queens, Graph coloring, Hamiltonian cycle. • Branch & Bound: General method, Travelling salesperson problem. 	17
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	

Learning Resources:

- **Recommended Texts**

1. Ellis Horowitz , Sartaj Sahni, Susan Anderson Freed, Second Edition ,
“Fundamentals of Data in C”, Universities Press
2. E. Horowitz, S. Sahni and S. Rajasekaran, Second Edition ,“Fundamentals of
Computer Algorithms “ Universities Press

- **Reference Books**

1. Seymour Lipschutz ,”Data Structures with C”, First Edition, Schaum’s outline
series in computers, Tata McGraw Hill.
2. .2. R.Krishnamoorthy and G.Indirani Kumaravel, Data Structures using C, Tata
McGrawHill – 2008.
3. A.K.Sharma, Data Structures using C , Pearson Education India,2011.
4. . G. Brassard and P. Bratley, “Fundamentals of Algorithms”, PHI, New Delhi,
1997.
5. 4, . A.V. Aho, J.E. Hopcroft, J.D. Ullmann,, “The design and analysis of
Computer
Algorithms”, Addison Wesley, Boston, 1974
7. 5. Thomas H. Cormen, C.E. Leiserson, R L.Rivest and C. Stein, Introduction to
Algorithms, Third edition, MIT Press, 2009
8. Sanjoy Dasgupta, C.Papadimitriou and U.Vazirani , Algorithms , Tata McGraw-
Hill, 2008.

- **Web resources:** Web resources from NDL Library, E-content from open source
libraries

Course Code: CC3	Data Structures & Algorithms Lab		Credits: 4
Lecture Hours: (L)	Tutorial Hours :	Lab Practice	Total: (L+T+P)

per week	(T) per week	Hours: (P)per week: 5	per week: 5
Course Category : CC3	Year & Semester: I Year II Semester	Admission Year:	
Pre-requisite	Basic skills in problem solving		
<p>Learning Objectives: (for teachers: what they have to do in the class/lab/field)</p> <ul style="list-style-type: none"> • To understand and implement basic data structures using C • To apply linear and non-linear data structures in problem solving. • To learn to implement functions and recursive functions by means of data structures • To implement searching and sorting algorithms 			
<p>Course Outcomes: (for students: To know what they are going to learn)</p> <p>CO1:Implement data structures using C</p> <p>CO2:Implement various types of linked lists and their applications</p> <p>CO3:Implement Tree Traversals</p> <p>CO4: Implement various algorithms in C</p> <p>CO5: Implement different sorting and searching algorithms</p>			
<p>Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)</p>			
	List of Exercises:	Required Hours	
	Implement the following exercises using C Programming language: <ol style="list-style-type: none"> 1. Array implementation of stacks 2. Array implementation of Queues 3. Linked list implementation of stacks 4. Linked list implementation of Queues 5. Binary Tree Traversals (Inorder, Preorder, Postorder) 6. Implementation of Linear search and binary search 7. Implementation Insertion sort, Quick sort and Merge Sort 8. Implementation of Depth-First Search & Breadth- 	17	

	<p>First Search of Graphs.</p> <p>9. Finding all pairs of Shortest Path of a Graph.</p> <p>10. Finding single source shortest path of a Graph.</p>	
<p>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</p>	<p>Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)</p>	
<p>Skills acquired from the course</p>	<p>Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</p>	
<p>Learning Resources:</p> <p>Learning Resources:</p> <ul style="list-style-type: none"> • Recommended Texts <ol style="list-style-type: none"> 1. Ellis Horowitz , Sartaj Sahni, Susan Anderson Freed, Second Edition , “Fundamentals of Data in C”, Universities Press 2. E. Horowitz, S. Sahni and S. Rajasekaran, Second Edition , “Fundamentals of Computer Algorithms “ Universities Press • Reference Books <ol style="list-style-type: none"> 1. Seymour Lipschutz ,”Data Structures with C”, First Edition, Schaum’s outline 		

series in computers, Tata McGraw Hill.

2. .2. R.Krishnamoorthy and G.Indirani Kumaravel, Data Structures using C, Tata McGrawHill – 2008.

3. A.K.Sharma, Data Structures using C , Pearson Education India,2011.

4. . G. Brassard and P. Bratley, “Fundamentals of Algorithms”, PHI, New Delhi, 1997.

5. 4, . A.V. Aho, J.E. Hopcroft, J.D. Ullmann,, “The design and analysis of Computer

6. Algorithms”, Addison Wesley, Boston, 1974

7. 5. Thomas H. Cormen, C.E. Leiserson, R L.Rivest and C. Stein, Introduction to Algorithms, Third edition, MIT Press, 2009

8. Sanjoy Dasgupta, C.Papadimitriou and U.Vazirani , Algorithms , Tata McGraw-Hill, 2008.

- **Web resources:** Web resources from NDL Library, E-content from open source libraries

Course Code: EC2	Graph		Credits: 3
	Theory and its applications		
Lecture Hours: (L) per week: 5	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week: 5
Course Category : EC2	Year & Semester: I Year & I Semester	Admission Year:	
Pre-requisite	Basic knowledge in data and representations		
Links to other Courses			

Learning Objectives: (for teachers: what they have to do in the class/lab/field)

1. Definition of Graph, sub graph their representations, degree and algebraic operations.
2. Connected graphs, weighted graphs and shortest paths
3. Trees: Characterizations, spanning tree, minimum spanning trees
4. Eulerian and Hamiltonian graphs: Characterization, Necessary and sufficient conditions
5. Special classes of graphs: Bipartite graphs, line graphs, chordal graphs.

Course Outcomes: (for students: To know what they are going to learn)

CO1: To Introduce the fundamental concepts in graph theory Graphs, subgraphs, walks, Euler graphs, Hamiltonian Paths Tree Properties , Hamiltonian paths and circuits

CO2: Understanding the concepts of Circuits, Cut set and its Properties, Network Flows, Isomorphism and Combinatorial and Planar Graphs.

CO3: Applying the concept of Colouring with Chromatic Number, Directed Graphs, Matching | , Covering Pattern and Euler Graphs

CO4: Analysing the Various Concepts of Representation of Graphs, Euler Paths Circuit, Kruskals and Prims Algorithms, Connected Components.

CO5: Implementation of an application using All Types of Graphs and evaluate the Applications with travelling sales person Problem, K colour Problem with n vertices in a Graph and Shortest Path finding Problem using Directed and Undirected Graphs.

Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)

Units	Contents	Required Hours
I	INTRODUCTION: Graph-mathematical definition- Introduction – sub graphs –Walks, paths, Circuits connectedness- Components- Euler Graphs- Hamiltonian paths and circuits-Trees- properties of Trees- Distance and centers in Tree- Rooted and Binary Trees	17
II	CONNECTIVITY AND PLANARITY: Introduction to circuits - cut set- properties of cut set- All cut sets –	17

	connectivity and separability – Network Flows - 1- Isomorphism - 2-Isomorphism- Combinatorial and Geometric graphs- Planar Graphs – Different representation of planar graph.	
III	COLORING AND DIRECTED GRAPH: Basics of Colouring & Chromatic number – Chromatic partitioning – Graph Colouring – four colour Problem Chromatic polynomial - Matching – Covering - Directed graphs - Types of Directed Graphs – Diagraphs and binary relations – Directed paths- Euler Graph.	17
IV	MATRIX REPRESENTATION IN GRAPH: Matrix representation of graphs, Sub graphs & Quotient Graphs, Transitive Closure digraph, Euler's Path & Circuit (only definitions and examples), spanning Trees of Connected Relations, Prim's Algorithm to construct Spanning Trees, Weighted Graphs, Minimal, Spanning Trees by Prim's Algorithm & Kruskal's Algorithm.	17
V	APPLICATIONS OF GRAPH: Traveling Sales Person Problem with Directed and Un directed Graph, - Graph with n vertices and k colours- Shortest path from one to many Cities with directed graph- Shortest Paths with Un directed Graphs-Connected Components.	17
Extended Professional Component (is a part of internal component only, Not to be included	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	

in the External Examination question paper)		
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	
<p>Learning Resources:</p> <p>1 Narsingh Deo , “ Graph Theory with Application to Engineering and Computer Science” Prentice Hall of India 2010(Reprint)</p> <p>2 Rosen H “Discrete Mathematics and Its Application “ Mc Graw Hill , 2007</p> <p>Reference Books:</p> <p>1 Discrete Maths for Computer Scientists & Mathematicians by Mott, Kandel, Baker</p> <p>2 Clark J and Holton DA “ First look at Graph Theory” Allied Publishers 1995</p> <p>3 Discrete Maths for Computer Scientists & Mathematicians by Mott, Kandel, Baker</p> <p>Web resources: Web resources from NDL Library, E-content from open source libraries</p> <p>https://d3gt.com/</p> <p>https://www.coursera.org/courses?query=graph%20theory</p>		

Course Code: SEC-2	Quantitative Aptitude		Credits: 2
Lecture Hours: (L) per week: 2	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week: 2
Course Category :SEC-2	Year & Semester:I Year II Semester		Admission Year:
Pre-requisite	Basic knowledge in numerical ability		

Learning Objectives: (for teachers: what they have to do in the class/lab/field)		
<ul style="list-style-type: none"> • To improve the quantitative skills of the students • To prepare the students for various competitive exams 		
Course Outcomes: (for students: To know what they are going to learn)		
CO1: To gain knowledge on LCM and HCF and its related problems		
CO2: To get an idea of age, profit and loss related problem solving.		
CO3: Able to understand time series simple and compound interests		
CO4: Understanding the problem related to probability, and series		
CO5: Able to understand graphs, charts		
Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)		
Units	Contents	Required Hours
I	Numbers - HCF and LCM of numbers - Decimal fractions - Simplification - Square roots and cube roots - Average - problems on Numbers	17
II	Problems on Ages - Surds and Indices - percentage - profits and loss - ratio and proportion - partnership - Chain rule.	17
III	Time and work - pipes and cisterns - Time and Distance - problems on trains - Boats and streams - simple interest - compound interest - Logarithms - Area - Volume and surface area - races and Games of skill.	17
IV	Permutation and combination - probability - True	17

	Discount - Bankers Discount - Height and Distances - Odd man out & Series.	
V	Calendar - Clocks - stocks and shares - Data representation - Tabulation - Bar Graphs - Pie charts - Line graphs	17
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	
<p>Learning Resources:</p> <ul style="list-style-type: none"> • Recommended Texts <ol style="list-style-type: none"> 1. . “Quantitative Aptitude”, R.S. AGGARWAL., S. Chand & Company Ltd., • Web resources: Authentic Web resources related to Competitive examinations 		

Course Code: SEC-3	Advanced Excel		Credits: 2
Lecture Hours: (L) per week: 2	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week: 2
Course Category : SEC-3	Year & Semester:I Year II Semester	Admission Year:	
Pre-requisite	Basic knowledge in office automation / Excel		
Learning Objectives: (for teachers: what they have to do in the class/lab/field) The objective of this course is to help the students learn the advanced features of Excel, to summarise, analyse, explore, and present visualisations of data in the form of charts, graphs.			

Course Outcomes: (for students: To know what they are going to learn)		
CO1: Handle large amounts of data		
CO2: Aggregate numeric data and summarise into categories and subcategories		
CO3: Filtering, sorting, and grouping data or subsets of data		
CO4: Create pivot tables to consolidate data from multiple files		
CO5: Presenting data in the form of charts and graphs		
Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)		
Units	Contents	Required Hours
I	Basics of Excel- Customizing common options- Absolute and relative cells- Protecting and un-protecting worksheets and cells- Working with Functions - Writing conditional expressions - logical functions - lookup and reference functions- VlookUP with Exact Match, Approximate Match- Nested VlookUP with Exact Match- VlookUP with Tables, Dynamic Ranges- Nested VlookUP with Exact Match- Using VLookUP to consolidate Data from Multiple Sheets	15
II	Data Validations - Specifying a valid range of values - Specifying a list of valid values- Specifying custom validations based on formula - Working with Templates Designing the structure of a template- templates for standardization of worksheets - Sorting and Filtering Data - Sorting tables- multiple-level sorting- custom sorting- Filtering data for selected view - advanced filter options- Working with Reports Creating subtotals- Multiple-level subtotal.	15
III	Creating Pivot tables Formatting and customizing Pivot tables- advanced options of Pivot tables- Pivot charts- Consolidating data from multiple sheets and files using Pivot	15

	tables- external data sources- data consolidation feature to consolidate data- Show Value As % of Row, % of Column, Running Total, Compare with Specific Field- Viewing Subtotal under Pivot- Creating Slicers.	
IV	More Functions Date and time functions- Text functions- Database functions- Power Functions - Formatting Using auto formatting option for worksheets- Using conditional formatting option for rows, columns and cells- WhatIf Analysis - Goal Seek- Data Tables- Scenario Manager.	15
V	Charts - Formatting Charts- 3D Graphs- Bar and Line Chart together- Secondary Axis in Graphs- Sharing Charts with PowerPoint / MS Word, Dynamically- New Features Of Excel Sparklines, Inline Charts, data Charts- Overview of all the new features.	15
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	

course		
Learning Resources: <ul style="list-style-type: none"> Recommended Text Excel 2019 All-in-One For Dummies – 2018- <u>Greg Harvey</u> Reference Books Microsoft Excel 2019 Pivot Table Data Crunching-2019,<u>Bill Jelen</u> and <u>Michael Alexander</u> Web resources: Web resources from NDL Library, E-content from open source libraries 		

Second Year (Semester – III)

Course Code: CC5	Microprocessor and Microcontroller		Credits: 4
Lecture Hours: (L) per week: 5	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week: 5
Course Category :CC5	Year & Semester:II Year III Semester		Admission Year:

Pre-requisite	Basic knowledge on micro processor and micro controllers	
<p>Learning Objectives: (for teachers: what they have to do in the class/lab/field)</p> <ul style="list-style-type: none"> • To introduce the internal organization of Intel 8085 Microprocessor. • To enable the students to write assembly language programs using 8085. • To interface the peripheral devices to 8085 using Interrupt controller and DMA interface. • To provide real-life applications using microcontroller. 		
<p>Course Outcomes: (for students: To know what they are going to learn)</p> <p>CO1: Remember the Basic binary codes and their conversions. Binary concepts are used in Microprocessor programming and provide a good understanding of the architecture of 8085.</p> <p>CO2: Understanding the 8085 instruction set and their classifications, enables the students to write the programs easily on their own using different logic..</p> <p>CO3: Applying different types of instructions to convert binary codes and analyzing the outcome. The instruction set is applied to develop programs on multibyte arithmetic operations.</p> <p>CO4: Analyze how peripheral devices are connected to 8085 using Interrupts and DMA controller.</p> <p>CO5: An exposure to create real time applications using microcontroller.</p>		
<p>Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)</p>		
Units	Contents	Required Hours
I	Digital Computers - Microcomputer Organization-Computer languages –Microprocessor Architecture and its operations – Microprocessor initiated operations and 8085 Bus organization – Internal Data operations and 8085 registers - Peripheral or External initiated operations.	
II	8085 Microprocessor – Pinout and Signals – Functional block diagram - 8085 Instruction Set and Classifications.	
III	BCD to Binary and Binary to BCD conversions - ASCII to	

	BCD and BCD to ASCII conversions - Binary to ASCII and ASCII to Binary conversions. BCD Arithmetic - BCD addition and Subtraction - Multibyte Addition and Subtraction - Multiplication and Division.	
IV	The 8085 Interrupts – RIM AND SIM instructions-8259 Programmable Interrupt Controller-Direct Memory Access (DMA) and 8257 DMA controller.	
V	Introduction to Microcontroller - Microcontroller Vs Microprocessor - 8051 Microcontroller architecture - 8051 pin description. Timers and Counters – Operating Modes- Control Registers. Interrupts – Interrupts in 8051 - Interrupts Control Register – Execution of interrupt.	
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	
Skills acquired	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and	

from the course	Transferrable Skill	
<p>Learning Resources:</p> <ul style="list-style-type: none"> • Recommended Texts <ol style="list-style-type: none"> 1. R. S. Gaonkar- "Microprocessor Architecture- Programming and Applications with 8085"- 5th Edition- Penram International Publications,2009. [For unit I to unit IV]. 2. Soumitra Kumar Mandal -“Microprocessors and Microcontrollers – Architectures, Programming and Interfacing using 8085, 8086, 8051”, Tata McGraw Hill Education Private Limited. [for unit V]. • Reference Books <ol style="list-style-type: none"> 1. Mathur- “Introduction to Microprocessor”- 3rd Edition- Tata McGraw-Hill -1993. 2. Raj Kamal - “Microcontrollers: Architecture, Programming, Interfacing and System Design”, Pearson Education, 2005. 3. Krishna Kant, “Microprocessors and Microcontrollers – Architectures, Programming and System Design 8085, 8086, 8051, 8096”, PHI, 2008. • Web resources: Web resources from NDL Library, E-content from open source libraries 		

Course Code: CC6	Microprocessor and Microcontroller Lab		Credits: 4
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week: 4	Total: (L+T+P) per week: 4
Course Category :CC6	Year & Semester:II Year III Semester	Admission Year:	
Pre-requisite	Basic knowledge on 8085 micro processor and micro		

	controllers	
<p>Learning Objectives: (for teachers: what they have to do in the class/lab/field)</p> <ul style="list-style-type: none"> • To introduce the internal organization of Intel 8085 Microprocessor. • To enable the students to write assembly language programs using 8085. • To interface the peripheral devices to 8085 using Interrupt controller and DMA interface. • To provide real-life applications using microcontroller. 		
<p>Course Outcomes: (for students: To know what they are going to learn)</p> <p>CO1: Remember the Basic binary codes and their conversions. Binary concepts are used in Microprocessor programming and provide a good understanding of the architecture of 8085.</p> <p>CO2: Understanding the 8085-instruction set and their classifications, enables the students to write the programs easily on their own using different logic.</p> <p>CO3: Applying different types of instructions to convert binary codes and analyzing the outcome. The instruction set is applied to develop programs on multibyte arithmetic operations.</p> <p>CO4: Analyze how peripheral devices are connected to 8085 using Interrupts and DMA controller.</p> <p>CO5: An exposure to create real time applications using microcontroller.</p>		
<p>Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)</p>		
	List of Exercises:	Required Hours
	<p>Addition and Subtraction</p> <ol style="list-style-type: none"> 1. 8 - bit addition 2. 16 - bit addition 3. 8 - bit subtraction 4. BCD subtraction <p>II. Multiplication and Division</p>	

	<ol style="list-style-type: none">1. 8 - bit multiplication2. BCD multiplication3. 8 - bit division <p>III. Sorting and Searching</p> <ol style="list-style-type: none">1. Searching for an element in an array.2. Sorting in Ascending and Descending order.3. Finding the largest and smallest elements in an array.4. Reversing array elements.5. Block move. <p>IV. Code Conversion</p> <ol style="list-style-type: none">1. BCD to Hex and Hex to BCD2. Binary to ASCII and ASCII to binary3. ASCII to BCD and BCD to ASCII <p>V. Simple programs on 8051 Microcontroller</p> <ol style="list-style-type: none">1. Addition2. Subtraction3. Multiplication4. Division5. Interfacing Experiments using 8051 <ol style="list-style-type: none">I. Realisation of Boolean Expression through	
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	<p>ports.</p> <p>II. Time delay generation using subroutines.</p> <p>III. Display LEDs through ports</p>	
<p>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</p>	<p>Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)</p>	
<p>Skills acquired from the course</p>	<p>Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</p>	
<p>Learning Resources:</p> <ul style="list-style-type: none"> • Recommended Texts <ol style="list-style-type: none"> 1. R. S. Gaonkar- "Microprocessor Architecture- Programming and Applications with 8085"- 5th Edition- Penram International Publications,2009. [For unit I to unit IV]. 2. Soumitra Kumar Mandal -"Microprocessors and Microcontrollers – Architectures, Programming and Interfacing using 8085, 8086, 8051", Tata McGraw Hill Education Private Limited. [for unit V]. • Reference Books 		

3. Mathur- “Introduction to Microprocessor”- 3rd Edition- Tata McGraw-Hill -1993.

4. Raj Kamal - “Microcontrollers: Architecture, Programming, Interfacing and System Design”, Pearson Education, 2005.

5. Krishna Kant, “Microprocessors and Microcontrollers – Architectures, Programming and System Design 8085, 8086, 8051, 8096”, PHI, 2008.

Web resources: Web resources from NDL Library, E-content from open-source libraries

Course Code: EC-3	DISCRETE MATHEMATICAL STRUCTURES		Credits: 3
Lecture Hours: (L) per week: 4	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week: 4
Course Category :EC-3	Year & Semester: II Year III Semester		Admission Year:
Pre-requisite	Basic Knowledge on probability and mathematical logic		

<p>Learning Objectives: (for teachers: what they have to do in the class/lab/field)</p> <p>To understand the mathematical concepts like set theory, logics, number theory, combinatory and relations.</p>		
<p>Course Outcomes: (for students: To know what they are going to learn)</p> <p>CO1:To gain knowledge on set theory</p> <p>CO2:Able to understand different mathematical logics and functions</p> <p>CO3:To get an idea on Permutations and Combinations</p> <p>CO4: Understanding the different form of number theory</p> <p>CO5: Able to understand Relations and its applications</p>		
<p>Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)</p>		
Units	Contents	Required Hours
I	<p>SET THEORY</p> <p>Introduction- set and Its Element – Set Description (Roster, Set Builder and cardinal number method)</p> <p>Types of Sets- Set Operations and Laws of set Theory.</p> <p>Partition of sets. Minsets-Countable and un Countable set. Algebra of sets and Duality</p>	
II	<p>MATHEMATICAL LOGIC</p> <p>Basic Logic and Proof, logical operations – Logic Propositional equivalence, Predicates and Quantities, Tautology-Contradiction-Methods of proofs(Direct and Indirect)- Function- Definition-Notation- Types of Function- Composition of Functions-</p>	
III	<p>NUMBER THEORY</p> <p>The Integers and Division, Integers and</p>	

	Algorithms,(Multiplication, Addition and Division -Sequences and Summations, Recursive algorithms, Program correctness	
IV	COMBINATORICS: The basics of counting, the pigeonhole principle, Permutations and Combinations, Binomial coefficients, Generalized permutations and combinations	
V	RELATIONS Relations – Relations and their properties, Representing Relations, Closures of relations, Equivalence relations, Partial orderings-Recurrence Relations Binary Relations.	
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	

Learning Resources:

- **Recommended Texts**

1. Rosen K.H. Discrete Mathematics and its Applications, 5th edition, Tata McGraw – Hills, 2003.
2. J.K Sharma “DISCRETE MATHEMATICS” 3 rd Edition Macmillan Reprint 2011

- **Reference Books**

1. Johnson Baugh R, and Carman R, Discrete mathematics, 5th edition, Person Education, 2003.
2. Kolman B, Busoy R.C, and Ross S.C, Discrete Mathematical Structures, 5th edition, Prentice – Hall, 2004.
3. Mott J.L, Kandel A, and Bake T.P, Discrete Mathematics for Computer Scientists & Mathematicians, 2nd edition, Prentice-Hall of India, 2002.

- **Web resources:** Web resources from NDL Library, E-content from open-source libraries

Course Code: SEC-4	PHP Programming		Credits: 1
Lecture Hours: (L) per week: 2	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week: 2
Course Category :SEC-4	Year & Semester:II Year III Semester	Admission Year:	
Pre-requisite	Basic Knowledge on Web		

Learning Objectives: (for teachers: what they have to do in the class/lab/field)

The objective of this course is to teach the fundamentals of quantum information processing, including quantum computation, quantum cryptography, and quantum information theory.

<p>Course Outcomes: (for students: To know what they are going to learn)</p> <p>CO1:Analyze the behaviour of basic quantum algorithms</p> <p>CO2: Implement simple quantum algorithms and information channels in the quantum circuit model</p> <p>CO3:Simulate a simple quantum error-correcting code</p> <p>CO4: Prove basic facts about quantum information channels</p> <p>CO5:</p>		
<p>Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)</p>		
Units	Contents	Required Hours
I	Introduction to PHP -Basic Knowledge of websites - Introduction of Dynamic Website -Introduction to PHP - Scope of PHP -XAMPP and WAMP Installation- PHP Programming Basics -Syntax of PHP -Embedding PHP in HTML -Embedding HTML in PHP .	15
II	Introduction to PHP Variable -Understanding Data Types - Using Operators -Using Conditional Statements -If(), else if() and else if condition Statement -Switch() Statements -Using the while() Loop -Using the for() Loop	15
III	PHP Functions -PHP Functions -Creating an Array - Modifying Array Elements -Processing Arrays with Loops - Grouping Form Selections with Arrays -Using Array Functions -Using Predefined PHP Functions -Creating User-Defined Functions	15
IV	PHP Advanced Concepts -Reading and Writing Files - Reading Data from a File -Managing Sessions and Using Session Variables -Destroying a Session -Storing Data in Cookies -Setting Cookies	15

V	OOPS Using PHP -OOPS Concept-Class, Object, Abstractions, Encapsulation, Inheritance, Polymorphism - Creating Classes and Object in PHP-Cookies and Session Management-Working with forms and system file - Error Handling- Model View Controller – AJAX.	15
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	
<p>Learning Resources:</p> <ul style="list-style-type: none"> • Recommended Texts Head First PHP & MySQL: A Brain-Friendly Guide- 2009-Lynn mighley and Michael Morrison. • Reference Books The Joy of PHP: A Beginner's Guide to Programming Interactive Web Applications with PHP and MySQL- Alan Forbes 		

Web resources: Web resources from NDL Library, E-content from open-source libraries

Course Code: SEC-5	Cloud Computing		Credits: 2
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week: 2
Course Category :SEC-5	Year & Semester: II Year IV Semester	Admission Year:	
Pre-requisite	Basic knowledge on virtual storage or cloud concept		
Learning Objectives: (for teachers: what they have to do in the class/lab/field)			
<ul style="list-style-type: none"> • To impart fundamental concepts of Cloud Computing. • To impart a working knowledge of the various cloud service types and their uses and 			

<p>pitfalls.</p> <ul style="list-style-type: none"> • To enable the students to know the common features and differences in the service offerings of the three major Cloud Computing service providers, namely Amazon, Microsoft and Google. • To provide know-how of the various aspects of application design, benchmarking and security on the Cloud. 		
<p>Course Outcomes: (for students: To know what they are going to learn)</p> <p>CO1:To understand the concepts and technologies involved in Cloud Computing.</p> <p>CO2: To understand the concepts of various cloud services and their implementation in the Amazon, Microsoft and Google cloud computing platforms.</p> <p>CO3:To understand the aspects of application design for the Cloud.</p> <p>CO4: To understand the concepts involved in benchmarking and security on the Cloud.</p> <p>CO5: To understand the way in which the cloud is used in various domains.</p>		
<p>Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)</p>		
Units	Contents	Required Hours
I	<p>Introduction to Cloud Computing: Definition of Cloud Computing – Characteristics of Cloud Computing – Cloud Models – Cloud Service Examples – Cloud-based Services and Applications.</p> <p>Cloud Concepts and Technologies: Virtualization – Load balancing – Scalability and Elasticity – Deployment – Replication – Monitoring – Software Defined Networking – Network Function Virtualization – MapReduce – Identity and Access Management – Service Level Agreements – Billing.</p>	17
II	<p>Cloud Services</p> <p>Compute Services: Amazon Elastic Computer Cloud - Google Compute Engine - Windows Azure Virtual Machines. Storage Services: Amazon Simple Storage Service - Google Cloud Storage - Windows Azure Storage</p>	17

	<p>Database Services: Amazon Relational Data Store - Amazon Dynamo DB - Google Cloud SQL - Google Cloud Data Store - Windows Azure SQL Database - Windows Azure Table Service</p> <p>Application Services: Application Runtimes and Frameworks - Queuing Services - Email Services - Notification Services - Media Services</p> <p>Content Delivery Services: Amazon CloudFront - Windows Azure Content Delivery Network</p> <p>Analytics Services: Amazon Elastic MapReduce - Google MapReduce Service - Google BigQuery - Windows Azure HDInsight</p> <p>Deployment and Management Services: Amazon Elastic Beanstack - Amazon CloudFormation</p> <p>Identity and Access Management Services: Amazon Identity and Access Management - Windows Azure Active Directory</p> <p>Open Source Private Cloud Software: CloudStack - Eucalyptus - OpenStack</p>	
<p>III</p>	<p>Cloud Application Design: Introduction – Design Consideration for Cloud Applications – Scalability – Reliability and Availability – Security – Maintenance and Upgradation – Performance – Reference Architectures for Cloud Applications – Cloud Application Design Methodologies: Service Oriented Architecture (SOA), Cloud Component Model, IaaS, PaaS and SaaS Services for Cloud Applications, Model View Controller (MVC), RESTful Web Services – Data Storage Approaches: Relational Approach</p>	<p>17</p>

	(SQL), Non-Relational Approach (NoSQL).	
IV	<p>Cloud Application Benchmarking and Tuning: Introduction to Benchmarking – Steps in Benchmarking – Workload Characteristics – Application Performance Metrics – Design Consideration for Benchmarking Methodology – Benchmarking Tools and Types of Tests – Deployment Prototyping.</p> <p>Cloud Security: Introduction – CSA Cloud Security Architecture – Authentication (SSO) – Authorization – Identity and Access Management – Data Security : Securing data at rest, securing data in motion – Key Management – Auditing.</p>	17
V	<p>Case Studies: Cloud Computing for Healthcare – Cloud Computing for Energy Systems - Cloud Computing for Transportation Systems - Cloud Computing for Manufacturing Industry - Cloud Computing for Education.</p>	17
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	<p>Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)</p>	

Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	
Learning Resources: <ul style="list-style-type: none"> • Recommended Texts <ol style="list-style-type: none"> 1. Arshdeep Bahga, Vijay Madiseti, <i>Cloud Computing – A Hands On Approach</i>, Universities Press (India) Pvt. Ltd., 2018. • Reference Books <ol style="list-style-type: none"> 1. Anthony T Velte, Toby J Velte, Robert Elsenpeter, <i>Cloud Computing: A Practical Approach</i>, Tata McGraw-Hill, 2013. 2. Barrie Sosinsky, <i>Cloud Computing Bible</i>, Wiley India Pvt. Ltd., 2013. 3. David Crookes, <i>Cloud Computing in Easy Steps</i>, Tata McGraw Hill, 2012. 4. Dr. Kumar Saurabh, <i>Cloud Computing</i>, Wiley India, Second Edition 2012. <p>Web resources: Web resources from NDL Library, E-content from open-source libraries</p>		

Second Year (Semester – IV)

Course Code: CC7	Java Programming		Credits: 4
Lecture Hours: (L) per week: 4	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week: 4
Course Category :CC7	Year & Semester: II Year IV Semester	Admission Year:	
Pre-requisite	Basic Programming skill		
Learning Objectives: (for teachers: what they have to do in the class/lab/field)			

<ul style="list-style-type: none"> • To provide fundamental knowledge of object-oriented programming. • To equip the student with programming knowledge in Core Java from the basics up. • To enable the students to use AWT controls, Event Handling and Swing for GUI. 		
<p>Course Outcomes: (for students: To know what they are going to learn)</p> <p>CO1: Understand the basic Object-oriented concepts.</p> <p>Implement the basic constructs of Core Java</p> <p>CO2: Implement inheritance, packages, interfaces and exception handling of Core Java.</p> <p>CO3: Implement multi-threading and I/O Streams of Core Java</p> <p>CO4: Implement AWT and Event handling.</p> <p>CO5: Use Swing to create GUI.</p>		
<p>Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)</p>		
Units	Contents	Required Hours
I	<p>Introduction: Review of Object Oriented concepts - History of Java - Java buzzwords - JVM architecture - Data types - Variables - Scope and life time of variables - arrays - operators - control statements - type conversion and casting - simple java program - constructors - methods - Static block - Static Data - Static Method String and String Buffer Classes</p>	17
II	<p>Inheritance: Basic concepts - Types of inheritance - Member access rules - Usage of this and Super key word - Method Overloading - Method overriding - Abstract classes - Dynamic method dispatch - Usage of final keyword.</p> <p>Packages: Definition - Access Protection - Importing Packages.</p> <p>Interfaces: Definition - Implementation - Extending</p>	17

	<p>Interfaces.</p> <p>Exception Handling: <i>try – catch - throw - throws – finally</i> – Built-inexceptions - Creating own Exception classes.</p>	
III	<p>Multithreaded Programming: Thread Class - Runnable interface – Synchronization – Using synchronized methods – Using <i>synchronized</i> statement - Interthread Communication – Deadlock.</p> <p>I/O Streams: Concepts of streams - Stream classes- Byte and Character stream - Reading console Input and Writing Console output - File Handling.</p>	17
IV	<p>AWT Controls: The AWT class hierarchy - user interface components- Labels - Button - Text Components - Check Box - Check Box Group - Choice - List Box - Panels – Scroll Pane - Menu - Scroll Bar. Working with Frame class - Colour - Fonts and layout managers.</p> <p>Event Handling: Events - Event sources - Event Listeners - Event Delegation Model (EDM) - Handling Mouse and Keyboard Events - Adapter classes - Inner classes.</p>	17
V	<p>Swing: Introduction to Swing - Hierarchy of swing components. Containers - Top level containers - JFrame - JWindow - JDialog - JPanel - JButton - JToggleButton - JCheckBox - JRadioButton - JLabel, JtextField - JTextArea - JList - JComboBox - JScrollPane</p>	17
Extended Professional Component (is a part of internal	<p>Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)</p>	

component only, Not to be included in the External Examination question paper)		
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	
<p>Learning Resources:</p> <ul style="list-style-type: none"> • Recommended Texts <ol style="list-style-type: none"> 1. Herbert Schildt, The Complete Reference, Tata McGraw Hill, New Delhi, 7th Edition, 2010. 2. Gary Cornell, Core Java 2 Volume I – Fundamentals, Addison Wesley, 1999. • Reference Books <ol style="list-style-type: none"> 1. Head First Java, O’Rielly Publications, 2. Y. Daniel Liang, <i>Introduction to Java Programming</i>, 7th Edition, Pearson Education India, 2010. <p>Web resources: Web resources from NDL Library, E-content from open-source libraries</p>		
Course Code: CC8	Java Programming Lab	Credits: 4
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week
		Total: (L+T+P) per week: 4
Course Category :CC8	Year & Semester:II Year IV Semester	Admission Year:
Pre-requisite	Basic Programming debugging skills	
Learning Objectives: (for teachers: what they have to do in the class/lab/field)		

<ul style="list-style-type: none"> • To gain practical expertise in coding Core Java programs • To become proficient in the use of AWT, Event Handling and Swing. 		
<p>Course Outcomes: (for students: To know what they are going to learn)</p> <p>CO1:Code, debug and execute Java programs to solve the given problems</p> <p>CO2:Implement multi-threading and exception-handling</p> <p>CO3:Implement functionality using String and StringBuffer classes</p> <p>CO4: Demonstrate Event Handling.</p> <p>CO5: Create applications using Swing and AWT</p>		
<p>Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)</p>		
	List of Exercises:	Required Hours
	<ol style="list-style-type: none"> 1. Write a Java program that prompts the user for an integer and then prints out all the prime numbers up to that Integer? 2. Write a Java program to multiply two given matrices. 3. Write a Java program that displays the number of characters, lines and words in a text? 4. Generate random numbers between two given limits using Random class and print messages according to the range of the value generated. 5. Write a program to do String Manipulation using Character Array and perform the following string operations: <ol style="list-style-type: none"> a. String length b. Finding a character at a particular position c. Concatenating two strings 6. Write a program to perform the following string 	17

	<p>operations using String class:</p> <ol style="list-style-type: none">a. String Concatenationb. Search a substringc. To extract substring from given string <p>7. Write a program to perform string operations using StringBuffer class:</p> <ol style="list-style-type: none">a. Length of a stringb. Reverse a stringc. Delete a substring from the given string <p>8. Write a java program that implements a multi-thread application that has three threads. First thread generates random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number.</p> <p>9. Write a threading program which uses the same method asynchronously to print the numbers 1 to 10 using Thread1 and to print 90 to 100 using Thread2.</p> <p>10. Write a program to demonstrate the use of following exceptions.</p> <ol style="list-style-type: none">a. Arithmetic Exceptionb. Number Format Exceptionc. Array Index Out of Bound Exceptiond. Negative Array Size Exception <p>11. Write a Java program that reads on file name from the user, then displays information about whether the file exists, whether the file is readable, whether the file is</p>	
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	<p>writable, the type of file and the length of the file in bytes?</p> <p>12. Write a program to accept a text and change its size and font. Include bold italic options. Use frames and controls.</p> <p>13. Write a Java program that handles all mouse events and shows the event name at the center of the window when a mouse event is fired. (Use adapter classes).</p> <p>14. Write a Java program that works as a simple calculator. Use a grid layout to arrange buttons for the digits and for the +, -, *, % operations. Add a text field to display the result. Handle any possible exceptions like divide by zero.</p> <p>15. Write a Java program that simulates a traffic light. The program lets the user select one of three lights: red, yellow, or green with radio buttons. On selecting a button, an appropriate message with “stop” or “ready” or “go” should appear above the buttons in a selected color. Initially there is no message shown.</p>	
<p>Extended Professional Component (is a part of internal component only, Not to be included in the External</p>	<p>Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)</p>	

Examination question paper)		
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	
<p>Learning Resources:</p> <p>Learning Resources:</p> <ul style="list-style-type: none"> • Recommended Texts <ol style="list-style-type: none"> 3. Herbert Schildt, The Complete Reference, Tata McGraw Hill, New Delhi, 7th Edition, 2010. 4. Gary Cornell, Core Java 2 Volume I – Fundamentals, Addison Wesley, 1999. • Reference Books <ol style="list-style-type: none"> 3. Head First Java, O’Rielly Publications, 4. Y. Daniel Liang, <i>Introduction to Java Programming</i>, 7th Edition, Pearson Education India, 2010. <p>Web resources: Web resources from NDL Library, E-content from open-source libraries</p>		

Course Code: SEC-7	Big Data Analytics		Credits: 2
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week: 2
Course Category :SEC-7	Year & Semester:II Year IV	Admission Year:	

		Semester	
Pre-requisite		Basic knowledge on Data handlings	
Learning Objectives: (for teachers: what they have to do in the class/lab/field)			
<ol style="list-style-type: none"> To know the fundamental concepts of big data and analytics. To explore tools and practices for working with big data. 			
Course Outcomes: (for students: To know what they are going to learn)			
CO1: Work with big data tools and its analysis techniques.			
CO2: Analyze data by utilizing clustering and classification algorithms.			
CO3: Learn and apply different mining algorithms and recommendation systems for large volumes of data.			
CO4: Perform analytics on data streams.			
CO5: Learn NoSQL databases and management.			
Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)			
Units	Contents	Required Hours	
I	INTRODUCTION TO BIG DATA : Evolution of Big data — Best Practices for Big data Analytics — Big data characteristics — Validating — The Promotion of the Value of Big Data — Big Data Use Cases- Characteristics of Big Data Applications — Perception and Quantification of Value -Understanding Big Data Storage — A General Overview of High-Performance Architecture — HDFS — MapReduce and YARN — Map Reduce Programming Model	17	
II	CLUSTERING AND CLASSIFICATION : Advanced Analytical Theory and Methods: Overview of Clustering — K-means — Use Cases — Overview of the Method — Determining the Number of Clusters — Diagnostics — Reasons to Choose and Cautions .- Classification: Decision Trees — Overview of a Decision Tree — The General Algorithm — Decision Tree Algorithms — Evaluating a Decision Tree — Decision Trees in R — Naïve Bayes —	17	

	Bayes? Theorem — Naïve Bayes Classifier	
III	ASSOCIATION AND RECOMMENDATION SYSTEM: Advanced Analytical Theory and Methods: Association Rules — Overview — Apriori Algorithm — Evaluation of Candidate Rules — Applications of Association Rules — Finding Association & finding similarity — Recommendation System: Collaborative Recommendation- Content Based Recommendation — Knowledge Based Recommendation- Hybrid Recommendation Approaches	17
IV	STREAM MEMORY: Introduction to Streams Concepts — Stream Data Model and Architecture — Stream Computing, Sampling Data in a Stream — Filtering Streams — Counting Distinct Elements in a Stream — Estimating moments — Counting oneness in a Window — Decaying Window — Real time Analytics Platform(RTAP) applications — Case Studies — Real Time Sentiment Analysis, Stock Market Predictions. Using Graph Analytics for Big Data: Graph Analytics	17
V	NOSQL DATA MANAGEMENT FOR BIG DATA AND VISUALIZATION : NoSQL Databases : Schema-less Models?: Increasing Flexibility for Data Manipulation-Key Value Stores- Document Stores — Tabular Stores — Object Data Stores — Graph Databases Hive — Sharding —Hbase — Analyzing big data with twitter — Big data for E-Commerce Big data for blogs — Review of Basic Data Analytic Methods using R.	17

<p>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</p>	<p>Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)</p>	
<p>Skills acquired from the course</p>	<p>Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</p>	
<p>Learning Resources:</p> <ul style="list-style-type: none"> • Recommended Texts <ol style="list-style-type: none"> 1. Anand Rajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, Cambridge University Press, 2012. • Reference Books <ol style="list-style-type: none"> 1. David Loshin, “Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph”, Morgan Kaufmann/Elsevier Publishers, 2013. 2. EMC Education Services, “Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data”, Wiley publishers, 2015. <p>Web resources: Web resources from NDL Library, E-content from open-source libraries</p>		

Third Year (Semester – V)

<p>Course Code: CC-9</p>	<p>Computer Networks</p>	<p>Credits: 4</p>
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Lecture Hours: (L) per week: 5	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week: 5
Course Category :CC-9	Year & Semester: III Year V Semester	Admission Year:	
Pre-requisite	Basic Knowledge on Networking		
<p>Learning Objectives: (for teachers: what they have to do in the class/lab/field)</p> <ul style="list-style-type: none"> • To understand the concept of Data communication and Computer network • To get a knowledge on routing algorithms. • To impart knowledge about networking and inter networking devices <p>To gain the knowledge on Security over Network communication</p>			
<p>Course Outcomes: (for students: To know what they are going to learn)</p> <p>CO1:To Understand the basics of Computer Network architecture, OSI and TCP/IP reference models</p> <p>CO2:To gain knowledge on Telephone systems and Satellite communications</p> <p>CO3:To impart the concept of Elementary data link protocols</p> <p>CO4: To analyze the characteristics of Routing and Congestion control algorithms</p> <p>CO5: To understand network security and define various protocols such as FTP, HTTP, Telnet, DNS</p>			
<p>Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)</p>			
Units	Contents	Required Hours	
I	Introduction – Network Hardware – Software – Reference Models – OSI and TCP/IP Models – Example Networks: Internet, ATM, Ethernet and Wireless LANs - Physical Layer – Theoretical Basis for Data Communication - Guided Transmission Media	15	
II	Wireless Transmission - Communication Satellites – Telephone System: Structure, Local Loop, Trunks and Multiplexing and Switching. Data Link Layer: Design Issues – Error Detection and Correction.	15	
III	Elementary Data Link Protocols - Sliding Window Protocols	15	

	– Data Link Layer in the Internet - Medium Access Layer – Channel Allocation Problem – Multiple Access Protocols – Bluetooth	
IV	Network Layer - Design Issues - Routing Algorithms - Congestion Control Algorithms – IP Protocol – IP Addresses – Internet Control Protocols.	15
V	Transport Layer - Services - Connection Management - Addressing, Establishing and Releasing a Connection – Simple Transport Protocol – Internet Transport Protocols (ITP) - Network Security: Cryptography.	15
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	

Learning Resources:

- **Recommended Texts**

1. A. S. Tanenbaum, “Computer Networks”, 4th Edition, Prentice-Hall of India, 2008.

- **Reference Books**

1. B. A. Forouzan, “Data Communications and Networking”, Tata McGraw Hill, 4th Edition, 2017.
2. F. Halsall, “Data Communications, Computer Networks and Open Systems”, Pearson Education, 2008.
3. D. Bertsekas and R. Gallager, “Data Networks”, 2nd Edition, PHI, 2008.
4. Lamarca, “Communication Networks”, Tata McGraw- Hill, 2002

Web resources: Web resources from NDL Library, E-content from open-source libraries

Course Code: CC-10	Database Management Systems		Credits:4
Lecture Hours: (L) per week: 5	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week: 5
Course Category :CC-10	Year & Semester: III YEAR V SEMESTER	Admission Year:	
Pre-requisite	Basic knowledge on Data and its relations		
<p>Learning Objectives: (for teachers: what they have to do in the class/lab/field)</p> <ul style="list-style-type: none"> • To enable the students to learn the designing of data base systems, foundation on the relational model of data and normal forms. • To understood the concepts of data base management system, design simple Database models • To learn and understand to write queries using SQL, PL/SQL. 			
<p>Course Outcomes: (for students: To know what they are going to learn)</p> <p>CO1: Understand the various basic concepts of Data Base System. Difference between file system and DBMS and compare various data models.</p> <p>CO2: Define the integrity constraints. Understand the basic concepts of Relational Data Model, Entity-Relationship Model.</p> <p>CO3: Design database schema considering normalization and relationships within database. Understand and construct database using Structured Query Language. Attain a good practical skill of managing and retrieving of data using Data Manipulation Language (DML).</p> <p>CO4: Classify the different functions and various join operations and enhance the knowledge of handling multiple tables.</p> <p>CO5: Learn to design Data base operations and implement using PL/SQL programs. Learn basics of PL/SQL and develop programs using Cursors, Exceptions</p>			
Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)			
Units	Contents		Required Hours
I	<p>Database Concepts:Database Systems - Data vs Information</p> <p>- Introducing the database -File system - Problems with file system – Database systems. Data models - Importance -</p>		17

	Basic Building Blocks - Business rules - Evolution of Data models - Degrees of Data Abstraction	
II	Design Concepts: Relational database model - logical view of data-keys -Integrity rules - relational set operators - data dictionary and the system catalog - relationships -data redundancy revisited -indexes - codd's rules. Entity relationship model - ER diagram	17
III	Normalization of Database Tables: Database tables and Normalization – The Need for Normalization –The Normalization Process – Higher level Normal Form. Introduction to SQL: Data Definition Commands – Data Manipulation Commands – SELECT Queries – Additional Data Definition Commands – Additional SELECT Query Keywords – Joining Database Tables.	17
IV	Advanced SQL: Relational SET Operators: UNION – UNION ALL – INTERSECT - MINUS.SQL Join Operators: Cross Join – Natural Join – Join USING Clause – JOIN ON Clause – Outer Join. Sub Queries and Correlated Queries: WHERE – IN – HAVING – ANY and ALL – FROM. SQL Functions: Date and Time Function – Numeric Function – String Function – Conversion Function	17
V	PL/SQL: A Programming Language: History – Fundamentals – Block Structure – Comments – Data Types – Other Data Types – Variable Declaration – Assignment operation – Arithmetic operators. Control Structures and Embedded SQL: Control Structures – Nested Blocks – SQL in PL/SQL – Data Manipulation – Transaction Control statements. PL/SQL Cursors and Exceptions: Cursors – Implicit Cursors, Explicit Cursors and Attributes – Cursor FOR loops – SELECT...FOR UPDATE – WHERE CURRENT OF clause – Cursor	17

	with Parameters – Cursor Variables – Exceptions – Types of Exceptions.	
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	
<p>Learning Resources:</p> <ul style="list-style-type: none"> • Recommended Texts <ol style="list-style-type: none"> 1. Coronel, Morris, Rob, "Database Systems, Design, Implementation and Management", Ninth Edition 2. Nilesh Shah, "Database Systems Using Oracle", 2nd edition, Pearson Education India, 2016 • Reference Books <ol style="list-style-type: none"> 1. Abraham Silberschatz, Henry F.Korth and S.Sudarshan, "Database System Concepts", McGraw Hill International Publication ,VI Edition. 2. Shio Kumar Singh , "Database Systems ", Pearson publications ,II Edition <p>Web resources: Web resources from NDL Library, E-content from open-source libraries</p>		

Course Code: CC-11	DATABASE MANAGEMENT SYSTEMS LAB		Credits:4
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week: 5	Total: (L+T+P) per week:5
Course Category :CC-11	Year & Semester: III Year V semester	Admission Year:	
Pre-requisite	Basic Knowledge on Database Tools		
<p>Learning Objectives: (for teachers: what they have to do in the class/lab/field)</p> <p>Students can learn various SQL and PL/SQL commands, cursor and various application programs.</p>			
<p>Course Outcomes: (for students: To know what they are going to learn)</p> <p>CO1: Understand the various basic concepts of Data Base System. Difference between file system and DBMS and compare various data models.</p> <p>CO2: Define the integrity constraints. Understand the basic concepts of Relational Data Model, Entity-Relationship Model.</p> <p>CO3: Design database schema considering normalization and relationships within database. Understand and construct database using Structured Query Language. Attain a good practical skill of managing and retrieving of data using Data Manipulation Language (DML).</p> <p>CO4: Classify the different functions and various join operations and enhance the knowledge of handling multiple tables.</p> <p>CO5: Learn to design Data base operations and implement using PL/SQL programs. Learn basics of PL/SQL and develop programs using Cursors, Exceptions</p>			
<p>Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)</p>			
	List of Exercises:		Required Hours
	<p><i>I. SQL</i></p> <ol style="list-style-type: none"> 1. DDL COMMANDS 2. DML COMMANDS 		

	<p>3. TCL COMMANDS</p> <p>II. PL/SQL</p> <p>4. FIBONACCI SERIES</p> <p>5. FACTORIAL</p> <p>6. STRING REVERSE</p> <p>7. SUM OF SERIES</p> <p>8. TRIGGER</p> <p>III. CURSOR</p> <p>9. STUDENT MARK ANALYSIS USING CURSOR</p> <p>IV. APPLICATION</p> <p>10. LIBRARY MANAGEMENT SYSTEM</p> <p>11. STUDENT MARK ANALYSIS</p>	
<p>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question</p>	<p>Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)</p>	

paper)		
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	
<p>Learning Resources:</p> <ul style="list-style-type: none"> • Recommended Texts <ol style="list-style-type: none"> 3. Coronel, Morris, Rob, "Database Systems, Design, Implementation and Management", Ninth Edition 4. Nilesh Shah, "Database Systems Using Oracle", 2nd edition, Pearson Education India, 2016 • Reference Books <ol style="list-style-type: none"> 3. Abraham Silberschatz, Henry F.Korth and S.Sudarshan, "Database System Concepts", McGraw Hill International Publication, VI Edition. 4. Shio Kumar Singh, "Database Systems", Pearson publications, II Edition 5. Albert Lulushi, "Developing ORACLE FORMS Applications", Prentice Hall, 1997 <p>Web resources: Web resources from NDL Library, E-content from open-source libraries</p>		

Course Code: EC5	Operating Systems		Credits: 3
Lecture Hours: (L) per week: 5	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week: 5
Course Category :EC-5	Year & Semester:III Year V Semester	Admission Year:	
Pre-requisite	Basic Knowledge on Computer and its functions		
<p>Learning Objectives: (for teachers: what they have to do in the class/lab/field)</p> <ul style="list-style-type: none"> • Understanding the design of the Operating System • Imparting knowledge on CPU scheduling, Process and Memory Management. • To code specialized programs for managing overall resources and operations of the computer. 			
<p>Course Outcomes: (for students: To know what they are going to learn)</p> <p>CO1: Define the fundamentals of OS and identify the concepts relevant to process , process life cycle, Scheduling Algorithms, Deadlock and Memory management</p> <p>CO2: know the critical analysis of process involving various algorithms, an exposure to threads and semaphores</p> <p>CO3: Have a complete study about Deadlock and its impact over OS. Knowledge of handling Deadlock with respective algorithms and measures to retrieve from deadlock. .</p> <p>CO4: Have complete knowledge of Scheduling Algorithms and its types.</p> <p>CO5: understand memory organization and management</p>			
Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)			
Units	Contents		Required Hours
I	<p>Introduction: operating system, history (1990s to 2000 and beyond), distributed computing, parallel computation.</p> <p>Process concepts: definition of process, process states- Life cycle of a process, process management- process state transitions, process control block(PCB), process operations</p>		17

	, suspend and resume, context switching, Interrupts - Interrupt processing, interrupt classes, Inter process communication-signals, message passing.	
II	Asynchronous concurrent processes: mutual exclusion-critical section, mutual exclusion primitives, implementing mutual exclusion primitives, Peterson's algorithm, software solutions to the mutual Exclusion Problem-, n-thread mutual exclusion- Lamports Bakery Algorithm. Semaphores – Mutual exclusion with Semaphores, thread synchronization with semaphores, counting semaphores, implementing semaphores. Concurrent programming: monitors, message passing	17
III	Deadlock and indefinite postponement: Resource concepts, four necessary conditions for deadlock, deadlock prevention, deadlock avoidance and Dijkstra's Banker's algorithm, deadlock detection, deadlock recovery	17
IV	Job and processor scheduling: scheduling levels, scheduling objectives, scheduling criteria, preemptive vs non-preemptive scheduling, interval timer or interrupting clock, priorities, scheduling algorithms- FIFO scheduling, RR scheduling, quantum size, SJF scheduling, SRT scheduling, HRN scheduling, multilevel feedback queues, Fair share scheduling	17
V	Real Memory organization and Management:: Memory organization, Memory management, Memory hierarchy, Memory management strategies, contiguous vs non-contiguous memory allocation, single user contiguous memory allocation, fixed partition multiprogramming, variable partition multiprogramming, Memory swapping	17

	<p>Virtual Memory organization: virtual memory basic concepts, multilevel storage organization, block mapping, paging basic concepts, segmentation, paging/segmentation systems.</p> <p>Virtual Memory Management: Demand Paging, Page replacement strategies</p>	
<p>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</p>	<p>Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)</p>	
<p>Skills acquired from the course</p>	<p>Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</p>	
<p>Learning Resources:</p> <ul style="list-style-type: none"> • Recommended Texts <ol style="list-style-type: none"> 1. H.M. Deitel, Operating Systems, Third Edition, Pearson Education Asia, 2011 • Reference Books <ol style="list-style-type: none"> 1. William Stallings, Operating System: Internals and Design Principles, Seventh Edition, 		

Prentice-Hall of India, 2012.

2. A. Silberschatz, and P.B. Galvin., Operating Systems Concepts, Ninth Edition, John Wiley & Sons (ASIA) Pte Ltd., 2012

Web resources: Web resources from NDL Library, E-content from open-source libraries

Course Code: EC-6	Data Mining and Warehousing		Credits:3
Lecture Hours: (L) per week: 4	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week: 4
Course Category : EC-6	Year & Semester:III Year V Semester	Admission Year:	
Pre-requisite	Basic concept of database knowledge		
<p>Learning Objectives: (for teachers: what they have to do in the class/lab/field)</p> <ul style="list-style-type: none"> • To provide the knowledge on Data Mining and Warehousing concepts and techniques. • To study the basic concepts of cluster analysis • To study a set of typical clustering methodologies, algorithms, and applications 			
<p>Course Outcomes: (for students: To know what they are going to learn)</p> <p>CO1:To understand the basic concepts and the functionality of the various data mining and data warehousing component</p> <p>CO2: To know the concepts of Data mining system architectures</p> <p>CO3:To analyse the principles of association rules</p> <p>CO4: To get analytical idea on Classification and prediction methods.</p> <p>CO5: To Gain knowledge on Cluster analysis and its methods.</p>			
Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)			
Units	Contents	Required Hours	
I	Introduction: Data mining – Functionalities – Classification – Introduction to Data Warehousing – Data Preprocessing: Preprocessing the Data – Data cleaning – Data Integration and Transformation – Data Reduction	17	
II	Data Mining, Primitives, Languages and System	17	

	Architecture: Data Mining – Primitives – Data Mining Query Language, Architecture of Data mining Systems. Concept Description, Characterization and Comparison: Concept Description, Data Generalization and Summarization, Analytical Characterization, Mining Class Comparison – Statistical Measures	
III	Mining Association Rules: Basic Concepts – Single Dimensional Boolean Association Rules From Transaction Databases, Multilevel Association Rules from transaction databases – Multi dimension Association Rules from Relational Database and Data Warehouses	17
IV	Classification and Prediction: Introduction – Issues – Decision Tree Induction – Bayesian Classification – Classification of Back Propagation. Classification based on Concepts from Association Rule Mining – Other Methods. Prediction – Introduction – Classifier Accuracy.	17
V	Cluster Analysis: Introduction – Types of Data in Cluster Analysis, Partitioning Methods – Hierarchical Methods-Density Based Methods – GRID Based Method – Model based Clustering Method	17
Extended Professional Component (is a part of internal component only, Not to be included in the	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	

External Examination question paper)		
Skills acquired from the Course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	
<p>Learning Resources:</p> <ul style="list-style-type: none"> • Recommended Texts <ol style="list-style-type: none"> 1. Han and M. Kamber, “Data Mining Concepts and Techniques”, 2001, Harcourt India Pvt. Ltd, New Delhi. • Reference Books <ol style="list-style-type: none"> 1. K.P. Soman, Shyam Diwakar, V. Ajay “Insight into Data Mining Theory and Practice “, Prentice Hall of India Pvt. Ltd, New Delhi 2. Parteek Bhatia, ‘Data Mining and Data Warehousing: Principles and Practical Techniques’, Cambridge University Press, 2019 <p>Web resources: Web resources from NDL Library, E-content from open-source libraries</p>		

Third Year (Semester – VI)

Course Code: CC13		Software Engineering		Credits: 4
Lecture Hours: (L) per week: 5		Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week: 5
Course Category :CC13		Year & Semester: III Year VI Semester		Admission Year:
Pre-requisite		Basic Knowledge on Software Applications		
<p>Learning Objectives: (for teachers: what they have to do in the class/lab/field)</p> <ul style="list-style-type: none"> To understand the software engineering concepts and to create a system model in real life applications 				
<p>Course Outcomes: (for students: To know what they are going to learn)</p> <p>CO1:Gain basic knowledge of analysis and design of systems</p> <p>CO2: Ability to apply software engineering principles and techniques</p> <p>CO3:Model a reliable and cost-effective software system</p> <p>CO4: Ability to design an effective model of the system</p> <p>CO5: Perform Testing at various levels and produce an efficient system.</p>				
<p>Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)</p>				
Units	Contents			Required Hours
I	<p>Introduction: The software engineering discipline, programs vs. software products, why study software engineering, emergence of software engineering, Notable changes in software development practices, computer systems engineering.</p> <p>Software Life Cycle Models: Why use a life cycle model, Classical waterfall model, iterative waterfall model, prototyping model, evolutionary model, spiral model,</p>			17

	comparison of different life cycle models.	
II	<p>Requirements Analysis and Specification: Requirements gathering and analysis, Software requirements specification (SRS)</p> <p>Software Design: Good software design, cohesion and coupling, neat arrangement, software design approaches, object-oriented vs function-oriented design</p>	17
III	<p>Function-Oriented Software Design: Overview of SA/SD methodology, structured analysis, data flow diagrams (DFD's), structured design, detailed design.</p> <p>User-Interface design: Characteristics of a good interface; basic concepts; types of user interfaces; component based GUI development, a user interface methodology.</p>	17
IV	<p>Coding and Testing: Coding; code review; testing; testing in the large vs testing in the small; unit testing; black-box testing; white-box testing; debugging; program analysis tools; integration testing; system testing; some general issues associated with testing.</p> <p>Software Reliability and Quality Management: Software reliability; statistical testing; software quality; software quality management system; SEI capability maturity model; personal software process.</p>	17
V	<p>Computer Aided Software Engineering: CASE and its scope; CASE environment; CASE support in software life cycle; other characteristics of CASE tools; towards second generation CASE tool; architecture of a CASE environment.</p> <p>Software Maintenance: Characteristic of software maintenance; software reverse engineering;</p>	17

	software maintenance process models; estimation of maintenance cost;	
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	
<p>Learning Resources:</p> <ul style="list-style-type: none"> • Recommended Texts <ol style="list-style-type: none"> 1. Rajib Mall, Fundamentals of Software Engineering, Fifth Edition, Prentice-Hall of India, 2018 • Reference Books <ol style="list-style-type: none"> 1. Richard Fairley, Software Engineering Concepts, Tata McGraw-Hill publishing company Ltd, Edition 1997. 2. Roger S. Pressman, Software Engineering, Seventh Edition, McGraw-Hill. James A. Senn, Analysis & Design of Information Systems, Second Edition, McGraw-Hill International Editions. <p>Web resources: Web resources from NDL Library, E-content from open-source libraries</p>		

Course Code: CC14	.Net Programming		Credits: 4
Lecture Hours: (L) per week: 5	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week:5
Course Category :CC14	Year & Semester: III Year VI Semester	Admission Year:	
Pre-requisite	Basic knowledge on web programming		
<p>Learning Objectives: (for teachers: what they have to do in the class/lab/field)</p> <ol style="list-style-type: none"> 1. To develop ASP.NET Web application using standard controls. 2. To create rich database applications using ADO.NET. 3. To implement file handling operations. 4. To utilize ASP.NET security features for authenticating the web site. 5. To handles SQL Server Database using ADO.NET. 			
<p>Course Outcomes: (for students: To know what they are going to learn)</p> <p>CO1: To identify and understand the goals and objectives of the .NET framework and ASP.NET with C# language.</p> <p>CO2:To develop web application using various controls.</p> <p>CO3:To analyze C# programming techniques in developing web applications.</p> <p>CO4: To assess a Web application using Microsoft ADO.NET.</p> <p>CO5: To develop a software to solve real-world problems using ASP.NET</p>			
<p>Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)</p>			
Units	Contents	Required Hours	
I	Overview of .NET framework: Common Language Runtime (CLR), Framework Class Library- C# Fundamentals: Primitive types and Variables – Operators - Conditional statements -Looping statements – Creating and using Objects – Arrays – String operations.		

II	Introduction to ASP.NET - IDE-Languages supported Components -Working with Web Forms – Web form standard controls: Properties and its events – HTML controls - List Controls: Properties and its events.	
III	Rich Controls: Properties and its events – validation controls: Properties and its events – File Stream classes - File Modes – File Share – Reading and Writing to files – Creating, Moving, Copying and Deleting files – File uploading.	
IV	ADO.NET Overview – Database Connections – Commands – Data Reader - Data Adapter - Data Sets - Data Controls and its Properties - Data Binding	
V	Grid View control: Deleting, editing, Sorting and Paging. XML classes – Web form to manipulate XML files - Website Security - Authentication - Authorization – Creating a Web application.	
Extended Professional Component (is a part of internal component only, Not to	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	

be included in the External Examination question paper)		
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	

Learning Resources:

- **Recommended Texts**

1. SvetlinNakov,VeselinKolev& Co, Fundamentals of Computer Programming with C#,Faber publication, 2019.
2. Mathew, Mac Donald, The Complete Reference ASP.NET, Tata McGraw-Hill ,2015.

- **Reference Books**

1. Herbert Schildt, The Complete Reference C#.NET, Tata McGraw-Hill,2017.
2. Kogent Learning Solutions, C# 2012 Programming Covers .NET 4.5 Black Book, Dreamtech pres,2013.
3. Anne Boehm, Joel Murach, Murach's C# 2015, Mike Murach& Associates Inc. 2016.
4. DenielleOtey, Michael Otey, ADO.NET: The Complete reference, McGraw Hill,2008.
5. Matthew MacDonald, Beginning ASP.NET 4 in C# 2010, APRESS,2010.

Web resources: Web resources from NDL Library, E-content from open-source libraries

Course Code: CC15	.Net Programming Lab		Credits: 4
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week: 5	Total: (L+T+P) per week: 5
Course Category :CC14	Year & Semester: III Year VI Semester	Admission Year:	
Pre-requisite	Basic knowledge on		
<p>Learning Objectives: (for teachers: what they have to do in the class/lab/field)</p> <ol style="list-style-type: none"> 1. To develop ASP.NET Web application using standard controls. 2. To create rich database applications using ADO.NET. 3. To implement file handling operations. 4. To utilize ASP.NET security features for authenticating the web site. 5. To handles SQL Server Database using ADO.NET. 			
<p>Course Outcomes: (for students: To know what they are going to learn)</p> <p>CO1: To identify and understand the goals and objectives of the .NET framework and ASP.NET with C# language.</p> <p>CO2:To develop web application using various controls.</p> <p>CO3:To analyze C# programming techniques in developing web applications.</p> <p>CO4: To assess a Web application using Microsoft ADO.NET.</p> <p>CO5: To develop a software to solve real-world problems using ASP.NET</p>			
<p>Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)</p>			
	List of Exercises:		Required Hours
	<ol style="list-style-type: none"> 1. Create an exposure of Web applications and tools 2. Implement the Html Controls 3. Implement the Server Controls 4. Web application using Web controls. 5. Web application using List controls. 		

	<p>6. Web Page design using Rich control. Validate user input using Validation controls. Working with File concepts.</p> <p>7. Web application using Data Controls.</p> <p>8. Data binding with Web controls</p> <p>9. Data binding with Data Controls.</p> <p>10. Database application to perform insert, update and delete operations.</p> <p>11. Database application using Data Controls to perform insert, delete, edit, paging and sorting operation.</p> <p>12. Implement the Xml classes.</p> <p>13. Implement Authentication – Authorization.</p> <p>14. Ticket reservation using ASP.NET controls.</p> <p>Online examination using ASP.NET controls</p>	
<p>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</p>	<p>Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)</p>	
<p>Skills acquired</p>	<p>Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and</p>	

from the course	Transferrable Skill	
<p>Learning Resources:</p> <ul style="list-style-type: none"> • Recommended Texts <ol style="list-style-type: none"> 1. SvetlinNakov, VeselinKolev & Co, Fundamentals of Computer Programming with C#, Faber publication, 2019. 2. Mathew, Mac Donald, The Complete Reference ASP.NET, Tata McGraw-Hill, 2015. • Reference Books <ol style="list-style-type: none"> 1. Herbert Schildt, The Complete Reference C#.NET, Tata McGraw-Hill, 2017. 2. Kogent Learning Solutions, C# 2012 Programming Covers .NET 4.5 Black Book, Dreamtech pres, 2013. 3. Anne Boehm, Joel Murach, Murach's C# 2015, Mike Murach & Associates Inc. 2016. 6. Denielle Otey, Michael Otey, ADO.NET: The Complete reference, McGraw Hill, 2008. 7. Matthew MacDonald, Beginning ASP.NET 4 in C# 2010, Apress, 2010. <p>Web resources: Web resources from NDL Library, E-content from open-source libraries</p>		

Course Code: EC7	Introduction to Data Science		Credits: 3
Lecture Hours: (L) per week:5	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week:6
Course Category : EC7	Year & Semester: III Year VI Semester	Admission Year:	
Pre-requisite	Basic knowledge on Data and statistics		
<p>Learning Objectives: (for teachers: what they have to do in the class/lab/field)</p> <ul style="list-style-type: none"> • To introduce the concepts, techniques and tools in Data Science • To understand the various facets of data science practice, including data collection and integration, exploratory data analysis, predictive modeling, descriptive modeling and effective communication. 			
<p>Course Outcomes: (for students: To know what they are going to learn)</p> <p>CO1:To describe what Data Science is, what Statistical Inference means, identify probability distributions, fit a model to data and use tools for basic analysis and communication</p> <p>CO2: To describe what Data Science is, what Statistical Inference means, identify probability distributions, fit a model to data and use tools for basic analysis and communication</p> <p>CO3:To describe what Data Science is, what Statistical Inference means, identify probability distributions, fit a model to data and use tools for basic analysis and communication</p> <p>CO4: To describe what Data Science is, what Statistical Inference means, identify probability distributions, fit a model to data and use tools for basic analysis and communication</p> <p>CO5: To describe what Data Science is, what Statistical Inference means, identify probability distributions, fit a model to data and use tools for basic analysis and communication</p>			
<p>Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)</p>			
Units	Contents		Required Hours
I	<p>Introduction:</p> <p>Benefits and uses – Facets of data – Data science process –</p>		17

	Big data ecosystem and data science	
II	<p>The Data science process:</p> <ul style="list-style-type: none"> • Overview – research goals - retrieving data - transformation – Exploratory Data Analysis – Model building 	17
III	<p>Algorithms :</p> <ul style="list-style-type: none"> • Machine learning algorithms – Modeling process – Types – Supervised – Unsupervised - Semi-supervised 	17
IV	<p>Introduction to Hadoop :</p> <ul style="list-style-type: none"> • Hadoop framework – Spark – replacing MapReduce– NoSQL – ACID – CAP – BASE – types 	17
V	<p>Case Study:</p> <ul style="list-style-type: none"> • Prediction of Disease - Setting research goals - Data retrieval – preparation - exploration - Disease profiling - presentation and automation 	17
Extended Professional Component (is a part of internal component only, Not to be included in the External	<p>Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)</p>	

Examination question paper)		
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	
<p>Learning Resources:</p> <ul style="list-style-type: none"> • Recommended Texts <ol style="list-style-type: none"> 1. Davy Cielen, Arno D. B. Meysman, Mohamed Ali, “Introducing Data Science”, manning publications 2016 • Reference Books <ol style="list-style-type: none"> 1. Roger Peng, “The Art of Data Science”, lulu.com 2016. 2. MurtazaHaider, “Getting Started with Data Science – Making Sense of Data with Analytics”, IBM press, E-book. 3. Davy Cielen, Arno D.B. Meysman, Mohamed Ali, “Introducing Data Science: Big Data, Machine Learning, and More, Using Python Tools”, Dreamtech Press 2016. 4. Annalyn Ng, Kenneth Soo, “Numsense! Data Science for the Layman: No Math Added”, 2017, 1st Edition. 5. Cathy O'Neil, Rachel Schutt, “Doing Data Science Straight Talk from the Frontline”, O'Reilly Media 2013. 6. Lillian Pierson, “Data Science for Dummies”, 2017 II Edition <p>Web resources: Web resources from NDL Library, E-content from open-source libraries</p>		

Course Code: EC8	Cyber Security		Credits: 3
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week: 5
Course Category :EC8	Year & Semester:III Year VI Semester	Admission Year:	
Pre-requisite	Basic skills on internet and its functions		
<p>Learning Objectives: (for teachers: what they have to do in the class/lab/field)</p> <p>The students will be able to</p> <ul style="list-style-type: none"> • Understand various block cipher and stream cipher models • Describe the principles of public key cryptosystems, hash functions and digital signature • To get a firm knowledge on Cyber Security Essentials 			
<p>Course Outcomes: (for students: To know what they are going to learn)</p> <p>CO1:Implement basic security algorithms required by any computing system</p> <p>CO2: Analyze the vulnerabilities in any computing system and hence be able to design a security solution</p> <p>CO3:Analyze the possible security attacks in complex real time systems and their effective countermeasures</p> <p>CO4: Differentiate various governing bodies of cyber laws</p> <p>CO5: Impart various privacy policies for an organization</p>			
<p>Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)</p>			
Units	Contents		Required Hours
	<p>Introduction to Security</p> <p>Data Encryption Standard-Block cipher principles-block cipher modes of operation-Advanced Encryption Standard (AES)-Triple DES-Blowfish-RC5 algorithm.</p>		

	<p>Public Key Cryptography and Hash Algorithms</p> <p>Principles of public key cryptosystems-The RSA algorithm- Key management - Diffie Hellman Key exchange- Hash functions-Hash Algorithms (MD5, Secure Hash Algorithm</p>	
	<p>Fundamentals of Cyber Security</p> <p>How Hackers Cover Their Tracks- Fraud Techniques- Threat Infrastructure- Techniques to Gain a Foothold (Shellcode, SQL Injection, Malicious PDF Files)- Misdirection, Reconnaissance, and Disruption Methods.</p>	
	<p>Planning for Cyber Security</p> <p>Privacy Concepts -Privacy Principles and Policies - Authentication and Privacy - Data Mining - Privacy on the Web - Email Security - Privacy Impacts of Emerging Technologies.</p>	
	<p>Cyber Security Management</p> <p>Security Planning - Business Continuity Planning - Handling Incidents - Risk Analysis - Dealing with Disaster – Legal Issues – Protecting programs and Data – Information and the law – Rights of Employees and Employers - Emerging Technologies - The Internet of Things - Cyber Warfare.</p>	

<p>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</p>	<p>Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)</p>	
<p>Skills acquired from the course</p>	<p>Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</p>	
<p>Learning Resources:</p> <ul style="list-style-type: none"> • Recommended Texts 1. William Stallings, “Cryptography and Network Security”, Pearson Education, 6th Edition, 2013. 2. Charles P. Pfleeger Shari Lawrence Pfleeger Jonathan Margulies, Security in Computing, 5th Edition , Pearson Education , 2015. <ul style="list-style-type: none"> • Reference Books 1. Graham, J. Howard, R., Olson, R., Cyber Security Essentials, CRC Press, 2011. 2. George K. Kostopoulos, Cyber Space and Cyber Security, CRC Press, 2013. <p>Web resources: Web resources from NDL Library, E-content from open-source libraries</p>		

S. No.	CONTENTS
SUGGESTIVE CORE & SKILL BASED / ELECTIVE SUBJECTS	
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2	Practical: C Programming
3	Problem Solving Techniques
4	Digital Computer Fundamentals
5	Practical: Digital Computer Fundamentals
6	Python programming
7	Practical: Python Programming
8	Data Structure and Algorithms
9	Practical: Data Structure and Algorithms
10	Object Oriented Programming with C++
11	Practical: Object Oriented Programming with C++
12	SBS: Office Automation
13	Microprocessor and Microcontroller
14	Practical: Microprocessor and Microcontroller
15	Database Management Systems
16	System Programming
17	Web Application Development
18	Practical: Web Application Development
19	Computer Graphics
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21	Practical: PHP Programming
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24	Java Programming

25	Practical: Java Programming
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27	Software Engineering
28	Unix Programming
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31	.NET Programming
32	Practical: .NET Programming
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37	Discrete Structure
38	Software Testing
39	Data Mining and Warehousing
40	Network Security
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Course Code		C PROGRAMMING		Credits
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week	
Course Category :	Year & Semester:	Admission Year:		
Pre-requisite				
Learning Objectives: <ul style="list-style-type: none"> To gain knowledge in C language. To inculcate fundamental programming skills. 				
Course Outcomes: (for students: To know what they are going to learn) CO1: Remember the program structure of C with its syntax and semantics CO2: Understand the programming principles in C (data types, operators, branching and looping, arrays, functions, structures, pointers and files) CO3: Apply the programming principles learnt in real-time problems CO4: Analyze the various methods of solving a problem and choose the best method CO5: Code, debug and test the programs with appropriate test cases				
Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)				
Units	Contents			Required Hours
I	Overview of C: Importance of C, sample C program, C program structure, executing C program. Constants, Variables, and Data Types: Character set, C tokens, keywords and identifiers, constants, variables, data types, declaration of variables, Assigning values to variables--- Assignment statement, declaring a variable as constant, as volatile. Operators and Expression: Arithmetic, Relational, logical, assignment, increment, decrement, conditional, bitwise and special operators, arithmetic expressions, operator precedence, type conversions, mathematical functions Managing Input and Output Operators: Reading and writing a character, formatted input, formatted output.			17
II	Decision Making and Branching: Decision making with If, simple IF, IF ELSE, nested IF ELSE , ELSE IF ladder, switch, GOTO statement. Decision Making and Looping:			17

	While, Do-While, For, Jumps in loops.	
III	<p>Arrays: Declaration and accessing of one & two-dimensional arrays, initializing two-dimensional arrays, multidimensional arrays.</p> <p>Functions: The form of C functions, Return values and types, calling a function, categories of functions, Nested functions, Recursion, functions with arrays, call by value, call by reference, storage classes-character arrays and string functions.</p>	17
IV	<p>Structures and Unions: Defining, giving values to members, initialization and comparison of structure variables, arrays of structure, arrays within structures, structures within structures, structures and functions, unions.</p> <p>Preprocessors: Macro substitution, file inclusion.</p>	17
V	<p>Pointers: definition, declaring and initializing pointers, accessing a variable through address and through pointer, pointer expressions, pointer increments and scale factor, pointers and arrays, pointers and functions, pointers and structures.</p> <p>File Management in C: Opening, closing and I/O operations on files, random access to files, command line arguments.</p>	17
Extended Professional Component (is a part of internal component only, Not to be included in the	<p>Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)</p>	

External Examination question paper)		
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	
<p>Learning Resources:</p> <ul style="list-style-type: none"> • Recommended Texts <ol style="list-style-type: none"> 1. E. Balagurusamy, Programming in ANSI C, Fifth Edition, Tata McGraw-Hill, 2010. • Reference Books <ol style="list-style-type: none"> 1. Byron Gottfried, Schaum's Outline Programming with C, Fourth Edition, Tata McGraw-Hill, 2018. 2. Kernighan and Ritchie, The C Programming Language, Second Edition, Prentice Hall, 1998. 3. Yashavant Kanetkar, Let Us C, Eighteenth Edition, BPB Publications, 2021 • Web resources 		

Course Code	C PROGRAMMING PRACTICAL	Credits
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Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week
Course Category :	Year & Semester:	Admission Year:	
Pre-requisite			
Learning Objectives: <ul style="list-style-type: none"> To implement programming skills using C To impart knowledge and provide efficient solutions for real time problems using C language 			
Course Outcomes: (for students: To know what they are going to learn) CO1: Remember and understand how to write programs using the basic syntax and semantics in C CO2: Apply the concepts of functions, macros, arrays, structures, pointers and files in programs to solve problems CO3: Analyze and understand programs written in C language CO4: Evaluate the program execution flow with test cases and apply debugging CO5: Design algorithms and write programs in C language for the given problems			
Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)			
Units	Contents	Required Hours	
I	Variables, Data types, Constants and Operators <ol style="list-style-type: none"> Evaluation of expression ex: $((x+y)^2 * (x+z))/w$ Temperature conversion problem (Fahrenheit to Celsius) Program to convert days to months and days (Ex: 364 days = 12 months and 4 days) Solution of quadratic equation Salesman salary (Given: Basic Salary, Bonus for every item sold, commission on the total monthly sales) 	17	
II	Decision making Statements <ol style="list-style-type: none"> Maximum of three numbers Calculate Square root of five numbers (using goto 	17	

	<p>statement)</p> <p>8. Pay-Bill Calculation for different levels of employee (Switch statement)</p> <p>9. Fibonacci series</p> <p>10. Floyds Triangle</p> <p>11. Pascal's Triangle</p>	
III	<p>Arrays, Functions and Strings</p> <p>12. Prime numbers in an array</p> <p>13. Sorting data (Ascending and Descending)</p> <p>14. Matrix Addition and Subtraction</p> <p>15. Matrix Multiplication</p> <p>16. Function with no arguments and no return values</p> <p>17. Function that convert lower case letters to upper case</p> <p>18. Factorial using recursion.</p> <p>19. Perform String Operations using Switch Case.</p>	17
IV	<p>Structures and Macros</p> <p>20. Structure that describes a Hotel (name, address, grade, avg room rent, number of rooms)</p> <p>Perform some operations (list of hotels of a given grade etc.)</p>	17

	<p>21. Using Pointers in Structures.</p> <p>22. Cricket team details using Union.</p> <p>23. Write a macro that calculates the max and min of two numbers</p> <p>24. Nested macro to calculate Cube of a number.</p>	
V	<p>Pointers and Files</p> <p>25. Evaluation of Pointer expressions</p> <p>26. Function to exchange two pointer values</p> <p>27. Creation, insertion and deletion in a linked list</p> <p>28. Program to read a file and print the data.</p> <p>29. Program to receive a file name and a line of text as command line arguments and write the text to the file</p> <p>30. Program to copy the content of one file to another file.</p>	17
<p>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</p>	<p>Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)</p>	

Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	
Learning Resources: <ul style="list-style-type: none"> • Recommended Texts <ol style="list-style-type: none"> 1. E. Balagurusamy, Programming in ANSI C, Fifth Edition, Tata McGraw-Hill, 2010. • Reference Books <ol style="list-style-type: none"> 1. Byron Gottfried, Schaum's Outline Programming with C, Fourth Edition, Tata McGraw-Hill, 2018. 2. Kernighan and Ritchie, The C Programming Language, Second Edition, Prentice Hall, 1998. 3. Yashavant Kanetkar, Let Us C, Eighteenth Edition, BPB Publications, 2021 • Web resources 		

Course Code	Problem Solving Techniques		Credits
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week
Course Category :	Year & Semester:	Admission Year:	
Pre-requisite			
Learning Objectives: <ul style="list-style-type: none"> • To understand the importance of algorithms and programs, and to know of the basic problem solving strategies. • To learn efficient strategies and algorithms to solve standard problems, thus laying a firm foundation for designing algorithmic solutions to problems. 			

<p>Course Outcomes: (for students: To know what they are going to learn)</p> <p>CO1: Understand the systematic approach to problem solving.</p> <p>CO2: Know the approach and algorithms to solve specific fundamental problems.</p> <p>CO3: Understand the efficient approach to solve specific factoring-related problems.</p> <p>CO4: Understand the efficient array-related techniques to solve specific problems.</p> <p>CO5: Understand the efficient methods to solve specific problems related to text processing. Understand how recursion works.</p> <p>Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)</p>		
Units	Contents	Required Hours
I	<p>Introduction: Notion of algorithms and programs – Requirements for solving problems by computer – The problem-solving aspect: Problem definition phase, Getting started on a problem, The use of specific examples, Similarities among problems, Working backwards from the solution – General problem-solving strategies - Problem solving using top-down design – Implementation of algorithms – The concept of Recursion.</p>	17
II	<p>Fundamental Algorithms: Exchanging the values of two variables – Counting - Summation of a set of numbers - Factorial computation - Sine function computation - Fibonacci Series generation - Reversing the digits of an integer – Base Conversion.</p>	17
III	<p>Factoring Methods: Finding the square root of a number – The smallest divisor of an integer – Greatest common divisor of two integers - Generating prime numbers – Computing the prime factors of an integer – Generation of pseudo-random numbers - Raising a number to a large power – Computing the nth Fibonacci number.</p>	17
IV	<p>Array Techniques: Array order reversal – Array counting or histogramming – Finding the maximum number in a set -</p>	17

	Removal of duplicates from an ordered array - Partitioning an array – Finding the k^{th} smallest element – Longest monotone subsequence.	
V	Text Processing and Pattern Searching: Text line length adjustment – Left and right justification of text – Keyword searching in text – Text line editing – Linear pattern search. Recursive algorithms: Towers of Hanoi – Permutation generation.	17
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	
<p>Learning Resources:</p> <ul style="list-style-type: none"> • Recommended Texts 2. R. G. Dromey, <i>How to Solve it by Computer</i>, Pearson India, 2007. • Reference Books 3. George Polya, Jeremy Kilpatrick, <i>The Stanford Mathematics Problem Book: With Hints and Solutions</i>, Dover Publications, 2009 (Kindle Edition 2013). 4. Greg W. Scragg, <i>Problem Solving with Computers</i>, Jones & Bartlett 1st edition, 1996. • Web resources 		

Course Code	Digital Computer Fundamentals		Credits
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week
Course Category :	Year & Semester:	Admission Year:	
Pre-requisite			
Links to other Courses			
Learning Objectives: (for teachers: what they have to do in the class/lab/field)			
<ul style="list-style-type: none"> • It aims to train the student to the basic concepts of Digital Computer Fundamentals • To impart the in-depth knowledge of logic gates, Boolean algebra, combinational circuits and sequential circuits. 			
Course Outcomes: (for students: To know what they are going to learn)			
CO1: Identify the logic gates and their functionality.			
CO2: Perform number conversions from one system to another system			
CO3: Understand the functions of combinational circuits			
CO4: Perform number conversions.			
CO5: Perform Counter design and learn its operations.			
Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)			
Units	Contents	Required Hours	
I	Number Systems and Codes: Number System – Base Conversion – Binary Codes – Code Conversion. Digital Logic: Logic Gates – Truth Tables – Universal Gates.	17	
II	Boolean Algebra: Laws and Theorems – SOP, POS Methods – Simplification of Boolean Functions – Using Theorems, K-Map, Prime – Implicant Method – Binary Arithmetic: Binary Addition – Subtraction – Various Representations of Binary Numbers – Arithmetic Building Blocks – Adder – Subtractor.	17	
III	Combinational Logic: Multiplexers – Demultiplexers – Decoders – Encoders – Code Converters – Parity Generators and Checkers.	17	
IV	Sequential Logic: RS, JK, D, and T Flip-Flops – Master-Slave Flip-Flops. Registers: Shift Registers – Types of Shift Registers.	17	
V	Counters: Asynchronous and Synchronous Counters - Ripple, Mod, Up-Down Counters– Ring Counters. Memory: Basic Terms and Ideas –Types of ROMs – Types of RAMs.	17	

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	
<p>Learning Resources:</p> <ul style="list-style-type: none"> • Recommended Texts <ol style="list-style-type: none"> 1.V.Rajaraman and T.Radhakrishnan, <i>Digital Computer Design</i>, Prentice Hall of India, 2001 2.D.P.Leach and A.P.Malvino, <i>Digital Principles and Applications – TMH – Fifth Edition – 2002.</i> 3.M. Moris Mano, <i>Digital Logic and Computer Design</i>, PHI, 2001. 4.T.C.Bartee, <i>Digital Computer Fundamentals</i>, 6th Edition, Tata McGraw Hill, 1991. • Reference Books • Web resources 		

Course Code	Digital Computer Fundamentals		Credits
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week
Course Category :	Year & Semester:		Admission Year:
Pre-requisite			

Links to other Courses		
<p>Learning Objectives: (for teachers: what they have to do in the class/lab/field)</p> <ul style="list-style-type: none"> • It aims to train the student to the basic concepts of Digital Computer Fundamentals □ To impart the in-depth knowledge of logic gates, Boolean algebra, combinational circuits and sequential circuits 		
<p>Course Outcomes: (for students: To know what they are going to learn)</p> <p>CO1: Formulate digital functions using Boolean Algebra and verify experimentally</p> <p>CO2: Design and implement combinational logic circuits.</p> <p>CO3: Design and implement sequential logic circuits.</p> <p>CO4: Design and fabricate a digital circuit using the knowledge acquired from the laboratory.</p> <p>CO5: Perform Counter design and learn its operations.</p>		
<p>Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)</p>		
Units	Contents	Required Hours
I	<ol style="list-style-type: none"> 1. Study of Basic Logic gates and Universal Gates. 2. Verification & Realisation of De Morgan's theorem. 3. Realisation of SOP & POS functions after K-map reduction. 4. Half adder & Full adder using gates. 5. 4-bit adder/subtractor & BCD adder using IC 7483. 6. Realisation of 2-bit comparator using gates and study of four-bit comparator IC 7485. 7. BCD to decimal decoder and BCD to 7-segment decoder & display. 8. Study of multiplexer IC and realization of combinational circuits using multiplexers. 9. Realization of RS, T, D & JK flip flops using gates. 	17

	<p>10. Study of flip flop ICs (7474 & 7476).</p> <p>11. Realisation of ripple up and down counters and modulo-N counter using flip-flops.</p> <p>12. Study of counter ICs (7490, 7493).</p> <p>13. Design of synchronous up, down & modulo-N counters.</p> <p>14. Realization of 4-bit serial IN serial OUT registers using flip flops.</p> <p>15. Study of shift register IC 7495, ring counter and Johnsons counter.</p>	
II		17
III		17
IV		17
V		17
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	

Learning Resources:

- **Recommended Texts**
- **Reference Books**
- **Web resources**

Course Code	Python Programming		Credits
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week
Course Category :	Year & Semester:	Admission Year:	
Pre-requisite			
Links to other Courses			
Learning Objectives: (for teachers: what they have to do in the class/lab/field) <ul style="list-style-type: none"> • Describe the core syntax and semantics of Python programming language. • Discover the need for working with the strings and functions. • Illustrate the process of structuring the data using lists, dictionaries, tuples and sets. • Understand the usage of packages and Dictionaries 			
Course Outcomes: (for students: To know what they are going to learn) <p>CO1:Develop and execute simple Python programs</p> <p>CO2:Write simple Python programs using conditionals and looping for solving problems</p> <p>CO3:Decompose a Python program into functions</p> <p>CO4: Represent compound data using Python lists, tuples, dictionaries etc.</p> <p>CO5: Read and write data from/to files in Python programs</p>			
Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)			
Units	Contents	Required Hours	
I	Introduction: The essence of computational problem solving – Limits of computational problem solving-Computer algorithms-Computer Hardware-Computer Software-The process of computational problem solving-Python programming language - Literals - Variables and Identifiers - Operators - Expressions and Data types, Input / output	17	
II	Control Structures: Boolean Expressions - Selection Control - If Statement- Indentation in Python- Multi-Way Selection -- Iterative Control- While Statement- Infinite loops- Definite vs. Indefinite Loops- Boolean Flag. String, List and Dictionary, Manipulations Building blocks of python programs,Understandig and using ranges.	17	
III	Functions: Program Routines- Defining Functions- More on Functions: Calling Value-Returning Functions- Calling Non-Value-Returning Functions- Parameter Passing - Keyword	17	

	Arguments in Python - Default Arguments in Python- Variable Scope. Recursion: Recursive Functions	
IV	Objects and their use: Software Objects - Turtle Graphics – Turtle attributes-Modular Design: Modules - Top-Down Design - Python Modules - Text Files: Opening, reading and writing text files – Database Programming: Connecting to a database, Creating Tables, INSERT, UPDATE, DELETE and READ operations, Transaction Control, Disconnecting from a database, String Processing - Exception Handling	17
V	Dictionaries and Sets: Dictionary type in Python - Set Data type. Object Oriented Programming using Python: Encapsulation - Inheritance – Polymorphism. Python packages: Simple programs using the built-in functions of packages matplotlib, numpy, pandas etc.	17
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	

Learning Resources:

- **Recommended Texts**

1. Charles Dierbach, “Introduction to Computer Science using Python - A computational Problem solving Focus”, Wiley India Edition, 2015.

2. Wesley J. Chun, “Core Python Applications Programming”, 3rd Edition , Pearson Education, 2016

- **Reference Books**

1. Mark Lutz, “Learning Python Powerful Object Oriented Programming”, O’reilly Media 2018, 5th Edition.

2. Timothy A. Budd, “Exploring Python”, Tata MCGraw Hill Education Private Limited 2011, 1 st Edition.

3. John Zelle, “Python Programming: An Introduction to Computer Science”, Second edition, Course Technology Cengage Learning Publications, 2013, ISBN 978-1590282410

4. Michel Dawson, “Python Programming for Absolute Beginners” , Third Edition, Course Technology Cengage Learning Publications, 2013, ISBN 978-1435455009

- **Web resources**

Course Code	Python Programming		Credits
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week
Course Category :	Year & Semester:	Admission Year:	
Pre-requisite			
Links to other Courses			
<p>Learning Objectives: (for teachers: what they have to do in the class/lab/field)</p> <ul style="list-style-type: none"> • Acquire programming skills in core Python. • Acquire Object-oriented programming skills in Python. • Develop the skill of designing graphical-user interfaces (GUI) in Python. • Develop the ability to write database applications in Python. • Acquire Python programming skills to move into specific branches 			
<p>Course Outcomes: (for students: To know what they are going to learn)</p> <p>CO1:To understand the problem solving approaches</p> <p>CO2:To learn the basic programming constructs in Python</p> <p>CO3:To practice various computing strategies for Python-based solutions to real world problems</p> <p>CO4: To use Python data structures - lists, tuples, dictionaries.</p> <p>CO5: To do input/output with files in Python.</p>			
<p>Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)</p>			
Units	Contents		Required Hours

I	<p>16. Program to convert the given temperature from Fahrenheit to Celsius and vice versa depending upon user's choice.</p> <p>17. Program to calculate total marks, percentage and grade of a student. Marks obtained in each of the five subjects are to be input by user. Assign grades according to the following criteria:</p> <p style="padding-left: 40px;">Grade A: Percentage ≥ 80 Grade B: Percentage ≥ 70 and < 80</p> <p style="padding-left: 40px;">Grade C: Percentage ≥ 60 and < 70 Grade D: Percentage ≥ 40 and < 60</p> <p style="padding-left: 40px;">Grade E: Percentage < 40</p> <p>18. Program, to find the area of rectangle, square, circle and triangle by accepting suitable input parameters from user.</p> <p>19. Write a Python script that prints prime numbers less than 20.</p> <p>20. Program to find factorial of the given number using recursive function.</p> <p>21. Write a Python program to count the number of even and odd numbers from array of N numbers.</p> <p>22. Write a Python class to reverse a string word by word.</p> <p>23. Given a tuple and a list as input, write a program to count the occurrences of all items of the list in the tuple. (Input : tuple = ('a', 'a', 'c', 'b', 'd'), list = ['a', 'b'], Output : 3)</p> <p>24. Create a Savings Account class that behaves just like a BankAccount, but also has an interest rate and a method that increases the balance by the</p>	17
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	<p>appropriate amount of interest (Hint:use Inheritance).</p> <p>25. Write a Python program to construct the following pattern, using a nested loop</p> <pre style="text-align: center;"> * ** *** **** ***** **** *** ** *</pre> <p>26. Read a file content and copy only the contents at odd lines into a new file.</p> <p>27. Create a Turtle graphics window with specific size.</p> <p>28. Write a Python program for Towers of Hanoi using recursion</p> <p>29. Create a menu driven Python program with a dictionary for words and their meanings.</p> <p>30. Devise a Python program to implement the Hangman Game.</p>	
II		17
III		17
IV		17
V		17

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	
Learning Resources: <ul style="list-style-type: none"> • Recommended Texts • Reference Books • Web resources 		

Course Code	Data Structures & Algorithms		Credits
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week
Course Category :	Year & Semester:	Admission Year:	
Pre-requisite			
Links to other Courses			
Learning Objectives: (for teachers: what they have to do in the class/lab/field) <ul style="list-style-type: none"> • To impart the basic concepts of data structures and algorithms. • To acquaint the student with the basics of the various data structures and make the students knowledgeable in the area of data structures. 			

- This course also gives insight into the various algorithm design techniques

Course Outcomes: (for students: To know what they are going to learn)

CO1: To introduce the concepts of Data structures and to understand simple linear data structures.

CO2: Learn the basics of stack data structure, its implementation and application

CO3: Use the appropriate data structure in context of solution of given problem and demonstrate a familiarity with major data structures.

CO4: To introduce the basic concepts of algorithms

CO5: To give clear idea on algorithmic design paradigms like Dynamic Programming, Backtracking, Branch and Bound

Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)

Units	Contents	Required Hours
I	<p>INTRODUCTION TO DATA STRUCTURES:</p> <ul style="list-style-type: none"> • Data Structures: Definition- Time & Space Complexity, • Arrays: Representation of arrays, Applications of arrays, sparse matrix and its representation, • Linear list: Singly linked list implementation, insertion, deletion and searching operations on linear list • Circular linked list: implementation, Double linked list implementation, insertion, deletion and searching operations. Applications of linked lists- Dynamic Storage management. 	17
II	<p>STACKS:</p> <ul style="list-style-type: none"> • Operations, array and linked representations of stack, • stack applications, infix to postfix conversion, postfix 	17

	expression evaluation, recursion implementation	
III	<p>QUEUES, TREES & GRAPHS:</p> <ul style="list-style-type: none"> • Queues: operations on queues, array and linked representations. • Circular Queue: operations,, applications of queues. • Trees: Definitions and Concepts- Representation of binary tree, Binary tree traversals (Inorder, Postorder , preorder), • Binary search trees • Graphs : Representation of Graphs- Types of graphs -Breadth first traversal – Depth first traversal- - Applications of graphs – 	17
IV	<p>INTRODUCTION TO ALGORITHMS:</p> <ul style="list-style-type: none"> • INTRODUCTION: Definition of Algorithms- Overview and importance of algorithms- pseudocode conventions, Asymptotic notations, practical complexities. • Divide-and-Conquer: : General Method – Binary Search- Quick Sort- Merge Sort. • Greedy Method: General method- Knapsack problem- Tree vertex splitting- Job sequencing with deadlines 	17
V	<p>DYNAMIC PROGRAMMING, BACKTRACKING & BRANCH & BOUND</p> <ul style="list-style-type: none"> • Dynamic programming: General method, Multistage 	17

	<p>Graphs, All pairs shortest path, Single source shortest path.</p> <ul style="list-style-type: none"> • Backtracking: General method, 8 Queens, Graph coloring, Hamiltonian cycle. • Branch & Bound: General method, Travelling salesperson problem. 	
<p>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</p>	<p>Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)</p>	
<p>Skills acquired from the course</p>	<p>Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</p>	
<p>Learning Resources:</p> <ul style="list-style-type: none"> • Recommended Texts <ol style="list-style-type: none"> 1. Ellis Horowitz , Sartaj Sahni, Susan Anderson Freed, Second Edition , “Fundamentals of Data in C”, Universities Press 2. E. Horowitz, S. Sahni and S. Rajasekaran, Second Edition , “Fundamentals of Computer Algorithms “ Universities Press • Reference Books <ol style="list-style-type: none"> 1. Seymour Lipschutz ,”Data Structures with C”, First Edition, Schaum’s outline series in computers, Tata McGraw Hill. 2. .2. R.Krishnamoorthy and G.Indirani Kumaravel, Data Structures using C, Tata McGrawHill – 2008. 		

3. A.K.Sharma, Data Structures using C , Pearson Education India,2011.
4. . G. Brassard and P. Bratley, “Fundamentals of Algorithms”, PHI, New Delhi, 1997.
5. 4, . A.V. Aho, J.E. Hopcroft, J.D. Ullmann,, “The design and analysis of Computer Algorithms”, Addison Wesley, Boston, 1974
7. 5. Thomas H. Cormen, C.E. Leiserson, R L.Rivest and C. Stein, Introduction to Algorithms, Third edition, MIT Press, 2009
8. Sanjoy Dasgupta, C.Papadimitriou and U.Vazirani , Algorithms , Tata McGraw-Hill, 2008.

- **Web resources**

Course Code	Data Structures & Algorithms		Credits
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week
Course Category :	Year & Semester:		Admission Year:
Pre-requisite			

Links to other Courses		
Learning Objectives: (for teachers: what they have to do in the class/lab/field)		
<ul style="list-style-type: none"> • To understand and implement basic data structures using C • To apply linear and non-linear data structures in problem solving. • To learn to implement functions and recursive functions by means of data structures • To implement searching and sorting algorithms 		
Course Outcomes: (for students: To know what they are going to learn)		
CO1: Implement data structures using C		
CO2: Implement various types of linked lists and their applications		
CO3: Implement Tree Traversals		
CO4: Implement various algorithms in C		
CO5: Implement different sorting and searching algorithms		
Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)		
Units	Contents	Required Hours
I	Implement the following exercises using C Programming language: <ol style="list-style-type: none"> 11. Array implementation of stacks 12. Array implementation of Queues 13. Linked list implementation of stacks 14. Linked list implementation of Queues 15. Binary Tree Traversals (Inorder, Preorder, Postorder) 16. Implementation of Linear search and binary search 17. Implementation Insertion sort, Quick sort and Merge Sort 18. Implementation of Depth-First Search & Breadth-First Search of Graphs. 19. Finding all pairs of Shortest Path of a Graph. 20. Finding single source shortest path of a Graph. 	17
II		17
III		17
IV		17
V		17

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	
Learning Resources: <ul style="list-style-type: none"> • Recommended Texts • Reference Books • Web resources 		

Course Code	Object Oriented Programming with C++		Credits
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week
Course Category :	Year & Semester:	Admission Year:	
Pre-requisite			
Links to other Courses			
<p>Learning Objectives: (for teachers: what they have to do in the class/lab/field)</p> <ul style="list-style-type: none"> • To engender an appreciation for the need and characteristics of Object-orientation. • To impart knowledge of the C++ language grammar in order to design and implement programming solutions to simple problems by applying Object-oriented thinking. 			
<p>Course Outcomes: (for students: To know what they are going to learn)</p> <p>CO1: Explain the various basic concepts of Object-orientation.</p> <p>CO2: Write programs to implement static binding</p> <p>CO3: Write programs to implement inheritance and dynamic binding</p> <p>CO4: Write programs to implement templates and exception handling and learn how to use STL class library.</p> <p>CO5: Write programs implementing File and Stream I/O.</p> <p>Conceptualize a given simple problem in an Object-oriented way, design classes and write a program to solve the problem by applying the concepts of Object-orientation and features of C++.</p> <p>Find and fix bugs in a given program snippet.</p> <p>Determine the output of a given program snippet.</p>			
<p>Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)</p>			
Units	Contents		Required Hours
I	<p>Object Oriented Programming Concepts: Complexity in software - The need for object-orientation – Abstraction –</p>		17

	<p>Encapsulation – Modularity – Hierarchy.</p> <p>Basic Elements of C++: Classes – Objects – Data members and member functions – <i>private</i> and <i>public</i> access specifiers - Static members - Constructors – Singleton class - Destructors - Friend Functions and Friend Classes - Array of objects – Pointer to objects - <i>this</i> pointer – References – Dynamic memory allocation - Namespaces.</p>	
II	<p>Function Overloading: Overloading a function - Default arguments – Overloading Constructors.</p> <p>Operator Overloading: Overloading an operator as a member function – Overloading an operator as a friend function – Overloading the operators [], (), -> and comma operators – Conversion Functions.</p>	17
III	<p>Inheritance: Types of inheritance – <i>protected</i> access specifier – Virtual Base Class – Base class and derived class constructors. Run-time Polymorphism: Virtual Functions – Function overriding - Pure virtual function – Abstract base class.</p>	17
IV	<p>Templates: Function templates – Overloading a function template – Class templates.</p> <p>Standard Template Library (STL): Containers: vector, list – Iterators: forward, backward – Algorithms: removing and replacing elements, sorting, counting, reversing a sequence.</p> <p>Exception Handling: Exceptions – <i>try</i>, <i>catch</i>, <i>throw</i> – Rethrowing an exception – Restricting exceptions - Handling</p>	17

	exceptions in derived classes - <i>terminate()</i> , <i>abort()</i> , <i>unexpected()</i> , <i>set_terminate()</i> .	
V	<p>I/O Streams: Formatted I/O with <i>ios</i> class functions - Manipulators – Creating own manipulator – Overloading << and >> operators.</p> <p>File I/O: <i>fstream</i> class – Opening and closing a file – Reading from and writing to a text file - Unformatted and Binary I/O – Random access I/O.</p>	17
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	<p>Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)</p>	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	
<p>Learning Resources:</p> <ul style="list-style-type: none"> • Recommended Texts <ol style="list-style-type: none"> 1. Herbert Schildt, <i>C++ - The Complete Reference</i>, Third Edition, TMH, 1999. 2. Grady Booch, <i>Object Oriented Analysis and Design</i>, Pearson Education, 2008. (For Unit I) • Reference Books <ol style="list-style-type: none"> 1. Bjarne Stroustrup, <i>The C++ Programming Language</i>, Addison Wesley, 2000. 2. J. P. Cohoon and J. W. Davidson, <i>C++ Program Design – An Introduction to Programming and</i> 		

Object-Oriented Design, Second Edition, McGraw Hill, 1999.

3. C. J. Lippman, *C++ Primer*, Third Edition, Addison Wesley, 2000.

- **Web resources**

Course Code	Object Oriented Programming with C++		Credits
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week
Course Category :	Year & Semester:	Admission Year:	
Pre-requisite			
Links to other Courses			
Learning Objectives: (for teachers: what they have to do in the class/lab/field) <ul style="list-style-type: none"> • Design classes for the given problems. • Write programs in C++. • Code, debug and execute a C++ program to solve the given problems using an IDE. 			
Course Outcomes: (for students: To know what they are going to learn) <p>CO1:<i>Design and create classes.Implement Stream I/O as appropriate.</i></p> <p>CO2:<i>Design appropriate data members and member functions.</i></p> <p>CO3: <i>Implement functions, friend functions, static members, constructors and compile-time polymorphism.</i></p> <p>CO4: <i>Implement inheritance, run-time polymorphism and destructors.</i></p> <p>CO5: <i>Implement templates and exceptions. Use STL class library.Implement File I/O.</i></p>			
Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)			
Units	Contents	Required Hours	
I	1. Write a class to represent a complex number which has member functions to do the following <ol style="list-style-type: none"> Set and show the value of the complex number Add, subtract and multiply two complex numbers Multiplying the complex number with a scalar value 	17	

	<ol style="list-style-type: none">2. Write a Point class that represents a 2-d point in a plane. Write member functions to<ol style="list-style-type: none">a. Set and show the value of a pointb. Find the distance between two pointsc. Check whether two points are equal or not3. Design and implement a class that represents a Harmonic Progression (HP). Implement functions to do the following:<ol style="list-style-type: none">a. Generate the HP up to a specified number of termsb. Calculate the sum of the HP to n terms and to infinityc. Generate the nth term of the HPd. Generate the corresponding Arithmetic Progression. (Design and implement a class that encapsulates an AP, and allow the HP class to use its facilities by implementing friend functions.)4. Design and implement a class to represent a Solid object.<ol style="list-style-type: none">a. Apart from data members to represent dimensions, use a data member to specify the type of solid.b. Use functions to calculate volume and surface area for different solids.5. Design a class representing time in hh:mm:ss. Write functions to<ol style="list-style-type: none">a. Set and show the timeb. Find the difference between two time objectsc. Adding a given duration to a timed. Conversion of the time object to seconds6. Design a 3x3 matrix class and demonstrate the following:	
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	<ul style="list-style-type: none">a. Addition and multiplication of two matrices using operator overloadingb. Maintaining a count of the number of matrix object created <p>7. Design a class called cString to represent a string data type. Create a data member in the class to represent a string using an array of size 100. Write the following functionality as member functions:</p> <ul style="list-style-type: none">a. Copy Constructorb. Concatenate two stringsc. Find the length of the stringd. Reversing a stringe. Comparing two strings <p>8. Design a class called cString to represent a string data type. Create a data member in the class to represent a string whose size is dynamically allocated. Write the following as member functions:</p> <ul style="list-style-type: none">a. Copy Constructorb. Destructorc. Concatenate two stringsd. Find the length of the stringe. Reversing a stringf. Comparing two strings <p>9. Create a class to represent a 2-d shape and derive classes to represent a triangle, rectangle and circle. Write a program using run-time polymorphism to compute the area of the figures.</p>	
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	<p>10. Define a class template representing a single-dimensional array. Implement a function to sort the array elements. Include a mechanism to detect and throw an exception for array-bound violations.</p> <p>11. Demonstrate the use of the vector STL container.</p> <p>Implement a telephone directory using files</p>	
II		17
III		17
IV		17
V		17
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	<p>Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)</p>	
Skills acquired from the course	<p>Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</p>	
<p>Learning Resources:</p> <ul style="list-style-type: none"> • Recommended Texts • Reference Books • Web resources 		

Course Code	Office Automation		Credits
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week
Course Category :	Year & Semester:	Admission Year:	
Pre-requisite			
Links to other Courses			
<p>Learning Objectives: (for teachers: what they have to do in the class/lab/field)</p> <ul style="list-style-type: none"> • The major objective in introducing the Computer Skills course is to impart training for students in Microsoft Office which has different components like MS Word, MS Excel and Power point. • The course is highly practice oriented rather than regular class room teaching. • To acquire knowledge on editor, spread sheet and presentation software. 			

<p>Course Outcomes: (for students: To know what they are going to learn)</p> <p>CO1: Understand the basics of computer systems and its components.</p> <p>CO2: Understand and apply the basic concepts of a word processing package.</p> <p>CO3: Understand and apply the basic concepts of electronic spreadsheet software.</p> <p>CO4: Understand and apply the basic concepts of database management system.</p> <p>CO5: Understand and create a presentation using PowerPoint tool.</p> <p>Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)</p>		
Units	Contents	Required Hours
I	Introductory concepts: Memory unit – CPU-Input Devices: Key board, Mouse and Scanner. Output devices: Monitor, Printer. Introduction to Operating systems & its features: DOS – UNIX– Windows. Introduction to Programming Languages.	17
II	Word Processing: Open, Save and close word document; Editing text – tools, formatting, bullets; Spell Checker - Document formatting – Paragraph alignment, indentation, headers and footers, numbering; printing – Preview, options, merge.	17
III	Spreadsheets: Excel – opening, entering text and data, formatting, navigating; Formulas – entering, handling and copying; Charts – creating, formatting and printing, analysis tables, preparation of financial statements, introduction to data analytics.	17
IV	Database Concepts: The concept of data base management system; Data field, records, and files, Sorting and indexing data; Searching records. Designing queries, and reports; Linking of data files; Understanding Programming environment in DBMS; Developing menu drive applications in query language (MS – Access).	17
V	Power point: Introduction to Power point - Features – Understanding slide typecasting & viewing slides – creating slide shows. Applying special object – including objects & pictures – Slide transition – Animation effects, audio inclusion, timers.	17

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	
<p>Learning Resources:</p> <ul style="list-style-type: none"> • Recommended Texts <ol style="list-style-type: none"> 1. Peter Norton, “Introduction to Computers” –Tata McGraw-Hill. • Reference Books <ol style="list-style-type: none"> 1. Jennifer Ackerman Kettel, Guy Hat-Davis, Curt Simmons, “Microsoft 2003”, Tata McGraw-Hill. • Web resources 		

Course Code	Database Management Systems		Credits
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week
Course Category :	Year & Semester:		Admission Year:
Pre-requisite			
Links to other Courses			

<p>Learning Objectives: (for teachers: what they have to do in the class/lab/field)</p> <ul style="list-style-type: none"> • To enable the students to learn the designing of data base systems, foundation on the relational model of data and normal forms. • To understand the concepts of data base management system, design simple Database models • To learn and understand to write queries using SQL, PL/SQL. 		
<p>Course Outcomes: (for students: To know what they are going to learn)</p> <p>CO1: Understand the various basic concepts of Data Base System. Difference between file system and DBMS and compare various data models.</p> <p>CO2: Define the integrity constraints. Understand the basic concepts of Relational Data Model, Entity-Relationship Model.</p> <p>CO3: Design database schema considering normalization and relationships within database. Understand and construct database using Structured Query Language. Attain a good practical skill of managing and retrieving of data using Data Manipulation Language (DML).</p> <p>CO4: Classify the different functions and various join operations and enhance the knowledge of handling multiple tables.</p> <p>CO5: Learn to design Data base operations and implement using PL/SQL programs. Learn basics of PL/SQL and develop programs using Cursors, Exceptions</p>		
<p>Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)</p>		
Units	Contents	Required Hours
I	<p>Database Concepts: Database Systems - Data vs Information</p> <p>- Introducing the database -File system - Problems with file system – Database systems. Data models - Importance - Basic Building Blocks - Business rules - Evolution of Data models - Degrees of Data Abstraction</p>	17
II	<p>Design Concepts: Relational database model - logical view of data-keys -Integrity rules - relational set operators - data dictionary and the system catalog - relationships -data redundancy revisited -indexes - codd's rules. Entity relationship model - ER diagram</p>	17
III	<p>Normalization of Database Tables: Database tables and Normalization – The Need for Normalization –The Normalization Process – Higher level Normal Form.</p> <p>Introduction to SQL: Data Definition Commands – Data Manipulation Commands – SELECT Queries – Additional</p>	17

	Data Definition Commands – Additional SELECT Query Keywords – Joining Database Tables.	
IV	Advanced SQL: Relational SET Operators: UNION – UNION ALL – INTERSECT – MINUS. SQL Join Operators: Cross Join – Natural Join – Join USING Clause – JOIN ON Clause – Outer Join. Sub Queries and Correlated Queries: WHERE – IN – HAVING – ANY and ALL – FROM. SQL Functions: Date and Time Function – Numeric Function – String Function – Conversion Function	17
V	PL/SQL: A Programming Language: History – Fundamentals – Block Structure – Comments – Data Types – Other Data Types – Variable Declaration – Assignment operation – Arithmetic operators. Control Structures and Embedded SQL: Control Structures – Nested Blocks – SQL in PL/SQL – Data Manipulation – Transaction Control statements. PL/SQL Cursors and Exceptions: Cursors – Implicit Cursors, Explicit Cursors and Attributes – Cursor FOR loops – SELECT...FOR UPDATE – WHERE CURRENT OF clause – Cursor with Parameters – Cursor Variables – Exceptions – Types of Exceptions	17
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	

Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	
<p>Learning Resources:</p> <ul style="list-style-type: none"> • Recommended Texts <ol style="list-style-type: none"> 5. Coronel, Morris, Rob, "Database Systems, Design, Implementation and Management", Ninth Edition 6. Nilesh Shah, "Database Systems Using Oracle", 2nd edition, Pearson Education India, 2016 • Reference Books <ol style="list-style-type: none"> 6. Abraham Silberschatz, Henry F.Korth and S.Sudarshan, "Database System Concepts", McGraw Hill International Publication ,VI Edition. 7. Shio Kumar Singh , "Database Systems ",Pearson publications ,II Edition 8. Albert Lulushi, "Developing ORACLE FORMS Applications", Prentice Hall ,1997 • Web resources 		

Course Code	Web Application and Development		Credits
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week
Course Category :	Year & Semester:	Admission Year:	
Pre-requisite			
Links to other Courses			
<p>Learning Objectives: (for teachers: what they have to do in the class/lab/field)</p> <ul style="list-style-type: none"> To learn the basic web concepts and to create rich internet applications that use most recent client-side programming technologies. To learn the basics of HTML, DHTML, XML, CSS, Java Script and AJAX. 			
<p>Course Outcomes: (for students: To know what they are going to learn)</p> <p>CO1:Ability to Develop and publish Web pages using Hypertext Markup Language (HTML).</p> <p>CO2:Ability to optimize page styles and layout with Cascading Style Sheets (CSS).</p> <p>CO3:Ability to Understand, analyze and apply the role of languages to create a capstone</p> <p>CO4: Website using client-side web programming languages like HTML, DHTML, CSS, XML, JavaScript, and AJAX</p> <p>CO5: Able to understand the concept of jQuery and AngularJS</p>			
<p>Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)</p>			
Units	Contents	Required Hours	
I	HTML: HTML-Introduction-tag basics- page structure-adding comments working with texts, paragraphs and line break. Emphasizing test- heading and horizontal rules-list-font size, face and color-alignment- links-tables-frames	17	
II	Forms & Images Using Html: Graphics: Introduction-How to work efficiently with images in web pages, image maps, GIF animation, adding multimedia, data collection with html forms textbox, password, list box, combo box, text area, tools for building web page front page	17	
III	XML & DHTML: Cascading style sheet (CSS)-what is CSS-Why we use CSS-adding CSS to your web pages-Grouping styles-extensible markup language (XML). Dynamic HTML: Document object model (DCOM)-Accessing HTML & CSS through DCOM Dynamic content styles & positioning-Event bubbling-data binding	17	
IV	JavaScript : Client side scripting, What is JavaScript, How to develop JavaScript, simple JavaScript, variables, functions, conditions, loops and repetition, Advance script, JavaScript and objects, JavaScript own objects, the DOM and web	17	

	browser environments, forms and validations	
V	Ajax: Introduction, advantages &disadvantages, Purpose of it, ajax based web application, alternatives of ajax Java Script & AJAX: Introduction to array-operators, making statements-date & time-mathematics- strings-Event handling-form properties. AJAX. Introduction to jQuery and AngularJS	17
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	
Learning Resources: <ul style="list-style-type: none"> • Recommended Texts <ol style="list-style-type: none"> 1. Pankaj Sharma, “<i>Web Technology</i>”, Sk Kataria & Sons Bangalore, 2011.(UNIT I, II, III & IV). 2. Achyut S Godbole & Atul Kahate, “<i>Web Technologies</i>”, 2002, 2nd Edition. (UNIT V: AJAX) • Reference Books <ol style="list-style-type: none"> 1. Laura Lemay, Rafe Colburn , Jennifer Kyrnin, “<i>Mastering HTML, CSS & Javascript Web Publishing</i>”, 2016. 2. DT Editorial Services (Author), “<i>HTML 5 Black Book (Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP, jQuery)</i>”, Paperback 2016, 2nd Edition. • Web resources 		

Course Code	Web Application And Development Lab		Credits
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week
Course Category :	Year & Semester:	Admission Year:	
Pre-requisite			
Links to other Courses			
Learning Objectives: (for teachers: what they have to do in the class/lab/field)			
<ul style="list-style-type: none"> • To develop an ability to design and implement static and dynamic website • Choose best technologies for solving web client/server problems 			
Course Outcomes: (for students: To know what they are going to learn)			
CO1: Study and Implement Webpages using Basic and Advanced HTML			
CO2: Differentiate between functionalities of Basic CSS and Advanced CSS			
CO3: Implement basic JavaScript.			
CO4: Program basic functions in JavaScript and XHTML CO5:			
Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)			
Units	Contents	Required Hours	
I	<ol style="list-style-type: none"> 1. Write a JavaScript to design a simple calculator to perform the following operations: sum, product, difference and quotient. 2. Write a JavaScript that calculates the squares and cubes of the numbers from 0 to 10 and outputs HTML text that displays the resulting values in an HTML table format. 3. Write a JavaScript code that displays text "TEXT-GROWING" with increasing font size in the interval of 100ms in RED COLOR, when the font size reaches 	17	

	<p>50pt it displays “TEXT-SHRINKING” in BLUE color. Then the font size decreases to 5pt.</p> <p>4. Develop and demonstrate a HTML5 file that includes JavaScript script that uses functions for the following problems: a. Parameter: A string b. Output: The position in the string of the left-most vowel c. Parameter: A number d. Output: The number with its digits in the reverse order</p> <p>5. Design an XML document to store information about a student in an engineering college affiliated to VTU. The information must include USN, Name, and Name of the College, Branch, Year of Joining, and email id. Make up sample data for 3 students. Create a CSS style sheet and use it to display the document.</p> <p>6. Change a Content of webpage using AJAX. Perform Different Operations using JQUERY Selectors.</p> <p>7. Create a XHTML form with Name, Address Line 1, Address Line 2, and E-mail text fields. On submitting, store the values in MySQL table. Retrieve and display the data based on Name.</p>	
II		17
III		17
IV		17
V		17
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)	<p>Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)</p>	

question paper)		
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	
Learning Resources: <ul style="list-style-type: none"> • Recommended Texts • Reference Books • Web resources 		

Course Code	PHP Programming		Credits
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week
Course Category :	Year & Semester:	Admission Year:	
Pre-requisite			
Links to other Courses			
Learning Objectives: (for teachers: what they have to do in the class/lab/field) The objective of this course is to teach the fundamentals of quantum information processing, including quantum computation, quantum cryptography, and quantum information theory.			
Course Outcomes: (for students: To know what they are going to learn)			
CO1: Analyze the behaviour of basic quantum algorithms			
CO2: Implement simple quantum algorithms and information channels in the quantum circuit model			
CO3: Simulate a simple quantum error-correcting code			
CO4: Prove basic facts about quantum information channels			
CO5:			

Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)		
Units	Contents	Required Hours
I	Introduction to PHP -Basic Knowledge of websites - Introduction of Dynamic Website -Introduction to PHP - Scope of PHP -XAMPP and WAMP Installation- PHP Programming Basics -Syntax of PHP -Embedding PHP in HTML -Embedding HTML in PHP .	17
II	Introduction to PHP Variable -Understanding Data Types - Using Operators -Using Conditional Statements -If(), else if() and else if condition Statement -Switch() Statements -Using the while() Loop -Using the for() Loop	17
III	PHP Functions -PHP Functions -Creating an Array - Modifying Array Elements -Processing Arrays with Loops - Grouping Form Selections with Arrays -Using Array Functions -Using Predefined PHP Functions -Creating User-Defined Functions	17
IV	PHP Advanced Concepts -Reading and Writing Files -Reading Data from a File -Managing Sessions and Using Session Variables -Destroying a Session -Storing Data in Cookies - Setting Cookies	17
V	OOPS Using PHP -OOPS Concept-Class, Object, Abstractions, Encapsulation, Inheritance, Polymorphism -Creating Classes and Object in PHP-Cookies and Session Management- Working with forms and system file - Error Handling- Model View Controller – AJAX.	17

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	
<p>Learning Resources:</p> <ul style="list-style-type: none"> • Recommended Texts <ol style="list-style-type: none"> 1. Head First PHP & MySQL: A Brain-Friendly Guide- 2009-Lynn mighley and Michael Morrison. 2. The Joy of PHP: A Beginner's Guide to Programming Interactive Web Applications with PHP and MySQL- Alan Forbes • Reference Books • Web resources 		

Course Code	PHP Programming		Credits
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week
Course Category :	Year & Semester:		Admission Year:
Pre-requisite			
Links to other Courses			
Learning Objectives: (for teachers: what they have to do in the class/lab/field)			

Course Outcomes: (for students: To know what they are going to learn)		
CO1:		
CO2:		
CO3:		
CO4:		
CO5:		
Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)		
Units	Contents	Required Hours
I	<ol style="list-style-type: none"> 1. Simple PHP programs using expressions and operators. 2. Programs to demonstrate the usage of control structures 3. Programs using Looping structures 4. Programs using arrays 5. Programs using string functions 6. Simple and parameterized functions 7. Programs using OOPS concepts 8. Program to design a web page using various form controls 9. Data validation in web pages. 10. Using cookies and session variables 	17
II		17
III		17
IV		17
V		17
Extended Professional Component (is a part of internal component only, Not to be included in the	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	

External Examination question paper)		
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	
Learning Resources: <ul style="list-style-type: none">• Recommended Texts • Reference Books • Web resources		

Course Code	Quantitative Aptitude		Credits
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week
Course Category :	Year & Semester:	Admission Year:	
Pre-requisite			
Links to other Courses			
Learning Objectives: (for teachers: what they have to do in the class/lab/field) <ul style="list-style-type: none"> • To improve the quantitative skills of the students • To prepare the students for various competitive exams 			
Course Outcomes: (for students: To know what they are going to learn) <p>CO1:</p> <p>CO2:</p> <p>CO3:</p> <p>CO4:</p> <p>CO5:</p>			
Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)			
Units	Contents	Required Hours	
I	Numbers - HCF and LCM of numbers - Decimal fractions - Simplification - Square roots and cube roots - Average - problems on Numbers	17	
II	Problems on Ages - Surds and Indices - percentage - profits and loss - ratio and proportion - partnership - Chain rule.	17	
III	Time and work - pipes and cisterns - Time and Distance - problems on trains - Boats and streams - simple interest - compound interest - Logarithms - Area - Volume and surface area - races and Games of skill.	17	
IV	Permutation and combination - probability - True Discount - Bankers Discount - Height and Distances - Odd man out & Series.	17	
V	Calendar - Clocks - stocks and shares - Data	17	

	representation - Tabulation - Bar Graphs - Pie charts - Line graphs	
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	
<p>Learning Resources:</p> <ul style="list-style-type: none"> • Recommended Texts <ol style="list-style-type: none"> 2. . “Quantitative Aptitude”, R.S. AGGARWAL., S. Chand & Company Ltd., • Reference Books • Web resources 		

Course Code	Operating Systems		Credits
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week
Course Category :	Year & Semester:	Admission Year:	
Pre-requisite			
Links to other Courses			
<p>Learning Objectives: (for teachers: what they have to do in the class/lab/field)</p> <ul style="list-style-type: none"> • Understanding the design of the Operating System • Imparting knowledge on CPU scheduling, Process and Memory Management. • To code specialized programs for managing overall resources and operations of the computer. 			
<p>Course Outcomes: (for students: To know what they are going to learn)</p> <p>CO1: Define the fundamentals of OS and identify the concepts relevant to process , process life cycle, Scheduling Algorithms, Deadlock and Memory management</p> <p>CO2: know the critical analysis of process involving various algorithms, an exposure to threads and semaphores</p> <p>CO3: Have a complete study about Deadlock and its impact over OS. Knowledge of handling Deadlock with respective algorithms and measures to retrieve from deadlock. .</p> <p>CO4: Have complete knowledge of Scheduling Algorithms and its types.</p> <p>CO5: understand memory organization and management</p>			
<p>Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)</p>			
Units	Contents		Required Hours
I	Introduction: operating system, history (1990s to 2000 and		17

	<p>beyond), distributed computing, parallel computation.</p> <p>Process concepts: definition of process, process states-Life cycle of a process, process management- process state transitions, process control block(PCB), process operations , suspend and resume, context switching, Interrupts - Interrupt processing, interrupt classes, Inter process communication-signals, message passing.</p>	
II	<p>Asynchronous concurrent processes: mutual exclusion-critical section, mutual exclusion primitives, implementing mutual exclusion primitives, Peterson's algorithm, software solutions to the mutual Exclusion Problem-, n-thread mutual exclusion- Lamports Bakery Algorithm. Semaphores – Mutual exclusion with Semaphores, thread synchronization with semaphores, counting semaphores, implementing semaphores.</p> <p>Concurrent programming: monitors, message passing</p>	17
III	<p>Deadlock and indefinite postponement: Resource concepts, four necessary conditions for deadlock, deadlock prevention, deadlock avoidance and Dijkstra's Banker's algorithm, deadlock detection, deadlock recovery</p>	17
IV	<p>Job and processor scheduling: scheduling levels, scheduling objectives, scheduling criteria, preemptive vs non-preemptive scheduling, interval timer or interrupting clock, priorities, scheduling algorithms- FIFO scheduling, RR scheduling, quantum size, SJF scheduling, SRT scheduling, HRN scheduling, multilevel feedback queues, Fair share scheduling</p>	17

V	<p>Real Memory organization and Management:: Memory organization, Memory management, Memory hierarchy, Memory management strategies, contiguous vs non-contiguous memory allocation, single user contiguous memory allocation, fixed partition multiprogramming, variable partition multiprogramming, Memory swapping</p> <p>Virtual Memory organization: virtual memory basic concepts, multilevel storage organization, block mapping, paging basic concepts, segmentation, paging/segmentation systems.</p> <p>Virtual Memory Management: Demand Paging, Page replacement strategies</p>	17
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	

Learning Resources:

- **Recommended Texts**

2. H.M. Deitel, Operating Systems, Third Edition, Pearson Education Asia, 2011

- **Reference Books**

3. William Stallings, Operating System: Internals and Design Principles, Seventh Edition, Prentice-Hall of India, 2012.

4. A. Silberschatz, and P.B. Galvin., Operating Systems Concepts, Ninth Edition, John Wiley & Sons(ASIA) Pte Ltd., 2012

- **Web resources**

Course Code	Java Programming		Credits
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week
Course Category :	Year & Semester:		Admission Year:
Pre-requisite			
Links to other Courses			
Learning Objectives: (for teachers: what they have to do in the class/lab/field)			
<ul style="list-style-type: none"> • To provide fundamental knowledge of object-oriented programming. • To equip the student with programming knowledge in Core Java from the basics up. • To enable the students to use AWT controls, Event Handling and Swing for GUI. 			

<p>Course Outcomes: (for students: To know what they are going to learn) CO1: Understand the basic Object-oriented concepts. Implement the basic constructs of Core Java CO2: Implement inheritance, packages, interfaces and exception handling of Core Java. CO3: Implement multi-threading and I/O Streams of Core Java CO4: Implement AWT and Event handling. CO5: Use Swing to create GUI.</p>		
<p>Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)</p>		
Units	Contents	Required Hours
I	<p>Introduction: Review of Object Oriented concepts - History of Java - Java buzzwords - JVM architecture - Data types - Variables - Scope and life time of variables - arrays - operators - control statements - type conversion and casting - simple java program - constructors - methods - Static block - Static Data - Static Method String and String Buffer Classes</p>	17
II	<p>Inheritance: Basic concepts - Types of inheritance - Member access rules - Usage of this and Super key word - Method Overloading - Method overriding - Abstract classes - Dynamic method dispatch - Usage of final keyword.</p> <p>Packages: Definition - Access Protection - Importing Packages.</p> <p>Interfaces: Definition - Implementation - Extending Interfaces.</p> <p>Exception Handling: <i>try - catch - throw - throws - finally</i> - Built-inexceptions - Creating own Exception classes.</p>	17
III	<p>Multithreaded Programming: Thread Class - Runnable interface - Synchronization - Using synchronized methods - Using <i>synchronized</i> statement - Interthread Communication - Deadlock.</p> <p>I/O Streams: Concepts of streams - Stream classes- Byte and</p>	17

	Character stream - Reading console Input and Writing Console output - File Handling.	
IV	<p>AWT Controls: The AWT class hierarchy - user interface components- Labels - Button - Text Components - Check Box - Check Box Group - Choice - List Box - Panels – Scroll Pane - Menu - Scroll Bar. Working with Frame class - Colour - Fonts and layout managers.</p> <p>Event Handling: Events - Event sources - Event Listeners - Event Delegation Model (EDM) - Handling Mouse and Keyboard Events - Adapter classes - Inner classes.</p>	17
V	<p>Swing: Introduction to Swing - Hierarchy of swing components. Containers - Top level containers - JFrame - JWindow - JDialog - JPanel - JButton - JToggleButton - JCheckBox - JRadioButton - JLabel, JtextField - JTextArea - JList - JComboBox - JScrollPane</p>	17
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	

Learning Resources:

- **Recommended Texts**

5. Herbert Schildt, *The Complete Reference*, Tata McGraw Hill, New Delhi, 7th Edition, 2010.
6. Gary Cornell, *Core Java 2 Volume I – Fundamentals*, Addison Wesley, 1999.

- **Reference Books**

5. Head First Java, O’Rielly Publications,
6. Y. Daniel Liang, *Introduction to Java Programming*, 7th Edition, Pearson Education India, 2010.

- **Web resources**

Course Code	Java Programming		Credits
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week
Course Category :	Year & Semester:		Admission Year:
Pre-requisite			
Links to other Courses			
Learning Objectives: (for teachers: what they have to do in the class/lab/field)			

- To gain practical expertise in coding Core Java programs
- To become proficient in the use of AWT, Event Handling and Swing.

Course Outcomes: (for students: To know what they are going to learn)

CO1:Code, debug and execute Java programs to solve the given problems

CO2:Implement multi-threading and exception-handling

CO3:Implement functionality using String and StringBuffer classes

CO4: Demonstrate Event Handling.

CO5: Create applications using Swing and AWT

Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)

Units	Contents	Required Hours
I	16. Write a Java program that prompts the user for an integer and then prints out all the prime numbers up to that Integer? 17. Write a Java program to multiply two given matrices. 18. Write a Java program that displays the number of characters, lines and words in a text? 19. Generate random numbers between two given limits using Random class and print messages according to the range of the value generated. 20. Write a program to do String Manipulation using Character Array and perform the following string operations: d. String length e. Finding a character at a particular position f. Concatenating two strings 21. Write a program to perform the following string operations using String class: d. String Concatenation	17

	<ul style="list-style-type: none">e. Search a substringf. To extract substring from given string <p>22. Write a program to perform string operations using StringBuffer class:</p> <ul style="list-style-type: none">d. Length of a stringe. Reverse a stringf. Delete a substring from the given string <p>23. Write a java program that implements a multi-thread application that has three threads. First thread generates random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number.</p> <p>24. Write a threading program which uses the same method asynchronously to print the numbers 1 to 10 using Thread1 and to print 90 to 100 using Thread2.</p> <p>25. Write a program to demonstrate the use of following exceptions.</p> <ul style="list-style-type: none">e. Arithmetic Exceptionf. Number Format Exceptiong. Array Index Out of Bound Exceptionh. Negative Array Size Exception <p>26. Write a Java program that reads on file name from the user, then displays information about whether the file exists, whether the file is readable, whether the file is writable, the type of file and the length of the file in bytes?</p> <p>27. Write a program to accept a text and change its size</p>	
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	<p>and font. Include bold italic options. Use frames and controls.</p> <p>28. Write a Java program that handles all mouse events and shows the event name at the center of the window when a mouse event is fired. (Use adapter classes).</p> <p>29. Write a Java program that works as a simple calculator. Use a grid layout to arrange buttons for the digits and for the +, -, *, % operations. Add a text field to display the result. Handle any possible exceptions like divide by zero.</p> <p>30. Write a Java program that simulates a traffic light. The program lets the user select one of three lights: red, yellow, or green with radio buttons. On selecting a button, an appropriate message with “stop” or “ready” or “go” should appear above the buttons in a selected color. Initially there is no message shown.</p>	
II		17
III		17
IV		17
V		17
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	<p>Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)</p>	

Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	
Learning Resources: <ul style="list-style-type: none">• Recommended Texts • Reference Books • Web resources		

Course Code	Computer Networks		Credits
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week
Course Category :	Year & Semester:	Admission Year:	
Pre-requisite			
Links to other Courses			
Learning Objectives: (for teachers: what they have to do in the class/lab/field) <ul style="list-style-type: none"> • To understand the concept of Data communication and Computer network • To get a knowledge on routing algorithms. • To impart knowledge about networking and inter networking devices 			
To gain the knowledge on Security over Network communication			
Course Outcomes: (for students: To know what they are going to learn) <p>CO1:To Understand the basics of Computer Network architecture, OSI and TCP/IP reference models</p> <p>CO2:To gain knowledge on Telephone systems and Satellite communications</p> <p>CO3:To impart the concept of Elementary data link protocols</p> <p>CO4: To analyze the characteristics of Routing and Congestion control algorithms</p> <p>CO5: To understand network security and define various protocols such as FTP, HTTP, Telnet, DNS</p>			
Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)			
Units	Contents		Required Hours
I	Introduction – Network Hardware – Software – Reference Models – OSI and TCP/IP Models – Example Networks: Internet, ATM, Ethernet and Wireless LANs - Physical Layer – Theoretical Basis for Data Communication - Guided Transmission Media		17
II	Wireless Transmission - Communication Satellites – Telephone System: Structure, Local Loop, Trunks and Multiplexing and Switching. Data Link Layer: Design Issues – Error Detection and Correction.		17
III	Elementary Data Link Protocols - Sliding Window Protocols – Data Link Layer in the Internet - Medium Access Layer –		17

	Channel Allocation Problem – Multiple Access Protocols – Bluetooth	
IV	Network Layer - Design Issues - Routing Algorithms - Congestion Control Algorithms – IP Protocol – IP Addresses – Internet Control Protocols.	17
V	Transport Layer - Services - Connection Management - Addressing, Establishing and Releasing a Connection – Simple Transport Protocol – Internet Transport Protocols (ITP) - Network Security: Cryptography.	17
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	

Learning Resources:

- **Recommended Texts**

2. A. S. Tanenbaum, “Computer Networks”, 4th Edition, Prentice-Hall of India, 2008.

- **Reference Books**

5. B. A. Forouzan, “Data Communications and Networking”, Tata McGraw Hill, 4th Edition, 2017.
6. F. Halsall, “Data Communications, Computer Networks and Open Systems”, Pearson Education, 2008.
7. D. Bertsekas and R. Gallager, “Data Networks”, 2nd Edition, PHI, 2008.
8. Lamarca, “Communication Networks”, Tata McGraw- Hill, 2002

- **Web resources**

Course Code	Open Source Software Technologies		Credits
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week
Course Category :	Year & Semester:	Admission Year:	
Pre-requisite			
<p>Learning Objectives: (for teachers: what they have to do in the class/lab/field)</p> <ul style="list-style-type: none"> • To become proficient in software development processes, databases middleware Components • To be productive in a software development environment that uses OSS components 			
<p>Course Outcomes: (for students: To know what they are going to learn)</p> <p>CO1:Acquire and understand the basic concepts in Java, application of OOPS concepts.</p> <p>CO2: Acquire knowledge about operators and decision-making statements.</p> <p>CO3: Identify the significance and application of Classes, arrays and interfaces and analyzing java arrays</p> <p>CO4: Understand about the applications of OOPS concepts and analyze overriding and packages through java programs.</p> <p>CO5: Create window-based programming using applet and graphics programming.</p> <p>Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)</p>			
Units	Contents		Required Hours
I	<p>Introduction:</p> <p>Open Source – open source vs. commercial software – What is Linux? – Free Software – Where I can use Linux? - Linux kernel – Linux distributions</p>		17

II	<p>LINUX:</p> <p>: Introduction Linux Essential Commands – File System concept – Standard Files –</p> <p>The Linux Security Model - Introduction to Unix – Unix Components – Unix Files – File</p> <p>Attributes and Permission – Standard I/O – Redirection – Pipes and Filters – Grep and Stream</p> <p>Editor – Process and Signal Commands Shell Programming – Shell Variables – Export, Read, Exit Commands – Control Structures – Arithmetic in Shell Programming – Debugging Scripts.</p>	17
III	<p>APACHE:</p> <p>Introduction - Apache Explained – Starting, Stopping and Restarting Apache –Modifying the Default configuration – Securing Apache – Set user and Group – Consider allowing access to local documentation – Don't allow public-html web sites – Apache control without access.</p>	17
IV	<p>MySQL:</p> <p>Introduction to MySQL – The show databases and table – The USE command –Create Database and Tables – Describe Table – Select, Insert, Update and Delete statement Some administrative detail – Table joins – Loading and Dumping a database.</p>	17

V	<p>PHP:</p> <p>Introduction –PHP Form processing – Database Access with PHP – MySQL, MySQL-Functions – Inserting Records – Selecting Records – Deleting Records – Update Records.Perl: Introducion – perl documentation – Perl Syntax rules – Mod perl: Introduction – Turning CGI into mod perl programs – Pure mod perl programs.</p>	17
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	
<p>Learning Resources:</p> <ul style="list-style-type: none"> • Recommended Texts <ol style="list-style-type: none"> 1. James Lee and Brent Ware “Open Source Web Development with LAMP using 2. LINUX, Apache, MySQL, Perl and PHP”, Dorling Kindersley (India) Pvt. Ltd, 2008. • Reference Books <ol style="list-style-type: none"> 1. Eric Rosebrock, Eric Filson, “Setting up LAMP: Getting Linux, Apache, MySQL and PHP and working together”, John Wiley and Sons, 2004. 		

2. Anthony Butcher , “Teach Yourself MySQL in 21 days”, 2nd Edition, Sams Publication.
3. 3. Rich Bower, Daniel Lopez Ridreejo, Alian Liska , “Apache Administrator’s Handbook”, Sams Publication.
4. Tammy Fox, “RedHat Enterprise Linux 5 Administration Unleashed”, Sams Publication.
5. 5. Naramore Eligabette, Gerner Jason, Wrox Press, Wiley Dreamtech Press, “Beginning PHP5, Apache, MySQL Web Development”, 2005.
6. Stever Holzner, “PHP: The Complete Reference”.
7. Vikram Vaswami, “The Complete Reference MySQL”, Tata McGraw Hill.
8. 8. M.G. Venkateshmurthy, “Introduction to Unix & Shell Programming”, Pearson Education India, Delhi, 2005.

- **Web resources**

Course Code	Open Source Software Technologies		Credits
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week
Course Category :	Year & Semester:	Admission Year:	
Pre-requisite			
Learning Objectives: (for teachers: what they have to do in the class/lab/field)			
<ul style="list-style-type: none"> • To introduce open source software concept • To study and learn to setup open source account, OSS license, understand Project structure and enhance open source projects. • To develop skill to make a significant contribution to open source community 			
Course Outcomes: (for students: To know what they are going to learn)			
CO1: Understand the definition of computer forensics fundamentals.			
CO2: Evaluate the different types of computer forensics technology.			
CO3: Analyze various computer forensics systems			
CO4: Apply the methods for data recovery, evidence collection and data seizure.			
CO5: Gain your knowledge of duplication and preservation of digital evidence			

Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)

Units	Contents	Required Hours
I	<p>Implement the following exercises:</p> <ol style="list-style-type: none"> 1. Design a menu driven program for rename, remove and copy commands. 2. Write a shell program to find the details of a user session. 3. Write a shell program to change the extension of a given file. 4. Write a program to get two user inputs – the file name and the column no(n). using cat 5. Command, list the nth column from mentioned file. 6. Use an if/then/else construct that prints information about the current month. The script should print the number of days in this month, and give information about leap year if the current month is February. 7. Check whether the given number is Armstrong / prime / perfect or not. 8. Write a shell program to find the substring of the given string. 9. Write a shell program to compare two given strings. 10. Create a text file containing any three lines using perl. 11. Create a MySQL table and execute queries to read, add, remove and modify a record from that table 12. Write a server side PHP program that displays marks, total, grade of student in tabular format by accepting user inputs for name, number 	17

	<p>and marks from a HTML form.</p> <p>13. Write a PHP program that adds products that are selected from a web page to a shopping cart.</p> <p>14. Write a PHP program to access the data stored in a MySQL table.</p>	
II		17
III		17
IV		17
V		17
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	<p>Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)</p>	
Skills acquired from the course	<p>Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</p>	
<p>Learning Resources:</p> <ul style="list-style-type: none"> • Recommended Texts • Reference Books • Web resources 		

Course Code	Mobile Application Development		Credits
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week
Course Category :	Year & Semester:	Admission Year:	
Pre-requisite			
<p>Learning Objectives: (for teachers: what they have to do in the class/lab/field)</p> <ol style="list-style-type: none"> 1. Student understands the working of Android OS Practically. 2. Student will be able to develop Android user interfaces 3. Student will be able to develop, deploy and maintain the Android Applications 			
<p>Course Outcomes: (for students: To know what they are going to learn)</p> <p>CO1:Introduction to Android, Installation process, application and resources.</p> <p>CO2: Android applications, activities and services on their design.</p> <p>CO3:Prototyping techniques to design and develop sophisticated mobile user interfaces.</p> <p>CO4: Program mobile applications for the Android operating system that use basic and advanced phone features.</p> <p>CO5: Deploy applications to the Android marketplace for distribution</p>			
<p>Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)</p>			
Units	Contents	Required Hours	
I	Introduction to Android: The Android Platform, Android SDK, Eclipse Installation, Android Installation, Android Architecture, Android-Application Components, Building your First Android application, Android Resources (Manifest file).	17	
II	Android Applications: Android terminologies, Application Context, Android-Activities, Android-Services, Android Broadcast Receivers, Android Intents and types of objects/Filters, Android-Fragment, Manifest File and its common settings, Using Intent Filter, Permissions.	17	
III	Android User Interface Design: UI Controls, Designing User Interfaces with Layouts, Android-Event Handling, Drawing and Working with Animation. Android UI Design, UI Patterns	17	

	and UI Testing.	
IV	Android Advanced Concepts: Android Drag and drop, Location Based Services, Android Sending Email and SMS, Testing Android applications, Publishing Android application. Managing Application resources in a hierarchy, working with different types of resources.	17
V	Using Common Android APIs: Using Android Data and Storage APIs, Managing data using Sqlite, Sharing Data between Applications with Content Providers, Using Android Networking APIs, Using Android Web APIs, Using Android Telephony APIs, Deploying Android Application to the World.	17
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	
Learning Resources: <ul style="list-style-type: none"> • Recommended Texts <ol style="list-style-type: none"> 1. Lauren Darcey and Shane Conder, “Android Wireless Application Development”, Pearson Education, 2nd ed. (2011) 2. Android Mobile Application Development, ISBN-978-81-940577-2-7 June 2019 by Dr. Babasaheb Ambedkar Open University • Reference Books <ol style="list-style-type: none"> 1. . Reto Meier, “Professional Android 2 Application Development”, Wiley India 		

Pvt Ltd

2. Mark L Murphy, "Beginning Android", Wiley India Pvt Ltd
3. Android Application Development All in one for Dummies by Barry Burd,
Edition: I

- **Web resources**

Course Code	Software Engineering		Credits
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week
Course Category :	Year & Semester:	Admission Year:	
Pre-requisite			
Learning Objectives: (for teachers: what they have to do in the class/lab/field)			
<ul style="list-style-type: none"> To understand the software engineering concepts and to create a system model in real life applications 			

<p>Course Outcomes: (for students: To know what they are going to learn)</p> <p>CO1: Gain basic knowledge of analysis and design of systems</p> <p>CO2: Ability to apply software engineering principles and techniques</p> <p>CO3: Model a reliable and cost-effective software system</p> <p>CO4: Ability to design an effective model of the system</p> <p>CO5: Perform Testing at various levels and produce an efficient system.</p>		
<p>Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)</p>		
Units	Contents	Required Hours
I	<p>Introduction: The software engineering discipline, programs vs. software products, why study software engineering, emergence of software engineering, Notable changes in software development practices, computer systems engineering.</p> <p>Software Life Cycle Models: Why use a life cycle model, Classical waterfall model, iterative waterfall model, prototyping model, evolutionary model, spiral model, comparison of different life cycle models.</p>	17
II	<p>Requirements Analysis and Specification: Requirements gathering and analysis, Software requirements specification (SRS)</p> <p>Software Design: Good software design, cohesion and coupling, neat arrangement, software design approaches, object- oriented vs function-oriented design</p>	17
III	<p>Function-Oriented Software Design: Overview of SA/SD methodology, structured analysis, data flow diagrams (DFD's), structured design, detailed design.</p>	17

	User-Interface design: Characteristics of a good interface; basic concepts; types of user interfaces; component based GUI development, a user interface methodology.	
IV	<p>Coding and Testing: Coding; code review; testing; testing in the large vs testing in the small; unit testing; black-box testing; white-box testing; debugging; program analysis tools; integration testing; system testing; some general issues associated with testing.</p> <p>Software Reliability and Quality Management: Software reliability; statistical testing; software quality; software quality management system; SEI capability maturity model; personal software process.</p>	17
V	<p>Computer Aided Software Engineering: CASE and its scope; CASE environment; CASE support in software life cycle; other characteristics of CASE tools; towards second generation CASE tool; architecture of a CASE environment.</p> <p>Software Maintenance: Characteristic of software maintenance; software reverse engineering; software maintenance process models; estimation of maintenance cost;</p>	17
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	<p>Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)</p>	

Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	
<p>Learning Resources:</p> <ul style="list-style-type: none"> • Recommended Texts <ol style="list-style-type: none"> 2. Rajib Mall, Fundamentals of Software Engineering, Fifth Edition, Prentice-Hall of India, 2018 • Reference Books <ol style="list-style-type: none"> 3. Richard Fairley, Software Engineering Concepts, Tata McGraw-Hill publishing company Ltd, Edition 1997. 4. Roger S. Pressman, Software Engineering, Seventh Edition, McGraw-Hill. <p>James A. Senn, Analysis & Design of Information Systems, Second Edition, McGraw-Hill International Editions.</p> • Web resources 		

Course Code	UNIX Programming		Credits
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week
Course Category :	Year & Semester:	Admission Year:	
Pre-requisite			
<p>Learning Objectives: (for teachers: what they have to do in the class/lab/field) In-depth coverage of the UNIX command shell, file manipulation, process control, file system utilities, mail, pipes and filters, I/O redirection, process management, UNIX editors, scripting language, and shell scripting.</p>			
<p>Course Outcomes: (for students: To know what they are going to learn) CO1:This manuscript provides a comprehensive introduction to UNIX and its variants. CO2: Create and modify text files using powerful text editors CO3:Share devices, printers, and files between Windows and UNIX systems. CO4: Work with files, directories, commands, and the UNIX shell. CO5: Use and manage e-mail, Protect and maintain the security of your UNIX system and network.</p>			
<p>Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)</p>			
Units	Contents		Required Hours
I	<p>Background Introduction of UNIX- Importance of UNIX -The Structure of the UNIX Operating System - Applications - The UNIX Philosophy - The Birth of the UNIX System -GNU and Linux - UNIX Standards - Widely Used UNIX Variants - A UNIX System Timeline - UNIX Contributors - The UNIX System and Microsoft Windows NT Versions - The Future of UNIX .</p>		17

II	Getting Started and Text Editing Starting Out - Logging In - Entering Commands - Getting Started with Electronic Mail - Logging Out - Text Editing - Editing with vi - Editing with emacs - Editing with vim - Editing with pico.	17
III	Working with Files and Directories Directories - The Hierarchical File Structure - UNIX System File Types - Common Commands for Files and Directories - Searching for Files - More About Listing Files - Permissions - Viewing Long Files - Printing Files .	17
IV	Command Shell Running the Shell - Using Wildcards - Standard Input and Output - Running Commands in the Background - Job Control - Configuring the Shell - Shell Variables - Command Aliases - Command History - Command-Line Editing - Command Substitution - Filename Completion - Removing Special Meanings in Command Lines .	17
V	Electronic Mail and Process Scheduling Command-Line Mail Programs - Screen-Oriented Mail Programs - Graphical Interfaces for E-Mail - Tools for Managing E-Mail - Processes - Process Scheduling - Process	17

	Priorities - Signals and Semaphores - Real Time Processes	
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	
<p>Learning Resources:</p> <ul style="list-style-type: none"> • Recommended Texts <ol style="list-style-type: none"> 1. UNIX-The Complete Reference, Second Edition, by Kenneth H. Rosen et al. McGraw-Hill/Osborne 2007 (912 pages) ISBN:9780072263367. • Reference Books <ol style="list-style-type: none"> 1. UNIX Programming Environment, The (Prentice-Hall Software Series) by BRAIN W. KERNIGHAN & ROB PIKE, . 2. The Art of UNIX Programming, Book by Eric S. Raymond, 2003. • Web resources 		

Course Code	UNIX Programming		Credits
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week
Course Category :	Year & Semester:	Admission Year:	
Pre-requisite			
Learning Objectives: (for teachers: what they have to do in the class/lab/field)			
Course Outcomes: (for students: To know what they are going to learn)			
CO1:			
CO2:			
CO3:			
CO4:			
CO5:			
Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)			
Units	Contents		Required Hours
I	1. In your home directory create a directory named DIR		17

	<ol style="list-style-type: none"> 2. Copy all files whose filenames satisfy the following conditions to ~/DIR. The files are in /usr/include directory, their names start with m, end with .h and contain a number. 3. Create a subdirectory called SUBDIR in your DIR directory. 4. The first five lines of each file you have copied from /usr/include copy to file ~/DIR/SUBDIR/firstfive. 5. The last lines of files in ~/DIR copy to file ~/DIR/SUBDIR/last. 6. Concatenate the two files in ~/DIR/SUBDIR into one file ~/DIR/SUBDIR/firstandlast 7. Delete the files in ~/DIR/SUBDIR except firstandlast. 8. Store the number of files and directories in ~/DIR into a file ~/DIR/SUBDIR/count 9. Output the long information on ~/DIR/SUBDIR directory. (Not its content, but information on it). 10. Delete the contents of ~/DIR/SUBDIR/firstandlast file without removing the file itself. 11. Add a line containing just a star sign (i.e. *) to file ~/DIR/SUBDIR/firstandlast. 12. Delete ~/DIR together with all the files it contains. (Show solutions to preceding exercises) 13. Output lines number 11-20 from file /etc/passwd. (Show solution) 	
II		17

III		17
IV		17
V		17
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	
Learning Resources: <ul style="list-style-type: none"> • Recommended Texts • Reference Books • Web resources 		

Course Code	Internet of Things		Credits
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week
Course Category :	Year & Semester:	Admission Year:	
Pre-requisite			
Learning Objectives: (for teachers: what they have to do in the class/lab/field) To understand the concepts of Internet of Things and the application of IoT			
Course Outcomes: (for students: To know what they are going to learn) CO1: Use of Devices, Gateways and Data Management in IoT. CO2: Design IoT applications in different domain and be able to analyze their performance CO3: Implement basic IoT applications on embedded platform CO4: To gain knowledge on Industry Internet of Things CO5: To Learn about the privacy and Security issues in IoT			
Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)			
Units	Contents	Required Hours	
I	IoT & Web Technology, The Internet of Things Today, Time for Convergence, Towards the IoT Universe, Internet of Things Vision, IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet Technologies, Infrastructure, Networks and Communication, Processes, Data Management, Security, Privacy & Trust, Device Level Energy Issues, IoT Related Standardization, Recommendations on Research Topics.	17	
II	M2M to IoT – A Basic Perspective– Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An	17	

	emerging industrial structure for IoT, The international driven global value chain and global information monopolies. M2M to IoT-An Architectural Overview–Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.	
III	IoT Architecture -State of the Art – Introduction, State of the art, Architecture. Reference Model- Introduction, Reference Model and architecture, IoT reference Model, IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views	17
IV	IoT Applications for Value Creations Introduction, IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications, Four Aspects in your Business to Master IoT, Value Creation from Big Data and Serialization, IoT for Retailing Industry, IoT For Oil and GasIndustry, Opinions on IoT Application and Value for Industry, Home Management, eHealth.	17
V	Internet of Things Privacy, Security and Governance Introduction, Overview of Governance, Privacy and Security Issues, Contribution from FP7 Projects, Security, Privacy and Trust in IoT-Data-Platforms for Smart Cities, First Steps Towards a Secure Platform, Smartie Approach. Data Aggregation for the IoT in Smart Cities, Security	17

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	

Learning Resources:

- **Recommended Texts**

1. Vijay Madiseti and Arshdeep Bahga, "Internet of Things: (A Hands-on Approach)", Universities Press (INDIA) Private Limited 2014, 1st Edition.

- **Reference Books**

1. Michael Miller, "The Internet of Things: How Smart TVs, Smart Cars, Smart Homes, and Smart Cities Are Changing the World", kindle version.
2. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", Apress Publications 2013, 1st Edition,.
3. WalteneagusDargie, ChristianPoellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice"
- 4..CunoPfister, "Getting Started with the Internet of Things", O"Reilly Media 2011

- **Web resources**

Course Code	R Programming		Credits
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week
Course Category :	Year & Semester:	Admission Year:	
Pre-requisite			
Learning Objectives: (for teachers: what they have to do in the class/lab/field) <ul style="list-style-type: none"> • To understand and able to use basic programming concepts • To automate data analysis, working collaboratively and openly on code • To know how to generate dynamic documents 			

<p>Course Outcomes: (for students: To know what they are going to learn)</p> <p>CO1:To understand the problem solving approaches</p> <p>CO2: To learn the basic programming constructs in R Programming</p> <p>CO3:To learn the basic programming constructs in R Programming</p> <p>CO4: To use R Programming data structures - lists, tuples, dictionaries.</p> <p>CO5: To do input/output with files in R Programming.</p> <p>Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)</p>		
Units	Contents	Required Hours
I	INTRODUCTION -Overview of R, R data types and objects, reading and writing data, sub setting R Objects, Essentials of the R Language, Installing R, Running R, Packages in R, Calculations, Complex numbers in R, Rounding, Arithmetic, Modulo and integer quotients, Variable names and assignment, Operators, Integers, Factors, Logical operations	17
II	CONTROL STRUCTURES AND VECTORS -Control structures, functions, scoping rules, dates and times, Introduction to Functions, preview of Some Important R Data Structures, Vectors, Character Strings, Matrices, Lists, Data Frames, Classes Vectors: Generating sequences, Vectors and subscripts, Extracting elements of a vector using subscripts, Working with logical subscripts, Scalars, Vectors, Arrays, and Matrices, Adding and Deleting Vector Elements, Obtaining the Length of a Vector, Matrices and Arrays as Vectors Vector Arithmetic and Logical Operations, Vector Indexing, Common Vector Operations	17
III	LISTS- Lists: Creating Lists, General List Operations, List Indexing Adding and Deleting List Elements, Getting the Size	17

	of a List, Extended Example: Text Concordance Accessing List Components and Values Applying Functions to Lists, Data Frames, Creating Data Frames, Accessing Data Frames, Other Matrix-Like Operations	
IV	FACTORS AND TABLES - Factors and Levels, Common Functions Used with Factors, Working with Tables, Matrix/Array-Like Operations on Tables , Extracting a Subtable, Finding the Largest Cells in a Table, Math Functions, Calculating a Probability, Cumulative Sums and Products, Minima and Maxima, Calculus, Functions for Statistical Distributions R PROGRAMMING	17
V	OBJECT-ORIENTED PROGRAMMING S Classes, S Generic Functions, Writing S Classes, Using Inheritance, S Classes, Writing S Classes, Implementing a Generic Function on an S Class, visualization, Simulation, code profiling, Statistical Analysis with R, data manipulation	17
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	

Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	
<p>Learning Resources:</p> <ul style="list-style-type: none"> • Recommended Texts <ol style="list-style-type: none"> 1. Roger D. Peng, " R Programming for Data Science ", 2012 2. Norman Matloff, "The Art of R Programming- A Tour of Statistical Software Design", 2011 • Reference Books <ol style="list-style-type: none"> 1. Garrett Golemund, Hadley Wickham, "Hands-On Programming with R: Write Your Own Functions and Simulations" , 1st Edition, 2014 2. Venables , W.N.,and Ripley, "S programming", Springer, 2000. • Web resources 		

Course Code	R Programming		Credits
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week
Course Category :	Year & Semester:	Admission Year:	
Pre-requisite			
Learning Objectives: (for teachers: what they have to do in the class/lab/field) <ul style="list-style-type: none"> • Acquire programming skills in core R Programming • Acquire Object-oriented programming skills in R Programming. • Develop the skill of designing graphical-user interfaces (GUI) in R Programming • Acquire R Programming skills to move into specific branches 			
Course Outcomes: (for students: To know what they are going to learn) CO1: To understand the problem solving approaches CO2: To learn the basic programming constructs in R Programming CO3: To practice various computing strategies for R Programming -based solutions to real world problems CO4: To use R Programming data structures - lists, tuples, dictionaries. CO5: To do input/output with files in R Programming			
Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)			
Units	Contents		Required Hours
I	LIST OF EXERCISES: 1. Program to convert the given temperature from Fahrenheit to Celsius and vice versa depending upon user's choice. 2. Program, to find the area of rectangle, square, circle and triangle by accepting suitable input		17

	<p>parameters from user.</p> <p>3. Write a program to find list of even numbers from 1 to n using R-Loops.</p> <p>4. Create a function to print squares of numbers in sequence.</p> <p>5. Write a program to join columns and rows in a data frame using cbind() and rbind() in R.</p> <p>6. Implement different String Manipulation functions in R.</p> <p>7. Implement different data structures in R (Vectors, Lists, Data Frames)</p> <p>8. Write a program to read a csv file and analyze the data in the file in R.</p> <p>9. Create pie chart and bar chart using R.</p> <p>10. Create a data set and do statistical analysis on the data using R.</p> <p>11. Program to find factorial of the given number using recursive function</p> <p>12. Write a R program to count the number of even and odd numbers from array of N numbers.</p>	
II		17
III		17
IV		17
V		17

<p>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</p>	<p>Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)</p>	
<p>Skills acquired from the course</p>	<p>Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</p>	
<p>Learning Resources:</p> <ul style="list-style-type: none"> • Recommended Texts • Reference Books • Web resources 		

Course Code		Advanced Excel		Credits
Lecture Hours: (L) per week		Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week
Course Category :		Year & Semester:		Admission Year:
Pre-requisite				
<p>Learning Objectives: (for teachers: what they have to do in the class/lab/field) The objective of this course is to help the students learn the advanced features of Excel, to summarise, analyse, explore, and present visualisations of data in the form of charts, graphs.</p>				
<p>Course Outcomes: (for students: To know what they are going to learn) CO1:Handle large amounts of data CO2: Aggregate numeric data and summarise into categories and subcategories CO3:Filtering, sorting, and grouping data or subsets of data CO4: Create pivot tables to consolidate data from multiple files CO5: Presenting data in the form of charts and graphs</p>				
<p>Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)</p>				
Units	Contents			Required Hours
I	Basics of Excel- Customizing common options- Absolute and relative cells- Protecting and un-protecting worksheets and cells- Working with Functions - Writing conditional expressions - logical functions - lookup and reference functions- VlookUP with Exact Match, Approximate Match- Nested VlookUP with Exact Match- VlookUP with Tables, Dynamic Ranges- Nested VlookUP with Exact Match- Using VLookUP to consolidate Data from Multiple Sheets			17

II	Data Validations - Specifying a valid range of values - Specifying a list of valid values- Specifying custom validations based on formula - Working with Templates Designing the structure of a template- templates for standardization of worksheets - Sorting and Filtering Data - Sorting tables- multiple-level sorting- custom sorting- Filtering data for selected view - advanced filter options- Working with Reports Creating subtotals- Multiple-level subtotal.	17
III	Creating Pivot tables Formatting and customizing Pivot tables- advanced options of Pivot tables- Pivot charts- Consolidating data from multiple sheets and files using Pivot tables- external data sources- data consolidation feature to consolidate data- Show Value As % of Row, % of Column, Running Total, Compare with Specific Field- Viewing Subtotal under Pivot- Creating Slicers.	17
IV	More Functions Date and time functions- Text functions- Database functions- Power Functions - Formatting Using auto formatting option for worksheets- Using conditional formatting option for rows, columns and cells- Whatif Analysis - Goal Seek- Data Tables- Scenario Manager.	17
V	Charts - Formatting Charts- 3D Graphs- Bar and Line Chart together- Secondary Axis in Graphs- Sharing Charts with PowerPoint / MS Word, Dynamically- New Features Of Excel Sparklines, Inline Charts, data Charts- Overview of all the	17

	new features.	
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	
<p>Learning Resources:</p> <ul style="list-style-type: none"> • Recommended Text <ol style="list-style-type: none"> 1. Excel 2019 All-in-One For Dummies – 2018- <u>Greg Harvey</u> 2. Microsoft Excel 2019 Pivot Table Data Crunching-2019,<u>Bill Jelen</u> and <u>Michael Alexander</u> • Reference Books • Web resources 		

Course Code	Advanced Excel		Credits
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week
Course Category :	Year & Semester:	Admission Year:	
Pre-requisite			
<p>Learning Objectives: (for teachers: what they have to do in the class/lab/field) The objective of this course is to help the students get hands on exposure on the advanced concepts in Excel .</p>			

Course Outcomes: (for students: To know what they are going to learn)		
CO1: Understand and use the formulas and filters		
CO2: Create and use pivot tables with required formatting		
CO3: Build pivot table reports with grouping options, formulas and subtotals.		
CO4: Implement report filters and report slicers		
CO5: Analyse data using Charts and Graphs.		
Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)		
Units	Contents	Required Hours
I	List of Exercises <ol style="list-style-type: none"> 1. Using Formulas – VLOOKUP,COUNTIFS,COUNT,IF,COUNTIF,COUNTIFS 2. Using Filters - Quick Filtering ,Filtering by Multiple Criteria, Saving the filtered data, Performing Calculations on Filtered Data 3. PivotTable - Adding row labels, adding column data, changing formulas in columns, changing headers & number formats 4. PivotTable Report – Adding multiple row labels, collapsing and expanding, drill down to data, sorting, & refreshing. 5. Pivot Table Report - Grouping by dates, grouping by ranges, show items with no detail, show values in empty cells, grouping across columns 6. User defined groups, adding/removing ,subtotals 7. Using formulas on pivoted data 8. Displaying multiple row labels in columns, or tabular form 9. Report Filters and Report Slicers 10. Expanding Filter Results to Individual Tabs 11. Using Date,Time and Text Functions 12. Formatting reports using Charts and Graphs 	17
II		17
III		17
IV		17

V		17
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	
<p>Learning Resources:</p> <ul style="list-style-type: none"> • Recommended Texts 1. Excel 2019 All-in-One For Dummies – 2018- <u>Greg Harvey</u> 2. Microsoft Excel 2019 Pivot Table Data Crunching-2019,<u>Bill Jelen</u> and <u>Michael Alexander</u> • Reference Books • Web resources 		

Course Code	.Net Programming		Credits
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week
Course Category :	Year & Semester:	Admission Year:	
Pre-requisite			
<p>Learning Objectives: (for teachers: what they have to do in the class/lab/field)</p> <p>6. To develop ASP.NET Web application using standard controls.</p> <p>7. To create rich database applications using ADO.NET.</p> <p>8. To implement file handling operations.</p> <p>9. To utilize ASP.NET security features for authenticating the web site.</p> <p>10. To handles SQL Server Database using ADO.NET.</p>			
<p>Course Outcomes: (for students: To know what they are going to learn)</p> <p>CO1: To identify and understand the goals and objectives of the .NET framework and ASP.NET with C# language.</p> <p>CO2: To develop web application using various controls</p> <p>CO3:To analyze C# programming techniques in developing web applications.</p> <p>CO4: To assess a Web application using Microsoft ADO.NET.</p> <p>CO5: To develop a software to solve real-world problems using ASP.NET</p>			
<p>Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)</p>			
Units	Contents	Required Hours	
I	Overview of .NET framework: Common Language Runtime (CLR), Framework Class Library- C# Fundamentals: Primitive types and Variables – Operators - Conditional statements -Looping statements – Creating and using Objects – Arrays – String operations.	17	
II	Introduction to ASP.NET - IDE-Languages supported	17	

	Components -Working with Web Forms – Web form standard controls: Properties and its events – HTML controls - List Controls: Properties and its events.	
III	Rich Controls: Properties and its events – validation controls: Properties and its events – File Stream classes - File Modes – File Share – Reading and Writing to files – Creating, Moving, Copying and Deleting files – File uploading	17
IV	ADO.NET Overview – Database Connections – Commands – Data Reader - Data Adapter - Data Sets - Data Controls and its Properties - Data Binding	17
V	Grid View control: Deleting, editing, Sorting and Paging. XML classes – Web form to manipulate XML files - Website Security - Authentication - Authorization – Creating a Web application	17
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	

Learning Resources:

- **Recommended Texts**

1. SvetlinNakov,VeselinKolev& Co, Fundamentals of Computer Programming with C#,Faber publication, 2019.
2. Mathew, Mac Donald, The Complete Reference ASP.NET, Tata McGraw-Hill ,2015.

- **Reference Books**

1. Herbert Schildt, The Complete Reference C#.NET, Tata McGraw-Hill,2017.
2. Kogent Learning Solutions, C# 2012 Programming Covers .NET 4.5 Black Book, Dreamtech pres,2013.
3. Anne Boehm, Joel Murach, Murach's C# 2015, Mike Murach& Associates Inc. 2016.
4. DenielleOtey, Michael Otey, ADO.NET: The Complete reference, McGraw Hill,2008.
5. Matthew MacDonald, Beginning ASP.NET 4 in C# 2010, APRESS,2010.

- **Web resources**

Course Code	.Net Programming		Credits
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week
Course Category :	Year & Semester:	Admission Year:	
Pre-requisite			
<p>Learning Objectives: (for teachers: what they have to do in the class/lab/field)</p> <ol style="list-style-type: none"> 1. To develop ASP.NET Web application using standard controls. 2. To create rich database applications using ADO.NET. 3. To implement file handling operations. 4. To utilize ASP.NET security features for authenticating the web site. 5. To handles SQL Server Database using ADO.NET. 			
<p>Course Outcomes: (for students: To know what they are going to learn)</p> <p>CO1: To identify and understand the goals and objectives of the .NET framework and ASP.NET with C# language.</p> <p>CO2: To develop web application using various controls.</p> <p>CO3:To analyze C# programming techniques in developing web applications</p> <p>CO4: To assess a Web application using Microsoft ADO.NET.</p> <p>CO5: To develop a software to solve real-world problems using ASP.NET</p>			
<p>Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)</p>			
Units	Contents		Required Hours

I	<p>List of Exercises:</p> <p>15. Create an exposure of Web applications and tools</p> <p>16. Implement the Html Controls</p> <p>17. Implement the Server Controls</p> <p>18. Web application using Web controls.</p> <p>19. Web application using List controls.</p> <p>20. Web Page design using Rich control. Validate user input using Validation controls. Working with File concepts</p> <p>21. Web application using Data Controls.</p> <p>22. Data binding with Web controls</p> <p>23. Data binding with Data Controls.</p> <p>24. Database application to perform insert, update and delete operations.</p> <p>25. Database application using Data Controls to perform insert, delete, edit, paging and sorting operation.</p> <p>26. Implement the Xml classes.</p> <p>27. Implement Authentication – Authorization.</p> <p>28. Ticket reservation using ASP.NET controls.</p> <p>Online examination using ASP.NET controls</p>	17
II		17
III		17
IV		17
V		17

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	

Learning Resources:

- **Recommended Texts**

1. SvetlinNakov,VeselinKolev& Co, Fundamentals of Computer Programming with C#,Faber publication, 2019.
2. Mathew, Mac Donald, The Complete Reference ASP.NET, Tata McGraw-Hill ,2015.

- **Reference Books**

1. Herbert Schildt, The Complete Reference C#.NET, Tata McGraw-Hill,2017.
2. Kogent Learning Solutions, C# 2012 Programming Covers .NET 4.5 Black Book, Dreamtech pres,2013.
3. Anne Boehm, Joel Murach, Murach’s C# 2015, Mike Murach& Associates Inc. 2016.
4. DenielleOtey, Michael Otey, ADO.NET: The Complete reference, McGraw Hill,2008.
5. Matthew MacDonald, Beginning ASP.NET 4 in C# 2010, APRESS,2010.

- **Web resources**

Course Code	Markup and Scripting Languages		Credits
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week
Course Category :	Year & Semester:	Admission Year:	
Pre-requisite			
<p>Learning Objectives: (for teachers: what they have to do in the class/lab/field)</p> <ul style="list-style-type: none"> • To understand Web based programming and scripting languages. • To learn the basic web concepts and to create rich internet applications that use most recent client-side programming technologies. 			

<p>Course Outcomes: (for students: To know what they are going to learn) CO1:To learn the basics of HTML, DHTML, XML, CSS, Java Script and AJAX. CO2: Ability to Develop and publish Web pages using Hypertext Markup Language (HTML). CO3:Ability to optimize page styles and layout with Cascading Style Sheets (CSS). CO4: Ability to Understand, analyze and apply the role of languages to create a capstone CO5: Website using client-side web programming languages like HTML, DHTML, CSS, XML, JavaScript, and AJAX.</p>		
<p>Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)</p>		
Units	Contents	Required Hours
I	HTML: HTML-Introduction-tag basics- page structure-adding comments working with texts, paragraphs and line break. Emphasizing test- heading and horizontal rules-list-font size, face and color-alignmentlinks-tables-frames	17
II	Forms & Images Using Html: Graphics: Introduction-How to work efficiently with images in web pages, image maps, GIF animation, adding multimedia, data collection with html forms textbox, password, list box, combo box, text area, tools for building web page front page	17
III	XML & DHTML: Cascading style sheet (CSS)-what is CSS-Why we use CSS-adding CSS to your web pages-Grouping styles-extensible markup language (XML). Dynamic HTML: Document object model (DCOM)-Accessing HTML & CSS through DCOM Dynamic content styles & positioning-Event bubbling-data binding.	17
IV	JavaScript: Client-side scripting, What is JavaScript, How to develop JavaScript, simple JavaScript, variables, functions, conditions, loops and repetition, Advance script, JavaScript and objects, JavaScript own objects, the DOM and web browser environments, forms and validations	17

V	Ajax: Introduction, advantages &disadvantages, Purpose of it, ajax based web application, alternatives of ajax Java Script & AJAX: Introduction to array-operators, making statements-date & time-mathematicsstrings-Event handling-form properties. AJAX. Introduction to jQuery and AngularJS.	17
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	
<p>Learning Resources:</p> <ul style="list-style-type: none"> • Recommended Texts <ol style="list-style-type: none"> 1. Pankaj Sharma, “Web Technology”, Sk Kataria & Sons Bangalore 2011.(UNIT I, II, III & IV). 2. Mike Mcgrath, “Java Script”, Dream Tech Press 2006, 1st Edition. (UNIT V: JAVASCRIPT) 3. Achyut S Godbole & Atul Kahate, “Web Technologies”, 2002, 2nd Edition. (UNIT V: AJAX) • Reference Books <ol style="list-style-type: none"> 1. Laura Lemay, Rafe Colburn , Jennifer Kyrnin, “Mastering HTML, CSS & Javascript Web Publishing”, 2016. 2. DT Editorial Services (Author), “HTML 5 Black Book (Covers CSS3, JavaScript, XML, 		

XHTML, AJAX, PHP, jQuery)”, Paperback 2016, 2nd Edition.

- **Web resources**

1. NPTEL & MOOC courses titled Web Design and Development.

Course Code	Markup and Scripting Languages		Credits
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week
Course Category :	Year & Semester:	Admission Year:	
Pre-requisite			
<p>Learning Objectives: (for teachers: what they have to do in the class/lab/field) Hyper Text Markup Language is a set of logical codes (markup) in parentheses that constitute the appearance of a web document and the information it contains. It is a language for creating static web pages. It specifies how the contents are to be presented on the web page. HTML is not a case sensitive language so; HTML and html both are same.</p>			
<p>Course Outcomes: (for students: To know what they are going to learn) CO1: CO2: CO3: CO4: CO5:</p>			
<p>Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)</p>			
Units	Contents		Required Hours
I	<ol style="list-style-type: none"> 1. Introduction to HTML. Create a basic web page 2. Create a static webpage using table tags of HTML 3. Create a static web page which defines all text formatting tags of HTML in tabular format 4. Create webpage using list tags of HTML 5. Create webpage to include image using HTML tag 6. Create employee registration webpage using HTML form objects 		17

II		17
III		17
IV		17
V		17
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	
Learning Resources: <ul style="list-style-type: none"> • Recommended Texts • Reference Books • Web resources 		

Course Code	Big Data Analytics		Credits
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week
Course Category :	Year & Semester:	Admission Year:	
Pre-requisite			
<p>Learning Objectives: (for teachers: what they have to do in the class/lab/field)</p> <ol style="list-style-type: none"> 3. To know the fundamental concepts of big data and analytics. 4. To explore tools and practices for working with big data. 			
<p>Course Outcomes: (for students: To know what they are going to learn)</p> <p>CO1: Work with big data tools and its analysis techniques.</p> <p>CO2: Analyze data by utilizing clustering and classification algorithms.</p> <p>CO3: Learn and apply different mining algorithms and recommendation systems for large volumes of data.</p> <p>CO4: Perform analytics on data streams.</p> <p>CO5: Learn NoSQL databases and management.</p>			
<p>Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)</p>			
Units	Contents		Required Hours

I	INTRODUCTION TO BIG DATA : Evolution of Big data — Best Practices for Big data Analytics — Big data characteristics — Validating — The Promotion of the Value of Big Data — Big Data Use Cases- Characteristics of Big Data Applications — Perception and Quantification of Value -Understanding Big Data Storage — A General Overview of High-Performance Architecture — HDFS — MapReduce and YARN — Map Reduce Programming Model	17
II	CLUSTERING AND CLASSIFICATION : Advanced Analytical Theory and Methods: Overview of Clustering — K-means — Use Cases — Overview of the Method — Determining the Number of Clusters — Diagnostics — Reasons to Choose and Cautions .- Classification: Decision Trees — Overview of a Decision Tree — The General Algorithm — Decision Tree Algorithms — Evaluating a Decision Tree — Decision Trees in R — Naïve Bayes — Bayes? Theorem — Naïve Bayes Classifier	17
III	ASSOCIATION AND RECOMMENDATION SYSTEM: Advanced Analytical Theory and Methods: Association Rules — Overview — Apriori Algorithm — Evaluation of Candidate Rules — Applications of Association Rules — Finding Association& finding similarity — Recommendation System: Collaborative Recommendation- Content Based Recommendation — Knowledge Based Recommendation- Hybrid Recommendation Approaches	17
IV	STREAM MEMORY: Introduction to Streams Concepts — Stream Data Model and Architecture — Stream Computing, Sampling Data in a Stream — Filtering Streams — Counting	17

	Distinct Elements in a Stream — Estimating moments — Counting oneness in a Window — Decaying Window — Real time Analytics Platform(RTAP) applications — Case Studies — Real Time Sentiment Analysis, Stock Market Predictions. Using Graph Analytics for Big Data: Graph Analytics	
V	NOSQL DATA MANAGEMENT FOR BIG DATA AND VISUALIZATION :NoSQL Databases : Schema-less Models?: Increasing Flexibility for Data Manipulation-Key Value Stores- Document Stores — Tabular Stores — Object Data Stores — Graph Databases Hive — Sharding —Hbase — Analyzing big data with twitter — Big data for E-Commerce Big data for blogs — Review of Basic Data Analytic Methods using R.	17
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	

Learning Resources:

- **Recommended Texts**

2. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.

- **Reference Books**

3. David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", Morgan Kaufmann/El sevier Publishers, 2013.
4. 2. EMC Education Services, "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", Wiley publishers, 2015.

- **Web resources**

Course Code	Mini Project		Credits
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week
Course Category :	Year & Semester:	Admission Year:	
Pre-requisite			
Learning Objectives: (for teachers: what they have to do in the class/lab/field)			

Course Outcomes: (for students: To know what they are going to learn) CO1: CO2: CO3: CO4: CO5:		
Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)		
Units	Contents	Required Hours
I	Each student will take a specific problem for the Mini Project and solve it using any one of latest tool and submit a report. Further each student will participate in regular project review with group project guide / Faculty.	17
II		17
III		17
IV		17
V		17
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	

Learning Resources:

- **Recommended Texts**
- **Reference Books**

- **Web resources**

Course Code		Computing Intelligence		Credits
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week	
Course Category :	Year & Semester:	Admission Year:		
Pre-requisite				
<p>Learning Objectives: (for teachers: what they have to do in the class/lab/field)</p> <ul style="list-style-type: none"> To provide strong foundation on fundamental concepts in Computing Intelligence To apply basic principles of Artificial Intelligence and solutions that require problem solving, influence, perception, knowledge representation and learning 				
<p>Course Outcomes: (for students: To know what they are going to learn)</p> <p>CO1: Describe the fundamentals of artificial intelligence concepts and searching techniques.</p> <p>CO2: Develop the fuzzy logic sets and membership function and defuzzification techniques.</p> <p>CO3: Understand the concepts of Neural Network and analyze and apply the learning techniques</p> <p>CO4: Understand the artificial neural networks and its applications</p> <p>CO5: Understand the concept of Genetic Algorithm and Analyze the optimization problems using GAs.</p>				
Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)				
Units	Contents			Required Hours
I	Introduction to AI: Problem formulation – AI Applications – Problems – State Space and Search – Production Systems – Breadth First and Depth First – Travelling Salesman Problem – Heuristic search techniques: Generate and Test – Types of Hill Climbing.			17
II	Fuzzy Logic Systems: Notion of fuzziness – Operations on fuzzy sets – T-norms and other aggregation operators – Basics of Approximate			17

	Reasoning – Compositional Rule of Inference – Fuzzy Rule Based Systems – Schemes of Fuzzification – Inferencing – Defuzzification – Fuzzy Clustering – fuzzy rule-based classifier.	
III	Neural Networks: What is Neural Network, Learning rules and various activation functions, Single layer Perceptions, Back Propagation networks, Architecture of Backpropagation (BP) Networks, Back propagation Learning, Variation of Standard Back propagation Neural Network, Introduction to Associative Memory, Adaptive Resonance theory and Self Organizing Map, Recent Applications.	17
IV	Artificial Neural Networks: Fundamental Concepts – Basic Models of Artificial Neural Networks – Important Terminologies of ANNs – McCulloch-Pitts Neuron – Linear Separability – Hebb Network.	17
V	Genetic Algorithm: Introduction – Biological Background – Genetic Algorithm Vs Traditional Algorithm – Basic Terminologies in Genetic Algorithm – Simple GA – General Genetic Algorithm – Operators in Genetic Algorithm.	17
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	

question paper)		
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	
<p>Learning Resources:</p> <ul style="list-style-type: none"> • Recommended Texts <ol style="list-style-type: none"> 1. S.N. Sivanandam and S.N. Deepa, “Principles of Soft Computing”, 2nd Edition, Wiley India Pvt. Ltd. 2. Stuart Russell and Peter Norvig, “Artificial Intelligence - A Modern Approach”, 2nd Edition, Pearson Education in Asia. 3. S. Rajasekaran, G. A. Vijayalakshmi, “Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis & Applications”, PHI. • Reference Books <ol style="list-style-type: none"> 1. F. Martin, Mc neill, and Ellen Thro, “Fuzzy Logic: A Practical approach”, AP Professional, 2000. Chin Teng Lin, C. S. George Lee,” Neuro-Fuzzy Systems”, PHI. 2. Chin Teng Lin, C. S. George Lee,” Neuro-Fuzzy Systems”, PHI. • Web resources 		

Course Code	Cyber Forensics		Credits
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week
Course Category :	Year & Semester:	Admission Year:	
Pre-requisite			
<p>Learning Objectives: (for teachers: what they have to do in the class/lab/field)</p> <ul style="list-style-type: none"> • To correctly define and cite appropriate instances for the application of computer forensics. • To Correctly collect and analyze computer forensic evidence and data seizure. Identify the essential and up-to-date concepts, algorithms, protocols, tools, and methodology of Computer Forensics. 			

<p>Course Outcomes: (for students: To know what they are going to learn)</p> <p>CO1: Understand the definition of computer forensics fundamentals.</p> <p>CO2: Evaluate the different types of computer forensics technology.</p> <p>CO3: Analyze various computer forensics systems.</p> <p>CO4: Apply the methods for data recovery, evidence collection and data seizure.</p> <p>CO5: Gain your knowledge of duplication and preservation of digital evidence.</p>		
<p>Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)</p>		
Units	Contents	Required Hours
I	<p>Overview of Computer Forensics Technology:</p> <ul style="list-style-type: none"> • Computer Forensics Fundamentals: What is Computer Forensics? Use of Computer • Forensics in Law Enforcement, Computer Forensics Assistance to Human • Resources/Employment Proceedings, Computer Forensics Services, Benefits of professional • Forensics Methodology, Steps taken by Computer Forensics Specialists. Types of Computer. • Forensics Technology: Types of Business Computer Forensic, Technology–Types of • Military Computer Forensic Technology–Types of Law Enforcement–Computer Forensic. • Technology–Types of Business Computer Forensic Technology. 	17
II	<p>Computer Forensics Evidence and capture:</p> <ul style="list-style-type: none"> • Data Recovery: Data Recovery Defined, Data Back–up and Recovery, The Role of Back –up • in Data Recovery, The Data –Recovery Solution. 	17

	<p>Evidence Collection and Data Seizure:</p> <ul style="list-style-type: none"> • Collection Options, Obstacles, Types of Evidence, The Rules of Evidence, Volatile Evidence, General Procedure, Collection and Archiving, Methods of Collections, Artefacts, Collection Steps, Controlling Contamination: The chain of custody. 	
III	<p>Duplication and Preservation of Digital Evidence:</p> <ul style="list-style-type: none"> • Processing steps, Legal Aspects of collecting and Preserving Computer forensic Evidence. Computer image Verification and Authentication: Special needs of Evidential Authentication, Practical Consideration, Practical Implementation. 	17
IV	<p>Computer Forensics Analysis:</p> <ul style="list-style-type: none"> • Discovery of Electronic Evidence: Electronic Document Discovery: A Powerful New Litigation Tool. Identification of Data: Time Travel, Forensic Identification and Analysis of Technical Surveillance Devices. 	17
V	<p>Reconstructing Past Events:</p> <ul style="list-style-type: none"> • How to Become a Digital Detective, Useable File Formats, • Unusable File Formats, Converting Files. • Networks: Network Forensics Scenario, a technical 	17

	<p>approach, Destruction Of E-Mail, Damaging Computer Evidence, Documenting</p> <ul style="list-style-type: none"> • The Intrusion on Destruction of Data, System Testing. 	
<p>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</p>	<p>Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)</p>	
<p>Skills acquired from the course</p>	<p>Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</p>	
<p>Learning Resources:</p> <ul style="list-style-type: none"> • Recommended Texts <ol style="list-style-type: none"> 1. John R. Vacca, “Computer Forensics: Computer Crime Investigation”, 3/E, Firewall Media, New Delhi, 2002. • Reference Books <ol style="list-style-type: none"> 1. Nelson, Phillips Enfinger, Steuart, “Computer Forensics and Investigations” Enfinger, Steuart, CENGAGE Learning, 2004. 2. Anthony Sammes and Brian Jenkinson, “Forensic Computing: A Practitioner’s Guide”, Second Edition, Springer–Verlag London Limited, 2007. 3. Robert M. Slade, “Software Forensics Collecting Evidence from the Scene of a Digital Crime”, TMH 2005. 		

- **Web resources**

Course Code	Multimedia Systems		Credits
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week
Course Category :	Year & Semester:	Admission Year:	
Pre-requisite			
Learning Objectives: (for teachers: what they have to do in the class/lab/field) <ul style="list-style-type: none"> • To understand the standards available for different audio, video and text applications • To learn various multimedia authoring systems in multimedia production team 			

Course Outcomes: (for students: To know what they are going to learn) CO1: CO2: CO3: CO4: CO5:		
Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)		
Units	Contents	Required Hours
I	Multimedia Definition - Use Of Multimedia - Delivering Multimedia - Text: About Fonts and Faces - Using Text in Multimedia - Computers and Text - Font Editing and Design Tools - Hypermedia and Hypertext.	17
II	Images: Plan Approach - Organize Tools - Configure Computer Workspace - Making Still Images - Color - Image File Formats. Sound: The Power of Sound - Digital Audio - Midi Audio - Midi vs. Digital Audio - Multimedia System Sounds - Audio File Formats -Vaughan's Law of Multimedia Minimums - Adding Sound to Multimedia Project.	17
III	Animation: The Power of Motion - Principles of Animation - Animation by Computer - Making Animations that Work. Video: Using Video - Working with Video and Displays - Digital Video Containers - Obtaining Video Clips - Shooting and Editing Video.	17
IV	Making Multimedia: The Stage of Multimedia Project - The Intangible Needs - The Hardware Needs - The Software Needs - An Authoring Systems Needs- Multimedia Production Team.	17
V	Planning and Costing: The Process of Making Multimedia	17

	- Scheduling - Estimating - RFPs and Bid Proposals. Designing and Producing - Content and Talent: Acquiring Content - Ownership of Content Created for Project - Acquiring Talent.	
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	
Learning Resources: <ul style="list-style-type: none"> • Recommended Texts <ol style="list-style-type: none"> 1. Tay Vaughan, "Multimedia: Making It Work", 8th Edition, Osborne/McGraw- Hill, 2001. • Reference Books <ol style="list-style-type: none"> 1. Ralf Steinmetz & Klara Nahrstedt "Multimedia Computing, Communication & Applications", Pearson Education, 2012 • Web resources 		

Course Code	Software Testing		Credits
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week
Course Category :	Year & Semester:		Admission Year:
Pre-requisite			

Learning Objectives: (for teachers: what they have to do in the class/lab/field)		
<ul style="list-style-type: none"> • To study various Software techniques • To study fundamental concepts in software testing 		
Course Outcomes: (for students: To know what they are going to learn)		
CO1:		
CO2:		
CO3:		
CO4:		
CO5:		
Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)		
Units	Contents	Required Hours
I	Introduction: Purpose – Productivity and Quality in Software – Testing Vs Debugging – Model for Testing – Bugs – Types of Bugs – Testing and Design Style.	17
II	Flow / Graphs and Path Testing – Achievable paths – Path instrumentation – Application – Transaction Flow Testing Techniques	17
III	Data Flow Testing Strategies - Domain Testing: Domains and Paths – Domains and Interface Testing.	17
IV	Linguistic –Metrics – Structural Metric – Path Products and Path Expressions. Syntax Testing – Formats – Test Cases.	17
V	Logic Based Testing – Decision Tables – Transition Testing – States, State Graph, State Testing.	17

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	
<p>Learning Resources:</p> <ul style="list-style-type: none"> • Recommended Texts <ol style="list-style-type: none"> 1. B. Beizer, “Software Testing Techniques”, II Edn., DreamTech India, NewDelhi, 2003. 2. K.V.K. Prasad , “Software Testing Tools”, DreamTech. India, New Delhi,2005. • Reference Books <ol style="list-style-type: none"> 1. Burnstein, 2003, “Practical Software Testing”, Springer International Edn. 2. . Kit, 1995, “Software Testing in the Real World: Improving the Process”, Pearson Education, Delhi. 3. R. Rajani, and P.P.Oak, 2004, “Software Testing”, Tata Mcgraw Hill, New Delhi. • Web resources 		

Course Code	Data Mining and Warehousing		Credits
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week
Course Category :	Year & Semester:	Admission Year:	
Pre-requisite			
<p>Learning Objectives: (for teachers: what they have to do in the class/lab/field)</p> <ul style="list-style-type: none"> • To provide the knowledge on Data Mining and Warehousing concepts and techniques. • To study the basic concepts of cluster analysis • To study a set of typical clustering methodologies, algorithms, and applications 			
<p>Course Outcomes: (for students: To know what they are going to learn)</p> <p>CO1:To understand the basic concepts and the functionality of the various data mining and data warehousing component</p> <p>CO2: To know the concepts of Data mining system architectures</p> <p>CO3:To analyse the principles of association rules</p> <p>CO4: To get analytical idea on Classification and prediction methods.</p> <p>CO5: To Gain knowledge on Cluster analysis and its methods.</p>			
<p>Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)</p>			
Units	Contents	Required Hours	
I	Introduction: Data mining – Functionalities – Classification – Introduction to Data Warehousing – Data Preprocessing: Preprocessing the Data – Data cleaning – Data Integration and Transformation – Data Reduction	17	
II	Data Mining, Primitives, Languages and System Architecture: Data Mining – Primitives – Data Mining Query Language, Architecture of Data mining Systems. Concept Description,	17	

	Characterization and Comparison: Concept Description, Data Generalization and Summarization, Analytical Characterization, Mining Class Comparison – Statistical Measures	
III	Mining Association Rules: Basic Concepts – Single Dimensional Boolean Association Rules From Transaction Databases, Multilevel Association Rules from transaction databases – Multi dimension Association Rules from Relational Database and Data Warehouses	17
IV	Classification and Prediction: Introduction – Issues – Decision Tree Induction – Bayesian Classification – Classification of Back Propagation. Classification based on Concepts from Association Rule Mining – Other Methods. Prediction – Introduction – Classifier Accuracy.	17
V	Cluster Analysis: Introduction – Types of Data in Cluster Analysis, Partitioning Methods – Hierarchical Methods-Density Based Methods – GRID Based Method – Model based Clustering Method	17
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	

Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	
<p>Learning Resources:</p> <ul style="list-style-type: none"> • Recommended Texts <ol style="list-style-type: none"> 1. Han and M. Kamber, “Data Mining Concepts and Techniques”, 2001, Harcourt India Pvt. Ltd, New Delhi. • Reference Books <ol style="list-style-type: none"> 3. K.P. Soman, Shyam Diwakar, V. Ajay “Insight into Data Mining Theory and Practice “, Prentice Hall of India Pvt. Ltd, New Delhi 4. Parteek Bhatia, ‘Data Mining and Data Warehousing: Principles and Practical Techniques’, Cambridge University Press, 2019 • Web resources 		

Course Code	Biometrics		Credits
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week
Course Category :	Year & Semester:	Admission Year:	
Pre-requisite			
<p>Learning Objectives: (for teachers: what they have to do in the class/lab/field)</p> <ul style="list-style-type: none"> • To learn and understand biometric technologies and their functionalities. • To learn the role of biometrics, computational methods, context of Biometric Applications. • To learn to develop applications with biometric security 			
<p>Course Outcomes: (for students: To know what they are going to learn)</p> <p>CO1:Identify the various biometric technologies.</p> <p>CO2: Design of biometric recognition.</p> <p>CO3:Develop simple applications for privacy</p> <p>CO4: Understand the need of biometric in the society</p> <p>CO5: Understand the scope of biometric techniques</p>			
Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)			
Units	Contents		Required Hours
I	<p>Introduction: What is Biometrics, History,Types of biometric Traits, General architecture of biometric systems, Basic working of biometric matching, Biometric system error and performance measures, Design of biometric system, Applications of biometrics, Biometrics versus traditional authentication methods.</p> <p>Face Biometrics: Introduction, Background of Face Recognition, Design of Face Recognition System, Neural Network for Face Recognition, Face Detection in Video Sequences, Challenges in Face Biometrics, .7 Face Recognition Methods, Advantages and Disadvantages</p>		17

<p>II</p>	<p>Retina and Iris Biometrics: Introduction, Performance of Biometrics, Design of Retina Biometrics, Design of Iris Recognition System, Iris Segmentation Method , Determination of Iris Region, Determination of Iris Region, Applications of Iris Biometrics, Advantages and Disadvantages</p> <p>Vein and Fingerprint Biometrics: Introduction, Biometrics Using Vein Pattern of Palm, Fingerprint Biometrics, Fingerprint Recognition System, Minutiae Extraction, Fingerprint Indexing, Experimental Results, Advantages and Disadvantages.</p>	<p>17</p>
<p>III</p>	<p>Privacy Enhancement Using Biometrics: Introduction, Privacy Concerns Associated with Biometric Deployments, Identity and Privacy, Privacy Concerns, Biometrics with Privacy Enhancement, Comparison of Various Biometrics in Terms of Privacy, Soft Biometrics.</p> <p>Multimodal Biometrics: Introduction to Multimodal Biometrics , Basic Architecture of Multimodal Biometrics, Multimodal Biometrics Using Face and Ear, Characteristics and Advantages of Multimodal Biometrics, Characteristics and Advantages of Multimodal Biometrics.</p>	<p>17</p>
<p>IV</p>	<p>Watermarking Techniques: Introduction, Data Hiding Methods, Basic Framework of Watermarking, Classification of Watermarking, Applications of Watermarking, Attacks on Watermarks, Performance Evaluation, Characteristics of</p>	<p>17</p>

	Watermarks, General Watermarking Process, Image Watermarking Techniques, Watermarking Algorithm, Experimental Results, Effect of Attacks on Watermarking Techniques, Attacks on Spatial Domain Watermarking	
V	<p>Scope and Future: Scope and Future Market of Biometrics, Biometric Technologies, Applications of Biometrics, Biometrics and Information Technology Infrastructure, Role of Biometrics in Enterprise Security, Role of Biometrics in Border Security, Smart Card Technology and Biometrics, Radio Frequency Identification (RFID) Biometrics, DNA Biometrics, Comparative Study of Various Biometric Techniques.</p> <p>Biometric Standards: Introduction, Standard Development Organizations, Application Programming Interface (API), Information Security and Biometric Standards, Biometric Template Interoperability.</p>	17
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	<p>Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)</p>	

Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	
<p>Learning Resources:</p> <ul style="list-style-type: none"> • Recommended Texts <ol style="list-style-type: none"> 1. Biometrics: Concepts and Applications by G.R Sinha and Sandeep B.Patil , Wiley, 2013 • Reference Books <ol style="list-style-type: none"> 1. Guide to Biometrics by Ruud M. Bolle , Sharath Pankanti, Nalini k.Ratha, Andrew W.Senior, Jonathan H. Connell , Springer 2009 2. Introduction to Biometrics by Anil k. Jain, Arun A. Ross, Karthik Nandakumar 3. Hand book of Biometrics by Anil K. Jain, Patrick Flynn, Arun A.Ross • Web resources 		

Course Code	E-Commerce		Credits
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week

Course Category :	Year & Semester:	Admission Year:
Pre-requisite		
<p>Learning Objectives: (for teachers: what they have to do in the class/lab/field)</p> <ul style="list-style-type: none"> • To provide knowledge on Ecommerce technology, Business Models and M-Commerce. • To explore the major issues associated with e-commerce-security, privacy, authentication, encryption and e-Payment 		
<p>Course Outcomes: (for students: To know what they are going to learn)</p> <p>CO1:Understanding the basic electronic business management</p> <p>CO2: Analyze the technologies and marketing trends in Ecommerce</p> <p>CO3:Knowledge gain in E security, Legal and Ethical issues</p> <p>CO4: A clear evaluation of the e payment systems</p> <p>CO5: Improve the expertise in mobile commerce and apply knowledge in development of E- Business portals</p>		
Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)		
Units	Contents	Required Hours
I	<p>History of E-commerce and Indian Business Context: E-Commerce –Emergence of the Internet –Emergence of the WWW – Advantages of E-Commerce – Transition to E-Commerce in India – The Internet and India – E-transition Challenges for Indian Corporate.</p> <p>Business Models for E- commerce: Business Model – E-business Models Based on the Relationship of Transaction Parties - E-business Models Based on the Relationship of Transaction Types.</p>	17
II	<p>Enabling Technologies of the World Wide Web: World Wide Web – Internet Client-Server Applications – Networks and Internets – Software Agents – Internet Standards and Specifications – ISP.</p> <p>e-Marketing :Traditional Marketing – Identifying Web Presence Goals – Online Marketing – E-advertising – E-branding.</p>	17

<p style="text-align: center;">III</p>	<p>E-Security: Information system Security – Security on the Internet – E-business Risk Management Issues – Information Security Environment in India.</p> <p>Legal and Ethical Issues : Cybers talking – Privacy is at Risk in the Internet Age – Phishing – Application Fraud – Skimming – Copyright – Internet Gambling – Threats to Children.</p>	<p style="text-align: center;">17</p>
<p style="text-align: center;">IV</p>	<p>e-Payment Systems: Main Concerns in Internet Banking – Digital Payment Requirements – Digital Token-based e-payment Systems – Classification of New Payment Systems – Properties of Electronic Cash – Cheque Payment Systems on the Internet – Risk and e-Payment Systems – Designing e-payment Systems – Digital Signature – Online Financial Services in India - Online Stock Trading.</p>	<p style="text-align: center;">17</p>
<p style="text-align: center;">V</p>	<p>Information systems for Mobile Commerce: What is Mobile Commerce? – Wireless Applications –Cellular Network – Wireless Spectrum – Technologies for Mobile Commerce – Wireless Technologies –Different Generations in Wireless Communication – Security Issues Pertaining to Cellular Technology.</p> <p>Portals for E-Business: Portals – Human Resource Management – Various HRIS Modules.</p>	<p style="text-align: center;">17</p>
<p>Extended Professional Component (is a part of internal component only, Not to</p>	<p>Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)</p>	

be included in the External Examination question paper)		
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	
<p>Learning Resources:</p> <ul style="list-style-type: none"> • Recommended Texts <ol style="list-style-type: none"> 1. P.T.Joseph, S.J., “E-Commerce - An Indian Perspective”, PHI 2012, 4th Edition • Reference Books <ol style="list-style-type: none"> 1. David Whiteley , “E-Commerce Strategy, Technologies and Applications”, Tata McGrawHill, 2001. 2. Ravi Kalakota, Andrew B Whinston, “Frontiers of Electronic Commerce”, Pearson 2006,12th Impression. • Web resources 		

Course Code	Network Security		Credits
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week
Course Category :	Year & Semester:	Admission Year:	
Pre-requisite			
Learning Objectives: (for teachers: what they have to do in the class/lab/field) <ul style="list-style-type: none"> • To study the number theory used for network security • To understand the design concept of cryptography and authentication • To develop experiments on algorithm used for security 			
Course Outcomes: (for students: To know what they are going to learn) <p>CO1:</p> <p>CO2:</p> <p>CO3:</p> <p>CO4:</p> <p>CO5:</p>			
Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)			
Units	Contents	Required Hours	
I	Model of network security – Security attacks, services and attacks – OSI security architecture – Classical encryption techniques – SDES – Block cipher PrinciplesDES – Strength of DES – Block cipher design principles – Block cipher mode of operation – Evaluation criteria for AES – RC4 - Differential and linear cryptanalysis – Placement of encryption function – traffic confidentiality.	17	
II	Number Theory – Prime number – Modular arithmetic – Euclid’s algorithm - Fermet’s and Euler’s theorem – Primality – Chinese remainder theorem – Discrete logarithm – Public key cryptography and RSA – Key distribution – Key management – Diffie Hellman key exchange – Elliptic curve cryptography.	17	

III	Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC – SHA - HMAC – CMAC - Digital signature and authentication protocols – DSS.	17
IV	Authentication applications – Kerberos – X.509 Authentication services - E- mail security – IP security - Web security	17
V	Intruder – Intrusion detection system – Virus and related threats – Countermeasures – Firewalls design principles – Trusted systems – Practical implementation of cryptography and security	17
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	

Learning Resources:

- **Recommended Texts**

1. William Stallings, “Cryptography & Network Security”, Pearson Education, Fourth Edition 2010.

- **Reference Books**

1. Charlie Kaufman, Radia Perlman, Mike Speciner, “Network Security, Private communication in public world”, PHI Second Edition, 2002.
2. Bruce Schneier, Neils Ferguson, “Practical Cryptography”, Wiley DreamtechIndia Pvt Ltd, First Edition, 2003.
3. Douglas R Simson “Cryptography – Theory and practice”, CRC Press, First Edition, 1995.

- **Web resources**

Course Code	ERP		Credits
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week

Course Category :	Year & Semester:	Admission Year:
Pre-requisite		
<p>Learning Objectives: (for teachers: what they have to do in the class/lab/field)</p> <ul style="list-style-type: none"> • Understand the concept of ERP and the ERP model; define key terms; identify the levels of ERP maturity. • To integrate business processes; define and analyze a process; create a process map and improve and/or simplify the process; apply the result to an ERP implementation. • To know the elements of a value chain, and explain how core processes relate; identify how the organizational infrastructure supports core business processes; explain the effect of a new product launch on the three core business processes 		
<p>Course Outcomes: (for students: To know what they are going to learn)</p> <p>CO1: Understand the basic concepts of ERP.</p> <p>CO2: Identify different technologies used in ERP</p> <p>CO3: Understand and apply the concepts of ERP Manufacturing Perspective and ERP Modules</p> <p>CO4: Discuss the benefits of ERP</p> <p>CO5: Apply different tools used in ERP</p>		
Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)		
Units	Contents	Required Hours
I	ERP Introduction, Benefits, Origin, Evolution and Structure: Conceptual Model of ERP, the Evolution of ERP, the Structure of ERP, Components and needs of ERP, ERP Vendors; Benefits & Limitations of ERP Packages.	17
II	Need to focus on Enterprise Integration/ERP; Information mapping; Role of common shared Enterprise database; System Integration, Logical vs. Physical System Integration, Benefits & limitations of System Integration, ERP's Role in Logical and Physical Integration. Business Process Reengineering, Data ware Housing, Data Mining, Online Analytic Processing (OLAP), Product Life Cycle Management	17

	(PLM), LAP, Supply chain Management.	
III	ERP Marketplace and Marketplace Dynamics: Market Overview, Marketplace Dynamics, the Changing ERP Market. ERP- Functional Modules: Introduction, Functional Modules of ERP Software, Integration of ERP, Supply chain and Customer Relationship Applications. Cloud and Open Source, Quality Management, Material Management, Financial Module, CRM and Case Study.	17
IV	ERP Implementation Basics, , ERP implementation Strategy, ERP Implementation Life Cycle ,Pre- Implementation task,Role of SDLC/SSAD, Object Oriented Architecture, Consultants, Vendors and Employees.	17
V	ERP & E-Commerce, Future Directives- in ERP, ERP and Internet, Critical success and failure factors, Integrating ERP into or-ganizational culture. Using ERP tool: either SAP or ORACLE format to case study.	17
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	

Learning Resources:

- **Recommended Texts**

1. Enterprise Resource Planning – Alexis Leon, Tata McGraw Hill.

- **Reference Books**

1. Enterprise Resource Planning – Diversified by Alexis Leon, TMH.

2. Enterprise Resource Planning – Ravi Shankar & S. Jaiswal , Galgotia

- **Web resources**

Course Code	Information Security		Credits
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week
Course Category :	Year & Semester:	Admission Year:	
Pre-requisite			
Learning Objectives: (for teachers: what they have to do in the class/lab/field)			
<ul style="list-style-type: none"> • To know the objectives of information security • Understand the importance and application of each of confidentiality, integrity, 			

<p>authentication and availability</p> <ul style="list-style-type: none"> • Understand various cryptographic algorithms • Understand the basic categories of threats to computers and networks 		
<p>Course Outcomes: (for students: To know what they are going to learn)</p> <p>CO1: Understand network security threats, security services, and countermeasures</p> <p>CO2: Understand vulnerability analysis of network security</p> <p>CO3: Acquire background on hash functions; authentication; firewalls; intrusion detection techniques.</p> <p>CO4: Gain hands-on experience with programming and simulation techniques for security protocols.</p> <p>CO5: Apply methods for authentication, access control, intrusion detection and prevention.</p>		
<p>Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)</p>		
Units	Contents	Required Hours
I	Introduction to Information Security : Security mindset, Computer Security Concepts (CIA), Attacks, Vulnerabilities and protections, Security Goals, Security Services, Threats, Attacks, Assets, malware, program analysis and mechanisms.	17
II	The Security Problem in Computing: The meaning of computer Security, Computer Criminals, Methods of Defense. Cryptography: Concepts and Techniques: Introduction, plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption	17

III	Symmetric and Asymmetric Cryptographic Techniques : DES, AES, RSA algorithms .Authentication and Digital Signatures : Use of Cryptography for authentication, Secure Hash function, Key management – Kerberos.	17
IV	Program Security : Non-malicious Program errors – Buffer overflow, Incomplete mediation, Time-of-check to Time-of-use Errors, Viruses, Trapdoors, Salami attack, Man-in-the-middle attacks, Covert channels. File protection Mechanisms, User Authentication Designing Trusted O.S: Security polices, models of security, trusted O.S design, Assurance in trusted O.S. Implementation examples.	17
V	Security in Networks : Threats in networks, Network Security Controls – Architecture, Encryption, Content Integrity, Strong Authentication, Access Controls, Wireless Security, Honeypots, Traffic flow security. Web Security: Web security considerations, Secure Socket Layer and Transport Layer Security, Secure electronic transaction.	17
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	

paper)		
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	
<p>Learning Resources:</p> <ul style="list-style-type: none"> • Recommended Texts <ol style="list-style-type: none"> 1. Security in Computing, Fourth Edition, by Charles P. Pfleeger, Pearson Education 2. Cryptography And Network Security Principles And Practice, Fourth or Fifth Edition, William Stallings, Pearson • Reference Books <ol style="list-style-type: none"> 1. Cryptography and Network Security: C K Shyamala, N Harini, Dr T R Padmanabhan, Wiley India, 1st Edition. 2. Cryptography and Network Security : Forouzan Mukhopadhyay, Mc Graw Hill, 2"d Edition 3. Information Security, Principles and Practice: Mark Stamp, Wiley India. 4. Principles of Computer Security: WM.Arthur Conklin, Greg White, TMH • Web resources 		

Course Code	Robotics and Its Applications		Credits
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week
Course Category :	Year & Semester:	Admission Year:	
Pre-requisite			
<p>Learning Objectives: (for teachers: what they have to do in the class/lab/field)</p> <ul style="list-style-type: none"> • To make the students familiar with the various drive systems of robots, sensors and their applications in robots • To introduce the parts of robots, basic working concepts and types of robots 			
<p>Course Outcomes: (for students: To know what they are going to learn)</p> <p>CO1:Describe the different physical forms of robot architectures</p> <p>CO2: Kinematically model simple manipulator and mobile robots</p> <p>CO3:Mathematically describe a kinematic robot system.</p> <p>CO4: Analyze manipulation and navigation problems using knowledge of coordinate frames, kinematics, optimization, control, and uncertainty.</p> <p>CO5: Program robotics algorithms related to kinematics, control, optimization, and uncertainty.</p>			
<p>Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)</p>			
Units	Contents		Required Hours

I	Introduction :Introduction, brief history, components of robotics, classification, workspace, work-envelop, motion of robotic arm, end-effectors and its types, service robot and its application, Artificial Intelligence in Robotics.	17
II	Actuators and sensors :Types of actuators, stepper-DC-servo-and brushless motors- model of a DC servo motor-types of transmissions-purpose of sensor-internal and external sensor-common sensors-encoders tachometers-strain gauge based force torque sensor-proximity and distance measuring sensors Kinematics of robots :Representation of joints and frames, frames transformation, homogeneous matrix, D-H matrix, Forward and inverse kinematics: two link planar (RR) and spherical robot (RRP). Mobile robot Kinematics: Differential wheel mobile robot	17
III	Localization:Self-localizations and mapping - Challenges in localizations – IR based localizations – vision based localizations – Ultrasonic based localizations - GPS localization systems.	17
IV	Path Planning :Introduction, path planning-overview-road map path planning-cell decomposition path planningpotential field path planning-obstacle avoidance-case studies	17

	Vision system: Robotic vision systems-image representation-object recognition-and categorization-depth measurement- image data compression-visual inspection-software considerations	
V	Application : Ariel robots-collision avoidance robots for agriculture-mining-exploration-underwater-civilian- and military applications-nuclear applications-space applications-Industrial robots-artificial intelligence in robots-application of robots in material handling-continuous arc welding-spot welding-spray painting-assembly operation-cleaning-etc.	17
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	
Learning Resources: <ul style="list-style-type: none"> • Recommended Texts <ol style="list-style-type: none"> 1. RicharedD.Klafter. Thomas Achmielewski and MickaelNegin, Robotic Engineering and Integrated Approach, Prentice Hall India-Newdelhi-2001 2. SaeedB.Nikku, Introduction to robotics, analysis, control and applications, Wiley- 		

India, 2 nd edition 2011

- **Reference Books**

1. Industrial robotic technology-programming and application by M.P.Groover et.al, McGrawhill2008

2. Robotics technology and flexible automation by S.R.Deb, THH-2009

- **Web resources**

Course Code		Simulation and Modeling		Credits
Lecture Hours: (L) per week		Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week
Course Category :		Year & Semester:	Admission Year:	
Pre-requisite				
<p>Learning Objectives: (for teachers: what they have to do in the class/lab/field) In this course, modeling and simulation (M&S) methodologies considering the theoretical aspects. A wide range of Modeling and Simulation concepts that will lead you to develop your own M&S applications. Students learn the methodologies and tools for simulation and modeling of a real time problem/ mathematical model.</p>				
<p>Course Outcomes: (for students: To know what they are going to learn) CO1:Introduction To Modeling & Simulation, Input Data Analysis and Modeling. CO2: Random Variate and Number Generation. Analysis of Simulations and methods. CO3:Comparing Systems via Simulation CO4: Entity Body Modeling, Visualization, Animation. CO5: Algorithms and Sensor Modeling.</p>				
<p>Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)</p>				
Units	Contents			Required Hours
I	Introduction To Modeling & Simulation – What is Modeling and Simulation? – Complexity Types – Model Types – Simulation Types – M&S Terms and Definitions Input Data Analysis – Simulation Input Modeling – Input Data Collection - Data Collection Problems - – Input Modeling Strategy - Histograms -Probability Distributions - Selecting a Probability Distribution.			17
II	Random Variate Generation – Random Numbers – Random Number Generators – General principles – Inverse Transform Method –Acceptance Rejection Method – Composition Method –Relocate and Rescale Method – Specific distributions-Output Data Analysis – Introduction – Types of Simulation With Respect to Output Analysis –			17

	Stochastic Process and Sample Path - Sampling and Systematic Errors - Mean, Standard Deviation and Confidence Interval - Analysis of Finite-Horizon Simulations - Single Run - Independent Replications - Sequential Estimation – Analysis of Steady-State Simulations - Removal of Initialization Bias (Warm-up Interval) - Replication-Deletion Approach - Batch-Means Method .	
III	Comparing Systems via Simulation – Introduction – Comparison Problems - Comparing Two Systems - Screening Problems - Selecting the Best - Comparison with a Standard - Comparison with a Fixed Performance Discrete Event Simulations – Introduction - Next-Event Time Advance - Arithmetic and Logical Relationships - Discrete-Event Modeling Approaches – Event-Scheduling Approach – Process Interaction Approach	17
IV	Entity Modeling – Entity Body Modeling – Entity Body Visualization – Entity Body Animation – Entity Interaction Modeling – Building Modeling Distributed Simulation – High Level Architecture (HLA) – Federation Development and Execution Process (FEDEP) – SISO RPR FOM Behavior Modeling – General AI Algorithms - Decision Trees - Neural Networks - Finite State Machines - Logic Programming - Production Systems – Path Planning - Off-Line Path Planning - Incremental Path Planning - Real-Time Path Planning – Script Programming -Script Parsing - Script Execution.	17
V	Optimization Algorithms – Genetic Algorithms –	17

	Simulated Annealing Examples: Sensor Systems Modeling – Human Eye Modeling – Optical Sensor Modeling – Radar Modeling.	
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	
<p>Learning Resources:</p> <ul style="list-style-type: none"> • Recommended Texts <ol style="list-style-type: none"> 1. Jerry Banks, “Handbook of Simulation: Principles, Methodology, Advances, Applications, and Practice”, John Wiley & Sons, Inc., 1998. 2. George S. Fishman, “Discrete-Event Simulation: Modeling, Programming and Analysis”, Springer-Verlag New York, Inc., 2001. • Reference Books <ol style="list-style-type: none"> 1. Andrew F. Seila, Vlatko Ceric, Pandu Tadikamalla, “Applied Simulation Modeling”, Thomson Learning Inc., 2003. • Web resources 		

Course Code	Pattern Recognition		Credits
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week
Course Category :	Year & Semester:	Admission Year:	
Pre-requisite			
Learning Objectives: (for teachers: what they have to do in the class/lab/field) To study the Pattern Recognition techniques and its applications			
Course Outcomes: (for students: To know what they are going to learn) CO1: To learn the fundamentals of Pattern Recognition techniques CO2: To learn the various Statistical Pattern recognition techniques CO3: To learn the linear discriminant functions and unsupervised learning and clustering CO4: To learn the various Syntactical Pattern recognition techniques CO5: To learn the Neural Pattern recognition techniques			
Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)			
Units	Contents	Required Hours	
I	PATTERN RECOGNITION OVERVIEW: Pattern recognition, Classification and Description-Patterns and feature Extraction with Examples-Training and Learning in PR systems-Pattern recognition Approaches	17	
II	STATISTICAL PATTERN RECOGNITION: Introduction to statistical Pattern Recognition-supervised Learning using Parametric and Non-Parametric Approaches.	17	

III	LINEAR DISCRIMINANT FUNCTIONS AND UNSUPERVISED LEARNING AND CLUSTERING: Introduction-Discrete and binary Classification Problems-Techniques to directly Obtain linear Classifiers - Formulation of Unsupervised Learning Problems-Clustering for unsupervised learning and classification	17
IV	SYNTACTIC PATTERN RECOGNITION: Overview of Syntactic Pattern Recognition-Syntactic recognition via parsing and other grammars-Graphical Approaches to syntactic pattern recognition-Learning via grammatical inference.	17
V	NEURAL PATTERN RECOGNITION: Introduction to Neural Networks-Feedforward Networks and training by Back Propagation-Content Addressable Memory Approaches and Unsupervised Learning in Neural PR	17
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	

Learning Resources:

- **Recommended Texts**

1. Robert Schalkoff, "Pattern Recognition: Statistical Structural and Neural Approaches", John Wiley & Sons.

- **Reference Books**

1. Earl Gose, Richard Johnsonbaugh, Steve Jost, "Pattern Recognition and Image Analysis", Prentice Hall of India, Pvt Ltd, New Delhi.
2. Duda R.O., P.E.Hart & D.G Stork, "Pattern Classification", 2nd Edition, J.Wiley.
3. Duda R.O. & Hart P.E., "Pattern Classification and Scene Analysis", J.Wiley.
4. Bishop C.M., "Neural Networks for Pattern Recognition", Oxford University Press.

- **Web resources**

Course Code	Fuzzy Logic		Credits
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week
Course Category :	Year & Semester:	Admission Year:	

Pre-requisite		
Learning Objectives: (for teachers: what they have to do in the class/lab/field) The objective of this course is to teach the fundamentals of fuzzy sets, relations and the various fuzzification and defuzzification methods.		
Course Outcomes: (for students: To know what they are going to learn) CO1: Understand the basics of Fuzzy sets, operation and properties. CO2: Apply Cartesian product and composition on Fuzzy relations and use the tolerance and Equivalence relations CO3: Analyze various fuzzification methods and features of membership Functions. CO4: Evaluate defuzzification methods for real time applications. CO5: Design an application using Fuzzy logic and its Relations.		
Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)		
Units	Contents	Required Hours
I	Introduction to Fuzzy Logic- Fuzzy Sets- Fuzzy Set Operations, Properties of Fuzzy Sets, Classical and Fuzzy Relations: Introduction-Cartesian Product of Relation-Classical Relations-Cardinality of Crisp Relation.	17
II	Operations on Crisp Relation-Properties of Crisp Relations-Composition Fuzzy Relations, Cardinality of Fuzzy Relations-Operations on Fuzzy Relations-Properties of Fuzzy Relations-Fuzzy Cartesian Product and Composition-Tolerance and Equivalence Relations ,Crisp Relation.	17
III	Membership Functions: Introduction, Features of Membership Function, Classification of Fuzzy Sets, Fuzzification, Membership Value Assignments, Intuition, Inference, Rank Ordering.	17
IV	Defuzzification: Introduction, Lambda Cuts for Fuzzy Sets,	17

	Lambda Cuts for Fuzzy Relations, Defuzzification Methods, Fuzzy Rule-Based System: Introduction, Formation of Rules, Decomposition of Rules, Aggregation of Fuzzy Rules, Properties of Set of Rules.	
V	Applications of Fuzzy Logic: Fuzzy Logic in Automotive Applications, Fuzzy Antilock Brake System-Antilock-Braking System and Vehicle Speed-Estimation Using Fuzzy Logic.	17
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	
Learning Resources: <ul style="list-style-type: none"> • Recommended Texts <ol style="list-style-type: none"> 1. S. N. Sivanandam, S. Sumathi and S. N. Deepa-Introduction to Fuzzy Logic using MATLAB, Springer-Verlag Berlin Heidelberg 2007 • Reference Books <ol style="list-style-type: none"> 1. Guanrong Chen and Trung Tat Pham- Introduction to Fuzzy Sets, Fuzzy Logic and Fuzzy Control Systems 2. Timothy J Ross , Fuzzy Logic with Engineering Applications 		

- **Web resources**

Course Code	Artificial Neural Networks		Credits
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week
Course Category :	Year & Semester:	Admission Year:	
Pre-requisite			
Learning Objectives: (for teachers: what they have to do in the class/lab/field)			
<ul style="list-style-type: none"> • The objective of this course is to teach the basics of artificial neural networks, learning process, single layer and multi-layer perceptron networks. 			

<p>Course Outcomes: (for students: To know what they are going to learn)</p> <p>CO1: Understand the basics of artificial neural networks and its architecture.</p> <p>CO2: Understand the various learning algorithms and their applications.</p> <p>CO3: Identify the appropriate neural network model to a particular application.</p> <p>CO4: Apply the selected neural network model to a particular application.</p> <p>CO5: Analyze the performance of the selected neural network.</p> <p>Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)</p>		
Units	Contents	Required Hours
I	Artificial Neural Model- Activation functions- Feed forward and Feedback, Convex Sets, Convex Hull and Linear Separability, Non-Linear Separable Problem - Multilayer Networks. Learning Algorithms- Error correction - Gradient Descent Rules, Perceptron Learning Algorithm, Perceptron Convergence Theorem.	17
II	Introduction, Error correction learning, Memory-based learning, Hebbian learning, Competitive learning, Boltzmann learning, credit assignment problem, Learning with and without teacher, learning tasks, Memory and Adaptation.	17
III	Single layer Perception: Introduction, Pattern Recognition, Linear classifier, Simple perception, Perception learning algorithm, Modified Perception learning algorithm, Adaptive linear combiner, Continuous perception, Learning in continuous perception. Limitation of Perception.	17
IV	Multi-Layer Perceptron Networks: Introduction, MLP with 2 hidden layers, Simple layer of a MLP, Delta learning rule of the output layer, Multilayer feed forward neural network with continuous perceptions, Generalized delta learning rule, Back propagation algorithm	17

V	Deep learning- Introduction- Neuro architectures building blocks for the DL techniques, Deep Learning and Neocognitron, Deep Convolutional Neural Networks, Recurrent Neural Networks (RNN), feature extraction, Deep Belief Networks, Restricted Boltzman Machines, Training of DNN and Applications	17
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	
Learning Resources: <ul style="list-style-type: none"> • Recommended Texts <ol style="list-style-type: none"> 1. Neural Networks A Classroom Approach- Satish Kumar, McGraw Hill- Second Edition. 2. “Neural Network- A Comprehensive Foundation”- Simon Haykins, Pearson Prentice Hall, 2nd Edition, 1999. • Reference Books <ol style="list-style-type: none"> 1. Artificial Neural Networks-B. Yegnanarayana, PHI, New Delhi 1998. • Web resources 		

Course Code	Agile Project Management		Credits
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week
Course Category :	Year & Semester:	Admission Year:	
Pre-requisite			
<p>Learning Objectives: (for teachers: what they have to do in the class/lab/field)</p> <ul style="list-style-type: none"> • To provide students with a theoretical as well as practical understanding of Agile software development practices and how small teams can apply them to creating high-quality software. • To provide a good understanding of software design and a set of software technologies and APIs. • To provide a detailed examination and demonstration of Agile development and testing techniques. • To provide an understanding of the benefits and pitfalls of working in an Agile team. 			
<p>Course Outcomes: (for students: To know what they are going to learn)</p> <p>CO1:Understanding of the Agile manifesto and its advantages over other SDLC paradigms.</p> <p>CO2: Understanding essential Agile concepts.</p> <p>CO3:Understanding how to plan and execute a project using Agile concepts</p> <p>CO4: Understanding Agile management concepts.</p> <p>CO5: Practical application of Agile principles.</p>			
<p>Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)</p>			
Units	Contents		Required Hours

I	<p>Introduction:Modernizing Project Management: Project Management Needed a Makeover – Introducing Agile Project Management.</p> <p>Applying the Agile Manifesto and Principles: Understanding the Agile manifesto – Outlining the four values of the Agile manifesto – Defining the 12 Agile Principles – Adding the Platinum Principles – Changes as a result of Agile Values – The Agile litmus test.</p> <p>Why Being Agile Works Better: Evaluating Agile benefits – How Agile approaches beat historical approaches – Why people like being Agile.</p>	17
II	<p>Being Agile:Agile Approaches: Diving under the umbrella of Agile approaches – Reviewing the Big Three: Lean, Scrum, Extreme Programming - Summary</p> <p>Agile Environments in Action: Creating the physical environment – Low-tech communicating – High-tech communicating – Choosing tools.</p> <p>Agile Behaviours in Action: Establishing Agile roles – Establishing new values – Changing team philosophy.</p>	17
III	<p>Agile Planning and Execution</p> <p>Defining the Product Vision and Roadmap: Agile planning – Defining the product vision – Creating a product roadmap – Completing the product backlog.</p> <p>Planning Releases and Sprints: Refining requirements and</p>	17

	<p>estimates – Release planning – Sprint planning.</p> <p>Working Throughout the Day: Planning your day – Tracking progress – Agile roles in the sprint – Creating shippable functionality – The end of the day.</p> <p>Showcasing Work, Inspecting and Adapting: The sprint review – The sprint retrospective.</p> <p>Preparing for Release: Preparing the product for deployment (the release sprint) – Preparing the operational support – Preparing the organization for product deployment – Preparing the marketplace for product deployment</p>	
IV	<p>Agile Management</p> <p>Managing Scope and Procurement: What’s different about Agile scope management – Managing Agile scope – What’s different about Agile procurement – Managing Agile procurement.</p> <p>Managing Time and Cost: What’s different about Agile time management – Managing Agile schedules – What’s different about Agile cost management – Managing Agile budgets.</p> <p>Managing Team Dynamics and Communication: What’s different about Agile team dynamics – Managing Agile team dynamics – What’s different about Agile communication – Managing Agile communication.</p> <p>Managing Quality and Risk: What’s different about Agile quality – Managing Agile quality – What’s different about Agile risk management – Managing Agile risk.</p>	17
V	<p>Implementing Agile</p> <p>Building a Foundation: Organizational and individual commitment – Choosing the right pilot team members – Creating and environment that enables Agility – Support</p>	17

	<p>Agility initially and over time.</p> <p>Being a Change Agent: Becoming Agile requires change – why change doesn't happen on its own – Platinum Edge's Change Roadmap – Avoiding pitfalls – Signs your changes are slipping.</p> <p>Benefits, Factors for Success and Metrics: Ten key benefits of Agile project management – Ten key factors for project success – Ten metrics for Agile Organizations.</p>	
<p>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</p>	<p>Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)</p>	
<p>Skills acquired from the course</p>	<p>Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</p>	
<p>Learning Resources:</p> <ul style="list-style-type: none"> • Recommended Texts <ol style="list-style-type: none"> 1. Mark C. Layton, Steven J. Ostermiller, <i>Agile Project Management for Dummies</i>, 2nd Edition, Wiley India Pvt. Ltd., 2018. 2. Jeff Sutherland, <i>Scrum – The Art of Doing Twice the Work in Half the Time</i>, Penguin, 2014. • Reference Books <ol style="list-style-type: none"> 1. Mark C. Layton, David Morrow, <i>Scrum for Dummies</i>, 2nd Edition, Wiley India Pvt. Ltd., 2018. 2. Mike Cohn, <i>Succeeding with Agile – Software Development using Scrum</i>, Addison-Wesley Signature Series, 2010. 		

<p>3. Alex Moore, Agile Project Management, 2020.</p> <p>4. Alex Moore, <i>Scrum</i>, 2020.</p> <p>5. Andrew Stellman and Jennifer Greene, <i>Learning Agile: Understanding Scrum, XP, Lean, and Kanban</i>, Shroff/O'Reilly, First Edition, 2014.</p> <ul style="list-style-type: none"> • Web resources <ol style="list-style-type: none"> 1. www.agilealliance.org/resources
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Java	Cloud Computing		Credits
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week
Course Category :	Year & Semester:	Admission Year:	
Pre-requisite			
<p>Learning Objectives: (for teachers: what they have to do in the class/lab/field)</p> <ul style="list-style-type: none"> • To impart fundamental concepts of Cloud Computing. • To impart a working knowledge of the various cloud service types and their uses and pitfalls. • To enable the students to know the common features and differences in the service offerings of the three major Cloud Computing service providers, namely Amazon, Microsoft and Google. • To provide know-how of the various aspects of application design, benchmarking and security on the Cloud. 			
<p>Course Outcomes: (for students: To know what they are going to learn)</p> <p>CO1:To understand the concepts and technologies involved in Cloud Computing.</p> <p>CO2: To understand the concepts of various cloud services and their implementation in the Amazon, Microsoft and Google cloud computing platforms.</p> <p>CO3:To understand the aspects of application design for the Cloud.</p> <p>CO4: To understand the concepts involved in benchmarking and security on the Cloud.</p> <p>CO5: To understand the way in which the cloud is used in various domains.</p>			
<p>Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)</p>			
Units	Contents		Required Hours
I	Introduction to Cloud Computing: Definition of Cloud		17

	<p>Computing – Characteristics of Cloud Computing – Cloud Models – Cloud Service Examples – Cloud-based Services and Applications.</p> <p>Cloud Concepts and Technologies: Virtualization – Load balancing – Scalability and Elasticity – Deployment – Replication – Monitoring – Software Defined Networking – Network Function Virtualization – MapReduce – Identity and Access Management – Service Level Agreements – Billing.</p>	
<p>II</p>	<p>Cloud Services</p> <p>Compute Services: Amazon Elastic Computer Cloud - Google Compute Engine - Windows Azure Virtual Machines. Storage Services: Amazon Simple Storage Service - Google Cloud Storage - Windows Azure Storage</p> <p>Database Services: Amazon Relational Data Store - Amazon Dynamo DB - Google Cloud SQL - Google Cloud Data Store - Windows Azure SQL Database - Windows Azure Table Service</p> <p>Application Services: Application Runtimes and Frameworks - Queuing Services - Email Services - Notification Services - Media Services</p> <p>Content Delivery Services: Amazon CloudFront - Windows Azure Content Delivery Network</p> <p>Analytics Services: Amazon Elastic MapReduce - Google MapReduce Service - Google BigQuery - Windows Azure HDInsight</p> <p>Deployment and Management Services: Amazon Elastic</p>	<p>17</p>

	<p>Beanstack - Amazon CloudFormation</p> <p>Identity and Access Management Services: Amazon Identity and Access Management - Windows Azure Active Directory</p> <p>Open Source Private Cloud Software: CloudStack - Eucalyptus - OpenStack</p>	
III	<p>Cloud Application Design: Introduction – Design Consideration for Cloud Applications – Scalability – Reliability and Availability – Security – Maintenance and Upgradation – Performance – Reference Architectures for Cloud Applications – Cloud Application Design Methodologies: Service Oriented Architecture (SOA), Cloud Component Model, IaaS, PaaS and SaaS Services for Cloud Applications, Model View Controller (MVC), RESTful Web Services – Data Storage Approaches: Relational Approach (SQL), Non-Relational Approach (NoSQL).</p>	17
IV	<p>Cloud Application Benchmarking and Tuning: Introduction to Benchmarking – Steps in Benchmarking – Workload Characteristics – Application Performance Metrics – Design Consideration for Benchmarking Methodology – Benchmarking Tools and Types of Tests – Deployment Prototyping.</p> <p>Cloud Security: Introduction – CSA Cloud Security Architecture – Authentication (SSO) – Authorization – Identity and Access Management – Data Security : Securing data at rest, securing data in motion – Key Management –</p>	17

	Auditing.	
V	Case Studies: Cloud Computing for Healthcare – Cloud Computing for Energy Systems - Cloud Computing for Transportation Systems - Cloud Computing for Manufacturing Industry - Cloud Computing for Education.	17
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	
<p>Learning Resources:</p> <ul style="list-style-type: none"> • Recommended Texts <ol style="list-style-type: none"> 2. Arshdeep Bahga, Vijay Madiseti, <i>Cloud Computing – A Hands On Approach</i>, Universities Press (India) Pvt. Ltd., 2018. • Reference Books <ol style="list-style-type: none"> 5. Anthony T Velte, Toby J Velte, Robert Elsenpeter, <i>Cloud Computing: A Practical Approach</i>, Tata McGraw-Hill, 2013. 6. Barrie Sosinsky, <i>Cloud Computing Bible</i>, Wiley India Pvt. Ltd., 2013. 7. David Crookes, <i>Cloud Computing in Easy Steps</i>, Tata McGraw Hill, 2012. 8. Dr. Kumar Saurabh, <i>Cloud Computing</i>, Wiley India, Second Edition 2012. 		

- **Web resources**

Course Code	Grid Computing		Credits
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week
Course Category :	Year & Semester:	Admission Year:	
Pre-requisite			
<p>Learning Objectives: (for teachers: what they have to do in the class/lab/field)</p> <ul style="list-style-type: none"> • To provide the knowledge on the basic construction and use of Grid computing. • To know and understand the grid computing applications. • To assess the efficiency of the grid computing in solving large scale scientific problems 			
<p>Course Outcomes: (for students: To know what they are going to learn)</p> <p>CO1:To understand the basic elements and concepts related to Grid computing</p> <p>CO2: To identify the Grid computing toolkits and Framework.</p> <p>CO3:To know about the concepts of Virtualization</p> <p>CO4: To analyze the concept of service oriented architecture.</p> <p>CO5: To Gain knowledge on grid and web service architecture.</p>			
<p>Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)</p>			
Units	Contents		Required Hours
I	Introduction: Early Grid Activity, Current Grid Activity, Overview of Grid Business areas, Grid Applications, Grid Infrastructures.		17

II	Grid Computing organization and their Roles: Organizations Developing Grid Standards, and Best Practice Guidelines, Global Grid Forum (GCF), #Organization Developing Grid Computing Toolkits and Framework#, Organization and building and using grid based solutions to solve computing, commercial organization building and Grid Based solutions.	17
III	Grid Computing Anatomy: The Grid Problem, The conceptual of virtual organizations, # Grid Architecture # and relationship to other distributed technology	17
IV	The Grid Computing Road Map: Autonomic computing, Business on demand and infrastructure virtualization, Service-Oriented Architecture and Grid, #Semantic Grids#.	17
V	Merging the Grid services Architecture with the Web Services Architecture: Service-Oriented Architecture, Web Service Architecture, #XML messages and Enveloping#, Service message description Mechanisms, Relationship between Web Services and Grid Services, Web services Interoperability and the role of the WS-I Organization.	17

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	
<p>Learning Resources:</p> <ul style="list-style-type: none"> • Recommended Texts <ol style="list-style-type: none"> 1. Joshy Joseph and Craig Fellenstein, Grid computing, Pearson / IBM Press, PTR, 2004. • Reference Books <ol style="list-style-type: none"> 2. Ahmer Abbas and Graig computing, A Practical Guide to technology and applications, Charles River Media, 2003. • Web resources 		

Course Code	Artificial Intelligence		Credits
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week
Course Category :	Year & Semester:		Admission Year:
Pre-requisite			
<p>Learning Objectives: (for teachers: what they have to do in the class/lab/field)</p> <ul style="list-style-type: none"> • To Acquire Knowledge on various AI Techniques and Expert Systems • To have enriched knowledge regarding heuristic search, Knowledge representation and Expert systems 			

Course Outcomes: (for students: To know what they are going to learn)		
CO1:		
CO2:		
CO3:		
CO4:		
CO5:		
Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)		
Units	Contents	Required Hours
I	Introduction: AI Problems – AI techniques – Criteria for success. Problems, Problem Spaces, Search: State space search – Production Systems – Problem Characteristics – Issues in design of Search.	17
II	Heuristic Search techniques: Generate and Test – Hill Climbing – Best-First, Problem Reduction, Constraint Satisfaction, Means-end analysis.	17
III	Knowledge representation issues: Representations and mappings – Approaches to Knowledge representations – Issues in Knowledge representations – Frame Problem.	17
IV	Using Predicate Logic: Representing simple facts in logic – Representing Instance and Is-a relationships – Computable functions and predicates – Resolution – Natural deduction.	17
V	Representing knowledge using rules: Procedural Vs Declarative knowledge – Logic programming – Forward Vs Backward reasoning – Matching – Control knowledge Brief explanation of Expert Systems- Definition- Characteristics-architecture- Knowledge Engineering- Expert System Life Cycle-Knowledge Acquisition Strategies- Expert System Tools.	17

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	

Learning Resources:

- **Recommended Texts**

1. Elaine Rich and Kevin Knight, Shiva Shankar Nair, “Artificial Intelligence”, McGraw-Hill Companies, 3rd edition.

- **Reference Books**

1. Stuart Russell & Peter Norvig , “*Artificial Intelligence A Modern Approach*”, Perason, 2nd Edition.
2. George F Luger , “*Artificial Intelligence*”, Pearson 2002, 4th Edition.
3. V S Janaki Raman, K Sarukesi, P Gopalakrishnan, “*Foundations of Artificial Intelligent and Expert Systems*”, MacMillan India limited.

- **Web resources**

1. NPTEL & MOOC courses titled Artificial Intelligence and Expert Systems
2. <https://nptel.ac.in/courses/106106140/>
3. <https://nptel.ac.in/courses/106106126/>

Course Code	Image Processing	Credits

Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week
Course Category :	Year & Semester:	Admission Year:	
Pre-requisite			
Learning Objectives: (for teachers: what they have to do in the class/lab/field) <ul style="list-style-type: none"> • To become familiar with digital image fundamentals • To get exposed to simple image enhancement techniques in Spatial and Frequency domain. • To learn concepts of degradation function and restoration techniques. • To study the image segmentation and representation techniques. • To become familiar with image compression and recognition methods 			
Course Outcomes: (for students: To know what they are going to learn) <p>CO1:</p> <p>CO2:</p> <p>CO3:</p> <p>CO4:</p> <p>CO5:</p>			
Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)			
Units	Contents	Required Hours	
I	DIGITAL IMAGE FUNDAMENTALS: Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels - Color image fundamentals - RGB, HSI models, Two-dimensional mathematical preliminaries, 2D transforms - DFT, DCT.	17	
II	IMAGE ENHANCEMENT: Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering– Smoothing and Sharpening Spatial Filtering, Frequency Domain: Introduction to Fourier Transform– Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters, Homomorphic filtering, Color image enhancement.	17	
III	IMAGE RESTORATION: Image Restoration - degradation	17	

	model, Properties, Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering	
IV	IMAGE SEGMENTATION: Edge detection, Edge linking via Hough transform – Thresholding - Region based segmentation – Region growing – Region splitting and merging – Morphological processing- erosion and dilation, Segmentation by morphological watersheds – basic concepts – Dam construction – Watershed segmentation algorithm.	17
V	IMAGE COMPRESSION AND RECOGNITION: Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, JPEG standard, MPEG. Boundary representation, Boundary description, Fourier Descriptor, Regional Descriptors – Topological feature, Texture - Patterns and Pattern classes - Recognition based on matching.	17
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	

Learning Resources:

- **Recommended Texts**
- **Reference Books**

- **Web resources**

Course Code	Introduction to Data Science		Credits
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week
Course Category :	Year & Semester:	Admission Year:	
Pre-requisite			
<p>Learning Objectives: (for teachers: what they have to do in the class/lab/field)</p> <ul style="list-style-type: none"> • To introduce the concepts, techniques and tools in Data Science • To understand the various facets of data science practice, including data collection and integration, exploratory data analysis, predictive modeling, descriptive modeling and effective communication. 			

Course Outcomes: (for students: To know what they are going to learn)		
CO1: To describe what Data Science is, what Statistical Inference means, identify probability distributions, fit a model to data and use tools for basic analysis and communication		
CO2: To describe what Data Science is, what Statistical Inference means, identify probability distributions, fit a model to data and use tools for basic analysis and communication		
CO3: To describe what Data Science is, what Statistical Inference means, identify probability distributions, fit a model to data and use tools for basic analysis and communication		
CO4: To describe what Data Science is, what Statistical Inference means, identify probability distributions, fit a model to data and use tools for basic analysis and communication		
CO5: To describe what Data Science is, what Statistical Inference means, identify probability distributions, fit a model to data and use tools for basic analysis and communication		
Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)		
Units	Contents	Required Hours
I	Introduction: <ul style="list-style-type: none"> • Benefits and uses – Facets of data – Data science process – Big data ecosystem and data science 	17
II	The Data science process: <ul style="list-style-type: none"> • Overview – research goals - retrieving data - transformation – Exploratory Data Analysis – Model building 	17
III	Algorithms : <ul style="list-style-type: none"> • Machine learning algorithms – Modeling process – Types – Supervised – Unsupervised - Semi-supervised 	17
IV	Introduction to Hadoop : <ul style="list-style-type: none"> • Hadoop framework – Spark – replacing MapReduce– 	17

	NoSQL – ACID – CAP – BASE – types	
V	<p>Case Study:</p> <ul style="list-style-type: none"> • Prediction of Disease - Setting research goals - Data retrieval – preparation - exploration - Disease profiling - presentation and automation 	17
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	<p>Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)</p>	
Skills acquired from the course	<p>Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</p>	
<p>Learning Resources:</p> <ul style="list-style-type: none"> • Recommended Texts <ol style="list-style-type: none"> 2. Davy Cielen, Arno D. B. Meysman, Mohamed Ali, “Introducing Data Science”, manning publications 2016 • Reference Books <ol style="list-style-type: none"> 7. Roger Peng, “The Art of Data Science”, lulu.com 2016. 8. MurtazaHaider, “Getting Started with Data Science – Making Sense of Data with Analytics”, IBM press, E-book. 9. Davy Cielen, Arno D.B. Meysman, Mohamed Ali, “Introducing Data Science: Big Data, Machine Learning, and More, Using Python Tools”, Dreamtech 		

Press 2016.

10. Annalyn Ng, Kenneth Soo, “Numsense! Data Science for the Layman: No Math Added”, 2017,1st Edition.
11. Cathy O'Neil, Rachel Schutt, “Doing Data Science Straight Talk from the Frontline”, O'Reilly Media 2013.
12. Lillian Pierson, “Data Science for Dummies”, 2017 II Edition

- **Web resources**

Course Code	Human – Computer Interaction	Credits
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Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week
Course Category :	Year & Semester:	Admission Year:	
Pre-requisite			
<p>Learning Objectives: (for teachers: what they have to do in the class/lab/field)</p> <ul style="list-style-type: none"> • To learn the foundations of Human Computer Interaction. • To become familiar with the design technologies for individuals and persons with disabilities. • To be aware of mobile HCI. • To learn the guidelines for user interface 			
<p>Course Outcomes: (for students: To know what they are going to learn)</p> <p>CO1:Design effective dialog for HCI</p> <p>CO2: Design effective HCI for individuals and persons with disabilities</p> <p>CO3:designing multimedia/ ecommerce/ e-learning Web sites</p> <p>CO4: Assess the importance of user feedback.</p> <p>CO5:</p>			
Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)			
Units	Contents	Required Hours	
I	<p>FOUNDATIONS OF HCI :</p> <ul style="list-style-type: none"> • The Human: I/O channels – Memory • Reasoning and problem solving; The Computer: Devices – Memory – processing and networks; • Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity- Paradigms. - Case Studies 	17	
II	<p>DESIGN & SOFTWARE PROCESS:</p> <ul style="list-style-type: none"> • Interactive Design: • Basics – process – scenarios • Navigation: screen design Iteration and prototyping. • HCI in software process: • Software life cycle – usability engineering – 	17	

	<p>Prototyping in practice – design rationale. Design rules: principles, standards, guidelines, rules.</p> <p>Evaluation Techniques – Universal Design</p>	
III	<p>MODELS AND THEORIES:</p> <ul style="list-style-type: none"> • HCI Models : Cognitive models:- Socio-Organizational issues and stakeholder requirements • Communication and collaboration models-Hypertext, Multimedia and WWW. 	17
IV	<p>Mobile HCI:</p> <ul style="list-style-type: none"> • Mobile Ecosystem: Platforms, Application frameworks • Types of Mobile Applications: Widgets, Applications, Games • Mobile Information Architecture, Mobile 2.0, • Mobile Design: Elements of Mobile Design, Tools. - Case Studies 	17
V	<p>WEB INTERFACE DESIGN:</p> <p>Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow - Case Studies</p>	17

<p>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</p>	<p>Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)</p>	
<p>Skills acquired from the course</p>	<p>Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</p>	
<p>Learning Resources:</p> <ul style="list-style-type: none"> • Recommended Texts <ol style="list-style-type: none"> 1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, "Human -Computer Interaction ", III Edition, Pearson Education, 2004 (UNIT I, II & III) 2. . Brian Fling, —"Mobile Design and Development", I Edition, O'Reilly Media Inc., 2009 (UNIT – IV) 3. . Bill Scott and Theresa Neil, —Designing Web Interfaces , First Edition, O'Reilly, 2009. (UNIT-V) • Reference Books <ol style="list-style-type: none"> 1. Shneiderman, "Designing the User Interface: Strategies for Effective Human-Computer Interaction", V Edition, Pearson Education • Web resources 		

Course Code	Mobile Ad-hoc Network		Credits
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week
Course Category :	Year & Semester:	Admission Year:	
Pre-requisite			
<p>Learning Objectives: (for teachers: what they have to do in the class/lab/field)</p> <ul style="list-style-type: none"> • To develop the skills to gain a basic understanding of neural network theory and fuzzy logic theory. • To introduce students to artificial neural networks and fuzzy theory from a theoretical perspective 			
<p>Course Outcomes: (for students: To know what they are going to learn)</p> <p>CO1: Understand the basic concepts ad-hoc networks and ad-hoc mobility models.</p> <p>CO2: Acquire knowledge about Medium access protocols and standards like IEEE 802.11a and HIPERLAN.</p> <p>CO3: Identify the significance of Routing protocols and analyze about routing Algorithm.</p> <p>CO4: Understand about the applications of end-end delivery and security issues in ad-hoc networks</p> <p>CO5: Analyze and understand the concept of cross-layer design and parameter optimization techniques.</p>			
Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)			
Units	Contents		Required Hours
I	Introduction:		17

	Introduction to ad-hoc networks – definition, characteristics features, applications. Characteristics of wireless channel, ad-hoc mobility models indoor and out-door models.	
II	<p>Medium Access Protocol:</p> <ul style="list-style-type: none"> • MAC Protocols: Design issues, goals and classification. • Contention based protocols – with reservation, scheduling algorithms, protocols using directional antennas. • IEEE standards: 802.11a, 802.11b, 802.11g, 802.15. HIPERLAN. 	17
III	<p>Network Protocols :</p> <p>: Routing Protocols: Design issues, goals and classification. Proactive Vs reactive routing, unicast routing algorithms, Multicast routing algorithms, hybrid routing algorithm, energy aware routing algorithm, hierarchical routing, QoS aware routing.</p>	17
IV	<p>End – end delivery and security:</p> <p>Transport Layer: Issues in designing – Transport layer classification, ad-hoc transport protocols. Security issues in</p>	17

	ad-hoc networks: issues and challenges, network security attacks, secure routing protocols.	
V	CROSS -LAYER DESIGN: Need for cross layer design, cross layer optimization, parameter optimization techniques, cross layer cautionary perspective. Integration of ad-hoc with Mobile IP networks.	17
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	
Learning Resources: <ul style="list-style-type: none"> • Recommended Texts <ol style="list-style-type: none"> 1. C. Siva Ram Murthy and B. S. Manoj, Ad hoc Wireless Networks Architecture and Protocols II edition, Pearson Edition, 2007. 2. Charles E. Perkins, Ad hoc Networking, Addison – Wesley, 2000. • Reference Books <ol style="list-style-type: none"> 1. Stefano Basagni, Marco Conti, Silvia Giordano and Ivan stojmenovic, Mobile ad- 		

2. hoc networking, Wiley-IEEE press, 2004.
3. Mohammad Ilyas, The handbook of ad-hoc wireless networks, CRC press, 2002.
4. T. Camp, J. Boleng, and V. Davies "A Survey of Mobility Models for Ad-hoc Network"
5. Research, "Wireless Commn. and Mobile Comp - Special Issue on Mobile Ad-
6. hoc networking Research, Trends and Applications", Vol. 2, no. 5, 2002, pp. 483 – 502.
7. A survey of integrating IP mobility protocols and Mobile Ad-hoc networks, Fekri
8. M. bduljalil and Shrikant K. Bodhe, IEEE communication Survey and tutorials, no:12007.

- **Web resources**

Course Code		Credits
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week
		Total: (L+T+P) per week
Course Category :	Year & Semester:	Admission Year:
Pre-requisite		
Learning Objectives: (for teachers: what they have to do in the class/lab/field)		
Course Outcomes: (for students: To know what they are going to learn)		
CO1:		
CO2:		
CO3:		
CO4:		
CO5:		
Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)		
Units	Contents	Required Hours
I		17
II		17
III		17

IV		17
V		17
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	
Learning Resources: <ul style="list-style-type: none"> • Recommended Texts • Reference Books • Web resources 		

Course Code		Credits
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week
		Total: (L+T+P) per week
Course Category :	Year & Semester:	Admission Year:
Pre-requisite		
Learning Objectives: (for teachers: what they have to do in the class/lab/field)		

Course Outcomes: (for students: To know what they are going to learn)		
CO1:		
CO2:		
CO3:		
CO4:		
CO5:		
Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)		
Units	Contents	Required Hours
I		17
II		17
III		17
IV		17
V		17
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	

Learning Resources:

- **Recommended Texts**
- **Reference Books**

- **Web resources**

Course Code		Credits
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week
		Total: (L+T+P) per week
Course Category :	Year & Semester:	Admission Year:
Pre-requisite		
Learning Objectives: (for teachers: what they have to do in the class/lab/field)		
Course Outcomes: (for students: To know what they are going to learn)		
CO1:		
CO2:		
CO3:		
CO4:		
CO5:		
Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)		
Units	Contents	Required Hours
I		17
II		17
III		17
IV		17
V		17

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	
Learning Resources: <ul style="list-style-type: none"> • Recommended Texts • Reference Books • Web resources 		

Course Code			Credits
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week
Course Category :	Year & Semester:		Admission Year:
Pre-requisite			
Learning Objectives: (for teachers: what they have to do in the class/lab/field)			

Course Outcomes: (for students: To know what they are going to learn) CO1: CO2: CO3: CO4: CO5:		
Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)		
Units	Contents	Required Hours
I		17
II		17
III		17
IV		17
V		17
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	
Learning Resources:		
<ul style="list-style-type: none"> • Recommended Texts • Reference Books • Web resources 		

Course Code		Credits
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week
Course Category :	Year & Semester:	Total: (L+T+P) per week
Pre-requisite		Admission Year:
Learning Objectives: (for teachers: what they have to do in the class/lab/field)		
Course Outcomes: (for students: To know what they are going to learn)		
CO1:		
CO2:		
CO3:		
CO4:		
CO5:		
Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)		
Units	Contents	Required Hours
I		17
II		17
III		17
IV		17
V		17
Extended Professional Component (is a part of internal component only, Not to be included	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	

in the External Examination question paper)		
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	
Learning Resources: <ul style="list-style-type: none"> • Recommended Texts • Reference Books • Web resources 		

Course Code		Credits
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week
		Total: (L+T+P) per week
Course Category :	Year & Semester:	Admission Year:
Pre-requisite		
Learning Objectives: (for teachers: what they have to do in the class/lab/field)		
Course Outcomes: (for students: To know what they are going to learn)		
CO1:		
CO2:		
CO3:		
CO4:		
CO5:		
Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)		
Units	Contents	Required Hours

I		17
II		17
III		17
IV		17
V		17
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	
Learning Resources: <ul style="list-style-type: none"> • Recommended Texts • Reference Books • Web resources 		

Course Code		Credits
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week
		Total: (L+T+P) per week

Course Category :		Year & Semester:	Admission Year:
Pre-requisite			
Learning Objectives: (for teachers: what they have to do in the class/lab/field)			
Course Outcomes: (for students: To know what they are going to learn) CO1: CO2: CO3: CO4: CO5:			
Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)			
Units	Contents	Required Hours	
I		17	
II		17	
III		17	
IV		17	
V		17	
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)		
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill		

Learning Resources:

- **Recommended Texts**
- **Reference Books**

- **Web resources**

Course Code		Credits
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week
Course Category :	Year & Semester:	Admission Year:
Pre-requisite		
Learning Objectives: (for teachers: what they have to do in the class/lab/field)		
Course Outcomes: (for students: To know what they are going to learn)		
CO1:		
CO2:		
CO3:		
CO4:		
CO5:		
Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)		
Units	Contents	Required Hours
I		17
II		17
III		17
IV		17
V		17

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	
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