

# **NATIONAL ENGINEERING COLLEGE**

*(An Autonomous Institution Affiliated to Anna University Chennai & Accredited by NAAC)*

**K.R.NAGAR, KOVILPATTI – 628 503**  
**[www.nec.edu.in](http://www.nec.edu.in)**

## **REGULATIONS – 2019**

### **CURRICULUM & SYLLABUS**

**B. Tech. – INFORMATION TECHNOLOGY**  
**Accredited by NBA**

**B.Tech. – INFORMATION TECHNOLOGY  
CURRICULUM AND SYLLABUS**

## DEPARTMENT OF INFORMATION TECHNOLOGY

### VISION

To produce technically competent and value based IT Professionals to meet the current challenges of the modern IT industry.

### MISSION

- Imparting quality education with innovative components in teaching learning process.
- Conducting student centric programme to enhance communication, team spirit, leadership skills and self learning.
- Motivating the students to realize the need of ethics and human values.
- Developing a conducive environment for collaborative research.

### PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

Programme Educational Objectives are broad statements that describe the career and professional accomplishments that the programme is preparing graduates to achieve:

- PEO 1 :** Excel in IT, ITES industries and higher education by applying the principles and practices of computing.
- PEO 2 :** Maintain professionalism and adapt to emerging technologies.
- PEO 3 :** Equip themselves as a leader and capable of managing Multidisciplinary environment.

### PROGRAMME OUTCOMES (POs)

At the time of graduation, our IT graduates are expected to have:

1. Apply knowledge of mathematics, physics, chemistry, biological sciences, Engineering fundamentals and Software Development Fundamentals, Information Management and Security, Networking and web Systems to the solution of complex engineering problems in Information Technology.
2. Identify, formulate, research literature and analyze complex Information Technology problems in Software Engineering, Data Mining, Mobility Engineering, Analytic Computing, Network Management and security, reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
3. Design solutions for complex Information Management and Security, Networking and web System problems and design systems, components or processes that meet specified needs with appropriate considerations for environment, culture, society, public health and safety.
4. Conduct investigations of complex Information Management and Security, Networking and web System problems using research based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions.
5. Create, select and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling, to complex engineering problems in Emerging technologies, Networking and web Systems with an understanding of the limitations.
6. Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice in Healthcare and Banking and solutions to complex engineering problems in Networking and Web Systems and Emerging Technologies.
7. Understand and evaluate the sustainability and impact of professional engineering work in the solution of complex Information Technology problems in societal and environmental contexts.
8. Apply ethical principles and commit to professional ethics and responsibilities and norms of Computer Ethics in engineering practice.
9. Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.
10. Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. Demonstrate knowledge and understanding of engineering management principles and economic decision making and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments
12. Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

## PREAMBLE OF THE CURRICULUM & SYLLABI

The Curriculum and Syllabi under Regulations 2019 are implemented based on the recommendations of AICTE, New Delhi and UGC, New Delhi. The course content of each course shall be fixed in accordance with the Programme Educational Objectives (PEOs), Programme Outcomes (POs) and Course Outcomes (COs).

Further, The CBCS enables the students to earn credits across programmes and provides flexibility for slow and fast learners in registering the required number of credits in a semester. The CBCS facilitates the transfer of credits earned in different departments / Centers of other recognized / accredited universities or institutions of higher education in India and abroad either by studying directly or by online method.

The curriculum of **IT programme** is designed with total number of credits **164** (**121** for Lateral entry). The curriculum shall have the following category of courses with credits as given in Table - I.

**TABLE – 1**                      **CATEGORY OF COURSES**

Sl. No	Coursework – Subject Area	The range of Total credits
1.	Humanities and Social Sciences including Management courses	15
2.	Basic Science courses	27
3.	Engineering Science courses	29
4.	Programme Core courses	50
5.	Programme Elective courses relevant to chosen specialization / branch	18
6.	Open Elective courses from other technical and /or emerging subject areas	9
7.	Skill Development Courses	16
8.	Mandatory courses	(non – credit)
	<b>TOTAL</b>	<b>164</b>

- i. **Humanities and Social Sciences (HSMC)** include English, Communication Skill laboratory and Management courses
- ii. **Basic Science Courses (BSC)** include Chemistry, Physics, Biology and Mathematics
- iii. **Engineering Science Courses (ESC)** include Workshop, Drawing, Basics of Electrical / Electronics / Mechanical / Civil / Computer / Instrumentation Engineering
- iv. **Programme Core Courses (PCC)** include the core courses relevant to the chosen programme of study.

- v. **Programme Elective Courses (PEC)** include the elective courses relevant to the chosen programme of study.
- vi. **Open Elective Courses (OEC)** include inter-disciplinary courses which are offered in other Engineering/Technology Programme of study.
- vii. **Skill Development Courses (SDC)** include the courses such as Project, Seminar and Inplant training / Internship for improving Employability Skills.
- viii. **Mandatory courses (MAC)** include Personality and Character development and the courses recommended by the regulatory bodies such as AICTE, UGC, etc.

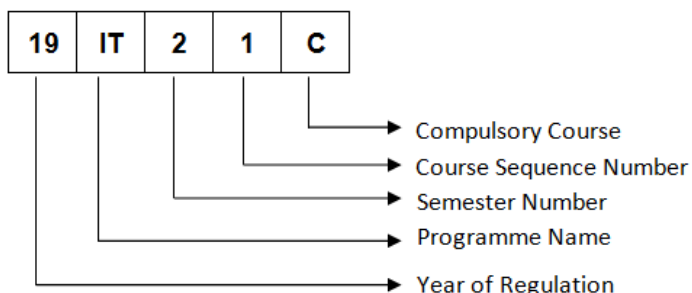
Performance in each course of study shall be evaluated based on Continuous Assessment throughout the semester and end semester examination at the end of the programme. Keeping in mind the content of the courses and delivery methods, different question paper patterns are suggested, as given in Table-2.

**TABLE – 2 QP – QUESTION PATTERN**

**R-2019 REVISED Question Pattern Format**

Subject Type	Question pattern	2 marks	4 marks	10 marks	11 marks	12 marks	16 marks	20 marks	Total
Theory (3 / 4 credit)	A	10	5	-	--	5 Qns (either or type)	--	--	100
Theory (2 credit)	B	10	-	-	5 Qns (either or type)	--	--	--	75
Theory (1 credit)	C	5	--	2 Qns (either or type)	--	--	--	--	30
Theory (Trans Disciplinary)	D	-	-	-	-	-	--	5 out of 8	100
Design Oriented / Theory	E	--	-	--	-	-	--	5 Qns (either or type)	100
Theory (3 / 4 credit)	F	10	--	--	--	--	5 Qns (either or type)	--	100

**FOR COURSE CODE**



## REGULATIONS – 2019 CURRICULUM AND SYLLABUS

### SEMESTER – I

S. No	Course Category	Course Code	Course Title	L	T	P	C	Question pattern®
<b>THEORY COURSES</b>								
1.	HSMC	19SH11C	Technical English	2	0	0	2	B
2.	BSC	19SH12C	Mathematical Foundations For Engineers	3	1	0	4	A
3.	BSC	19SH13C	Engineering Physics	2	0	0	2	B
4.	BSC	19SH14C	Engineering Chemistry	2	0	0	2	B
5.	ESC	19IT11C	Python Programming	3	0	0	3	A
6.	ESC	19SH15C	Engineering Graphics	2	0	4	4	E
<b>PRACTICAL COURSES</b>								
7.	BSC	19SH16C	Engineering Physics and Engineering Chemistry Laboratory Part A – Engineering Physics Laboratory Part B – Engineering Chemistry Laboratory	0	0	3	1.5	-
8.	ESC	19IT12C	Python Programming Laboratory	0	0	4	2	-
<b>TOTAL</b>				<b>14</b>	<b>1</b>	<b>11</b>	<b>20.5</b>	

### SEMESTER – II

S. No	Course Category	Course Code	Course Title	L	T	P	C	Question pattern®
<b>THEORY COURSES</b>								
1	HSMC	19IT21C	Professional English	2	0	0	2	B
2	BSC	19IT22C	Probability and Queueing theory	3	1	0	4	A
3	BSC	19IT23C	Physics for Information Science	2	0	0	2	B
4	BSC	19IT24C	Biology for Engineers	2	0	0	2	B
5	ESC	19IT25C	Problem Solving Techniques	3	0	0	3	A
6	ESC	19IT26C	Basic Electrical and Electronics Engineering	3	0	0	3	A
7	HSMC	19GN02C	Heritage of Tamils (தமிழர் மரபு)	1	0	0	1	C
<b>PRACTICAL COURSES</b>								
8.	BSC	19IT27C	Physics for Information Science and Biology Laboratory Part A – Physics for Information Science Laboratory Part B – Biology Laboratory	0	0	3	1.5	-
9.	ESC	19IT28C	Problem Solving Techniques Laboratory	0	0	4	2	-
10.	SDC	19GN01C	Innovation through Design Thinking	1	0	2	2	
<b>TOTAL</b>				<b>17</b>	<b>1</b>	<b>9</b>	<b>22.5</b>	<b>-</b>

## SEMESTER – III

S. No.	Course Category	Course Code	Course Title	L	T	P	C	Question pattern®
<b>THEORY COURSES</b>								
1.	BSC	19IT31C	Discrete Mathematics	3	1	0	4	A
2.	PCC	19IT32C	Data Structures and Algorithms	3	1	0	4	A
3.	PCC	19IT33C	Object Oriented Programming	3	1	0	4	A
4.	ESC	19IT34C	Principles of Data Communication	3	0	0	3	A
5.	HSMC	19IT35C	Professional Ethics and Human values	3	0	0	3	A
6.	ESC	19IT36C	Computer Organization and Architecture	3	0	0	3	A
7.	HSMC	19GN03C	Tamils and Technology (தமிழரும் தொழில் நுட்பமும்)	1	0	0	1	C
<b>PRACTICAL COURSES</b>								
8.	PCC	19IT37C	Data Structures Laboratory	0	0	3	1.5	-
9.	PCC	19IT38C	Object Oriented Programming Laboratory	0	0	3	1.5	-
10.	HSMC	19IT39C	Communication Skills Laboratory	0	0	2	1	-
<b>TOTAL</b>				<b>19</b>	<b>3</b>	<b>8</b>	<b>26</b>	

## SEMESTER – IV

S. No.	Course Category	Course Code	Course Title	L	T	P	C	Question pattern®
<b>THEORY COURSES</b>								
1.	BSC	19IT41C	Statistics and Numerical Methods	3	1	0	4	A
2.	PCC	19IT42C	Operating Systems	3	0	0	3	A
3.	PCC	19IT43C	Database Management Systems	3	0	0	3	A
4.	PCC	19IT44C	Computer Networks	3	0	0	3	A
5.	PCC	19IT45C	Algorithmics	2	0	0	2	B
6.	HSMC	19IT46C	Finance and Accounting	3	0	0	3	A
7.	MAC	19MC01C	Environmental Science and Engineering	3	0	0	0	D
<b>PRACTICAL COURSES</b>								
8.	PCC	19IT47C	Operating Systems Laboratory	0	0	3	1.5	-
9.	PCC	19IT48C	Networking Laboratory	0	0	3	1.5	-
10.	PCC	19IT49C	Database Management Systems Laboratory	0	0	3	1.5	-
<b>TOTAL</b>				<b>20</b>	<b>1</b>	<b>9</b>	<b>22.5</b>	



### SEMESTER – V

S. No.	Course Category	Course Code	Course Title	L	T	P	C	Question pattern®
<b>THEORY COURSES</b>								
1.	PCC	19IT51C	Java Programming	3	0	0	3	A
2.	ESC	19IT52C	Software Engineering	3	0	0	3	A
3.	PCC	19IT53C	Cryptography and Network Security	3	0	0	3	A
4.	PCC	19IT54C	Internet and Web Technology	3	0	0	3	A
5.	ESC	19IT55C	Embedded System	3	0	0	3	A
6.	PEC		Elective-I	3	0	0	3	-
7.	MAC	19MC02C	Constitution of India	3	0	0	0	D
<b>PRACTICAL COURSES</b>								
8.	PCC	19IT56C	Java Programming Laboratory	0	0	3	1.5	-
9.	PCC	19IT57C	Cryptography and Network Security Laboratory	0	0	3	1.5	-
10.	PCC	19IT58C	Internet and Web Technology Laboratory	0	0	3	1.5	-
<b>TOTAL</b>				<b>18</b>	<b>0</b>	<b>9</b>	<b>22.5</b>	

### SEMESTER – VI

S. No.	Course Category	Course Code	Course Title	L	T	P	C	Question pattern®
<b>THEORY COURSES</b>								
1.	PCC	19IT61C	Big Data Analytics	3	0	0	3	A
2.	PCC	19IT62C	Enterprise Mobility	3	0	0	3	A
3.	HSMC	19IT63C	Business Process Management	2	0	0	2	B
4.	PEC		Elective – II	3	0	0	3	-
5.	OEC		Elective – I (Open Elective)	3	0	0	3	-
<b>PRACTICAL COURSES</b>								
6.	PCC	19IT64C	Comprehension	0	0	2	1	-
7.	PCC	19IT65C	Big Data Analytics Laboratory	0	0	3	1.5	-
8.	PCC	19IT66C	Mobile Technologies Laboratory	0	0	3	1.5	-
9.	SDC	19IT67C	Product Development Laboratory	1	0	2	2	-
<b>TOTAL</b>				<b>15</b>	<b>0</b>	<b>10</b>	<b>20</b>	

**SEMESTER – VII**

S. No.	Course Category	Course Code	Course Title	L	T	P	C	Question pattern <sup>®</sup>
<b>THEORY COURSES</b>								
1.	PEC		Elective - III	3	0	0	3	-
2.	PEC		Elective - IV	3	0	0	3	-
3.	PEC		Elective - V	3	0	0	3	-
4.	OEC		Elective - II (Open Elective)	3	0	0	3	-
<b>PRACTICAL COURSES</b>								
5.	SDC	19IT71C	Project Work – I	0	0	6	3	-
6.	SDC	19IT72C	Research Paper and Patent Review – Seminar	0	0	2	1	-
<b>TOTAL</b>				<b>11</b>	<b>0</b>	<b>8</b>	<b>16</b>	

**SEMESTER – VIII**

S. No.	Course Category	Course Code	Course Title	L	T	P	C	Question pattern <sup>®</sup>
<b>THEORY COURSES</b>								
1.	PEC		Elective-VI	3	0	0	3	-
2.	OEC		Elective – III (Open Elective)	3	0	0	3	-
<b>PRACTICAL COURSES</b>								
3.	SDC	19IT81C	Project Work – II	0	0	12	6	-
4.	SDC	19IT82C	Internship / In-plant Training	0	0	4	2	-
<b>TOTAL</b>				<b>6</b>	<b>0</b>	<b>16</b>	<b>14</b>	

**TOTAL CREDITS TO BE EARNED FOR THE AWARD OF THE DEGREE –164**

## PROGRAMME ELECTIVE COURSES

S. No.	Course Category	Course Code	Course Title	L	T	P	C	Question pattern <sup>®</sup>
<b>ANALYTICS</b>								
1.	PEC	19IT01E	Deep Learning	3	0	0	3	A
2.	PEC	19IT02E	Machine Learning	3	0	0	3	A
3.	PEC	19IT03E	Bioinformatics	3	0	0	3	A
4.	PEC	19IT04E	Data Warehousing and Data Mining	3	0	0	3	A
5.	PEC	19IT05E	Scalable Data Science	3	0	0	3	A
6.	PEC	19IT06E	Business Intelligence for IT	3	0	0	3	A
7.	PEC	19IT07E	Artificial Intelligence	3	0	0	3	A
8.	PEC	19IT08E	Reinforcement Learning	3	0	0	3	A
9.	PEC	19IT09E	Analytics Computing	3	0	0	3	A
10.	PEC	19IT10E	Web Analytics	3	0	0	3	A
11.	PEC	19IT11E	Data Science using R	3	0	0	3	A
12.	PEC	19IT12E	Soft Computing	3	0	0	3	A
<b>ADVANCED COMPUTING</b>								
13.	PEC	19IT13E	Social Networking	3	0	0	3	A
14.	PEC	19IT14E	Cloud Computing	3	0	0	3	A
15.	PEC	19IT15E	Information Visualization	3	0	0	3	A
16.	PEC	19IT16E	GPU Computing	3	0	0	3	A
17.	PEC	19IT17E	Multi-core Architectures	3	0	0	3	A
18.	PEC	19IT18E	Service Oriented Architecture	3	0	0	3	A
19.	PEC	19IT19E	Quantum Computing	3	0	0	3	A
20.	PEC	19IT20E	Cloud Management Security	3	0	0	3	A
21.	PEC	19IT21E	Edge and Fog Computing	3	0	0	3	A
22.	PEC	19IT22E	Virtual and Augmented Reality	3	0	0	3	A
23.	PEC	19IT23E	BlockChain Technology	3	0	0	3	A
<b>MOBILE COMPUTING</b>								
24.	PEC	19IT24E	Mobile communications	3	0	0	3	A
25.	PEC	19IT25E	Mobile and Ubiquitous Computing	3	0	0	3	A
26.	PEC	19IT26E	IoT programming	3	0	0	3	A
27.	PEC	19IT27E	Android programming	3	0	0	3	A
28.	PEC	19IT28E	M-commerce	3	0	0	3	A
29.	PEC	19IT29E	IoT and its Applications	3	0	0	3	A
30.	PEC	19IT30E	Digital Marketing	3	0	0	3	A
<b>PROGRAMMING</b>								
31.	PEC	19IT31E	Advanced Java Programming	3	0	0	3	A
32.	PEC	19IT32E	Game programming	3	0	0	3	A
33.	PEC	19IT33E	ASP .NET Frameworks	3	0	0	3	A
34.	PEC	19IT34E	DevOps (Agile)	3	0	0	3	A
35.	PEC	19IT35E	UNIX Internals	3	0	0	3	A

36.	PEC	19IT36E	Compiler Design	3	0	0	3	A
37.	PEC	19IT37E	Software testing tools	3	0	0	3	A
38.	PEC	19IT38E	Functional Programming	3	0	0	3	A
<b>NETWORKING AND SECURITY</b>								
39.	PEC	19IT39E	Wireless Adhoc and Sensor Networks	3	0	0	3	A
40.	PEC	19IT40E	Next Generation Networks	3	0	0	3	A
41.	PEC	19IT41E	Network Programming and Management	3	0	0	3	A
42.	PEC	19IT42E	Information Security	3	0	0	3	A
43.	PEC	19IT43E	Cyber Forensics and Ethical Hacking	3	0	0	3	A
44.	PEC	19IT44E	Information Theory and Coding	3	0	0	3	A
<b>DATA SCIENCE</b>								
45.	PEC	19IT45E	Introduction to Data Science	3	0	0	3	A
46.	PEC	19IT46E	Machine learning Techniques	2	0	2	3	A
47.	PEC	19IT47E	Data Engineering Concepts and Tools	2	0	2	3	A
48.	PEC	19IT48E	Web data mining	2	0	2	3	A
49.	PEC	19IT49E	Business Intelligence	3	0	0	3	A
<b>SKILL DEVELOPMENT COURSE</b>								
50.	PEC	19IT50E	Professional Readiness for Innovation, Employability and Entrepreneurship	0	0	6	3	-

### ONE CREDIT ELECTIVE COURSES

S. No.	Course Category	Course Code	Course Title	L	T	P	C	Question pattern <sup>⊕</sup>
1.	OEC	19IT01L	Agile Development Process	1	0	0	1	C
2.	OEC	19IT02L	Computer Hardware and Trouble Shooting	0	0	2	1	-
3.	OEC	19IT03L	PHP Programming	0	0	2	1	-
4.	OEC	19IT04L	Theory of Computation	1	0	0	1	C
5.	OEC	19IT05L	Basics of Compiler Design	1	0	0	1	C
6.	OEC	19IT06L	Virtualization	1	0	0	1	C
7.	OEC	19IT07L	Social Media Application Development	1	0	0	1	C
8.	OEC	19IT08L	IoT Development	1	0	0	1	C
9.	OEC	19IT09L	E-Commerce Security	1	0	0	1	C
10.	OEC	19IT10L	Hadoop Architecture and Installation	0	0	2	1	-
11.	OEC	19IT11L	Microcontroller and Raspberry Pi	1	0	0	1	C

S. No.	Course Category	Course Code	Course Title	L	T	P	C	Question pattern⊕
12.	OEC	19IT12L	Programming in IOT	0	0	2	1	-
13.	OEC	19IT13L	R Programming	0	0	2	1	-
14.	OEC	19IT14L	Java Generics and Collections framework	0	0	2	1	-
15.	OEC	19IT15L	Deep Learning Algorithms	0	0	2	1	-
16.	OEC	19IT16L	Database Design and Programming with SQL	0	0	2	1	-
17.	OEC	19IT17L	Introduction to Networks	1	0	0	1	C
18.	OEC	19IT18L	Routing and Switching Essentials	1	0	0	1	C
19.	OEC	19IT19L	Scaling Networks	1	0	0	1	C
20.	OEC	19IT20L	Connecting Networks	1	0	0	1	C
21.	OEC	19IT21L	Robotic Process Automation	0	0	2	1	-
22.	OEC	19IT22L	Matlab Programming	0	0	2	1	-
23.	OEC	19IT23L	Ethics in cybersecurity	1	0	0	1	C
24.	OEC	19IT24L	Arduino Programming	1	0	0	1	C
25.	OEC	19IT25L	Mathematics for Machine Learning	1	0	0	1	C
26.	OEC	19IT26L	Real Time Systems	1	0	0	1	C
27.	OEC	19IT27L	Network Simulation with NS3	0	0	2	1	C
28.	OEC	19IT28L	Python for Data Science	0	0	2	1	-
29.	OEC	19IT29L	Node JS	0	0	2	1	-
30.	OEC	19IT30L	Introduction to NoSQL with MongoDB	0	0	2	1	-

### OPEN ELECTIVE COURSES (OEC)

S. No.	Course Category	Course Code	Course Title	L	T	P	C	Question pattern⊕
1.	OEC	19IT01N	Fundamentals of Java Programming	3	0	0	3	A
2.	OEC	19IT02N	Python Programming - Basics	3	0	0	3	A
3.	OEC	19IT03N	Introduction to Virtual and Augmented Reality	3	0	0	3	A
4.	OEC	19IT04N	Internet of Things	3	0	0	3	A
5.	OEC	19IT05N	Basic of Networking	3	0	0	3	A
6.	OEC	19IT06N	Advanced Networking	3	0	0	3	A
7.	OEC	19IT07N	Industrial Networking	3	0	0	3	A
8.	OEC	19IT08N	Data Analytics	3	0	0	3	A
9.	OEC	19IT09N	E-waste Management	3	0	0	3	A

## List of courses under verticals

### DATA SCIENCE

S. No	Course Category	Course Code	Course Title	L	T	P	C	Question pattern <sup>®</sup>
1.	PEC	19IT45E	Introduction to Data Science	3	0	0	3	A
2.	PEC	19IT46E	Machine learning Techniques	2	0	2	3	A
3.	PEC	19IT49E	Business Intelligence	3	0	0	3	A
4.	PEC	19IT51E	Data Engineering	3	0	2	4	A
5.	PEC	19IT52E	Data Visualization	3	0	2	4	A
6.	PEC	19IT53E	Privacy Preservation	3	0	0	3	A
7.	OEC	19IT31L	Deep Learning	1	0	0	1	C
8.	OEC	19IT32L	Reinforcement Learning	1	0	0	1	C
9.	OEC	19IT33L	Natural Language Processing	1	0	0	1	C
<b>TOTAL</b>				<b>20</b>	<b>0</b>	<b>6</b>	<b>23</b>	

19SH11C

**TECHNICAL ENGLISH**  
(Common to all B.E. / B.Tech. Degree Programmes)

**L T P C**  
**2 0 0 2**

**COURSE OUTCOMES**

Upon completion of this course, the students will be able to

- CO1: apply the basic language skills to understand various aspects of communication skills (K3)
- CO2: express their thoughts with correct usage of language in formal writings (K3)
- CO3: understand various language components and develop the pronunciation skill. (K2,S4)
- CO4: make effective technical writings and interpret any pictorial representation. (K3,S4)
- CO5: frame sentences and write effective reports. (K3)

**UNIT I**

**6**

Parts of Speech – Word formation using Prefixes and Suffixes - Informal writing - Diary writing, letter to Friend / Parent / Siblings - Greetings and Self Introduction – Situational Phrases - Tense (Present)

**UNIT II**

**6**

Technical terms and extended definitions - Transformation of words into different grammatical forms – Tense (Past) –Letter writing (for Industrial visit and training) - Instruction Writing - Listening for general information.

**UNIT III**

**6**

Personality Adjectives - Phonetics (Vowels - Consonants– Diphthongs - Transcriptions) – Kinds of Sentences (Statement, Interrogative, Imperative & Exclamatory) – Situational Conversation.

**UNIT IV**

**6**

Commonly Misspelled words – Active and Passive Voices – E - mail writing - Picture Description – Checklists

**UNIT V**

**6**

Homophones - Concord - Tense (Future) - Foreign Words and Phrases - Report writing (Types – Structure - Stages in Report writing- Model Report) – Reading Comprehension.

**Suggested Activity:** Book Review – Herein the students will be required to submit a review of a book (Literary or non-literary) of their choice. This will be followed by a presentation of the same in the class.

**L: 30; TOTAL: 30 PERIODS**

**TEXT BOOKS**

1. Anderson, Paul V. “Technical Communication: A Reader - Centered Approach”, 9<sup>th</sup> Edition, Cengage, New Delhi, 2018.
2. Jan Svartvik, et.al. “A Comprehensive Grammar of the English Language”, Longman Inc., Newyork, 2014.

**REFERENCES**

1. Murphy Raymond, "Basic Grammar Practice on Tense", Cambridge University Press: New Delhi, 2018.
2. Kumar, Suresh. E., "Engineering English", Orient Blackswan, Hyderabad, 2015.

<b>19SH12C</b>	<b>MATHEMATICAL FOUNDATIONS FOR ENGINEERS</b> (Common to all B.E. / B.Tech. Degree Programmes)	<b>L T P C</b> <b>3 1 0 4</b>
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**COURSE OUTCOMES**

Upon completion of this course, the students will be able to

- CO1: make use of orthogonal transformation. (K3)
- CO2: find the evolutes of various curves.(K2)
- CO3: maxima and minima of real valued functions.(K3)
- CO4: solve ordinary differential equations.(K2)
- CO5: solve partial differential equations.(K2)

**UNIT I MATRICES 12**

Characteristic equation – Eigen values and Eigen vectors of a real matrix – Properties of Eigen values and Eigen vectors – Diagonalisation of a matrix by orthogonal transformation – Quadratic forms – Reduction of quadratic form to canonical form by orthogonal transformation and its nature; Cayley – Hamilton theorem (excluding proof)

**UNIT II DIFFERENTIAL CALCULUS 12**

Curvature in cartesian, parametric and polar forms – Centre of curvature, radius of curvature and circle of curvature – Evolutes – Envelopes – Evolute as envelope of normals.

**UNIT III FUNCTIONS OF SEVERAL VARIABLES 12**

Partial derivative – Total derivative – Euler's theorem on homogeneous functions – Taylor's Series – Jacobians – Maxima and Minima – Constrained Maxima and Minima by the method of Lagrange's multipliers.

**UNIT IV ORDINARY DIFFERENTIAL EQUATIONS 12**

Solutions of first order ordinary differential equations - Equations solvable for 'p', equations solvable for 'y', equations solvable for 'x' - Solutions of higher order linear differential equations with constant coefficients – Cauchy's and Legendre's linear equations - Method of variation of parameters – Solution of simultaneous linear differential equation.

**UNIT V PARTIAL DIFFERENTIAL EQUATIONS 12**

Formation of partial differential equations – Solutions of standard types of first order partial differential equations - Lagrange's linear equations - Solutions of homogeneous and Non homogeneous linear partial differential equations of second and higher order with constant coefficients.

**L: 45; T: 15; TOTAL: 60 PERIODS**

**TEXT BOOKS**

1. Grewal.B.S. "Higher Engineering Mathematics", 44<sup>th</sup> Edition, Khanna Publications, New Delhi, 2017.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", 10<sup>th</sup> Edition, Wiley India, 2014.



## REFERENCES

1. Bali.N.P. and Manish Goyal, "A Text book of Engineering Mathematics", 9<sup>th</sup> Edition, Laxmi Publications Private Limited, 2017.
2. George B.Thomas, Jr. Ross L.Finney, "Calculus and Analytic Geometry", 9<sup>th</sup> Edition, Dorling Kindersley Private Limited, 2010.

19SH13C

**ENGINEERING PHYSICS**  
(Common to all B.E. / B.Tech. Degree Programmes)

**L T P C**  
**2 0 0 2**

## COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: summarize the properties and structures of crystal solids. (K2)

CO2: understand the principle and propagation of different types of waves (K2)

CO3: choose the appropriate Laser technique for industrial and medical applications (K2)

CO4: describe the different types, fabrication, losses of optical fibers and their applications in communication and instrumentation. (K2)

CO5: explain the physical properties of photons & electrons and their applications in different electron microscopes. (K2)

### UNIT I CRYSTALLOGRAPHY

6

Lattice, Unit cell, Bravais lattice, Lattice planes - Crystal system - Miller indices – d spacing - Characteristics of SC, BCC, FCC and HCP structures- Crystal defects.

### UNIT II WAVES

6

Simple harmonic oscillators - Damped harmonic oscillator - Forced mechanical and electrical oscillators - Transverse wave on a string - Wave equation on a string - Longitudinal waves and wave equation - Acoustics waves

### UNIT III LASER

6

Principle of spontaneous emission and stimulated emission, Population inversion, Pumping, Einstein's A and B coefficients – Different types of lasers: gas lasers (CO<sub>2</sub>), solid-state lasers (Nd-YAG) - Applications of lasers in science, engineering and medicine.

### UNIT IV FIBRE OPTICS

6

Principle – Total internal reflection - Acceptance angle and Numerical aperture - Types of optical fibers - Double crucible technique – Splicing - Losses in optical fibers - Fiber optic communication system - Applications - Fiber optic sensors – Medical Endoscope.

### UNIT V QUANTUM PHYSICS

6

Black Body Radiation - Matter Waves - Heisenberg's uncertainty principle - Schrodinger's wave equation - Particle in one dimensional box - Electron microscope - Scanning electron microscope - Transmission electron microscope.

**L: 30; TOTAL: 30 PERIODS**

## TEXT BOOKS

1. David Halliday, Robert Resnick, Jearl Walker, "Fundamentals of Physics", 11<sup>th</sup> Edition, John Wiley & Sons Inc.USA, 2018.
2. Arthur Beiser, "Concepts of Modern Physics", 7<sup>th</sup> Edition, Mc-Graw Hill Publications Private Limited, 2017.
3. D.J.Griffiths, "Quantum mechanics", 2<sup>nd</sup> Edition, Cambridge University Press, 2014.

**REFERENCES**

1. Renk, Karl.F "Basics of laser physics", 2<sup>nd</sup> Edition, Springer international publishing, 2017.
2. H. J. Pain, Patricia Rankin "Introduction to vibration and waves", 1<sup>st</sup> Edition, Wiley, 2015
3. K.S.Mathur, "Fundamentals of Fiber Optics", 1<sup>st</sup> Edition, Zorba books, 2018.

**19SH14C**

**ENGINEERING CHEMISTRY**  
(Common to all B.E. / B.Tech. Degree Programmes)

**L T P C**  
**2 0 0 2**

**COURSE OUTCOMES**

Upon completion of this course, the students will be able to

- CO1: identify the various water treatment technique for domestic and industrial purpose. (K2)
- CO2: understand the various isotherms, kinetics in surface chemistry and catalysis. (K2)
- CO3: acquire the knowledge of electrochemistry and corrosion and its control. (K2)
- CO4: familiar with the various novel organic material used in electronics industry. (K2)
- CO5: understand the principle, components and working of various analytical instruments. (K2)

**UNIT I WATER TREATMENT****6**

Hardness - Estimation of hardness of water – Specifications for drinking water (BIS and WHO standards) - Softening of water: External and Internal treatments of water – Desalination - Methods of treatment of municipal water - Waste water treatments: primary, secondary and tertiary

**UNIT II SURFACE CHEMISTRY AND CATALYSIS****6**

Adsorption – Types - Freundlich's adsorption isotherm – Langmuir's adsorption isotherm – contact theory – Kinetics of surface reactions - Unimolecular reactions - Applications of adsorption on pollution abatement.

Catalysis: Catalyst – Types of catalysis – Criteria – Autocatalysis – Acid base catalysis – applications - Catalytic convertor – Enzyme catalysis – Michaelis – Menten equation.

**UNIT III ELECTROCHEMISTRY AND CORROSION****6**

Electrode potential-Nernst Equation-reference electrode - glass electrode - measurement of pH – electrochemical series – significance – Conductometric titrations (strong acid vs strong base and weak acid vs strong base)

Corrosion: Types of corrosion - Factors influencing corrosion – Corrosion control – Sacrificial anode and impressed current cathodic methods – Corrosion inhibitors

**UNIT IV ELECTRONIC MATERIALS****6**

Organic semiconducting materials: advantages- p-type and n-type semiconducting materials – pentacene – fullerens-C-60; organic light emitting polymer: polyvinylidene fluoride - OLED material – polyphenylene vinylene - micro and nano sensors - fundamentals of sensors, bloSensor - chemical sensors

**UNIT V ANALYTICAL TECHNIQUES****6**

Spectroscopy: Principle, instrumentation and applications of UV-Visible and IR spectroscopy. chromatography: - HPLC (Principle, instrumentation and applications of HPLC and gas chromatography - Flame photometry – Estimation of sodium and potassium by Flame photometry.

**L: 30; TOTAL: 30 PERIODS**

## TEXT BOOKS

1. Jain P.C. and Jain. M., "Engineering Chemistry", Dhanpat Rai Publishing Company, 16<sup>th</sup> Edition, New Delhi, 2016.
2. S.S Dara and S.S Umare, A Text Book of Engineering Chemistry, S.Chand & Company Limited, 20<sup>th</sup> Edition, 2018.

## REFERENCES

1. P. Brezonik, W. Arnold, Water Chemistry: An Introduction to the Chemistry of Natural and Engineered Aquatic Systems, Oxford Press, 6<sup>th</sup> Edition, 2017.
2. B.R. Puri, L.R. Sharma, M.S. Pathania, Vishal, Principles of Physical Chemistry, Vishal Publishing Co., Punjab, 47<sup>th</sup> Edition, 2017.
3. S. Crouch, D. Skoog, F Holler, Principles of Instrumental Analysis Hardcover, 2017.
4. H. Klauk, "Organic Electronics: Materials, manufacturing and applications", Wiley - VCH, 2016

19IT11C

PYTHON PROGRAMMING

L T P C  
3 0 0 3

## COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: develop simple Python programs. (K3)

CO2: structure simple Python programs for solving problems and decompose a Python program into functions. (K3)

CO3: represent compound data using Python lists, tuples, and dictionaries. (K3)

CO4: understand file management concepts and develop packages in Python Programs. (K3)

CO5: design and Develop GUI Programming. (K5)

### UNIT I DATA, EXPRESSIONS, STATEMENTS

9

Python interpreter and interactive mode - values and data types: Variables - expressions - statements – Operators - precedence of operators – Input and Output - comments – Errors: Syntax Errors - Runtime errors - Logical Errors.

### UNIT II CONTROL FLOW, FUNCTIONS

9

Conditionals: Boolean values and operators - conditional (if) - alternative (if-else) – chained conditional (if-elif-else) - Iteration: state – while – for – break – continue - pass - Fruitful functions: Function argument and its types - return values – parameters - local and global scope - function composition – recursion - Documenting Function – Classes and Inheritance - Object Oriented Programming - Class Instances – Class Methods.

### UNIT III LISTS, TUPLES, DICTIONARIES

9

Strings: string slices – immutability - string functions and methods - string module - Lists: list operations - list slices - list methods - list loop – mutability – aliasing - cloning lists – list Parameters - Lists as arrays - Tuples: tuple assignment - tuple as return value - Dictionaries: operations and methods - advanced list processing - list comprehension

### UNIT IV FILES, MODULES, PACKAGES

9

Files and exception: text files - reading and writing files - format operator - command line arguments - errors and exceptions - handling exceptions – modules – packages - Name space

### UNIT V GRAPHICAL USER INTERFACE PROGRAMMING

9

Event driven programming - TkInter introduction - Introducing callbacks - User input - Mini-case study: Graphics: Moving the ball - Adding randomness - Keyboard input - Checking for collisions - Keeping score

**L: 45; TOTAL: 45 PERIODS****TEXT BOOKS**

1. "Think Python: How to Think Like a Computer Scientist", by Allen B. Downey, O'Reilly Media, Inc. , 2016
2. "A Practical Introduction to Python Programming", Brian Heinold, Mount St. Mary's University, 2012.
3. "Learning to Program with Python", Richard L. Halterman, 2019, E-book
4. Dive into Python, Mark Pilgrim, Apress, 2012.

**REFERENCES**

1. "Exploring Python", Timothy A.Budd, Mc-Graw Hill Education (India) Private Limited, 2015.
2. "Introduction to Computer Science using python: A Computational Problem-solving Focus, Charles Dierbach, Wiley India Edition, 2015.
3. "Practical Programming: An Introduction to Computer Science using Python 3.6", Paul Gries, Jennifer Campbell and Jason Montojo, second edition, Pragmatic Programmers, LLC, 2018.
4. "Introduction to Programming in Python: An Inter-disciplinary Approach", Robert Sedgewick, Kevin Wayne, Robert Dondero, Pearson India Education Services Pvt. Ltd, 2016.

**19SH15C**

**ENGINEERING GRAPHICS**  
(Common to all B.E. / B.Tech. Degree Programmes)

**L T P C**  
**2 0 4 4**

**COURSE OUTCOMES**

Upon completion of this course, the students will be able to

- CO1: familiarize with the fundamentals of Engineering graphics and construct the engineering curves. (K2)
- CO2: construct the orthographic projections of points, straight lines and lamina (K2)
- CO3: draw the projections of simple solids in different positions. (K3)
- CO4: visualize the sectional views and surface areas of various solids. (K3)
- CO5: perform freehand sketching and prepare elementary 2-D and 3D sketches of simple solids. (K3)

**INTRODUCTION****5**

Principles of Engineering Graphics – significance. Usage of Drawing Instruments. Lettering and dimensioning exercise. First angle projection should be followed for all the topics except projection of points.

**UNIT I ENGINEERING CURVES****17**

Construction of ellipse, parabola and hyperbola using eccentricity method– Construction of cycloids, Epi and Hypo-cycloids - construction of involutes for square and circle –Tangent and Normal to the above curves.

**UNIT II ORTHOGRAPHIC PROJECTIONS****17**

Principle of orthographic projections – Conventions - First angle and third angle projections. Projections of points placed in all quadrants – projections of straight lines – inclined to both reference planes - determination of true length and inclinations. Projections of regular polygonal surfaces and circular lamina inclined to both reference planes.

### UNIT III PROJECTIONS OF SOLIDS 17

Projections of simple solids like prisms, pyramids, cylinder and cone - axis inclined to one reference plane - change of position method.

### UNIT IV SECTIONS OF SOLIDS AND DEVELOPMENT OF SURFACES 17

Sectioning of simple solids – Axis perpendicular to horizontal plane- Drawing sectional views with true shape of the section.

Development of lateral surfaces of truncated solids – Prisms, pyramids, cylinder and cone.

### UNIT V ISOMETRIC PROJECTIONS AND FREE HAND SKETCHING 17

Principles of isometric projection – isometric scale – isometric projections of simple solids like prism, pyramid, cone and cylinder – Combination of solids. Orthographic views of simple components by Free hand drawing - Transferring measurement from the given object to the free hand sketches.

**L: 30; P: 60; TOTAL: 90 PERIODS**

#### TEXT BOOKS

1. Bhatt N.D, "Engineering Drawing", Charotar Publishing House, 53<sup>rd</sup> Edition, 2014.
2. Shah M.B and Rana B.C, "Engineering Drawing", Pearson Education, 2<sup>nd</sup> Edition, 2009.

#### REFERENCES

1. Agrawal B. & Agrawal C.M., Engineering Graphics, TMH Publication, 2<sup>nd</sup> Edition, 2013
2. Narayana K.L. & Kannaiah P, Text book on Engineering Drawing, Scitech Publishers, 2010.
3. Gopalakrishna K.R, "Engineering Drawing", Subhas Publications, 32<sup>nd</sup> Edition, 2017.

19SH16C

### ENGINEERING PHYSICS AND ENGINEERING CHEMISTRY LABORATORY

(Common to all B.E. / B.Tech. Degree Programmes)

**L T P C  
0 0 3 1.5**

#### PART A – ENGINEERING PHYSICS LABORATORY

#### COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: demonstrate the different phenomenon exhibited by the waves. (K3, S3)

CO2: interpret the production of ultrasounds and the variation of velocity of ultrasounds with respect to different medium.(K3, S3)

CO3: illustrate the electrical properties of materials. (K3, S3)

#### LIST OF EXPERIMENTS

1. Determination of thickness of a thin wire – Air wedge method.
2. Determination of velocity of sound and compressibility of the liquid – Ultrasonic Interferometer.
3. Determination of Dispersive power of a prism using Spectrometer.
4. Determination of angle of divergence of laser beam and acceptance angle, numerical aperture of optical fibre.
5. Determination of acceleration due to gravity using compound pendulum.
6. Determination of (a) spring Constant (b) Value of g and (c) Modulus of Rigidity of a spring by studying motion of a spring.
7. Determination of specific resistance of the coil using Carey-Foster's bridge.

- A minimum of FIVE experiments shall be offered.

**REFERENCES**

1. David Loyd, "Physics laboratory" 4<sup>th</sup> Edition, Cengage learning, 2013
2. Sessa Sai Kumar Vemula, "Engineering Physics lab manual" 1<sup>st</sup> Edition, LAP LAMBERT Academic Publishing, 2017

**PART B - ENGINEERING CHEMISTRY LABORATORY****COURSE OUTCOMES**

Upon completion of this course, the students will be able to

- CO 1: determine various water quality parameters. (K2, S3)  
 CO 2: quantify different ions by different analytical techniques. (K2, S3)  
 CO3: determine the rate of corrosion of mild steel plate. (K2, S3)  
 CO4: verify the freundlich adsorption isotherm. (K2, S3)

**LIST OF EXPERIMENTS**

1. Estimation of hardness of water sample by EDTA method.
2. Estimation of iron ( $\text{Fe}^{2+}$ ) by dichrometric method.
3. Determination of rate of corrosion of mild steel plate by weight loss method.
4. Estimation of hydrochloric acid by conductometric method.
5. Estimation of mixture of acids by conductometric method.
6. Determination of purity of simple organic compounds using HPLC- (Demo).
7. Estimation of iron ( $\text{Fe}^{2+}$ ) by spectrophotometric method.
8. Verification of Freundlich adsorption isotherm by using oxalic acid in activated charcoal.

**P: 45; TOTAL: 45 PERIODS**

- A minimum of FIVE experiments shall be offered.
- Laboratory classes on alternate weeks for Physics and Chemistry.

**REFERENCES**

1. D.C. Harris "Quantitative Chemical Analysis: International Edition", W.H.Freeman, 9<sup>th</sup> Edition, 2016.
2. A.I. Vogel, A.R. Tatchell, B.S. Furnis, A.J. Hannaford, P.W.G.Smith, Vogel's Textbook of Practical Organic Chemistry, Pearson Education Limited, England, 8<sup>th</sup> Edition, 2015.
3. M. Nath, Inorganic Chemistry: A Laboratory Manual, Alpha Science, New Delhi, 2016.

**19IT12C****PYTHON PROGRAMMING LABORATORY****L T P C  
0 0 4 2****COURSE ONTCOMES**

Upon completion of this course, the students will be able to

- CO1: solve Simple problems using conditional and control statement in Python.(K3)  
 CO2: develop user defined function for solving problems in modular approach. (K3)  
 CO3: enhance the program skills with lists and dictionaries. (K3)  
 CO4: design and develop packages and GUI application. (K5)

**LIST OF EXPERIMENTS**

1. **Simple Programs**
  - a. To calculate the average of numbers
  - b. To read two numbers and print their quotient and remainder
2. **Programs using control flow**
  - a. To compute prime factors of an integer

- b. To form an integer that has the number of digits at ten's place and the least significant digit of the entered integer at one's place
- c. To get the marks of students for 5 subjects and display their grade as per the 2019 regulation.
- d. To print all numbers in a range divisible by a given number
- e. To accept three digits and print all possible combinations from the digits

**3. Programs using functions**

- a. To determine all Pythagorean triplets in the range
- b. Given a square matrix with n rows and n columns, you have to write a program to rotate this matrix such that each element is shifted by one place in a clockwise manner.
- c. To check whether a string is a palindrome or not using recursion

**4. Programs using strings**

- a. To detect if two strings are anagrams
- b. To accept a hyphen separated sequence of words as input and print the words in a hyphen-separated sequence after sorting them alphabetically

**5. Programs using lists**

- a. To find the second largest number in a list
- b. To merge two lists and sort it

**6. Programs using dictionaries**

- a. There is a robot which wants to go the charging point to charge itself. The robot moves in a 2-d plane from the original point (0,0). The robot can move toward up, down, left and right with given steps.

The trace of robot movement is shown as the following:

- i. Up 5
- ii. Down 3
- iii. Left 3
- iv. Right 2

Write a program to compute the distance between the current position after a sequence of movement and original point. If the distance is a float, then just print the nearest integer (use round() function for that and then convert it into an integer).

- b. Consider a cricket series containing five matches between india and australia read the scores of individual players of both teams and finally identify the man of the series.

**7. Programs using files**

- a. To count the number of words and number of lines in a text file
- b. That reads a text file and counts the number of times a certain letter appears in the text file

**8. Programs using modules and packages.**

**9. Case study: GUI programming**

**P: 60; TOTAL: 60 PERIODS**

**SOFTWARE REQUIREMENTS**

- 1. Python 3.x
- 2. Anaconda Navigator

19IT21C

**PROFESSIONAL ENGLISH**  
(Common to all B.E. / B.Tech. Degree Programmes)

**L T P C**  
**2 0 0 2**

**COURSE OUTCOMES**

Upon completion of this course, the student will be able to

CO 1: Integrate and apply the acquired skills in real life situation. (K3, S4)

CO 2: Write effectively in any professional contexts. (K3)

CO 3: Enhance the vital sub-functions of communication in any formal situation. (K3, A2)

CO 4: Participate actively in any informal and formal discussion. (K3, A3)

CO 5: Recall the acquired skills and apply them in their work place. (K2, S3)

**UNIT I****6**

Standard Abbreviations - If Conditionals - Presenting articles based on newspaper reading - Listening for specific information - Argumentative essay.

**UNIT II****6**

One word substitution - Rearranging the jumbled phrases of sentences – Chart Description - Business Letters for Quotations and Clarification.

**UNIT III****6**

Idioms and Phrases - Direct & Indirect Speech - Business Letters for Placing orders and Making Complaints - Process Description.

**UNIT IV****6**

Synonyms - Group Discussion (Uses – Structure – Strategies – Team Work – Positive & Negative Body Languages – Samples - Demo) - Proposal Writing.

**UNIT V****6**

Error Spotting (Based on Concord, Pronouns, Articles & Adverb Placement) - Job Application Letter & Resume Preparation - Circular and Minutes of the meeting - Reading Comprehension.

**Suggested Activity:** Career Analysis – Herein the students will be required to submit a report about their dream career / company of their choice. This will be followed by a presentation of the same in the class.

**L: 30; TOTAL: 30 PERIODS**

**TEXT BOOKS**

1. Board of editors. "Fluency in English A Course book for Engineering and Technology", Orient Blackswan, Hyderabad, 2016.
2. Bovee, Courtland, L., John V.Thill. "Business Communication Today", 13<sup>th</sup> Edition, Pearson Education, New Delhi, 2018.

**REFERENCES**

1. Lester Mark and Larry Beason, "Hand book of English Grammar and Usage", McGraw Hill Education, 1<sup>st</sup> Edition, 2017.
2. Raman, Meenakshi and Sharma, Sangeetha, "Technical Communication Principles and Practice", Oxford University Press, New Delhi, 2014.



19IT22C

PROBABILITY AND QUEUEING THEORY

L T P C  
3 1 0 4

### COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: grasp the basic concepts of probability and random variables.(K2)

CO2: find the correlation and regression of two dimensional random variables.(K2)

CO3:characterize the phenomena which evolve with respect to time in a probabilistic manner. (K3)

CO4: interpret the basic characteristic features of Markovian queues. .(K3)

CO5: utilize the concepts of Non Markovian queues and Networks.(K3)

### UNIT I RANDOM VARIABLES

12

Random Variable - Discrete and continuous random variables - Moments - Moment generating functions and their properties; Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions .

### UNIT II TWO DIMENSIONAL RANDOM VARIABLES

12

Joint distributions - Marginal and conditional distributions – Covariance - Correlation and regression - Transformation of random variables - Central limit theorem.

### UNIT III CLASSIFICATION OF RANDOM PROCESSES

12

Random process - Classification - Stationary process – WSS and SSS - Markov process - Markov chains – Transition probabilities - Limiting distributions - Poisson process

### UNIT IV QUEUEING THEORY

12

Markovian models – Birth and Death Queueing models- Steady state results: Single and multiple server queueing models- Queues with finite waiting rooms- Finite source models- Little's Formula

### UNIT V NON-MARKOVIAN QUEUES AND QUEUE NETWORKS

12

M/G/1 queue- Pollaczek- Khintchine formula, series queues- Open and closed networks.

L: 45; T: 15; TOTAL: 60 PERIODS

### TEXT BOOKS

1. O.C. Ibe, "Fundamentals of Applied Probability and Random Processes", Elsevier, 1<sup>st</sup> Indian Reprint, 2007.
2. D. Gross and C.M. Harris, "Fundamentals of Queueing Theory", Wiley and Sons Publication Limited, 4<sup>th</sup> Edition, 2008.

### REFERENCES

1. A.O. Allen, "Probability, Statistics and Queueing Theory with Computer Applications", Elsevier, 2<sup>nd</sup> Edition, 2005.
2. H.A. Taha, "Operations Research", Pearson Education, Asia, 10<sup>th</sup> Edition, 2017.
3. K.S. Trivedi, "Probability and Statistics with Reliability, Queueing and Computer Science Applications", John Wiley and Sons, 2<sup>nd</sup> Edition, 2016.

19IT23C

PHYSICS FOR INFORMATION SCIENCE

L T P C  
2 0 0 2

### COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: understand the basics of Boolean algebra and illustrate the Boolean functions by logic gates.(K2)



CO2: understand the various bimolecular interactions in living organisms. (K2)

CO3: familiar with biological database. (K2)

CO4: understand the thermodynamic concepts in living organisms. (K2)

CO5: apply the molecular modeling methods in the drug design. (K2)

**UNIT I CELL BIOLOGY 6**

Cell as a basic unit of life-Cell organization of prokaryotic and eukaryotic cells-Structural and functional capitalization of cell: Mitochondria, Chloroplast, Lysosomes, Golgi bodies, Plasma membrane, Cytoskeleton, Cell wall and Nucleus - Cell cycle - cell division: mitosis and meiosis.

**UNIT II BIO MOLECULAR INTERACTIONS 6**

DNA and RNA-hydrophobicity and hydrophilicity-Molecular interactions: covalent and non covalent interactions – Spectroscopic methods to measure the interactions.

**UNIT III BIOLOGICAL DATABASES 6**

Primary and secondary sequence databases – Composite protein sequence databases - General concepts of sequence analysis - Identification of functional sequences PDB (Protein Data Bank) and NDB (Nucleic Acid Data Bank).

**UNIT IV BIOCHEMICAL THERMODYNAMICS 6**

First and Second laws of thermodynamics, Details of thermodynamic variables and functions. Application of thermodynamic laws in Life Science with examples.

Bioenergetics: Energy rich bonds - Coupled reactions-Group transfer - Autotrophic and Heterotrophic principle of energy transductions - Gibbs free-energy calculation for Bio-redox reactions – Thermodynamics of ligand binding – Association and dissociation constant.

**UNIT V DRUG DESIGN AND MOLECULAR MODELING 6**

Principles of drug development – partition coefficient (Log p): octanol - Water system - Lipinski's rule of five - structure based drug designing approaches - target identification and validation - semi-empirical calculations - single point calculations - full-geometry optimization methods - Molecular docking programs: AutoDock.

**L: 30; TOTAL: 30 PERIODS**

**TEXT BOOKS**

1. Y. Nelson, L. David, Lehninger Principles of Biochemistry, International Edition, W.H.Freeman, Macmillan Learning, New York, 7<sup>th</sup> Edition, 2017.
2. Nagata, Kazuhiro, Real-Time Analysis of Biological Interactions, Springer, Japan, 3<sup>rd</sup> Edition, 2015.
3. I. Bertini, H. B Gray, Bioinorganic Chemistry, Viva Books Private Limited, New Delhi, 4<sup>th</sup> Edition, 2014.

**REFERENCES**

1. B.A. Bunin, B. Siesel, G. Morales, J. Bajorath, Chemoinformatics: Theory, Practice, & Products, Springer, 2<sup>nd</sup> Edition, 2014.
2. A. Nag and B. Dey, Computer aided drug design and delivery system, McGraw-Hill, ISBN: 978-0-07-170125-9, 2011.
3. B. Wang, E.V. Anslyn, Chemosensor: Principles, Strategies, and Applications, a John Wiley & Sons, inc., Publication, 2011.

19IT25C

**PROBLEM SOLVING TECHNIQUES****L T P C**  
**3 0 0 3****COURSE OUTCOMES**

Upon completion of this course, the students will be able to

- CO 1: develop algorithmic solutions to simple computational problems. (K3)
- CO 2: make appropriate decisions and solve problems using looping techniques.(K2)
- CO 3: solve problems using array and functions. (K3)
- CO 4: implement various sorting techniques. (K3)
- CO 5: implement various searching techniques. (K3)

**UNIT I BASICS OF PROBLEM SOLVING****9**

Overview of programming: Problem Solving in Everyday Life, Types of Problem, Computer-based problem solving, Difficulties in problem solving, Program design, implementation issues, programming environment, Data Storage and Communication with Computer, Organizing the Problem. Algorithms for problem solving: Algorithms and flow charts, flowchart symbols, design of algorithms for simple and scientific problems, divide and conquer strategy.

**UNIT II BASIC TECHNIQUES****9**

Sequential Logic Structure, Decision Making, Looping Techniques, Multi-Way decision Making, Solving With Modules.

**UNIT III ARRAYS AND FUNCTIONS****9**

Arrays: one dimensional array – Two dimensional arrays – Multi dimensional arrays. Character arrays and Strings: Declaring and initializing String Variables – Comparison of two strings – String handling functions. User defined Functions: Definition – Declaration – Function calls – Category of Functions – Recursion - Storage Classes.

**UNIT IV SORTING TECHNIQUES****9**

Sorting: Bubble Sort, Selection Sort, Insertion Sort, Postman Sort, Quick Sort, Merge Sort, Radix Sort, Applications

**UNIT V SEARCHING TECHNIQUES****9**

Searching algorithms: Linear search, Binary search, Fibonacci search, Golden-ratio selection, Golden section search method, Applications

**L: 45; TOTAL: 45 PERIODS****TEXT BOOKS**

1. Maureen Sprankle and Jim Hubbard, "Problem Solving and Programming Concepts", Prentice Hall, 9<sup>th</sup> Edition, 2012.
2. Harsha Priya, R. Ranjeet, — "Programming and Problem Solving Through C Language", Firewall/Laxmi Publications (P) Ltd., New Delhi, 2015.

**REFERENCES**

1. Pradip Dey, Manas Ghosh, Fundamentals of Computing and Programming in C, 2<sup>nd</sup> Edition, Oxford University Press, 2013.
2. M.G.Venkateshmurthy, Programming Techniques through C: A Beginner's Companion, Pearson Education, Canada, 2009.
3. Ashok.N.Kamthane, Computer Programming, Pearson Education, India, 2011.

**19IT26C                      BASIC ELECTRICAL AND ELECTRONICS ENGINEERING                      L T P C**  
**3 0 0 3**

### **COURSE OUTCOMES**

Upon completion of this course, the students will be able to

- CO1: explain the concepts of basic electrical circuits (K2)
- CO2: describe the working principles of electrical machines and instruments (K2)
- CO3: outline the functions of the component of low voltage electrical installations (K2)
- CO4: explain the characteristics and applications of semiconductor devices (K2)
- CO5: recall the different logic principles used in digital circuits(K2)

### **UNIT I                      CONCEPTS OF DC AND AC ELECTRICAL CIRCUITS                      9**

Electrical Circuit Elements – Ideal and Practical Sources – Electrical Quantities: Voltage, Current, Power and Energy – Ohms Law – Kirchoffs Laws – analysis of simple circuit with DC excitation- AC Circuits Fundamentals – Single Phase Circuits and Three Phase Circuits – Power and Power Factor.

### **UNIT II                      ELECTRICAL MACHINES                      9**

DC Machines: Types – Construction – Working Principles – Need for Starters - Speed control of DC motors.

AC Motors: Construction and Working of Single Phase and Three Phase Induction Motor – Starting and Speed Control of Induction Motors.

AC Synchronous Generators: Construction – Working Principle.

Transformers: Single Phase and Three Phase Transformers – Auto Transformers- Construction – Working Principle.

### **UNIT III                      INSTRUMENTS AND ELECTRICAL INSTALLATION                      9**

Instruments: Functional Elements – Principles of Measurements of Electrical Quantities: Voltage, Current, Power and Energy – Multifunction meter.

Electrical Installation: Components of LT Switchgear – Switch Fuse – MCB – ELCB – MCCB – Types of Wires and Cables – Earthing – Energy Storage devices - Elementary Calculations for Energy Consumptions and Battery Backup.

### **UNIT IV                      SEMICONDUCTOR DEVICES AND APPLICATIONS                      9**

Operation, Characteristics and Applications: PN Junction Diode - Rectifiers - Zener Diode – Regulators - Bipolar Junction Transistor –CE Amplifier - FET – Opto-Electronic Devices – LEDs – Photo Diodes.

### **UNIT V                      DIGITAL ELECTRONICS                      9**

Binary Number System – Logic Gates – Boolean Algebra – Adders - Flip Flops – Shift Registers – Counters – ADC and DAC.

**L: 45; TOTAL: 45 PERIODS**

### **TEXT BOOKS**

1. D.P. Kothari and I.J. Kothari, “Basic Electrical and Electronics Engineering”, Tata McGraw Hill, 1<sup>st</sup> Edition, 2014.
2. P.S. Bimbhra, “Electrical Machinery”, Khanna Publishes, 7<sup>th</sup> Edition, 2011.
3. Thomas L. Floyd, “Digital Fundamentals”, 10th Edition, Pearson Education Inc, New Delhi, 2009.
4. A.K. Sawhney, “A Course in Electrical & Electronic Measurements & Instrumentation”, Dhanpat Rai and Co, 2004.

### **REFERENCES**

1. D.C. Kulshreshtha, “Basic Electrical Engineering”, Tata McGraw Hill, Revised 1<sup>st</sup> Edition, 2011.

2. L.S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
3. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
4. V.D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.
5. E.O. Doebelin, "Measurement Systems – Application and Design", Tata McGraw Hill, 2003.
6. David Bell, "Electronic Devices and Circuits", Prentice Hall Private Limited, 2007.
7. M. Morris Mano, "Digital Design", Pearson Education, 4<sup>th</sup> Edition, 2007.

**19GN02C**                      **HERITAGE OF TAMILS (தமிழர் மரபு)**                      **LT P C**  
**1 0 0 1**

**UNIT I                      LANGUAGE AND LITERATURE                      3**

Language Families in India - Dravidian Languages – Tamil as a Classical Language – Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature - Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.

**UNIT II                      HERITAGE - ROCK ART PAINTINGS TO MODERN ART–SCULPTURE                      3**

Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.

**UNIT III                      FOLK AND MARTIAL ARTS                      3**

Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leather puppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

**UNIT IV                      THINAI CONCEPT OF TAMILS                      3**

Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.

**UNIT V                      CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE                      3**

Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.

**L: 15; TOTAL: 15 PERIODS**

**REFERENCE BOOKS**

1. தமிழக வரலாறு – மக்களும் பண்பாடும் - கே.கே.பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்)

2. கணினித் தமிழ் - முனைவர். இல.சுந்தரம் (விகடன் பிரசுரம்)
3. கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரீகம் (தொல்லியல் துறை வெளியீடு)
4. பொருறை - ஆற்றங்கரை நாகரீகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL - (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.)
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies.)
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) - Reference Book.

19GN02C

HERITAGE OF TAMILS (தமிழர் மரபு)

LT P C

1 0 0 1

**அலகு I மொழி மற்றும் இலக்கியம்**

**3**

இந்திய மொழிக்குடும்பங்கள் - திராவிட மொழிகள் - தமிழ் ஒரு செம்மொழி - தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை - சங்க இலக்கியத்தில் பகிர்தல் அறம் - திருக்குறளில் மேலாண்மைக் கருத்துக்கள் - தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம் - பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் - சிற்றிலக்கியங்கள் - தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி - தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

**அலகு II மரபு பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை - சிற்பக்கலை**

**3**

நடுகல் முதல் நவீன சிற்பங்கள் வரை - ஐம்பொன் சிலைகள் - பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் - தேர் செய்யும் கலை - சுடுமண் சிற்பங்கள் - நாட்டுப்புறத் தெய்வங்கள் - குமரிமுனையில் திருவள்ளூர் சிலை - இசைக் கருவிகள் - மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் - தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

**அலகு III நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்**

**3**

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஓயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.

**அலகு IV தமிழர்களின் திணைக் கோட்பாடுகள்**

**3**

தமிழகத்தின் தாவரங்களும், விலங்குகளும் - தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் - தமிழர்கள் போற்றிய அறக்கோட்பாடு - சங்ககாலத்தில்

தமிழகத்தில் எழுத்தறிவும், கல்வியும் - சங்ககால நகரங்களும் துறை முகங்களும் - சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி.

**அலகு V இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு 3**

இந்திய விடுதலைப் போரில் தமிழர்களின் பங்கு - இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் - சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு - கல்வெட்டுகள், கையெழுத்துப் படிக்கல்கள் - தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு.

**L: 15; TOTAL: 15 PERIODS**

**REFERENCE BOOKS**

1. தமிழக வரலாறு - மக்களும் பண்பாடும் - கே.கே.பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்)
2. கணினித் தமிழ் - முனைவர். இல.சுந்தரம் (விகடன் பிரசுரம்)
3. கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரீகம் (தொல்லியல் துறை வெளியீடு)
4. பொருறை - ஆற்றங்கரை நாகரீகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL - (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.)
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies.)
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) - Reference Book.

**19IT27C**

**PHYSICS FOR INFORMATION SCIENCE AND  
BIOLOGY LABORATORY**

**L T P C  
0 0 3 1.5**

**PART A PHYSICS FOR INFORMATION SCIENCE LABORATORY**

**COURSE OUTCOMES**

Upon completion of this course, the students will be able to

CO 1: design and implement various applications using gates.(K3,S3)

1. Verification of Boolean theorems using digital logic gates.



2. Design and implementation of code converters.
  3. Design and implementation of binary adder / subtractor using logic gates.
  4. Verification of Flip flops.
  5. Design and implementation of Shift registers.
  6. Design and implementation of Ripple counters.
  7. Design and implementation of Up/Down counters.
- A minimum of FIVE experiments shall be offered.

## REFERENCES

1. William Kleitz, "Digital Electronics: A Practical Approach", Prentice Hall, 3<sup>rd</sup> Edition, 1992.
2. G.L.Squires, " Practical Physics" Cambridge University Press, 4<sup>th</sup> Edition, 2001

## PART B BIOLOGY LABORATORY

### COURSE OUTCOMES

Upon completion of this course, the students will be able to

- CO 1: identify the various biomolecules by suitable chemical analysis. (K3, S3)
- CO 2: quantify the amount of acid by pH metric method. (K3, S3)
- CO3: estimate the retention factor and log P value of paracetamol and aspirin. (K2, S3)
- CO4: draw the structure of different types of drugs using Gaussian and Chem Draw soft ware. (K3, S3)
- CO5: identify the molecular interactions of drug with biomolecules. (K3, S3)

### LIST OF EXPERIMENTS

1. Qualitative analysis of biomolecules.
2. Estimation of acid by pH metric method.
3. Calculation of retention factor of amino acids.
4. Determination of (log P) value for paracetamol and aspirin.
5. Low energy conformation of medicinally important compounds using Gaussian soft ware.
6. Draw the chemical structure of important drugs using Chem Draw software.
7. Identification of interactions between drug and biomolecules using Auto Dock software.

**P: 45; TOTAL: 45 PERIODS**

- A minimum of FIVE experiments shall be offered.
- Laboratory classes on alternate weeks for Physics and Biology.

## REFERENCES

1. P.Worsfold, A.Townshend, C.Poole, M.Miro, Encyclopedia of Analytical science Elsevier, 3<sup>rd</sup> Edition, 2018.
2. A.I. Vogel, B.S. Furniss, A.J. Hannaford, P.W.G. Smith, A.R. Tatchell, "Vogel's Textbook of Practical Organic Chemistry", Pearson Education Limited, England, 8<sup>th</sup> Edition, 2015.

## 19IT28C PROBLEM SOLVING TECHNIQUES LABORATORY

**L T P C**  
**0 0 4 2**

### COURSE OUTCOMES

Upon completion of this course, the students will be able to

- CO 1: solve simple and Complex problems. (K3)
- CO 2: solve sorting and searching problems. (K3)

**LIST OF EXERCISES****Programs using simple logics and switch cases**

1. Solve problems such as temperature conversion, student grading, interest calculation.
2. Find the roots of a quadratic equation
3. Design a simple arithmetic calculator. (Use switch statement)
4. Design a traffic light controller (Use switch statement)

**Programs using Control Structures**

5. Perform the following operations:
  - a. Generate Pascal's triangle.
  - b. Construct a Pyramid of numbers.
6. Generate of the first n terms of the Fibonacci sequence and prime sequence.
7. Compute Sine series and Cosine series.
8. Find the 2's complement of a binary number.

**Programs using Arrays**

9. Perform the following operations:
  - a. Matrix addition.
  - b. Transpose of a matrix.
  - c. Matrix multiplication by checking compatibility

**Programs to manipulate Strings**

10. Perform the following operations on a string:
  - a. Insert a sub-string into main string at a given position.
  - b. Delete n characters from a given position in a string.
  - c. Check whether the given string is palindrome or not.
  - d. Replace a character of string either from beginning or ending or at a specified location.

**Programs using Functions**

11. Perform the following operations: (Use recursive functions)
  - a. Find the factorial of a given integer.
  - b. Find the GCD (Greatest Common Divisor) of two given integers.
  - c. Solve the Towers of Hanoi problem.

**Programs using sorting and searching techniques**

12. Implement Insertion Sort, Merge Sort
13. Implement Linear search, Binary search

**P: 60; TOTAL: 60 PERIODS****Software Requirement: Turbo C / Python****19GN01C****INNOVATION THROUGH DESIGN THINKING****L T P C  
1 0 2 2****COURSE OUTCOMES**

Upon Successful completion of this course, the students will be able to

CO1: To discuss the design thinking process and innovation. (K2)

CO2: Practice design thinking process through a multidisciplinary task. (K3)

**UNIT I****BASICS OF DESIGN THINKING PROCESS****15**

Design thinking process basics-Ideation tools-case studies.

## UNIT II PRACTICING DESIGN THINKING PROCESS

30

Real world problem selection-Practicing the preliminary stages of Design Thinking Process - work presentation.

**L: 15; P: 30; TOTAL: 45 PERIODS**

### REFERENCES

1. Falk Uebernickel, Li Jiang, Walter Brenner, Britta Pukall, Therese Naef, "Design Thinking: The Handbook", WS Professional, 2020
2. Pavan Soni, "Design Your Thinking: The Mindsets, Toolsets and Skill Sets for Creative Problem solving", Penguin Random House, 2020
3. D.M. Arvind Mallik, "Design Thinking for Educators", Notion Press, 2019
4. Michael Lewrick, "The Design Thinking Playbook", Wiley, 2019
5. Kathryn Christopher, "Design Thinking in Engineering", Kendall Hunt Publishing Company, 2019
6. Robert Curedale, "Design Thinking Process & Methods" 5<sup>th</sup> Edition, Design Community College Inc, 2019
7. David Lee, "Design Thinking in the Classroom", Ulysses Press, 2018
8. Jimmy Jain, "Design Thinking for Startups", Notion Press, 2018
9. Monika Hestad Silvia Rigoni Anders Grnli, "The Little Booklet on Design Thinking: An Introduction", 2<sup>nd</sup> Edition, Zaccheus Entertainment, 2017
10. Scott Swan, Michael G. Luchs and Abbie Griffin, "Design Thinking: New Product Development Essentials", Wiley-Blackwell, 2016
11. Thomas Lockwood, "Design Thinking: Integrating Innovation, Customer Experience, and Brand Value", Allworth Press, 2009

### MENTOR ACTIVITIES:

Educating the design thinking process: basics, Ideation tools and 10 Hours empathy map through case studies - presentation

Forming multidisciplinary batches among the students- Guide the 20 Hours batches to select a real-world task- Apply and practice the different stages of Design thinking process to bring out innovative solutions

Evaluating the students' activities through their presentations

End semester Assessments can be made through:

- Design Thinking presentation(PowerPoint format)
- Design Thinking poster preparation and presentation (PDF format, in color and monochrome, printable in A3 size)

### Other points:

This course is for all department students

- A class/section should be with all department students
- A course instructor will be responsible for the academic process.
- In a project batch, maximum number of students should be four and no two students from same discipline possibly.
- The course has no pre-requisite and may be offered to second/fourth semester students.

19IT31C

**DISCRETE MATHEMATICS****L T P C****3 1 0 4****COURSE OUTCOMES**

Upon completion of this course, the students will be able to

- CO 1: check the validity of the arguments. (K2)
- CO 2: understand the concepts of Sets, Relations and Functions. (K2)
- CO 3: perform the principles of counting and solve recurrence relations. (K3)
- CO 4: interpret the basic concepts of graphs. (K2)
- CO 5: Find all Spanning Trees of a graph and understand the concepts of colouring of graphs. (K3)

**UNIT I MATHEMATICAL LOGIC****12**

Propositional Logic – Equivalences and Implications – Normal forms – Predicate Calculus and Quantifiers - Rules of inference – Proof methods and Strategies - Forward Proof, Proof by Contradiction, Proof by Contraposition, Proof of Necessity and Sufficiency.

**UNIT II SETS, RELATIONS AND FUNCTIONS****12**

Basic Definitions - Set operations – Laws of set theory – Relations – Properties of relations - Partial Ordering Relation - Equivalence Relation - Matrices of relations - Closure of relations – Functions - Bijective functions - Inverse and Compositions of functions.

**UNIT III COMBINATORICS****12**

Mathematical induction - Strong induction and well ordering -The basics of counting –The pigeonhole principle - Permutations and combinations – Recurrence relations - Solving linear recurrence relations – Generating functions - Inclusion and exclusion principle.

**UNIT IV GRAPH THEORY****12**

Graphs and their properties - Special types of graphs – Matrix representation of graphs and graph isomorphism- connectivity, Cut vertex and cut edge - Euler and Hamiltonian graphs.

**UNIT V GRAPH COLOURING AND TREES****12**

Graph Colouring - Colouring Vertices, Colouring Edges - Perfect Graph, properties - Trees – Some properties of Trees – Pendant vertices in a Tree – Distance and centers in a Tree – Rooted and Binary Trees - Spanning Trees.

**L: 45; T: 15; TOTAL: 60 PERIODS****TEXT BOOKS**

1. Kenneth H. Rosen, "Discrete Mathematics and its Applications (with Combinatorics and Graph Theory)", 6<sup>th</sup> Edition, Special Indian Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi (5<sup>th</sup> Reprint, 2008).
2. Trembly J.P and Manohar. R. "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw-Hill Pub. Company Limited, New Delhi, 35<sup>th</sup> Reprint 2008.
3. Narsingh Deo, "Graph Theory with Applications to Engineering and Computer Science", Dover Publications Inc., 2016.

**REFERENCES**

1. Ralph .P. Grimaldi, "Discrete and Combinatorial Mathematics: An Applied Introduction", 4<sup>th</sup> Edition, Pearson Education Asia, Delhi, 2002.
2. J.A. Bondy U.S.R. Murty, "Graph Theory", Springer, 2008.

19IT32C

DATA STRUCTURES AND ALGORITHMS

L T P C  
3 1 0 4

### COURSE OUTCOMES

Upon completion of this course, the students will be able to

- CO 1: apply the concepts of array and linked list for solving problems. (K3)
- CO 2: apply stack and queue data structures to solve problems. (K3)
- CO 3: apply tree data structure concepts to solve any computing problems. (K3)
- CO 4: analyze the various hashing techniques and heaps and apply them to solve problems. (K3)
- CO 5: apply graph data structure concepts to solve problems. (K3)

#### UNIT I                    LINEAR DATA STRUCTURES – ARRAY & LIST                    12

Introduction – Abstract Data Types - Arrays: Operations - searching and sorting on arrays - Linear search - binary search on a sorted array - Bubble sort – Selection sort - Insertion sort - Merge Sort - Quick sort - Counting sort - Radix sort – Heap sort - bucket sort – Singly Linked Lists – Doubly Linked Lists – Circular Linked Lists - Applications of Linked Lists

#### UNIT II                    LINEAR DATA STRUCTURES – STACK & QUEUE                    12

Recursion - Stack ADT: Representation - Operations – Applications: Evaluating arithmetic expressions- Conversion of Infix to postfix expression – Queue ADT: Operations – Circular Queue – Priority Queue – Applications of Queues.

#### UNIT III                    TREE DATA STRUCTURES                    12

Introduction - Tree representation and other tree parameters – Tree traversal - Application of binary trees in Huffman coding - Expression trees - Binary search trees - Balanced binary search trees

#### UNIT IV                    HASHING AND BINARY HEAP                    12

Hashing: Introduction - properties of good hash functions - collisions - open and closed hashing - Priority Queues: Binary heaps with application to in-place sorting – Binomial Heaps – Disjoint Sets

#### UNIT V                    GRAPH DATA STRUCTURES                    12

Introduction - Representations (Matrix and Adjacency List) - Traversal techniques: Depth First Search, Breadth First Search (Stacks and Queues) – Prim's and Kruskal's Algorithm for Minimum Spanning Tree - Single Source Shortest Path algorithm - Biconnectivity

**L: 45; T:15; TOTAL: 60 PERIODS**

### TEXT BOOK

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2<sup>nd</sup> Edition, Pearson Education, 2016.

### REFERENCES

1. Debasis Samanta, "Classic Data Structures", 2<sup>nd</sup> Edition, Prentice Hall, 2012.
2. Reema Thareja, "Data Structures Using C", 2<sup>nd</sup> Edition, Oxford University Press, 2019.
3. Alfred V. Aho, John E. Hopcroft, Jeffrey D.Ullman, "Data Structures and Algorithms", Pearson Education, 2012.
4. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, "Fundamentals of Data Structures in C", 2<sup>nd</sup> Edition, Universities Press, 2008.
5. Richard Gilberg, Behrouz Forouzan, "Data Structures: A Pseudocode Approach with C", 2<sup>nd</sup> Edition, Cengage Learning, 2004.

19IT33C

**OBJECT ORIENTED PROGRAMMING****L T P C**  
**3 1 0 4****COURSE OUTCOMES**

Upon completion of this course, the students will be able to

- CO 1: list and use object oriented programming concepts. (K2)
- CO 2: explain the fundamentals of C++. (K2)
- CO 3: define the advanced features of C++. (K2)
- CO 4: solve simple problems in file handling using C++. (K3)
- CO 5: define the fundamental concepts in java. (K3)

<b>UNIT I</b>	<b>INTRODUCTION TO OOPS CONCEPTS</b>	<b>12</b>
OOPs concepts – Inheritance - Polymorphism - Encapsulation - Abstract – Interface – constructor - Destructor		
<b>UNIT II</b>	<b>C++ FUNDAMENTALS</b>	<b>12</b>
Overview of C++ – Class – Object – Variable – method – Data types – Operators – Control statements – Storage classes – Recursion		
<b>UNIT III</b>	<b>C++ ADVANCED FEATURES</b>	<b>12</b>
Virtual Function – Exception Handling – Array and its simple problems – String – Simple problems on string inbuilt functions – Friend Function – Namespace		
<b>UNIT IV</b>	<b>C++ FILE HANDLING</b>	<b>12</b>
File handling – Writing – Reading – Delete – Rename – Simple problems on using File – Templates		
<b>UNIT V</b>	<b>JAVA FUNDAMENTALS</b>	<b>12</b>
Overview of JAVA : Class, Object, Variables, Methods – Constants – Data types – Expressions – Branching and Looping statements – Simple programs.		

**L: 45; T: 15; TOTAL: 60 PERIODS****TEXT BOOKS**

1. Balagurusamy.E., “Object Oriented Programming with C++”, Sixth Edition, TMH, 2013.
2. Balagurusamy.E., “Programming with Java”, Sixth Edition, TMH,2019.

**REFERENCES**

1. K.R.Venugopal, Rajkumar Buyya, T.Ravishankar, “Mastering C++”, Second Edition, TMH, 2013.
2. Herbert Schildt, Java: The Complete Reference, Eleventh Edition, 11th Edition, 2018.

**WEB REFERENCES**

1. <http://www.geeksforgeeks.org/c-plus-plus/>
2. <http://www.geeksforgeeks.org/java/>
3. <https://www.javatpoint.com/cpp-tutorial>
4. <https://www.javatpoint.com/java-tutorial>

**19IT34C PRINCIPLES OF DATA COMMUNICATION**

**L T P C**  
**3 0 0 3**

**COURSE OUTCOMES**

Upon completion of this course, the students will be able to

- CO 1: describe the basic concepts of Analog Communications. (K1)
- CO 2: analyze and compare various digital modulation schemes. (K2)
- CO 3: describe the concepts of data communication standards and connectionless protocols. (K1)
- CO 4: illustrate the fundamentals of data communication codes. (K2)
- CO 5: illustrate the concept of Spectrum and access techniques in wireless communication. (K2)

**UNIT I FUNDAMENTALS OF ANALOG COMMUNICATION 9**

Principles of amplitude modulation, AM envelope, frequency spectrum and bandwidth, modulation index and percent modulation, AM Voltage distribution, AM power distribution, Angle modulation - FM and PM waveforms, phase deviation and modulation index, frequency deviation and percent modulation, Frequency analysis of angle modulated waves. Bandwidth requirements for Angle modulated waves.

**UNIT II DIGITAL COMMUNICATION 9**

Introduction, Shannon limit for information capacity, digital amplitude modulation, frequency shift keying (FSK), phase shift keying (PSK)- binary phase shift keying (BPSK) - QPSK, Quadrature Amplitude modulation (QAM), bandwidth efficiency.

**UNIT III INTRODUCTION TO DATA COMMUNICATION 9**

Introduction – History of Data communications, Standards Organizations for data communication – Layered Network architecture- data communication circuits – Serial and Parallel Data Transmission –Data Communication Network.

**UNIT IV DATA COMMUNICATION CODES 9**

Introduction –Data communication codes, Bar codes, Error control, Error Detection – Redundancy checking – Checksum – LRC - CRC, Error correction – Retransmission - Forward Error Correction (FRC), Line control Unit.

**UNIT V SPREAD SPECTRUM AND MULTIPLE ACCESS TECHNIQUES 9**

Introduction, Pseudo-noise sequence, DS spread spectrum with coherent binary PSK, processing gain, FH spread spectrum, multiple access techniques, wireless communication - Cellular architecture - frequency reuse, Universal Mobile Telecommunications system (UMTS).

**L: 45; TOTAL: 45 PERIODS**

**TEXT BOOKS**

1. Wayne Tomasi, "Advanced Electronic Communication Systems", 6<sup>th</sup> Edition, Pearson Education, 2013.
2. Simon Haykin, "Communication Systems", 4<sup>th</sup> Edition, John Wiley & Sons. 2007.
3. Rappaport T.S, "Wireless Communications: Principles and Practice", 2<sup>nd</sup> Edition, Pearson Education, 2012.

**REFERENCES**

1. H.Taub, D L Schilling, G Saha, "Principles of Communication", 3<sup>rd</sup> Edition, 2007.

2. B.P.Lathi, "Modern Analog And Digital Communication systems", 3<sup>rd</sup> Edition, Oxford University Press, 2007
3. B.Sklar, "Digital Communication Fundamentals and Applications", 2<sup>nd</sup> Edition, Pearson Education, 2007.
4. Blake, "Electronic Communication Systems", Thomson Delmar Publications, 2002.
5. Martin S.Roden, "Analog and Digital Communication System", 3<sup>rd</sup> Edition, PHI, 2002.

**19IT35C****PROFESSIONAL ETHICS AND HUMAN VALUES****L T P C  
3 0 0 3****COURSE OUTCOMES**

Upon completion of this course, the students will be able to

- CO1: Recognize the core human values that shape the ethical behavior of an engineer. (K2)
- CO2: Expose awareness on professional ethics. (K2)
- CO3: Analyze the engineering ethical breach from past study. (K2)
- CO4: Distinguish and apply safety, responsibility and rights in workplaces. (K2)
- CO5: Discuss about the global issues with regard to ethics. (K2)

**UNIT I HUMAN VALUES****9**

Morals, Values and Ethics - Integrity - Work Ethics - Service Learning - Civic Virtue - Respect for Others - Living Peacefully - Caring - Sharing - Honesty - Courage - Valuing Time - Cooperation - Commitment - Empathy - Self-Confidence - Character – Spirituality.

**UNIT II ENGINEERING ETHICS****9**

Senses of 'Engineering Ethics' - variety of moral issued - types of inquiry - moral dilemmas - moral autonomy - Kohlberg's theory - Gilligan's theory - consensus and controversy - Models of Professional Roles - theories about right action - Self-interest - customs and religion - uses of ethical theories.

**UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION****9**

Engineering as experimentation - engineers as responsible experimenters - codes of ethics - a balanced outlook on law - Case study: The challenger disaster.

**UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS****9**

Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk - Collegiality and loyalty - respect for authority - collective bargaining - confidentiality - conflicts of interest - occupational crime - professional rights - employee rights - Intellectual Property Rights (IPR) - discrimination. Case studies: The Three mile island and Chernobyl disaster.

**UNIT V GLOBAL ISSUES****9**

Multinational corporations - Environmental ethics - computer ethics - weapons development - engineers as managers - consulting engineers - engineers as expert witnesses and advisors - Code of Conduct – Corporate Social Responsibility.

**L: 45 TOTAL: 45 PERIODS****TEXT BOOKS**

1. Mike W Martin and Roland Schinzinger, "Ethics in Engineering", 4<sup>th</sup> Edition, McGraw-Hill, New York 2017.
2. Govindarajan M, Natarajan S and Senthil Kumar VS, "Engineering Ethics", Prentice Hall of India, New Delhi, 2013.



## REFERENCES

1. John R Boatright, "Ethics and the Conduct of Business", 4<sup>th</sup> Edition, Pearson Education, New Delhi, 2017.
2. Charles D and Fleddermann, "Engineering Ethics", Pearson Education / Prentice Hall, New Jersey, 2012.
3. Charles E Harris, Michael S Protchard and Michael J Rabins, "Engineering Ethics - Concepts and Cases", Fourth Edition, Wadsworth Thompson Learning, United States, 2005.
4. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford 2001.

**19IT36C**

**COMPUTER ORGANIZATION AND ARCHITECTURE**

**L T P C  
3 0 0 3**

## COURSE OUTCOMES

Upon completion of this course, the students will be able to

- CO 1: describe the internal structure and operation of digital computer. (K2)
- CO 2: explain the instruction execution and programming sequences. (K2)
- CO 3: apply pipelining concept for instruction execution. (K3)
- CO 4: explain the types of memory systems. (K2)
- CO 5: summarize the different I/O mechanisms. (K2)

### **UNIT I                    COMPUTER SYSTEM AND MACHINE INSTRUCTIONS                    9**

Comparison of Computer Organization & Architecture -Computer Types -Functional units – Basic operational concepts – Bus structures – Software- Performance –Memory location and addressing- Instructions and instruction sequencing – Addressing modes–Assembly language(8085)-Basic I/O Operation.

### **UNIT II                    BASIC PROCESSING AND CONTROL UNIT                    9**

Fundamental concepts – Execution of a complete instruction – Multiple bus organization – Hardwired control – Micro programmed control.

### **UNIT III                    PIPELINING AND PARELLEL PROCESSING                    9**

Basic concepts – Parallel processing –Instruction pipeline - Data hazards – Instruction hazards – Influence on instruction sets – data path and control consideration–Super scalar operation.

### **UNIT IV                    MEMORY SYSTEM                    9**

Basic concepts – Semiconductor RAM – ROM – Speed – Size and cost – Cache memories – Improving cache performance – Virtual memory – Memory management requirements – Secondary storage devices.

### **UNIT V                    COMPUTER PHERIPHERALS AND I/O ORGANIZATION                    9**

I/O Devices- Accessing I/O devices – Interrupts – Direct Memory Access – Buses – Interface circuits – Standard I/O Interfaces-PCI, SCSI, USB.

**L: 45 TOTAL: 45 PERIODS**

**TEXT BOOKS**

1. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, "Computer Organization", 5<sup>th</sup> Edition, Tata McGraw Hill, 2017.
2. Morris Mano. M, "Computer System Architecture" 3<sup>rd</sup> Edition, Pearson Education, 2014

**REFERENCES**

1. David A. Patterson and John L. Hennessy, "Computer Organization and Design: The Hardware/Software interface", 5<sup>th</sup> Edition, Elsevier, 2016.
2. William Stallings, "Computer Organization and Architecture – Designing for Performance", 10<sup>th</sup> Edition, Pearson Education, 2016.
3. John P. Hayes, "Computer Architecture and Organization", 3<sup>rd</sup> Edition, Tata McGraw-Hill, 2017.
4. V.P. Heuring, H.F. Jordan, T.G.Venkatesh "Computer Systems Design and Architecture", 2<sup>nd</sup> Edition, Pearson Education, 2008.

**19GN03C      TAMILS AND TECHNOLOGY (தமிழரும் தொழில்நுட்பமும்)      LT P C**  
**1 0 0 1**

**UNIT I      WEAVING AND CERAMIC TECHNOLOGY      3**

Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.

**UNIT II      DESIGN AND CONSTRUCTION TECHNOLOGY      3**

Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.

**UNIT III      MANUFACTURING TECHNOLOGY      3**

Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting, steel -Copper and goldCoins as source of history - Minting of Coins – Beads making-industries Stone beads - Glass beads - Terracotta beads -Shell beads/ bone beats - Archeological evidences - Gem stone types described in Silappathikaram.

**UNIT IV      AGRICULTURE AND IRRIGATION TECHNOLOGY      3**

Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoempu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.

**UNIT V      SCIENTIFIC TAMIL & TAMIL COMPUTING      3**

Development of Scientific Tamil - Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.

**L: 15; TOTAL : 15 PERIODS**

## REFERENCE BOOKS

1. தமிழக வரலாறு – மக்களும் பண்பாடும் - கே.கே.பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்)
2. கணினித் தமிழ் - முனைவர். இல.சுந்தரம் (விகடன் பிரசுரம்)
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரீகம் (தொல்லியல் துறை வெளியீடு)
4. பொருதை – ஆற்றங்கரை நாகரீகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

**19GN03C**

**TAMILS AND TECHNOLOGY (தமிழரும் தொழில்நுட்பமும்)**

**LT P C**

**1 0 0 1**

**அலகு I நெசவு மற்றும் பாணைத் தொழில்நுட்பம்**

**3**

சங்க காலத்தில் நெசவுத் தொழில் - பாணைத் தொழில்நுட்பம் - கருப்பு சிவப்பு பாண்டங்கள் - பாண்டங்களில் கீறல் குறியீடுகள்.

**அலகு II வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்**

**3**

சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு - சங்க காலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் - சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் - மாமல்லபுரம் சிற்பங்களும், கோவில்களும் - மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் - செட்டிநாட்டு வீடுகள் - பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ-சாரோசெனிக் கட்டிடக்கலை.

**அலகு III உற்பத்தித் தொழில்நுட்பம்**

**3**

கப்பல் கட்டும் கலை – உலோகவியல் - இரும்புத் தொழிற்சாலை - இரும்பை உருக்குதல், எ.கு – வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் - நாணயங்கள் அச்சடித்தல் - மணி உருவாக்கும் தொழிற்சாலைகள் - கல்மணிகள், கண்ணாடி மணிகள் -

சுடுமண் மணிகள் - சங்கு மணிகள் - எலும்புத் துண்டுகள் - தொல்லியல் சான்றுகள் - சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

**அலகு IV வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில்நுட்பம் 3**  
அணை, ஏரி, குளங்கள், மதகு – சோழர்காலக் குழுமித் தூம்பின் முக்கியத்துவம் - கால்நடை பராமரிப்பு – கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் - வேளாண்மை மற்றும் வேளாண்மைச் சார்ந்த செயல்பாடுகள் - கடல்சார் அறிவு – மீன்வளம் - முத்து மற்றும் முத்துக்குளித்தல் - பெருங்கடல் குறித்த பண்டைய அறிவு – அறிவுசார் சமூகம்.

**அலகு V அறிவியல் தமிழ் மற்றும் கணினித்தமிழ் 3**  
அறிவியல் தமிழின் வளர்ச்சி - கணினித்தமிழ் வளர்ச்சி – தமிழ் நூல்களை மின்பதிப்பு செய்தல் - தமிழ் மென்பொருட்கள் உருவாக்கம் - தமிழ் இணையக் கல்விக் கழகம் - தமிழ் மின் நூலகம் - இணையத்தில் தமிழ் அகராதிகள் - சொற்குவைத் திட்டம்.

**L: 15; TOTAL: 15 PERIODS**

### REFERENCE BOOKS

1. தமிழக வரலாறு – மக்களும் பண்பாடும் - கே.கே.பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்)
2. கணினித் தமிழ் - முனைவர். இல.சுந்தரம் (விகடன் பிரசுரம்)
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரீகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை – ஆற்றங்கரை நாகரீகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

**19IT37C**

**DATA STRUCTURES LABORATORY**

**L T P C  
0 0 3 1.5**

### COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: apply data structure concepts for solving computing problems. (K3)

## LIST OF EXPERIMENTS

1. Implement sorting algorithms such as Merge sort, Quick sort, and Heap sort and analyze its complexities.
2. Implementation of singly linked lists.
3. Represent a polynomial as a linked list and write functions for polynomial addition.
4. Convert infix to postfix expression using Stack.
5. Implement an expression tree. Produce its pre-order, in-order, and post-order traversals.
6. Implement binary search tree.
7. Implement insertion in AVL trees
8. Implement hashing with open addressing methods.
9. Implement Prim's algorithm and Kruskal's Algorithm using priority queues to find MST of an undirected graph
10. Implement Dijkstra's algorithm to find the shortest path.

**P: 45; TOTAL: 45 PERIODS**

**19IT38C**

**OBJECT ORIENTED PROGRAMMING LABORATORY**

**L T P C  
0 0 3 1.5**

## COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: implement object oriented programming features using C++. (K3)

CO 2: develop simple programs using java. (K3)

## LIST OF EXPERIMENTS

### C++

1. Programs Using Functions
  - Functions with default arguments
  - Implementation of Call by Value, Call by Address and Call by Reference
2. Simple Classes for understanding objects, member functions and Constructors
  - Classes with primitive data members and constant data members
  - Classes with static member functions
  - Constructor and Destructor
3. C++ programs to demonstrate
  - Structure data types
  - Enumeration

- Inline functions
  - Copy constructor
  - Friend function
4. Programs using inheritance.
  5. Compile time Polymorphism.
    - Operator Overloading including Unary and Binary Operators.
    - Function Overloading
  6. C++ program to demonstrate pure virtual function implementation.

## **JAVA**

7. Simple Java applications using
  - instance of classes and objects
8. Java Program to demonstrate
  - the use of nested class
  - array of objects

**P: 45; TOTAL: 45 PERIODS**

**19IT39C                      COMMUNICATION SKILLS LABORATORY                      L T P C**  
 (Common to all B.E. / B.Tech., Programmes)                      **0 0 2 1**

### **COURSE OUTCOMES**

Upon completion of this course, the students will be able to

CO 1: Listen and respond effectively to interact at different situations fluently (K2, S3)

CO2: Excel appropriately in professional contexts. (K3,S4)

CO3: Acquire the sub-skills required for paper presentations and group discussions which will help them to excel in their workplace. (K3, S4)

### **UNIT I**

*Lab session:* Listening and responding to audio files

*Practice session:* Mini Presentation related to Business English & Picture description.

### **UNIT II**

*Lab session:* Role Play – News Reader.

*Practice session:* Resume Preparation.

### **UNIT III**

*Lab session:* Listening to audio files related to soft skills.

*Practice session:* Practicing Power point presentation, Group discussion.

**P: 30; TOTAL: 30 PERIODS**

### **REFERENCES**

1. Dutt P. Kiranmai and Rajeevan Geeta, "Basic Communication Skills", Foundation Books, 2013.

2. Comfort, Jeremy, et al. "Speaking Effectively, Developing Speaking Skills for Business English", Cambridge University Press, Cambridge: Reprint 2011.
3. Rizvi.M.Ashraf, "Effective Technical Communication", The MC Graw Hill Education Private Limited, Companies, New Delhi, 2010.

**19IT41C**

**STATISTICS AND NUMERICAL METHODS**

**L T P C**  
**3 1 0 4**

**COURSE OUTCOMES**

Upon completion of this course, the students will be able to

- CO1: Calculate the various measures of dispersion.(K3)
- CO2: Apply the concept of testing of hypothesis for small and large samples (K3)
- CO3: Apply the basic concepts of classifications of design of experiments (K3)
- CO4: Use numerical techniques to interpolate, solve algebraic equation, differentiation and integration.(K3)
- CO5: Solve differential equations using numerical methods.(K3)

**UNIT I**

**STATISTICS**

**12**

Central tendencies - Mean, median, mode - Measures of Dispersion – Mean deviation, and Quartile deviation–Moments – Skewness –Kurtosis - Correlation and Regression .

**UNIT II**

**TESTING OF HYPOTHESIS**

**12**

Sampling distributions - Estimation of parameters - Statistical hypothesis - Large sample tests based on Normal distribution for single mean and difference of means -Tests based on t, Chi-square and F distributions for mean, variance and proportion - Contingency table for independent of attributes – Goodness of fit.

**UNIT III**

**DESIGN OF EXPERIMENTS**

**12**

One way and two way classifications - Completely randomized design – Randomized block design – Latin square design – 2<sup>2</sup> factorial design.

**UNIT IV**

**NUMERICAL SOLUTION OF EQUATIONS, NUMERICAL DIFFERENTIATION AND INTEGRATION**

**12**

Solution of Algebraic and transcendental linear equations - Newton - Raphson Method- Solution of simultaneous equations – Gauss Elimination method – Gauss Seidel method – Interpolation – Newton's forward and backward formulae - Numerical Differentiation – Newton's forward difference and backward difference formula – Numerical integration - Single and double integration using Trapezoidal and Simpson's rules.

**UNIT V**

**NUMERICAL SOLUTION OF DIFFERENTIAL EQUATIONS**

**12**

Taylor's Series Method - Euler's Method – Runge Kutta fourth order Method – Predictor - corrector Methods - Milne's Method - Solution of one dimensional heat equation by explicit and implicit methods - Two dimensional Laplace and Poisson equations – Liebman's Iteration Process

**L: 45; T: 15; TOTAL: 60 PERIODS**

**TEXT BOOKS**

1. Richard A. Johnson, Irwin Miller, John Freund, "Miller & Freund's Probability and Statistics for Engineers," Pearson Education Limited, Global Edition, 9<sup>th</sup> Edition, 2017 (For units 1 and 2).
2. Grewal, B.S., "Numerical Methods in Engineering & Science: With Programs in C, C++ & MATLAB", 10<sup>th</sup> Edition, Khanna Publishers, New Delhi, 2014 (For units 3, 4 and 5).

## REFERENCES

1. R.E. Walpole, R.H. Myers, S.L. Myers, and K Ye, "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia, 9<sup>th</sup> Edition, 2013.
2. M.R. Spiegel, J. Schiller and R.A. Srinivasan, "Schaum's Outlines Probability and Statistics", Tata McGraw Hill Edition, 2017.
3. Arnold O. Allen, "Probability, Statistic and Queueing Theory with Computer Science Applications", 2<sup>nd</sup> Edition, Elsevier a division of Reed Elsevier India Private limited, New Delhi, 2012
4. Chapra, S. C and Canale, R. P. "Numerical Methods for Engineers", 7<sup>th</sup> Edition, Tata McGraw- Hill, New Delhi, 3<sup>rd</sup> Edition, 2016.
5. Gerald, C. F. and Wheatley, P. O., "Applied Numerical Analysis", 7<sup>th</sup> Edition, Pearson Education Asia, New Delhi, 2007.

**19IT42C**

**OPERATING SYSTEMS**

**L T P C**  
**3 0 0 3**

### PRE- REQUISITE:

- Machine architecture.
- Problem solving techniques.
- Programming concepts
- Computer architecture and organization

### COURSE OUTCOMES

Upon completion of this course, the students will be able to

- CO 1: explain the various services of an operating system. (K2)
- CO 2: solve process scheduling, synchronization and deadlock problems. (K3)
- CO 3: illustrate the various storage management techniques. (K2)
- CO 4: summarize the various I/O techniques. (K2)
- CO 5: describe protection methods in operating system. (K2)

### UNIT I

#### INTRODUCTION

**9**

Introduction to operating systems –Types of OS - operating system structures – Process, Memory and storage management - Distributed System - system calls. Process Management: Processes. Threads: Multi-threading models – Threading issues. Case Study: IPC in Linux.

### UNIT II

#### PROCESS MANAGEMENT

**9**

CPU Scheduling: Scheduling algorithms. Process Synchronization: The critical-section problem – Semaphores – Classic problems of synchronization- Critical region-Monitors-Deadlock: System model – Deadlock characterization – Methods for handling deadlocks – Case study: Process scheduling in Linux.

### UNIT III

#### STORAGE MANAGEMENT

**9**

Memory Management- Swapping- Continuous Memory allocation – Paging- Segmentation - Demand paging - Virtual Memory: Background- Page replacement – Thrashing.



**UNIT IV I/O MANAGEMENT 9**

Mass Storage Structure: Disk Structure, Disk Scheduling, and Disk Management –swap space management – File System Mounting - File System Interface: File concept, Access methods, Directory Structure.

**UNIT V PROTECTION AND SECURITY 9**

Principles of protection – Access matrix – Implementation of Access matrix – Access Control – Revocation of access rights – Program threats – System and network threats – User authentication- Firewalling to Protect Systems and Networks. Case Study: Tripwire file system.

**L: 45; TOTAL: 45 PERIODS**

**TEXT BOOK**

1. Silberschatz, Galvin, and Gagne, “Operating System Concepts”, 9<sup>th</sup> Edition, Wiley India Pvt. Ltd, 2013.

**REFERENCES**

1. Andrew S. Tanenbaum, “Modern Operating Systems”, 4<sup>th</sup> Edition, Pearson Education, 2014.
2. Harvey M. Deital, “Operating Systems”, 3<sup>rd</sup> Edition, Pearson Education, 2014.
3. Gary Nutt, “Operating Systems”, 3<sup>rd</sup> Edition, Pearson Education, 2004.

**19IT43C DATABASE MANAGEMENT SYSTEMS L T P C  
3 0 0 3**

**COURSE OUTCOMES**

Upon completion of this course, the students will be able to

- CO1: explain the role of a database management system in an organization. (K1)
- CO2: design E-R models for simple database application scenarioS and normalize databases to reduce cost due to redundancy constraints. (K3)
- CO3: implement the concept of a database transaction and related database facilities, including concurrency control, backup and recovery. (K2)
- CO4: demonstrate the database Indexing and storage mechanisms for effective query processing. (K2)
- CO5: explain different types of databases in emerging information systems (K2)

**UNIT I RELATIONAL DATABASES 9**

Purpose of Database System - Views of data - Database Architecture - Database users and Administrator – Structure of relational databases- Relational Model -Keys --Relational Algebra –SQL fundamentals

**UNIT II DATABASE DESIGN 9**

Data Models - Entity Relationship model - E-R Diagrams - Functional Dependencies –Non loss Decomposition–Functional Dependencies –First, Second, Third Normal Forms, Dependency Preservation –Boyce/Codd Normal Form -Multi-valued Dependencies and Fourth Normal Form –Join Dependencies and Fifth Normal Form

**UNIT III TRANSACTION MANAGEMENT 9**

Transaction Concepts - ACID Properties - Transaction States -A Simple Transaction Model – Serializability - Two Phase Commit - Concurrency - Need for Concurrency - Lock Based Protocols - Two Phase Locking – Failure Classification -Transaction Recovery -Deadlock.

**UNIT IV DATA STORAGE AND QUERYING 9**  
 File Organization - Indexing and Hashing - B+ tree Index Files - B tree Index Files - Query Processing Overview - Catalog Information for Cost Estimation - Selection Operation - Sorting - Join Operation-Query Optimization –Transformation of Relational expressions.

**UNIT V RECENT TRENDS 9**  
 Overview: Distributed Databases -Parallel Database - Multimedia Database - Mobile Database - Web Database - Multidimensional Database. Schema less database: NoSQL Database.

**L: 45; TOTAL: 45 PERIODS**

**TEXT BOOK**

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", Sixth Edition, Tata McGraw Hill, 2013.

**REFERENCES**

1. Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", 6<sup>th</sup> Edition, Pearson / Addison wesley, 2016.
2. Raghu Ramakrishnan, "Database Management Systems", 4<sup>th</sup> Edition, Tata McGraw-Hill, 2006.
3. Shashank Tiwari, Professional NoSql, Wiley, 2011.
4. C.J.Date, A.Kannan, S.Swamynathan, "An Introduction to Database Systems", 8<sup>th</sup> Edition, Pearson Education, 2012.

**19IT44C COMPUTER NETWORKS L T P C  
3 0 0 3**

**PRE- REQUISITE**

- C or Java programming
- Course in probability

**COURSE OUTCOMES**

Upon completion of this course, the students will be able to

- CO 1: Describe the functionalities of physical and datalink layer (K1)
- CO 2: Explain the routing algorithms for the given network (K2)
- CO 3: Develop simple applications using sockets (K2)
- CO 4: Implement the application layer protocol for the given application (K2)
- CO 5: Analyze the various issues involved in transition from IPv4 to IPv6 (K2)

**UNIT I PHYSICAL AND DATALINK LAYER 9**  
 Data Communication – Network models – OSI model – TCP/IP model – Layers – Physical layer –Topology – Transmission media - Datalink layer – Error Detection and correction – Parity – LRC – CRC – Hamming code – Flow Control – Sliding window– Ethernet – IEEE 802.11 – FDDI – Bridges

**UNIT II NETWORK LAYER 9**  
 Circuit switching vs. packet switching – IP addressing – Internet Protocol – ARP – IGMP – ICMP – OSPF – RIP- Distributed Bellman-Ford algorithm

**UNIT III TRANSPORT LAYER AND ELEMENTARY SOCKETS 9**

Process to process delivery – TCP and UDP – segment format – services and features – Congestion control and avoidance – QoS – Sockets – Address structures – Elementary TCP UDP Sockets and functions – Iterative Server – Concurrent Server - I/O multiplexing. Congestion control-TCP variants -Reno, Tahoe, Vegas, Compound and CUBIC

#### **UNIT IV APPLICATION LAYER**

**9**

Domain Name System (DNS) – Dynamic DNS - E-mail – Message transfer agent:SMTP, Message access agent: IMAP, POP3 – File Transfer Protocol - Anonymous FTP – Simple Network Management Protocol – RMON

#### **UNIT V IPv6**

**9**

IPv6 Introduction – Packet format – Extension Headers - IPv6 addressing - Address Representation – IPv6 Protocol – I2B - B2B- ICMPv6 Protocol - Transition from IPV4 to IPV6 – Dual Stack - Tunneling – Header Translation – Advantages of Ipv6 - strategies - use of IP addresses

**L: 45; TOTAL: 45 PERIODS**

#### **TEXT BOOKS**

1. Kurose and Ross, "Computer Networking - A top-down approach", 7<sup>th</sup> Edition, Pearson, 2017
2. Behrouz A. Foruzan, "Data communication and Networking", Tata McGraw-Hill, 5<sup>th</sup> Edition, 2017.
3. Larry L. Peterson, Bruce S. Davie, "Computer Networks: A Systems Approach", Morgan Kauffmann Publishers Inc., 3<sup>rd</sup> Edition, 2011.

#### **REFERENCES**

1. Ying-Dar Liu, Ren-Hung Hwang, Fred Baker, "Computer Networks: An Open Source Approach", McGraw-Hill, 2011
2. William Stallings, "Data and Computer Communication", Pearson Education, 9<sup>th</sup> Edition, 2014
- a. Andrew S. Tannenbaum, "Computer Networks", Pearson Education, 5<sup>th</sup> Edition, 2013.
3. D.E. Comer, "Internetworking with TCP/IP Vol- III", (BSD Sockets Version), Pearson Education, 2<sup>nd</sup> Edition, 2003.
4. W. Richard Stevens, "Unix Network Programming Vol-I", Pearson Education, 4<sup>th</sup> Edition, 2000.

#### **WEB REFERENCES**

1. <http://nptel.ac.in/courses/106105081/>
2. [http://nptel.ac.in/courses/Webcourse-contents/IIT%20Kharagpur/Computer%20networks/New\\_index1.html](http://nptel.ac.in/courses/Webcourse-contents/IIT%20Kharagpur/Computer%20networks/New_index1.html)
3. Nptel Video references
4. [http://compnetworking.about.com/od/basicnetworkingconcepts/a/network\\_types.htm](http://compnetworking.about.com/od/basicnetworkingconcepts/a/network_types.htm)
5. <http://www.protocols.com/pbook/tcpip1.htm>
6. <http://cnp3book.info.ucl.ac.be/network/network/>
7. [http://docs.oracle.com/cd/E23824\\_01/html/821-1453/ipv6-troubleshoot-2.html](http://docs.oracle.com/cd/E23824_01/html/821-1453/ipv6-troubleshoot-2.html)
8. <http://searchsecurity.techtarget.com/tip/Get-ready-for-IPv6-Five-security-issues-to-consider>
9. [http://www.highteck.net/EN/Application/Application\\_Layer\\_Functionality\\_and\\_Protocols.htm](http://www.highteck.net/EN/Application/Application_Layer_Functionality_and_Protocols.htm)

2 0 0 2

**COURSE OUTCOMES**

Upon completion of this course, the students will be able to

- CO 1: analyze the asymptotic performance of algorithms. (K3)
- CO 2: derive and solve recurrences describing the performance of dynamic programming and divide and-conquer algorithms. (K3)
- CO 3: find optimal solution by applying various methods. (K3)
- CO 4: apply number theoretic algorithms to solve computing problems. (K3)
- CO 5: find optimal solution by applying approximation algorithms. (K3)

**UNIT I INTRODUCTION 6**

Role of algorithms in computing - Analyzing algorithms - Designing algorithms - Asymptotic notation - Efficiency of algorithms - Notion of time and space complexity - Amortized analysis.

**UNIT II DIVIDE & CONQUER AND DYNAMIC PROGRAMMING 6**

Introduction - Strassen's algorithm for matrix multiplication - The substitution method for solving recurrences - Elements of dynamic programming – Warshall's and Floyd's algorithm for shortest path – optimization problems - Optimal binary search trees.

**UNIT III GREEDY ALGORITHMS 6**

Minimum Spanning Trees – Dijkstra's algorithm – Scheduling – Huffman code – Knapsack problem.

**UNIT IV NUMBER-THEORETIC ALGORITHMS 6**

Elementary number theoretic notions - Solving modular linear equations - The Chinese remainder theorem - RSA public-key cryptosystem - Primality testing - Integer factorization

**UNIT V APPROXIMATION ALGORITHMS 6**

Introduction – n-Queens Problem – Hamiltonian Circuit Problem – Subset-Sum problem Assignment Problem – Graph coloring problem – 0-1 Knapsack problem - Travelling Salesman Problem.

**L: 30; TOTAL: 30 PERIODS****TEXT BOOKS**

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", Third Edition, 2009.
2. Anany Levitin, "Introduction to The Design & Analysis of Algorithms", Second Edition, Pearson Education, 2016.

**REFERENCES**

1. Richard Neapolitan, "Foundations of Algorithms", Fifth Edition, Jones and Bartlett Publishers, 2015.
2. Parag H.Dave, Himanshu B.Dave, "Design and Analysis of Algorithms", Pearson Education, 2008.
3. Brassard Gills, Bratley Paul, "Fundamentals of Algorithmics", Prentice Hall India Pvt.Ltd., 2001.
4. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education, 2006.
5. Donald E. Knuth, "The Art of Computer Programming", Volumes 1 & 3, Pearson Education, 2009.
6. Steven S. Skiena, "The Algorithm Design Manual", Second Edition, Springer, 2008.

## COURSE OUTCOMES

Upon completion of this course, the students will be able to

- CO 1: Explain the basic concepts and process of accounting and finance. (K2)
- CO 2: Describe the financial status of an organization. (K2)
- CO 3: Identify the concepts and operations of CVP analysis for decision making (K3)
- CO 4: Apply techniques like budgetary control and capital budgeting for planning and Controlling in an organization. (K3)
- CO 5: Explain the application of accounting software. (K2)

### UNIT I INTRODUCTION TO ACCOUNTING 9

Introduction and Definition - Accounting concepts and conventions - Final Accounts - Preparation of Trading, Profit and Loss Account and Balance Sheet.

### UNIT II ANALYSIS AND INTERPRETATION OF FINANCIAL STATEMENTS 9

Meaning and importance - Comparative statement, Common size statement - Trend analysis and accounting ratioS - latest trend in presenting financial data.

### UNIT III ACCOUNTING FOR DECISION MAKING 9

CVP Analysis - Relevant Costs and Revenue for Decision Making - Pricing Decisions - Operational Decisions - Exploring New markets - Make or buy decisions.

### UNIT IV ACCOUNTING FOR PLANNING AND CONTROLLING 9

Budgets, Budgetary Control – Meaning – Importance and applications - Capital budgeting - Meaning – Importance - steps in capital budgeting - Information needed - Methods of evaluating capital budgeting decisions.

### UNIT V COMPUTERIZED ACCOUNTING SYSTEM 9

Meaning - Concept - Comparison between Manual and Computerized Accounting - Sourcing of Accounting Software - Accounting Packages.

**L: 45; TOTAL: 45 PERIODS**

## TEXT BOOKS

1. V. K. Gupta, R. L. Gupta, "Financial Accounting" 3<sup>rd</sup> Edition, S.Chand, New Delhi, 2016.
2. Dr.V.R.Palanivelu, "Accounting for Management", 3<sup>rd</sup> Edition, University science press New Delhi, 2013.
3. Manoj Bansal, Ajay Sharma, "Computerized Accounting System", 1<sup>st</sup> Edition, Sahitya Bhawan Publications, Agra, 2019.

## REFERENCES

1. S. N. Maheshwari, Suneel K. Maheshwari, Sharad K. Maheshwar, "Financial Accounting", 2<sup>nd</sup> Edition, Vikas Publishing House, 2018.
2. Peter Atrill, Eddie McLaney "Financial Accounting for Decision Makers" 7<sup>th</sup> Edition, Pearson Education, 2013.
3. Dr.Alok Dwivedi, Prof.C.M.Tembhurnekar, "Computerized Accounting", 1<sup>st</sup> Edition, Sai Jyoti Pulication, Nagpur, 2016.

19MC01C ENVIRONMENTAL SCIENCE AND ENGINEERING

L T P C QP  
3 0 0 0 D

## COURSE OUTCOMES

Upon completion of this course, the students will be able to

Upon completion of this course, the students will be able to

CO 1: explain the structure and function of ecosystem. (K2)

CO 2: recognize the values of biodiversity and natural resources and the ways to protect the biodiversity of his /her locality. (K2)

CO 3: explain the causes and effects of pollution. (K2)

CO 4: describe social issues related to the environment and the environment act. (K2)

CO 5: identify the nutrients in food and impact of metals on human health. (K2)

### **UNIT I ENVIRONMENT AND ECOSYSTEMS 9**

Scope and importance of environment – need for public awareness – ecosystem – structure and function of an ecosystem – energy flow in the ecosystem – forest and aquatic ecosystems – Field study of simple ecosystems – pond and forest.

### **UNIT II BIODIVERSITY AND NATURAL RESOURCES 9**

Biodiversity: genetic, species and ecosystem diversity – threats to biodiversity – endangered and endemic species in India – conservation of biodiversity; forest resources: use and over-exploitation – deforestation – water resources: use and overutilization of surface and ground water – role of an individual in conservation of natural resources.

### **UNIT III ENVIRONMENTAL POLLUTION 9**

Causes, effects and control measures of air pollution, water pollution, noise pollution and nuclear hazards – e-waste – toxic substances in e-waste – risks related to toxic substances – role of an individual in prevention of pollution.

### **UNIT IV SOCIAL ISSUES, HUMAN POPULATION AND ENVIRONMENTAL LAW 9**

Water conservation – rain water harvesting – climate change – global warming, acid rain, ozone layer depletion – population growth – population explosion – family welfare programme; Environment laws: environmental (protection) act 1986-the wild life (protection) act 1972.

### **UNIT V FOOD AND HUMAN HEALTH 9**

Carbohydrates, lipids and vitamins in balanced diet food; disease caused by deficiency of carbohydrates, amino acids, proteins, lipids and vitamins - food adulteration - simple test for food adulterants; environmental toxicology: metals in environment- impacts of lead, cadmium, mercury and chromium on human health.

### **TEXT BOOKS**

1. Miller G. and Spoolman S, "Environmental Science", 14<sup>th</sup> Edition, Brooks / Cole Publishing Co., 2012.
2. Maczulak A.E., "Environmental Engineering", Facts on file Inc., 2009
3. Han D, "Concise Environmental Engineering", Ph.D. & Ventus Publishing ApS, 2012

### **REFERENCES**

1. Weller K. "Environmental Science and Biological Engineering", 1<sup>st</sup> Edition, WIT Press, 2015
2. Strange C. "Environmental Science and production" Nason Trest Publisher, 2010

**19IT47C**

**OPERATING SYSTEMS LABORATORY**

**L T P C**

**0 0 3 1.5**

**COURSE OUTCOMES**

Upon completion of this course, the students will be able to

CO 1: implement the various Linux commands and system calls. (K3)

CO 2: develop programs for process handling and memory management methods.(K3)

### LIST OF EXPERIMENTS

1. Basic Linux commands such as ls, cd, mkdir, cp,rm, mv, more, lpr, man, grep, sed, etc.
2. Write programs using the following system calls of UNIX operating system: fork, exec, getpid, exit, wait, close, stat, opendir, readdir
3. Write programs using the I/O system calls of UNIX operating system (open, read, write, etc)
4. Write C programs to simulate UNIX commands like ls, grep, etc.
5. Given the list of processes, their CPU burst times and arrival times, display/print the Gantt chart for FCFS and SJF. For each of the scheduling policies, compute and print the average waiting time and average turnaround time.
6. Given the list of processes, their CPU burst times and arrival times, display/print the Gantt chart for Priority and Round robin. For each of the scheduling policies, compute and print the average waiting time and average turnaround time
7. Develop application using Inter Process communication (using shared memory, pipes or message queues)
8. Deadlock avoidance using semaphore.
9. Implement Threading & Synchronization Applications
- 10.Implement the Producer – Consumer problem using semaphores (using UNIX system calls).
- 11.Implement various memory management schemes.
- 12.Implement any file allocation technique (Linked, Indexed or Contiguous)

**P: 45; TOTAL: 45 PERIODS**

**19IT48C**

**NETWORKING LABORATORY**

**L T P C**  
**0 0 3 1.5**

### COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Implement error correction techniques and develop socket programming (K2)

CO2: Simulate networks and analyze traffic using various tools (K2)

### LIST OF EXPERIMENTS:

1. Implement error correction & detection techniques.
2. Configure a network topology with distance vector routing protocols using CISCO Packet Tracer
3. Implementation of ARP/RARP
4. Implementation of socket programs using TCP/UDP
5. Simulation of sliding window protocols
6. Implement connection/connectionless oriented concurrent server
7. Implement multicasting protocols
8. Sniff and Analyse packet capture & network traffic
9. Configure spanning tree protocol using CISCO Packet Tracer
- 10.Configuring Point-to-point protocol authentication using PAP and CHAP.

**SUGGESTED SOFTWARE TOOLS/UTILITIES:**

- KaliLinux
- CISCO Packet Tracer
- NetSim

**P: 45; TOTAL: 45 PERIODS**

**19IT49C                      DATABASE MANAGEMENT SYSTEMS LABORATORY                      L T P C**  
**0 0 3 1.5**

**COURSE OUTCOMES**

Upon completion of this course, the students will be able to

- CO 1: develop a set of queries in SQL and PL/SQL to handle typical user inquiries for information extraction from the database. (K2)  
 CO 2: design and develop an application. (K3)

**LIST OF EXPERIMENTS**

1. Creation and Modification of relations
2. Integrity constraint enforcement
3. Nested Queries & Join Queries
4. Creation and Updation of Views
5. Exercises using PL/SQL
6. Nosql
7. High level programming language extensions (Control structures, Procedures and Functions).
8. Creation of Triggers
9. Cursor management
10. Database Design and implementation (Mini Project).

**REFERENCES**

1. Ivan Bayross, Commercial Application Development Using ORACLE Developer 2000, BPB Publications, 2000.
2. ORACLE PL/SQL Programming – Scott Urman BPB Publications

**LAB EQUIPMENTS**

Hardware and Software required for a batch of 30 students:

**Hardware:**

- 30 Personal Computers

**Software:**

- Front end: VB/C#/JAVA
- Back end: Oracle 11g, my SQL, DB2
- Platform: Windows 7
- Oracle server could be loaded and can be connected from individual PCs.

**P: 45; TOTAL: 45 PERIODS**

**19IT51C                                      JAVA PROGRAMMING                                      L T P C**  
**3 0 0 3**

**COURSE OUTCOMES**

Upon completion of this course, the students will be able to

- CO 1: define the basic OOP concepts using java. (K2)



- CO 2: explain the principles of GUI, AWT and swing concepts. (K2)
- CO 3: implement error handling and file handling using java. (K3)
- CO 4: apply multithreading and concurrency control techniques. (K3)
- CO 5: describe the collection framework and lambda expressions in java. (K3)

**UNIT I INTRODUCTION TO OOP AND JAVA FUNDAMENTALS 9**

Object Oriented Programming – Inheritance – Polymorphism - Abstract – Interface - Encapsulation – Constructor – Access specifiers – Static members – Packages in JAVA – Math class – String: StringBuffer - StringBuilder

**UNIT II GUI, AND AWT SWING 9**

GUI – AWT Basics – Event Handling – AWT Hierarchy – Components – Swing Introduction – JFC – Swing Hierarchy – Components – Simple Programs

**UNIT III EXCEPTION AND FILE HANDLING 9**

Exceptions Handling – Try, Catch and Finally blocks - Exception hierarchy - File – FileWriter – FileReader - BufferWriter – BufferedReader – InputStream – OutputStream.

**UNIT IV MULTITHREADING AND CONCURRENT PROGRAMMING 9**

Thread –Thread lifecycle – Working on Mult-thread – Runnable interface – Thread Priority synchronization – Concurrent Programming – Need of Concurrent Programming – Basic steps for Concurrency.

**UNIT V COLLECTION GENERIC AND LAMBDA EXPRESSION 9**

Wrapper classes – Collection framework: Set – List – Map - Generic Programming – Basic Generic concept – Lambda Expressions – Simple programs

**L: 45; TOTAL: 45 PERIODS**

**TEXT BOOKS**

1. Herbert Schildt, Java: The Complete Reference, Eleventh Edition, 11<sup>th</sup> Edition, 2018
2. Cay S. Horstmann, Gary Cornell, “Core Java Volume - I Fundamentals”, 10<sup>th</sup> Edition, Prentice Hall, 2016.

**REFERENCES**

1. Paul Deitel, Harvey Deitel, “Java SE 8 for programmers”, 3<sup>rd</sup> Edition, Pearson, 2015.
2. Steven Holzner, “Java 2 Black book”, Dreamtech press, 2011.
3. Timothy Budd, “Understanding Object-oriented programming with Java”, Updated Edition, Pearson Education, 2000.

**WEB REFERENCES**

1. <http://www.geeksforgeeks.org/java/>; <https://www.javatpoint.com/java-tutorial>

**19IT52C**

**SOFTWARE ENGINEERING**

**L T P C  
3 0 0 3**

**COURSE OUTCOMES**

Upon completion of this course, the students will be able to

- CO1: explain the principles of software development process (K1)

CO2: describe the importance of requirements and cost estimation techniques. (K2)

CO3: elicit the role of software design concepts. (K2)

CO4: describe the role of software testing and maintenance. (K2)

CO5: summarize the principal approaches of software management. (K2)

#### **UNIT I INTRODUCTION 9**

Software Engineering - Software Process - Generic process model - Prescriptive process model - Agile development - Agile Process - Extreme Programming - Other agile Process models - Software engineering Knowledge - core principles - Principles that guide each framework Activity

#### **UNIT II REQUIREMENTS AND COST ESTIMATION 9**

Requirements Engineering - Establishing the Groundwork - Eliciting Requirements - Negotiating, validating Requirements - Software cost estimation: Introduction – Software cost factors – Software cost estimation techniques – Staffing level estimation – Estimating software maintenance costs.

#### **UNIT III SOFTWARE DESIGN CONCEPTS 9**

Abstraction – Modularity – Software architecture – Cohesion, coupling – Various design concepts and notations – Real time and distributed system – Design – Documentation – Data flow oriented design – Jackson system development – Design for reuse – Programming standards.

#### **UNIT IV SOFTWARE TESTING AND MAINTENANCE 9**

Strategic Approach to software Testing - Strategic Issues - Strategies for Conventional Software - Validating Testing - System Testing - Software Maintenance - Software Supportability – Reengineering- Business Process Reengineering - Software Reengineering.

#### **UNIT V MANAGING SOFTWARE PROJECT 9**

Project Management Concepts – Software Measurement – metrics for software quality – resources – Estimation - Decomposition technique - project scheduling - Risk identification – risk projection - The RMMM plan.

**L: 45; TOTAL: 45 PERIODS**

#### **TEXT BOOKS**

1. Roger S Pressman, “Software Engineering – A Practitioner’s Approach”, 8<sup>th</sup> Edition, Tata McGraw Hill Education, 2019.
2. Ian Sommerville, “Software Engineering”, 10<sup>th</sup> Edition, Pearson Education, 2014.

#### **REFERENCES**

1. Richard Fairley, “Software Engineering Concepts”, Indian Edition, Tata Mc Graw Hill Education, 2014.
2. Hans Van Vliet, “Software Engineering: Principles and Practices”, 3<sup>rd</sup> Edition, John Wiley and Sons, 2008.

**19IT53C**

**CRYPTOGRAPHY AND NETWORK SECURITY**

**L T P C**

**3 0 0 3**



**REFERENCES**

1. Behrouz A. Foruzan and Debdeep Mukhopadhyay, "Cryptography and Network Security", 3<sup>rd</sup> Edition, Tata McGraw-Hill Education, 2015.
2. Atul Kahate, "Cryptography and Network Security", 4<sup>th</sup> Edition, Tata McGraw-Hill Education, 2019.
3. Douglas Stinson, "Cryptography Theory and Practice", 4<sup>th</sup> Edition, Chapman & Hall / CRC, 2019.
4. Wade Trappe, Lawrence C Washington, "Introduction to Cryptography with coding theory", 2<sup>nd</sup> Edition, Pearson Education, 2005.

**19IT54C****INTERNET AND WEB TECHNOLOGY****L T P C****3 0 0 3****COURSE OUTCOMES**

Upon completion of this course, the students will be able to

CO 1: design web pages using HTML and CSS and build dynamic web page with validation using client side scripting. (K3)

CO 2: Use web services to develop interactive web applications. (K3)

CO 3: develop server side programs using Servlets. (K3)

CO 4: develop server side programs using JSP. (K3)

CO 5: construct simple web pages in AJAX and to represent data in XML format. (K3)

**UNIT I WEB ESSENTIALS****9**

Web Essentials – The Internet - Basic Internet Protocols - World Wide Web – HTTP – Web Clients – Web Servers - Markup Languages: HTML, XHTML – CSS – JavaScript -Introduction to Angular JS

**UNIT II WEB SERVICES****9**

Web Service Concepts - Writing a Java Web Service - Writing a Java Web Service Client - Describing Web Services: WSDL - Representing Data Types: XML Schema - Communicating Object Data: SOAP - UDDI

**UNIT III SERVLETS****9**

Java Servlets - Architecture – Overview - A Servlet - Generating Dynamic Content - Life Cycle - Parameter Data Sessions - Cookies - URL Rewriting - Other Capabilities - Data Storage Servlets and Concurrency Databases and Java.

**UNIT IV JSP****9**

JSP: Basic – JSP and Servlets - Running JSP Applications - JavaBeans Classes and JSP - Tag Libraries and Files - Database Connectivity

**UNIT V XML AND AJAX****9**

XML: Basic XML - Document Type Definition - XML Schema DOM and Presenting XML - XML Parsers and Validation - XSL and XSLT Transformation - News Feed (RSS and ATOM) - AJAX: Ajax Client Server Architecture - XML Http Request Object-Call Back Methods – JSON - MVC Paradigm - Google Apps Script

**L: 45; TOTAL: 45 PERIODS**

### **TEXT BOOKS**

1. Jeffrey C. Jackson, "Web Technologies - A Computer Science Perspective", Pearson, 2012.
2. Paul Deitel, Harvey Deitel and Abbey Deitel, "Internet & World Wide Web: How to Program", 5<sup>th</sup> Edition, Pearson, 2012.

### **REFERENCES**

1. Chuck Musciano, Bill Kennedy "HTML & XHTML: The Definitive Guide", 6<sup>th</sup> Edition, O'Reilly Media, 2007.
2. Ethan Cerami, "Web Services Essentials - Distributed Applications with XML-RPC, SOAP, UDDI & WSDL, 1<sup>st</sup> Edition, O'Reilly, 2002.
3. Robert W. Sebesta, "Programming the World Wide Web", 8<sup>th</sup> Edition, Pearson, 2015.
4. Tyler Jewell, David Chappell, "Java Web Services", 1<sup>st</sup> Edition, O'Reilly, 2002.
5. Marty Hall, Larry Brown, "Core Web Programming, 2<sup>nd</sup> Edition, Pearson, 2009.
6. Jayson Falkner, Kevin Jones, "Servlets and Java Server Pages: The J2EE Technology Web Tier", Addison Wesley, 2003.
7. Steven Holzner, "AJAX: A beginner's guide" ,Mc Graw Hill,2009

**19IT55C**

**EMBEDDED SYSTEM**

**L T P C**  
**3 0 0 3**

### **COURSE OUTCOMES**

Upon completion of this course, the students will be able to

- CO 1: describe the architecture and functionalities of processor. (K2)
- CO 2: discuss the Memory and interrupt handling in ARM processor. (K2)
- CO 3: outline the importance of Multi-tasking in embedded systems. (K2)
- CO 4: develop basic programs using embedded C. (K3)
- CO 5: illustrate the design of distributed embedded system. (K2)

### **UNIT I INTRODUCTION 9**

Introduction to microprocessors – Features – Architecture - Challenges of Embedded Systems – Embedded system design process - Embedded processors – 8051 - Microcontroller, ARM processor – Architecture, Instruction sets

### **UNIT II MEMORY AND INTERRUPT HANDLING 9**

Programming Input and Output – Memory system mechanisms – Memory and I/O devices and interfacing – Design Examples: Cell Phones –Digital Still cameras.

### **UNIT III MULTIPROCESS AND SCHEDULING POLICIES 9**

Multiple tasks and processes – Context switching – Scheduling policies – Inter process communication mechanisms – Design Examples: Compact Discs and DVDs.

### **UNIT IV EMBEDDED PROGRAMMING 9**

Programming embedded systems in assembly and C – Meeting real time constraints – Object-oriented programming with C- Multi-state systems and function sequences.

**UNIT V DISTRIBUTED EMBEDDED SYSTEM 9**

Distributed embedded architecture – Networks for Embedded system – Network based design – Internet-Enabled Systems – Vehicles as Networks – Sensor Networks – Design Example: Elevator Controller.

**L: 45; TOTAL: 45 PERIODS**

**TEXT BOOKS**

1. Marilyn Wolf, “Computers as Components - Principles of Embedded Computing System Design”, 3<sup>rd</sup> Edition, Morgan Kaufmann Publishers, 2012.
2. Michael J. Pont, “Embedded C”, Pearson Education, 2008.

**REFERENCES**

1. Shibu K.V, “Introduction to Embedded Systems “, McGraw Hill Education, 2014.
2. Jonathan W.Valvano, “Embedded Microcomputer Systems: Real Time Interfacing”, 3<sup>rd</sup> Edition, Cengage Learning, 2012.
3. Raj Kamal, “Embedded Systems: Architecture, Programming and Design”, McGraw-Hill Higher Education, 2015.
4. Lyla.B.Das, “Embedded Systems: An Integrated Approach”, Pearson Education, 2013.
5. David E.Simon, “An Embedded Software Primer”, Pearson Education, Dorling Kindersley Pvt. Ltd, 2000.

**WEB RESOURCE**

1. <https://www.coursera.org/learn/interface-with-arduino>

**19MC02C**

**CONSTITUTION OF INDIA**

**L T P C  
3 0 0 0**

**COURSE OUTCOMES**

Upon completion of this course, the students will be able to

- CO1: describe the salient features of the Indian Constitution. (K2)
- CO2: discuss the structure and functions of parliament. (K2)
- CO3: elaborate the structure and functions of state legislature. (K2)
- CO4: explain the fundamentals of organization and working of the Judiciary. (K2)
- CO5: discuss the foreign policy of India. (K2)

**UNIT I INDIAN CONSTITUTION 9**

Salient Features – Preamble-Pillars of constitution - Fundamental Rights – Directive Principles of State Policy - Fundamental Duties.

**UNIT II PARLIAMENTARY SYSTEM 9**

Powers and Functions of President and Prime Minister - Council of Ministers - The Legislature Structure and Functions of Lok Sabha and Rajya Sabha – Speaker.

**UNIT III FEDERAL SYSTEM 9**

Features of Federal System - Administrative Relationship between Union and States - Powers and Functions of Governor and Chief Minister – Council of Ministers - State Legislature.

**UNIT IV THE JUDICIARY 9**

Organization and Composition of Judiciary - Powers and Functions of the Supreme Court - Judicial Review – High Courts.

**UNIT V INTERNATIONAL POLITICS 9**

Foreign Policy of India – VISA Application Process- International Institutions like UNO, WTO, SAARC and Environmentalism.

**L: 45; TOTAL: 45 PERIODS**

**TEXT BOOKS**

1. Basu D.D, "Introduction to Indian Constitution", Prentice Hall of India, New Delhi, 2015.
2. Gupta D.C, "Indian Government and Politics", Vikas Publishing House, New Delhi, 2010.

**REFERENCES**

1. Pylee M.V, "Introduction to the Constitution of India", Vikas Publishing House, New Delhi, 2011.
2. Kashyap S, "Our Constitution", National Book Trust, New Delhi, 2010.
3. Shukla V N, "Constitution of India", Eastern Book Company Ltd., New Delhi, 2011.

**19IT56C**

**JAVA PROGRAMMING LABORATORY**

**L T P C  
0 0 3 1.5**

**COURSE OUTCOMES**

Upon completion of this course, the students will be able to

- CO1: implement classical problems using java programming. (K2)
- CO2: develop a mini project using java features. (K3)

**LIST OF EXPERIMENTS**

**JAVA PROGRAMS**

1. Write a JAVA program to implement class mechanism. – Create a class, methods and invoke them inside main method.
2. Write a JAVA program to implement constructor overloading and method overloading.
3. Write a JAVA program to implement Single Inheritance and multi level Inheritance.
4. Write a JAVA program to implement Interface.
5. Write a JAVA program that describes exception handling mechanism. Runtime Polymorphism:
6. Write a JAVA program that implements Runtime polymorphism.

7. Write a JAVA program for creation of illustrating throw and finally.
8. Write a JAVA program for creation of Java Built-in Exceptions and User Defined Exception.
9. Write a program to implement the concept of threading by extending Thread Class.
10. Write a program to implement the concept of threading by implementing Runnable Interface.
11. Write a program to implement the concept of Exception Handling using predefined exception.
12. Write a program to implement the concept of Exception Handling by creating user defined exceptions.
13. Write a JAVA program to build a Calculator in Swings.

### MINI PROJECT

Develop a mini project for any application using Java concepts

**P: 45; TOTAL: 45 PERIODS**

**19IT57C    CRYPTOGRAPHY AND NETWORK SECURITY LABORATORY    L T P C**  
**0 0 3 1.5**

### COURSE OUTCOMES

Upon completion of this course, the students will be able to

- CO1: solve cryptographic problems using symmetric, asymmetric and data integrity techniques.
- CO2: evaluate security techniques used to protect system and user data using network security tools.

### LIST OF EXPERIMENTS

1. Perform encryption and decryption using the following algorithms (Substitution)
  - a. Ceaser Cipher
  - b. Affine Cipher
  - c. Playfair Cipher
  - d. Hill Cipher
2. Perform encryption and decryption using the following algorithms (Transposition)
  - a. Rail fence technique
  - b. Simple Columner
3. Implement Simplified DES algorithm.
4. Implement RSA algorithm.
5. Calculate the message digest of a text using the SHA-1 algorithm in JAVA.
6. Implement the Signature Scheme - Digital Signature Standard.
7. Perform wireless audit on an access point or a router and decrypt WEP and WPA
8. Automated Attack and Penetration Tools  
Exploring N-Stalker, a Vulnerability Assessment Tool
9. Defeating Malware
  - i) Building Trojans ii) Rootkit Hunter
10. Analyze HTTP traffic using Wireshark

**P: 45; TOTAL: 45 PERIODS**



## LIST OF HARDWARE REQUIREMENTS & SOFTWARE REQUIREMENTS

### SOFTWARE REQUIREMENTS

- C/Java or equivalent compiler GnuPG

### HARDWARE REQUIREMENTS

- Standalone desktops (or) Server supporting 30 terminals or more

### PRE REQUISTES

- C/Java
- Mathematical Logic

## 19IT58C INTERNET AND WEB TECHNOLOGY LABORATORY

L T P C  
0 0 3 1.5

### COURSE OUTCOMES

Upon completion of this course, the students will be able to

- CO1: design interactive web pages using Scripting languages. (K3)
- CO2: create applications using XML and AJAX. (K3)

### LIST OF EXPERIMENTS

1. Create a web page using HTML with all types of CSS.
2. Writing client side scripts for validating web form controls using JavaScript.
3. Create web application using AngularJS.
4. Create the application using Web Services.
5. Write programs in Java using Servlets: a) to invoke servlets from HTML forms. b) Session Tracking.
6. Write programs using Servlets and Databases
7. Write programs using JSP and Databases
8. Programs using XML –Schema –XSL.
9. Programs using AJAX

P: 45; TOTAL: 45 PERIODS

## 19IT61C BIG DATA ANALYTICS

L T P C  
3 0 0 3

### COURSE OUTCOMES

Upon completion of the course, the students will be able to:

- CO 1: discuss big data tools and its analysis techniques (K2)
- CO 2: describe Graph analytics and NoSQL databases (K2)
- CO 3: Analyze data by utilizing clustering and classification algorithms (K4)
- CO 4: apply different mining algorithms and recommendation systems for large volumes of data. (K3)
- CO 5: Perform analytics on data streams. (K3)

## UNIT I INTRODUCTION TO BIG DATA

9

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

### **UNIT I GRAPH ANALYTICS AND NO SQL DATABASES 9**

Using Graph Analytics for Big Data: Graph Analytics - The Graph Model - Representation as Triples - Graphs and Network Organization - Choosing Graph Analytics - Graph Analytics Use Cases - Graph Analytics Algorithms and Solution Approaches - Technical Complexity of Analyzing Graphs- Features of a Graph Analytics Platform - Considerations: Dedicated Appliances for Graph -. NoSQL Databases : Schema-less ModelsII: Increasing Flexibility for Data Manipulation-Key Value Stores- Document Stores – Tabular Stores – Object Data Stores – Graph Databases Hive – Sharding – Hbase

### **UNIT III SUPERVISED AND UNSUPERVISED LEARNING 9**

Supervised Learning - Unsupervised Learning-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- principal component analysis –Linear Dimensionality Reduction

### **UNIT IV ASSOCIATION AND RECOMMENDATION SYSTEM 9**

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.

### **UNIT V STREAM MEMORY 9**

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

**L: 45; TOTAL: 45 PERIODS**

#### **TEXT BOOKS**

1. Anand Rajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, 2<sup>nd</sup> Edition, Cambridge University Press, 2014.
2. David Loshin, “Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph” 1<sup>st</sup> Edition, Morgan Kaufmann/Elsevier Publishers, 2013.

#### **REFERENCES**



warfare. Mobile NFC – standards and modes of operation, NFC versus existing wireless mobile, applications of NFC, Popular mobile solutions in the market.

**L: 45; TOTAL: 45 PERIODS**

### TEXT BOOK

1. Jithesh Sathyan, Anoop N, Navin Narayan, Shibu Kizhakke Vallathai, “A Comprehensive Guide to Enterprise Mobility”, CRC Press, 2016.
2. Zak Ruvalcaba and Anne Boehm, “Murachs HTML5 & CSS3”, 3<sup>rd</sup> Edition, Mike Murach & Associates Inc, 2015.
3. John Horton, “Android Programming for Beginners”, 1<sup>st</sup> Edition, Packt publishing, 2015.
4. Zigurd Mednieks, Laird Dornin, G.Blake Meike & Masumi Nakamura, “Programming Android”, 2<sup>nd</sup> Edition, O’ Reilly Media, 2012.

### REFERENCES

1. Dawn Griffiths and David Griffiths, “Head first Android Development”, O’Reilly Media, 2015.
2. Nicholas C. Zakas, “Professional Javascript For Web Developers”, Third Edition, Wiley India Pvt Ltd, 2012.
3. Greg Shackles, “Mobile Development with C#: Building Native IOS, Android, and Windows Phone Applications (Paperback)”, O’Reilly Media Publishers, 2012.
4. Sumi Helal, Raja Bose, Wengdong Li, “Mobile Platforms and Development Environments (Paperback)”, Morgan & Claypool Publishers, 2012.
5. Jeffrey C. Jackson, “Web Technologies: A Computer Science Perspective”, Pearson Education, 2007.
6. Herbert Schildt, “Java The Complete Reference”, 10<sup>th</sup> Edition, Tata McGraw Hill Publishing Company Limited, 2017

### WEB REFERENCE

1. <https://www.javatpoint.com/android-tutorial>

**19IT63C**

**BUSINESS PROCESS MANAGEMENT**

**L T P C  
2 0 0 2**

### COURSE OUTCOMES

Upon completion of this course the students will be able to

- CO 1: define the required processes and able to identify process improvement opportunities / strategies. (K2)
- CO 2: plan a BPM strategy for an organization. (K3)
- CO 3: propose business solutions in written and verbal forms for process innovation and redesign Projects. (K2)
- CO 4: explain the role of Information Technology and other resources in BPM. (K2)
- CO 5: synthesis the principles of organizational strategy and process design. (K2)

**UNIT I**

**INTRODUCTION TO BUSINESS PROCESS MANAGEMENT**

**6**

Ingredients of Business Process, BPM Life Cycle, Process Identification – The context of process identification, Definition of the process architecture, process selection.

<b>UNIT II</b>	<b>PROCESS MODELING</b>	<b>6</b>
Essential Process Modeling – First Steps with BPMN, Branching and merging, Business Objects, Resources, Process decomposition, Process model reuse.		
<b>UNIT III</b>	<b>ADVANCED PROCESS MODELING</b>	<b>6</b>
Rework and repetition, Handling events, Handling exceptions, Process and Business rules. Process Discovery - The setting of process discovery, process discovery methods, process modeling methods.		
<b>UNIT IV</b>	<b>QUALITATIVE AND QUANTITATIVE PROCESS ANALYSIS</b>	<b>6</b>
Value added analysis, waste analysis, stakeholder analysis and issue documentation, root cause analysis. Flow analysis, Queues, Simulation.		
<b>UNIT V</b>	<b>PROCESS AWARE INFORMATION SYSTEM</b>	<b>6</b>
Types of Process Aware Information System, Advantages of Introducing a BPMS, Challenges of Introducing a BPMS. Process implementation with executable models.		

**L: 30; TOTAL: 30 PERIODS**

#### TEXT BOOKS

1. Marlon Dumas, Marcello La Rosa, Jan Mendling, Hajo A. Reijers, “Fundamentals of Business Process Management”, 2<sup>nd</sup> Edition, Springer, 2018.
2. Akhil Kumar, “Business Process Management”, 1<sup>st</sup> Edition, Routledge, 2018.

#### REFERENCES

1. Carl F. Lehmann, “Strategy and Business Process Management: Techniques for Improving Execution, Adaptability, and Consistency”, CRC Press, 2016.
2. John Jeston, Johan Nelis, “Business Process Management”, 3<sup>rd</sup> Edition, Routledge, 2014.
3. Van der Aalst, Wil, “Process Mining: Data Science in Action”, 2<sup>nd</sup> Edition, Springer 2016.

<b>19IT64C</b>	<b>COMPREHENSION</b>	<b>L T P C</b>
	<b>Common to B.E/ B.Tech programme</b>	<b>0 0 2 1</b>

Assessment procedure and pattern may be structured and well defined as follows.

No.of Assessments : Three

**Continuous Assessment Test 1 - ( 50 Marks)**

**- Duration : 90 Min –  
Passing Requirements**

General Apps Questions (Ratio/Quans / DI...)	-	20 Marks	- 7 Marks
Core fundamental Subject Question (Data Structures, Database Management Systems, Digital Systems)	-	20 Marks	- 7 Marks
Programming (C, C++ Language)	-	10 Marks	- 4 Marks

**Continuous Assessment Test 2 - ( 50 Marks)****- Duration : 90 Min –****Passing Requirements**

General Apps Question (Age, train , analytical, verbal...)	-	20 Marks - 7 Marks
Core Fundamental Subject Questions (Operating Systems, Computer Networks, Software Engineering)	-	20 Marks - 7 Marks
Programming (Java)	-	10 Marks - 4 Marks

**Continuous Assessment Test 3 - (50 Marks)****- Duration : 90 Min –****Passing Requirements**

General Apps Questions	-	20 Marks	- 7 Marks
Core Subject Questions	-	20 Marks	- 7 Marks
Programming	-	10 Marks	- 4 Marks

- The candidate may be declared pass in this course if he/she satisfies the minimum passing requirement in two CAT
- Best two among the three test may be considered for grading in the marksheet.

**P: 30; TOTAL: 30PERIODS****19IT65C****BIG DATA ANALYTICS LABORATORY****L T P C****0 0 3 1.5****COURSE OUTCOMES**

Upon completion of this course, the students will be able to

- CO 1: set up multi-node Hadoop Clusters and integrated infrastructure of R and Hadoop.  
(K3)
- CO 2: Apply classification and clustering algorithms. (K3)

**List of Experiments**

- Installation of Apache Hadoop and MapReduce.
- Installation of clustered Hadoop and MapReduce.
- Develop MapReduce programs.
- Classification using SVM.
- Implement data mining clustering algorithms.
- Big Data processing with Hive.
- Query Processing using Hive and Beeswax.
- Data Visualization using R
- Mini Project.

**Software:** R and Hadoop Integrated Programming Environment**P: 45; TOTAL: 45 PERIODS****19IT66C****MOBILE TECHNOLOGIES LABORATORY****L T P C**

### COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: develop Android mobile applications using Layout. (K3)

CO2: Develop mobile application with SQLite & Firebase. (K3)

### LIST OF EXPERIMENTS

1. Develop mobile applications that use User Interface Components
2. Develop an application using Layout Managers and event listeners.
3. Develop a mobile application for loading images to the SD card
4. Develop mobile applications using SQLITE
5. Develop mobile applications using external database.
6. Implement an application that creates an alert upon receiving a message.
7. Write a mobile application that creates alarm clock
8. Firebase cloud connectivity
9. Android Multimedia Player
10. Mini project

**Software:** ADT bundle, XCODE

**P: 45; TOTAL: 45 PERIODS**

**19IT67C**

**PRODUCT DEVELOPMENT LABORATORY**

**L T P C**

**1 0 2 2**

### COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: recognize the needs of the customer and select concept to meet the requirements (K4)

CO2: verify the functionality of the concept through prototyping (K4)

### UNIT I                    NEED IDENTIFICATION, TARGET SPECIFICATIONS AND CONCEPT SELECTION                    20

Planning-customer need identification through empathy, problem definition, target specifications, concept development and selection.

### UNIT II                    PROTOTYPING AND DEMONSTRATION                    25

Prototype development and demonstration - cost estimation - product documentation

**L: 15; P: 30; TOTAL: 45 PERIODS**

### REFERENCES

1. Michael G Luchs, Scott Swan, Abbie Griffin, "Design Thinking: New Product Development Essentials from the PDMA", Willey, 2015
2. Christian Muller-Roterberg, "Design Thinking", Wiley Publications, 2021
3. Anita Goyal, Karl T Ulrich, Steven D Eppinger, "Product Design and Development", Tata Mc Graw Hill Education, 4<sup>th</sup> Edition, 2011.

4. George E Dieter, Linda C Schmidt, "Engineering Design", Mc-Graw Hill International Edition, 5<sup>th</sup> Edition, 2013.
5. Kevin Otto, Kristin Wood, "Product Design", Indian Reprint, Pearson Education, 2013

### **Mentor Activities**

- Forming multidisciplinary/interdisciplinary batches among the students
- Facilitating the batches to define a problem through empathizing
- Guiding the batches to develop a prototype to verify the functionality of the concept
- Evaluating the students' activities through demonstration and presentations

### **End semester Assessments can be made through**

- Product demonstration and presentation

### **Other points**

- This course is for all department students
- Course instructor and mentors will be responsible for the academic process.
- In a project batch, maximum number of students shall be limited to four
- Project batch may be interdisciplinary / multidisciplinary
- Multidisciplinary project batches are encouraged and permitted to take mentors from various discipline.

**19IT71C**

**PROJECT WORK – I**

**L T P C  
0 0 6 3**

### **COURSE OUTCOMES**

Upon completion of this course, the students will be able to

CO1: identify an innovate or creative idea / concept / solution to a problem (K3)

CO2: perform the detailed literature survey related to concept / idea (K2)

CO3: implement basic prototype to demonstrate the concept (K4)

1. The Project is a theoretical study/analysis / prototype design / modeling and simulation or a combination of these.
2. Should be done as group (preferably four students) project.
3. The progress of the project is evaluated based on a minimum three reviews and final viva-voce examination.
4. A project report is required to be submitted in the standard prescribed format.

**P: 45; TOTAL: 45 PERIODS**

**19IT72C**

**RESEARCH PAPER AND PATENT REVIEW - SEMINAR**

**L T P C  
0 0 2 1**

### **COURSE OUTCOMES**



Upon completion of this course, the students will be able to

- CO1: understand the emerging technology / research development in the engineering Field (K2)
- CO2: acquaint with the concepts published in reputed journals on their area of interest (K2)
- CO3: examine patents and procedures available in the data base.(K3)
- CO4: effectively communicate the contents to the target audience and handle the questions with confidence (K3)
- CO5: Check for patent plagiarism (K2)

The Students will make a technical presentation on current topics related to the specialization. The same will be assessed by a committee appointed by the department. The students are expected to submit a report at the end of semester covering the various aspects of his/her presentation.

**P: 30; TOTAL: 30 PERIODS**

**19IT81C**

**PROJECT WORK – II**

**L T P C**  
**0 0 12 6**

**COURSE OUTCOMES**

Upon completion of this course, the students will be able to

- CO1: design and develop the working model (K3)
- CO2: work independently to complete the project along with team members (K2)
- CO3: demonstrate the results and documents the report (K4)

**Project work shall be based on any of the following:**

1. Fabrication of product/ testing setup of an experimentation unit/ apparatus / small equipment, in a group.
2. Experimental / Theoretical verification of principles used in the concept.
3. Projects having valid database, data flow, algorithm, and output reports, preferably software based.
4. Research findings, Recommendations and future scope.

**P: 180; TOTAL: 180 PERIODS**

**19IT82C**

**INTERNSHIP / IN-PLANT TRAINING**

**L T P C**  
**0 0 4 2**

**COURSE OUTCOMES**

Upon completion of this course, the students will be able to

- CO1: acquire the knowledge of different industrial / organizational activities (K2)
- CO2: document the work and communicate effectively through technical presentation (K2)

1. Student shall undergo internship/in-plant training after getting prior permission from the department

2. A report should be submitted after the successful completion of internship / in-plant training.

**P: 60; TOTAL: 60 PERIODS**

19IT01E

DEEP LEARNING

L T P C  
3 0 0 3

### COURSE OUTCOMES

Upon completion of this course, the students will be able to

- CO1: explain the basics of deep learning. (K2)
- CO2: implement various deep learning models. (K2)
- CO3: realign high dimensional data using reduction techniques. (K2)
- CO4: discuss optimization and generalization in deep learning. (K2)
- CO5: enumerate deep learning applications. (K2)

### UNIT I INTRODUCTION 9

Introduction to Machine Learning - Linear models (SVMs and Perceptrons - Logistic Regression) - Intro to Neural Nets: What a shallow network computes - Training a network: loss functions - Back Propagation and Stochastic gradient descent - Neural Networks as Universal Function Approximates.

### UNIT II DEEP NETWORKS 9

History of Deep Learning - A Probabilistic Theory of Deep Learning - Backpropagation and regularization, Batch normalization - VC Dimension and Neural Nets - Deep Vs Shallow Networks - Convolutional Networks - Generative Adversarial Networks (GAN) - Semi-Supervised Learning.

### UNIT III DIMENSIONALITY REDUCTION 9

Linear (PCA, LDA) and manifolds, metric learning - Auto encoders and dimensionality reduction in networks - Introduction to Convnet - Architectures - AlexNet - VGG - Inception - ResNet - Training a Convnet: Weights initialization, Batch Normalization, Hyperparameter Optimization.

### UNIT IV OPTIMIZATION AND GENERALIZATION 9

Optimization in Deep Learning – Non-convex optimization for deep networks - Stochastic Optimization Generalization in Neural Networks - Spatial Transformer Networks - Recurrent networks - LSTM -Recurrent Neural Network Language Models - Word-Level RNNs & Deep Reinforcement Learning - Computational & Artificial Neuroscience.

### UNIT V CASE STUDY AND APPLICATIONS 9

Imagenet- Detection - Audio WaveNet - Natural Language Processing Word2Vec - Joint Detection Bioinformatics - Face Recognition - Scene Understanding - Gathering Image Captions.

**L: 45; TOTAL: 45 PERIODS**

### TEXT BOOKS

1. Ian Goodfellow, YoshuaBengio, Aaron Courville, "Deep Learning", MIT Press, 2016.

### REFERENCES

1. Cosma Rohilla Shalizi, "Advanced Data Analysis from an Elementary Point of View", Cambridge University Press, 2015.
2. Li Deng & Dong Yu, "Deep Learning: Methods and Applications, Now Publishers", 2014.
3. Michael Nielsen, "Neural Networks and Deep Learning", Determination Press, 2015.

19IT02E

MACHINE LEARNING

L T P C  
3 0 0 3**PRE REQUISITE**

- Bigdata Analytics
- Python
- Maths

**COURSE OUTCOMES**

Upon completion of this course, the students will be able to

- CO1: distinguish between supervised, unsupervised and semi-supervised learning. (K2)  
 CO2: apply the machine learning strategy for any given problem. (K3)  
 CO3: identify the learning algorithm for any given problem. (K2)  
 CO4: define the importance of dimensionality reduction in machine learning. (K2)  
 CO5: describe the systems that use the appropriate graph models. (K3)

**UNIT I INTRODUCTION 9**

Learning – Types of Machine Learning – Supervised Learning –Design a Learning System – Perspectives and Issues in Machine Learning – Concept Learning Task – Concept Learning as Search – Finding a Maximally Specific Hypothesis –Linear Discriminants – Perceptron – Linear Separability – Linear Regression.

**UNIT II LINEAR MODELS 9**

Multi-layer Perceptron – Going Forwards – Going Backwards: Back Propagation Error – Multi-layer Perceptron in Practice – Examples of using the MLP – Overview – Deriving Back-Propagation – Radial Basis Functions and Splines – Concepts – RBF Network – Curse of Dimensionality – Interpolations and Basis Functions – Support Vector Machines.

**UNIT III TREE AND PROBABILISTIC MODELS 9**

Learning with Trees – Decision Trees – Constructing Decision Trees – Classification and Regression Trees – Ensemble Learning – Boosting – Bagging – Different ways to Combine Classifiers – Probability and Learning – Data into Probabilities – Basic Statistics – Gaussian Mixture Models – Nearest Neighbour Methods – Unsupervised Learning – K means Algorithms – Vector Quantization – Self Organizing Feature Map.

**UNIT IV DIMENSIONALITY REDUCTION AND EVOLUTIONARY MODELS 9**

Dimensionality Reduction – Linear Discriminant Analysis – Principal Component Analysis – Factor Analysis – Independent Component Analysis – Locally Linear Embedding – Isomap – Least Squares Optimization – Evolutionary Learning – Genetic algorithms – Genetic Offspring: - Genetic Operators – Using Genetic Algorithms – Reinforcement Learning – Overview – Getting Lost Example – Markov Decision Process.

**UNIT V GRAPHICAL MODELS 9**

Markov Chain Monte Carlo Methods – Sampling – Proposal Distribution – Markov Chain Monte Carlo – Graphical Models – Bayesian Networks – Markov Random Fields – Hidden Markov Models – Tracking Methods – Microsoft Azure- AWS

**L: 45; TOTAL: 45 PERIODS****TEXT BOOK**

1. Stephen Marsland, "Machine Learning – An Algorithmic Perspective", Second Edition, Chapman and Hall/CRC Machine Learning & Pattern Recognition Series, 2015.

## REFERENCES

1. Tom M Mitchell, "Machine Learning", First Edition, McGraw Hill Education, 2014.
2. Peter Flach, "Machine Learning: The Art and Science of Algorithms that Make Sense of Data", First Edition, Cambridge University Press, 2012.
3. Jason Bell, "Machine learning – Hands on for Developers and Technical Professionals", First Edition, Wiley Publishers, 2014.
4. Ethem Alpaydin, "Introduction to Machine Learning", Adaptive Computation and Machine Learning Series, Third Edition, MIT Press, 2014.

**19IT03E**

**BIOINFORMATICS**

**L T P C**  
**3 0 0 3**

## COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: comprehend the importance of bioinformatics. (K2)

CO2: describe the databases and data mining tools for bioinformatics. (K2)

CO3: state the role of data warehousing, data mining and machine learning in bioinformatics applications. (K2)

CO4: explain various modelling techniques for bioinformatics. (K2)

CO5: apply Perl programming for Bioinformatics problems. (K3)

### **UNIT I INTRODUCTION 9**

Need for Bioinformatics technologies - An Overview of Bioinformatics Technologies - Structural bioinformatics: Organization - Primary Resource - Secondary Resources - Applications - Future scope.

### **UNIT II DATABASES AND TOOLS 9**

Description and Organization of Sequence - Structure and Other databases - Need for tools - Knowledge discovery - Industry trends and data mining tools - Data submission tools - Data analysis tools - Prediction tools and modeling tools.

### **UNIT III DATAWAREHOUSING DATAMINING AND MACHINE LEARNING IN BIOINFORMATICS 9**

Data warehousing: Bioinformatics data – Data warehouse architecture – Data quality - Data mining: Biomedical data analysis – DNA data analysis - Machine learning: Neural network architecture and applications in bioinformatics - Bioinformatics for the Health sector - A case study.

### **UNIT IV MODELING FOR BIOINFORMATICS 9**

Hidden Markov modeling for biological data analysis – Sequence identification – Sequence classification – Multiple alignment generation – Comparative modeling – Protein modeling – genomic modeling – Probabilistic modeling – Bayesian networks – Boolean networks - Molecular modeling – Computer programs for molecular modeling.

### **UNIT V TOOLS FOR BIOINFORMATICS 9**

Bio-algorithms and Tools – Identifying genes, Overview of sequence annotation. Gene prediction methods – Human variation and disease identification, Visualizing and comparing nucleic acids and Protein Introduction to Phylogenetic analysis definition, concepts of tree, steps in constructing Phylogenetic analysis. Introduction to microarray.

**L: 45 TOTAL: 45 PERIODS**

**TEXT BOOKS**

1. Orpita Bosu and Simminder Kaur Thukral, "Bioinformatics Databases, Tools and Algorithms", First Edition, Oxford University press, New Delhi, 2007.
2. Yi-Ping Phoebe Chen (Ed), "Bioinformatics Technologies", First Indian Reprint, Springer Verlag, 2007.

**REFERENCES**

1. Harshawardhan P.Bal, "Bioinformatics principles and applications", Tata Mc-Graw Hill Publishing Company Ltd, New Delhi, 2007.
2. Kenneth Baclawski, Tianhua Niu, "Bioinformatics", Jaico Publishing House, Delhi, 2007.
3. Lukas K. Beehler and Hooman H. Rashidi, "Bioinformatics basics Applications in biological science and medicine", Taylor and Francis Group, 2005.
4. Tindall, J., "Beginning Perl for Bioinformatics: An introduction to Perl for Biologists" First Edition, O'Reilly Media, 2001.

**19IT04E****DATA WAREHOUSING AND DATA MINING****L T P C  
3 0 0 3****PRE REQUISITE**

- Database management system concepts.
- Problem solving techniques.

**COURSE OUTCOMES**

Upon completion of this course, the students will be able to

- CO1: define a Data warehouse system and perform business analysis with OLAP tools. (K2)
- CO2: explain the suitable pre-processing and visualization techniques for data analysis. (K2)
- CO3: describe the frequent pattern and association rule mining techniques for data analysis. (K2)
- CO4: select appropriate classification and clustering techniques for data analysis. (K2)
- CO5: discuss the working principles of Weka tool. (K2)

**UNIT I BUSINESS ANALYSIS AND OLAP****9**

Basic Concepts – Data Warehousing Components – Building a Data Warehouse – Database Architectures for Parallel Processing – Parallel DBMS Vendors – Multidimensional Data Model – Data Warehouse Schemas for Decision Support, Concept Hierarchies - Characteristics of OLAP Systems – Typical OLAP Operations, OLAP and OLTP.

**UNIT II DATA MINING INTRODUCTION****9**

Introduction to Data Mining Systems – Knowledge Discovery Process – Data Mining Techniques – Issues – applications- Data Objects and attribute types, Statistical description of data, Data Preprocessing – Cleaning, Integration, Reduction, Transformation and discretization, Data Visualization, Data similarity and dissimilarity measures.

**UNIT III DATA MINING FREQUENT PATTERN ANALYSIS****9**

Mining Frequent Patterns, Associations and Correlations – Mining Methods- Pattern Evaluation Method – Pattern Mining in Multilevel, Multi Dimensional Space – Constraint Based Frequent Pattern Mining, Classification using Frequent Patterns.

**UNIT IV CLASSIFICATION AND CLUSTERING 9**

Decision Tree Induction – Bayesian Classification – Rule Based Classification – Classification by Back Propagation – Support Vector Machines — Lazy Learners – Model Evaluation and Selection-Techniques to improve Classification Accuracy. Clustering Techniques – Cluster analysis-Partitioning Methods – Hierarchical Methods – Density Based Methods – Grid Based Methods – Evaluation of clustering – Clustering high dimensional data- Clustering with constraints, Outlier analysis-outlier detection methods.

**UNIT V DATA MINING TOOLS 9**

Datasets – Introduction, Iris plants database, Breast cancer database, Auto imports database – Introduction to WEKA, RAPID Miner and ETL tool- The Explorer – Getting started, Exploring the explorer, Learning algorithms, Clustering algorithms, Association–rule learners.

**L: 45; TOTAL: 45 PERIODS**

**TEXT BOOK**

1. Jiawei Han and Micheline Kamber, Jian Pei, “Data Mining Concepts and Techniques”, Third Edition, Elsevier Science & Technology, 2012.

**REFERENCES**

1. Alex Berson and Stephen J.Smith, “Data Warehousing, Data Mining & OLAP”, Tata McGraw Hill Edition, Thirty fifth Reprint, 2016.
2. K.P. Soman, Shyam Diwakar and V. Ajay, “Insight into Data Mining Theory and Practice”, Eastern Economy Edition, Prentice Hall of India, 2006.
3. Ian H.Witten and Eibe Frank, “Data Mining: Practical Machine Learning Tools and Techniques”, Elsevier Science and Technology, Second Edition, 2005.

**19IT05E**

**SCALABLE DATA SCIENCE**

**L T P C  
3 0 0 3**

**PRE REQUISITE**

- Data Analytics

**COURSE OUTCOMES**

Upon completion of this course, the students will be able to

- CO1: discuss the fundamentals of probability and machine learning. (K2)
- CO2: summarize the memory efficient data structure for scalable data analysis. (K2)
- CO3: describe variant analysis for data processing. (K2)
- CO4: discuss the hadoop ecosystem. (K2)
- CO5: explain optimization using machine learning. (K2)

**UNIT I PROBABILITY AND BASICS OF MACHINE LEARNING 9**

Introduction - Probability: Concentration inequalities- Linear algebra: PCA, SVD Optimization: Basics, Convex, Machine Learning: Supervised, generalization, feature learning, clustering.

**UNIT II MEMORY EFFICIENT DATA STRUCTURES 9**

Memory-efficient data structures: Hash functions, universal / perfect hash families - Bloom filters - Sketches for distinct count Misra-Gries sketch, Count Sketch, Count-Min Sketch, Approximate near neighbors search: Introduction, kd-trees, LSH families, MinHash for Jaccard, SimHash for L2.

**UNIT III VARIANT ANALYSIS 9**

Approximate near neighbors search: Extensions, multi-probe, b-bit hashing, Data dependent variants, Randomized Numerical Linear Algebra Random projection, Randomized Numerical Linear Algebra CUR Decomposition, Sparse RP, Subspace RP, Kitchen Sink.

**UNIT IV MAPREDUCE AND HADOOP 9**

Map-reduce and related paradigms Map reduce - Programming examples - (page rank, k-means, matrix multiplication), Big data: computation goes to data. + Hadoop ecosystem Map-reduce and related paradigms - Scala + Spark - Distributed Machine Learning.

**UNIT V OPTIMIZATION 9**

Distributed Machine Learning and Optimization: Introduction, ADMM, applications and Clustering.

**L: 45; TOTAL: 45 PERIODS****TEXT BOOKS**

1. Woodruff, David P, "Sketching as a tool for numerical linear algebra", Foundations and Trends in Theoretical Computer Science, 2014.
2. Mahoney, Michael W, "Randomized algorithms for matrices and data", Foundations and Trends in Machine Learning, 2011.

**REFERENCES**

1. J. Leskovec, A. Rajaraman and JD Ullman, "Mining of Massive Datasets", Cambridge University Press, Second Edition, 2014.
2. Muthukrishnan.S, "Data streams: Algorithms and applications", Foundations and Trends in Theoretical Computer Science, 2005.
3. Jimmy Lin, Chris Dyer, Morgan and Claypool, "Data-Intensive Text Processing with MapReduce", 2010.
4. Tom White, "Hadoop: The definitive Guide", Fourth Edition, Oreilly Press, 2015.
5. Stephen Boyd, Neal Parikh, Eric Chu, Borja Peleato, and Jonathan Eckstein, "Distributed optimization and statistical learning via the alternating direction method of multipliers", Now Publishers Inc, Volume 3, 2011.

**WEB RESOURCES**

1. [https://swayam.gov.in/nd1\\_noc19\\_cs61/preview](https://swayam.gov.in/nd1_noc19_cs61/preview)

**19IT06E BUSINESS INTELLIGENCE FOR IT L T P C  
3 0 0 3**

**PRE-REQUISITE**

- Big Data Analytics
- Business Process Management

**COURSE OUTCOMES**

Upon completion of this course, the students will be able to

- CO1: explain the foundation for Business Intelligence (BI). (K2)
- CO2: discuss the relationship of data mining with the BI environment. (K2)
- CO3: describe text and web mining approaches in BI. (K2)
- CO4: implement BI techniques. (K2)
- CO5: apply the techniques in the context of a business problem. (K3)



**UNIT I INTRODUCTION TO BUSINESS INTELLIGENCE 9**

A framework for Business Intelligence - Business intelligence architectures: Cycle of a business intelligence analysis - Major tools and techniques of BI - Development of a business intelligence system – Ethics and business intelligence link.

**UNIT II KNOWLEDGE DELIVERY 9**

The business intelligence user types – Standard reports Interactive Analysis and Ad Hoc Querying – Parameterized Reports and Self-Service Reporting, dimensional analysis, Alerts/Notifications – Visualization: Charts, Graphs, Widgets, Scorecards and Dashboards. Geographic Visualization – Integrated Analytics – Considerations: Optimizing the Presentation for the Right Message.

**UNIT III DECISION SUPPORT AND BUSINESS INTELLIGENCE 9**

Changing Business Environments and Computerized Decision Support – Managerial Decision Making - Computerized Support for Decision Making - An Early Framework for Computerized Decision Support –The Concept of Decision Support Systems (DSS) - Case Studies: Giant Food Stores Prices the Entire Store.

**UNIT IV TEXT MINING AND BI IMPLEMENTATION 9**

Text Mining: Concepts and Definitions - Applications - Process –Tools - Implementing BI – Overview – BI and Integration Implementation – Connecting BI System to Database and other Enterprise Systems – On-Demand BI – Issues of Legality, Privacy, and Ethics – Emerging Topics in BI.

**UNIT V FUTURE OF BUSINESS INTELLIGENCE 9**

Future of business intelligence – Emerging Technologies, Machine Learning, Predicting the Future, BI Search & Text Mining Analytics – Advanced Visualization – Rich Report, Future beyond Technology.

**L: 45; TOTAL: 45 PERIODS**

**TEXT BOOKS**

1. Efraim Turban, Ramesh Sharda, Jay E.Aronson, David King, “Business Intelligence: A Managerial Approach”, Fourth Edition, Pearson Education, 2019.
2. Efraim Turban, Ramesh Sharda, Dursun Delen, “Decision Support and Business Intelligence Systems”, 9th Edition, Pearson 2013.

**REFERENCES**

1. Carlo Vercellis, “Business Intelligence: Data Mining and Optimization for Decision Making”, Wiley Publications, 2013.
2. David Loshin, “Business Intelligence: The Savvy Manager’s Guide”, Morgan, Kaufman Publishers, Second Edition, 2012.
3. Rajiv Sabherwal, Irma Becerra-Fernandez “Business Intelligence Practices, Technologies, and Management”, Wiley Publications, 2011.
4. Cindi Howson, “Successful Business Intelligence: Secrets to Making BI a Killer App”, TataMcGraw Hill Publishing Company Ltd, 2008.

**19IT07E**

**ARTIFICIAL INTELLIGENCE**

**L T P C**

**3 0 0 3**

**COURSE OUTCOMES**

Upon completion of this course, the students will be able to

CO1: explain the various characteristics of intelligent agents. (K2)

- CO2: discuss the different search strategies in AI. (K2)  
 CO3: represent knowledge in solving AI problems. (K2)  
 CO4: describe various software agents. (K2)  
 CO5: identify appropriate AI technique for various applications. (K2)

<b>UNIT I</b>	<b>INTRODUCTION</b>	<b>9</b>
Introduction–Definition - Future of Artificial Intelligence – Characteristics of Intelligent Agents– Typical Intelligent Agents – Problem Solving Approach to Typical AI problems.		
<b>UNIT II</b>	<b>PROBLEM SOLVING METHODS</b>	<b>9</b>
Problem solving Methods - Search Strategies- Uninformed - Informed - Heuristics - Local Search Algorithms and Optimization Problems - Searching with Partial Observations - Constraint Satisfaction Problems – Constraint Propagation - Backtracking Search - Game Playing - Optimal Decisions in Games – Alpha - Beta Pruning - Stochastic Games.		
<b>UNIT III</b>	<b>KNOWLEDGE REPRESENTATION</b>	<b>9</b>
First Order Predicate Logic – Prolog Programming – Unification – Forward Chaining- Backward Chaining – Resolution – Knowledge Representation - Ontological Engineering- Categories and Objects – Events - Mental Events and Mental Objects - Reasoning Systems for Categories - Reasoning with Default Information.		
<b>UNIT IV</b>	<b>SOFTWARE AGENTS</b>	<b>9</b>
Architecture for Intelligent Agents – Agent communication – Negotiation and Bargaining – Argumentation among Agents – Trust and Reputation in Multi-agent systems.		
<b>UNIT V</b>	<b>APPLICATIONS</b>	<b>9</b>
AI applications – Language Models – Information Retrieval- Information Extraction – Natural Language Processing - Machine Translation – Speech Recognition – Robot – Hardware – Perception – Planning – Moving.		

**L: 45 TOTAL: 45 PERIODS**

#### **TEXT BOOKS**

1. S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach", Prentice Hall, Third Edition, 2017.
2. Ivan Bratko, "Prolog: Programming for Artificial Intelligence", Fourth edition, Addison-Wesley Educational Publishers Inc., 2011.

#### **REFERENCES**

1. David L. Poole and Alan K. Mackworth, "Artificial Intelligence: Foundations of Computational Agents", Cambridge University Press, 2017.
2. M. Tim Jones, "Artificial Intelligence: A Systems Approach", Jones and Bartlett Publishers, Inc, First Edition, 2008.
3. Nils J. Nilsson, "The Quest for Artificial Intelligence", Cambridge University Press, 2009.
4. William F. Clocksin and Christopher S. Mellish, "Programming in Prolog: Using the ISO Standard", Fifth Edition, Springer, 2003.
5. William F. Clocksin and Christopher S. Mellish, "Programming in Prolog: Using the ISO Standard", Fifth Edition, Springer, 2003.

19IT08E

REINFORCEMENT LEARNING

L T P C  
3 0 0 3

### COURSE OUTCOMES

Upon completion of this course, the students will be able to

- CO1: explain the basics of Reinforcement learning using dynamic programming. (K2)
- CO2: outline the markov process using linear model. (K2)
- CO3: discuss distance models for RL. (K2)
- CO4: describe tree and rule models for RL. (K2)
- CO5: apply reinforcement learning techniques for real life problems. (K3)

### UNIT I INTRODUCTION 9

Origin and history of Reinforcement Learning research, Dynamic Programming (Value iteration, Policy iteration, and Q-learning) - Probability Primer- Probability concepts - Axioms of probability, concepts of random variables, PMF, PDFs, CDFs, Expectation. Concepts of joint and multiple random variables, joint, conditional and marginal distributions. Correlation and independence.

### UNIT II LINEAR MODELS 9

Introduction to RL terminology, Markov property, Markov chains, Markov reward process (MRP). Introduction to and proof of Bellman equations for MRPs along with proof of existence of solution to Bellman equations in MRP. Introduction to Markov decision process (MDP), state and action value functions, Bellman expectation equations, optimality of value functions and policies, Bellman optimality equations.

### UNIT III DISTANCE-BASED MODELS 9

Overview of dynamic programming for MDP, definition and formulation of planning in MDPs, principle of optimality, iterative policy evaluation, policy iteration, value iteration, Banach fixed point theorem, proof of contraction mapping property of Bellman expectation and optimality operators, proof of convergence of policy evaluation and value iteration algorithms, DP extensions.

### UNIT IV TREE AND RULE MODELS 9

Overview of Monte Carlo methods for model free RL, First visit and every visit Monte Carlo, Monte Carlo control, On policy and off policy learning, Importance sampling.

### UNIT V PREDICTION AND EVALUATION METHODS 9

Incremental Monte Carlo Methods for Model Free Prediction, Overview TD(0), TD(1) and TD( $\lambda$ ), k-step estimators, unified view of DP, MC and TD evaluation methods, TD Control methods - SARSA, Q-Learning and their variants.

**L: 45 TOTAL: 45 PERIODS**

### TEXT BOOKS

1. Richard Sutton and Andrew Barto, "Reinforcement Learning: An Introduction", Second Edition, 2018, The MIT Press, Cambridge.
2. Csaba Szepesvari, "Algorithms for Reinforcement Learning", Morgan & Claypool Publishers, Series Edition, 2010.

### REFERENCES

1. Ethem Alpaydin, "Introduction to Machine Learning", Adaptive Computation and Machine Learning Series, Third Edition, MIT Press, 2014.
2. Jason Bell, "Machine learning – Hands on for Developers and Technical Professionals", First Edition, Wiley Publishers, 2014.

19IT09E

**ANALYTICS COMPUTING****L T P C**  
**3 0 0 3****COURSE OUTCOMES**

Upon completion of this course, the students will be able to

- CO1: explain the descriptive statistics and probability distributions. (K2)
- CO2: describe the continuous and discrete probability distributions. (K2)
- CO3: describe the machine learning approaches. (K2)
- CO4: summarize the association rule mining and big data. (K2)
- CO5: explain the clustering methods for data analysis. (K2)

**UNIT I DESCRIPTIVE STATISTICS 9**

The Role of Statistics in Engineering - Descriptive Statistics: Sampling Distributions and Point Estimation of Parameters - Statistical Intervals - Tests of Hypotheses.

**UNIT II PROBABILITY DISTRIBUTIONS 9**

Probability Distributions: Discrete Random Variables- Continuous Random Variables - Joint Probability Distributions – Regression.

**UNIT III MACHINE LEARNING 9**

Introduction to Machine Learning - Supervised Learning - Support Vector Machines -- Neural Networks -Deep Learning.

**UNIT IV ASSOCIATION RULE MINING AND BIG DATA 9**

Supervised Learning: Associative Rule Mining - Big Data - Hadoop – HIVE.

**UNIT V CASE STUDY AND APPLICATIONS 9**

Clustering Analysis - Introduction to Experimentation and Active Learning - An Introduction to Online Learning - Reinforcement Learning.

**L: 45;TOTAL: 45 PERIODS****TEXT BOOK**

1. Trevor Hastie, Robert Tibshirani, Jerome Friedman, “The elements of statistical learning - DataMining Inference and Prediction”, Second Edition, Springer Verlag New York Inc, 2015

**REFERENCES**

1. Montgomery, Douglas C., and George C. Runger, “Applied statistics and probability for engineers”, Fifth Edition, John Wiley & Sons, 2010.
2. Edward Capriolo, Dean Wampler, Jason Rutherglen, “Programming Hive”, O’Reilly Kindle Edition, 2012.
3. Vignesh Prajapati, “Big Data Analytics with R and Hadoop”, Packt Publishing, Kindle Edition, 2012.

19IT10E

**WEB ANALYTICS****L T P C**  
**3 0 0 3****COURSE OUTCOMES**

Upon completion of this course, the students will be able to

- CO1: discuss the fundamentals of web analytics. (K2)
- CO2: describe the heuristic data capture using optimal tools. (K2)
- CO3: discuss e-commerce web and blog analysis. (K2)

CO4: enumerate the usage of search engine optimization. (K2)

CO5: describe email and multichannel marketing. (K2)

<b>UNIT I</b>	<b>INTRODUCTION</b>	<b>9</b>
Web analytics fundamentals – present and future- data collection- click stream data- research data-competitive data.		
<b>UNIT II</b>	<b>HEURISTIC DATA CAPTURE</b>	<b>9</b>
Heuristic evaluation - customer centricity - data capturing - optimal web analysis tool.		
<b>UNIT III</b>	<b>E-COMMERCE WEB ANALYSIS</b>	<b>9</b>
Creating foundational reports - E-commerce website- data capturing- business outcomes- Blog measurement.		
<b>UNIT IV</b>	<b>SEARCH ANALYTICS</b>	<b>9</b>
site search analytics-search engine optimization-SEO efforts- analyzing PPC metrics and evaluation, AWS and case studies.		
<b>UNIT V</b>	<b>EMAIL AND MULTICHANNEL MARKETING</b>	<b>9</b>
Email marketing- multichannel marketing- google analytics-tracking and analysis-competitive intelligence and web2.0 analytics - data segmentation.		

**L: 45 TOTAL: 45 PERIODS**

#### TEXT BOOK

1. Avinash Kaushik, “Web Analytics: An Hour a Day”, First Edition, 2007.

#### REFERENCES

1. Avinash Kaushik, “Web Analytics 2.0: The Art of Online Accountability and Science of Customer Centricity”, First edition, 2009.
2. Brian Clifton, “Advanced Web Metrics with Google Analytics”, Third edition, 2012.
3. Justin Cutroni, “Google Analytics: Understanding Visitor Behavior”, Paperback, 2010.

<b>19IT11E</b>	<b>DATA SCIENCE USING R</b>	<b>LT P C</b> <b>3 0 0 3</b>
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#### COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1: apply the basics of R programming with its datatypes. (K3)

CO 2: apply the functional programming and data manipulation statements in R. (K3)

CO 3: identify packages to implement machine learning techniques in R. (K2)

CO 4: explore concepts of object oriented programming in R. (K3)

CO 5: implement graphics and create new packages with R. (K3)

<b>UNIT I</b>	<b>INTRODUCTION TO DATA SCIENCE &amp; R</b>	<b>9</b>
Introduction to Data Science – Data Science Lifecycle - Introduction – R environmental setup – Installation – RStudio – Programming with R – R as a calculator – Dealing with Missing Values – Using R Packages – Expression – Data Types – Data Structures – Control Structures – Functions – Lazy Evaluation – Recursive Functions – Exercises.		
<b>UNIT II</b>	<b>DATA MANIPULATION AND FUNCTIONAL PROGRAMMING</b>	<b>9</b>
Creating a R Markdown – YAML – Markdown language – R Code in Markdown documents – Data Manipulation – Data Import and Export – Manipulation data with dplyr – Vectorizing		

Functions – Apply Family – Infix operator – Replacement Functions – Function with arguments & return – Filter, Map and Reduce.

### **UNIT III MACHINE LEARNING 9**

Dealing with large dataset – Sampling – Regression – Linear Regression – Logistic Regression – Evaluating and Validating Models – Cross Validation – Classification – Decision Trees– Neural Network – Support Vector Machine – Unsupervised Learning - Clustering - Association Rule Mining.

### **UNIT IV CLASS AND OBJECTS 9**

Immutable objects and Polymorphic functions – Data structures – Classes Introduction: Why Classes? - Programming with New Classes - Inheritance and Inter-class Relations - Virtual Classes - Creating and Validating Objects - Programming with S3 Classes – Class Hierarchies - Exercises.

### **UNIT V DATA VISUALIZATION AND PACKAGES 9**

XY Plot – Graphics Package – ggplot2 - Package concept and tools – Creating an R package – Description – Namespace – Roxygen – Adding data to Package - Documentation for Packages – Building an R Package.

**L: 45 TOTAL: 45 PERIODS**

#### **TEXT BOOKS**

1. Thomas Mailund, “Beginning Data Science in R – Data Analysis, Visualisation and Modelling for the Data Scientist”, Apress Publication, 2017.
2. John Chambers, “Software for Data Analysis: Programming with R “, Springer; First Edition. 2008.

#### **REFERENCES**

1. Torsten Hothorn, Brian S. Everitt, “A Handbook of Statistical Analyses Using R”, Chapman and Hall/CRC; Second edition, 2009
2. Thomas Lumley, “Complex Surveys: A Guide to Analysis Using R”, Wiley Series in survey methodology, 2010.
3. Nicholas J. Horton, Ken Kleinman,” Using R and RStudio for Data Management, Statistical Analysis, and Graphics”, CRC Press, Second Edition, 2015 .
4. John Maindonald, W. John Braun,”Data Analysis and Graphics Using R: An Example-Based Approach”, University Press, Cambridge, Third Edition, 2010.
5. John M. Quick,” Statistical Analysis with R”, Packt Publishing , 2010.
6. K.G.Srinivasa, G.M.Siddesh, Chetan Shetty, “Statistical Programming in R”, Oxford University Press, New Delhi, 2017.

**19IT12E**

**SOFT COMPUTING**

**L T P C  
3 0 0 3**

#### **COURSE OUTCOMES**

Upon completion of the course, the students will be able to

- CO1: discuss the fundamentals of soft computing. (K2)
- CO2: describe the ANN models. (K2)
- CO3: explain fuzzy systems and its applications. (K2)
- CO4: enumerate the usage of genetic algorithms in optimization. (K2)
- CO5: describe neuro-fuzzy modeling. (K2)

<b>UNIT I</b>	<b>INTRODUCTION TO SOFT COMPUTING</b>	<b>9</b>
Introduction-Artificial Intelligence-Artificial Neural Networks-Fuzzy Systems-Genetic Algorithm and Evolutionary Programming-Swarm Intelligent Systems-Classification of ANNs-McCulloch and Pitts Neuron Model-Learning Rules: Hebbian and Delta- Perceptron Network-Adaline Network-Madaline Network.		
<b>UNIT II</b>	<b>ARTIFICIAL NEURAL NETWORKS</b>	<b>9</b>
Back propagation Neural Networks – Kohonen Neural Network -Learning Vector Quantization -Hamming Neural Network – Hopfield Neural Network- Bi-directional Associative Memory - Adaptive Resonance Theory Neural Networks- Support Vector Machines – Spike Neuron Models.		
<b>UNIT III</b>	<b>FUZZY SYSTEMS</b>	<b>9</b>
Introduction to Fuzzy Logic, Classical Sets and Fuzzy Sets – Classical Relations and Fuzzy Relations -Membership Functions -Defuzzification – Fuzzy Arithmetic and Fuzzy Measures - Fuzzy Rule Base and Approximate Reasoning – Introduction to Fuzzy Decision Making.		
<b>UNIT IV</b>	<b>GENETIC ALGORITHMS</b>	<b>9</b>
Basic Concepts- Working Principles -Encoding- Fitness Function – Reproduction -Inheritance Operators – Cross Over – Inversion and Deletion -Mutation Operator – Bit-wise Operators - Convergence of Genetic Algorithm.		
<b>UNIT V</b>	<b>NEURO-FUZZY MODELING</b>	<b>9</b>
Adaptive Neuro-Fuzzy Inference Systems – Coactive Neuro-Fuzzy Modeling – Classification and Regression Trees – Data Clustering Algorithms – Rule base Structure Identification – Neuro-Fuzzy Control – Case Studies.		

**L: 45; TOTAL: 45 PERIODS**

#### **TEXT BOOKS**

1. N.P.Padhy, S.P.Simon, "Soft Computing with MATLAB Programming", Oxford University Press, 2015.
2. S.Rajasekaran, G.A.Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm, Synthesis and Applications ", PHI Learning Pvt. Ltd., 2017.

#### **REFERENCES**

1. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, "Neuro-Fuzzy and Soft Computing", Prentice-Hall of India, 2002.
2. Kwang H.Lee, "First course on Fuzzy Theory and Applications", Springer, 2005.
3. George J. Klir and Bo Yuan, "Fuzzy Sets and Fuzzy Logic-Theory and Applications", Prentice Hall, 1996.
4. James A. Freeman and David M. Skapura, "Neural Networks Algorithms, Applications, and Programming Techniques", Addison Wesley, 2003.

**19IT13E**

**SOCIAL NETWORKING**

**L T P C**  
**3 0 0 3**

#### **COURSE OUTCOMES**

Upon the completion of the course, the students should be able to

- CO1: develop semantic web related simple applications. (K3)
- CO2: represent knowledge using ontology.(K2)

- CO3: explain the data extraction and mining of social networks.(K2)  
 CO4: discuss the prediction of human behavior in social communities.(K2)  
 CO5: describe the applications of social networks.(K2)

### **UNIT I INTRODUCTION 9**

Introduction to Semantic Web: Limitations of current Web - Development of Semantic Web - Emergence of the Social Web - Social Network analysis: Development of Social Network Analysis - Key concepts and measures in network analysis - Electronic sources for network analysis: Electronic discussion networks, Blogs and online communities - Web-based networks - Applications of Social Network Analysis.

### **UNITII MODELLING, AGGREGATING AND KNOWLEDGE REPRESENTATION 9**

Ontology and their role in the Semantic Web: Ontology-based knowledge Representation - Ontology languages for the Semantic Web: Resource Description Framework - Web Ontology Language - Modelling and aggregating social network data: State-of-the-art in network data representation - Ontological representation of social individuals - Ontological representation of social relationships - Aggregating and reasoning with social network data - Advanced representations.

### **UNIT III EXTRACTION AND MINING COMMUNITIES IN WEB SOCIAL NETWORKS 9**

Extracting evolution of Web Community from a Series of Web Archive - Detecting communities in social networks - Definition of community - Evaluating communities - Methods for community detection and mining - Applications of community mining algorithms - Tools for detecting communities social network infrastructures and communities - Decentralized online social networks - MultiRelational characterization of dynamic social network communities.

### **UNIT IV PREDICTING HUMAN BEHAVIOUR AND PRIVACY ISSUES 9**

Understanding and predicting human behaviour for social communities - User data management - Inference and Distribution - Enabling new human experiences - Reality mining - Context - Awareness - Privacy in online social networks - Trust in online environment - Trust models based on subjective logic - Trust network analysis - Trust transitivity analysis - Combining trust and reputation - Trust derivation based on trust comparisons - Attack spectrum and countermeasures.

### **UNIT V VISUALIZATION AND APPLICATIONS OF SOCIAL NETWORKS 9**

Graph theory - Centrality - Clustering - Node-Edge Diagrams - Matrix representation - Visualizing online social networks, Visualizing social networks with matrix-based representations - Matrix and Node-Link Diagrams - Hybrid representations - Applications - Cover networks - Community welfare - Collaboration networks - Co-Citation networks.

**L: 45; TOTAL: 45 PERIODS**

#### **TEXT BOOKS**

1. Peter Mika, "Social Networks and the Semantic Web", First Edition, Springer 2007.
2. BorkoFurht, "Handbook of Social Network Technologies and Applications", First Edition, Springer, 2010.
3. David Easley, Jon Kleinberg, "Networks, Crowds, and Markets: Reasoning about a Highly Connected World", First Edition, Cambridge University Press, 2010.

#### **REFERENCES**

1. GuandongXu ,Yanchun Zhang and Lin Li, "Web Mining and Social Networking – Techniques and applications", First Edition, Springer, 2011.



2. Dion Goh and Schubert Foo, "Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively", IGI Global Snippet, 2008.
3. Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, "Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modelling", IGI Global Snippet, 2009.
4. John G. Breslin, Alexander Passant and Stefan Decker, "The Social Semantic Web", Springer, 2009.
5. <https://nptel.ac.in/courses/106/106/106106169/>

**19IT14E**

**CLOUD COMPUTING**

**L T P C**  
**3 0 0 3**

**PREREQUISITE**

- Operating Systems
- Networking
- Database Management Systems

**COURSE OUTCOMES**

Upon completion of the course, the students should be able to

- CO1: explain the main concepts, key technologies, and limitations of cloud computing. (K2)
- CO2: discuss the key and enabling technologies that help in the development of cloud. (K2)
- CO3: develop the ability to understand and use the architecture of cloud. (K2)
- CO4: explain the concepts of resource management and scheduling in cloud computing. (K2)
- CO5: describe the cloud technologies using Hadoop. (K2)

**UNIT I INTRODUCTION 9**

Introduction to Cloud Computing – Definition of Cloud – Evolution of Cloud Computing Underlying Principles of Parallel and Distributed Computing – Cloud Characteristics - Elasticity in Cloud – On-demand Provisioning.

**UNIT II CLOUD ENABLING TECHNOLOGIES 9**

Service Oriented Architecture – REST and Systems of Systems – Web Services – Publish-Subscribe Model – Basics of Virtualization – Types of Virtualization – Implementation Levels of Virtualization – Virtualization Structures – Tools and Mechanisms – Virtualization of CPU – Memory – I/O Devices –Virtualization Support and Disaster Recovery.

**UNIT III CLOUD ARCHITECTURE, SERVICES AND STORAGE 9**

Layered Cloud Architecture Design – NIST Cloud Computing Reference Architecture – Public, Private and Hybrid Clouds – IaaS – PaaS – SaaS – Architectural Design Challenges – Cloud Storage – Storage-as-a-Service – Advantages of Cloud Storage – Cloud Storage Providers – S3.

**UNIT IV CLOUD RESOURCE MANAGEMENT AND SCHEDULING 9**

Inter Cloud Resource Management – Resource Provisioning and Resource Provisioning Methods – Global Exchange of Cloud Resources – Scheduling Algorithms for Computing Clouds–Cloud Scheduling Subject to Deadlines, Scheduling MapReduce Applications Subject to Deadlines.

**UNIT V CLOUD TECHNOLOGIES AND ADVANCEMENTS 9**

Hadoop – MapReduce – Virtual Box — Google App Engine – Programming Environment for Google App Engine — Open Stack – Case study: AWS, VMWare

**L: 45 TOTAL: 45 PERIODS**

**TEXT BOOKS**

1. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, “Distributed and Cloud Computing, From Parallel Processing to the Internet of Things”, Morgan Kaufmann Publishers, 2012.
2. Rittinghouse, John W., and James F. Ransome, “Cloud Computing: Implementation, Management and Security”, CRC Press, 2017.

**REFERENCES**

1. RajkumarBuyya, Christian Vecchiola, S. ThamaraiSelvi, “Mastering Cloud Computing”, Tata Mcgraw Hill, 2013.
2. Toby Velte, Anthony Velte, Robert Elsenpeter, “Cloud Computing – A Practical Approach”, Tata Mcgraw Hill, 2009.
3. George Reese, “Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice)”, O’Reilly, 2009.

**19IT15E**

**INFORMATION VISUALIZATION**

**L T P C  
3 0 0 3**

**COURSE OUTCOMES**

Upon completion of the course, the students will be able to

- CO1: explain principles of visual perception. (K2)
- CO2: describe the data analysis using time-series. (K2)
- CO3: discuss multivariate analysis for data processing. (K2)
- CO4: discuss and design information dashboard. (K2)
- CO5: describe visualizing data process.(K2)

**UNIT I CORE SKILLS FOR VISUAL ANALYSIS 9**

Information visualization – effective data analysis – traits of meaningful data – visual perception –making abstract data visible – building blocks of information visualization – analytical interaction – analytical navigation – optimal quantitative scales – reference lines and regions – trellises and crosstabs – multiple concurrent views – focus and context – details on demand – over-plotting reduction – analytical patterns – pattern examples.

**UNIT II TIME-SERIES RANKING AND DEVIATION ANALYSIS 9**

Time-series analysis – time-series patterns – time-series displays – time-series best practices – part-to-whole and ranking patterns – part-to-whole and ranking displays – best practices – deviation analysis – displays – best practices.

**UNIT III DISTRIBUTION CORRELATION AND MULTIVARIATE ANALYSIS 9**

Distribution analysis – describing distributions – distribution patterns – distribution displays – distribution analysis best practices – correlation analysis – describing correlations – correlation patterns – correlation displays – correlation analysis techniques and best practices – multivariate analysis – multivariate patterns – multivariate displays – multivariate analysis techniques & best practices.

**UNIT IV INFORMATION DASHBOARD DESIGN 9**

Information dashboard – Introduction– dashboard design issues and assessment of needs – Considerations for designing dashboard-visual perception – Achieving eloquence.

**UNIT V VISUALIZING DATA PROCESS 9**

Acquiring data, - Where to Find Data, Tools for Acquiring Data from the Internet, Locating Files for Use with Processing, Loading Text Data, Dealing with Files and Folders, Listing Files in a Folder, Asynchronous Image Downloads, Advanced Web Techniques, Using a Database, Dealing with a Large Number of Files. Parsing data - Levels of Effort, Tools for Gathering Clues, Text Is Best, Text Markup Languages, Regular Expressions (regexps), Grammars and BNF Notation, Compressed Data, Vectors and Geometry, Binary Data Formats, Advanced Detective Work.

**L: 45; TOTAL : 45 PERIODS**

**TEXT BOOKS**

1. Ben Fry, "Visualizing data: Exploring and explaining data with the processing environment", O'Reilly, 2008.
2. Nathan Yau, "Data Points: Visualization that means something", Wiley, 2013.

**REFERENCES**

1. Edward R. Tufte, "The visual display of quantitative information", Second Edition, Graphics Press, 2001.
2. Evan Stubbs, "The value of business analytics: Identifying the path to profitability", Wiley, 2011.
3. Gert H. N. Laursen and Jesper Thorlund, "Business Analytics for Managers: Taking business intelligence beyond reporting", Wiley, 2010.
4. Stephen Few, "Information dashboard design: Displaying data for at-a-glance monitoring", Second Edition, Analytics Press, 2013.
5. Stephen Few, "Now you see it: Simple Visualization techniques for quantitative analysis", Analytics Press, 2009.

**19IT16E**

**GPU COMPUTING**

**L T P C  
3 0 0 3**

**COURSE OUTCOMES**

Upon completion of the course, the students will be able to

- CO1: describe GPU Architecture. (K2)
- CO2: develop programs using CUDA. (K3)
- CO3: enumerate the various programming issues. (K2)
- CO4: develop simple programs using OpenCL. (K3)
- CO5: identify efficient parallel programming patterns to solve problems. (K2)

**UNIT I GPU ARCHITECTURE 9**

Evolution of GPU architectures – Understanding Parallelism with GPU –Typical GPU Architecture – CUDA Hardware Overview – Threads, Blocks, Grids, Warps, Scheduling – Memory Handling with CUDA: Shared Memory, Global Memory, Constant Memory and Texture Memory.

**UNIT II CUDA PROGRAMMING 9**

Using CUDA – Multi GPU – Multi GPU Solutions – Optimizing CUDA Applications: Problem Decomposition, Memory Considerations, Transfers, Thread Usage, Resource Contentions.

**UNIT III PROGRAMMING ISSUES 9**

Common Problems: CUDA Error Handling, Parallel Programming Issues, Synchronization, Algorithmic Issues, Finding and Avoiding Errors.

**UNIT IV OPENCL BASICS 9**

OpenCL Standard – Kernels – Host Device Interaction – Execution Environment – Memory Model – Basic OpenCL Examples.

**UNIT V ALGORITHMS ON GPU 9**

Parallel Patterns: Convolution, Prefix Sum, Sparse Matrix – Matrix Multiplication – Programming Heterogeneous Cluster.

**L: 45; TOTAL: 45 PERIODS**

**TEXT BOOKS**

1. Shane Cook, "CUDA Programming: —A Developer's Guide to Parallel Computing with GPUs (Applications of GPU Computing)", First Edition, Morgan Kaufmann, 2012.
2. David R. Kaeli, Perhaad Mistry, Dana Schaa, Dong Ping Zhang, "Heterogeneous computing with OpenCL", Third Edition, Morgan Kauffman, 2015.

**REFERENCES**

1. Nicholas Wilt, "CUDA Handbook: A Comprehensive Guide to GPU Programming", Addison – Wesley, 2013.
2. Jason Sanders, Edward Kandrot, "CUDA by Example: An Introduction to General Purpose GPU Programming", Addison – Wesley, 2010.
3. David B. Kirk, Wen-mei W. Hwu, "Programming Massively Parallel Processors – A Hands-on Approach", Third Edition, Morgan Kaufmann, 2016.

**WEB REFERENCES**

1. [http://www.nvidia.com/object/cuda\\_home\\_new.html](http://www.nvidia.com/object/cuda_home_new.html)
2. <http://www.openCL.org>

**19IT17E****MULTI-CORE ARCHITECTURES****L T P C  
3 0 0 3****COURSE OUTCOMES**

Upon completion of the course, the students will be able to

CO1: describe the core concept of multiprocessors. (K2)

CO2: write the program for Parallel Processors. (K3)

CO3: develop programs using OpenMP and MPI. (K3)

CO4: compare and contrast programming for serial processors and programming for parallel processors. (K3)

CO5: analyze the case studies related to open MP and MPI. (K3)

**UNIT I MULTI-COREPROCESSORS 9**

Single core to Multi-core architectures – SIMD and MIMD systems – Interconnection networks - Symmetric and Distributed Shared Memory Architectures – Cache coherence - Performance Issues – Parallel program design- NVIDIA kepler- Architecture.

**UNIT II PARALLEL PROGRAM CHALLENGES 9**

Performance – Scalability – Synchronization and data sharing – Data races – Synchronization primitives (mutexes, locks, semaphores, barriers) – deadlocks and livelocks – communication between threads (condition variables, signals, message queues and pipes).

- UNIT III SHARED MEMORY PROGRAMMING WITH OPENMP 9**  
OpenMP Execution Model – Memory Model – OpenMP Directives – Work-sharing Constructs - Library functions – Handling Data and Functional Parallelism – Handling Loops - Performance Considerations.
- UNIT IV DISTRIBUTED MEMORY PROGRAMMING WITH MPI 9**  
MPI program execution – MPI constructs – libraries – MPI send and receive – Point-to-point and Collective communication – MPI derived datatypes – Performance evaluation.
- UNIT V PARALLEL PROGRAM DEVELOPMENT 9**  
Case studies - n-Body solvers – Tree Search – OpenMP and MPI implementations and comparison.

**L: 45; TOTAL: 45 PERIODS**

#### **TEXT BOOKS**

1. Peter S. Pacheco, “An Introduction to Parallel Programming”, Morgan-Kaufman/Elsevier, 2011.
2. Darryl Gove, “Multicore Application Programming for Windows, Linux, and Oracle Solaris”, Pearson, 2011

#### **REFERENCES**

1. Michael J Quinn, “Parallel programming in C with MPI and OpenMP”, Tata Mc-Graw Hill, 2003.
2. Shameem Akhter and Jason Roberts, “Multi-core Programming”, Intel Press, 2006.
3. Gerassimosbarlas “Multi core and GPU programming an integrated approach”, Springer, 2015.

**19IT18E**

**SERVICE ORIENTED ARCHITECTURE**

**L T P C  
3 0 0 3**

#### **COURSE OUTCOMES**

Upon completion of the course the students will be able to

- CO1: identify how the components are interrelated in SOA. (K2)
- CO2: develop a simple web services using SOA principles. (K3)
- CO3: apply various activity management and a series of composition techniques for SOA. (K3)
- CO4: implement the various services using J2EE. (K3)
- CO5: apply various web service specification standards. (K3)

- UNIT I SOA AND BUSINESS PROCESS MANAGEMENT CONCEPTS 9**  
Service Oriented Enterprise – Service Oriented Architecture (SOA) – SOA and Web Services – Multichannel Access – Business Process management – Extended Web Services Specifications – Overview of SOA – Concepts – Key Service Characteristics – Technical Benefits – Business Benefits-Microservices architecture-Emergence of MSA Service
- UNIT II SOA AND WEB SERVICES 9**  
Web Services Platform – Service Contracts – Service-Level Data Model – Service Discovery – Service-Level Security – Service-Level Interaction patterns – Atomic Services and Composite Services – Proxies and Skeletons – Communication – Integration Overview – XML and Web Services - .NET and J2EE Interoperability – Service- Enabling Legacy Systems – Enterprise Service Bus Pattern – Creating simple web services.

**UNIT III SOA AND MULTICHANNEL ACCESS 9**

Multi-Channel Access – Business Benefits – SOA for Multichannel Access – Tiers – Business Process Management – Concepts – BPM - SOA and Web Services – WS- BPEL – Web Services Composition-Case Study Tools: BMC Software's AppSight.

**UNIT IV JAVA WEB SERVICES ARCHITECTURE 9**

Java Web Service Developer pack– JAXP- Architecture-SAX-DOM-XSLT-JDOM-JAX RI – JAX-RPC-Service Model - JAX RPC and J2EE - JAXM – JAXM Architecture –JAXR - Registries and Repositories – JAXR Architecture – JAXR Information Model - JAXB – Architecture – Developing with JAXB - XML to Java mapping – JAXB API - Validation with JAXB – Customizing JAXB-Case Study Tool:Mindreef's SOAP scope Server.

**UNIT V EXTENDED WEB SERVICES SPECIFICATION 9**

Metadata Management - Metadata Specification - Policy – Metadata exchange – Web Services Security -Core concepts – Challenges - Threads and Remedies – Message Level Security – Data Level Security – Advanced Messaging – Reliable Messaging - Notification – Transaction Management - Protocols and Specification – Transaction Specification.

**L: 45 TOTAL: 45 PERIODS****TEXTBOOKS**

1. Eric Newcomer, Greg Lomow, “Understanding SOA with Web Services”, First Edition, Pearson Education, 2005.
2. James McGovern, Sameer Tyagi, Michael E Stevens, Sunil Mathew, “Java Web Services Architecture”, Elsevier, 2003.

**REFERENCES**

1. Thomas Erl, “Service Oriented Architecture”, Pearson Education, 2005.
2. Frank Cohen, “Fast SOA”, Elsevier, 2007.
3. Scott Campbell, Vamsi Mohun, “Mastering Enterprise SOA”, Wiley, 2007.
4. Eric Pulier, Hugh Taylor, “Understanding Enterprise SOA”, Dreamtech Press, 2007.
5. Jeff Davies, “The Definitive Guide to SOA”, Apress, 2007.
6. Sandeep Chatterjee, James Webber, “Developing Enterprise Web Services”, Pearson Education, 2004.

**WEB REFERENCES**

1. [http://www.servicearchitecture.com/webservice/articles/serviceoriented\\_architecture\\_soa\\_definition.html](http://www.servicearchitecture.com/webservice/articles/serviceoriented_architecture_soa_definition.html)
2. <http://www.W3.orh/TR/soap12-part1/>
3. <http://www.w3.org/TR/ws-arch/>
4. <http://www.whatissaoa.com/>
5. <http://www.ibm.com/developerworks/webservices/library/ws-soad/>
6. <http://xml.coverpages.org/Burdett-WShoreographyJune032003.pdf>
7. <http://download.oracle.com/javaee/1.4/tutorial/doc/JAXR2.html>
8. <http://java.sun.com/developer/technicalArticles/xml/jaxb/>
9. <http://java.ociweb.com/mark/JavaUserGroup/JAXB.pdf>
10. <http://java.sun.com/xml/downloads/jaxrpc.html>

19IT19E

QUANTUM COMPUTING

L T P C  
3 0 0 3

### COURSE OUTCOMES

Upon completion of the course, the student will be able to

- CO1: describe the quantum computing and quantum physics. (K2)
- CO2: elicit the fundamentals of quantum circuits. (K2)
- CO3: compare the quantum information and cryptography. (K2)
- CO4: describe the quantum algorithms and error correction techniques. (K2)
- CO5: enumerate the noise and error correction techniques in quantum computing. (K2)

### UNIT I INTRODUCTION TO QUANTUM COMPUTATION AND PHYSICS 9

Quantum bits – Bloch sphere representation of a qubit, multiple qubits–Hilber space– Probabilities and measurements, entanglement, density operators and correlation – basics of quantum mechanics – Measurements in bases other than computational basis.

### UNITII QUANTUM CIRCUITS 9

Quantum algorithms- Single qubit operation – multiple qubit gates – controlled qubit operations-universal quantum gates- design of quantum circuits.

### UNIT III QUANTUM INFORMATION AND CRYPTOGRAPHY 9

Quantum operation-Example of quantum noise and quantum operation-Comparison between classical and quantum information theory – Bell states – Quantum teleportation – Quantum Cryptography – no cloning theorem.

### UNIT IV QUANTUM ALGORITHMS 9

Classical computation on quantum computers– Relationship between quantum and classical complexity classes– Deutsch’s algorithm– Deutsch’s-Jozsa algorithm– Shor factorization, Grover search.

### UNIT V NOISE AND ERROR CORRECTION 9

Graph states and codes – Shor code- Theory of Quantum error correction –constructing quantum codes- stabilizer code- fault-tolerant computation.

**L: 45; TOTAL : 45 PERIODS**

### TEXT BOOK

1. Nielsen M.A, Chuange I.L, “Quantum Computation and Quantum Information”, Cambridge University Press, 2013.

### REFERENCES

1. Benenti G., Casati G. and Strini G., “Principles of Quantum Computation and Information, Vol. I: Basic Concepts, Vol II: Basic Tools and Special Topics”, World Scientific, 2014.
2. Pittenger A. O., “An Introduction to Quantum Computing Algorithms”, 2002.

19IT20E

CLOUD MANAGEMENT SECURITY

L T P C  
3 0 0 3

### COURSE OUTCOMES

Upon completion of this course, the students will be able to

- CO1: define the basic cloud concepts. (K2)
- CO2: explain the security challenges in cloud. (K2)
- CO3: define cloud policy and governance, compliance and legal considerations. (K2)

CO4: classify risk, audit, assessment and infrastructure security in cloud. (K2)

CO5: describe the importance of data security in cloud. (K2)

<b>UNIT I</b>	<b>INTRODUCTION TO CLOUD COMPUTING</b>	<b>9</b>
Delivery models: Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS) - Cloud types (public, private, hybrid) - Explaining the Jericho Cloud Cube Model.		
<b>UNIT II</b>	<b>SECURITY CHALLENGES</b>	<b>9</b>
Introduction - Virtualization and multi-tenancy - Risk assessment for cloud migration - Unique SaaS challenges and Cloud Access Security Brokers (CASBs).		
<b>UNIT III</b>	<b>POLICY AND GOVERNANCE COMPLIANCE AND LEGAL CONSIDERATIONS</b>	<b>9</b>
Internal policy needs - Contract requirements for security - Service-level agreements - Governance models for the cloud - Compliance challenges for the cloud - Legal and geographic jurisdiction - Privacy concerns.		
<b>UNIT IV</b>	<b>RISK AUDIT ASSESSMENT AND INFRASTRUCTURE SECURITY FOR THE CLOUD</b>	<b>9</b>
Risk management - Auditing the cloud – Remote – Onsite - CloudAudit A6 - Patch and configuration management - Change management - Network and virtualization security - Application security for SaaS, PaaS, and IaaS.		
<b>UNIT V</b>	<b>DATA SECURITY IN THE CLOUD</b>	<b>9</b>
Encryption types and availability - Key management and encryption architectures - Data/information lifecycle – Retention – Disposal – Classification.		

**L: 45; TOTAL: 45 PERIODS**

#### TEXT BOOKS

1. Raj Kumar Buyya , James Broberg, andrzej Goscinski, “Cloud Computing:”, Wiley 2013
2. Raj Kumar buyya, Christian Vecchiola, “Mastering Cloud Computing”, 2013.
3. Arshdeep Bahga, Vijay Madiseti, “Cloud Computing”, University Press, 2014
4. Dave shackleford, “Virtualization Security”, SYBEX a wiley Brand 2013.

#### REFERENCES

1. Mark C. Chu-Carroll “Code in the Cloud”,CRC Press, 2011.
2. K Chandrasekharan “Essentials of cloud computing”, CRC Press, 2015.
3. John W. Rittinghouse, James Ransome, “Cloud Computing”, CRC Press, 2009
4. Mather, Kumaraswamy and Latif, “Cloud Security and Privacy”, OREILLY 2011.

**19IT21E**

**EDGE AND FOG COMPUTING**

**L T P C**  
**3 0 0 3**

#### COURSE OUTCOMES

Upon completion of this course, the students will be able to

- CO 1: explore the fundamentals and management in fog computing. (K2)
- CO 2: use the design of fog architecture. (K2)
- CO 3: design new services with fog computing. (K3)
- CO 4: apply different real time applications in fog. (K3)
- CO 5: design mobile fog applications with 5G network. (K3)



<b>UNIT I</b>	<b>FOG COMPUTING</b>	<b>9</b>
Fog Computing Fundamentals in the Internet-of-Things - IoT Resource Estimation Challenges and Modeling in Fog - Tackling IoT Ultra Large Scale Systems: Fog Computing in Support of Hierarchical Emergent Behaviors.		
<b>UNIT II</b>	<b>FOG REFERENCE ARCHITECTURE</b>	<b>9</b>
OpenFog Reference Architecture - Areas of Opportunity - Use Cases for Fog - Pillars of Open Fog RA - Reference Architecture Overview: Functional Viewpoint - Deployment Viewpoint - OpenFog Architecture Description – Perspectives - Node View - System Architecture View - Software Architecture View.		
<b>UNIT III</b>	<b>SERVICES OF FOG LAYER</b>	<b>9</b>
Self-Aware Fog Computing in Private and Secure Spheres– Urban IoT Edge Analytics - The Present and Future of Privacy-Preserving Computation in Fog Computing.		
<b>UNIT IV</b>	<b>APPLICATION USE-CASES</b>	<b>9</b>
Control-as-a-Service in Cyber-Physical Energy Systems over Fog Computing - Leveraging Fog Computing for Healthcare IoT. Programming with iFogSim.		
<b>UNIT V</b>	<b>FOG COMPUTING IN 5G NETWORKS</b>	<b>9</b>
Fog computing in 5G networks: an application perspective -Fog computing on 5G networks - Smart traffic light system - Mobile gaming - Smart homes - Distributed camera networks - software-defined networking and network functions virtualisation in 5G emerging mobile computing.		

**L: 45 TOTAL: 45 PERIODS**

#### **TEXT BOOKS**

1. Amir M. Rahmani, Pasi Liljeberg, Jürjo-Sören Preden, Axel Jantsch, “Fog Computing in the Internet of Things: Intelligence at the Edge”, Springer, 2018.
2. Evangelos Markakis, George Mastorakis, Constandinos X. Mavromoustakis and Evangelos Pallis, “Cloud and Fog Computing in 5G Mobile Networks Emerging advances and applications” IET 2017.

#### **REFERENCES**

1. OpenFog Consortium Architecture Working Group, “OpenFog Reference Architecture for Fog Computing”, [www.OpenFogConsortium.org](http://www.OpenFogConsortium.org).
2. Zaigham Mahmood, “Fog Computing: Concepts, Frameworks and Technologies”, Springer, 2018.

<b>19IT22E</b>	<b>VIRTUAL AND AUGMENTED REALITY</b>	<b>L T P C</b>
		<b>3 0 0 3</b>

#### **COURSE OUTCOMES**

Upon completion of this course, the students will be able to

- CO1: Demonstrate an understanding of the underlying enabling technologies of Virtual Reality systems. (K3)
- CO2: Explain the computing architecture needed for Virtual Reality. (K2)
- CO3: Demonstrate the concepts of augmented reality. (K3)
- CO4: Identify augmented reality contents and interactions. (K2)
- CO5: Describe hardware and software used in augmented reality. (K2)

**UNIT I VIRTUAL REALITY FUNDAMENTALS 9**

Elements of Virtual Reality Experience - Components of a VR system - Evolution of VR. Input Devices - Position trackers, Gesture Interfaces, Manipulation Interfaces. Output Devices - Visual Displays: Properties, Monitor Based, Projection Based, Head Based, See-through head based, Hand Held VR Displays Aural Displays: Properties, Head based and Stationary aural devices Haptic Displays: Human haptic system, Tactile type, force type.

**UNIT II COMPUTING ARCHITECTURES, VR DESIGN ISSUES 9**

Visual representation in VR, Aural representation in VR, Haptic representation in VR – Visual Rendering System – Aural Rendering System -Haptic Rendering System – PC Graphics Accelerators and Architecture – Multipipeline synchronisation – collocated rendering pipelines – distributed VR environment – VR Haptic Interface software – Creating a VR application – Designing a VR experience -VR health and safety issues – VR and Society

**UNIT III AUGMENTED REALITY CONCEPTS 9**

Augmented Reality –Introduction – Physical world augmentation – Relationship between augmented reality and other technologies. Augmented Reality Concepts – How augmented reality works – two step process of augmented reality application – related concepts – Ingredients of augmented reality experience.

**UNIT IV AUGMENTED REALITY CONTENT AND INTERACTION 9**

Content – Creating visual content – 3D objects – 2D images – visual elements. Interaction in Augmented Reality –interaction in real world – manipulation – navigation –multi person augmented reality application – subjective vsobjective point of view.

**UNIT V AUGMENTED REALITY HARDWARE AND SOFTWARE 9**

Major hardware components for Augmented Reality System – Sensors – Processors – Displays - Augmented Reality Systems. Major software components for Augmented Reality – Software used to create content for augmented reality application.

**L: 45; TOTAL: 45 PERIODS****TEXT BOOKS**

1. William R. Sherman, Alan B. Craig, "Understanding Virtual Reality: Interface, Application, and Design", Morgan Kaufmann Publishers (Elsevier) U.S./India, Second Edition, 2017..
2. Grigore C. Burdea, Philippe Coiffet, "Virtual Reality Technology", Wiley India, Second Edition, 2003.
3. Alan B. Craig, "Understanding Augmented Reality- Concepts and Applications", Morgan Kaufmann, First Edition, 2013.
4. RaghavSood, "Pro Android Augmented Reality", First Edition, Apress, 2012.
5. Furht, Borko, "Handbook of Augmented Reality", First Edition, Springer, 2011.

**REFERENCES**

1. Tony Parisi, "Learning Virtual Reality: Developing Immersive Experiences and Applications for Desktop, Web and Mobile", O'Reilly, First Edition, 2016.
2. Greg Kipper and Joseph Rampolla, "Augmented Reality: An Emerging Technologies Guide to AR", Morgan Kaufmann, First Edition, 2012.

19IT23E

BLOCKCHAIN TECHNOLOGY

L T P C  
3 0 0 3

### PRE REQUISTES

- Data Structures and Algorithms
- Object-Oriented Programming
- Database Management System and Operating Systems

### COURSE OUTCOMES

Upon completion of the course the students will be able to

- CO1: Explain the emerging abstract models for Blockchain technology landscape. (K2)
- CO2: Explain design principles of Bitcoin and Ethereum. (K2)
- CO3: discuss the transactions using Hyperledger Fabric. (K2)
- CO4: Familiarize the functional/operational aspects of Blockchain data structure. (K2)
- CO5: Explain the concepts of Mining and Consensus in Blockchain technology. (K2)

### UNIT I INTRODUCTION TO BLOCKCHAIN 9

Introduction to Blockchain : Basics, History, Architecture, Conceptualization - Basic Crypto Primitives - Byzantine Generals Problem - Types of Blockchain – Blockchain Implementations - Blockchain Collaborative Implementations - Blockchain Components and Concepts - Blockchain in Practical Use Today - Case Study: SecureVote.

### UNIT II BITCOIN AND ETHEREUM 9

Introduction to Bitcoin - How Bitcoin Works: Transactions, Blocks, Mining, and the Blockchain - Bitcoin Transactions - Constructing a Transaction - Bitcoin Mining – Mining Transactions in Blocks - Consensus in Bitcoin - Spending the Transaction – Bitcoin Addresses - The Bitcoin Network - Ethereum - Case Study: AgriDigital - Ethereum, Consensus – Mechanisms - Smart Contracts - Metamask Setup - Ethereum Accounts.

### UNIT III TRANSACTIONS AND HYPERLEDGER FABRIC 9

Introduction - Transaction Lifecycle - Transaction Structure - Transaction Outputs and Inputs - Transaction Scripts and Script Language - Standard Transactions - Introduction to Hyperledger: Hyperledger Fabric – Transaction Flow - Membership and Identity Management - Hyperledger Fabric Network Setup - Fabric Demo on IBM Blockchain Cloud.

### UNIT IV BLOCKCHAIN DATA STRUCTURE 9

Introduction - Structure of a Block - Block Header - Block Identifiers: Block Header Hash and Block Height - The Genesis Block - Linking Blocks in the Blockchain - Merkle Trees – Merkle Trees and Simplified Payment Verification (SPV) - Blockchain Security - Case Study: Origin Chain.

### UNIT V MINING AND CONSENSUS 9

Introduction - Decentralized Consensus - Independent Verification of Transactions – Mining Nodes - Aggregating Transactions into Blocks - Constructing the Block Header - Mining the Block - Successfully Mining the Block - Validating a New Block - Assembling and Selecting Chains of Blocks - Consensus Attacks.

**L: 45; TOTAL: 45 PERIODS**

### TEXT BOOKS

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016.
2. Andreas M. Antonopoulos, "Mastering Bitcoin: Unlocking Digital Cryptocurrencies", O'Reilly Media, Inc., ISBN: 978-1-449-37404-4, 2014.

3. Andreas M. Antonopoulos, "Mastering Bitcoin: Programming the Open Blockchain", O'Reilly Media, Inc., ISBN: 978-1-491-95438-6, 2017.

## REFERENCES

1. Nick Furneaux, Investigating Cryptocurrencies: Understanding, Extracting, and Analyzing Blockchain Evidence, John Wiley & Sons, Inc., 2018.
2. Joseph J. Bambara, Paul R. Allen, "Blockchain: A Practical Guide to developing Business, Law, and Technology Solutions, McGraw-Hill Education, 2018.
3. Xiwei Xu, Ingo Weber, Mark Staples, "Architecture for Blockchain Applications", Springer, ISBN 978-3-030-03034-6, 2019.
4. Melanie Swan, Blockchain : Blueprint for a New Economy, O'Reilly Media, Inc., ISBN: 978-1-491-92049-7,2015.
5. Tiana Laurence, "Blockchain", Second Edition, Wiley Publications, ISBN 978-1-119-55501-8, 2019.

## WEB REFERENCES

1. Hyperledger Fabric - <https://www.hyperledger.org/projects/fabric>.
2. Hands-On Blockchain with Hyperledger - <https://www.packtpub.com/big-data-and-business-intelligence/hands-blockchain-hyperledger>.

**19IT24E**

**MOBILE COMMUNICATIONS**

**L T P C  
3 0 0 3**

### COURSE OUTCOMES:

Upon completion of the course the students will be able to

- CO1: explain the basics of mobile telecommunication system.(K2)
- CO2: illustrate the generations of telecommunication systems in wireless network. (K2)
- CO3: discuss the architecture of Wireless LAN technologies. (K2)
- CO4: determine the functionality of network layer and Identify a routing protocol for Ad-hoc networks.(K3)
- CO5: explain the functionality of Transport and Application layer.(K2)

### **UNIT I INTRODUCTION 9**

Introduction to Mobile Computing – Applications of Mobile Computing- Generations of Mobile Communication Technologies-MAC Protocols – SDMA- TDMA- FDMA- CDMA.

### **UNIT II MOBILE TELECOMMUNICATION SYSTEM 9**

GSM – Architecture – Protocols – Connection Establishment – Frequency Allocation – Routing – Mobility Management – Security –GPRS- UMTS- Architecture.

### **UNIT III WIRELESS NETWORKS 9**

Wireless LANs and PANs – IEEE 802.11 Standard – system Architecture -Protocol Architecture–MAC-HIPERLAN-- Blue Tooth- Wi-Fi – WiMAX.

### **UNIT IV MOBILE NETWORK LAYER 9**

Mobile IP – DHCP – AdHoc– Proactive and Reactive Routing Protocols – Multicast Routing– Vehicular Ad Hoc networks ( VANET) –MANET Vs VANET – Security.

**UNIT V MOBILE TRANSPORT AND APPLICATION LAYER 9**

Mobile TCP– WAP – Architecture – WDP – WTLS – WTP –WSP – WAE – WTA Architecture – WML.

**L: 45; TOTAL: 45 PERIODS**

**TEXT BOOKS**

1. Jochen Schiller, "Mobile Communications", PHI, Second Edition, 2014.
2. Prasant Kumar Pattnaik, Rajib Mall, "Fundamentals of Mobile Computing", PHI Learning Pvt. Ltd, New Delhi – 2012.

**REFERENCES**

1. Dharma Prakash Agarval, Qing and An Zeng, "Introduction to Wireless and Mobile systems", Thomson Asia Pvt Ltd, 2005.
2. Uwe Hansmann, LotharMerk, Martin S. Nicklons and Thomas Stober, "Principles of Mobile Computing", Springer, 2003.
3. William.C.Y.Lee, "Mobile Cellular Telecommunications - Analog and Digital Systems", Second Edition, Tata Mc Graw Hill Edition ,2006.
4. C.K.Toth, "AdHoc Mobile Wireless Networks", First Edition, Pearson Education, 2002.

**19IT25E**

**MOBILE AND UBIQUITOUS COMPUTING**

**L T P C  
3 0 0 3**

**COURSE OUTCOMES**

Upon completion of the course the students will be able to

- CO1: explain the basic architecture and concepts of Third Generation Communication systems. (K2)
- CO2: explain the 4G Telecommunication System Principle. (K2)
- CO3: discuss the basics of ubiquitous computing. (K2)
- CO4: outline the need of wearable computing. (K2)
- CO5: explain the concepts of HCI in ubiquitous computing. (K2)

**UNIT I INTRODUCTION 9**

History – Wireless communications: GSM – DECT – TETRA – UMTS – IMT – 2000 – Blue tooth, WiFi, WiMAX, 3G ,WATM.- Mobile IP protocols -WAP push architecture - WML scripts and applications. Data networks – SMS –EDGE – Hybrid Wireless Networks – ATM – WirelessATM.

**UNIT II OVERVIEW OF A MODERN 4G TELECOMMUNICATIONS SYSTEM 9**

Introduction - LTE-A System Architecture. LTE RAN. OFDM Air Interface. Evolved Packet Core - LTE Requirements. LTE - Advanced - OFDMA – Introduction - OFDM Principles - LTE Uplink—SC.

**UNIT III BASICS OF UBIQUITOUS COMPUTING 9**

Introduction, Overview – Challenges networking Basics – NFC, Wireless LAN-Location in ubiquitous computing: Personal assistants – Location aware computing – Location tracking – Architecture – Location based service and applications – Location based social networks (LBSN), LBSN Recommendation.

**UNIT IV WEARABLE COMPUTING****9**

Glass and Augmented Reality – Eye-Tracking, – Digital Pen and Paper Mobile social networking & crowd sensing – Event based social network.

**UNIT V MOBILE AFFECTIVE COMPUTING****9**

Application domains for ubiquitous computing: Illustration of some existing application domains for ubiquitous computing -Human Activity and Emotion Sensing – Health Apps – Mobile2p computing-Smart Homes and Intelligent Buildings– Mobile HCI.

**L: 45; TOTAL: 45 PERIODS****TEXT BOOKS**

1. Ian Colman, Jun Han, and Muhammad AshadKabir, "Pervasive Social Computing Socially-Aware Pervasive Systems and Mobile Applications", Springer, 2016.
2. J.Schiller,"Mobile Communication", Addison Wesley, Second Edition,2004
3. John Krumm,"Ubiquitous Computing Fundamentals", CRC Press, 2010.

**REFERENCES**

1. JuhaKorhonen, "Introduction to 4G Mobile Communications", Artech House Publishers, 2014.
2. M.Bala Krishna, Jaime Lloret Mauri, "Advances in Mobile Computing and Communications: Perspectives and Emerging Trends in 5G NetworksII", CRC 2016.

**19IT26E****IoT PROGRAMMING****L T P C  
3 0 0 3****COURSE OUTCOMES**

Upon completion of the course the students will be able to

- CO1: explain the basics of IoT programming. (K2)
- CO2: explain the user interfaces in XCODE. (K2)
- CO3: outline the views and gestures in IoT. (K2)
- CO4: describe the table and navigation in IoT. (K2)
- CO5: describe the swift programming using IoT. (K2)

**UNIT I UNDERSTANDING IoT PROGRAMMING****9**

Learning about Xcode- view and class files- designing user interface- IBOutlet variable creation-Apple framework UI-Xcode editor- Xcode navigation and appearance.

**UNIT II XCODE UI****9**

Working with controllers- transition between multiple controllers- Navigation controller- adding user interface objects- using common interface objects.

**UNIT III IMAGE VIEW AND GESTURE IN IoT****9**

Using Image Views-text view- button switches and segment controllers- gestures tap, pinch and rotation- using alerts and pickers-constraints and stack view.

**UNIT IV TABLE VIEW AND NAVIGATION VIEW 9**  
Table view- indexing-collection view-navigation controller-tab bar- tool bar-page view controller.

**UNIT V SWIFT PROGRAMMING 9**  
Swift for Object oriented App development-OS X Notes APP- user interface and icloud.

**L: 45; TOTAL: 45 PERIODS**

### TEXT BOOKS

1. Wallace Wang, "Beginning iPhone Development with Swift 5: Exploring the iOS SDK", Fifth Edition, Apress, June 2019.
2. Paris Buttfield-Addison, Jon Manning, Tim Nugent, "Learning Swift: Building Apps for OS X and iOS", O'Reilly Media, First Edition, 2016.

### WEB REFERENCES

1. <https://www.raywenderlich.com/>
2. <https://www.appcoda.com/ios-programming-course/>
3. <https://www.hackingwithswift.com/read>
4. <https://developer.apple.com/develop/>
5. <https://books.apple.com/us/book/the-swift-programming-language-swift-3-1/id881256329>

**19IT27E ANDROID PROGRAMMING L T P C**  
**3 0 0 3**

### COURSE OUTCOMES

Upon completion of the course the students will be able to:

- CO1: design and validate web pages using HTML and JavaScript. (K3)
- CO2: explain the fundamentals of android development lifecycle. (K2)
- CO3: outline the android development components. (K2)
- CO4: explain the GUI in android development. (K2)
- CO5: describe the services in android development. (K2)

**UNIT I INTRODUCTION 9**  
Development in Web Standards – Markup Languages :HTML5 – Client- Side Programming: The JavaScript Language-History and Versions Introduction JavaScript in Perspective-Syntax Variables and Data Types-Statements- Operators- Literals-Functions-Objects-Arrays-Built-in Objects-JavaScript Debuggers- Event programming in Java.

**UNIT II MOBILE APPLICATION DEVELOPMENT 9**  
Mobile Applications Development – Understanding the Android Software Stack – Android Application Architecture –The Android Application Life Cycle – The Activity Life Cycle Creating Android Activity – Views– Layout – Creating User Interfaces with basic views– linking activities with Intents.

**UNIT III                    ANDROID FRAMEWORK OVERVIEW                    9**

Android Application Components–Android Activities: Defining the UI– Android Services: Processing in the Background–Broadcast Receivers: Announcements and Notifications  
Content Providers: Data Management, Android Intent Objects: Messaging for Components  
Android Manifest XML: Declaring Your Components.

**UNIT IV                    GRAPHICAL USER INTERFACE SCREEN WITH VIEWS                    9**

Displaying Text with TextView– Retrieving Data from Users– Using Buttons– Check Boxes and Radio Groups, Getting Dates and Times from Users–Using Indicators to Display Data to Users–Adjusting Progress with SeekBar– Working with Menus using views.

**UNIT V                    MOBILE APPLICATION DEVELOPMENT SERVICES                    9**

Services-Broadcast Receivers – Adapters – Data Storage– Retrieval and Sharing.-Location based services- Development of simple mobile applications.

**L: 45 TOTAL: 45 PERIODS****TEXT BOOKS**

1. Barry A. Burd, "Android Application Development For Dummies All in One", Wiley Publications, 2015.
2. Ed Burnette, "Hello, Android: Introducing Google's Mobile Development Platform", Third Edition, Pragmatic Programmers, 2012.

**WEB REFERENCES**

1. Android Developers : <http://developer.android.com/index.html>
2. Apple Developer : <https://developer.apple.com/>
3. Windows Phone Dev Center : <http://developer.windowsphone.com>
4. BlackBerry Developer : <http://developer.blackberry.com>
5. <https://developer.android.com/guide/components/fundamentals>

**19IT28E****M-COMMERCE****L T P C****3 0 0 3****COURSE OUTCOMES**

Upon completion of this course the students will be able to

- CO1: explain the underlying economic mechanisms and driving forces of E-Commerce. (K2)
- CO2: discuss the critical building blocks of M-Commerce. (K2)
- CO3: outline the infrastructure of M-Commerce Services. (K2)
- CO4: enumerate the security challenges of M- commerce. (K2)
- CO5: explain various business application services of M-Commerce. (K2)

**UNIT I                    E-COMMERCE                    9**

Electronic Commerce Framework – Electronic Commerce and Media Convergence –Anatomy of E-Commerce Applications – Consumer Application -Electronic Commerce organization application.



<b>UNIT II</b>	<b>INTRODUCTION TO M – COMMERCE</b>	<b>9</b>
M-Commerce – Framework – Business Models – Impact of M-Commerce – Services– Applications – Technology of M-Commerce – Mobile Payments Mode – Types –Security & Privacy Issues.		
<b>UNIT III</b>	<b>M - COMMERCE: PAYMENTS &amp; SERVICES</b>	<b>9</b>
Overview of M-Commerce - M-commerce and Technology Acceptance Model(TAM) -M-commerce and trust - concept of m-payment - importance of m-commerce and m-payment in global business - Innovativeness, trust, demographic characteristics on mobile services		
<b>UNIT IV</b>	<b>M- COMMERCE: SECUIRTY</b>	<b>9</b>
SWOT Analysis of M-commerce – Fraudulent Activities through M-commerce – Security& Its prevention – mobile payments for conducting M-commerce –Architecture and transaction model in securing M-commerce – Regulatoryframeworks of M-commerce - Security risks of M-commerce – Comparative analysis of M-commerce and E-commerce		
<b>UNIT V</b>	<b>BUSINESS APPLICATIONS AND SERVICES</b>	<b>9</b>
Mobile Information Services–Directory Services– Banking and Trading– E-Tailing and E-Ticketing–Entertainment– Business Applications and Services– Next Generation M-commerce Scenarios– Personalization– Location-Based Services.		

**L: 45; TOTAL: 45 PERIODS**

#### **TEXT BOOKS**

1. Ravi Kalakota, B.Andrew Whinston, “Frontiers of Electronic Commerce”, Ninth Edition, Pearson Education, 2009.
2. Sushila Madan, JyotiBatra Arora, “Securing Transactions and Payment Systems for M-Commerce”, Business Science Reference (an imprint of IGI Global), 2016.

#### **REFERENCE**

1. Norman Sadeh, “M-Commerce: Technologies, Services and Business models”, John Wiley & Sons, 2002.
2. Karabi Bandyopadhyay, “Mobile Commerce”, PHI Learning Private Limited, 2013
3. Paul May, “Mobile Commerce: Opportunities, Applications and Technologies of Wireless Business”, Cambridge University Press, 2001.
4. Dr.Pandey , Saurabh Shukla “E-commerce and Mobile commerce Technologies” Sultan Chand ,2011
5. E.Brian Mennecke, J.Troy Strader, “Mobile Commerce: Technology, Theory and Applications”, Idea Group Inc., IRM press, 2003.

**19IT29E**

**IoT AND ITS APPLICATIONS**

**L T P C**

**3 0 0 3**

#### **PREREQUISITES**

- Basic courses on communication
- Computer Networks
- Embedded Systems

**COURSE OUTCOMES**

Upon completion of the course students will be able to

- CO1: explain and demonstrate various components of Internet of Things (IoT). (K2)
- CO2: analyze basic protocols and Enabling Technologies of IoT in the modern world. (K2)
- CO3: realize the revolution of Cloud and Fog Computing for the IoT. (K2)
- CO4: evaluate a variety of existing and developing architecture technologies for IoT. (K3)
- CO5: describe and evaluate different applications of the IoT. (K2)

**UNIT I INTERNET OF THINGS: AN OVERVIEW 9**

Introduction- Internet of Things Definition Evolution - IoT Architectures - Resource Management - IoT Data Management and Analytics - Communication Protocols - Internet of Things Applications – Security - Identity Management and Authentication – Privacy - Standardization and Regulatory Limitations.

**UNIT II INTERNET OF THINGS: PROTOCOLS AND ENABLING TECHNOLOGIES 9**

6LoWPAN and RPL – IEEE 802.15.4 and ZigBee - Bluetooth and BLE – AMQP – CoAP – MQTT - REST Architectures - Enabling technologies of IoT - Internet in IoT – RFID Technology - Wireless Sensor Networks: Technology Overview – M2M – Web of Things - Unit Internet of Things.

**UNIT III CLOUD AND FOG COMPUTING FOR IOT 9**

Cloud Computing – Amazon Web Services for IoT – Cloud Storage Models - Big Data Processing Pattern - Big Stream - Big Stream and Security – Data Analytics for IoT - Fog Computing and the IoT - The Role of the IoT Hub.

**UNIT IV IOT IN PRACTICE 9**

Hardware for the IoT - Software for the IoT - Vision and Architecture of a Testbed for the Web of Things - Wearable Computing for the IoT: Interaction Patterns with Smart Objects in RESTful Environments - Effective Authorization for the Web of Things.

**UNIT V IOT APPLICATIONS 9**

The Smart Grid – Electric Vehicle Charging – Domain Specific IoTs: Home Automation – Cities – Environment – Agriculture – Industry – Health & Lifestyle.

**L: 45; TOTAL: 45 PERIODS**

**TEXT BOOKS**

1. Simone Cirani, Gianluigi Ferrari, Marco Picone, Luca Veltri “Internet of Things - Architectures, Protocols and Standards”, Wiley Publications, 2018, ISBN 9781119359678.
2. Rajkumar Buyya, Amir Vahid Dastjerdi, “Internet of Things - Principles and Paradigms”, Morgan Kaufmann Publication, 2016, ISBN: 978-0-12-805395-9.

**REFERENCES**

1. Oliver Hersent, David Boswarthick, Omar Elloumi, “The Internet of Things: Key Applications and Protocols”, Wiley Publications, 2018, ISBN: 978-81-265-5765-3.
2. Arshdeep Bahga, Vijay Madiseti, “Internet of Things: A Hands-on Approach”, University Press, 2018, ISBN: 978-8173719547.

3. Hakima Chaouchi, "The Internet of Things: Connecting Objects to the Web", Wiley-ISTE, 2010, ISBN: 9781848211407.
4. Huansheng Ning, "Unit and Ubiquitous Internet of Things", CRC Press, Taylor & Francis Group, 2013.
5. Constandinos X. Mavromoustakis, George Mastorakis, Jordi MongayBatalla, "Internet of Things (IoT) in 5G Mobile Technologies", Springer Publication, ISBN 978-3-319-30911-8. 2016.

**19IT30E**

**DIGITAL MARKETING**

**L T P C**  
**3 0 0 3**

### **COURSE OUTCOMES**

Upon completion of this course, the students will be able to

- CO1: define the basic concepts of Digital Marketing. (K2)
- CO2: develop insight on Current Trends - Digital and Social Statistics (Infographics). (K2)
- CO3: explain the Digital Marketing Platforms like Facebook, Twitter, YouTube, etc.(K2)
- CO4: describe the basics of Search Engine Optimization (SEO) and Mobile Marketing. (K2)
- CO5: describe the various strategies involved in Marketing products and Services Digitally. (K2)

### **UNIT I INTRODUCTION TO DIGITAL MARKETING 9**

Evolution of Digital Marketing from traditional to modern era, Role of Internet; Current trends, Info-graphics, implications for business & society; Emergence of digital marketing as a tool; Drivers of the new marketing environment; Digital marketing strategy; P.O.E.M. framework, Digital landscape, Digital marketing plan, Digital marketing models.

### **UNIT II INTERNETMARKETING AND DIGITAL MARKETING 9**

Internet Marketing, opportunities and challenges; Digital marketing framework; Digital Marketing mix, Impact of digital channels on IMC. Search Engine Advertising - Pay for Search Advertisements, Ad Placement, Ad Ranks, Creating Ad Campaigns, Campaign Report Generation. Display marketing- Types of Display Ads - Buying Models - Programmable Digital Marketing - Analytical Tools - YouTube marketing.

### **UNIT III SOCIAL MEDIA MARKETING ROLE OF INFLUENCER MARKETING TOOLS AND PLAN 9**

Introduction to social media platforms, penetration & characteristics; Building a successful social media marketing strategy. Facebook Marketing - Business through Facebook Marketing, Creating Advertising Campaigns, Adverts, Facebook Marketing Tools. LinkedIn Marketing - Introduction and Importance of LinkedIn Marketing, Framing LinkedIn Strategy, Lead Generation through LinkedIn, Content Strategy, Analytics and Targeting. Twitter Marketing- Introduction to Twitter Marketing, how twitter Marketing is different than other forms of digital marketing, framing content strategy, Twitter Advertising Campaigns.

### **UNIT IV INTRODUCTION TO SEO SEM WEB ANALYTICS 9**

Introduction and need for SEO, How to use internet & search engines; search engine and its working pattern, On-page and off-page optimization, SEO Tactics - Introduction to SEM. Web Analytics - Google Analytics & Google AdWords; data collection for web analytics, multichannel attribution, Universal analytics, Tracking code.

### **UNIT V MOBILEMARKETING, TRENDS IN DIGITAL ADVERTISING 9**

Trends in digital advertising. Mobile Marketing- Mobile Advertising, Forms of Mobile Marketing, Features, Mobile Campaign Development, Mobile Advertising Analytics. E-Mail marketing. Social Media and online consumer engagement. Introduction to social media metrics.

**L: 45; TOTAL: 45 PERIODS**

### TEXT BOOKS

1. Seema Gupta, "Digital Marketing", First Edition McGraw Hill Education, 2018.
2. Damian Ryan, Calvin Jones, "Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation", Second Edition, Kogan Page Publishers, 2012.

### REFERENCES

1. Puneet Singh Bhatia, "Fundamentals of Digital Marketing", First Edition, Pearson, 2017.
2. Ian Dodson, "The Art of Digital Marketing: The Definitive Guide to Creating Strategic, Targeted, and Measurable Online Campaigns", Wiley, 2016.

### WEB REFERENCE

1. <https://learndigital.withgoogle.com/digitalunlocked>
2. <https://digitalskills.fb.com/en-in/>
3. <https://www.hubspot.com/digital-marketing>
4. [https://onlinecourses.swayam2.ac.in/ugc19\\_hs26](https://onlinecourses.swayam2.ac.in/ugc19_hs26)

**19IT31E**

**ADVANCED JAVA PROGRAMMING**

**L T P C  
3 0 0 3**

### PRE REQUISTE

- Problem Solving Techniques
- Java
- Computer Networks
- Internet and Web Technology

### COURSE OUTCOMES

Upon completion of this course the students will be able to

- CO1: develop dynamic web applications using servlets. (K3)
- CO2: extend dynamic web applications using JSP. (K3)
- CO3: implement struts actions and action mappings. (K3)
- CO4: configure the spring framework as part of the project. (K3)
- CO5: explain distributed and network programs using java. (K2)

### UNIT I

#### SERVLETS

**9**

Servlet Overview and Architecture – Interface Servlet - Servlet Life Cycle – Handling HTTP get Requests – Handling HTTP post Requests – Redirecting Requests.

### UNIT II

#### JAVA SERVER PAGES

**9**

Introduction – Java Server Pages Overview – JSP Tags – JSP Lifecycle - A First JavaServer Page Example – Implicit Objects – Scripting – Standard Actions – Directives.

### UNIT III

#### STRUTS 2

**9**

struts2: Features, architecture, action class, configuration, interceptors – struts2 validation: custom validation and bundled validation.

### UNIT IV

#### SPRING FRAMEWORK

**9**

spring modules - spring in eclipse - dependency injection - dependency AOP spring - spring JDBC template - spring MVC: MVC curd example, File upload example, validation – MVC form tag library - spring remoting.

**UNIT V DISTRIBUTED AND NETWORK PROGRAMMING 9**

RMI: Stub and Skeleton - Creating a Simple RMI application - RMI application with database–Sockets – secure sockets – custom sockets – UDP datagrams – multicast sockets – URLclasses – configuring the connection

**L: 45 TOTAL: 45 PERIODS**

**TEXT BOOKS**

1. Paul J. Deitel, Harvey Deitel, “Java How To Program, Late Objects Version”, Tenth Edition, 2014.
2. H. M.Deitel, P. J. Deitel, S. E. Santry, “Advanced Java 2 Platform How To Program”, Second Edition, Prentice Hall, 2002.

**REFERENCES**

1. Herbert Schildt, “Java the Complete Reference”, Eleventh Edition, Tata McGraw Hill Publishing Company Limited, 2018.
2. Hortsman and Cornell, “Core Java: Advanced features”, Eighth Edition, Volume II, 2013.
3. Ed Roman, “Mastering Enterprise JavaBeans and the Java 2 Platform”, Enterprise Edition, Wiley Publishing Inc, 2004.

**19IT32E**

**GAME PROGRAMMING**

**L T P C  
3 0 0 3**

**PRE REQUISTE**

- Multimedia Computing

**COURSE OUTCOMES**

Upon completion of this course the students will be able to

- CO1: discuss the concepts of Game design and development. (K2)
- CO2: design the processes, and use mechanics for game development. (K3)
- CO3: explain the Core architectures of Game Programming. (K2)
- CO4: use Game programming platforms, frame works and engines. (K2)
- CO5: create interactive Games. (K3)

**UNIT I 3D GRAPHICS FOR GAME PROGRAMMING 9**

3D Transformations – Quaternions - 3D Modeling and Rendering - Ray Tracing – Shader Models – Lighting – Color – Texturing - Camera and Projections - Culling and Clipping - Character Animation - Physics-based Simulation - Scene Graphs.

**UNIT II GAME ENGINE DESIGN 9**

Game engine architecture - Engine support systems - Resources and File systems – Gameloop and real-time simulation - Human Interface devices - Collision and rigid body dynamics- Game profiling.

**UNIT III GAME PROGRAMMING 9**

Application layer - Game logic - Game views - managing memory - controlling the main loop - loading and caching game data - User Interface management - Game event management.

**UNIT IV GAMING PLATFORMS AND FRAMEWORKS 9**

2D and 3D Game development using Flash – DirectX – Java – Python – OpenGL – Game engines – Unity – DX Studio.

**UNIT V GAME DEVELOPMENT 9**

Developing 2D and 3D interactive games using DirectX or Python – Isometric and TileBased Games - Puzzle games - Single Player games - Multi Player games.

**L: 45; TOTAL: 45 PERIODS**

**TEXT BOOKS**

1. Mike Mc Shaffrly and David Graham, “Game Coding Complete”, Fourth Edition, Cengage Learning, PTR, 2012.
2. Jason Gregory, “Game Engine Architecture”, CRC Press / A K Peters, 2009.
3. David H. Eberly, “3D Game Engine Design, Second Edition: A Practical Approach to Real-Time Computer Graphics” Second Edition, Morgan Kaufmann, 2006.

**REFERENCES**

1. Ernest Adams and Andrew Rollings, “Fundamentals of Game Design”, Second Edition Prentice Hall / New Riders, 2009.
2. Eric Lengyel, “Mathematics for 3D Game Programming and Computer Graphics”, Third Edition, Course Technology PTR, 2011.
3. Jesse Schell, “The Art of Game Design: A book of lenses”, First Edition, CRC Press, 2008.

**19IT33E**

**ASP.NET FRAMEWORKS**

**L T P C  
3 0 0 3**

**COURSE OUTCOMES:**

Upon completion of this course, the students will be able to

- CO1: Describe about the basics of .NET Framework and C# Framework(K2)
- CO2: Describe the architecture and razor pages in ASP. NET(K2)
- CO3: Describe the web service layers in ASP.NET Framework(K3)
- CO4: Describe the grid view control in ADO.NET(K3)
- CO5: Use advanced concepts related to Web Services, WCF, and WPF in project development.(K2)

**UNIT 1 INTRODUCTION TO .NET FRAMEWORK AND C# FRAMEWORK 9**

Functional Programming-Event Programming and GUI-Limitations of Conventional Programming Technologies before .NET-What is .NET - .NET Platform Explore NET Framework 4.7- Understand Common language Runtime- Garbage Collection-Role of CTS and CLS- Base Class Libraries-Difference between Managed Code and Unmanaged Code-Basics of C# -Nameof Expression-Null Conditional Operator-Expression Bodied Methods-String interpolation-Tuples-Local functions

**UNIT II ASP.NET MVC, RAZOR PAGES (PRESENTATION LAYER) 9**

Introduction to MVC Models-Introduction to MVC Controllers-Introduction to MVC Views-Creating MVC Models using Entity Framework- Creating a Data Repository- Customizing Entities-Writing Controllers and Actions-Adding Action Filters with Controllers- Creating Views with Razor Syntax-Using HTML Helpers

**UNIT III WEB API & REST PRINCIPLE (SERVICE LAYER) 9**  
Creating a Web API that Supports CRUD Operations, Using Web API with ASP.NET Web Forms, Calling a Web API from a .NET Client- Restful APIs, Scaffolding, Error Handling.

**UNIT IV ENTITY FRAMEWORK 6.0 9**  
Generating and Querying an Entity Data Model (EDM)- Creating Database First-Model First and Code First Entity Data Models-Customizing the Entity Data Model-Create CRUD Database Applications using SqlDataReader-SqlDataAdapter-DataSet-DataRow and DataColumn-Create Database Applications with Stored Procedures- XML and ADO.NET Communication-Create GridView-Working with FormView, ListView, DetailsView, DataList, Chart Control and DataPager controls-Bound Fields and Customized Template Columns.

**UNIT V ADVANCED .NET 9**  
Introduction to Windows Presentation Foundation (WPF)- Window Communication Foundation and its Application

**L: 45 TOTAL: 45 PERIODS**

### TEXTBOOKS

1. Matthew Macdonald and Robert Standefer, "ASP.NET Complete Reference", 1<sup>st</sup> Edition, Mc Graw Hill, 2002
2. Andrew Troelsen, Philip Japikse," C# 6.0 and the .NET 4.6 Framework", 7<sup>th</sup> Edition, Apress, 2015

### REFERENCES

1. Vijay Mukhi, "C# The Basics", 1<sup>st</sup> Edition, BPB Publications ,2001
2. Christian Nagel, "Professional C# .Net", 7<sup>th</sup> Edition, Wrox Publication, 2018
3. <https://www.tutorialspoint.com/asp.net/index.htm>
4. <https://www.javatpoint.com/asp-net-tutorial>

**19IT34E**

**DEVOPS (AGILE)**

**L T P C**

**3 0 0 3**

### PRE REQUISITES

- Linux Basics
- Python

### COURSE OUTCOMES

Upon completion of this course the students will be able to

- CO1: discuss the different actions performed through Version control tools like Git & Git Huband. (K2)
- CO2: perform Continuous Integration using Jenkins by building and automating test cases using Maven.(K3)
- CO3: develop microservices based application using Dockers & Containers. (K3)
- CO4: install Ansible and configure ansible roles and to write playbooks and finally executead-commands using Ansible. (K3)
- CO5: explain how to continuously monitor application specific tasks using various plugins and implement NagloS Commands. (K2)

**UNIT I INTRODUCTION TO DEVOPS, AWS, GIT & GITHUB 9**  
Devops Essentials - Introduction To Amazoncloud - Version control systems: Git and Github.

**UNIT II                    COMPILER AND BUILD USING MAVEN                    9**

Introduction, Installation of Maven, POM files, Maven Build lifecycle, Build phases (compile, build, test, package) Maven Profiles, Maven repositories (local, central, global), Maven plugins, Maven create and build Artifacts, Dependency management, Maven Plugin management.

**UNIT III                    CONTINUOUS INTEGRATION USING JENKINS                    9**

Install & Configure Jenkins, Jenkins Architecture Overview, Creating a Jenkins Job, Configuring a Jenkins job, Introduction to Plugins, Adding Plugins to Jenkins, Commonly used plugins (Git Plugin, Parameter Plugin, HTML Publisher, Copy Artifact and Extended choice parameters). Configuring Jenkins to work with java, Git and Maven, Creating a Jenkins Build and Jenkins workspace.

**UNIT IV                    CONFIGURATION MANAGEMENT USING ANSIBLE                    9**

Ansible Introduction, Installation, Ansible master/slave configuration, YAML basics, Ansible modules, Ansible Inventory files, Ansible playbooks, Ansible Roles, adhoc commands in ansible.

**UNIT V                    DOCKERS AND CONTAINERS                    9**

Virtualization vs Containerization, Introduction to Docker, Docker Architecture, Docker Fundamentals, Docker Images & Distribution, Searching for images in docker repository, Pulling images from docker repository, Executing docker images pulled from repository, Create, Start, Stop and Remove Containers, Sharing Data in your Docker Host with Container, Saving Images and containers as Tar File for Sharing.

**L: 45; TOTAL: 45 PERIODS**

**TEXT BOOKS**

1. Roberto Vormittag, "A Practical Guide to Git and GitHub for Windows Users: From Beginner to Expert in Easy Step-By-Step Exercises", Second Edition, Kindle Edition, 2016.
2. James Turnbull, "The Docker Book: Containerization is the new virtualization", Kindle Edition, 2014.
3. Jason Cannon, "Linux for Beginners: An Introduction to the Linux Operating System and Command Line", Kindle Edition, 2014.

**REFERENCES**

1. James Turnbull, Sid Orlando, "The Art of Monitoring", Kindle Edition, 2016.
2. Jeff Geerling, "Ansible for DevOps: Server and configuration management for humans", First Edition, 2015.
3. David Johnson, "Ansible for DevOps: Everything You Need to Know to Use Ansible for DevOps", Second Edition, 2016.
4. Mariot Tsitoara, "Ansible 6. Beginning Git and GitHub: A Comprehensive Guide to Version Control, Project Management, and Teamwork for the New Developer", Second Edition, 2019.

**19IT35E**

**UNIX INTERNALS**

**L T P C  
3 0 0 3**

**PREREQUISITES**

- Computer Organization and Architecture
- Operating System

**COURSE OUTCOMES**

Upon completion of this course the students will be able to



- CO1: explain the UNIX operating system working principles. (K2)
- CO2: describe the UNIX programs using file system calls. (K2)
- CO3: explain the structure and file allocation techniques. (K2)
- CO4: define the various process scheduling approaches. (K2)
- CO5: explain the memory and I/O management concepts. (K2)

**UNIT I OVERVIEW 9**

General Overview of the System: History – System Structure – User Perspective – Operating System Services – Assumptions about Hardware. Introduction to the Kernel: Architecture of the UNIX Operating System – Introduction to System Concepts. The Buffer Cache: Buffer Headers – Structure of the Buffer Pool – ScenarioS for Retrieval of a Buffer – Reading and Writing Disk Blocks – Advantages and Disadvantages of the Buffer Cache.

**UNIT II FILE SUBSYSTEM 9**

Internal Representation of Files: Inodes – Structure of a Regular File – Directories – Conversion of a Path Name to an Inode – Super Block – Inode Assignment to a New File – Allocation of Disk Blocks.

**UNIT III SYSTEM CALLS FOR THE FILE SYSTEM 9**

Open – Read – Write – File and Record Locking – Adjusting the Position of File I/O – Lseek – Close – File Creation – Creation of Special Files – Changing Directory, Root Owner, Mode – stat and fstat – Pipes – Dup – Mounting and Unmounting File Systems – Link – Unlink.

**UNIT IV PROCESSES 9**

Process States and Transitions – Layout of System Memory – TheContext of a Process – Saving the Context of a Process – Manipulation of the Process Address Space - Sleep. Process Control : Process Creation – Signals – Process Termination – Awaiting Process Termination – Invoking Other Programs – User Id of a Process – Changing the Size of a Process - Shell – System Boot and the INIT Process– Process Scheduling.

**UNIT V MEMORY MANAGEMENT AND I/O 9**

Memory Management Policies: Swapping – Demand Paging. The I/O Subsystem: Driver Interface – Disk Drivers – Terminal Drivers– Streams – Inter Process Communication.

**L: 45 TOTAL: 45 PERIODS**

**TEXTBOOK**

1. Maurice J. Bach, "The Design of the Unix Operating System", First Edition, Pearson Education, 2015.

**REFERENCES**

1. John Lion, "Lion's Commentary on UNIX", Sixth Edition, Peer-to-Peer Communications, 2004.
2. Goodheart.B, Cox.J, "The Magic Garden Explained: The Internals of UNIX System", Prentice Hall of India, 1994.
3. Daniel P. Bovet & Marco Cesati, "Understanding the Linux Kernel", O'REILLY, Shroff Publishers & Distributors Pvt. Ltd, 2000.
4. Uresh Vahalia, "Unix Internals: The New Frontiers", Pearson Education, 2000.

19IT36E

**COMPILER DESIGN****L T P C**  
**3 0 0 3****PRE REQUISTE**

- Problem Solving Techniques
- Data Structures
- Computer Architecture

**COURSE OUTCOMES:**

Upon completion of the course the students will be able to

- CO1: explain the various phases of a prototype compiler. (K2)
- CO2: apply lexical rules and grammars for a programming language. (K2)
- CO3: describe various parsing techniques. (K2)
- CO4: explain memory allocation and symbol table. (K2)
- CO5: apply various types of intermediate code generation for various constructs. (K2)

**UNIT I INTRODUCTION TO COMPILER 9**

Translators-Compilation and Interpretation-Language processors -The Phases of Compiler-Errors encountered in Different Phases-The Grouping of Phases-Compiler Programming Language basics.

**UNIT II LEXICAL ANALYSIS 9**

Lexical Analysis – Role of Lexical Analyzer – Input Buffering – Specification of Tokens – Recognition of Tokens–Finite Automata – Converting Regular expression to DFA–Minimization of DFA-Language for Specifying Lexical Analyzers - LEX.

**UNIT III SYNTAX ANALYSIS 9**

Role of Parser – Grammars – Error Handling – Context-free grammars – Writing a grammar, Top-Down Parsing – General Strategies Recursive Descent Parser – Predictive Parser – LL(1) Parser-Shift Reduce Parser–LR Parser- LR(0) Item Construction of SLR Parsing Table –Introduction to LALR Parser – Error Handling and Recovery in Syntax Analyzer–YACC.

**UNIT IV SYNTAX DIRECTED TRANSLATION AND RUN TIME ENVIRONMENT 9**

Syntax Directed Definitions–Evaluation Orders for Syntax Directed Definitions–Intermediate Languages: Syntax Tree, Three Address Code, Types and Declarations, Translation of Expressions, Type Checking.  
Run-Time Environment: Source Language Issues–Storage Organization–Storage Allocation–Parameter Passing–Symbol Tables–Dynamic Storage Allocation.

**UNIT V CODE OPTIMIZATION AND CODE GENERATION 9**

Principal Sources of Optimization – Peep-hole optimization – DAG – Optimization of Basic Blocks – Global Data Flow Analysis – Efficient Data Flow Algorithm – Issues in Code Generation – Design of a simple Code Generator

**L: 45; TOTAL: 45 PERIODS****TEXT BOOK**

1. Alfred V Aho, Monica S. Lam, Ravi Sethi and Jeffrey D Ullman, “Compilers – Principles, Techniques and Tools”, Second Edition, Pearson Education, 2015.

**REFERENCES**

1. K.Muneeswaran, “Compiler Design”, Oxford University Press 2013.
2. Steven S. Muchnick, “Advanced Compiler Design and Implementation”, “Morgan Kaufmann Publishers – Elsevier Science, India, Indian Reprint 2003.

19IT37E

SOFTWARE TESTING TOOLS

L T P C  
3 0 0 3

### COURSE OUTCOMES

Upon completion of the course, the students will be able to:

- CO1: explain the fundamental concepts in software engineering. (K2)
- CO2: discuss the software testing process. (K2)
- CO3: generate test cases using WinRunner tool. (K3)
- CO4: explain and work on QuickTestPro and selenium testing tool. (K3)
- CO5: apply Load Runner and Test Director tools for testing projects. (K3)

### UNIT I SOFTWARE ENGINEERING EVALUATION 9

Software Development Process Models - Requirements Management - Software Design - Coding and Unit Testing - Integration Testing - System testing - Installation and Acceptance - Customer Support / Maintenance.

### UNIT II SYSTEM TESTING PROCESS 9

System testing Process - System Test Commencement - System Test Planning - Test Design - Test Execution - Test Reporting and Defect Tracking.

### UNIT III WINRUNNER 9

Introduction to WinRunner - checkpoints in WinRunner - Data Driven and Batch Testing - Improve Test Automation in WinRunner - GUI Mapping - Web test Option in WinRunner.

### UNIT IV QTP & SELENIUM 9

QuickTestPro Introduction - Edit Test Scripts - Improving Test Automation in QTP - Data Driven and Batch Testing - Web Test Options in QTP – Selenium: Selenium Ide - Overview Of Selenium Webdriver - Testing Framework for Selenium.

### UNIT V LOADRUNNER AND TESTDIRECTOR 9

LoadRunner: Introduction to Performance Testing - VuserScript Creation Using LoadRunner - VuserScript Execution and Results Analysis - TestDirector: Site Administrator - Understanding TestDirector.

**L: 45; TOTAL: 45 PERIODS**

### TEXT BOOKS

1. Ali Mili, Fairouz Tchier, "Software Testing Concepts and Operations", Wiley, 2015.
2. Nageshwar Rao Pusuluri, "Software Testing Concepts and Tools", Dreamtech Press, 2008.

### REFERENCES

1. Dr. K.V.K.K. Prasad, "Software Testing Tools: Covering WinRunner, Silk Test, LoadRunner, JMeter, TestDirector and QTP with case studies", 2009.

### WEB REFERENCES

1. [http://sqa.fyicenter.com/winrunner\\_tutorial/index.html](http://sqa.fyicenter.com/winrunner_tutorial/index.html)
2. <https://www.tutorialspoint.com/qtp/index.html>
3. <https://www.wisdomjobs.com/e-university/selenium-tutorial-476.html>
4. [https://www.tutorialspoint.com/loadrunner\\_online\\_training/index.asp](https://www.tutorialspoint.com/loadrunner_online_training/index.asp)
5. <https://www.wisdomjobs.com/e-university/loadrunner-tutorial-170.html>
6. <http://www.etestinghub.com/testdirector.php>

19IT38E

**FUNCTIONAL PROGRAMMING****L T P C**  
**3 0 0 3****COURSE OUTCOMES**

Upon completion of this course, the students will be able to

- CO 1: write simple Programs using functional programming. (K2)
- CO 2: implement List with functional programming. (K2)
- CO 3: apply Haskell in various Data structures. (K3)
- CO 4: analyze the efficiency of Haskell Programming. (K3)
- CO 5: create functional programming with Monads. (K3)

**UNIT I INTRODUCTION 9**

Functional programming-Introduction-Function Types-Function composition-Example-Haskell Platform Expression, Types and values-Session with GHCi-Names and operators-Evaluation-Types and Type classes-Printing Values-Modules-Haskell Layout-Numbers-type class NUM-numeric type classes-computing floors-Natural Numbers.

**UNIT II LIST 9**

List notation - Enumerations - List comprehensions - Some basic operations - Concatenation - concat, map and filter -zip and zip With - Common words, completed –A simple Sudoku solver- Specification - Lawful program construction Pruning the matrix of choices - Expanding a single cell.

**UNIT III DATA STRUCTURE WITH HASKELL 9**

Functional Vs Imperative Data Structure-Strict Vs Lazy Evaluation-List-Binary Search Trees-Left list Heaps-Binomial Heaps-Red Black Trees-Techniques of Amortized Analysis-Queues-. Drawing Primitive Shapes,Sierpinski's Triangle,Snow-flake,Coordinate Systems.

**UNIT IV PROOFS AND EFFICIENCY 9**

Induction over natural numbers - Induction over lists - The function foldr - The function foldl - The function scanl - The maximum segment sum -Lazy evaluation-Controlling space-Controlling time- Analysing time- Accumulating parameters –Tupling-Sorting.

**UNIT V IMPERATIVE FUNCTIONAL PROGRAMMING 9**

The IO monad- More monads- The State monad - The ST monad- Mutable arrays - Immutable arrays-Parsers as monads -Basic parsers - Choice and repetition-Grammars and expressions-Showing expressions.

**L: 45; TOTAL: 45 PERIODS****TEXT BOOKS**

1. Richard Bird, "Thinking Functionally With Haskell", Cambridge University Press, 2015
2. Chris Okasaki," Purely Functional Data Structures", Cambridge University Press, 2014

**REFERENCES**

1. Simon Thompson Haskell: "The Craft of Functional Programming", Third Edition,2011
2. Graham Hutton, "Programming in Haskell", Cambridge University Press, 2007.
3. Bryan O'Sullivan, Don Stewart, and John Goerzen, "Real World Haskell", O'Reilly Media, 2008.
4. Miran Lipovača, "Learn You a Haskell for Great Good! A Beginner's Guide", No Starch Press, 2011.
5. Richard Bird, "Introduction to Functional Programming using Haskell", second edition, Prentice-Hall International, 1998

19IT39E

WIRELESS ADHOC AND SENSOR NETWORKS

L T P C

3 0 0 3

### COURSE OUTCOMES

Upon completion of the course, the students will be able to

CO1: Identify different issues in wireless ad hoc and sensor networks. (K2)

CO2: analyze protocols developed for ad hoc and sensor networks. (K3)

CO3: identify and understand security issues in ad hoc and sensor networks. (K2)

CO4: describe the importance of QoS in wireless sensor network. (K2)

CO5: identify the attacks and suitable defense mechanism in sensor networks. (K2)

### UNIT I MAC & ROUTING IN AD HOC NETWORKS

9

Introduction – Issues and challenges in ad hoc networks – MAC Layer Protocols for wireless ad hoc networks – Contention-Based MAC protocols – MAC Protocols Using Directional Antennas – Multiple-Channel MAC Protocols – Power-Aware MAC Protocols – Routing in Ad hoc Networks – Design Issues – Proactive, Reactive and Hybrid Routing Protocols.

### UNIT II TRANSPORT & QOS IN AD HOC NETWORKS

9

TCP's challenges and Design Issues in Ad Hoc Networks – Transport protocols for ad hoc networks – Issues and Challenges in providing QoS – MAC Layer QoS solutions – Network Layer QoS solutions – QoS Model.

### UNIT III MAC & ROUTING IN WIRELESS SENSOR NETWORKS

9

Introduction – Applications – Challenges – Sensor network architecture – MAC Protocols for wireless sensor networks – Low duty cycle protocols and wakeup concepts – ContentionBased protocols – Schedule-Based protocols – IEEE 802.15.4 Zigbee – Topology Control – Routing Protocols.

### UNIT IV TRANSPORT & QOS IN WIRELESS SENSOR NETWORKS

9

Data-Centric and Contention-Based Networking – Transport Layer and QoS in Wireless Sensor Networks – Congestion Control in network processing – Operating systems for wireless sensor networks – Examples.

### UNIT V SECURITY IN AD HOC AND SENSOR NETWORKS

9

Security Attacks – Key Distribution and Management – Intrusion Detection – Software based Anti-tamper techniques – Water marking techniques – Defense against routing attacks - Secure Ad hoc routing protocols – Broadcast authentication WSN protocols – TESLA – Biba – Sensor Network Security Protocols – SPINS.

**L: 45; TOTAL: 45 PERIODS**

### TEXT BOOKS

1. C.Siva Ram Murthy and B.S.Manoj, "Ad Hoc Wireless Networks – Architectures and Protocols", Pearson Education, 2006.
2. Holger Karl, Andreas Willing, "Protocols and Architectures for Wireless Sensor Networks", John Wiley & Sons, Inc., 2005.

### REFERENCES

1. Subir Kumar Sarkar, T G Basavaraju, C Puttamadappa, "Ad Hoc Mobile Wireless Networks", Auerbach Publications, 2008.

2. Carlos De MoraisCordeiro, Dharma Prakash Agrawal, "Ad Hoc and Sensor Networks: Theory and Applications" Second Edition, World Scientific Publishing, 2011.
3. WalteneagusDargie, Christian Poellabauer," Fundamentals of Wireless Sensor Networks Theory and Practice", John Wiley and Sons, 2010.
4. Xiang-Yang Li, "Wireless Ad Hoc and Sensor Networks: Theory and Applications", Seventh Edition, Cambridge university Press, 2008.

**19IT40E****NEXT GENERATION NETWORKS****L T P C****3 0 0 3****COURSE OUTCOMES**

Upon completion of the course, the students will be able to

- CO1: explain the 4G networks and LTE. (K2)
- CO2: design systems for the requirements of the recent standards. (K2)
- CO3: outline the concept of fiber access technologies. (K2)
- CO4: discuss the mobile IP networks and routing. (K2)
- CO5: describe the mobile ad hoc networks and routing. (K2)

**UNIT I INTRODUCTION 9**

Introduction to 1G/2G/3G/4G Terminology - Evolution of Public Mobile Services - Motivation for IP Based Wireless Networks - Requirements and Targets for Long Term Evolution (LTE) - Technologies for LTE- 4G Advanced Features and Roadmap Evolutions from LTE to LTEA - Wireless Standards. Network Model-Network Connectivity-Wireless Network Design with Small World Properties – 5G Roadmap – Ten Pillars of 5G.

**UNIT II REVIEW OF ACCESS TECHNOLOGIES 9**

Phone-Line modem– cable-access ISDN– Emerging Broad band Technologies–Cable DSL– Fiber and Wireless– Standards for access network.

**UNIT III FIBER ACCESS TECHNOLOGIES 9**

Optical Fiber in access networks, Architecture and Technologies- Hybrid fiber – Coax (HFC) system, Switched Digital Video (SDV) – Passive optical networks (PON) – FTTX (FTTH, FTTB, FTTC, FTT cab) comparison, Broadband PON , Gigabit-Capable PON.

**UNIT IV MOBILE - IP NETWORKS 9**

Macro-mobility Protocols, Micro-mobility protocol: Tunnel based : Hierarchical Mobile IP, Intra domain Mobility Management, Routing based: Cellular IP, Handoff Wireless Access Internet Infrastructure (HAWAII).

**UNIT V MOBILE AD-HOC NETWORKS 9**

Internet-based mobile ad-hoc networking communication strategies, Routing algorithms – Proactive routing: destination sequenced Distance Vector Routing (DSDV) – Reactive routing : Dynamic Source Routing (DSR) – Ad hoc On-Demand Distance Vector Routing (AODV) – Hybrid Routing: Zone Based Routing (ZRP).

**L:45; TOTAL :45 PERIODS**

## TEXT BOOKS

1. Ayman ElNashar, Mohamed El-saidny, Mahmoud Sherif, "Design, Deployment and Performance of 4G-LTE Networks: A Practical Approach", John Wiley & Sons, 2014.
2. Sassan Ahmadi, "LTE-Advanced – A practical systems approach to understanding the 3GPP LTE Releases 10 and 11 radio access technologies", Elsevier, 2014.
3. Niel Ransom and Albert A. Azzam, "Broadband Access Technologies: ADSL, VDSL Cable Modem, Fiber and LMDS", McGraw Hill, 1999.
4. Jonathan Rodriguez, "Fundamentals of 5G Mobile Networks", Wiley, 2015.

## REFERENCES

1. Walter J Woralski, "ADSL and DSL Technologies", McGraw Hill Computer Communication Series, Second Edition, Oct 2001.
2. William Webb, "Introduction to Wireless Local Loop Broadband and Narrow Band System", Mobile Communication Series, Artech House Publishers, Second Edition 2000.
3. C.Siva Rama Murthy and Mohan Gurusamy, "WDM Optical Networks – Concepts, Design and Algorithms", Prentice Hall of India Pvt. Ltd, New Delhi , 2002.
4. Ian F. Akyildiz, Jiang Xie and Shantidev Mohanty, "A Survey of mobility Management in Next generation All IP- Based Wireless Systems", IEEE Wireless Communications Aug 2004.
5. Yin Zhang, Min Chen, "Cloud Based 5G Wireless Networks – Springer Briefs in Computer Science", Springer, 2016.

**19IT41E**

**NETWORK PROGRAMMING AND MANAGEMENT**

**L T P C**

**3 0 0 3**

## COURSE OUTCOMES

Upon completion of the course students will be able to

- CO1: explain the basics of computer networks and the inter-process communication. (K2)
- CO2: elaborate the client server sockets and some of its widely used protocols. (K2)
- CO3: narrate the client and server side network programming concepts and its applications. (K3)
- CO4: explain the basics of network management concepts and its types. (K2)
- CO5: discuss the various network management protocols and tools. (K2)

**UNIT I**

**INTRODUCTION TO NETWORK PROGRAMMING**

**9**

Basic Network Concepts – Streams – Multi-threading - Inter-thread and Inter-process Communication - Internet Addresses - URLs and URIs – HTTP – URLConnections.

**UNIT II**

**SOCKETS FOR CLIENTS AND SERVER**

**9**

Using Client Sockets - Constructing and Connecting Client Sockets - Setting Client Socket Options - Using ServerSockets - Constructing Server Sockets – Server Socket Options - Support for Communication-Based Services.

**UNIT III**

**CLIENT–SERVER NETWORK PROGRAMMING**

**9**

Client-Side: Introduction - Web Documents Classification - Static Documents - Active Documents, Server-Side: Introduction - Non-Java Server-Side Network Programming Solutions – JavaServlets - Java Server Pages.

#### **UNIT IV NETWORK MANAGEMENT OVERVIEW 9**

Requirements for the Management of Networked Systems - IP Network Management - Network Management Issues - Network Management Architecture – Challenges of IT Managers - Passive and Active Network Monitoring - MPLS Network Management.

#### **UNIT V NETWORK MANAGEMENT PROTOCOLS AND TOOLS 9**

SNMP – RMON – System Utilities for Management – Network Statistics Management Systems – MIB Engineering – NMS Design – Mobile Wireless Networks - Network Management Applications.

**L: 45; TOTAL :45 PERIODS**

#### **TEXT BOOKS**

1. Elliotte Rusty Harold, “Java Network Programming”, Fourth Edition, O’Reilly Media, Inc, ISBN: 978-1-449-35767-2, 2013.
2. Mani Subramanian, “Network Management: Principles and Practice”, Second Edition, Pearson Education, ISBN: 978-81-317-2759-1, 2010.

#### **REFERENCES**

1. Bogdan Ciubotaru, Gabriel-Miro Muntean, “Advanced Network Programming – Principles and Techniques: Network Application Programming with Java”, Springer, ISBN 978-1-4471-5291-0, 2013.
2. Adrian Farrel, “Network Management Know It All”, Morgan Kaufmann Publishers, ISBN 978-0-12-374598-9, 2009
3. W. Richard Stevens, “TCP/IP Illustrated, Volume 1: The Protocols”, Addison-Wesley, ISBN: 0201633469, 1994.
4. Jan Graba, “An Introduction to Network Programming with Java”, Springer, ISBN-13: 978-1-84628-380-2, 2007.
5. Timothy Rooney, “IP Address Management Principles and Practice”, Wiley-IEEE Press, 2011.
6. Richard Burke, “Network Management: Concepts and Practice, A Hands-On Approach”, Pearson Education, ISBN: 9788131718490, 2008.

**19IT42E**

**INFORMATION SECURITY**

**L T P C  
3 0 0 3**

#### **PRE REQUISTE**

- Cryptography and Network Security
- Fundamentals of Network

#### **COURSE OUTCOMES**

Upon completion of this course, the students will be able to

- CO1: explain the various components and their security in an information system. (K2)  
 CO2: acquire the basic knowledge on vulnerabilities in any computing system. (K2)  
 CO3: analyze the possible security attacks in complex real time systems. (K2)



CO4: explain the concepts of audits and controls for information security. (K2)

CO5: explore the knowledge on different techniques for physical security. (K2)

**UNIT I INTRODUCTION 9**

History - Information Security - Critical Characteristics of Information - NSTISSC Security Model - Components of an Information System - Securing the Components - Balancing Security and Access – SDLC – Security.

**UNIT II SECURITY INVESTIGATION 9**

Need for Security - Business Needs - Threats - Attacks - Legal - Ethical and Professional Issues.

**UNIT III SECURITY ANALYSIS 9**

Risk Management: Overview- Identification – Assessment – Control Strategies – Benchmarking and Best practices.

**UNIT IV AUDITS, CONTROLS AND CONSOLIDATION 9**

Introduction – Establishing a control environment – security audits – preparing and planning for a security audit – executing a security audit – security policies: information security policies – building and implementing security policies.

**UNIT V PHYSICAL DESIGN 9**

Security Technology – IDS - Scanning and Analysis Tools – Cryptography - Access Control Devices - Physical Security - Security and Personnel.

**L: 45; TOTAL: 45 PERIODS**

**TEXT BOOK**

1. Michael E Whitman and Herbert J Mattord, “Principles of Information Security”, Cengage Learning, Fourth Edition, 2012.

**REFERENCES**

1. Micki Krause, Harold F. Tipton, “Handbook of Information Security Management”, Vol 1-3 CRC Press LLC, 2004.
2. Stuart Mc Clure, Joel Scrambray, George Kurtz, “Hacking Exposed”, Tata McGraw-Hill, 2003.
3. Amjad Umar, “Information Security and Auditing in the Digital Age A Practical Managerial Perspective”, NGE solutions, Inc. 2004.
4. Matt Bishop, “Computer Security Art and Science”, Pearson/PHI, 2002.

**19IT43E**

**CYBER FORENSICS AND ETHICAL HACKING**

**L T P C  
3 0 0 3**

**COURSE OUTCOMES**

Upon completion of this course, the students will be able to

CO1: explain the basics of computer forensic. (K2)

CO2: identify different computer forensic tools to a given scenario. (K2)

CO3: analysis and validate the various forensics data techniques. (K3)

CO4: identify the vulnerabilities in a given network infrastructure. (K3)

CO5: Apply the real-world hacking techniques to test system security. (K4)

<b>UNIT I</b>	<b>INTRODUCTION TO COMPUTER FORENSICS</b>	<b>9</b>
Introduction to Traditional Computer Crime, Traditional problems associated with Computer Crime. Introduction to Identity Theft & Identity Fraud. Types of CF techniques - Incident and incident response methodology - Forensic duplication and investigation. Preparation for IR: Creating response tool kit and IR team. - Forensics Technology and Systems - Understanding Computer Investigation – Data Acquisition.		
<b>UNIT II</b>	<b>EVIDENCE COLLECTION AND FORENSICS TOOLS</b>	<b>9</b>
Processing Crime and Incident Scenes – Working with Windows and DOS Systems. Current Computer Forensics Tools: Software/ Hardware Tools.		
<b>UNIT III</b>	<b>ANALYSIS AND VALIDATION</b>	<b>9</b>
Validating Forensics Data – Data Hiding Techniques – Performing Remote Acquisition – Network Forensics – Email Investigations – Cell Phone and Mobile Devices Forensics.		
<b>UNIT IV</b>	<b>ETHICAL HACKING</b>	<b>9</b>
Introduction to Ethical Hacking -Foot printing and Reconnaissance - Scanning Networks - Enumeration - System Hacking - Malware Threats – Sniffing.		
<b>UNIT V</b>	<b>ETHICAL HACKING IN WEB</b>	<b>9</b>
Social Engineering - Denial of Service - Session Hijacking - Hacking Web servers - Hacking Web Applications – SQL Injection - Hacking Wireless Networks - Hacking Mobile Platforms.		

**L: 45; TOTAL: 45 PERIODS**

#### **TEXTBOOKS**

1. Bill Nelson, Amelia Phillips, Frank Enfinger, Christopher Steuart, “Computer Forensics and Investigations”, Cengage Learning, India Edition, 2016.
2. CEH official Certified, “Ethical Hacking Review Guide”, Wiley India Edition, 2015.

#### **REFERENCES**

1. John R.Vacca, “Computer Forensics”, Cengage Learning, 2005
2. MarjieT.Britz, “Computer Forensics and Cyber Crime: An Introduction”, Third Edition, Prentice Hall, 2013.
3. AnkitFadia, “Ethical Hacking”, Second Edition, Macmillan India Ltd, 2006.
4. Kenneth C.Brancik, “Insider Computer Fraud”, Auerbach Publications Taylor & Francis Group–2008.

<b>19IT44E</b>	<b>INFORMATION THEORY AND CODING</b>	<b>L T P C</b>
		<b>3 0 0 3</b>

#### **COURSE OUTCOMES**

Upon completion of this course the students will be able to

- CO1: define the fundamental concepts of Information Theory, Source Coding and Error Control. (K2)
- CO2: examine the various coding and error Control Mechanisms available for text and audio data. (K2)
- CO3: demonstrate various source compression codes for image and video data. (K2)
- CO4: explain various methods of generating and detecting different types of error correcting block codes. (K2)
- CO5: formulate the basic equations of Convolutional codes. (K2)

**UNIT I INFORMATION THEORY 9**

Information – Entropy, Information rate, classification of codes, Kraft McMillan inequality, Source coding theorem, Shannon-Fano coding, Huffman coding, Extended Huffman coding - Joint and conditional entropies, Mutual information - Discrete memory less channels – BSC, BEC – Channel capacity, Shannon limit.

**UNITII SOURCE CODING: TEXT, AUDIO AND SPEECH 9**

Text: Adaptive Huffman Coding, Arithmetic Coding, LZW algorithm – Audio: Perceptual coding, Masking techniques, Psychoacoustic model, MEG Audio layers I,II,III, Dolby AC3 - Speech: Channel Vocoder, Linear Predictive Coding.

**UNIT III SOURCE CODING: IMAGE AND VIDEO 9**

Image and Video Formats – GIF, TIFF, SIF, CIF, QCIF – Image compression: READ, JPEG – Video Compression: Principles-I,B,P frames, Motion estimation, Motion compensation, H.261,H.264 and MPEG standards.

**UNIT IV ERROR CONTROL CODING: BLOCK CODES 9**

Definitions and Principles: Hamming weight, Hamming distance, Minimum distance decoding - Single parity codes, Hamming codes, Repetition codes - Linear block codes, binary cyclic codes, BCH codes, Reed-Solomon codes, Golay codes, Cyclic codes - Syndrome calculation, Encoder and decoder – CRC.

**UNIT V ERROR CONTROL CODING: CONVOLUTIONAL CODES 9**

Convolutional codes – code tree, trellis, state diagram - Encoding – Decoding: Sequential and Maximum-Likelihood decoding - Viterbi algorithm – Principle of Turbo coding.

**L: 45; TOTAL: 45 PERIODS**

**TEXT BOOKS**

1. R Bose, "Information Theory, Coding and Cryptography", Tata McGraw Hill, 2008
2. Fred Halsall, "Multimedia Communications: Applications, Networks, Protocols and Standards", Pearson Education Asia, 2007.
3. Paul May, "Mobile Commerce: Opportunities, Applications and Technologies of Wireless Business", Cambridge University Press, 2001.

**REFERENCES**

1. K.Sayood, "Introduction to Data Compression", Elsevier, Third Edition, 2012.
2. S Gravano, "Introduction to Error Control Codes", Oxford University Press, 2007
3. Amitabha Bhattacharya, "Digital Communication", Tata McGraw Hill, 2006.

<b>19IT45E</b>	<b>INTRODUCTION TO DATA SCIENCE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**COURSE OUTCOMES**

Upon completion of this course, the students will be able to

- CO1: explain how data are collected, managed and stored using data science (K2)
- CO2: describe various statistical and probability techniques used in the data science. (K2)
- CO3: explain the key concepts in data visualization approaches in the real-world applications (K2)
- CO4: analyze various data analytics techniques for the dataset. (K3).
- CO5: apply R tool used for solving problems in data science. (K3).

**UNIT I INTRODUCTION 9**

Benefits and uses of data science and big data – Facets of data – The data science process: Overview-Defining goals-Retrieving data – Cleaning, integrating and transforming data – Exploratory data analysis- Build the model – The big data ecosystem and data science – An introductory working example of Hadoop.

**UNIT II STATISTICAL TECHNIQUES 9**

Different Sectors using Data science-Linear algebra- vectors, matrices, product of matrix & vector, rank, null space – Statistics- Describing a single set of data-correlation- Simpson's paradox- Probability: Conditional probability - Bayes theorem-Random variables- Continuous and normal distribution- Hypothesis Testing.

**UNIT III DATA VISUALIZATION 9**

Basic principles, ideas and tools for data visualization, Plots and inferential statistics techniques matplotlib – barcharts - line charts - Scatter plots - Hypothesis and inferences: Statistical hypothesis testing- p-values – Confidence intervals – p-Hacking – Bayesian inference.

**UNIT IV DATA ANALYTICS 9**

Data Analytics Process, Knowledge Check, Exploratory Data Analysis (EDA), EDA- Quantitative technique, EDA- Graphical Technique, Data Analytics Conclusion and Predictions, Mathematical computing with Python (NumPy)- Scientific Computing with Python (SciPy). Data Manipulation with Pandas.

**UNIT V APPLICATION TOOL 9**

R Programming, Working with Data in R, data analysis problems using R tool, Data visualization in R, Recent trends in various data collection, application development methods in data science with Jupiter Stack.

**L: 45; TOTAL: 45 PERIODS**

**TEXT BOOKS**

1. Joel Grus, "Data Science from Scratch: First principles with python", Second edition, O'Reilly, 2019.
2. Davy cielen arno d. B. Meysman mohamed ali, "Introducing data science, big data, machine learning, and more, using python tools", Manning Publications, 2016.

**REFERENCES**

1. Hadley Wickham, Garrett Golemund, R for Data Science: Import, Tidy, Transform, Visualize, and Model Data, O'Reilly Media Inc, 2017.
2. Vijay Kotu, Bala Deshpande, Data Science: Concepts and Practice, Second Edition, Morgan Kaufmann Publishers,2018
3. Lillian Pierson, Data Science For Dummies, John Wiley & Sons, 2017.

**19IT46E MACHINE LEARNING TECHNIQUES**

**L T P C**  
**2 0 2 3**

**COURSE OUTCOMES**

Upon completion of the course, the students will be able to:

- CO1: explain the supervised and unsupervised techniques in machine learning. (K2)
- CO2: understand various classification techniques used in machine learning. (K2)
- CO3: analyze various types of clustering techniques for analyzing data. (K3)

CO4: apply optimization techniques for the effective implementation of algorithms. (K3)

CO5: apply the reinforcement learning concepts and its real time applications. (K3)

**UNIT I INTRODUCTION 12**

Introduction to machine learning – Machine learning applications – Supervised - Semi supervised - Unsupervised learning – Learning a class from example – Probably Approximately Correct learning – Noise – Learning multiple classes – Regression – Model selection and generalization.

**UNIT II CLASSIFICATION TECHNIQUES 12**

Introduction – Univariate trees: classification trees - Regression trees – Pruning – Rule extraction from trees – Learning rules from data – Multivariate trees- Linear discrimination – Generalizing linear model – Geometry of the linear discriminant – Pair wise separation – Parametric discrimination – Gradient Descent-Logistic discrimination

**UNIT III CLUSTERING TECHNIQUES 12**

Introduction – mixture densities – K-means Clustering – Expectation maximization algorithms – mixture of latent variable models – Supervised learning after clustering- Spectral clustering – Hierarchical clustering – Choosing the number of clusters.

**UNIT IV KERNEL MACHINES 12**

Support Vector Machine: Optimal separating hyper plane –  $\nu$ -SVM – Kernel trick – Vectorial kernels – Multiple kernel learning – multiclass kernel machines – Kernel machines for regression – kernel machines for ranking – One class kernel machine – Large margin nearest neighbor classifier – kernel dimensionality reduction.

**UNIT V REINFORCEMENT LEARNING 12**

Introduction – Single state case: K-Armed Bandit – Elements of reinforcement learning – Model based learning: Value iteration – Policy iteration – Temporal Difference learning: Exploration strategies- Deterministic and Non deterministic Rewards and Actions – Eligibility traces – Generalization – Partially observable states.

**L: 30; P: 30; TOTAL: 60 PERIODS**

**TEXT BOOKS**

1. Ethem Alpaydin, “Introduction to machine learning”, Third edition, PHI Learning Pvt.Ltd, 2017.

**REFERENCES**

1. Joel Grus, “Data Science from Scratch: First principles with python”, Second edition, O’Reilly, 2019.
2. Andreas C.Muller and Sarah Guido, —Introduction to Machine Learning with Python, O’Reilly Media, 2017.
3. <https://www.coursera.org/learn/machine-learning>.

<b>19IT47E</b>	<b>DATA ENGINEERING CONCEPTS AND TOOLS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>0</b>	<b>2</b>	<b>3</b>

**COURSE OUTCOMES**

Upon completion of the course, the students will be able to:

CO 1: discuss big data architecture and its computing techniques. (K2)

CO 2: Analyze the Hbase architecture functionalities. (K3)

CO 3: apply the data storage and processing techniques. (K3)

CO 4: describe the data stream architecture and its processing techniques (K3).

CO 5: explore the data analysis techniques using Power BI. (K3)

- UNIT I INTRODUCTION 12**  
 Evolution of Big data – Structure in big data – characteristics of big data – Big data Analytics – Architecture of big data systems - Big Data Use Cases – Data analytics life cycle: Life cycle for data- centric projects – Big data life cycle- Distributed and parallel computing for big data- cloud services and providers in big data market.
- UNIT II HADOOP ECOSYSTEM 12**  
 Introduction - HDFS architecture – Using HDFS files – HDFS commands – HBASE architecture – Storing Big data with HBase – Combing HDFS and HBase- Selecting the suitable Hadoop data organization for applications.
- UNIT III DATA STORAGE AND PROCESSING 12**  
 Overview of YARN – YARN Architecture – Scheduler – YARN configuration & commands – Log management – exploring Hive: Variables, Properties and Queries – Data types – Built-in functions – Hive DDL-Data manipulation in Hive – Data retrieval queries - Using JOINS in Hive- Impala – Kudu.
- UNIT IV MINING DATA STREAMS 12**  
 Introduction to Streams Concepts – Processing data streams – Data streaming architecture using Kafka and Spark- Spark streaming in R- 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
- UNIT V DATA ANALYSIS WITH POWER BI 12**  
 Introduction – Preparing data for analysis – Power BI architecture - Key metrics – Comparison analysis – Trend analysis – Ranking – Contribution analysis – Variance – Correlation – Frequency analysis- Power BI Visualizations- Interacting with Power BI.

**L: 30; P: 30; TOTAL: 60 PERIODS**

#### TEXT BOOKS

1. “Big data Black book”, comprehensive problem solver, DreamTech press, 2015 Edition.
2. Brain Larson, “Data Analysis with Microsoft Power BI”, first Edition, McGrawHill publication, 2019.

#### REFERENCES

1. Seema Acharya & Subhashini Chellappan, “Big Data and Analytics”, Wiley publications, Second Edition, 2019.
2. Sudha Sadasivam, R.Thirumahal, “Big data Analytics”, Oxford Higher education, 2020.
3. Bart Baesens, —Analytics in a Big Data World: The Essential Guide to Data Science and its Applications, Wiley Publishers, 2015.
4. Kim H. Pries and Robert Dunnigan, —Big Data Analytics: A Practical Guide for Managers, CRC Press, 2015.

19IT48E

WEB DATA MINING

L T P C  
2 0 2 3

### COURSE OUTCOMES

Upon completion of the course, the students will be able to:

- CO1: explain the association rule mining technique for the web data. (K2)
- CO2: analyze various information retrieval methods used in webpage processing. (K3)
- CO3: explain the social network analysis and web searching techniques.(K2)
- CO4: describe the use of various web crawlers for updating web content.. (K2)
- CO5: analyze the data modeling techniques for web usage mining. (K3)

### UNIT I INTRODUCTION 12

Introduction to internet and WWW, Data Mining Foundations, Association Rules and Sequential Patterns, Basic Concepts of Association Rules, Apriori Algorithm, Frequent Itemset Generation, Association Rule Generation, Data Formats for Association Rule Mining.

### UNIT II INFORMATION RETRIEVAL 12

Basic concepts - Information Retrieval models – Relevance Feedback - Text and Web Page Pre-Processing: Stopword Removal, Stemming, Web Page Preprocessing, Duplicate Detection - Inverted Index and its compression- Latent Semantic Indexing- Web Search- Meta-Search: Combining Multiple Rankings- Web Spamming.

### UNIT III SOCIAL NETWORK ANALYSIS 12

Introduction- Co-Citation and Bibliographic Coupling- Page Rank Algorithm - Strengths and Weaknesses of PageRank- Timed PageRank and Recency Search- HITS Algorithm: Finding Other Eigenvectors- Community Discovery: Bipartite Core Communities- Maximum Flow Communities- Email Communities Based on Betweenness - Overlapping Communities of Named Entities.

### UNIT IV WEB CRAWLING 12

A Basic Crawler Algorithm – Breadth First Crawlers, Preferential Crawlers, Implementation Issues – Fetching, Parsing, Stopword Removal and stemming, Link Extraction and Canonicalization, Spider Traps, Page Repository, Concurrency- Universal Crawlers, Focused Crawlers, Topical Crawlers, Crawler Ethics and Conflicts.

### UNIT V WEB USAGE MINING 12

Data Collection and Preprocessing, Sources and Types of Data, Key Elements of Web Usage Data Preprocessing, Data Modeling for Web Usage Mining, Discovery and Analysis of Web Usage Patterns, Session and Visitor Analysis, Cluster Analysis and Visitor Segmentation, Association and Correlation Analysis, Analysis of Sequential and Navigation Patterns- Classification and Prediction based on Web User Transactions- Query log mining.

**L: 30; P: 30; TOTAL: 60 PERIODS**

### TEXT BOOKS

1. Bing Liu, "Web Data Mining: Exploring Hyperlinks, Contents, and Usage Data", 2<sup>nd</sup> Edition, Springer Publications, 2011.

### REFERENCES

1. Avinash Kaushik, "Web Analytics 2.0, The art of online accountability and science of customer centrality", Wiley publication, 2016.
2. Anthony Scime, Web Mining: Applications and Techniques, (State University of New York at Brockport, USA), 2005.
3. Mining the Web: Discovering Knowledge from Hypertext Data, Soumen Chakrabarti, Morgan Kaufmann Publishers. 2002.

19IT49E

**BUSINESS INTELLIGENCE****L T P C**  
**3 0 0 3****COURSE OUTCOMES**

Upon completion of the course, the students will be able to:

- CO1: describe the importance of business process and reporting. (K2)
- CO2: explain various business analytics process in an organization. (K2)
- CO3: explain the descriptive data analytics process and issues. (K2)
- CO4: analyze the performance of various predictive analytics techniques for business data. (K3)
- CO5: analyze the prescriptive analytics models for solving problems in the organization. (K3)

**UNIT I INTRODUCTION 9**

Introduction- Business Process Management lifecycle – Context of process Identification – Process Architecture - BI architecture and components - building blocks of business reports- types of business reports, and the components and structure of business reporting systems- Online Analytical processing (OLAP).

**UNIT II BUSINESS ANALYTICS 9**

Introduction- Scope - Business Analytics Process - Relationship of Business Analytics Process and organization- competitive advantages of Business Analytics. Statistical Tools: Statistical Notation- Descriptive Statistical methods- Statistical Testing.

**UNIT III DESCRIPTIVE ANALYTICS 9**

Introduction, Visualizing and Exploring business data, Descriptive Statistics, Sampling and Estimation: Sampling Methods, Sampling Estimation, Introduction to Probability Distributions, Marketing/Planning Case Study on Descriptive Analytics model.

**UNIT IV PREDICTIVE ANALYTICS 9**

Introduction, Predictive Modeling: Logic-Driven Models, Data-Driven Models, Data mining for Types of Variation in Time Series Data, Regression Model, Smoothing, Fitting models to Data, Marketing/Planning.

**UNIT V PRESCRIPTIVE ANALYTICS 9**

Introduction, Decision Theory Model Elements for business process, Types of Decision Environments, Decision Theory Formulation, Decision-Making Under Certainty, Decision-Making Under Risk, Decision-Making under Uncertainty, Expected Value of Perfect Information, Sequential Decisions and Decision Trees, The Value of Imperfect Information: Bayes's Theorem, Decision Theory Practice Problems.

**L: 45; TOTAL: 45 PERIODS****TEXT BOOKS**

1. Marc J. Schniederjans, Dara G.Schniederjans, Christopher M. Starkey, Business analytics Principles, Concepts, and Applications, Pearson FT Press, 1st Edition, 2014.

**REFERENCES**

1. Marlon Dumas, Marcello La Rosa, Jan Mendling, Hajo A. Reijers, "Fundamentals of Business Process Management", 2nd Edition, Kindle Edition, 2018.
2. James R Evans, "Business Analytics", Pearson Education, 2nd Edition, 2017.
3. "Business intelligence concepts, tools, and applications", Coursera course materials.



**19IT50E                      PROFESSIONAL READINESS FOR INNOVATION,  
EMPLOYABILITY AND ENTREPRENEURSHIP**

**L T P C  
0 0 6 3**

**COURSE OBJECTIVES**

- To empower students with overall Professional and Technical skills required to solve a real world problem.
- To mentor the students to approach a solution through various stages of Ideation, Research, Design Thinking, workflows, architecture and building a prototype in keeping with the end-user and client needs.
- To provide experiential learning to enhance the Entrepreneurship and employability skills of the students.

**COURSE OUTCOMES**

Upon completion of this course, the students will be able to

CO1: Upskill in emerging technologies and apply to real industry-level use cases

CO2: Understand agile development process

CO3: Develop career readiness competencies, Team Skills / Leadership qualities

CO4: Develop Time management, Project management skills and Communication Skills

CO5: Use Critical Thinking for Innovative Problem Solving

CO6: Develop entrepreneurship skills to independently work on products

**TABLE 1: ACTIVITIES**

<b>Activity Name</b>	<b>Activity Description</b>	<b>Time (weeks)</b>
Choosing a Project	Selecting a project from the list of projects categorized various technologies & business domains	2
Team Formation	Students shall form a team of 4 Members before enrolling to a project. Team members shall distribute the project activities among themselves.	1
Hands on Training	Students will be provided with hands-on training on selected technology in which they are going to develop the project.	2
Project Development	Project shall be developed in agile mode. The status of the project shall be updated to the mentors via appropriate platform	6
Code submission, Project Doc and Demo	Project deliverables must include the working code, project document and demonstration video. All the project deliverables are to be uploaded to cloud based repository such as GitHub.	3
Mentor Review and	Mentor will be reviewing the project	1

Approval	deliverables as per the milestone schedule and the feedback will be provided to the team.	
Evaluation and scoring	Evaluators will be assigned to the team to evaluate the project deliverables, and the scoring will be provided based on the evaluation metrics	1
<b>TOTAL</b>		<b>16 WEEKS</b>

Essentially, it involves 15 weeks of learning and doing, and one week for evaluation. The evaluation will be carried out to assess technical and soft skills as given in Table 2.

**TABLE 2: EVALUATION SCHEMA**

TECHNICAL SKILLS		SOFT SKILLS	
<i>Criteria</i>	<i>Weightage</i>	<i>Criteria</i>	<i>Weightage</i>
Project Design using Design Thinking	10	Teamwork	5
Innovation & Problem Solving	10	Time Management	10
Requirements Analysis using Critical Thinking	10	Attendance and Punctuality	5
Project Planning using Agile Methodologies	5	Project Documentation	5
Technology Stack (APIs, tools, Platforms)	5	Project Demonstration	5
Coding & Solutioning	15		
User Acceptance Testing	5		
Performance of Product / Application	5		
Technical Training & Assignments	5		
<b>Total</b>	<b>70</b>	<b>Total</b>	<b>30</b>
<b>Total Weightage</b>		<b>100</b>	
<b>Passing Requirement</b>		<b>50</b>	
<b>Continuous Assessment Only</b>			

**P: 90; TOTAL: 90 PERIODS**

**19IT51E**

**DATA ENGINEERING**

**L T P C**  
**3 0 2 4**

**COURSE OUTCOMES**

Upon completion of the course, the students will be able to:

CO 1: discuss big data architecture and its computing techniques. (K2)

CO 2: illustrate the Hbase architecture functionalities. (K3)

CO 3: demonstrate the data storage and processing techniques. (K3)

CO 4: apply the data stream architecture and its processing techniques (K3).

CO 5: describe the cloud data warehousing techniques applied in real time. (K2)

## **UNIT I INTRODUCTION 12**

Evolution of Big data – Structure in big data – characteristics of big data – Big data Analytics – Architecture of big data systems - Big Data Use Cases – Data analytics life cycle: Life cycle for data- centric projects – Big data life cycle- Distributed and parallel computing for big data- cloud services and providers in big data market.

## **UNIT II HADOOP ECOSYSTEM 12**

Introduction - HDFS architecture – Using HDFS files – HDFS commands – HBASE architecture – Storing Big data with HBase – Combing HDFS and HBase- Selecting the suitable Hadoop data organization for applications.

## **UNIT III DATA STORAGE AND PROCESSING 12**

Overview of YARN – YARN Architecture – Scheduler – YARN configuration & commands – Log management – exploring Hive: Variables, Properties and Queries – Data types – Built-in functions – Hive DDL-Data manipulation in Hive – Data retrieval queries - Using JOINS in Hive- Impala – Kudu.

## **UNIT IV MINING DATA STREAMS 12**

Introduction to Streams Concepts – Processing data streams – Data streaming architecture using Kafka and Spark- Spark streaming in R- 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

## **UNIT V CLOUD DATA WAREHOUSES 12**

Introduction to Data Warehouses - ELT and Data Warehouse Technology in the Cloud - AWS Data Technologies - Big Data Ecosystem, Data Lakes, & Spark- Using Spark & Data Lakes in the AWS Cloud.

## **PRACTICAL EXCERISES 15**

- Installation of Apache Hadoop, MapReduce and SPARK.
- MapReduce application for word counting on R HADOOP
- Perform adhoc query on HDFS data using Hive Query Language (HQL)
- Implementation of Support Vector Machine classification.
- Implementation of data mining clustering algorithms.

**L: 45; P: 30; TOTAL: 75 PERIODS**

## **TEXT BOOKS**

1. “Big data Black book”, Comprehensive Problem Solver, Dream Tech Press, 2015 Edition.
2. Brain Larson, “Data Analysis with Microsoft Power BI”, 1<sup>st</sup> Edition, Mc-Graw Hill publication, 2019.

**REFERENCES**

1. Seema Acharya & Subhashini Chellappan, "Big Data and Analytics", Wiley publications, Second Edition, 2019.
2. Sudha Sadasivam, R.Thirumahal, "Big data Analytics", Oxford Higher education, 2020.
3. Bart Baesens, Analytics in a Big Data World: The Essential Guide to Data Science and its Applications-II, Wiley Publishers, 2015.
4. Kim H. Pries and Robert Dunnigan, Big Data Analytics: A Practical Guide for Managers-II, CRC Press, 2015.

**19IT52E****DATA VISUALIZATION****L T P C  
3 0 2 4****COURSE OUTCOMES**

Upon completion of the course, the students will be able to:

- CO1: describe the fundamentals of exploratory data analysis. (K2)
- CO2: explain the data visualization using Matplotlib. (K2)
- CO3: apply univariate data exploration and analysis. (K3)
- CO4: illustrate bivariate data exploration and analysis. (K3)
- CO5: summarize data exploration and visualization techniques for multivariate and time series data. (K2)

**UNIT I                    EXPLORATORY DATA ANALYSIS                    15**

EDA fundamentals – Understanding data science – Significance of EDA – Making sense of data – Comparing EDA with classical and Bayesian analysis – Software tools for EDA - Visual Aids for EDA- Data transformation techniques-merging database, reshaping and pivoting, Transformation techniques - Grouping Datasets - data aggregation – Pivot tables and cross-tabulations.

**UNIT II                    VISUALIZING USING MATPLOTLIB                    15**

Importing Matplotlib – Simple line plots – Simple scatter plots – visualizing errors – density and contour plots – Histograms – legends – colors – subplots – text and annotation – customization – three dimensional plotting - Geographic Data with Basemap - Visualization with Seaborn.

**UNIT III                    UNIVARIATE ANALYSIS                    15**

Introduction to Single variable: Distributions and Variables - Numerical Summaries of Level and Spread - Scaling and Standardizing – Inequality - Smoothing Time Series.

**UNIT IV                    BIVARIATE ANALYSIS                    15**

Relationships between Two Variables - Percentage Tables - Analyzing Contingency Tables - Handling Several Batches - Scatterplots and Resistant Lines – Transformations.

**UNIT V                    MULTIVARIATE AND TIME SERIES ANALYSIS                    15**

Introducing a Third Variable - Causal Explanations - Three-Variable Contingency Tables and Beyond - Longitudinal Data – Fundamentals of TSA – Characteristics of time series data – Data Cleaning – Time-based indexing – Visualizing – Grouping – Resampling.

## PRACTICAL EXERCISES

- Study and applying data exploration and visualization for the categorical and continuous data Using R.
- Implementation of Analyzing Acoustic data using R.
- Implementation of estimating population density and biodiversity using R Script.
- Implementation of analyzing vigilance behavior using R Script.
- Implementation of trend analysis using PowerBI.

**L: 45; P: 30; TOTAL: 75 PERIODS**

## TEXT BOOKS

1. Suresh Kumar Mukhiya, Usman Ahmed, "Hands-On Exploratory Data Analysis with Python", Packet Publishing, 2020. (Unit 1)
2. Jake Vander Plas, "Python Data Science Handbook: Essential Tools for Working with Data", Oreilly, 1<sup>st</sup> Edition, 2016. (Unit 2)
3. Catherine Marsh, Jane Elliott, "Exploring Data: An Introduction to Data Analysis for Social Scientists", Wiley Publications, 2<sup>nd</sup> Edition, 2008. (Unit 3,4,5)

## REFERENCES

1. Eric Pimpler, Data Visualization and Exploration with R, GeoSpatial Training service, 2017.
2. Claus O. Wilke, "Fundamentals of Data Visualization", O'reilly publications, 2019.
3. Matthew O. Ward, Georges Grinstein, Daniel Keim, "Interactive Data Visualization: Foundations, Techniques, and Applications", 2nd Edition, CRC press, 2015.

**19IT53E**

**PRIVACY PRESERVATION**

**L T P C  
3 0 0 3**

## COURSE OUTCOMES

Upon completion of the course, the students will be able to:

- CO1: explain the importance of data privacy in real time. (K2)
- CO2: describe privacy preservation methods to identify the anonymization of data.(K2)
- CO3: summarize the data preservation methods to find the static data anonymization for the complex data structure. (K2)
- CO4: illustrate various data anonymization threats involved in the privacy preservation. (K3)
- CO5: apply the data mining methods which support privacy preservation of data. (K3)

## UNIT I DATA PRIVACY AND ITS IMPORTANCE

**9**

Need for Sharing Data, Methods of Protecting Data, Importance of Balancing Data Privacy and Utility, Disclosure, Tabular Data, Micro data, Approaches to Statistical disclosure control, Ethics, principles, guidelines and regulations.

## UNIT II STATIC DATA ANONYMIZATION ON MULTIDIMENSIONAL DATA

**9**

Privacy Preserving Methods, Classification of Data in a Multidimensional Data Set, Group-Based Anonymization, k- Anonymity, l-Diversity, t-closeness.

**UNIT III DATA ANONYMIZATION ON COMPLEX DATA STRUCTURES 9**

Privacy Preserving Graph Data, Privacy Preserving Time Series Data, Time Series Data Protection Methods, Privacy Preservation of Longitudinal Data, Privacy Preservation of Transaction Data.

**UNIT IV DATA ANONYMIZATION THREATS 9**

Threats to Anonymized Data, Threats to Data Structures, Threats by Anonymization Techniques, Randomization, k-Anonymization, l-Diversity, t-Closeness. Dynamic Data Protection: Tokenization, Understanding Tokenization, Use Cases for Dynamic Data Protection, Benefits of Tokenization Compared to Other Methods, Components for Tokenization.

**UNIT V PRIVACY PRESERVATION FOR DATA MINING TECHNIQUES 9**

Key Functional Areas of Multidimensional Data for privacy preservation, Association Rule Mining, Clustering algorithms for privacy preservation.

**L: 45; TOTAL: 45 PERIODS**

**TEXT BOOKS**

1. Nataraj Venkataramanan, Ashwin Shriram, Data Privacy: Principles and Practice, Taylor Francis, 2016. (ISBN No.: 978-1-49-872104-2).
2. Anco Hundepool, Josep Domingo-Ferrer, Luisa Franconi, Sarah Giessing, Eric Schulte Nordholt, Keith Spicer, Peter-Paul de Wolf, Statistical Disclosure Control, Wiley, 2012. (ISBN No.: 978- 1-11-997815-2)

**REFERENCES**

1. George T. Duncan. Mark Elliot, Juan-Jose Salazar-Gonzalez, "Statistical Confidentiality: Principle and Practice". Springer, 2011.
2. Aggarwal, Charu C., Yu, Philip S., " Privacy-Preserving Data Mining: Models and Algorithms", Springer, 2010.

**B.Tech. – INFORMATION TECHNOLOGY**  
**ONE CREDIT ELECTIVE COURSES**

**19IT01L****AGILE DEVELOPMENT PROCESS****L T P C**  
**1 0 0 1****COURSE OUTCOMES**

Upon Completion of this course, the students will be able to

- CO1: describe the fundamental principles and practices associated agile development methods. (K2)

**LIST OF CONTENTS**

1. Agile Methodology
2. Agile Models in Software Development & Testing
3. SCRUM Process Framework
4. KANBAN Process Framework
5. Software Development using SCRUM
6. Software Testing using KANBAN

**L: 15 TOTAL: 15 PERIODS****REFERENCES**

1. Robert C.Martin, "Agile Software Development, Principles, Patterns, and Practices", Pearson New International publication, First Edition, 2013.
2. Ken Schwaber, Mike Beedle,"Agile Software Development with Scrum", First Edition, Van Haren Publishing, 2001.

**19IT02L****COMPUTER HARDWARE ANDTROUBLESHOOTING****L T P C**  
**0 0 2 1****COURSE OUTCOMES**

Upon Completion of this course, the students will be able to

- CO 1: explain the working principles of components required for system assembly, data transfer and networking. (K2)
- CO 2: perform software installation, data recovery and troubleshooting techniques. (K3)

**LIST OF EXPERIMENTS****1. PC HARDWAREOVERVIEW**

Basic Parts of PC, System board, Microprocessor, Interrupts, DMA, SMPS, BIOS, POST sequence, System configuration, Memory, Mass storage, I/O interface standards.

**2. BUS STANDARDS AND NETWORKING**

ISA, PCI, SCSI, IDE, USB, Network Interface Cards, Cables and connectors, MODEM.

**3. INSTALLATION AND PREVENTIVE MAINTENANCE**

System Configuration, Installation Practice, PC Assembling and Integration, Virus, data Recovery.

**4. TROUBLESHOOTING & TOOLS**

Troubleshooting problems of system boards, add on cards and peripherals.

**P: 30 TOTAL: 30 PERIODS**



## REFERENCES

1. Michael Meyers, "Introduction to PC Hardware and Troubleshooting", Mc Graw Hill Publisher, First Edition, 2003.
2. Kyle McRae, Gary Marshall," Computer Troubleshooting: The Complete step-by-step Guide to Diagnosing and Fixing Common PC Problems", Second Edition, 2008
3. Govindarajalu.B, "IBM PC AND CLONES: Hardware, Troubleshooting and Maintenance", Tata McGraw-Hill, 2011.

**19IT03L**

**PHP PROGRAMMING**

**L T P C**  
**0 0 2 1**

## COURSE OUTCOMES

Upon Completion of this course, the students will be able to

- CO1: develop PHP programs to build interactive, data-driven sites with Database connectivity.(K3)

## LIST OF EXPERIMENTS

1. History
2. Web Brower
3. Web - Server, Xampp
4. Installation and Configuration files
5. Variable Types, Constants
6. Function, recursion, Pure Functions and Referential Transparency, Higher Order Functions, Lambda Functions, Partial Functions and Currying
7. Arrays
8. Date & Time, Image Uploading
9. PHP OOP concepts: Class Inheritance, Auto loading Classes, constructors and destructors, Member and method visibility, Abstract Classes, Object Interfaces, Overloading, Class Members
10. WEB FEATURES: Sessions, Forms, GET and POST data, Cookies, HTTP Headers
11. Database Programming
12. AJAX
13. Error handling in PHP
14. File handling in PHP

**P: 30; TOTAL: 30 PERIODS**

## REFERENCES

1. W.J.Gilmore "A Programmer"s Introduction to PHP4.0", Apress, 2001.
2. W.Jason Gilmore, "Beginning PHP and MySQL", Fifth Edition, Apress, 2014.

**19IT04L**

**THEORYOF COMPUTATION**

**L T P C**  
**1 0 0 1**

## COURSE OUTCOMES

Upon Completion of this course, the students will be able to

- CO 1: explain the basics of finite automata and construct the equivalence of Languages described by Context-free grammars and push down automata. (K3)

CO 2: describe the working principles of Turing machine. (K2)

## LIST OF CONTENTS

### 1. REGULAR LANGUAGES

Regular Expression (RE) - Regular operations - Closure properties- Finite Automata: Deterministic Finite Automata (DFA) and Non-deterministic Finite Automata (NFA) – Nonregular languages

### 2. CONTEXT FREE LANGUAGES

Context-free grammars - Parse Trees- Pushdown automata - Non-context-free languages - Equivalence of Pushdown automata and CFG

### 3. TURING MACHINES AND DECIDABILITY

Turing Machines - Programming Techniques for TM - Decidable languages - The halting problem

**L: 15 TOTAL: 15 PERIODS**

## REFERENCES

1. J.E. Hopcroft, R. Motwani and J.D.Ullman, "Introduction to Automata Theory, Languages and Computations", Third Edition, Pearson Education, 2007.
2. Anil Maheshwari, Michiel Smid, "Introduction to Theory of Computation", E-book, 2016.

19IT05L

**BASICS OF COMPILER DESIGN**

**L T P C**

**1 0 0 1**

## COURSE OUTCOMES

Upon Completion of this course, the students will be able to

- CO 1: describe the functions of lexical analyzer and design various types of parser for language specification. (K3)
- CO 2: apply various types of intermediate code generation for various constructs. (K3).

## LIST OF CONTENTS

### 1. INTRODUCTION TO COMPILER

Compiler and its phases - The role of language translation in the programming process - Comparison of interpreters and compilers.

### 2. LEXICAL AND SYNTAX ANALYSIS

Lexical analyzer - Specification of tokens –Recognition of tokens– Role of parser – CFG - Top Down and Bottom up Parsing - Case study: Parsing with Lex and Yacc.

### 3. INTERMEDIATE CODE GENERATION

Different Intermediate Forms - Implementation of Three Address Code - Intermediate code for all constructs of programming languages - Directed Acyclic Graph. Case Study: C Compiler

**L: 15 TOTAL: 15 PERIODS**

## REFERENCES

1. K.Muneeswaran, "Compiler Design", Oxford University Press, 2013.
2. Alfred Aho, Monica S.Lam, Ravi Sethi and Jeffrey D.Ullman, "Compiler Principles, Techniques and Tools", Third Edition, Addison Wesley, 2006.

**19IT06L**

**VIRTUALIZATION**

**L T P C**

**1 0 0 1**

## COURSE OUTCOMES

Upon Completion of this course, the students will be able to

CO 1: describe the fundamental concepts of server and client virtualization. (K2)

CO 2: develop an application by utilizing cloud platforms such as Google app Engine and Amazon Web Services. (K3)

## LIST OF CONTENTS

### 1. INTRODUCTION TO CLOUD COMPUTING

Cloud Computing in a Nutshell, Roots of Cloud Computing, Layers and Types of Cloud, Features of a cloud, Infrastructure-as-a-Service, Software-as-a-Service, Platform- as-a-Service, Google App Engine, Microsoft Azure;, Amazon EC2; Challenges and Risks.

### 2. CLOUD TECHNOLOGIES HYPERVISOR

Introduction, Types of Hypervisor. Virtualization Technology: Virtual machine Technology, virtualization applications in enterprises.

### 3. NETWORK STORAGE

Network Attached Storage (NAS), Storage Area Network (SAN), Network Virtualization, Server Virtualization, Pitfalls of virtualization.

**L: 15 TOTAL: 15 PERIODS**

## REFERENCES

1. Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, "Cloud Computing: Principles and Paradigms", John Wiley & Sons, First Edition, 2011.
2. Mitch Tulloch with Nigel Cain, Alvin Morales, Michel Luescher, Damian Flynn, "Microsoft System Center: Building a Virtualized Network Solution", Microsoft Press, First edition, 2014.

**19IT07L**

**SOCIAL MEDIA APPLICATION DEVELOPMENT**

**L T P C**

**1 0 0 1**

## COURSE OUTCOMES

Upon Completion of this course, the students will be able to

CO1: explain various concepts in developing Social Media Applications. (K2)

## LIST OF CONTENTS

1. Overview of Graph theory
2. Strong and Weak Ties
3. Positive and Negative Relationships

4. Evolutionary Game Theory
5. Modeling Network Traffic using Game Theory
6. Auctions
7. Markets and Strategic Interaction in Networks
8. Bargaining and Power in Networks
9. Information Cascades
10. Power Laws
11. Cascading Behavior in Networks
12. Design own social media application

**L: 15 TOTAL: 15 PERIODS**

## REFERENCES

1. Easley D. Kleinberg J., "Networks, Crowds, and Markets – Reasoning about a Highly Connected World", Cambridge University Press, 2010.
2. Jackson, Matthew O., "Social and Economic Networks", Princeton University Press, 2008.

**19IT08L**

**IoT DEVELOPMENT**

**L T P C**  
**1 0 0 1**

## COURSE OUTCOMES

Upon Completion of this course, the students will be able to

- CO 1: describe key programming terms relevant to Swift and IoT programming. (K2)  
CO 2: develop mobile apps using networking and tvOS. (K3)

## LIST OF EXPERIMENTS

### 1. SWIFT

Introduction- Control- Function and closure-Class and structure.

### 2. IoT

User Interactivity - Multiple View Controllers & Navigation –webservice.

### 3. PERSISTENCE AND NETWORKING

Introduction to Developing for tvOS –Location- Locomotion and Motion.

**L: 15 TOTAL: 15 PERIODS**

## REFERENCES

1. Vandanahavandipoor, "IoT 8 Swift Programming Cookbook Solutions & Examples for IoT Apps", O'Reilly Media, 2014.
2. Boisy G. Pitre, "Swift for Beginners: Design and Development", PEACHPIT PRESS, 2013.
3. Christian Keur and Aaron Hillegass, "iOS Programming: The Big Nerd Ranch, 2015.
4. Guide -Big Nerd Ranch Guides", Fourth Edition, 2011.

**19IT09L**

**E-COMMERCE SECURITY**

**L T P C**  
**1 0 0 1**

**COURSE OUTCOMES**

Upon Completion of this course, the students will be able to

- CO 1: explain wide range of security issues in online forums and services. (K2)
- CO 2: illustrate various E-commerce security techniques. (K2)

**LIST OF CONTENTS**

1. Online Security Issues - Overview
2. Security for Client Computers
3. Communication Channel Security
4. Security for Server Computers
5. Organizations that provide Computer Security
6. Payment Systems for Electronic Commerce
7. Online Payment Basics
8. Digital Wallets
9. Internet Technologies and the Banking Industry
10. Criminal Activity and payment systems: Phishing and Identity Theft

**L: 15 TOTAL: 15 PERIODS**

**REFERENCES**

1. Gray P. Schneider, "Electronic Commerce", Course Technology, Cengage Learning, USA, 10th Edition, 2012.
2. Anup K. Ghosh, "E-Commerce Security and Privacy (Advances in Information Security)", Springer, 2001.

**19IT10L**

**HADOOP ARCHITECTURE AND INSTALLATION**

**L T P C**  
**0 0 2 1**

**COURSE OUTCOMES**

Upon Completion of this course, the students will be able to

- CO 1: install and build a Hadoop cluster capable of processing large data. (K3)
- CO 2: implement Map/Reduce concepts for parallel programming using Java. (K3)

**LIST OF EXPERIMENTS**

1. Hadoop Architecture
2. Installing Ubuntu with Java 1.8 on VM Workstation 11
3. Hadoop Versioning and Configuration
4. Single Node Hadoop 1.2.1 installation on Ubuntu 14.4.1
5. Multi Node Hadoop 1.2.1 installation on Ubuntu 14.4.1
6. Linux commands and Hadoop commands 1.8. Cluster architecture and block placement
7. Pseudo Distributed Mode
8. Fully Distributed Mode
9. Master Daemons(Name Node, Secondary Name Node, Job Tracker)

10. Slave Daemons(Job tracker, Task tracker)
11. Task Instance
12. Hadoop HDFS Commands
13. Accessing HDFS
14. CLI Approach
15. Implementation of Map/Reduce using Java

**P: 30 TOTAL: 30 PERIODS****REFERENCES**

1. [https://www.tutorialspoint.com/hadoop/hadoop\\_tutorial.pdf](https://www.tutorialspoint.com/hadoop/hadoop_tutorial.pdf).
2. Tom White, "Hadoop: The Definitive Guide, Storage and Analysis at Internet Scale", O'Reilly Media / Yahoo Press, Third Edition, 2012.

**19IT11L****MICROCONTROLLER AND RASPBERRY PI****L T P C  
1 0 0 1****COURSE OUTCOMES**

Upon Completion of this course, the students will be able to

- CO1: describe the architecture and applications of microcontroller. (K2)  
 CO2: describe the functionality of raspberry Pi and its interfacing. (K2)

**LIST OF CONTENTS**

1. Introduction to microcontroller- Architecture of 8051 Microcontroller.
2. Instruction sets and Addressing modes.
3. Signals and I/O ports, Timers and interrupt.
4. Interfacing -keyboard, LCD, ADC & DA. Applications- Stepper motor- Power plant control, Traffic light controller
5. Raspberry Pi
6. HDMI output
7. Connection with VGA, VIM text editor
8. Switch relay ,Servo Control ,GUI interface
9. Simple Arduino application

**L: 15 TOTAL: 15 PERIODS****REFERENCES**

1. Kenneth J.Ayala, "The 8051 microcontroller Architecture, Programming and applications", Third Edition, Minneapolis West Pub, 2005.
2. Eben Upton, Gareth Halfacree, "Raspberry Pi User Guide", Third Edition, Wiley, 2014.

**19IT12L****PROGRAMMING IN IOT****L T P C  
0 0 2 1****COURSE OUTCOMES**

Upon Completion of this course, the students will be able to

- CO 1: describe the fundamentals of IOT and networking. (K2).  
 CO 2: apply programming in IOT devices. (K3).

## LIST OF EXPERIMENTS

1. Introduction to IOT: Sensing, Actuation
2. Interfacing of Temperature, Humidity, Motion, Light and Gas Sensor with Arduino.
3. Basics of IOT Networking: Communication Protocols, Sensor Networks, Machine- to-Machine Communications.
4. Interoperability in IOT: Introduction to Arduino Programming, Integration of Sensors and Actuators
5. Introduction to Raspberry Pi

**P: 30 TOTAL: 30 PERIODS**

## REFERENCES

1. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling technologies, Platforms, and Use Cases", CRC Press, 2017.
2. Arshdeep Bahga and Vijay Madisetti, "Internet of Things: A Hands-on Approach", Universities Press, 2015.

**19IT13L**

**R PROGRAMMING**

**L T P C**  
**0 0 2 1**

## COURSE OUTCOMES

Upon Completion of this course, the students will be able to

CO 1: develop simple applications using R programming. (K3)

## LIST OF EXPERIMENTS

- Getting Data In and Out of R
- Control Structures
- Functions
- Data Manipulation
- String Operations
- Data Visualization
- Basic statistics
- Regression modeling

**P: 30 TOTAL: 30 PERIODS**

## REFERENCES

1. Torsten Hothorn, Brian S. Everitt, "A Handbook of Statistical Analyses using R", Third Edition, CRC Press, 2014.
2. Michael J. Crawley, "Statistics: An Introduction using R", Second edition, Wiley, 2015.
3. <https://www.analytixlabs.co.in/data-analytics-using-r>.

**19IT14L**

**JAVA GENERICS AND COLLECTIONS FRAMEWORK**

**L T P C**  
**0 0 2 1**

## COURSE OUTCOMES

Upon Completion of this course, the students will be able to

CO 1: apply the concepts of generic classes and collections for computing problems. (K3)

**LIST OF EXPERIMENTS**

1. Add String values to the ArrayList class from collection Framework and sort those Strings and print it separately.
2. Take different values in HashMap class and print the Keys and values separately.
3. Write a program to add the items in cart lik amazon applications by using any of these collection Framework classes (ArrayList, LinkedList, Vector).  
Say for example, if you select Mobile, TV, and Pant. The cart should collect all the items and need to print it as **[Mobile,TV,Pant]**  
You should consider each item as a separate class.  
You must override the **toString** method from **Object** class to to return correspnding classes name.
4. Write a program to add the items in cart lik amazon applications by using any of these collection Framework classes (HashMap, LinkedHashMap, TreeMap).  
Say for example, if you select Mobile, TV, and Pant. The cart should collect all the items with its cost and need to print it as **[5600 = Mobile,12000 = TV,780=Pant]**  
You should consider each item (Mobile, TV and Pant) as a separate class.  
You must override the **toString** method from **Object** class to to return correspnding class's name.  
**Note:** Please take the cost as key, also enter manually.
5. Write a program to receive Three Employee's details Employee name, Employee ID, Employee Salary.  
Encapsulate all these Employees Informations for Each employee, build the ArrayList object to holds the Object of Each Employee.  
Print the all Employee's informations Separately.

**P: 30 TOTAL: 30 PERIODS****REFERENCES**

1. Herbert Schildt, "Java™ The Complete Reference", Ninth Edition, McGraw-Hill, 2014.
2. Cay S. Horstmann and Gary Cornell, "Core Java: Volume I – Fundamentals", Ninth Edition, Sun Microsystems Press, 2012.

**19IT15L****DEEP LEARNING ALGORITHMS****L T P C  
0 0 2 1****COURSE OUTCOMES**

Upon Completion of this course, the students will be able to

CO1: Apply supervised CNN &amp; RNN models for various datasets.(K3)

CO2: Build a classifier with pre-trained models and validate.(K3)

**LIST OF EXERCISES**

1. Build a classifier using k-Nearest Neighbour (kNN) algorithm for iris dataset to classify its class.
2. Create a Neural Network model to train and test the birds dataset to classify the bird species.
3. Construct a CNN model by considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set, then build an LENET algorithm and test the same.
4. Implement RNNmodel for smile detection. Print both correct and wrong predictions.



5. Design a LSTM network for sentiment analysis on a corpus of movie reviews. Label each phrase on a scale of zero to four. The sentiment corresponding to each of the labels are:
  - 0: negative
  - 1: somewhat negative
  - 2: neutral
  - 3: somewhat positive
  - 4: positive
6. Build and train the stacked Autoencoder for image classification. Use handwritten digits dataset.

## SOFTWARE REQUIREMENTS

- **Operating System:** Windows / Linux
- **Software:** Anaconda / Jupyter, Keras, Tensorflow, Google colab

## REFERENCES:

1. Bengio, Yoshua, Ian J. Goodfellow, and Aaron Courville. "Deep learning." An MIT Press book in preparation, 2016.
2. Dr. Adrian Rosebrock, —Deep Learning for Computer Vision with Python: Starter Bundle, PyImage Search, 1st edition, 2017.

19IT16L

**DATABASE DESIGN AND PROGRAMMING WITH SQL**

**L T P C**

**0 0 2 1**

## COURSE OUTCOMES

Upon Completion of this course, the students will be able to

CO 1: demonstrate a database solution for a business or organization. (K3)

## LIST OF EXPERIMENTS

### Database Design

- Introduction
- Entities and Attributes
- Relationship Basics
- Super/Sub Types and Business Rules
- Relationship Fundamentals
- UIDs and Normalization
- Arcs, Hierarchies, and Recursive Modeling
- Changes and Historical Modeling
- Mapping
- Creating Database Projects
- Presenting Database Projects

### Database Programming with SQL

- Introduction
- Select with WHERE, ORDER BY, and Intro to Functions

- Types of Functions
- JOINS
- Group Functions
- Sub queries
- DML, DDL Statements
- Constraints
- Database Objectives
- Privileges and Regular Expressions
- TCL

**P: 30 TOTAL: 30 PERIODS**

#### REFERENCE

1. <http://ilearning.oracle.com>

<b>19IT17L</b>	<b>INTRODUCTION TO NETWORKS</b>	<b>L T P C</b>
		<b>1 0 0 1</b>

#### COURSE OUTCOMES

Upon Completion of this course, the students will be able to

- CO1: build simple LANs, perform basic configurations for routers and switches. (K2)
- CO2: implement IP addressing schemes. (K3)

Introduction and explore the network - Configure a network operating system - Network Protocol and Communications - Network Access – Ethernet - Network Layer - IP addressing - Subnetting IP Network - Transport layer - Application Layer - Build a small network

**L: 15 TOTAL: 15 PERIODS**

#### REFERENCES

1. <https://www.freecnastudyguide.com/study-guides/ccna/ch1/intro-to-networks/>
2. <https://www.netacad.com/group/resources/ccna-rs-itn/6.0>

<b>19IT18L</b>	<b>ROUTING AND SWITCHING ESSENTIALS</b>	<b>L T P C</b>
		<b>1 0 0 1</b>

#### COURSE OUTCOMES

Upon Completion of this course, the students will be able to

- CO1: recognize architecture, components, and operations of routers and switches in a small network. Students learn how to configure a router and a switch for basic functionality. (K2)
- CO2: build simple LANs, perform basic configurations for routers and switches, and implement IP. (K2)

Routing Concepts - Routing Initial configuration - Routing Operation - Static Routing - Configuration & Troubleshooting - Dynamic Routing - Protocols and Routing Tables - Switched Networks - Switch Configuration - Device Configuration – LAN Design and Switched Environment – VLANs - Segmentation - Implementation - VLAN Routing - Access Control

Lists - ACL Operation - Standard IPv4 ACL – DHCP - DHCP v4 – DHCP v6 - NAT for IPv4 - Operation - Configuration - Device Discovery - Management and Maintenance.

**L: 15 TOTAL: 15 PERIODS**

**REFERENCES**

1. CCNA Routing and Switching Complete Study Guide”, Todd Lammle, Second Edition, John Wiley & Sons, 2016.
2. <https://www.netacad.com/group/resources/ccna-rs-rse/6.0>

**19IT19L**

**SCALING NETWORKS**

**L T P C**  
**1 0 0 1**

**COURSE OUTCOMES**

Upon Completion of this course, the students will be able to

- CO1: configure and troubleshoot routers and switches for advanced functionality. (K3)
- CO2: resolve common issues with protocols in both IPv4 and IPv6 networks. (K2)

LAN Design: Campus Wired LAN Designs - Campus Network Device Selection. Scaling VLANs: VTP, Extended VLANs, and DTP - Troubleshoot Multi-VLAN Issues. Spanning Tree Protocol (STP): Spanning Tree Concepts - Varieties of Spanning Tree Protocols. Ether Channel and HSRP: Link Aggregation Concepts - Link Aggregation Configuration - First Hop Redundancy Protocols.

Dynamic Routing: Dynamic Routing Protocols - Distance Vector Dynamic Routing - Link-State Dynamic Routing. EIGRP: features and characteristics - Implement EIGRP for IPv4 - EIGRP Tuning and Troubleshooting. OSPF: Single-Area OSPF Operation - Varieties of Spanning Tree Protocols - Multiarea OSPF - OSPF Tuning and Troubleshooting.

**L: 15 TOTAL: 15 PERIODS**

**REFERENCES**

1. Scaling Networks Companion Guide”, CISCO Press, 2014.
2. <https://www.netacad.com/group/resources/ccna-rs-scaling/6.0>

**19IT20L**

**CONNECTING NETWORKS**

**L T P C**  
**1 0 0 1**

**COURSE OUTCOMES**

Upon Completion of this course, the students will be able to

- CO1: configure and troubleshoot network devices. (K3)
- CO2: implement Virtual Private Networks. (K3)

WAN Concepts - WAN Technologies Overview - Selecting a WAN Technology - Point-to-Point Connections - Serial Point-to-Point Overview - PPP Operation - Troubleshoot WAN Connectivity - Branch Connections - Remote Access Connections – VPNs.

Access Control Lists - Standard ACL Operation and Configuration Review - Extended IPv4 ACLs - LAN Security – SNMP - QoS Overview - QoS Mechanisms - Network Evolution - Network Troubleshooting - Troubleshooting Methodology - Troubleshooting Scenarios

**L: 15 TOTAL: 15 PERIODS****REFERENCES**

1. Connecting Networks Companion Guide", CISCO Press, 2014.
2. <https://www.netacad.com/group/resources/ccna-rs-connect/6.0>

**19IT21L****ROBOTIC PROCESS AUTOMATION****L T P C**  
**0 0 2 1****COURSE OUTCOMES**

Upon Completion of this course, the students will be able to

- CO 1: understand basic programming concepts and the underlying logic/ structure. (K2)  
CO 2: manage and use different variables, arguments and Control flow statements. (K3)

**INTRODUCTION**

Introduction to Robotic Process Automation – Life Cycle of RPA – RPA tools – Advantages of RPA

**LIST OF EXPERIMENTS**

1. Practice on RPA tool - Managing variables - arguments panel
2. Practice on Control flow statements –Data Manipulation
3. Extracting data from PDF
4. Data Manipulation in Excel
5. Email Automation
6. Transferring Data from one system to another

**SOFTWARE REQUIREMENTS**

- UiPath or Blue Prism

**P: 30 TOTAL: 30 PERIODS****REFERENCES**

1. Alok Mani Tripathi ,llLearning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool - UiPath: Create Software robots with the leading RPA tool – UiPathll, Packt Publishing, 2018.
2. Kelly Wibbenmeyer, —The Simple Implementation Guide to Robotic Process Automation (RPA): How to Best Implement RPA in an Organization ll, Universe, 2018.

**19IT22L****MATLAB PROGRAMMING****L T P C**  
**0 0 2 1****COURSE OUTCOME**

Upon Completion of this course, the students will be able to

- CO1: develop simple matlab programs. (K2)

**LIST OF CONTENTS**

1. The MATLAB environment
2. Creating and initializing MATLAB variables
3. Built-in MATLAB functions

4. Introduction to plotting
5. The Logical Data type
6. Branches

**P: 30 TOTAL: 30 PERIODS**

### REFERENCES

1. Irfan Turk, "MATLAB Programming for beginners and professionals", CreateSpace Independent Publishing Platform, December 7, 2018.
2. Stephen J. Chapman, "MATLAB Programming for Engineers", Sixth Edition, CL Engineering, Sixth edition, January 15, 2019.

**19IT23L**

**ETHICS IN CYBERSECURITY**

**L T P C**  
**1 0 0 1**

### COURSE OUTCOMES

Upon Completion of this course, the students will be able to

- CO1: explain ethics and cybersecurity ethics and the role of computer engineers making engineering decisions which have ethical consequences. (K2)

Introduction to Cyberethics: Concepts, Perspectives, and Methodological Frameworks – Basic Concepts and Models of Cybersecurity- Ethics - Three ethical frameworks -The ethical hacker - Ethical and Unethical Hacking - A Framework for Ethical Cyber-Defence for Companies - Privacy-Preserving Technologies - Cybersecurity and Cyber Warfare: The Ethical Paradox of 'Universal Diffidence.

**L: 15 TOTAL: 15 PERIODS**

### REFERENCES

1. Mary Manjikian, Cybersecurity Ethics - An Introduction, Routledge - Taylor & Francis Group, 2018.
2. Markus Christen, Bert Gordijn, Michele Loi, "The Ethics of Cybersecurity", Springer, 2020.
3. Herman T. Tavani, "Ethics and Technology: Controversies, Questions, and Strategies for Ethical Computing, John Wiley and Sons, Fourth Edition, 2012.
4. Corey Schou, Steven Hernandez, "Information Assurance Handbook: Effective Computer Security and Risk Management Strategies", McGraw-Hill Education; First Edition, 2014.

**19IT24L**

**ARDUINO PROGRAMMING**

**L T P C**  
**1 0 0 1**

### COURSE OUTCOMES

Upon Completion of this course, the students will be able to

- CO 1: describe the fundamental Arduino programming language and IDE. (K2)  
CO 2: Connect the Arduino microcontroller to a serial terminal to understand communication and stand-alone use. (K3)

**LIST OF CONTENTS**

1. Introduction to Microcontroller
2. Embedded C and Arduino platform
3. Arduino data types
4. Variables and constants
5. Control Statements
6. Arduino I/O Functions
7. Arduino Secondary Integrations
8. Arduino Communications
9. Arduino Display

**L: 15 TOTAL: 15 PERIODS****REFERENCES**

1. Simon Monk "Programming Arduino Next Steps: Going Further with Sketches", 2<sup>nd</sup> Edition, McGraw-Hill, 2018
2. Jack Purdum "Beginning C for Arduino: Learn C Programming for the Arduino", 2<sup>nd</sup> Edition, TIA, 2019

**19IT25L MATHEMATICS FOR MACHINE LEARNING**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>1</b>	<b>0</b>	<b>0</b>	<b>1</b>

**COURSE OUTCOMES**

Upon Completion of this course, the students will be able to

CO1: Understand the mathematical concepts for Machine Learning (K2)

CO2: Understand how the concepts extend for real world ML problems (K2)

**UNIT I LINEAR ALGEBRA****5**

Scalars, Vectors, Matrices and Tensors - Vector and Matrix Norms – Eigen values and Eigen vectors – Norms and Eigen decomposition.

**UNIT II MULTIVARIATE CALCULUS****5**

Introduction to Derivatives – Basics of Integration – Gradients and Gradient Visualization – Optimization.

**UNIT III PROBABILITY THEORY****5**

Introduction – Probability Distributions – Expectation, Variance and Covariance.

**L: 15 TOTAL: 15 PERIODS****REFERENCES**

1. Marc Peter Deisenroth, A.Aldo Faisal, Cheng Soon Ong, "Mathematics for Machine Learning", Cambridge University Press, 2020.'
2. "Mathematical Foundation For Machine Learning and AI", Udemy Course

**19IT26L**

**REAL TIME SYSTEMS**

**L T P C**  
**1 0 0 1**

**COURSE OUTCOMES**

Upon Completion of this course, the students will be able to

- CO 1: explain various components and methodologies in Real Time Operating Systems.  
(K2)

**LIST OF CONTENTS**

1. Real-Time Multi-Tasking OS
2. Classification of Real-time Systems
3. Concepts of Computer Control
4. Memory Management
5. Overview of Real-Time Languages
6. Task Management
7. Mutual Exclusion
8. Yourdon Methodology
9. Ward and Mellor Method
10. Hatley and Pirbhai Method

**L: 15 TOTAL: 15 PERIODS**

**REFERENCES**

1. Stuart Bennet, "Real-Time Computer Control", 2<sup>nd</sup> Edition, Pearson Education, 2008
2. Rajib Mall, "Real-Time Systems: Theory and Practice", 1<sup>st</sup> Edition, Pearson Education, 2012

**19IT27L**

**NETWORK SIMULATION WITH NS3**

**L T P C**  
**0 0 2 1**

**COURSE OUTCOMES**

Upon Completion of this course, the students will be able to

- CO 1: understand the software architecture, conventions, and basic usage of NS3 and NS4 (K2)

**LIST OF CONTENTS**

- Installation of NS3
- Introduction
- NS3 Features
- Models
- WAF
- Study of network components (Node and Packets)
- Simple Network Creation with NS3 scripts
- Logging Module
- Attributes and Tracing
- Building a Topology
- Building a wireless network topology
- Routing Protocols

- generating flow table entries from user configuration using NS4

## REFERENCES

1. Na Vikraman, "How to Write a Perfect Network Simulator - 3 Program (NS - 3): NS - 3 Workshop Manual for All", Volume 2019 of 01 Series, 2019
2. <https://www.nsnam.org/tutorials/simutools08/>

**19IT28L**

**PYTHON FOR DATA SCIENCE**

**L T P C**  
**0 0 2 1**

## COURSE OUTCOMES

Upon Completion of this course, the students will be able to

- CO1: identify and make use of python programming elements to solve problems in Data Science.

## LIST OF EXERCISES

1. Mathematical Computations with NumPy & ndarray
2. Working with Data in Python: Reading, Writing and Loading data with Pandas
3. Implementation of Data Preparation and Preprocessing Techniques
4. Implementation of Data visualization using matplotlib and seaborn libraries
5. Working on basics of Python Spyder (Tool)
6. Implementation of Clustering Algorithms
7. Implementation of Classification Algorithms
8. Implementation of Regression Algorithms
9. CASE STUDY: Regression: Predicting price of pre-owned cars, Classification: Classifying personal income

**P: 30 TOTAL: 30 PERIODS**

## REFERENCES

1. Jake VanderPlas, Python Data Science Handbook: Essential Tools for working with Data.
2. Dr.Mohd. Abdul Hameed, "Python for Data Science", Wiley.
3. Samir Madhavan, "Mastering Python for Data Science" Packt Publishers, 1st Edition, 2015.
4. [https://onlinecourses.nptel.ac.in/noc22\\_cs74/preview](https://onlinecourses.nptel.ac.in/noc22_cs74/preview)

**19IT29L**

**NODE JS**

**L T P C**  
**0 0 2 1**

## COURSE OUTCOMES

Upon Completion of this course, the students will be able to

- CO1: Develop Interactive data driven based web application using Node JS with database Connection. (K3)

## LIST OF EXPERIMENTS

1. Installation/Set up of Node.js



2. Implementation of Functions and local Modules
3. Implementation of User defined packages in NPM
4. Handling HTTP requests in web server
5. Asynchronous File Management
6. Implementation of user defined events by EventEmitter Class
7. Creating web application using Express framework
8. Mysql Connection with Node.Js
9. Mongo DB connection with Node.js
10. Debugging Nodejs using Core Node
11. Mean stack Application development includes Angular JS

**P: 30 TOTAL: 30 PERIODS**

## REFERENCES

1. Basarat Ali Syed, — Beginning Node.js, APress, 2014
2. Shelley Powers, - Learning Node – Moving to the Server Side, Second Edition, O'Reilly (2016).
3. Simon Holmes, - Getting MEAN with Mongo, Express, Angular, and Node, Second Edition, Manning (2016).
4. <https://www.coursera.org/learn/server-side-javascript-with-nodejs>

**19IT30L**

**INTRODUCTION TO NoSQL WITH MONGODB**

**L T P C**  
**0 0 2 1**

## COURSE OUTCOMES

Upon Completion of this course, the students will be able to

- CO1: Understand the basic structure of NoSQL Components through the CRUD operations (K2)
- CO2: Implement database navigation operations using ODBC /JDBC (K3)

## LIST OF EXERCISES

1. Study of Open Source NOSQL Database: Mongo DB (Installation, Basic CRUD operations, Execution).
2. Design and Develop Mongo DB Queries using CRUD operations. (Use CRUD operations, SAVE method, logical operators).
3. Implement aggregation and indexing with suitable example using Mongo DB.
4. Implement Map reduces operation with suitable example using Mongo DB.
5. Create simple objects and array objects using JSON.
6. Case Study discussion (Social Media and IoT based applications).
7. Implement a simple Database navigation operations using ODBC/JDBC by connecting PHP/PYTHON/JAVA

## SOFTWARE REQUIREMENTS

Operating System: Windows / Linux  
Software: Mongo DB 5.0

**P: 30 TOTAL: 30 PERIODS**

**REFERENCES**

1. Peter Membrey, "MongoDB Basics", Apress; First Edition, 2014.
2. <https://docs.mongodb.com/manual/tutorial/>
3. <https://www.tutorialspoint.com/mongodb/index.htm>

**19IT31L****DEEP LEARNING****L T P C****1 0 0 1****COURSE OUTCOME**

Upon Completion of this course, the students will be able to

- CO1: understand the theoretical foundations, algorithms and methodologies of Neural Network. (K2)

**LIST OF CONTENTS**

Width and Depth of Neural Networks - Activation Functions: RELU, LRELU, ERELU - Unsupervised Training of Neural Networks- Restricted Boltzmann Machines - Auto Encoders : Regularized Auto encoder, stochastic Encoders and Decoders - Deep Learning Applications.

**L: 15; TOTAL: 15 PERIODS****REFERENCES**

1. Ian Goodfellow, YoshuaBengio and Aaron Courville, "Deep Learning", MIT Press, 2017.
2. Josh Patterson, Adam Gibson "Deep Learning: A Practitioner's Approach", O'Reilly Media, 2017.

**19IT32L****REINFORCEMENT LEARNING****L T P C****1 0 0 1****COURSE OUTCOMES**

Upon Completion of this course, the students will be able to

- CO1: understand value functions and the purpose of optimal decision-making in reinforcement learning. (K2)

**LIST OF CONTENTS**

Introduction - Elements of Reinforcement Learning -Sequential Decision-Making - Markov Decision Processes- Value Functions & Bellman Equations- Bandit algorithms – UCB, PAC - Dynamic Programming- Function Approximation- Hierarchical RL.

**L: 15; TOTAL: 15 PERIODS****REFERENCE**

1. Richard S. Sutton and Andrew G. Barto, "Reinforcement Learning: An Introduction", The MIT Press Cambridge, Massachusetts London, England, 2<sup>nd</sup> Edition, 2015.

19IT33L

NATURAL LANGUAGE PROCESSING

L T P C

1 0 0 1

### COURSE OUTCOMES

Upon Completion of this course, the students will be able to

CO1: explain regular expressions, Semantic analysis and translation of information. (K2)

### LIST OF CONTENTS

Regular Expressions and Automata- Words and Transducers- N-grams – Part Of Speech Tagging and Sequence Labeling- Hidden Markov and Maximum Entropy Models- LSTM Recurrent Neural Networks- Syntactic parsing- Semantic Analysis- Information Extraction - Machine Translation.

**L: 15; TOTAL: 15 PERIODS**

### REFERENCE

1. Daniel Jurafsky and James H. Martin, "An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition", Second Edition, 2009.

**B.Tech. – INFORMATION TECHNOLOGY**  
**OPEN ELECTIVE COURSES**

**19IT01N**

**FUNDAMENTALS OF JAVA PROGRAMMING**

**L T P C**  
**3 0 0 3**

### **COURSE OUTCOMES**

Upon completion of this course the students will be able to

- CO1: describe the fundamentals of java programming. (K1)
- CO2: identify the variables, arguments and return statements of java. (K1)
- CO3: explain the various OOPs concepts in java. (K2)
- CO4: create constructors and packages in java programming. (K2)
- CO5: analyze the exception handling in java. (K2)

### **UNIT I INTRODUCTION TO OOP AND JAVA FUNDAMENTALS 9**

Object Oriented Programming – Classes and Objects – Methods - Inheritance – Polymorphism - Abstract – Interface - Encapsulation – Constructor – Access specifiers – Static members– Data types – Variables.

### **UNIT II PACKAGES AND STRING IN JAVA 9**

Packages in JAVA – Math class – String in java: String, StringBuffer, StringBuilder, Mutable and immutable, Conversion of string to StringBuffer and vice versa – Synchronized keyword.

### **UNIT III EXCEPTION AND FILE HANDLING 9**

Exceptions – Try, Catch and Finally blocks - Exception hierarchy - Build-in exceptions – Checked and unchecked exception - Creating own exceptions - File – FileWriter – FileReader

### **UNIT IV MULTITHREADING IN JAVA 9**

Thread class – Run method overriding thread lifecycle - Creating a thread – Setting priority to threads – Runnable interfaces.

### **UNIT V COLLECTION AND GENERIC PROGRAMMING 9**

Wrapper classes – Collection framework – Collections class – Set: ArrayList, LinkedList, Vector- List: HashSet, LinkedHashSet, TreeSet – Map: HashMap, HashTable, TreeMap - Generic Programming – Generic concept – Restrictions and Limitations.

**L: 45; TOTAL: 45 PERIODS**

### **TEXTBOOKS**

1. Herbert Schildt, “Java The complete reference”, Eighth Edition, McGraw Hill Education, 2011.

### **REFERENCES**

1. Paul Deitel, Harvey Deitel, “Java SE 8 for programmers”, Third Edition, Pearson, 2015.
2. Cay S. Horstmann, Gary cornell, “Core Java Volume – I Fundamentals”, Ninth Edition, Prentice Hall, 2013.

**19IT02N**

**PYTHON PROGRAMMING - BASICS**

**L T P C**  
**3 0 0 3**

### **COURSE OUTCOMES**

Upon completion of this course, the students will be able to

- CO 1: classify and make use of python programming elements to solve problems. (K3)
- CO 2: experiment with the various control statements in python.(K3)
- CO 3: develop python programs using functions and strings.(K3)
- CO 4: analyse a problem and use appropriate data structures to solve it.(K4)

CO5: develop python programs to implement various file operations and exception handling. (K3)

- UNIT I INTRODUCTION 9**  
Introduction-Python Interpreter-Interactive and script mode -Values and types- operators-expressions- statements-precedence of operators-Multiple assignments- comments.
- UNIT II CONTROL STATEMENTS AND FUNCTIONS 9**  
Conditional (if)-alternative (if-else)- chained conditional (if-elif-else)-Iteration-while- for- break-continue-pass – Functions – Introduction- inbuilt functions-user defined functions- passing parameter- return values- recursion- Lambda functions.
- UNIT III DATA STRUCTURES 9**  
Strings-String slices- immutability-string methods and operations -Lists-creating list- list operations-list methods-mutability- aliasing-cloning lists-list and strings- list and functions-list processing-list comprehension, searching and sorting, Sets-creating sets, set operations-Tuples-Tuple assignment- Operations on Tuples- lists and tuples- Tuple as return value- Dictionaries-operations and methods- Nested Dictionaries.
- UNIT IV FILES, MODULES, PACKAGES 9**  
Files and Exception-Text files- reading and writing files- format Operator-Modules-Python Modules-Creating own python modules-packages, Introduction to exception handling.
- UNIT V OBJECT-ORIENTED PROGRAMMING 9**  
Object-Oriented Programming- Classes and Objects-Creating Classes in Python-Creating Objects in Python- The Constructor Method-Classes with Multiple Objects-Class Attributes versus Data Attributes-Encapsulation-Inheritance-The Polymorphism.

**L: 45; TOTAL: 45 PERIODS**

#### TEXTBOOKS

1. Ashok Namdev Kamthane, Amit Ashok Kamthane, "Programming and Problem Solving with Python" , Mc-Graw Hill Education,2018.
2. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", Second Edition, Updated for Python 3, Shroff / O'Reilly Publishers, 2016.
3. Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-disciplinary Approach", Pearson India Education Services Pvt. Ltd., 2016.
4. Timothy A. Budd," Exploring Python", Mc-Graw Hill Education (India) Private Ltd., 2015.

#### REFERENCES

1. Kenneth A. Lambert, "Fundamentals of Python: First Programs", CENGAGE Learning, 2012.
2. Charles Dierbach, "Introduction to Computer Science using Python: A Computational Problem Solving Focus", Wiley India Edition, 2013.

#### WEB REFERENCES

1. <http://greenteapress.com/wp/think-python/>
2. <http://www.mhhe.com/kamthane/python>
3. <https://www.sanfoundry.com/python-problems-solutions/>



3. Fei GAO, "Design and Development of Virtual Reality Application System", Tsinghua Press, March 2012.
4. Doug A Bowman, Ernest Kuijff, Joseph J LaViola, Jr and Ivan Poupyrev, "3D User Interfaces, Theory and Practice", Addison Wesley, USA, 2005.
5. Oliver Bimber and Ramesh Raskar, "Spatial Augmented Reality: Merging Real and Virtual Worlds", 2005.
6. Burdea, Grigore C and Philippe Coiffet, "Virtual Reality Technology", Wiley Interscience, India, 2003.

**19IT04N****INTERNET OF THINGS****L T P C  
3 0 0 3****COURSE OUTCOMES**

Upon completion of this course, the students will be able to

CO1: discover key IoT concepts including identification, sensors, localization, wireless protocols, data storage and security. (K2)

CO2: explore IoT technologies with M2M Communications and Web of Things. (K2)

CO3: realize the cloud computing technologies by collecting, communicating, coordinating and leveraging the data from connected devices. (K2)

CO4: examine technological developments that will likely shape the industrial landscape in the future. (K2)

CO5: develop and implement IoT technologies, solutions, and applications (K2)

**UNIT I INTRODUCTION****9**

Introduction – Characterizes – Sensing - Actuation and fundamentals of network - Enabling technologies of IoT - Different Communication Protocols in Internet of Things - Internet of Things Network Protocol Stack - 6LoWPAN – CoAP – MQTT - Bluetooth Low Energy – Zigbee - Case study on RFID.

**UNIT II M2M COMMUNICATIONS AND WEB OF THINGS****9**

Introduction – Applications - Key features - Architecture and components - Requirements for M2M, Issues /concerns in M2M - Standardization Efforts for M2M – Web of Things.

**UNIT III UBIQUITOUS CLOUDS AND THE INTERNET OF THINGS****9**

Cloud Trends in Supporting Ubiquitous Computing - Performance of Distributed Systems and the Cloud - Enabling Technologies for the Internet of Things - Innovative Applications of the Internet of Things - Online Social and Professional Networking.

**UNIT IV TECHNOLOGIES****9**

Wireless protocols - Data storage and analysis – Localization - Security in Internet of Things - HCI and Internet of Things World - Robotics and Autonomous Vehicles.

**UNIT V APPLICATIONS****9**

Smart Buildings - Wireless Technologies for Indoor Localization - Smart Homes - Smart Health - Smart Cities.

**L: 45; TOTAL: 45 PERIODS****TEXTBOOKS**

1. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press, Taylor & Francis Group, 2017.
2. Arshdeep Bahga, Vijay Madiseti, "Internet of Things: A Hands-on Approach, Universities Press, 2014.



3. Kai Hwang, Geoffrey C. Fox and Jack J. Dongarra, Distributed and Cloud Computing: From Parallel Processing to the Internet of Things, Morgan Kaufmann, 2012.

## REFERENCES

1. Rajkumar Buyya and Amir Vahid Dastjerdi, Internet of Things Principles and Paradigms, Morgan Kaufmann, 2016.
2. Fei Hu, Security and Privacy in Internet of Things (IoT): Models, Algorithms, and Implementations, CRC Press, Taylor & Francis Group, 2016.
3. Olivier Hersent and David Boswarthick, Internet of Things: Key Applications and Protocols, John Wiley, 2015.
4. Marco Schwartz, Internet of Things with the Arduino Yun, Packt Publishing, 2014.
5. Herve Chabanne, Pascal Urien, Jean-Ferdinand Susini, RFID and the Internet of Things, Wiley, 2011.
6. Dieter Uckelmann, Mark Harrison, Florian Michahelles, Architecting the Internet of Thingsm Springer, 2011.
7. Hakima Chaouchi, The Internet of Things Connecting Objects to the Web, Wiley, 2010.

**19IT05N**

**BASIC OF NETWORKING**

**L T P C**  
**3 0 0 3**

## COURSE OUTCOMES

Upon completion of this course, the students will be able to

- CO1: describe the fundamental various types of computer networks. (K2)
- CO2: compare the TCP/IP and OSI models with merits and demerits. (K2)
- CO3: explore the various layers of OSI Model. (K2)
- CO4: describe the UDP and TCP Models. (K1)
- CO5: enumerate the concept of different routing techniques for data communications.(K2)

### UNIT I INTRODUCTION TO NETWORKS

**9**

Internet, Protocols and Standards, The OSI Model, Layers in OSI Model, TCP/IP Suite, Addressing.

### UNIT II PHYSICAL LAYER

**9**

Multiplexing, Transmission Media, Circuit Switched Networks, Datagram Networks, and Virtual Circuit Networks.

### UNIT III DATA LINK LAYER

**9**

Introduction, Checksum, Framing, Flow and Error Control, Noiseless Channels, Noisy Channels, Random Access Controlled Access, Channelization, IEEE Standards, Ethernet, Giga-Bit Ethernet.

### UNIT IV NETWORK LAYER AND CONNECTING DEVICES

**9**

Tunneling, Address Mapping, ICMP, IGMP, Forwarding. Connecting Devices-Passive Hubs, Repeaters, Active Hubs, Bridges, Routers.

### UNIT V ROUTING PROTOCOLS

**9**

Routing-Flooding, Bellman& Ford, Disjkstra's routing protocols, RIP, OSPF, BGP and Multicast Routing Protocols.

**L: 45; TOTAL: 45 PERIODS**

**TEXTBOOKS**

1. Behrouz A. Forouzan, "Data Communications and Networking", Fourth Edition, Mc Graw Hill Education, 2006.
2. Andrew S Tanenbaum, "Computer Networks", Fifth Edition, Pearson Education, 2012.
3. James F. Kurose, K. W. Ross, "Computer Networking: A Top-Down Approach Featuring the Internet", Third Edition, Pearson Education, 2007.

**REFERENCES**

1. Bhusan Trivedi, "Data communication and Networks", Oxford university press 2016.
2. S.Keshav, "An Engineering Approach to Computer Networks", Second Edition, Pearson Education, 2008.
3. William A. Shay, "Understanding Data Communications and Networks", Third Edition, 2003.

**19IT06N****ADVANCED NETWORKING****L T P C  
3 0 0 3****COURSE OUTCOMES**

Upon completion of this course, the students will be able to

- CO1: describe the network protocols and standards. (K2)
- CO2: enumerate the concept of multiplexing and LAN. (K2)
- CO3: elicit the optical networking concepts. (K2)
- CO4: describe the integrated service digital networking needs. (K2)
- CO5: importance of ATM and WAN protocols. (K2)

**UNIT I INTRODUCTION TO PROTOCOLS AND STANDARDS 9**

Overview of reference models: The OSI model, The OSI Reference Model, TCP/IP protocol Suite, The TCP/IP Reference Model, Comparison of the OSI & the TCP/IP Reference Models, Addressing, IP versions.

**UNIT II MULTIPLEXING AND LOCAL AREA NETWORKS 9**

Multiplexing, Types of Multiplexing- FDM, TDM, SM; - Ethernet, token ring, FDDI; switching - circuit switching, packet switching, multicasting.

**UNIT III OPTICAL NETWORKING 9**

SONET/SDH standards, Dense Wavelength division multiplexing (DWDM), Performance and design Considerations.

**UNIT IV INTEGRATED SERVICE DIGITAL NETWORK 9**

History of Analog and Digital Network - Access to ISDN - ISDN Layers - Broadband ISDN - X.25 Layers - Packet Layer Protocol.

**UNIT V ATM: THE WAN PROTOCO 9**

Faces of ATM, ATM Protocol operations (ATM cell and Transmission) ATM Networking basics, Theory of Operations, B-ISDN reference model, PHY layer, ATM Layer (Protocol model), ATM layer and cell, Traffic Descriptor and parameters, Traffic Congestion control defined, AAL Protocol model.

**L: 45; TOTAL: 45 PERIODS****TEXTBOOK**

1. Comer, Douglas E., "Computer Networks and Internets", Sixth Edition, Prentice Hall, 2016.

## REFERENCES

1. Behrouz A. Forouzan, "TCP/IP Protocol Suite", Fourth Edition, McGraw Hill, ISBN 978-0-07-337604-2, 2010.
2. Tanenbaum, A. S., "Computer Networks", Fourth Edition, Prentice Hall, Upper Saddle River, New Jersey, 2002.
3. William Stallings, "Data and Computer Communications", Seventh edition, by, Prentice Hall, 2003.

**19IT07N**

**INDUSTRIAL NETWORKING**

**L T P C**  
**3 0 0 3**

## PREREQUISITE

- Basic Networking

## COURSE OUTCOMES

Upon completion of this course, the students will be able to

- CO1: identify various internetworking devices involved in industrial networks. (K2)
- CO2: understand the various serial communication used in process industries. (K2)
- CO3: outline the working of HART and Field bus used in process digital communication. (K2)
- CO4: summarize the operation of MODBUS, PROFIBUS protocol & its applications. (K2)
- CO5: illustrate the industrial Ethernet and wireless communication. (K2)

## UNIT I DATA NETWORK FUNDAMENTALS

**9**

Networks hierarchy and switching – Open System Interconnection model of ISO - Data link control protocol - Media access protocol - Token passing - CSMA/CD, TCP/IP.

## UNIT II INTERNET WORKING and RS 232

**9**

Bridges - Routers - Gateways - Standard ETHERNET and ARCNET configuration special requirement for networks used for control - RS 232, Devicenet.

## UNIT III HART AND FIELDBUS

**9**

Introduction - Evolution of signal standard - HART communication protocol - HART networks – HART applications – Field bus - Introduction - General Field bus architecture – Basic requirements of Field bus standard – Field bus topology.

## UNIT IV MODBUS AND PROFIBUS

**9**

MODBUS protocol structure– Introduction, Profibus protocol stack, Profibus communication model - communication objects - system operation - review of foundation field bus - Data Highway.

## UNIT V INDUSTRIAL ETHERNET AND WIRELESS COMMUNICATION

**9**

Industrial Ethernet, Introduction, 10 Mbps Ethernet, 100 Mbps Ethernet - Radio and wireless communication, Introduction, components of radio link - radio spectrum and frequency allocation - radio MODEMs.

**L: 45; TOTAL: 45 PERIODS**

## TEXTBOOKS

1. Steve Mackay, Edwin Wrijut, Deon Reynders, John Park, "Practical Industrial Data Networks Design, Installation and Troubleshooting" Newnes Publication, Elsevier First Edition, 2004.
2. William Buchanan, "Computer Buses", CRC Press, 2000.

- Behrouz Forouzan, "Data Communications & Networking", Third edition, Tata McGraw hill, 2006.

## REFERENCES

- Andrew S. Tanenbaum, David J. Wetherall, "Computer Networks", Prentice Hall of India Pvt. Ltd., Fifth Edition, 2011.
- Theodore S Rappaport, "Wireless Communication: Principles and Practice", Prentice Hall of India, Second Edition, 2001.
- William Stallings, "Wireless Communication & Networks", Prentice Hall of India, Second Edition, 2005.

**19IT08N**

**DATA ANALYTICS**

**L T P C**  
**3 0 0 3**

## COURSE OUTCOMES

Upon completion of the course, the students will be able to:

CO 1: discuss big data tools and its analysis techniques (K2)

CO 2: describe Graph analytics and NoSQL databases (K2)

CO 3: Analyze data by utilizing clustering and classification algorithms (K4)

CO 4: apply different mining algorithms and recommendation systems for large volumes of data. (K3)

CO 5: Perform analytics on data streams. (K3)

### UNIT I INTRODUCTION TO BIG DATA

**9**

Evolution of Big data – Best Practices for Big data Analytics – Big data characteristics – Validating – The Promotion of the Value of Big Data – A General Overview of High-Performance Architecture – HDFS – Map Reduce and YARN – Map Reduce Programming Model

### UNIT I NO SQL DATABASES

**9**

Using Graph Analytics for Big Data: Graph Analytics - The Graph Model - Representation as Triples - Graphs and Network Organization - Dedicated Appliances for Graph -. No SQL Databases : Schema-less Models||: Increasing Flexibility for Data Manipulation-Key Value Stores- Document Stores – Tabular Stores – Object Data Stores – Graph Databases Hive – Hbase.

### UNIT III SUPERVISED AND UNSUPERVISED LEARNING

**9**

Supervised Learning - Unsupervised Learning-Advanced Analytical Theory and Methods: Overview of Clustering – K-means – Use Cases – Overview of the Method – 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

### UNIT IV ASSOCIATION AND RECOMMENDATION SYSTEM

**9**

Advanced Analytical Theory and Methods: Association Rules – Overview – Apriori Algorithm –Recommendation System: Collaborative Recommendation- Content Based Recommendation – Knowledge Based Recommendation- Hybrid Recommendation Approaches.

## UNIT V STREAM MEMORY

9

Introduction to Streams Concepts – Stream Data Model and Architecture - Stream Computing, Sampling Data in a Stream – Filtering Streams –Real time Analytics Platform(RTAP) applications - Case Studies -Stock Market Predictions

**L: 45; TOTAL: 45 PERIODS**

### TEXT BOOKS

1. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Second Edition, Cambridge University Press, 2014.
2. David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph" First Edition, Morgan Kaufmann/Elsevier Publishers, 2013.

### REFERENCES

1. EMC Education Services, "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", Wiley publishers, 2015.
2. Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications", Wiley Publishers, 2015.
3. Dietmar Jannach and Markus Zanker, "Recommender Systems: An Introduction", Cambridge University Press, 2010.
4. Kim H. Pries and Robert Dunnington, "Big Data Analytics: A Practical Guide for Managers" CRC Press, 2015.
5. Jimmy Lin and Chris Dyer, "Data-Intensive Text Processing with MapReduce", Synthesis Lectures on Human Language Technologies, Vol. 3, No. 1, Pages 1-177, Morgan Claypool publishers, 2010.

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E-WASTE MANAGEMENT

L T P C  
3 0 0 3

### PREREQUISITE

- Environmental Science and Engineering

### COURSE OUTCOMES

Upon completion of this course the students will be able to

- CO1: explain cause and effect of environmental pollution. (K2)
- CO2: describe the characteristics of different substances of e-waste. (K2)
- CO3: discuss the human impacts of e-waste upon the environment. (K2)
- CO4: summarize the storage, transport, processing and disposal of e-waste. (K2)
- CO5: discuss the different policies of recycling e-waste. (K2)

## UNIT I ENVIRONMENTAL POLLUTION

9

Causes, effects and control measures of Water, Soil, Marine, Thermal pollution - Nuclear hazards - Solid waste Management: Causes, effects and control measures of urban and industrial wastes - Role of an individual in prevention of pollution.

## UNIT II OVERVIEW OF E-WASTE

9

E-waste growth- hazards of E-waste - Hazardous substances- Waste Electrical and Electronic Equipment - characteristics of pollutants, batteries, electrical and electronic components, plastic and flame retardants, circuit boards, pollutants in waste electrical and electronic equipment.

**UNIT III            IMPACTS OF E-WASTE**

**9**

Toxicity due to hazardous substances - domestic e-waste disposal - occupational and environmental health perspectives of recycling e-waste in India.

**UNIT IV            E-WASTE MANAGEMENT**

**9**

Regulatory aspects of E-Waste management - Waste characteristics- Generation– Collection - Material Composition-Transport– Treatment and disposal.

**UNIT V            RECYCLING OF E-WASTE**

**9**

Optimal planning for Computer waste - Technologies for recovery of resources from electronic waste - resource recovery potential of e-waste – Recycling e-waste in a global environment – opportunities and challenges - Environmentally responsible business: Policies, Practices and Metrics.

**L: 45 TOTAL: 45 PERIODS**

**TEXT BOOKS**

1. R.E. Hester, Roy M Harrison, "Electronic waste management", Cambridge, UK, RSC Publication, 2009.
2. Rakesh Johri, "E-waste: Implications, Regulations and Management in India and Current Global Best Practices", The Energy and Resources Institute, New Delhi, 2008.

**REFERENCES**

1. Bharucha Erach, "Text Book of Environmental Studies for undergraduate Courses", University Press, Second Edition, 2013.
2. Vishakha Munshi, "E-Waste Managing the Digital Dump Yard", ICFAI University Press, 2007.