B.Tech. Information Technology

CURRICULUM AND SYLLABI

I to VI Semesters

Regulation - 2020

ENGINEERING COLLEGE

(Autonomous)

Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

Accredited by NBA and NAAC with "A+"and Recognized by UGC (2f&12B)

KOMARAPALAYAM – 637303

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EXCEL ENGINEERING COLLEGE

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KOMARAPALAYAM - 637303

B.TECH. - INFORMATION TECHNOLOGY
REGULATION 2020
CHOICE BASED CREDIT SYSTEM
I TO VIII SEMESTERS CURRICULUM AND SYLLABI

I – SEMESTER									
Code No.	**Course**	**Category**	**Periods / Week**			**C**	**Maximum Marks**		
			L	**T**	**P**		**CA**	**FE**	**Total**
Theory Course(s)									
20MA103	Mathematics – I for Computer Sciences	BS	3	2	0	4	40	60	100
20CS101	Computer Hardware and Networking	ES	3	0	0	3	40	60	100
Theory with Practical Course(s)									
20ENEXX	Language Elective – I	HSS	2	0	2	3	50	50	100
20PH102	Physics for Computer Sciences	BS	3	0	2	4	50	50	100
20CS102	Problem Solving using Python	ES	3	0	2	4	50	50	100
Practical Course(s)									
20CS103	Computer Practices Laboratory	ES	0	0	2	1	50	50	100
Mandatory Course									
20MC101	Induction Programme	MC	2 Weeks			0	100	0	100
TOTAL			**14**	**2**	**8**	**19**	**380**	**320**	**700**

Language Electives – I									
Code No.	**Course**	**Category**	**Periods / Week**			**C**	**Maximum Marks**		
			L	**T**	**P**		**CA**	**FE**	**Total**
20ENE01	Communicative English	HSS	2	0	2	3	50	50	100
20ENE02	Advanced Communicative English	HSS	2	0	2	3	50	50	100

II- SEMESTER									
Code No.	**Course**	**Category**	**Periods /Week**			**C**	**Maximum Marks**		
			L	**T**	**P**		**CA**	**FE**	**Total**
Theory Course(s)									
20MA203	Mathematics – II for Computer Sciences	BS	3	2	0	4	40	60	100
20IT201	Programming and Data Structures	ES	3	0	0	3	40	60	100
Theory with Practical Course(s)									
20ENEXX	Language Elective – II*	HSS	2	0	2	3	50	50	100
20CH201	Chemistry for Computer Sciences	BS	3	0	2	4	50	50	100
20ME203	Engineering Graphics	ES	1	0	4	3	50	50	100
Practical Course(s)									
20IT202	Programming and Data Structures Laboratory	ES	0	0	4	2	50	50	100
Mandatory Course									
20MC202	Interpersonal Skills	MC	0	0	2	0	100	0	100
Total			**12**	**2**	**14**	**19**	**380**	**320**	**700**

Language Electives – II									
Code No.	**Course**	**Category**	**Periods /Week**			**C**	**Maximum Marks**		
			L	**T**	**P**		**CA**	**FE**	**Total**
20ENE02	Advanced Communicative English	HSS	2	0	2	3	50	50	100
20ENE03	Hindi	HSS	2	0	2	3	50	50	100
20ENE04	French	HSS	2	0	2	3	50	50	100
20ENE05	German	HSS	2	0	2	3	50	50	100

III- SEMESTER									
Code No.	**Course**	**Category**	**Periods /Week**			**C**	**Maximum Marks**		
			L	**T**	**P**		**CA**	**FE**	**Total**
Theory Course(s)									
20MA303	Discrete Mathematics & Graph theory	BS	3	2	0	4	40	60	100
20IT301	Object Oriented Programming	PC	3	0	0	3	40	60	100
20IT302	Computer Architecture and Organization	PC	3	0	0	3	40	60	100
Theory with Practical Course(s)									
20IT303	Operating Systems	PC	3	0	2	4	50	50	100
20IT304	Database Management Systems	PC	3	0	2	4	50	50	100
20EC306	Digital Logics and Microprocessor	ES	3	0	2	4	50	50	100
Practical Course(s)									
20IT305	Object Oriented Programming Laboratory	PC	0	0	4	2	50	50	100
Mandatory Course									
20MC301	Environmental Sciences	MC	2	0	0	0	100	0	100
Total			**20**	**4**	**10**	**24**	**420**	**380**	**800**

IV- SEMESTER									
Code No.	**Course**	**Category**	**Periods /Week**			**C**	**Maximum Marks**		
			L	**T**	**P**		**CA**	**FE**	**Total**
Theory Course(s)									
20MA403	Probability and Statistical methods	BS	3	2	0	4	40	60	100
20IT401	Data communication and Computer Networks	ES	3	0	0	3	40	60	100
20IT402	Computational Intelligence	PC	3	0	0	3	40	60	100
20IT403	Software Engineering	PC	3	0	0	3	40	60	100
Theory with Practical Course(s)									
20IT404	Web Technology	PC	3	0	2	4	50	50	100
20IT405	Wireless Sensor Networks and Architecture	PC	3	0	2	4	50	50	100
Practical Course(s)									
20IT406	Data communication and Computer networks laboratory	ES	0	0	4	2	50	50	100
Mandatory Course									
20MC401	Soft Skills	MC	2	0	0	0	100	0	100
Total			**20**	**2**	**8**	**23**	**410**	**390**	**800**

V- SEMESTER									
Code No.	**Course**	**Category**	**Periods /Week**			**C**	**Maximum Marks**		
			L	**T**	**P**		**CA**	**FE**	**Total**
Theory Course(s)									
20IT501	Mobile Application Development	PC	3	0	0	3	40	60	100
20IT502	Data Analytics	PC	3	0	0	3	40	60	100
20IT503	Machine Learning techniques	PC	3	0	0	3	40	60	100
20ITEXX	Professional Elective I	PE	3	0	0	3	40	60	100
20YYOXX	Open Elective I	OE	3	0	0	3	40	60	100
Theory with Practical Course(s)									
20IT504	Internet of Things	PC	3	0	2	4	50	50	100
Practical Course(s)									
20IT505	Mobile Application Development Laboratory	PC	0	0	4	2	50	50	100
20IT506	Machine Learning Laboratory	PC	0	0	4	2	50	50	100
Total			**18**	**0**	**10**	**23**	**350**	**450**	**800**

VI- SEMESTER									
Code No.	**Course**	**Category**	**Periods /Week**			**C**	**Maximum Marks**		
			L	**T**	**P**		**CA**	**FE**	**Total**
Theory Course(s)									
20IT601	Computer Graphics and Multimedia	PC	3	0	0	3	40	60	100
20ITEXX	Professional Elective – II	PE	3	0	0	3	40	60	100
20YYOXX	Open Elective – II	OE	3	0	0	3	40	60	100
Theory with Practical Course(s)									
20IT602	Cryptography and Network Security	PC	3	0	2	4	50	50	100
20IT603	Object Oriented Analysis and Design	PC	3	0	2	4	50	50	100
Practical Course(s)									
20IT604	Open Source Laboratory	PC	0	0	2	1	50	50	100
20IT605	Mini Project	EEC	0	0	2	1	50	50	100
20IT606	Internship	EEC	2 Weeks			1	50	50	100
Total			**15**	**0**	**8**	**20**	**370**	**430**	**800**

VII- SEMESTER									
Code No.	**Course**	**Category**	**Periods /Week**			**C**	**Maximum Marks**		
			L	**T**	**P**		**CA**	**FE**	**Total**
Theory Course(s)									
20IT701	Principles of Management and Professional Ethics	HSS	3	0	0	3	40	60	100
20IT702	Cloud Computing and Virtualization	PC	3	0	0	3	40	60	100
20IT703	Management Information systems	PC	3	0	0	3	40	60	100
20ITEXX	Professional Elective – III	PE	3	0	0	3	40	60	100
20ITEXX	Professional Elective – IV	PE	3	0	0	3	40	60	100
20YYOXX	Open Elective – III	OE	3	0	0	3	40	60	100
Practical Course(s)									
20IT704	Cloud Computing Laboratory	PC	0	0	4	2	50	50	100
20IT705	Design Project	EEC	0	0	2	1	50	50	100
Total			**18**	**0**	**6**	**21**	**340**	**460**	**800**

VIII- SEMESTER									
Code No.	**Course**	**Category**	**Periods /Week**			**C**	**Maximum Marks**		
			L	**T**	**P**		**CA**	**FE**	**Total**
Theory Course(s)									
20ITEXX	Professional Elective – V	PE	3	0	0	3	40	60	100
20ITEXX	Professional Elective – VI	PE	3	0	0	3	40	60	100
20IT801	Major Project	EEC	0	0	20	10	50	50	100
Total			**6**	**0**	**20**	**16**	**130**	**170**	**300**

PROFESSIONAL ELECTIVES (PE)

Code No.	Course	Category	Periods /Week			C	Maximum Marks		
			L	T	P		CA	FE	Total
STREAM 1 ARTIFICIAL INTELLIGENCE									
20ITE01	Soft Computing Techniques	PE	3	0	0	3	40	60	100
20ITE02	Natural Language Processing	PE	3	0	0	3	40	60	100
20ITE03	Social Intelligence	PE	3	0	0	3	40	60	100
20ITE04	Business Intelligence	PE	3	0	0	3	40	60	100
20ITE05	Social Network Analysis	PE	3	0	0	3	40	60	100
20ITE06	Computational Neuroscience	PE	3	0	0	3	40	60	100
20ITE07	Deep Learning Techniques	PE	3	0	0	3	40	60	100
20ITE08	Cognitive Science	PE	3	0	0	3	40	60	100
20ITE09	Cybernetics and brain simulation	PE	3	0	0	3	40	60	100
20ITE10	Computer Vision	PE	3	0	0	3	40	60	100
STREAM 2 CYBER SECURITY									
20ITE21	Information Security	PE	3	0	0	3	40	60	100
20ITE22	Cyber forensics	PE	3	0	0	3	40	60	100
20ITE23	Quantum cryptography	PE	3	0	0	3	40	60	100
20ITE24	Ethical Hacking and network defense	PE	2	0	2	3	40	60	100
20ITE25	Wireless security	PE	3	0	0	3	40	60	100
20ITE26	Machine learning for cyber security	PE	3	0	0	3	40	60	100
20ITE27	Secure Data Management	PE	3	0	0	3	40	60	100
20ITE28	Advanced cryptology	PE	3	0	0	3	40	60	100
20ITE29	Mobile application Security and Penetration testing	PE	3	0	0	3	40	60	100
20ITE30	Block chain Technology	PE	3	0	0	3	40	60	100
STREAM 3 DATA SCIENCE									
20ITE41	Data science with python	PE	2	0	2	3	40	60	100
20ITE42	Big data for Data Engineering	PE	3	0	0	3	40	60	100
20ITE43	R Programming	PE	2	0	2	3	40	60	100
20ITE44	Data analytics and Hadoop	PE	2	0	2	3	40	60	100
20ITE45	Predictive analytics	PE	3	0	0	3	40	60	100
20ITE46	Data mining	PE	3	0	0	3	40	60	100
20ITE47	Information retrieval Techniques	PE	3	0	0	3	40	60	100
20ITE48	Online and Real Time Systems	PE	3	0	0	3	40	60	100
20ITE49	Optimization based data analysis	PE	3	0	0	3	40	60	100
20ITE50	Web database and information systems	PE	3	0	0	3	40	60	100

STREAM 4 : INTERNET OF THINGS									
20ITE61	Programming the IoT	PE	2	0	2	3	40	60	100
20ITE62	Developing industrial IoT	PE	3	0	0	3	40	60	100
20ITE63	IoT and Embedded systems	PE	3	0	0	3	40	60	100
20ITE64	Edge computing technologies	PE	3	0	0	3	40	60	100
20ITE65	IoT and AI Cloud	PE	3	0	0	3	40	60	100
20ITE66	Industrial IoT Markets and Security	PE	3	0	0	3	40	60	100
20ITE67	Developing Solutions with Azure	PE	2	0	2	3	40	60	100
20ITE68	Data Analytics and Storage	PE	3	0	0	3	40	60	100
20ITE69	IoT Communication Technologies	PE	3	0	0	3	40	60	100
20ITE70	Cyber security in IOT	PE	3	0	0	3	40	60	100

OPEN ELECTIVE COURSES(For Other Branches)									
20ITO01	Smart Agriculture	OE	3	0	0	3	40	60	100
20ITO02	Application of machine learning in industries	OE	3	0	0	3	40	60	100
20ITO03	Deep learning fundamentals	OE	3	0	0	3	40	60	100
20ITO04	Data Analytics for IOT	OE	3	0	0	3	40	60	100
20ITO05	Robot learning	OE	3	0	0	3	40	60	100
20ITO06	Augmented and Virtual Reality	OE	2	0	2	3	40	60	100
20ITO07	Web database development	OE	2	0	2	3	40	60	100
20ITO08	Service Oriented Architecture	OE	3	0	0	3	40	60	100
20ITO09	Pattern and Anomaly Detection	OE	3	0	0	3	40	60	100
20ITO10	Big Data and Food Security	OE	3	0	0	3	40	60	100

ONE CREDIT COURSES									
20ITA01	Embedded C Programming	EEC	0	0	2	1	100	0	100
20ITA02	Linux Shell programming	EEC	0	0	2	1	100	0	100
20ITA03	Programming for the Web with JavaScript	EEC	0	0	2	1	100	0	100
20ITA04	CMS web development	EEC	0	0	2	1	100	0	100
20ITA05	R Programming	EEC	0	0	2	1	100	0	100
20ITA06	Network simulation	EEC	0	0	2	1	100	0	100
20ITA07	C# and .net Programming	EEC	0	0	2	1	100	0	100
20ITA08	Machine Learning with Tensor Flow	EEC	0	0	2	1	100	0	100
20ITA09	Explore animation	EEC	0	0	2	1	100	0	100
20ITA10	Entrepreneurship	EEC	0	0	2	1	100	0	100
20ITA11	Embedded Systems in Python	EEC	0	0	2	1	100	0	100

CREDITS DISTRIBUTION – SEMESTER WISE

S.No	CATEGORY	CREDITS PER SEMESTER								TOTAL CREDIT (AICTE)	CREDITS in %
		I	II	III	IV	V	VI	VII	VIII		
1	**HSS**	3	3					3		**9 (10-14)**	**5.45%**
2	**BS**	8	8	4	4					**24 (22-28)**	**14.54%**
3	**ES**	8	8	4	5					**25 (24)**	**15.15%**
4	**PC**			16	14	17	12	8		**67 (48)**	**40.60%**
5	**PE**					3	3	6	6	**18 (18)**	**10.90%**
6	**OE**					3	3	3		**9**	**5.45%**
7	**EEC**						2	1	10	**13 (12-16)**	**7.87%**
8	**MC**	0	0	0	0	-	-	-	-	**0**	**0.00%**
Total		**19**	**19**	**24**	**23**	**23**	**20**	**21**	**16**	**165**	**100.00 %**

HSS - Humanities and Social Sciences

BS - Basic Sciences

ES - Engineering Sciences

PC - Professional Core

PE - Professional Electives

OE - Open Electives

EEC - Employability Enhancement Courses

MC - Mandatory Courses (Non-Credit Courses)

CA - Continuous Assessment

FE - Final Examination

I SEMESTER

20MA103	MATHEMATICS-I FOR COMPUTER SCIENCES (Common to CSE, IT & AI & DS)	3/2/0/4
Nature of Course	Basic Sciences	
Pre requisites	Fundamentals of Basic Mathematics	

Course Objectives

The course is intended to

1. Acquire the concept of matrix algebra techniques those are needed by engineers for practical applications.
2. Acquaint the mathematical tools needed in evaluating limits, derivatives and differentiation of one variable.
3. Learn the curvature; calculate the radius of curvature, centre, evolutes, involutes and envelope of curves.
4. Acquire the knowledge of linear and simultaneous differential equations.
5. Learn the Green's theorem, Stokes' theorem and the Divergence theorem to compute integrals.

Course Outcomes

On successful completion of the course, students will be able to

CO. No	Course Outcome	Bloom's Level
CO1	Identify the eigen values, eigenvectors and apply Cayley- Hamilton theorem.	Apply
CO2	Interpret the limit definition and rules of differentiation to differentiate the functions.	Understand
CO3	Identify the circle of curvature, evolutes and envelope of the curves.	Understand
CO4	Solve the linear and simultaneous differential equations.	Apply
CO5	Interpret the Green's theorem, Stokes' theorem, or Divergence theorem to evaluate integrals.	Apply

Course Contents:

Unit - I Matrices **12**

Characteristic equation – Eigen values and Eigen vectors of a real matrix – Properties(statement only) – Cayley-Hamilton theorem and its applications – Orthogonal transformation of a symmetric matrix to diagonal form – Reduction of quadratic form to canonical form by orthogonal transformation.

Unit - II Limits and Continuity **12**

Representation of functions – Limit of a function – Continuity – Derivatives – Differentiation rules - Maxima and Minima of functions of one variable.

Unit – III Differential Calculus **12**

Curvature – Curvature in Cartesian co-ordinates - Centre and Radius of curvature- Circle of curvature- Evolutes and Involutes-Envelopes.

Unit – IV Ordinary Linear Differential Equations **12**

Linear differential equations of second and higher order with constant co-efficient - R.H.S is sinax, cosax e^{ee}, e^{e}– Differential equations with variable co-efficients : Cauchy's and Legendre's form of linear equation – Method of variation of parameters.

Unit–V Vector Calculus **12**

Gradient, divergence and curl – Directional derivative – Irrotational and Solenoidal vector fields - Green's theorem in a plane, Gauss divergence theorem and Stoke's theorem (excluding proofs) – Verification of theorem and simple applications.

Total: 60 Periods

Text Books:

1. Grewal B.S, "Higher Engineering Mathematics", Khanna Publishers, 44th Edition, 2019.
2. Veerarajan.T, "Engineering Mathematics for Semester I and II", Tata McGraw Hill Publishers, 3rd Edition, 2014.

Reference Books:

1. Kandasamy P., Thilagavathy K., and Gunavathy K., "Engineering Mathematics", S. Chand & Co.Publishers, 3rd Edition, 2019.
2. Weir M.D. and Joel Hass, ''Thomas calculus'' Pearson Publishers, 12th Edition, 2016.

Additional References:

1. nptel.ac.in/courses/111/105/111105121
2. nptel.ac.in/courses/122/104/122104017

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
Cos	**Pos**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3						3				3		
CO2	3	3	2						2				2		
CO3	3	3	2						2				2		
CO4	3	3	2						2				3		
CO5	3	2	2						2				2		
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Online Quiz	5	15
Understand	Tutorial Class/ Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	**Internal Assessment Examinations**			**Final Examination (60)**
	IAE1 (7.5)	**IAE2 (7.5)**	**IAE3 (10)**	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

20CS101	COMPUTER HARDWARE AND NETWORKING (Common to CSE, IT and AI & DS)	3/0/0/3
Nature of Course	Engineering Sciences	
Pre requisites	Fundamentals of computers	

Course Objectives

The course is intended to

1. Impart knowledge of mother board components and memory storage devices.
2. Gain knowledge of I/O devices and interfaces.
3. Learn the Maintenance and Trouble Shooting of Desktop.
4. Develop a clear understanding about network devices.
5. Explore the knowledge on network model and various network protocols

Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	Interpret the concepts of motherboard components and memory storage devices	Understand
CO2	Manipulate I/O Devices and Interfaces	Apply
CO3	Carry out experimental investigation for maintenance of Desktop and Laptop.	Apply
CO4	Summarize computer viruses and troubleshooting mechanism.	Understand
CO5	Determine the properties of various network devices.	Understand

Course Contents:

Unit - I Motherboard Components and Memory Storage Devices 9

Introduction: Hardware, Software and Firmware. Mother board, IO and memory expansion slots, SMPS, Drives, front panel and rear panel connectors. Processors: multi core Processor Architecture, Evolution of processors – Pentium, dual core, core i3, i5, i7 (Concepts only) - Bus Standards: PCI, AGP, and PCMCIA Primary Memory: Introduction-Main Memory, Cache memory – DDR2, DDR3 and Direct RDRAM. Secondary Storage: Hard Disk – Construction – Working Principle Specification of IDE, Ultra ATA, Serial ATA; HDD Partition - Formatting.

Unit - II I/O Devices and Interface 9

Keyboard: Signals – operations –troubleshooting; wireless Keyboard. Mouse: types, connectors, operations- troubleshooting. Printers: Introduction–Types- Dot Matrix, Inkjet Laser, Multi Function Printer and Thermal printer – Operations-Troubleshooting. I/O Ports: Serial, Parallel, USB, Game Port and HDMI. Displays: Principles of LED, LCD and TFT Displays. Graphic Cards: VGA and SVGA card. Power Supply: Servo Stabilizers, online and offline UPS - working principles; SMPS: Operation and block diagram of ATX Power supply.

Unit - III Maintenance of Desktop and Laptop 9

Bios-setup: Standard CMOS setup, Power management, advanced chipset features, PC Bios communication – upgrading BIOS, Flash BIOS -setup. POST: Definition – IPL hardware – POST Test sequence – beep codes. Laptop: Types of laptop –block diagram – working principles– configuring laptops.

Unit – IV Trouble Shooting and Computer Viruses 9

Diagnostic Software and Viruses: Computer Viruses – Precautions –Anti-virus Software – identifying the signature of viruses – Firewalls and latest diagnostic softwares. Installation and Troubleshooting: Formatting, Partitioning and Installation of OS – Trouble Shooting Hardware problems.

Unit - V Computer Network Devices 9

Data Communication: Components of a data communication. Data flow: simplex – half duplex – full duplex; Topologies: Star, Bus, Ring, Mesh, Hybrid – Advantages and Disadvantages of each topology. Networks: Definition -Types of Networks: LAN – MAN – WAN – CAN – HAN – Internet – Intranet –Extranet, Client-Server, Peer To Peer Networks. Network devices: Features and concepts of Switches – Routers (Wired and Wireless) – Gateways.

Total: 45 Periods

Text Books:

1. B.Govindrajalu, “IBM PC and Clones Hardware Troubleshooting and Maintenance”, Tata Mc Graw hill Publishers,2008.
2. BehrouzA.Forouzan, “Data Communication and networking”, Tata Mc-Graw Hill, NewDelhi.

Reference Books:

1. D.Balasubramanian, “Computer Installation and Servicing”, Tata McGraw Hill.
2. Michael ,Stephen J Bigelow , “Troubleshooting, Maintaining and Repairing PCs”, Tata MCGraw Hill Publication.
3. AchyutGodbole,” Computer Networks”, TataMc-Graw Hill -New Delhi.
4. Kaveh Pahlavan and Prashant Krishnamurty, “Principles of Wireless Networks– A unified Approach”, Pearson Education, 2002.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2									1	3	1	
CO2	3	3	2									1	3	1	
CO3	3	3	2									1	3	1	
CO4	3	3	2									1	3	1	
CO5	3	3	2									1	3	1	
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	**Continuous Assessment Tests**			**Terminal Examination**
	1 (7.5)	**2 (7.5)**	**3 (10)**	**(60)**
Remember	10	10	10	20
Understand	20	20	20	50
Apply	20	20	20	30
Analyse	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0

20ENE01	COMMUNICATIVE ENGLISH (Common to all branches)	2/0/2/3
Nature of Course	Humanities and Social Science	
Pre requisites	Nil	

Course Objectives

The course is intended to

1. Improve lexical, grammatical and semantic competence.
2. Enhance communicative skills in real life situations.
3. Augment thinking in all forms of communication.
4. Equip with oral and written communication skills.
5. Gain employability skills.

Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	Use effectively the lexical, grammatical and semantic knowledge	Remember
CO2	Communicate with clarity using intentional vocabulary in English	Apply
CO3	Articulate perfectly and express their opinions confidently using communicative strategies	Remember
CO4	Accomplish listening and reading skills for lifelong learning	Understand
CO5	Comprehend, interpret and present data	Understand

Course Contents

Unit - I Basic structure and Usage **6**

Parts of Speech –- Articles –Tenses - Subject-Verb Agreement – Different Grammatical forms of the same word - Listening to Speeches and Conversations from Globareana software – Listening to Announcements – Listening and Gap Filling.

Unit - II Vocabulary and Language Development **6**

Intentional vocabulary used in and around Airport, Hospital, Hotel, Court – Abbreviations and acronyms - One Word Substitution - Compound words – Homophones and Homonyms – Types of sentences - Ordering Jumbled Sentences Letter writing – informal.

Unit – III Oral Communication Skills **6**

Improving fluency – Articulation with pronunciation – Voice modulation in Speaking – One minute talk -Self Introduction and introducing ones friend – Telephonic conversations – Group Discussion – Modal Auxiliaries – discourse markers.

Unit – IV Comprehensive Listening and Reading **6**

Effective listening Strategies –– Listening to Interviews from Globareana software – Phrasal verbs – Reading Comprehension – “An Astrologer’s Day” by R.K.Narayan and “Building a New State” by Dr. A.P.J. Abdul Kalam.

Unit – V Effective Writing **6**

Interpretation and presentation of data – developing Hints – general essays and paragraph writing – Report Writing – survey report and accident report - Instructions and Recommendations.

Total: 30 Periods

Laboratory Components

S.No	List of Exercises	CO Mapping	RBT
1	Role-play – One minute talk	3	Understand
2	Role-play – Telephonic conversations	3	Understand
3	Listening to speeches and lectures and gap filling	4	Understand
4	Group Discussion.	4	Understand
5	Articulation with pronunciation practice	3	Apply
6	Listening to Announcements – Listening and Gap Filling	4	Understand
7	Listening to Interviews & Native speakers' Conversations	4	Understand
8	Reading practice with articles in magazine and news papers.	4	Understand
9	Model – Job Interviews	4	Understand
10	Introspective report – Personal analysis	5	Understand
11	Telephone etiquette	3	Remember
12	Reading – Shorter texts and News Articles	4	Understand
13	Role Play – Getting and Giving Permission	3	Remember
14	Self Introduction(Formal)	3	Understand
15	Recommendations/Suggestions	3	Apply

Total: 30 Periods

Text Books

1. Rizvi, Ashraf M., "Effective Technical Communication", Tata McGraw Hill Publishing Company Limited, New Delhi, 5th Edition, 2007.
2. Board of Editers, "Using English – A Coursebook for Undergraduate Engineers and Technologists", Orient BlackSwan Private Limited, Hyderabad, 2nd Edition, 2017.

Reference Books:

1. Meenakshi Raman and Sangeetha Sharma, "Technical Communication", Oxford University Press, USA, 10th Edition, 2007.

2. John Cunnison Catford, “A Practical Introduction to Phonetics”, Clarendon Press, Jamaica, 2nd Edition, 2001.
3. Hewings. M, “Advanced English Grammar”, Cambridge University Press, Chennai, 3rd Edition, 2000.
4. S P Dhanavel “English and Soft Skills”, Orient BlackSwan Private Limited, Hyderabad, 1st Edition, 2010.

Web reference:

https://www.googleadservices.com/pagead/aclk?sa=L&ai=DChcSEwij4dCTucfsAhXE1pYKHch4ABMYABABGgJ0bA&ohost=www.google.com&cid=CAASEuRo76H- Vx9BpazOOBfXeJSKVQ&sig=AOD64_3O-HNEnUO4A5sc31MsUfaTBGG- dQ&q&adurl&ved=2ahUKEwjC3ceTucfsAhXBeisKHatlBewQ0Qx6BAgfEAE

Software used: Globareana

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)															
COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1							1			3	2	2			
CO2							1			3	2	2			
CO3							1			3	2	2			
CO4							1			3	2	2			
CO5							1			3	2	2			
	3	**High**				**2**	**Medium**				**1**	**Low**			

Summative assessment						
Bloom’s Level	**Continuous Assessment**					**Final Examination (Theory) [50 marks]**
	Theory Marks				**Practical**	
	IAE-I [7.5]	**IAE-II [7.5]**	**IAE -III [10]**	**Attendance [5]**	**Rubric based CIA [20 Marks]**	
Remember	20	20	20		40	40
Understand	20	20	20		40	40
Apply	10	10	10		20	20
Analyse						
Evaluate						
Create						

20ENE02	ADVANCED COMMUNICATIVE ENGLISH (Common to all branches)	2/0/2/3
Nature of Course	Humanities and Social Sciences	
Pre requisites	Basics of Communicative English	

Course Objectives

The course is intended to

1. Demonstrate satisfactory control over complex structures and mechanics in English.
2. Develop fluency and accuracy in oral communication.
3. Communicate effectively and actively in social interactions.
4. Read English at inspectional level.
5. Face interviews with confidence.

Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	Apply knowledge of English grammar for effective communication	Remember
CO2	Make use of common English phrases and vocabulary strength.	Understand
CO3	Build self confidence and enhance professionalism	Apply
CO4	Implement listening, reading and writing skills in real - life situations	Apply
CO5	Speak fluently in English with proper pronunciation, intonation, tone and accent.	Understand

Course Contents

Unit – I Grammar and usage **6**

Active voice and passive voice – Prefixes and suffixes – Compound words – Clauses - If conditionals – Idioms & Phrases - Right forms of verbs – Modal Auxiliaries - Spotting errors.

Unit - II Lexical competence **6**

Technical Vocabulary - Expressions – Frequency – Cause and effect - Words often Miss-spelled – Syntax and structure - Homophones and Homonyms- Verbal analogy - idioms and phrases.

Unit - III Conversational etiquette **6**

Processes description – Tone and accent in speech – Role-play (Job-Interview) – Presentation skills – Mechanics of presentation - Telephone etiquette – Group Discussion strategy - Formal & Informal subjective and objective introduction – Body Language – Mock Interview.

Unit – IV Listening reading and writing **6**

Listen to Scientific / Technical talks and gap filling – Listening to TED/INK Talks – Reading – “Water: The Elixir of Life” by C.V.Raman. “Progress” by St. John Ervine - Instructions and Recommendations – Letter writing formal – Job application- Report writing – Introspective report – Creative writing – Essays and Paragraphs.

Unit – V Phonetics **6**

Production and classification of speech sound – International Phonetic Alphabet and transcriptions – Phonological rules – way and Place of articulation – Vowels, consonants and diphthongs. Specific characteristics feature of vowel sounds.

Total: 30 Periods

Laboratory Components

S.No	List of Exercises	CO Mapping	RBT
1	Role-play – Processes Description	2	Remember
2	Listening to TED/INK Talks and gap filling	4	Understand
3	Group Discussion	3	Understand
4	Articulation with pronunciation practice	3	Apply
5	Reading – Longer texts and Technical Articles (Skimming & Scanning).	4	Apply
6	Presentation skills – Mechanics of presentation	5	Understand
7	Individual presentation on given topics	5	Remember
8	Telephone etiquette	5	Understand
9	Instructions and Recommendations	5	Remember
10	Writing – General Essays.	4	Apply
11	Report writing technique- write up	4	Remember
12	Introspective report – Personal analysis	4	Understand
13	Model Job Interviews	3	Understand
14	Job Interviews(Role play)	3	Apply
15	Body Language	3	Understand

Text Books

1. Rizvi, Ashraf.M, “Effective Technical Communication”, Tata McGraw Hill Publishing Company Limited, New Delhi, 5th Edition, 2007.
2. Hewings. M, “Advanced English Grammar”, Cambridge University Press, Chennai, 3rd Edition, 2000.
3. Board of Editers, “Using English – A Coursebook for Undergraduate Engineers and Technologists”, Orient BlackSwan Private Limited, Hyderabad, 2nd Edition, 2017.

Reference Books:

1. Raman M & Sangeetha Sharma, “Technical Communication”, Oxford University Press, USA, 10th Edition, 2007.

2. John Cunnison Catford, “A Practical Introduction to Phonetics”,Clarendon Press, Jamaica, 2nd Edition, 2001.
3. Norman Whitby, Business Benchmark – “Pre-Intermediate to Intermediate, Students Book”, Cambridge University Press, 1st Edition, 2006.
4. Dhanavel S. P., “English and Soft Skills”, Orient BlackSwan Private Limited, Hyderabad, 1st Edition, 2010.

Web reference:

1. https://www.coursera.org/lecture/tesol-speaking/video-2-listening-strategies-for-learners-3AeBL?utm_source=mobile&utm_medium=page_share&utm_content=vlp&utm_campaign=to p_button
2. blob:https://www.youtube.com/73f7256d-d302-4563-bed5-9e84c94a26ac

Software used: Globareana

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)															
COs	**Pos**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1										3	1	2			
CO2										3	1	2			
CO3										3	1	2			
CO4										3	1	2			
CO5										3	1	2			
	3	High				2	Medium				1	Low			

Summative assessment						
Bloom’s Level	**Continuous Assessment**					**Final Examination (Theory) [50 marks]**
	Theory Marks				**Practical**	
	IAE-I [7.5]	**IAE-II [7.5]**	**IAE -III [10]**	**Attendance [5]**	**Rubric based CIA [20 Marks]**	
Remember	20	20	20		40	40
Understand	20	20	20		40	40
Apply	10	10	10		20	20
Analyse						
Evaluate						
Create						

20PH101	PHYSICS FOR COMPUTER SCIENCES (Common to CSE, IT and AI & DS)	3/0/2/4
Nature of Course	Basic Science	
Pre requisites	Nil	

Course Objectives:

The course is intended to

1. Impart knowledge of optics, especially laser and their applications in fiber optics.
2. Gain knowledge to learn thermal properties of materials and their applications.
3. Provide knowledge of properties of matter like elasticity and its applications.
4. Learn the electronic properties of materials like semiconductors and its applications.
5. Develop a clear understanding of optical devices like solar cell, LED etc.

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1	Compare the working of lasers and propagation of light through optical fibers and its applications	Understand
CO2	Demonstrate the thermal conductivity of the good and bad conductors	Understand
CO3	Explain the knowledge about elastic modulus	Understand
CO4	Interpret the knowledge about semiconductor materials	Understand
CO5	Illustrate the working of optoelectronic devices	Understand

Course Contents:

UNIT I Laser and Fiber Optics 9

Lasers: population of energy levels, Einstein's A and B coefficients derivation – resonant cavity, optical amplification (qualitative) – Semiconductor lasers: homojunction and heterojunction – Fiber optics: principle, numerical aperture and acceptance angle - types of optical fibers (material, refractive index, mode) – optical fiber communication system – fiber optic endoscope.

UNIT II Thermal Physics 9

Transfer of heat energy – thermal expansion of solids and liquids – expansion joints - bimetallic strips - thermal conductivity - Forbe's and Lee's disc method: theory and experiment - conduction through compound media (series and parallel) – thermal insulation – applications : heat exchangers in refrigerators, ovens and solar water heaters.

UNIT III Properties of Matter 9

Elasticity – Stress-strain diagram and its uses - factors affecting elastic modulus and tensile strength – torsional stress and deformations – twisting couple - torsion pendulum: theory and experiment - bending of beams - bending moment – cantilever – uniform and non-uniform bending - I-shaped girders - stress due to bending in beams.

UNIT IV Semiconductor Physics 9

Intrinsic Semiconductors – Energy band diagram – direct and indirect band gap semiconductors – Carrier concentration in intrinsic semiconductors – extrinsic semiconductors - Carrier concentration in N-type & P-type semiconductors – Variation of carrier concentration with temperature – variation of Fermi level with temperature and impurity concentration –Hall effect and its applications.

UNIT V Optical Properties of Materials 9

Classification of optical materials – carrier generation and recombination processes - photo current in a P- N diode : principle and working – solar cell and photo detectors : working principle – LED : principle and working – Organic LED : principle and working, advantages over LED – Laser diodes : principle, working and applications.

Total : 45 Periods

Laboratory Components

S.No	List of Experiments	CO Mapping	RBT
1	Determination of rigidity modulus – Torsion pendulum	CO3	Apply
2	Determination of Young's modulus by non-uniform bending method.	CO3	Apply
3	Determination of wavelength, and particle size using Laser	CO1	Apply
4	Determination of acceptance angle in an optical fiber	CO1	Apply
5	Determination of thermal conductivity of a bad conductor by Lee's Disc method.	CO2	Apply
6	Determination of velocity of sound and compressibility of liquid Ultrasonic interferometer	CO3	Apply
7	Determination of Coefficient of viscosity of liquid	CO3	Apply

Total: 30 Periods

TEXT BOOKS:

1. Bhattacharya D.K. and Poonam T., "Engineering Physics", Oxford University Press, 2nd Edition, 2015.
2. Avadhanulu M.N. and Kshirsagar P.G., "A Text book of Engineering Physics", S.Chand and company., New Delhi, 10th Edition, 2014.
3. William D Callister Jr. and David G Rethwisch., "Materials Science and Engineering", 9th Edition, John Wiley & Sons, Inc, 2019.

REFERENCES:

1. David Halliday. Robert Resnick. and Jearl Walker., "Principles of Physics", Wiley, 10th Edition, 2014.

2. Raymond A Serway. and John W Jewett., “Physics for Scientists and Engineers”, Cengage Learning, 9th Edition, 2019.
3. Raghavan V., “Materials Science and Engineering, A First course”, PHI Learning, 5th Edition, 2015.

Web References:

1. https://nptel.ac.in/courses/115/107/115107095/
2. https://www.coursera.org/lecture/fe-exam/stresses-in-beams-strains-in-pure-and- nonuniform-bending-6aMRx
3. https://nptel.ac.in/courses/115/105/115105099/#
4. https://www.youtube.com/watch?v=uv0LxMoalEQ

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2													
CO2	3	1													
CO3	3	2													
CO4	3	2													
CO5	3														
	3	High				2	Medium					1	Low		

Summative assessment						
Bloom’s Level	Internal Assessment					Final Examination (Theory) [50 marks]
	Theory Marks				Practical	
	IAE-I [7.5]	IAE-II [7.5]	IAE-III [10]	Attendance [5]	Rubric based CIA [20 Marks]	
Remember	10	10	10			30
Understand	35	35	35		40	62
Apply	5	5	5		60	8
Analyze						
Evaluate						
Create						

20CS102	PROBLEM SOLVING USING PYTHON (Common to all branches)	3/ 0/ 2/ 4
Nature of Course	Engineering Sciences	
Pre requisites	Mathematical and Logical Knowledge	

Course Objectives

The course is intended

1. To think logically and write algorithm and draw flow charts for problems.
2. To read and write simple Python programs.
3. To develop Python programs with conditionals and loops.
4. To define Python functions and call them.
5. To use Python data structures –- lists, tuples, dictionaries and files.

Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	Develop algorithmic solutions to simple computational problems and read, write, execute by simple python programs.	Apply
CO2	Structure simple python programs for solving problems.	Understand
CO3	Administer the role of control statements and functions involving the idea of modularity.	Apply
CO4	Represent compound data using python strings and lists.	Apply
CO5	Read and write data from/to files in python Programs.	Understand

Course Contents:

UNIT I Basics of cComputers & Problem solving 9

Computer Basics – Components-Computer organization - Computer Software- Types of software - Software Development steps -Need for logical analysis and thinking- Algorithms – Flowchart - Number system.

UNIT II Introduction of Python Programming 9

Introduction-Python Interpreter-Interactive and script mode -Values and types, variables, operators, expressions, statements, precedence of operators, Multiple assignments, comments, Input and Output Statements.

UNIT III 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 parameters, return values, recursion, Lambda functions.

UNIT IV STRINGS,LISTS 9

Strings-String slices, immutability, string methods and operations -Lists-creating lists, list operations, list methods, mutability, aliasing, cloning lists, list and strings, list and functions-list processing-list comprehension, searching and sorting.

UNIT V TUPLES, DICTIONARIES, FILES 9

Tuples- Tuple assignment, lists and tuples, Tuple as return value- Dictionaries-operations and methods, Files and Exception-Text files, reading and writing files, format Operator, Exception handling.

TOTAL : 45 PERIODS

Laboratory Components

S.No	List of Experiments	CO Mapping	RBT
1	Write a algorithm & draw flowchart for simple computational problems	1	Understand
2	Write a program to perform different arithmetic operations on numbers in python.	2	Understand
3	Write a python program to implement the various control structures	3	Apply
4	Write a python program for computational problems using recursive function.	3	Apply
5	Demonstrate use of list for data validation.	4	Apply
6	Develop a python program to explore string functions	4	Analyze
7	Implement linear search and binary search.	4	Apply
8	Develop a python program to implement sorting methods	4	Analyze
9	Develop python programs to perform operations on dictionaries.	5	Analyze
10	Write a python program to read and write into a file	5	Apply

TOTAL: 30 PERIODS

Text Books

1. Reema Thareja, "Problem Solving and Programming with Python", Oxford University Press, 2018
2. Dr. R. Nageswara Rao, "Core Python Programming", Dreamtech Press, 2017 Edition

Reference Books:

1. Kenneth A. Lambert, "Fundamentals of Python: First Programs", CENGAGE Learning, 2012
2. Ashok Namdev Kamthane, Amit Ashok Kamthane, "Programming and Problem Solving with Python" , Mc-Graw Hill Education, 2018.
3. Charles Dierbach, "Introduction to Computer Science using Python: A Computational Problem Solving Focus", Wiley India Edition, 2013
4. Timothy A. Budd," Exploring Python", Mc-Graw Hill Education (India) Private Ltd., 2015

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)															
COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	1										3	1	
CO2	3	2	1										3	1	
CO3	3	2	2										3	1	
CO4	3	2	2										3	1	
CO5	3	2	2										3	1	
	3	High				2	Medium					1	Low		

Summative Assessment						
Bloom's Level	**Continuous Assessment**					**Final Examination (Theory) [50]**
	Theory				**Practicals**	
	IAE-I [7.5]	**IAE-II [7.5]**	**IAE-III [10]**	**Attendance [5]**	**Rubric based CIA [20]**	
Remember	10	10	10		20	20
Understand	20	20	20		20	40
Apply	20	20	20		10	40
Analyze						
Evaluate						
Create						

20CS103	COMPUTER PRACTICES LABORATORY (Common to CSE , IT and AI &DS)	0/0/2/1
Nature of Course	Engineering Sciences	
Pre requisites	NA	

Course Objectives

The course is intended to

1. Learn the use of basic hardware components and its setup.
2. Make familiar with BIOS setup and I/O ports.
3. Impart knowledge in configuration and partitioning
4. Experiment the installation and uninstallation of various hardware and software components.
5. Develop network group and sharing between devices

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1	Interpret the concepts of hardware devices	Understand
CO2	Make simple BIOS setup and I/O ports	Understand
CO3	Experiment the configuration and partitioning	Apply
CO4	Carry out basic installation setup of hardware devices	Apply
CO5	Apply the workgroup creation network and sharing	Apply

Laboratory components

S.No	List of Exercises	CO Mapping	RBT
1	Study of mother Board, Power supply, Keyboard and monitors	1	Understand
2	Study of Building and Assembling a Desktop PC	1	Understand
3	BIOS Setup Utility. Input- Output Ports	1	Understand
4	Hard Disk Drive Partitioning and Formatting	2	Understand
5	Installing and configuring a DVD Writer	3	Apply
6	Installing and configuring Operating System.	4	Apply
7	Installing Motherboard Device Drivers OS Platform	4	Apply
8	Installing and uninstalling an Application Software.	4	Apply
9	Printers and Installation of Printers and scanners and Local Printer sharing	5	Apply
10	Workgroup based Network using Operating System.	5	Apply

TOTAL: 30 PERIODS

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)															
COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	
CO1	3	3	3	1									2	3	
CO2	3	3	3	1									2	3	
CO3	3	3	3	1									2	3	
CO4	3	3	3	1									2	3	
CO5	3	3	3	1									2	3	
	3	High				2	Medium					1	Low		

Summative assessment based on Continuous and End Semester Examination		
Bloom's Level	**Rubric based Continuous Assessment [50 marks]**	**End Semester Examination [50 marks]**
Remember		10
Understand	30	40
Apply	20	50
Analyze		
Evaluate		
Create		

20MC101	INDUCTION PROGRAMME (Common to all branches)	2/0/0/0
Nature of Course	Mandatory, Non Credit	
Pre requisites	Completion of Schooling at Higher Secondary Level	

Course Objectives

The course is intended to

1. To nurture the character and behavior as a student.
2. To have broad understanding of society and relationships.
3. To impart interpersonal and soft skills.
4. To inspire the students in the field of engineering.
5. To provide exposure to industries.

Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO 1	Perform curricular and co-curricular activities excellently.	Knowledge
CO 2	Do the skill based training with excellence.	Understand
CO 3	Work as team for the given task	Apply
CO 4	Gain character and behavior	Knowledge
CO 5	Demonstrate the acquired skills effectively	Apply

Course Contents

PHYSICAL ACTIVITY
Yoga, Sports
CREATIVE ARTS (students can select any one of their choice)
Painting, sculpture, pottery, music, craft making and so on
UNIVERSAL HUMAN VALUES
Enhancing soft skills
LITERARY AND PROFICIENCY MODULES
Reading, Writing, Speaking- Debate, Role play etc.,
Communication and computer skills
LECTURES BY EMINENT PEOPLE
Guest lecture by subject experts
VISIT TO LOCAL CITIES
Meditation centers / Industry
FAMILARIZATION TO DEPARTMENT / BRANCH INNOVATION
Lectures by Departments Head and senior faculty members

Total Hours: 45 Periods

Activity Component

S.No	Name of the Experiment	CO Mapping	RBT
1	Field study of simple eco system: pond, river and hill slopes	2	Understand
2	Case study regarding environmental management	1	Knowledge

TEXT BOOKS

1. AnubhaKaushik and C.P. Kaushik, Environmental Science and Engineering, New Age International Publishers, New Delhi,2015

2. Dr. A.Ravikrishan, Envrionmental Science and Engineering, Sri Krishna Hi-tech Publishing co. Pvt.Ltd., Chennai,12thEdition, 2016

REFERENCE BOOKS

1. Masters, Gilbert M, Introduction to Environmental Engineering and Sciencell, Second Edition, Pearson Education, New Delhi,2012

2. Santosh Kumar Garg, Rajeshwarigarg, smfRanjniGarg —Ecological and Environmental Studies Khanna Publishers, NaiSarak, Delhi,2014

3. MillerT.G.Jr., —EnvironmentalScience‖,TenthEdition,WadsworthPublishingCo.,.

WEB RESOURCES

1. https://nptel.ac.in/courses/122103039/38
2. https://bch.cbd.int/cms/ui/collaboration/download/download.aspx?id=909
3. https://nptel.ac.in/courses/105102089/air%20pollution%20(Civil)/Module-3/3a.htm
4. www.vssut.ac.in/lecture_notes/lecture1428910296.pdf
5. nptel.ac.in/courses /120108004/module7/lecture8.pdf

Mapping of COs with POs and PSOs

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1						2	1	2				3	2		
CO2						2	1	2				3	2		
CO3						2	1	2				3	2		
CO4						2	1	2				3	2		
CO5						2	1	2				3	2		
	3	High				2	Medium					1	Low		

Bloom's Level	**Continuous Assessment (Non-Credit, Mandatory)**				
	Test -I [20]	**Test -II [20]**	**Test - III [20]**	**Assignment/ Activity [20]**	**Attendance [20]**
Remember	10	10	10		
Understand	20	20	20	10	
Apply	20	20	20	10	
Analyse					
Evaluate					
Create					

II-SEMESTER

20MA203	MATHEMATICS – II FOR COMPUTER SCIENCES (Common to CSE, IT and AI & DS)	3/2/0/4
Nature of Course	Basic Sciences	
Prerequisites	Fundamentals of Calculus and Algebra	

Course Objectives

The course is intended to

1. Incorporate the functions of several variables, Taylor's series expansion, Jacobins, maximum & minimum values.
2. Introduce the basic notions of groups, rings, fields which will then be used to solve related problems.
3. Learn the concepts of rings, finite fields and polynomials.
4. Acknowledge the basic concepts in number theory.
5. Acquire the concepts of Laplace transform and its inverse.

Course Outcomes

On successful completion of the course, students will be able to

CO.No	Course Outcome	Bloom's Level
CO1	Analyze functions of two variables with their visualization, compute their limits, continuity, derivatives and extreme values	Analyze
CO2	Apply the basic notions of groups, rings, fields and to solve their engineering problems	Apply
CO3	Explain the concepts of advanced algebra and identify their role in modern mathematics.	Understand
CO4	Demonstrate accurate and efficient use of advanced algebraic techniques.	Understand
CO5	Find Laplace transform of standard functions and solve initial value problems / differential equations using Laplace transforms	Apply

Course Contents:

UNIT - I Functions of Several Variables **12**

Functions of two variables -Limits and Continuity-Partial derivatives - Euler's theorem for homogenous functions –Differentiation of implicit functions –Jacobians–Taylor's expansion – Maxima and Minima – Lagrange's Method of Undetermined Multipliers.

UNIT – II Groups and Rings **12**

Groups: Definition - Properties - Homomorphism - Isomorphism - Cyclic groups – Cosets - Lagrange's theorem. Rings: Definition - Sub rings - Integral domain - Field - Integer modulo n - Ring homomorphism.

UNIT – III Finite Fields and Polynomials **12**

Rings - Polynomial rings - Irreducible polynomials over finite fields - Factorization of polynomials over finite fields.

UNIT – IV Divisibility Theory and Canonical Decompositions **12**

Division algorithm – Base representations – Number patterns – Prime and composite numbers – GCD – Euclidean algorithm – Fundamental theorem of arithmetic – LCM.

UNIT – V Laplace Transforms **12**

Laplace transform –Transform of elementary functions –Properties –Transforms of derivatives and integrals -Transform of periodic functions. Inverse Laplace transform – Statement and applications of Convolution theorem –Initial and Final value theorems – Method of solving second order ordinary differential equations with constant coefficients by using Laplace transform technique.

Total: 60 Periods

Text Books:

1. Grewal B.S, "Higher Engineering Mathematics", Khanna Publishers, 44th Edition, 2019.
2. Grimaldi, R.P and Ramana, B.V., "Discrete and Combinatorial Mathematics", Pearson Publishers, 5th Edition, 2007.

Reference Books:

1. Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, 1st edition, 2017.
2. Bali.N.Pand Dr.ManishGoyal,"A text book of Engineering Mathematics", Laxmi Publications (P)LTD, 8thedition,2011.
3. Lidl, R. and Pitz, G, "Applied Abstract Algebra", Springer Verlag Publishers, 2nd Edition, 2006.
4. Niven, I., Zuckerman.H.S., and Montgomery, H.L., -An Introduction to Theory of Numbers|, John Wiley and Sons Publishers, 2nd Edition, 2004

Additional References:

1. nptel.ac.in/courses/111/105/111105134
2. nptel.ac.in/courses/122/104/122104017

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Online Quiz	5	15
Understand	Tutorial Class / Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	**Internal Assessment Examinations**			**Final Examination (60)**
	IAE1 (7.5)	**IAE2 (7.5)**	**IAE3 (10)**	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

20CS201/20IT201	PROGRAMMING AND DATA STRUCTURES (Common to CSE, IT and AI & DS)	3/0/0/3
Nature of Course	Professional Core	
Pre requisites	Basics of C	

Course Objectives

The course is intended to

1. Learn the features of C
2. Gain Knowledge in linear and non-linear data structures
3. Explore the applications of linear and non-linear data structures
4. Represent data using graph data structure
5. Learn the basic sorting and searching algorithms

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1.	Determine the basic concepts and terminology of programming in C	Understand
CO2.	Interprets the concept of functions, pointers, structures and unions operations and their usage.	Understand
CO3.	Implement linear data structure operations using C	Apply
CO4.	Suggest appropriate linear / non-linear data structure for any given data set	Apply
CO5.	Appropriately choose the searching and sorting algorithm for an application	Apply

Course Contents:

Unit - I C Programming Basics 9

Structure of a C program – compilation and linking processes – Constants, Variables – Data Types – Expressions using operators in C – Managing Input and Output operations – Decision Making and Branching – Looping statements. Arrays – Initialization – Declaration – One dimensional and Two-dimensional arrays. Strings- String operations – String Arrays. Simple programs- sorting- searching – matrix operations.

Unit - II Functions, Pointers, Structures and Unions 9

Functions – Pass by value – Pass by reference – Recursion – Pointers – Definition – Initialization – Pointers arithmetic. Structures and unions – definition – Structure within a structure – Union – Programs using structures and Unions – Storage classes, Pre-processor directives.

Unit - III Linear Data Structures 9

Arrays and its representations – Stacks and Queues – Linked lists – Linked list-based implementation of Stacks and Queues – Evaluation of Expressions – Linked list based polynomial addition.

Unit - IV Non-Linear Data Structures: 9

Trees – Binary Trees – Binary tree representation and traversals –Binary Search Trees – Applications of trees. Set representations – Union-Find operations. Graph and its representations – Graph Traversals.

Unit - V Searching and Sorting Algorithms 9

Linear Search – Binary Search. Bubble Sort, Insertion sort – Merge sort – Quick sort – Hash tables – Overflow handling.

Total: 45 Periods

Text Books:

1. Pradip Dey and Manas Ghosh, —Programming in C, Second Edition, Oxford University Press, 2011.
2. Ellis Horowitz, Sartaj Sahni, Susan AndersonFreed,"Fundamentals of Data Structures in C" ,Second Edition, University Press, 2008.

Reference Books:

1. Mark Allen Weiss, —Data Structures and Algorithm Analysis in C, Second Edition, Pearson Education, 1996
2. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, —Data Structures and Algorithms, Pearson Education, 1983.
3. Robert Kruse, C.L.Tondo, Bruce Leung, Shashi Mogalla , — Data Structures and Program Design in C, Second Edition, Pearson Education, 2007
4. Jean-Paul Tremblay and Paul G. Sorenson, —An Introduction to Data Structures with Applications, Second Edition, Tata McGraw-Hill, 1991.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1										3	1	
CO2	3	2	2	1									3	1	
CO3	3	2	1	1									3	1	
CO4	3	3	2	1									3	1	
CO5	3	3	2	2									3	1	
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Apply	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE-I (7.5)	**IAE-II (7.5)**	**IAE-III (10)**	
Remember	10	10	10	10
Understand	20	20	20	40
Apply	20	20	20	50
Evaluate	0	0	0	0
Create	0	0	0	0

20CH201	CHEMISTRY FOR COMPUTER SCIENCES (Common to CSE, IT and AI & DS)	3/0/2/4
Nature of Course	Basic Sciences	
Prerequisites	Nil	

Course Objectives

The course is intended to

1. Impart knowledge and understanding about the constituents present in water and the need for purification of water.
2. Understand the fundamentals of batteries.
3. Provide knowledge about materials like metals, refractories and cement.
4. Develop the understanding and applications of basic concepts of electrochemistry.
5. Conversant with the basics of polymers and engineering plastics.

Course Outcomes

On successful completion of the course, students will be able to

CO. No	Course Outcome	Bloom's Level
CO1	Develop innovative and eco-friendly method for water purification to meet the growing industrial demand	Apply
CO2	Understand the basic principles and mechanism of working of batteries and fuel cells	Understand
CO3	Discuss about various types of alloys and engineering materials	Understand
CO4	Use the principles of electro chemical cells, EMF, electroplating and electrolysis	Apply
CO5	Classify engineering plastics and some important industrial polymers	Understand

Course Contents

Unit-I Water Analysis and Water Treatment **9**

Water analysis: Sources of water, Hard water and soft water, Hardness of water, acidity, alkalinity, pH value, amount of free CO_2, fluoride content and chloride content. Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD). Water treatment: Definition, Zeolite process, Conditioning methods: Internal conditioning (Phosphate, Calgon) and external conditioning (Demineralisation), Desalination, Reverse osmosis (RO).

Unit-II Energy Storage Devices **9**

Batteries: Definition, characteristics and classification, Primary battery: Alkaline battery, Secondary battery: lead acid battery, nickel cadmium battery, lithium battery and lithium ion battery, Fuel cells: construction and working of phosphoric acid fuel cell.

Unit-III Alloys and Engineering Materials **9**

Alloys: classification and types, Ferrous alloys (Nichrome and stainless steel only), Non- ferrous alloys (brass and bronze), Heat treatment of steel, Refractories: characteristics, classification and manufacture. Cement: manufacture and setting.

Unit-IV Electrochemistry **9**

Electrode potential, Nernst equation and problems, Reference electrodes, Standard hydrogen electrode, Calomel electrode, Ion selective electrode (glass electrode), Determination of pH by glass electrode, Electrochemical series, Electrochemical cell, Galvanic cell: measurement of EMF.

Unit-V Polymeric Materials 9

Engineering plastics: Thermosetting and Thermoplastics, Polymers: polyethylene (PE), polyvinylchloride, Teflon, nylon-6:6, Fabrication: injection moulding, Composites: definition, types, polymer matrix composites, FRP, Biodegradable polymers: definition. Polylactide acid: production, properties and applications.

Total: 45 Periods

Laboratory Component

S.No.	Name of the Experiment	CO Mapping	RBT
1	Determination of hardness of water	CO1	Apply
2	Determination of chloride content in water sample	CO1	Apply
3	Conductometric titration of strong acid versus strong base	CO2	Understand
4	Determination of strength of HCl by pH metry	CO2	Understand
5	Estimation of copper in brass by EDTA method	CO3	Apply
6	Determination of CaO in cement	CO3	Apply
7	Estimation of strength of iron by potentiometric titration	CO4	Apply
8	Determination of molecular weight of a given polymer by Ostwald viscometer	CO5	Apply

Total: 30 Periods

Text Books

1. O.G.Palanna, “Engineering Chemistry”, Tata McGraw-Hill Pub.Co.Ltd, New Delhi, 1st Edition, 2017
2. P.C.Jain and Monicka Jain, “Engineering Chemistry”, Dhanapat Rai Publishing Company Pvt. Ltd, 2nd Edition, 2017.

Reference Books

1. B. Sivasankar “Engineering Chemistry” Tata McGraw-Hill Pub.Co.Ltd, New Delhi, 2nd Edition, 2009.
2. R. Sivakumar and N. Sivakumar, “Engineering Chemistry” Tata McGraw-Hill Pub.Co.Ltd, New Delhi, 1st Edition, 2009.
3. Dr.Sivanesan and Nandagopal, “Engineering Chemistry-I” V. K. Pub. Pvt. Ltd, 2nd Edition, 2011.

Additional Resources

1. https://nptel.ac.in/downloads/122101001
2. https://nptel.ac.in/courses/103103033/module9/lecture1.pdf
3. https://nptel.ac.in/courses/102103044/3
4. https://www.sciencedirect.com/topics/chemistry/phosphoric-acid-fuel-cells
5. https://en.wikipedia.org/wiki/Polylactic acid

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) and Programme Specific Outcomes (PSO)															
COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2									1				
CO2	3	2									1				
CO3	3	2									1				
CO4	3	2									1				
CO5	3	1									1				
	3	High				2	Medium				1	Low			

Summative Assessment						
Bloom's Level	**Continuous Assessment**					**Final Examination (Theory) [50]**
	Theory				**Practicals**	
	IAE-I [7.5]	**IAE-II [7.5]**	**IAE-III[10]**	**Attendance [5]**	**Rubric based CIA [20]**	
Remember	30	20	10		20	
Understand	10	20	30		20	
Apply	10	10	10		10	
Analyze						
Evaluate						
Create						

20ME101	ENGINEERING GRAPHICS (Common to all branches)	L/T/P/C 1/0/4/3
Nature of Course	Engineering Sciences	
Pre requisites	Knowledge on Mathematics and Drawing Skills	

Course Objectives:

The course is intended to

1. Understand technical drawings in various fields of engineering
2. Imagine and visualize the geometric details of engineering objects.
3. Translate the geometric information of engineering objects into engineering drawings.
4. Develop the graphical skills for communication of concepts, ideas and design of engineering products through technical drawings.
5. Visualize and draw isometric and perspective views

Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
1	Develop the conic sections, special curves, and draw orthographic views from pictorial views.	Apply
2	Apply the principles of orthographic projections of points in all quadrants, lines and planes in first quadrant.	Apply
3	Construct the projections of simple solids like prisms,pyramids, cylinder and cone.	Apply
4	Build the sectional views of solids like cube, prisms, pyramids, cylinders & cones and development of its lateral surfaces.	Apply
5	Organize and draw isometric and perspective sections of simple solids.	Apply

Course Contents:

Concepts and Conventions (Not for Examination) 1

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

UNIT -I Plane Curves and Free Hand Sketching (3+12)

Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves. Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three-Dimensional objects – Layout of views- Free hand sketching of multiple views from pictorial views of objects

UNIT –II Projection of Points, Lines and Plane Surfaces (3+12)

Orthographic projection- principles-Principal Planes-First angle projection-projection of points Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method.Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT –III Projection of Solids (3+12)

Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one of the principal planes by rotating object method.

UNIT- IV Projection of Sectioned Solids and Development of Surface (3+12)

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section, Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones. Development of lateral surfaces of solids with cut-outs and holes

UNIT -V Isometric and Perspective Projections (3+12)

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions and miscellaneous problems. Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method.

TOTAL: (15+60) Periods

TEXT BOOK:

1. Venugopal K. and Prabhu Raja V., —Engineering Graphics, New Age International (P) Limited, 2011
2. Venkatesan, S.P “A text book of Engineering Graphics”, Trisea Publication,Nagercoil, 2017
3. Natarajan K.V., “A text book of Engineering Graphics””, Dhanalakshmi Publishers, Chennai, 2012.

REFERENCES:

1. Bhatt N.D. and Panchal V.M., —Engineering Drawing, Charotar Publishing House, 50th Edition, 2010.
2. Basant Agarwal and Agarwal C.M., —Engineering Drawing, Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
3. NS Parthasarathy And Vela Murali, “Engineering Graphics”, Oxford University, Press, New Delhi, 2015.

Web References:

1. http://nptel.ac.in/courses/112103019/Engineering drawing
2. http://pioneer.netserv.chula.ac.th/~kjirapon/self-practice.html

Publication of Bureau of Indian Standards:

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.

4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

Special points applicable to University Examinations on Engineering Graphics:

1. There will be five questions, each of either-or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)															
COs	**Pos**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2								1					
CO2	3	2													
CO3	3	2													
CO4	3	3													
CO5	3	2													
	3	High				2	Medium				1	Low			

Summative assessment						
Bloom's Level	**Continuous Assessment**					**Final Examination (Theory) [50 marks]**
	Theory				**Practicals**	
	IAE-I [7.5]	**IAE-II [7.5]**	**IAE-III [10]**	**Attendance [5]**	**Rubric based CIA [20 Marks]**	
Remember	50	30	30		40	30
Understand	30	50	40		30	40
Apply	20	20	30		30	30
Analyse	-	-	-		-	-
Evaluate	-	-	-		-	-
Create	-	-	-		-	-

20CS211/20IT202	Programming and Data Structures Laboratory (Common to CSE, IT and AI & DS)	0/0/4/2
Nature of Course	Practical	
Pre requisites	Basic Structure of C Program	

Course Objectives

The course is intended to

1. Make familiar with C programming Language
2. Write simple programs using arrays and pointers
3. Develop applications in C using functions and structures
4. Implement linear data structure List ADT in various applications
5. Apply Stack and Queue ADTs using C in real time applications

Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	Write simple C programs using basic language constructs	Understand
CO2	Solve problems using arrays and strings	Apply
CO3	Develop modular programs using functions, pointers and structures	Apply
CO4	Implement various List ADTs for various applications	Apply
CO5	Make use of Stack and Queue ADT to solve real-time problem	Analyze

Laboratory Components:

S.No	List of Exercises	CO Mapping	RBT
1	Create a C application to get employee information	CO1	Apply
2	Write programs using simple control statements	CO1	Apply
3	Design and develop a health application that computes indexes and suggest the diet plan.	CO2	Analyze
4	Program to do simple operations with arrays and strings.	CO2	Apply
5	Implement a telephone directory using structures and pointers.	CO3	Analyze
6	Write a program to implement functions and recursive functions.	CO3	Apply
7	Creation of Array and linked list implementation of Stack and Queue ADTs	CO4	Apply
8	Choose an appropriate data structures and create a token system for banking service.	CO4	Analyze
9	Create a food delivering system which allocates the path for delivery of food using appropriate data structures.	CO5	Apply
10	Choose an appropriate data structures and create a book rack allocation system in a library.	CO5	Apply

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)															
COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2	3	3	2									2	3	
2	2	3	3	2									2	3	
3	2	3	3	2									2	3	
4	2	3	3	2									2	3	
5	2	3	3	3									2	3	
	3	High				2	Medium					1	Low		

Summative assessment based on Continuous and End Semester Examination		
Bloom's Level	**Rubric based Continuous Assessment [50 marks]**	**End Semester Examination [50 marks]**
Remember		
Understand	10	30
Apply	20	50
Analyze	20	20
Evaluate		
Create		

20MC202	INTERPERSONAL SKILLS (Common to all branches)	2/0/2/0
Nature of Course	Mandatory, Non Credit	
Pre requisites	Nil	

Course Objectives

The course is intended to

1. Use interpersonal communication skills to influence and build good relationships.
2. Identify and pursue personal learning goals.
3. Obtain feedback skills in service of evolving learning goals.
4. Learn about group dynamics, behaviors and feelings
5. Enhance the communication process in both formal and informal contexts

Course Outcomes

On successful completion of the course, students will be able to

CO.No	Course Outcome	Bloom's Level
CO1	Practice interpersonal communication skills to influence and build good relationships	Understand
CO2	Identify and pursue personal learning goals.	Understand
CO3	Give evident feedback	Understand
CO4	Reveal group dynamics and amiable behavior	Understand
CO5	Emphasis the communication process	Understand

Course Contents:

Unit I: Fundamentals of Interpersonal Communication **6**

Facts of communication and Interpersonal communication – culture and gender – Communication and Self disclosure – Presentation of Interpersonal perception - Learning goals – Feeling and feedback.

Unit II: Interpersonal communication in action **6**

Nature of language – language and culture – usage and abuse of language –Positive communication -Non verbal communication - Listening strategies – Barriers of listening.

Unit III: Emotional Intelligence **6**

Influence of emotional experience and expressions – Accepting the responsibilities and changes - Negotiation tactics - Dealing with criticism and appreciation - Collaborative Problem Solving - Resilience Building.

Unit IV: Transactions **6**

Different types of transactions - Building Positive Relationship - Managing Conflict – Connecting across Difference – Factors hampering Interpersonal interactions – Assertiveness in communication.

Unit V: Essential Interpersonal Competencies **6**

Behaviour – Understanding limiting behaviour - Interpersonal and small group behavior – Critical and lateral thinking- Win – Win attitude – Positive thinking – Stress management – Assertive feedback - Personal Evaluation of Interpersonal Relationship Skills

Total 30 Periods

Activity Component

S.No	Name of the Exercises	CO Mapping	RBT
1	Self Introduction	1	Remember
2	Presentation of Individual perception	2	Understand
3	Role play - Non verbal communication - Body language	4	Apply
4	Role play - Interpersonal interactions & Assertive feedback	3	Remember
5	Group Discussion	4	Apply
6	Role play - Situational conversation (On spot)	5	Understand

Text Books

1. Bozeman, Jeanine C and Argile Smith, "Interpersonal Relationship Skills for Ministers" Gretna, LA: Pelican Publishing Company, 1st Edition, 2004.
2. Floyd, Kory, "Interpersonal Communication", 2d. Boston: McGraw-Hill, 2nd Edition, 2011.

Reference Books:

1. Augsburger, David, "Caring Enough to Confront How to Understand and Express Your Deepest Feelings Towards Others", updated ed. Ventura, CA: Regal Books, 2nd Edition 2009.
2. Vohs, Kathleen D., and Eli J., Finkel, eds, "Self and Relationships: Connecting Intrapersonal and Interpersonal Processes", New York: Guilford Press, 1st Edition, 2006.

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1										2	2	1			
CO2										2	2	1			
CO3										2	2	1			
CO4										2	2	1			
CO5										2	2	1			
	3	High				2	Medium				1	Low			

Bloom's Level	Summative Assessment (Internal Mode)	
	Assessment 1 (50 Marks)	Assessment 2 (50 Marks)
Remember	20	20
Understand	10	10
Apply	20	20
Analyze		
Evaluate		
Create		

SEMESTER III

20MA303	DISCRETE MATHEMATICS AND GRAPH THEORY (Common to CSE, IT and AI&DS)	L	T	P	C
		3	2	0	4
Nature of Course	Basic Sciences				
Pre requisites	Mathematics – I & II for Computing Sciences				

Course Objectives

The course is intended to

1. Introduce the concepts of mathematical logic for analyzing propositions.
2. Learn the basic concepts of combinatorics.
3. Provide the concepts of graph theory and solving problems in different fields of study.
4. Acquaint with the applications of algebraic structures.
5. Learn the concepts and significance of lattices and Boolean algebra in computer science and engineering.

Course Outcomes

On successful completion of the course, students will be able to

CO.No	Course Outcome	Bloom's Level
CO1	Explain the mathematical arguments for logical connectives.	Understand
CO2	Compute the techniques of combinatorial analysis.	Apply
CO3	Interpret the graph theory to solve practical problems.	Understand
CO4	Distinguish the properties of algebraic structures for groups, rings and fields.	Understand
CO5	Illustrate the logical notations of lattices and Boolean algebra.	Apply

Course Contents:

UNIT I MATHEMATICAL LOGIC 12

Propositions – Logical connectives – Compound propositions –Conditional and biconditional propositions-Truth tables – Tautologies and contradictions- Contra positive – Logical equivalences and implications –Normal forms –PCNF and PDNF – Rules of inference-Predicates- Statement functions.

UNIT II 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 and its applications.

UNIT III GRAPHS 12

Graphs and graph models – Graph terminology and special types of graphs – Matrix representation of graphs and graph isomorphism – Connectivity – Euler and Hamilton paths-Coloring-Matchings

UNIT IV ALGEBRAIC STRUCTURES 12

Algebraic systems – Semi groups and monoids - Groups – Subgroups –Homomorphism‘s –Normal subgroup and cosets –Lagrange‘s theorem – Definitions and examples of Rings and Fields.

UNIT V LATTICES AND BOOLEAN ALGEBRA 12

Partial ordering – Posets – Lattices as posets – Properties of lattices - Lattices as algebraic systems – Some special lattices – Boolean algebra-Definition and Examples.

Total: 60 Periods

Text Books:

1. Rosen, K.H., "Discrete Mathematics and its Applications", Tata McGraw Hill Pub Co. Ltd., New Delhi, Special Indian Edition,6- Edition,2015.
2. Tremblay, J.P. and Manohar.R, " Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill Pub. Co. Ltd, New Delhi, 2011.

Reference Books:

1. Grimaldi, R.P. "Discrete and Combinatorial Mathematics: An Applied Introduction", Pearson Education Asia, Delhi, 4th Edition, 2007.
2. Lipschutz, S. and Mark Lipson., "Discrete Mathematics", Schaum's Outlines, Tata McGraw HillPub. Co. Ltd., New Delhi, 3rd Edition, 2010.
3. Douglas B West. "Introduction to Graph Theory", Pearson Education, 2nd Edition,2002.

Additional References:

1. nptel.ac.in/courses/111/104/111104026
2. nptel.ac.in/courses/111/107/111107058

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
Cos	**Pos**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	2	-	-	-	-	-	-	-	-	1	2	-	-
CO2	3	3	2	-	-	-	-	-	-	-	-	1	3	-	-
CO3	3	2	2	-	-	-	-	-	-		-	1	2	-	_
CO4	2	2	1	-	-	-	-	-	-	-	-	1	1	-	-
CO5	3	2	2	-	-	-	-	-	-	-	-	1	1	-	-
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Quiz	5	15
Understand	Tutorial Class/ Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	**Internal Assessment Examinations**			**Final Examination (60)**
	IAE-I (7.5)	**IAE-II (7.5)**	**IAE-III (10)**	
Remember	10	10	10	20
Understand	30	30	30	60
Apply	10	10	10	20
Analyze				
Evaluate				
Create				

20IT301	OBJECT ORIENTED PROGRAMMING (Common to IT,CSE and AI&DS)	L	T	P	C
		3	0	0	3
Nature of Course	Professional Core				
Pre requisites	Basics of C				

Course Objectives

The course is intended to

1. Learn the features of Java
2. Gain Knowledge in Classes, Objects and Methods
3. Explore the concepts of inheritance and interfaces
4. Get detailed knowledge about multithreading and generic programming
5. Discover the event driven programming concepts.

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1.	Infer the basic concepts of java programming.	Understand
CO2.	Solve simple applications by utilizing the java classes and interfaces.	Apply
CO3.	Categorize the principles of exception handling and I/O streams	Analyze
CO4.	Appraise java programs using generic programming and multithreading.	Analyze
CO5.	Perform real time applications using event handling concepts.	Apply

Course Contents

UNIT I INTRODUCTION TO JAVA FUNDAMENTALS 9

Features of java – Type Conversion and Casting – Java Collections - Data types and Operators - Operator Precedence and Associativity – Expression - Conditional Statements and Control Structures -Arrays-Handling Strings - Java Classes, Objects, Methods – Constructors - Static and Final Keyword -Java Application Programming.

UNIT II INHERITANCE AND INTERFACES 9

Inheritance basics – Using Super, Method overriding –Abstract Classes – Polymorphism - Interfaces-Multiple Inheritance - this keyword - Garbage Collection- finalize() method -Packages – Access Protection-Importing Packages-Nested and Inner Class-Wrapper Classes-Command Line Arguments

UNIT III APPLETS, EXCEPTION HANDLING AND I/O 9

Applets-Life Cycle – Invoking an Applet – Getting Applet Parameters –Try, catch , finally and throws clause – Catching Multiple Exceptions – User Defined Exceptions- Byte streams – Character streams – Reading and Writing files

UNIT IV MULTITHREADING AND GENERIC PROGRAMMING 9

The Java Thread Model-Thread Life Cycle-Thread Class and Runnable Interface-Multiple Threads and Synchronization-Inter Thread Communication-Generic Classes and Methods-Bounded Type Parameters, Parallelism.

UNIT V EVENT DRIVEN PROGRAMMING 9

Graphics Programming- AWT event hierarchy–Container Class-Layouts-Components-Basics of event handling – event handlers and listener interfaces – adapter classes –Mouse, Keyboard actions and events – Difference between AWT and Java Swing

Total: 45 Periods

Text Books

1. Herbert Schildt, —Java The complete reference 11th Edition, McGraw Hill Education, 2018.
2. Cay S. Horstmann, Gary cornell, —Core Java Volume –I Fundamentals 11th Edition, Prentice Hall, 2018.

Reference Books

1. Paul Deitel, Harvey Deitel, —Java How to program,Early Objects, Global Edition, 11th Edition, Pearson, 2018.
2. Steven Holzner, —Java 2 Black book, Dreamtech press, 2011.
3. Timothy A Budd, —Understanding Object-oriented programming with Java, Second Updated Edition for the open university, 1st edition, Pearson Education, 2018..

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1										3	1	
CO2	3	2	1										3	1	
CO3	3	2	2	1								1	3	1	
CO4	3	2	2	2								1	3	1	
CO5	3	2	2	2								1	3	1	
	3	High				2	Medium					1	Low		

Formative assessment

Bloom's Level	Assessment Component	Marks	Total marks
Apply	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment

Bloom's Category	Continuous Assessment Tests			Final Examination (60)
	IAE-I (7.5)	IAE-II (7.5)	IAE-III (10)	
Remember	10	10	10	10
Understand	20	20	10	40
Apply	20	20	15	30
Analyze	0	0	15	20
Evaluate	0	0	0	0
Create	0	0	0	0

20IT302	COMPUTER ARCHITECTURE AND ORGANIZATION	L	T	P	C
		3	0	0	3
Nature of Course	Professional Core				
Pre requisites	Computer Hardware				

Course Objectives

The course is intended to

1. Have knowledge of basic structure and operation of digital computer.
2. Be familiarize with implementation of fixed point and floating-point arithmetic operations
3. Learn the design of data path unit and control unit for processor
4. Establish the parallel processing technique
5. Distinguish the organization of various parts of a system memory hierarchy

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1.	Recognize the basic structure of computer, operations and instructions.	Understand
CO2.	Design arithmetic and logic unit.	Apply
CO3.	Design a pipeline for consistent execution of instructions with minimum hazards	Apply
CO4.	Comprehend parallel processing architectures.	Understand
CO5.	Manipulate the function of each element in memory and Interfacing	Apply

Course Contents

UNIT I BASIC STRUCTURE OF A COMPUTER SYSTEM 9

Functional Units – Basic Operational Concepts – Performance – Instructions: Language of the Computer – Operations, Operands – Instruction representation – Logical operations – decision making – MIPS Addressing.

UNIT II ARITHMETIC FOR COMPUTERS 9

Addition and Subtraction – Multiplication – Division – Floating Point Representation – Floating Point Operations – Subword Parallelism

UNIT III PROCESSOR AND CONTROL UNIT 9

A Basic MIPS implementation – Building a Datapath – Control Implementation Scheme – Pipelining – Pipelined datapath and control – Handling Data Hazards & Control Hazards – Exceptions.

UNIT IV PARALLELISIM 9

Parallel processing challenges – Flynn‘s classification- Vector Architectures – Hardware multithreading – Multi-core processors and other Shared Memory Multiprocessors – Introduction to Graphics Processing Units, Clusters, Warehouse Scale Computers and other Message-Passing Multiprocessors.

UNIT V MEMORY & I/O SYSTEMS **9**

Memory Hierarchy – memory technologies – cache memory – measuring and improving cache performance – virtual memory, TLB's – Accessing I/O Devices – Interrupts – Direct Memory Access – Bus structure – Bus operation – Arbitration – Interface circuits – USB.

Total: 45 Periods

Text Books

1. David A. Patterson and John L. Hennessy, Computer Organization and Design MIPS edition: The Hardware/Software Interface, Morgan Kaufmann / Elsevier, 6th Edition, 2020.
2. Carl Hamacher, Zvonko Vranesic, Safwat Zaky and Naraig Manjikian, Computer Organization and Embedded Systems, Tata McGraw Hill, 6th Edition, 2012.

Reference Books

1. William Stallings, Computer Organization and Architecture – Designing for Performance,Pearson Education, 11th Edition, 2018.
2. John P. Hayes, Computer Architecture and Organization, Tata McGraw Hill, 3rd Edition, 2012.
3. John L. Hennessey and David A. Patterson, Computer Architecture – A Quantitative Approachǁ, Morgan Kaufmann / Elsevier Publishers, 5th Edition, 2012.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1										3	1	
CO2	3	2	2	1									3	1	
CO3	3	2	1	1									3	1	
CO4	3	3	2	1									3	1	
CO5	3	3	2	2									3	1	
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Apply	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE-I (7.5)	**IAE-II (7.5)**	**IAE-III (10)**	
Remember	10	10	10	10
Understand	30	30	30	50
Apply	10	10	10	40
Evaluate	0	0	0	0
Create	0	0	0	0

20IT303	OPERATING SYSTEMS (Common to IT,CSE and AI&DS)	L	T	P	C
		3	0	2	4
Nature of Course	Professional Core				
Pre requisites	Programming and Data Structures				

Course Objectives

The course is intended to

1. Be familiar on the role, core structure, functions and services of operating systems.
2. Identify the components and appropriate management of computer hardware required for a process to execute correctly and compare the various Algorithms used for CPU Scheduling.
3. Provide solutions for issues that arise in process synchronization and distributed programming situations which lead to deadlock
4. Recognize the memory management and I/O management required to support concurrent processing and multi-threaded environments.
5. Make case studies about all the concepts of Operating system in Linux and VMware.

Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	Comprehend the structures, functions and services of operating systems.	Understand
CO2	Compare various Algorithms used for process and CPU Scheduling to solve problems.	Apply
CO3	Discover the issues that arise in process synchronization which lead to deadlock	Apply
CO4	Interpret the storage management policies with respect to different storage management technologies	Apply
CO5	Perform administrative tasks on Linux Servers	Analyze

Course Contents

UNIT I OPERATING SYSTEMS OVERVIEW 9

Overview and Functions of operating systems, operating Systems structures, services, system programs, system calls and their working. History and Evolution of operating system- Batch, multiprogramming, time sharing, parallel, distributed & real -time.

UNIT II PROCESS MANAGEMENT 9

Process and Threads – Process concepts, scheduling-criteria, Process Scheduling, Basic Concepts of Concurrency, Cooperating process, Basic Concepts of Inter-process Communication. Thread concept, issues and types, Multi-threading models. CPU Scheduling algorithms.

UNIT III CONCURRENCY CONTROL 9

Concurrency: Principles of Concurrency, Mutual Exclusion: Critical section problem, Semaphores, pipes, Message Passing, Monitors, Classical Problems of Synchronization: Readers-Writers, Producer Consumer, and Dining Philosopher. Deadlock: Principles of deadlock, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Deadlock recovery.

UNIT IV MEMORY MANAGEMENT AND MASS STORAGE STRUCTURE 9

Memory Management: contiguous memory allocation, Swapping, paging, segmentation, virtual memory, demand paging, page- replacement algorithms. File concept - Access Methods, Allocation methods - protection and sharing, Directory Structure, Free-space management. Disk structure, disk scheduling.

UNIT V CASE STUDY 9

Linux System- Basic Concepts; System Administration - Requirements for System Administrator, Setting up a LINUX Multifunction Server, Domain Name System, Setting Up Local Network Services; Virtualization. VMware: Infrastructure, Physical Topology, Virtual datacenter architecture, network and storage architecture, virtual center server.

TOTAL : 45 PERIODS

Laboratory Components

S.No	List of Experiments	CO Mapping	RBT
1	Hands on Activity for OS Installation.	1	Understand
2	Demonstration of fork, exec and wait system calls along with zombie and orphan states.	1	Understand
3	Implementing a CPU scheduling policy with FCFS,SJF, Priority and RR algorithms	2	Apply
4	Thread synchronization using counting semaphores and mutual exclusion using mutex. Application to demonstrate: producer-consumer problem with counting semaphores and mutex.	3	Apply
5	Implement Deadlock Avoidance Using Semaphores	3	Apply
6	Develop a C program to simulate Page replacement using FIFO, LRU and Optimal algorithms.	4	Analyze
7	Write a C program to simulate the following file allocation strategies. a) Sequential b) Indexed c) Linked	4	Analyze
8	Implement a new system call, add this new system call in the Linux kernel (any kernel source, any architecture and any Linux kernel distribution) and demonstrate the use of same.	5	Analyze

TOTAL : 30 Periods

Text Books

1. Operating System Concepts, Peter B. Galvin, Greg Gagne, Abraham Silberschatz, John Wiley & Sons, Inc. ,10th edition ,2018
2. Operating Systems, William Stallings, Pearson Education India, 9th Edition 2018.

Reference Books

1. Ramaz Elmasri, A. Gil Carrick, David Levine, —Operating Systems – A Spiral Approach, Tata McGraw Hill Edition, 2010.
2. Andrew S. Tanenbaum, Modern Operating Systems, Pearson Education, 4th Edition, 2014.
3. Gary Nutt, —Operating Systems, Pearson Education, 3rd Edition, 2014.

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1										3	1	
CO2	3	2	2	1									3	1	
CO3	3	2	2	1									3	1	
CO4	3	2	2	1									3	1	
CO5	3	3	2	1	1						2	2	3	1	
	3	High				2	Medium					1	Low		

Summative Assessment						
	Continuous Assessment					Final
	Theory				Practicals	
Bloom's Level	IAE-I [7.5]	IAE-II [7.5]	IAE-III [10]	Attendance [5]	Rubric based CIA [20]	Examination (Theory) [50]
Remember	10	10	10			10
Understand	20	20	20		10	20
Apply	20	20	20		20	50
Analyze					20	20
Evaluate						
Create						

20IT304	DATABASE MANAGEMENT SYSTEMS (Common to IT,CSE and AI&DS)	L	T	P	C
		3	0	2	4
Nature of Course	Professional Core				
Pre requisites	Basics of Data Structures				

Course Objectives

The course is intended to

1. Familiarize the fundamentals of data models and SQL
2. Represent a database system using ER diagrams and relational schema
3. Understand the fundamental concepts of transaction processing- concurrency control Techniques and recovery procedures
4. Identify with the internal storage structures using different file and indexing techniques which will help in physical database design.
5. Have a comparative knowledge about the various advanced databases.

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1.	Classify the modern and futuristic database applications and write queries using various SQL commands	Analyze
CO2.	Construct ER Model and Design relational schema for a given database application.	Apply
CO3.	Illustrate the concepts for transaction processing and concurrency control.	Understand
CO4.	Apply indexing and hashing techniques to access and generate user reports for a database.	Apply
CO5.	Appraise how advanced databases differ from traditional databases	Evaluate

Course Contents

UNIT I RELATIONAL DATABASES 9

Purpose of Database System – Views of data – Data Models – Database System Architecture – Introduction to relational databases – Relational Model – Keys – SQL fundamentals – Advanced SQL features, PL/SQL.

UNIT II DATABASE DESIGN 9

Entity-Relationship model: Diagrams – Enhanced Model –Relational Mapping – Relational Algebra – Functional Dependencies – Non-loss Decomposition – First, Second, Third Normal Forms, Boyce/Codd Normal Form – Multi-valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form

UNIT III TRANSACTIONS 9

Transaction Concepts – ACID Properties – Schedules – Serializability – Concurrency Control – Need for Concurrency – Locking Protocols – Two Phase Locking – Deadlock – Transaction Recovery - Save Points – Isolation Levels – SQL Facilities for Concurrency and Recovery.

UNIT IV IMPLEMENTATION TECHNIQUES 9

RAID – File Organization – Organization of Records – Indexing and Hashing –Ordered Indices – B tree and B+ tree Index Files – Static and Dynamic Hashing – Query Processing Overview – Algorithms for SELECT and JOIN operations – Query optimization using Heuristics and Cost Estimation.

UNIT V ADVANCED DATABASES 9

Distributed Databases: Architecture, Storage, Transaction Processing – Object-based Databases: Concepts-Object-Relational features, MongoDB – Concepts and features, XML Databases: XML Hierarchical Model, DTD, XQuery – Information Retrieval: Retrieval Models, Queries in IR systems**.**

Total: 45 Periods

Laboratory Components

S.No	List of Experiments	CO Mapping	RBT
1	Data Definition Commands, Data Manipulation Commands for inserting, deleting, updating and retrieving Tables and Transaction Control statements. Database Querying – Simple queries, Nested queries, Sub queries and Joins	1	Understand
2	Practicing PL/SQL for a real time application	1	Apply
3	Database Design using ER modeling, normalization and Implementation for any application	2	Apply
4	Write relational algebra queries for a given set of relations.	2	Apply
5	XML database creation and validation	5	Analyze
6	Case Study using real life database applications	5	Apply

Total : 30 Periods

Text Books

1. Abraham Silberschatz, Henry Korth, and S. Sudarshan, “Database System Concepts”, 7th Edition, McGraw-Hill, 2020.
2. Ramez Elmasri, Shamkant B. Navathe, —Fundamentals of Database Systems, 6th Edition, Pearson, 2016.

Reference Books

1. C. J. Date, A.Kannan, S. Swamynathan, —An Introduction to Database Systems Pearson Education, 8th Edition, 2012.
2. Raghu Ramakrishnan, —Database Management Systems, McGraw-Hill College Publications, 4th Edition, 2015.
3. G.K.Gupta, "Database Management Systems, Tata McGraw Hill, 2011.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	2										3	1	
CO2	3	2	2	1								1	3	1	
CO3	3	2	1	1								1	3	1	
CO4	3	3	2	1	2						2	1	3	1	
CO5	3	3	2	2	2						2	1	3	1	
	3	High				2	Medium					1	Low		

Summative Assessment						
Bloom's Level	**Continuous Assessment**					Final Examination (Theory) [50]
	Theory				Practicals	
	IAE-I [7.5]	IAE-II [7.5]	IAE-III [10]	Attendance [5]	Rubric based CIA [20]	
Remember	10	10	10			10
Understand	10	20	20		10	20
Apply	20	20	10		20	50
Analyze	10		10		20	10
Evaluate						10
Create						

20EC306	DIGITAL LOGICS AND MICROPROCESSOR (Common to IT,CSE and AI&DS)	L	T	P	C
		3	0	2	4
Nature of Course	Engineering Science				
Pre requisites	-				

Course objectives:

The course is intended to

1. Learn Digital fundamentals, Boolean theorems and Minimization of logical functions for logic circuit implementation.
2. Acquire the Knowledge of Combinational Logic Circuits using Logic Gates
3. Expose Synchronous and Asynchronous Sequential Circuits
4. Study the 8086 Microprocessor Architecture and its Configuration with Timing Diagram
5. Know Assembly Language Programming and Interfacing of 8086 Microprocessor for different applications.

Course Outcomes:

On successful completion of the course, students will be able to

CO	Course Outcome	Bloom's Level
CO1	Apply the Minimization Techniques for Logical functions to Realize the logical Circuits.	Apply
CO2	Construct the combinational digital circuits using logic gates	Apply
CO3	Develop the Synchronous and Asynchronous Sequential Circuits	Apply
CO4	Explain the basic concept of 8086 microprocessor architecture and its configuration	Understand
CO5	Analyze the assembly language Program and interfacing of 8086 microprocessor with various applications	Analyze

Course Contents:

UNIT I NUMBER SYSTEM AND DIGITAL LOGIC GATES 9

Number Systems - Decimal, Binary, Octal, Hexadecimal, radix conversion, 1's and 2's complements, Codes - Binary, BCD, Excess 3, Gray, Alphanumeric codes, Boolean theorems & Postulates, Logic gates, Universal gates, Sum of products and product of sums, Minterms and Maxterms, Karnaugh Map Minimization (up to 4 variables).

UNIT II COMBINATIONAL LOGIC CIRCUITS 9

Constructions of adder, Subtractor, Carry look ahead Adder, BCD Adder, Multiplier, Magnitude Comparator– Encoder, Decoder, Multiplexer and Demultiplexer – Parity Checker & Generator Realization of combinational circuits using decoders and multiplexers.

UNIT III SEQUENTIAL LOGIC CIRCUITS 9

Synchronous : Latches, Flip flops - SR, JK, T, D, Master/Slave FF - operation and excitation tables, Triggering of FF, Analysis and design of clocked sequential circuits – Shift Registers – Counters (Fundamental and Types).

Asynchronous (Quantitative Analysis only)**:** Stable and Unstable states, output specifications, cycles and races, state reduction, race free assignments.

UNIT IV THE 8086 MICROPROCESSOR 9

Evolution of Microprocessor – Features, Pin Diagram & Architecture of 8086 Microprocessor – Memory segmentation – Physical address generation, Minimum mode and Maximum mode Configurations.

UNIT V ASSEMBLY LANGUAGE PROGRAMMING AND INTERFACING APPLICATIONS 9

Addressing modes and Instruction set of 8086 – Assembly language programming using 8086 – Keyboard and Display Controller - Interfacing of Keyboard and display using 8086 –Parallel Communication Interface - Traffic Light Interfacing using PPI.

Total :45 Periods

Laboratory Components

S.No	List of Experiments	CO Mapping	RBT
1	Study and Verification of Boolean theorems using digital logic gates	CO1	Apply
2	Design and implementation of Binary to Gray and Gray to Binary code converters	CO1	Apply
3	Design and implementation of Half adder / Half subtractor, Full adder / Full subtractor using basic gates	CO2	Apply
4	Design and implementation of Encoder, Decoder, Multiplexer and Demultiplexer	CO2	Apply
5	Design and implementation of Shift registers	CO3	Apply
6	Basic arithmetic and Logical operations using 8086 Microprocessor	CO4	Apply
7	Code conversion, decimal arithmetic and Matrix operations using 8086 Microprocessor	CO4	Apply
8.	Floating point operations, string manipulations, sorting and searching using 8086 Microprocessor	CO4	Apply
9	Key board and Display interfacing using 8086 Microprocessor	CO5	Apply
10	Traffic light controller using 8086 Microprocessor	CO5	Apply

Total: 30 Periods

Text Books

1. Morris Mano.M and Michael D. Ciletti, "Digital Design", Pearson, 6th Edition, 2018.
2. Doughlas V.Hall, "Microprocessors and Interfacing, Programming and Hardware",TMH,2012
3. Yu-Cheng Liu, Glenn A.Gibson, "Microcomputer Systems: The 8086 / 8088 Family - Architecture, Programming and Design", Prentice Hall of India, Second Edition, 2007.

Reference Books

1. Charles H.Roth, "Fundamentals of Logic Design", Thomson Learning, 6th Edition, 2013.
2. Thomas L. Floyd," Digital Fundamentals", Pearson Education Inc, 10th Edition, 2011
3. Soumitra Kumar Mandal, "Digital Electronics", McGraw Hill Education Pvt. Limited, 2016.
4. Savaliya.M.T, "8086 Programming and Advanced Processor Architecture", Wiley India, New Delhi, 2013.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) Program Specific Outcomes (PSOs)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	1								1	2	3	1	
CO2	3	2	2		2						2	2	3	1	1
CO3	3	3	2		2						2	2	3	1	1
CO4	3	2									1	2	3	1	
CO5	3	2	2		2						3	2	3	1	1
	3	High				2	Medium					1	Low		

Summative Assessment						
Bloom's Level	**Continuous Assessment**					**Final Examination (Theory) (50)**
	Theory				**Practical's**	
	IAE – I (7.5)	**IAE – II (7.5)**	**IAE – III (10)**	**Attendance (5)**	**Rubric based CIA (20)**	
Remember	10	10	10			30
Understand	15	15	15			30
Apply	25	25	15		50	25
Analyze			10			15
Evaluate						
Create						

20IT305	OBJECT ORIENTED PROGRAMMING LABORATORY (Common to IT,CSE and AI&DS)	L	T	P	C
		0	0	4	2
Nature of Course	Practical				
Pre requisites	Basic Structure of C				

Course Objectives

The course is intended to

1. Make familiar with java programming Language
2. Write simple programs using java applets
3. Develop applications in java using I/O streams and Exception handling mechanism
4. Implement generic programming for real time applications
5. Apply AWT and Java Swing to create GUI based applications

Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	Write simple java programs using basic language constructs	Understand
CO2	Execute programs using inheritance and interfaces	Apply
CO3	Solve complex problems using Exception Handling	Apply
CO4	Extend the concepts of multithreading and generic programming to solve real world problems	Apply
CO5	Integrate the concept of event driven programming to develop GUI based applications	Analyze

Laboratory Components

S.No	List of Exercises	CO Mapping	RBT
1	Create java applications using java classes and methods	CO1	Apply
2	Write java applications using constructors	CO1	Apply
3	Design java applications to implement different types of inheritance.	CO2	Analyze
4	Develop a simple program to get and display data using command line arguments.	CO2	Apply
5	Implement the concept of exception handling to solve complex problems.	CO3	Analyze
6	Write programs to read and display the contents of a file using I/O streams	CO3	Apply
7	Creation of real time applications using multithreading	CO4	Apply
8	Develop a java application using generic programming	CO4	Analyze
9	Write programs in Java to create three-tier applications.	CO4	Analyze
10	Create a GUI based java applet using appropriate controls from abstract window toolkit.	CO5	Apply
11	Develop a java GUI applet using Swings	CO5	Apply

Total: 60 Periods

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)															
Cos	**Pos**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	1	1	1	3						1	2	3	3	
2	3	1	1	1	3						1	2	3	3	
3	3	1	1	1	3						1	2	3	2	
4	3	2	1	2	3						1	2	3	2	
5	3	2	1	1	3						1	2	3	2	
	3	High				2	Medium					1	Low		

Summative assessment based on Continuous and End Semester Examination		
Bloom's Level	**Rubric based Continuous Assessment [50 marks]**	**End Semester Examination [50 marks]**
Remember		
Understand	10	20
Apply	20	50
Analyze	20	30
Evaluate		
Create		

20MC301	ENVIRONMENTAL SCIENCE (Common to CSE, IT, AI&DS, ECE and BME)	L	T	P	C
		2	0	0	0
Nature of Course	Mandatory				
Prerequisites	Nil				

Course Objectives

The course is intended to

1. Understand the concept of eco system and environment.
2. Become conversant with ecological balance and values of bio diversity.
3. Know the role of human in prevention of pollution and making a clean environment.
4. Get knowledge about conservation of non conventional energy resources.
5. Study about the nature and management of e-waste and solid waste.

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1	Describe the ecosystem and environment	Understand
CO2	Understand the ecological balance and preservation of bio diversity	Understand
CO3	Demonstrate various types of pollution in order tocontrol pollution	Apply
CO4	Classify the energy sources for the conservation of non conventional energy sources	Understand
CO5	Identify the nature and management of e-waste and solid waste	Apply

Course Contents

UNIT I ECOSYSTEM **6**

Eco system**-**Food chains, Food webs and Ecological pyramids. Ecosystem-(a) Forest eco system,(b) Aquatic eco system(pond ecosystem and marine ecosystem).

UNIT II BIODIVERSITY **6**

Introduction to Bio diversity, Values of Bio diversity**,** Threads to Biodiversity**,** Endangered and Endemic species of India, Hotspots of biodiversity. Conservation of Bio diversity: In-Situ and Ex-Situ conservation of bio diversity.

UNIT III ENVIRONMENTAL POLLUTION **6**

Definition, Causes, Effects and Control of (a) Air pollution (b) Water pollution (c) Soil pollution. Electrostatic Precipitator for controlling air pollution.

UNIT IV NON CONVENTIONAL ENERGY RESOURCES **6**

Introduction, Types: Solar Energy, Wind Energy and Geo Thermal Energy.

UNIT V ENVIRONMENTAL MANAGEMENT **6**

Sustainable Development, Role of Information technology in Environment and Human.HIV and AIDS: causes and control measures. Green chemistry: Definition and Principles

Activity Component

S.No	Name of the Experiment	CO Mapping	RBT
1	Field study of simple eco system: pond, river and hill slopes	CO1	Understand
2	Case studyregarding environmental management	CO5	Apply

Total: 30 periods

Text Books

1. AnubhaKaushik and C.P. Kaushik, "Environmental Science and Engineering, New Age International Publishers, New Delhi, 2nd Edition, 2015.
2. V. Kumar, "An Introduction to Green Chemistry" Vishal publishing Co. Reprint Edition,2010.

Reference Books

1. Masters, Gilbert M, "Introduction to Environmental Engineering and Science", Pearson Education, New Delhi, 2nd Edition, 2012.
2. Santosh Kumar Garg and Rajeshwari Garg, "Ecological and Environmental Studies", Khanna Publishers, NaiSarak, Delhi, 2nd Edition, 2014.

Additional Resources

1. https://nptel.ac.in/courses/122103039/38
2. https://bch.cbd.int/cms/ui/collaboration/download/download.aspx?id=909
3. https://nptel.ac.in/courses/105102089/air%20pollution%20(Civil)/Module-3/3a.htm
4. www.vssut.ac.in/lecture_notes/lecture1428910296.pdf
5. nptel.ac.in/courses/120108004/module7/lecture8.pdf

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1							3					3			
CO2							3					3			
CO3							3					3			
CO4							3					3			
CO5							3					3			
	3	High					2	Medium				1	Low		

Bloom's Level	**Continuous Assessment**				
	IAE-I [20]	**IAE-II [20]**	**IAE-III [20]**	**Attendance [10]**	**Activity [30]**
Remember	30	20	20		
Understand	10	20	20		
Apply	10	10	10		
Analyze					
Evaluate					
Create					

SEMESTER IV

20MA403	PROBABILITY AND STATISTICAL METHODS (common to CSE, IT & Food Tech)	L	T	P	C
		3	2	0	4
Nature of Course	Basic Sciences				
Pre requisites	Mathematics-I & II for Computing and Bio Sciences				

Course Objectives

The course is intended to

1. Introduce the basic concepts of random variables**.**
2. Acquire the concepts of random variables essential for the subsequent and digital communication.
3. Acquaint with the knowledge of testing of hypothesis for small and large samples.
4. Familiarize with the basic concept on types of design of experiments used in the field of engineering
5. Study the concepts on types of classifications and statistical quality control.

Course Outcomes

On successful completion of the course, the students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1	Explain the concepts of a random variables and Probability distributions.	Understand
CO2	Examine the functions of multiples random variable.	Apply
CO3	Interpret the testing of hypothesis for small and large samples.	Understand
CO4	Apply the concepts of classifications of design of experiments in the field of engineering.	Apply
CO5	Illustrate the sampling distribution and statistical techniques	Understand

Course Contents:

UNIT I PROBABILITY AND RANDOM VARIABLES 12

Basics of Probability-Random Variables – Types of Random Variables: Discrete random variables Continuous random variables– Probability functions, Moment Generating Functions – Discrete Distributions: Binomial and Poisson distributions–Continuous Distributions: Uniform and Exponential distributions.

UNIT II TWO – DIMENSIONAL RANDOM VARIABLES 12

Joint distributions – Marginal distributions– Covariance – Correlation and linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

UNIT III 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 for mean, variance and proportion -Contingency table (test for independent) -Goodness of fit.

UNIT IV DESIGN OF EXPERIMENTS 12

One way and two way classifications – Completely randomized design – Randomized block design – Latin square design – 2^2 factorial design.

UNIT V STATISTICAL QUALITY CONTROL 12

Control charts for measurements (X and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits – Acceptance sampling.

Total: 60 Periods

Text Books:.

1. Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, 4th Edition, 2007.
2. 0liver.C.Ibe, 'Fundamentals of Applied Probability and Random Processes'', Elsevier India,2nd Edition , 2014

Reference Books:

1. Bali N.P and Manish Goyal, "A Text book of Engineering Mathematics", Lakshmi Publications Pvt Ltd, 9th Edition,2014.
2. Ronald E. Walpole, Raymond H. Myersand Sharon L. Myers "Probability And Statistics and for Engineers and scientists ", Pearson India ,9th edition, 2012.
3. Robert V. Hogg Elliot Tanis Dale Zimmermann., "Probability and Statistical inference "Pearson Education,2021.

Additional References:

1.https://nptel.ac.in/courses/111/102/111102111

2.https://nptel.ac.in/courses/110/107/110107114

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
Cos	**Pos**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	2	-	-	-	-	-	-	-	-	1	2	-	-
CO2	3	2	2	-	-	-	-	-	-	-	-	1	2	-	-
CO3	3	3	2	-	-	-	-	-	-	-	-	1	2	-	-
CO4	3	2	1	-	-	-	-	-	-	-	-	1	1	-	-
CO5	3	2	2	-	-	-	-	-	-	-	-	1	2	-	-
	3	High				2	Medium					1	Low		

Formative Assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Quiz	5	15
Understand	Tutorial Class / Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	**Internal Assessment Examinations**			**Final Examination (60)**
	IAE 1 (7.5)	**IAE 2 (7.5)**	**IAE 3 (10)**	
Remember	10	10	10	20
Understand	30	30	30	60
Apply	10	10	10	20
Analyze				
Evaluate				
Create				

20IT401	DATA COMMUNICATION AND COMPUTER NETWORKS (Common to IT,CSE and AI&DS)	L	T	P	C
		3	0	0	3
Nature of Course	Professional Core				
Pre requisites	Computer Architecture				

Course Objectives

The course is intended to

1. Understand the protocol layering and physical level communication.
2. Examine the performance of a Data link control.
3. Learn the functions of network layer and the various routing protocols.
4. Recognize the components required to build different networks.
5. Familiarize with the functions and protocols of the application layer.

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1.	Classify the basic layers and its functions in computer networks.	Understand
CO2.	Interpret the protocols of data link layer can be used to assist in network design and implementation.	Apply
CO3.	Analyze the topological and routing strategies for an IP based networking infrastructure	Analyze
CO4.	Apply reliable and unreliable transfer of data in TCP and UDP.	Apply
CO5.	Recognize the working of various application layer protocols.	Understand

Course Contents

UNIT I INTRODUCTION AND PHYSICAL LAYER 9

The internet-Protocol and standards, Network model - OSI model – Layers -TCP/IP protocol suite - Addressing, Analog and Digital signals- Transmission impairment - Data rate limits - performance, Multiplexing, Spread spectrum, Transmission media. Switching.

UNIT II DATA-LINK LAYER & MEDIA ACCESS 9

Error detection and correction – Introduction - Block coding – CRC - Checksum, DLC – Framing - Flow and Error control – Protocols : Noiseless and noisy channels – HDLC – PPP, Multiple access - Random and controlled access, Wired LANs: Ethernet, Wireless LANs: IEEE 802.11 - Bluetooth, Connecting devices.

UNIT III NETWORK LAYER 9

Logical addressing, Internet protocol: Internetworking - IPV4 and IPV6, Address mapping – ICMP – IGMP. Delivery - Forwarding – Unicast and Multicast routing protocols,

UNIT IV TRANSPORT LAYER 9

Process to process delivery: UDP – TCP – SCTP, Adaptive Flow Control – Adaptive Retransmission - Congestion control –Congestion avoidance – examples - QoS- Techniques to improve QoS.

UNIT V APPLICATION LAYER 9

Email (SMTP, MIME, IMAP, POP3) –WWW - HTTP – DNS - SNMP –Telnet – FTP – Security –PGP – SSL/TLS.

Total: 45 Periods

Text Books

1. Behrouz A. Forouzan, Data Communications and Networking, McGraw-Hill Professional, 5th Edition 2017.
2. Kurose, Ross , Computer Networking: A top down approach, Pearson Education, India. 7th edition, 2017

Reference Books

1. Larry L. Peterson, Bruce S. Davie, Computer Networks: A Systems Approach, Morgan Kaufmann Publishers Inc., 6th Edition, 2021.
2. William Stallings, Data and Computer Communications, Pearson Education, 10th Edition, 2014.
3. Ying-Dar Lin, Ren-Hung Hwang and Fred Baker, Computer Networks: An Open Source Approach, McGraw Hill Publisher, 2011.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

Cos	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	2									3	1	
CO2	3	2	3	1								1	3	1	
CO3	3	2	1	2	1							1	3	1	
CO4	3	3	3	2								1	3	1	
CO5	3	3	1	1	1							1	3	1	
	3	High				2	Medium					1	Low		

Formative assessment

Bloom's Level	Assessment Component	Marks	Total marks
Apply	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment

Bloom's Category	Continuous Assessment Tests			Final Examination (60)
	IAE-I (7.5)	IAE-II (7.5)	IAE-III (10)	
Remember	10	10	10	10
Understand	20	20	20	50
Apply	20	20	20	30
Analyze	0	0	0	10
Evaluate	0	0	0	0
Create	0	0	0	0

20IT402	COMPUTATIONAL INTELLIGENCE	L	T	P	C
		3	0	0	3
Nature of Course	Professional Core				
Pre requisites	NIL				

Course Objectives

The course is intended to

1. Understand the various searching and game playing techniques
2. Acquire the knowledge of real world Knowledge representation.
3. Be familiar on uncertainty concepts with soft computing techniques.
4. Relate the Computational Intelligence techniques in applications which involve perception, reasoning and learning.
5. Have Knowledge about machine learning concepts in real life problems.

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Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1	Identify with state space and its searching strategies.	Understand
CO2	Apply knowledge representation and predicate logic to transform the real life information in different representation.	Apply
CO3	Recognize the uncertainty in real world problems	Apply
CO4	Employ Linear Regression, Classification and Artificial Neural Networks for applications involves Learning	Analyze
CO5	Discover the proficiency in applying scientific method to models of machine learning.	Apply

Course Contents

UNIT I INTRODUCTION 9

Introduction to Artificial Intelligence – Search - Heuristic Search - Hill climbing- A* algorithm- Game Playing- Alpha - Beta Pruning - Constraint satisfaction problem - Expert systems – Inference – Rules - Forward Chaining and Backward Chaining- Introduction to Genetic Algorithms.

UNIT II KNOWLEDGE REPRESENTATION AND REASONING 9

Proposition Logic — First Order Predicate Logic — Unification — Forward Chaining -Backward Chaining — Resolution — Knowledge Representation — Ontological Engineering — Categories and Objects — Events — Mental Events and Mental Objects — Prolog Programming.

UNIT III UNCERTAINTY 9

Non monotonic reasoning - Fuzzy Logic - Fuzzy rules - fuzzy inference - Temporal Logic - Temporal Reasoning - Neural Networks - Neuro-fuzzy Inference. Basic plan generation systems – STRIPS and K- STRIPS

UNIT IV LEARNING 9

Probability basics — Baye's Rule — Bayesian Networks — Exact and Approximate Inference — Hidden Markov Models — Supervised and unsupervised Learning — Learning Decision Trees — Regression and Classification with Linear Models — Artificial Neural Networks —Support Vector Machines — Statistical Learning - Reinforcement Learning.

UNIT V INTELLIGENCE AND APPLICATIONS 9

Natural language processing-Morphological Analysis-Syntax analysis-Semantic Analysis- Language Models — Information Retrieval — Information Extraction — Machine Translation — Machine Learning — Symbol-Based and Connectionist.

Total: 45 Periods

Text Books

1. Stuart Russell, Peter Norvig, Artificial Intelligence: A Modern Approach, Pearson Education / Prentice Hall of India, 3rd Edition, 2021.
2. Elaine Rich and Kevin Knight, Artificial Intelligence, Tata McGraw-Hill, 3rd Edition, 2019.

Reference Books

1. Patrick H. Winston. "Artificial Intelligence", 3rd edition, Pearson Edition, 2006.
2. Dan W.Patterson, Introduction to Artificial Intelligence and Expert Systems, PHI, 2006.
3. Nils J. Nilsson, Artificial Intelligence: A new Synthesis, Harcourt Asia Pvt. Ltd., 2000.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2										3	1	
CO2	3	3	2	2									3	1	
CO3	3	3	3	3								1	3	1	
CO4	3	3	3	2		2						1	3	1	
CO5	3	3	3	3		2						1	3	1	
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Understand	Classroom or Online Quiz	5	15
Apply/Analyze	Case Study	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE-I (7.5)	**IAE-II (7.5)**	**IAE-III (10)**	
Remember	10	10	10	10
Understand	20	20	20	30
Apply	20	20	10	50
Analyze	0	0	10	10
Evaluate	0	0	0	0
Create	0	0	0	0

20IT403	SOFTWARE ENGINEERING (Common to IT,CSE and AI&DS)	L	T	P	C
		3	0	0	3
Nature of Course	Professional Core				
Pre requisites	NIL				

Course Objectives

The course is intended to

1. Understand the phases in a software project
2. Perform feasibility study of the projects under the requirement engineering process and system models
3. Acquire the knowledge about Agile Software development model
4. Learn various testing Strategies.
5. Have knowledge about the Metrics for Process, Projects and Quality Management

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1.	Recognize the software development lifecycles, phases, activities and the artifacts created in each phase of a lifecycle	Understand
CO2.	Identify software development needs and challenges that require various engineering solutions, and formulate such solutions	Understand
CO3.	Apply systematic procedure for Agile software design and deployment	Apply
CO4.	Propose testing strategy for a given software	Analyze
CO5.	Analyze project schedule and cost estimation.	Analyze

Course Contents

UNIT I INTRODUCTION TO SOFTWARE ENGINEERING AND PROCESS MODELS 9

Professional Software Development - Layered Technology - Process framework, CMM, Process Patterns and Assessment. Process Models - Prescriptive Models: Waterfall Model, Incremental, RAD Models Evolutionary Process Models: Prototyping, Spiral and Concurrent Development Model Specialized Models: Component based, Aspect Oriented development

UNIT II REQUIREMENTS ANALYSIS AND DESIGN ENGINEERING 9

Requirements Engineering Tasks, Elicitation, building analysis model, Data Modeling concepts, Object Oriented Analysis. Design Concepts, Design Model – Data, Architecture, Interface, Component Level and Deployment Level design elements

UNIT III AGILE SOFTWARE DEVELOPMENT AND MODELING PRACTICES 9

Agile Process and Process Models, Adaptive and Dynamic system Development, Scrum, Feature Driven Development and Agile Modeling - Core Principles, Communication, Planning, Modeling, Construction and deployment. System Modeling and UML

UNIT IV TESTING STRATEGIES 9

Overview of Testing- Testing Concepts-Faults, Erroneous States, Failures-Test Cases- Test Stubs and Drivers- Corrections-Testing Activities- Component Inspection – Usability Testing-Unit Testing-Integration Testing-System Testing-Managing Testing-Planning Testing-Documenting Testing-Assigning Responsibilities-Regression Testing- Automating testing

UNIT V METRICS FOR PROCESS AND PROJECTS AND QUALITY MANAGEMENT 9

Process Metrics and Project Metrics, Software Measurement, Object Oriented Metrics, Software Project Estimation-COCOMO, Decomposition Techniques, LOC based, FP based and Use case based estimations, Empirical estimation Models. Quality Management - Quality Concepts, SQA activities, Software reviews, FTR, Software reliability and measures, SQA plan.

Total: 45 Periods

Text Books

1. Roger S. Pressman, —Software Engineering – A Practitioner's Approach‖, Mc Graw-Hill International Edition,8th Edition, 2019.
2. Ian Sommerville, —Software Engineering‖, Pearson Education Asia, 10th Edition, 2016.

Reference Books

1. Rajib Mall, —Fundamentals of Software Engineering‖, Fifth Edition, PHI Learning Pvt. Ltd, 2018.
2. Pankaj Jalote, —Software Engineering, A Precise Approach, Wiley India, 2010.
3. Kelkar S.A., —Software Engineering, Prentice Hall of India Pvt Ltd, 2007.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1	1									3	1	
CO2	3	2	2	1	2						2	2	3	1	
CO3	3	2	1	1									3	1	
CO4	3	3	2	1	2	1		1			1	2	3	1	
CO5	3	3	2	2	2	1		1			3	2	3	1	
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Apply	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE-I (7.5)	**IAE-II (7.5)**	**IAE-III (10)**	
Remember	10	10	10	10
Understand	20	20	10	30
Apply	20	20	20	40
Analyze	0	0	10	20
Evaluate	0	0	0	0
Create	0	0	0	0

20IT404	WEB TECHNOLOGY	L	T	P	C
		3	0	2	4
Nature of Course	Professional Core				
Pre requisites	NIL				

Course Objectives

The course is intended to

1. Be familiar with client-server communication and protocols.
2. Design interactive web pages using Scripting languages.
3. Learn server side programming using Servlets.
4. Develop web pages using JSP.
5. Acquire knowledge on web services and their interactions.

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1.	Recognize best technologies for solving web client/server problems	Understand
CO2.	Apply Cascading Style Sheet to design a HTML Webpage and Develop a HTML form and validate it using Java Script	Apply
CO3.	Integrate java and server side scripting languages to develop web applications.	Analyze
CO4.	Deploy real time web applications in web servers and in the cloud	Apply
CO5.	Demonstrate the use of XML in the web service platform	Apply

Course Contents

UNIT I WEB SITE BASICS AND HTML 9

Web Essentials: Clients, Servers, and Communication. WWW - HTTP request and response message. Markup Languages: XHTML. Introduction to HTML - Basic XHTML Syntax and Semantics-Fundamental HTML Elements – Lists – tables – Frames – Forms - HTML 5.0.

UNIT II CSS AND CLIENT SIDE SCRIPTING 9

CSS – Features - Syntax - Cascading and Inheritance - Text Properties - Box Model - Flow - Other style Properties. JavaScript introduction - Basic Elements – Variable - Data Types - Operators and Literals-Functions – Objects – Arrays - Built-in - Object.

UNIT III SERVER SIDE SCRIPTING 9

Server-Side Programming: Java Servlets - Architecture -Overview- Servlet - Generating Dynamic Content - Life Cycle - Parameter Data – Sessions – Cookies, Node.Js - Introduction, JSON.

UNIT IV JSP 9

JSP Overview - Basic JSP: Architecture – Lifecycle – Directives – Actions - Implicit Objects - JavaBeans Classes and JSP - MVO Paradigm - Databases and JSP,.

UNIT V XML and WEB SERVICES 9

Xml: Namespaces - XML Processing - XML Documents - X-Path - X-Link, X-Query, XSL — XSLT, Web services: WSDL- XML Schema — Introduction to SOAP, UDDI.

Total: 45 Periods

Laboratory Components

S.No	List of Experiments	CO Mapping	RBT
1	Create a web page using HTML and with all types of Cascading style sheets.	2	Apply
2	Client Side Scripts for Validating Web Form Controls using DHTML	2	Analyze
3	Write programs in Java using Servlets: a. To invoke servlets from HTML forms b. Session Tracking	3	Analyze
4	Write programs in Java to create three-tier applications using JSP and Databases a. for conducting on-line examination. b. for displaying student mark list. Assume that student information is available in a database which has been stored in a database server.	4	Analyze
5	Consider a case where we have two web Services- an airline service and a travel agent and the travel agent is searching for an airline. Implement this scenario using Web Services and Data base.	5	Apply

Total: 30 Periods

Text Books

1. Jeffrey C. Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education, 2007.

Reference Books

1. Robert. W. Sebesta, "Programming the World Wide Web", Fourth Edition, Pearson Education, 2015 .
2. Deitel, Deitel, Goldberg, "Internet & World Wide Web How To Program", 8th Edition, Pearson Education, 2020
3. Marty Hall and Larry Brown, ”Core Web Programming” Second Edition, Volume I and II, Pearson Education, 2001.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	POs												PSOs		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	3	1	1						1	2	2	3	
CO2	3	2	3	1	1						2	2	2	3	
CO3	3	2	3	1	2						2	2	2	3	
CO4	3	2	3	2	2						2	2	2	3	
CO5	3	2	3	2	2						2	2	2	3	
	3	High				2	Medium					1	Low		

Summative Assessment						
Bloom's Level	**Continuous Assessment**					**Final Examination (Theory) (50)**
	Theory				**Practical's**	
	IAE – I (7.5)	**IAE – II (7.5)**	**IAE – III (10)**	**Attendance (5)**	**Rubric based CIA (20)**	
Remember	10	10	10			10
Understand	20	20	10			50
Apply	20	10	30		30	30
Analyze		10			20	10
Evaluate						
Create						

20IT405	WIRELESS SENSOR NETWORKS AND ARCHITECTURE	L	T	P	C
		3	0	2	3
Nature of Course	Professional Core				
Pre requisites	Computer Networks and Computer Architecture				

Course Objectives

The course is intended to

1. Understand the basic WSN technology with emphasis placed on standardization basic sensor systems.
2. be familiar on sensor node architecture energy consumption and design principles
3. Acquire knowledge on the medium access control protocols and address physical layer issues
4. Learn sensor tasking related to the databases.
5. Recognize the Sensor management in operating systems.

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1.	Comprehend the fundamental concepts of wireless sensor networks	Understand
CO2.	Identify Wireless sensor network platforms: Hardware and Software.	Understand
CO3.	Interpret the knowledge of routing protocols developed for WSN	Apply
CO4.	Evaluate the performance of sensor networks and identify bottlenecks.	Evaluate
CO5.	Discriminate Sensor data acquisition, processing and handling with mobile data-centric networking principles	Analyze

Course Contents

UNIT I INTRODUCTION TO WSN 9

WSN architecture - Commercial and Scientific Applications of WSN, Category of Applications in WSN, Challenges for WSN, Enabling Technologies for WSN

UNIT II SINGLE NODE ARCHITECTURE 9

Hardware Components, Energy Consumption of Sensor nodes, Operating Systems and Execution Environments, Examples of Sensor Nodes, Network Architecture: WSN Scenarios, Optimization Goals and figures of Merits, Design principles for WSNs, Service Interfaces for WSNs, Gateway Concepts.

UNIT III WIRELESS TRANSMISSION 9

Wireless Communication Fundamentals, Physical Layer & Transceiver, WSN Design Considerations, MAC Protocols: Fundamentals, MAC Protocols for WSNs, IEEE802.15.4 MAC, Routing Protocols: Gossip and agent based unicast protocols, Energy Efficient Unicast, Broadcast and Multicast, Geographic Routing, Transport Control Protocols: Traditional Protocols, Design Issues, Performance.

UNIT IV SENSOR TASKING AND CONTROL 9

Information-Based Sensor Tasking, Joint Routing Information Aggregation, Sensor Network Databases: Challenges, Query Interfaces, In-Network Aggregation, Data Centric Storage, Data Indices and Range queries, Distributed Hierarchical Aggregation, Temporal Data.

UNIT V OPERATING SYSTEMS FOR SENSOR NETWORKS 9

Introduction, Design Issues, Examples, Node Level Simulators, Performance and Traffic Management Issues: WSN Design Issues, Performance Modeling of WSN, Emerging Applications and Future Research Directions.

Total: 45 Periods

Laboratory Components

S.No	List of Experiments	CO Mapping	RBT
1	Spread Spectrum – DSSS Modulation & Demodulation.	2	Apply
2	Network Simulator installation of wireless sensor network.	3	Analyze
3	Applications and its simulation.	2	Analyze
4	Write TCL script for transmission between mobile nodes.	3	Analyze
5	Implementation of routing protocol in NS2 for AODV protocol.	3	Apply

Text Books

1. Kazem Sohraby,Daniel Minoli,Taieb Znati, "Wireless Sensor Networks: Technology, Protocols, and Applications", John wiley & Sons. 2010
2. Holger Karl, Andreas Willig, "Protocols and architectures for wireless sensor networks", John wiley & Sons. 2005.

Reference Books

1. Feng Zhao, Leonidas Guibas, "Wireless Sensor Networks; An Information Processing Approach", Elsevier. 2005
2. C. S. Raghavendra, Krishna M. Shivalingam, Taieb Znati, "Wireless sensor networks", Springer Verlag. 2006
3. H. Edgar, Jr. Callaway, "Wireless Sensor networks, Architectures and Protocols", CRC Press. 2003

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1										3	1	
CO2	3	2	2	1									3	1	
CO3	3	2	1	1	1							1	3	1	
CO4	3	3	2	1	1						1	1	3	1	
CO5	3	3	2	2	1						1	1	3	1	
	3	High				2	Medium					1	Low		

Summative Assessment						
Bloom's Level	**Continuous Assessment**					**Final Examination (Theory) (50)**
	Theory				**Practical's**	
	IAE – I (7.5)	**IAE – II (7.5)**	**IAE – III (10)**	**Attendance (5)**	**Rubric based CIA (20)**	
Remember	10	10	10			10
Understand	40	10	10			40
Apply		20	20		30	30
Analyze		10	10		20	10
Evaluate						10
Create						

20IT406	DATA COMMUNICATION AND COMPUTER NETWORKS LABORATORY (Common to IT,CSE and AI&DS)	L	T	P	C
		0	0	4	2
Nature of Course	Practical				
Pre requisites	Basic Network Concepts				

Course Objectives

The course is intended to

1. Learn and use network commands.
2. Develop the error correction codes.
3. Implement and analyze various network protocols.
4. Implement the TCP UDP
5. Use simulation tools to analyze the performance of application layer protocol.

Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	Practicing various network commands.	Apply
CO2	Implement error correction codes.	Apply
CO3	Use simulation tools to analyze the performance of various network protocols.	Analyze
CO4	Compare the performance of different transport layer protocols.	Apply
CO5	Analyze Application Layer Protocols	Analyze

Laboratory Components

S.No	List of Exercises	CO Mapping	RBT
1	Learn to use commands like tcpdump, netstat, ifconfig, nslookup and traceroute. Capture ping and traceroute PDUs using a network protocol analyzer and examine.	CO1	Apply
2	Write a code for error correction and detection (like CRC).	CO2	Apply
3	Implement Flow control mechanisms in Data link control	CO2	Apply
4	Write a code simulating ARP /RARP protocols.	CO2	Analyze
5	Study of Network simulator (NS) and Simulation of Congestion Control Algorithms using NS.	CO3	Apply
6	Simulation of Distance Vector/ Link State Routing algorithm.	CO3	Analyze
7	Write a HTTP web client program to download a web page using TCP sockets.	CO4	Apply
8	Applications using TCP sockets like: a)Echo client and echo server b) Chat c) File Transfer	CO4	Analyze
9	Study of TCP/UDP performance using Simulation tool.	CO4	Apply
10	Simulation of DNS using UDP sockets.	CO5	Apply

60 Periods

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)															
COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	2	3	3	2									2	3	
2	2	3	3	2									2	3	
3	2	3	3	2									2	3	
4	2	3	3	2									2	3	
5	2	3	3	3									2	3	
	3	High				2	Medium					1	Low		

Summative assessment based on Continuous and End Semester Examination		
Bloom's Level	**Rubric based Continuous Assessment [50 marks]**	**End Semester Examination [50 marks]**
Remember		
Understand	10	20
Apply	20	40
Analyze	20	40
Evaluate		
Create		

20MC401	SOFT SKILL (Common to All Branches of B.E., / B.Tech.)	L	T	P	C
		2	0	0	0
Nature of Course	Mandatory Course				
Pre requisites	Nil				

Course Objectives

The course is intended to

1. Improve language skills in personal and professional life.
2. Equip students with the vital communication and soft skills to succeed in the highly competitive international arena.
3. Focus on the fundamental soft skills and of their practical social and work place usage.
4. Learn to identify and overcome the barriers in interpersonal relationships.
5. Enhance employability skills and ensure career success.

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1	Relate the significance and fundamental nature of soft skills.	Remember
CO2	Take part in a wide range of Public speaking and professional group discussions.	Understand
CO3	Plan one's time effectively and productively, especially at work.	Apply
CO4	Make use of leadership skills to manage stress &conflict.	Apply
CO5	Organize presentation effectively and participate in interview with confidence.	Apply

Course Contents

UNIT I INTRODUCTION TO SOFT SKILLS AND INTERPERSONAL COMMUNICATION 6

An Introduction – Definition and Significance of Soft Skills; Interpersonal communication-types of interpersonal communication.

UNIT II PUBLIC SPEAKING AND ORAL COMMUNICATION SKILLS 6

Public Speaking: Skills, Methods, Strategies Group Discussion: Importance, Planning, Elements.

UNIT III TIME MANAGEMENT AND PERSONALITY DEVELOPMENT 6

Time Management – concepts and essentials tips. Personality-development – meaning, SWOT analysis & goal setting- Stress and conflict management.

UNIT IV LEADERSHIP SKILLS AND EMOTIONAL INTELLIGENCE 6

Leadership skills: Concept of Leadership and honing Leadership Skills- Problem-Solving Skills - Group and Ethical Decision-Making. Emotional Intelligence: Strategies to enhance Emotional Intelligence.

UNIT V INTERVIEW SKILLS 6

Interviewer - Interviewee perspectives - Self Introduction and Presentation: Types, Content and Essential Tips–before, during and after a presentation, Overcoming Nervousness - Mock Interview.

Total : 30 Periods

Text Books

1. Managing Soft Skills for Personality Development–edited by B.N.Ghosh, McGraw Hill India, 2018.
2. English and Soft Skills–S.P. Dhanavel, Orient Black swan India, 2017

Reference Books:

1. Soft Skill Business and Professional Communication Book by Sutapa Banerjee,2016
2. Communication Skills Book by PushpLata and Sanjay Kumar,2015

WEB REFERENCE:

https://nptel.ac.in/courses/109/107/109107121/

Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1								1	2	3		2			
CO2								1	2	3		2			
CO3								1	2	3		2			
CO4								1	2	3		2			
CO5								1	2	3		2			
	3	High				2	Medium				1	Low			

Bloom's Level	Summative Assessment (Internal Mode)	
	Assessment 1 (50 Marks)	Assessment 2 (50 Marks)
Remember	10	10
Understand	10	10
Apply	30	30
Analyze		
Evaluate		
Create		

SEMESTER V

20IT501	MOBILE APPLICATION DEVELOPMENT	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Web Technology				

Course Objectives

The course is intended to

1. Facilitate to understand android SDK
2. Gain a basic understanding of Android application development
3. Acquire knowledge on Android user interface design
4. Inculcate working knowledge of Android Studio development tool
5. Understand database management in Android applications

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1.	Identify various concepts of mobile programming that make it unique from programming for other platforms.	Understand
CO2.	Critique mobile applications on their design pros and cons	Apply
CO3.	Utilize rapid prototyping techniques to design and develop sophisticated mobile interfaces	Apply
CO4.	Program mobile applications for the Android operating system that use basic and advanced phone features	Analyze
CO5.	Deploy applications to the Android marketplace for distribution	Analyze

Course Contents

UNIT I Introduction to Android 9

Android Platform, Android SDK, Eclipse Installation, Android Installation, Building First Android application, Understanding Anatomy of Android Application, AndroidManifest file.

UNIT II Android Application Design 9

Android Application Design Essentials: Anatomy of an Android applications, Android terminologies, Application Context, Activities, Services, Intents, Receiving and Broadcasting Intents, AndroidManifest File and its common settings, Using Intent Filter, Permissions.

UNIT III Android User Interface Design 9

Android User Interface Design Essentials: User Interface Screen elements, Designing User Interfaces with Layouts, Drawing and Working with Animation.

UNIT IV Testing and Publishing Android applications 9

Testing Android applications, Publishing Android application, Using Android preferences, Managing Application resources in a hierarchy, working with different types of resources.

UNIT V Android APIs 9

Using Common Android APIs: Using Android Data and Storage APIs, Managing data using SQLite, Sharing Data between Applications with Content Providers, Using Android Networking APIs, Using Android Web APIs, Using Android Telephony APIs, Deploying Android Application to the World.

Total: 45 Periods

TEXT BOOKS:

1. Lauren Darcey and Shane Conder, "Android Wireless Application Development", Pearson Education, 2nd ed. (2011)

REFERENCES BOOKS:

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

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes(PSOs)															
COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	1	1									3	1	
CO2	3	2	2	1	2						2	2	3	1	
CO3	3	2	1	1									3	1	
CO4	3	3	2	1	2	1		1			1	2	3	1	
CO5	3	3	2	2	2	1		1			3	2	3	1	
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Apply	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE-I (7.5)	**IAE-II (7.5)**	**IAE-III (10)**	
Remember	10	10	10	10
Understand	20	20	10	30
Apply	20	20	20	40
Analyze	0	0	10	20
Evaluate	0	0	0	0
Create	0	0	0	0

20IT502	DATA ANALYTICS	L	T	P	C
		3	0	0	3
Nature of Course	Professional Core				
Pre requisites	Database Management systems				

Course Objectives

The course is intended to

1. Understand the Big Data Platform and its Use cases
2. Explore the HDFS Concepts and Interfacing with HDFS
3. Perform Map Reduce Jobs
4. Be responsible for hands on Hadoop Eco System
5. Discover data analytics with R

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1.	Identify Big Data and its Business Implications	Understand
CO2.	Access and Process Data on Hadoop Distributed File System	Understand
CO3.	Manage Job Execution in Hadoop Environment	Apply
CO4.	Develop Big Data Solutions using Hadoop Eco system	Analyze
CO5.	Analyze the data with R	Analyze

Course Contents

UNIT I INTRODUCTION TO BIG DATA AND HADOOP 9

Types of Digital Data, Introduction to Big Data, Big Data Analytics, History of Hadoop, Apache Hadoop, Analyzing Data with Unix tools, Analyzing Data with Hadoop, Hadoop Streaming, Hadoop Echo System, IBM Big Data Strategy, Introduction to Infosphere BigInsights and Big Sheets.

UNIT II HDFS (Hadoop Distributed File System) 9

The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Data flow, DataIngest with Flume and Scoop and Hadoop archives, Hadoop I/O: Compression, Serialization, Avro and File-Based Data structures.

UNIT III MAP REDUCE 9

Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features.

Unit IV HADOOP ECO SYSTEM 9

Pig : Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators. Hive : Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, Querying Data and User Defined Functions. Hbase : HBasics, Concepts, Clients, Example, Hbase Versus RDBMS. Big SQL : Introduction

UNIT V DATA ANALYTICS WITH R 9

Machine Learning : Introduction, Supervised Learning, Unsupervised Learning, Collaborative Filtering. Big Data Analytics with BigR.

Total: 45 Periods

TEXT BOOKS:

1. Tom White " Hadoop: The Definitive Guide" Third Edition on, O'reily Media, 2012.
2. Seema Acharya, Subhasini Chellappan, "Big Data Analytics" Wiley 2015.

REFERENCES BOOKS:

1. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.
2. Jay Liebowitz, "Big Data and Business Analytics" Auerbach Publications, CRC press (2013)
3. Tom Plunkett, Mark Hornick, "Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R,Enterprise and Oracle R Connector for Hadoop", McGraw-Hill/Osborne Media (2013), Oracle press.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes(PSOs)

COs	POs												PSOs		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	1	1									3	1	
CO2	3	2	2	1	2								3	1	
CO3	3	2	1	1									3	1	
CO4	3	3	2	1	2								3	1	
CO5	3	3	2	2	2								3	1	
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Apply	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE-I (7.5)	**IAE-II (7.5)**	**IAE-III (10)**	
Remember	10	10	10	10
Understand	20	20	10	30
Apply	20	20	20	40
Analyze	0	0	10	20
Evaluate	0	0	0	0
Create	0	0	0	0

20IT503	MACHINE LEARNING TECHNIQUES	L	T	P	C
		3	0	0	3
Nature of Course	Professional core				
Pre requisites	Introduction to Artificial Intelligence				

Course Objectives

The course is intended to

1. Discover the basic concepts and techniques of machine learning.
2. Have a thorough understanding of the Supervised and Unsupervised learning techniques
3. Be familiar with various probability based learning techniques
4. Acquire knowledge on dimensionality reduction and Evolutionary models.
5. Understand graphical models of machine learning algorithms

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1.	Distinguish between, supervised, unsupervised and semi-supervised learning	Understand
CO2.	Apply the appropriate machine learning strategy for any given problem	Apply
CO3.	Suggest the appropriate machine learning approach for the various types of problem	Apply
CO4.	Identify various dimensionality reduction and Evolutionary models	Understand
CO5.	Design systems that uses the appropriate graph models of machine learning	Apply

Course Contents

UNIT I INTRODUCTION 9

Learning – Types of Machine Learning – Supervised Learning – The Brain and the Neuron – Design a Learning System – Perspectives and Issues in Machine Learning – Concept Learning Task – Concept Learning as Search – Finding a Maximally Specific Hypothesis – Version Spaces and the Candidate Elimination Algorithm – Linear Discriminants – Perceptron – Linear Separability – Linear Regression.

UNIT II LINEAR MODELS 9

Multi-layer Perceptron – Going Forwards – Going Backwards: Back Propagation Error – Multilayer 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 Neighbor 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

Total: 45 Periods

Text books:

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 Professional, First Edition, Wiley, 2014.

Reference Books:

1. Peter Flach, —Machine Learning: The Art and Science of Algorithms that Make Sense of Datall, First Edition, Cambridge University Press, 2012.
2. Stephen Marsland, —Machine Learning – An Algorithmic Perspectivell, Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.
3. Tom M Mitchell, —Machine Learningll, First Edition, McGraw Hill Education, 2013.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1										3	1	
CO2	3	2	1										3	1	
CO3	3	2	2										3	1	
CO4	3	2	2										3	1	
CO5	3	2	2										3	1	
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Apply	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE-I (7.5)	**IAE-II (7.5)**	**IAE-III (10)**	
Remember	10	10	10	10
Understand	20	20	20	50
Apply	20	20	20	40
Evaluate	0	0	0	0
Create	0	0	0	0

20IT504	INTERNET OF THINGS	L	T	P	C
		3	0	2	4
Nature of Course	Professional Elective				
Pre requisites	Wireless sensor networks				

Course Objectives

The course is intended to

1. Understand Smart Objects and IoT Architectures
2. Learn about various IOT-related protocols
3. Build simple IoT Systems using Arduino and Raspberry Pi.
4. Understand data analytics and cloud in the context of IoT
5. Make a case study on IoT infrastructure for popular applications

Course Outcomes

On successful completion of the course, students will be able to

CO.No	Course Outcome	Bloom's Level
CO1.	Describe basic principles and concepts of Internet-of-Things use cases, applications.	Understand
CO2.	Understand Networking and communication for IoT.	Understand
CO3.	Build simple IoT Systems using Arduino and Raspberry Pi.	Apply
CO4.	Comprehend IoT data processing and storage.	Understand
CO5.	Develop IoT infrastructure for industrial applications.	Analyze

Course Contents

UNIT I FUNDAMENTALS OF IoT 9

Evolution of Internet of Things – Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT models -Fog, Edge and Cloud in IoT – Functional blocks of an IoT ecosystem

UNIT II IoT PROTOCOLS 9

Network Layer: IP versions, Constrained Nodes and Constrained Networks – Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks – Application Transport Methods: Supervisory Control and Data Acquisition – Application Layer Protocols: CoAP and MQTT

UNIT III DESIGN AND DEVELOPMENT 9

Design Methodology – Embedded computing logic – Microcontroller, System on Chips – IoT system building blocks – Arduino – Board details, IDE programming – Raspberry Pi – Interfaces and Raspberry Pi with Python Programming.

UNIT IV DATA ANALYTICS AND SUPPORTING SERVICES 9

Structured Vs Unstructured Data and Data in Motion Vs Data in Rest – Role of Machine Learning – No SQL Databases – Hadoop Ecosystem – Apache Kafka, Apache Spark – Edge Streaming Analytics and Network Analytics – Xively Cloud for IoT, Python Web Application Framework.

UNITV CASE STUDIES/INDUSTRIAL APPLICATIONS 9

Cisco IoT system – IBM Watson IoT platform – Manufacturing – Converged Plant wide Ethernet Model (CPwE) – Power Utility Industry – Grid Blocks Reference Model – Smart and Connected Cities: Layered architecture, Smart Lighting, Smart Parking Architecture and Smart Traffic Control

Total: 45 Periods

LABORATORY COMPONENTS

S.No	List of Experiments	CO Mapping	RBT
1	Model a system to control the railway gate using stepper motors**.**	2	Apply
2	Measure the power and energy consumption in a home using Arduino	3	Analyze
3	To interface Bluetooth with Arduino/Raspberry pi and write a program to turn LED ON/OFF when '1'/'0' is received from smart phone using Bluetooth	3	Apply
4	Write a program on Arduino/Raspberry pi to upload temperature and humidity data to thingspeak cloud	4	Analyze
5	Design a system to control the traffic signals through IOT	5	Apply

TEXT BOOKS:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, —IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Cisco Press, 2017

REFERENCE BOOKS :

1. Arshdeep Bahga, Vijay Madisetti, —Internet of Things – A hands-on approach, Universities Press, 2015
2. Olivier Hersent, David Boswarthick, Omar Elloumi , —The Internet of Things – Key applications and Protocols, Wiley, 2012 .
3. Michael Margolis, Arduino Cookbook, Recipes to Begin, Expand, and Enhance Your Projects, 2nd Edition, O'Reilly Media, 2011.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes(PSOs)

COs	POs												PSOs		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2											3	1	
CO2	3	2	2										3	1	
CO3	3	2	1										3	1	
CO4	3	3	2								1	2	3	1	
CO5	3	3	2					1			1	1	3	1	
	3	High				2	Medium					1	Low		

Summative Assessment						
Bloom's Level	Continuous Assessment					Final Examination (Theory) [50]
	Theory				Practicals	
	IAE-I [7.5]	IAE-II [7.5]	IAE-III [10]	Attendance [5]	Rubric based CIA[20]	
Remember	10	10	10			10
Understand	20	20	20		10	20
Apply	20	20	20		20	50
Analyze					20	20
Evaluate						
Create						

20IT505	MOBILE APPLICATION DEVELOPMENT LABORATORY	L	T	P	C
		0	0	4	2
Nature of Course	Professional core				
Pre requisites	Computer Networks				

Course Objectives

The course is intended to

1. Realize the components and structure of mobile application development frameworks for Android and windows OS based mobiles.
2. Perform to work with various mobile application development frameworks.
3. Acquire the basic and important design concepts and issues of development of mobile applications.
4. Recognize the capabilities and limitations of mobile devices.
5. Develop own mobile application.

Course Outcomes

On successful completion of the course students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1.	Develop mobile applications using GUI and Layouts	Apply
CO2.	Design mobile applications using Event Listener.	Apply
CO3.	Implement mobile applications using Databases.	Apply
CO4.	Develop mobile applications using RSS Feed, Internal/External Storage, SMS, Multithreading and GPS.	Analyze
CO5.	Analyze and discover own mobile app for simple needs	Analyze

Course Contents

LABORATORY COMPONENTS

1. Develop an application that uses GUI components, Font and Colours.
2. Develop an application that uses Layout Managers and event listeners.
3. Write an application that draws basic graphical primitives on the screen.
4. Develop an application that makes use of databases.
5. Develop an application that makes use of Notification Manager
6. Implement an application that uses Multi-threading
7. Develop a native application that uses GPS location information
8. Implement an application that writes data to the SD card.
9. Implement an application that creates an alert upon receiving a message
10. Write a mobile application that makes use of RSS feed
11. Develop a mobile application to send an email.
12. Develop a Mobile application for simple needs (Mini Project)

Total: 60 Periods

Reference Books:

1. Reto Meier, "Professional Android 2 Application Development", Wiley India Pvt Ltd
2. Mark L Murphy, "Beginning Android", Wiley India Pvt Ltd

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

Standalone desktops with Windows or Android or iOS or Equivalent Mobile Application Development Tools with appropriate emulators and debuggers - 30 Nos.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes(PSOs)															
COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	1	1									3	1	
CO2	3	2	2	1									3	1	
CO3	3	2	1	1									3	1	
CO4	3	3	2	1									3	1	
CO5	3	3	2	2									3	1	
	3	High				2	Medium					1	Low		

Summative assessment based on Continuous and End Semester Examination		
Bloom's Level	**Rubric based Continuous Assessment [50 marks]**	**End Semester Examination [50 marks]**
Remember		
Understand	10	20
Apply	20	50
Analyze	20	30
Evaluate		
Create		

20IT506	MACHINE LEARNING LABORATORY	L	T	P	C
		0	0	4	2
Nature of Course	Professional Elective				
Pre requisites	Artificial Intelligence				

Course Objectives

The course is intended to

1. Make use of Data sets in implementing the machine learning algorithms
2. Implement the machine learning concepts and algorithms in any suitable language of choice.
3. Propose appropriate data sets to the Machine Learning algorithms
4. Identify the appropriate algorithms for real world problems.
5. Demonstrate Machine learning with readily available data.

Course Outcomes

On successful completion of the course students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1.	Implement the procedures for the machine learning algorithms.	Apply
CO2.	Design Java/Python programs for various Learning algorithms.	Apply
CO3.	Classify appropriate data sets to the Machine Learning algorithms.	Apply
CO4.	Apply Machine Learning algorithms to solve real world problems.	Apply
CO5.	Perform experiments in Machine Learning using real-world data.	Analyze

Course Contents

LABORATORY COMPONENTS:

1. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
3. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
4. Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.
5. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
6. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
7. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.
8. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.
9. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
10. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.

Total: 60 Periods

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes(PSOs)															
COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	1	1									3	1	
CO2	3	2	2	1	2						2	2	3	1	
CO3	3	2	1	1									3	1	
CO4	3	3	2	1	2	1		1			1	2	3	1	
CO5	3	3	2	2	2	1		1			3	2	3	1	
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Apply	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative assessment based on Continuous and End Semester Examination		
Bloom's Level	**Rubric based Continuous Assessment [50 marks]**	**End Semester Examination [50 marks]**
Remember		
Understand	10	20
Apply	20	50
Analyze	20	30
Evaluate		
Create		

SEMESTER VI

20IT601	COMPUTER GRAPHICS AND MULTIMEDIA	L	T	P	C
		3	0	0	3
Nature of Course	Professional Core				
Pre requisites	Basics of C				

Course Objectives

The course is intended to

1. Get familiar with line drawing, circle drawing and ellipse drawing algorithms.
2. Acquire knowledge about two dimensional transformations.
3. Explore the concepts of three dimensional transformations and clipping algorithms.
4. Understand the various multimedia software, hardware and authoring tools.
5. Exposed with various multimedia networks, operating system and database.

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1.	Implement line, circle and ellipse drawing algorithms.	Understand
CO2.	Illustrate the two dimensional transformation and viewing functions	Apply
CO3.	Categorize the principles of two dimensional and three dimensional concepts	Analyze
CO4.	Appraise various multimedia software, hardware and authoring tools.	Evaluate
CO5.	Determine the concepts of multimedia networks, operating system and database.	Understand

Course Contents

Unit I INTRODUCTION 9

Output primitives — points and lines- line drawing algorithms-loading the frame buffer-line function-circle and ellipse generating algorithms- Pixel addressing and object geometry,-filled area primitives.

Unit II TWO DIMENSIONAL GRAPHICS 9

Two dimensional geometric transformations — Matrix representations and homogeneous coordinates-composite transformations-Two dimensional viewing — viewing pipeline, viewing coordinate reference frame- window-to-viewport coordinate transformation- Two dimensional viewing functions- clipping operations — point, line, and polygon clipping algorithms.

Unit III THREE DIMENSIONAL GRAPHICS 9

Three dimensional concepts- Three dimensional object representations — Polygon surfaces- Polygon tables- Plane equations — Polygon meshes- Curved Lines and surfaces- Quadratic surfaces- Blobby objects Transformation and Viewing: Three dimensional geometric and modeling transformations — Translation, Rotation, Scaling, composite transformations- Three dimensional viewing — viewing pipeline-Projections.

Unit IV MULTIMEDIA AUTHORING 9

Hypertext and Hypermedia-Document Architecture MHEG-Basic tools- Image editing tool-Painting and drawing tools-Sound editing programs-Video formats-Linking multimedia objects-OLE and DDE-office suite-Presentation tools-authoring tools-User Interface Design

Unit V MULTIMEDIA OS, DATABASE AND INFORMATION RETRIEVAL 9

Multimedia OS-Process Management-File Systems-Multimedia DBMS-Data Structures for indexing techniques-Information Retrieval-Multimedia Search Engine

Total: 45 Periods

TEXT BOOKS:

1. Donald Hearn and Pauline Baker M, —Computer Graphics", Prentice Hall, New Delhi, 2007
2. Andleigh, P. K and Kiran Thakrar, —Multimedia Systems and Designǁ, PHI, 2003.

REFERENCE BOOKS:

1. Tay Vaughan, Multimedia: Making it work, Seventh Edition, Tata McGraw Hill Publishing Company Ltd, Eight Edition, 2011
2. Foley, Vandam, Feiner and Hughes, —Computer Graphics: Principles and Practice, 2nd Edition, Pearson Education, 2003.
3. Ralf Steinmetz and KlaraNahrstedt, Multimedia: Computing, Communication and Application, Pearson Educational Asia, 1995

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
COs	**Pos**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	1	1	1									3	3	
CO2	3	1	1	1									3	3	
CO3	3	1	1	1									3	2	
CO4	3	2	1	2									3	2	
CO5	3	2	1	1									3	2	
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Apply	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE-I (7.5)	**IAE-II (7.5)**	**IAE-III (10)**	
Understand	10	10	10	20
Apply	20	20	20	50
Analyze	20	20	20	20
Evaluate	0	0	0	10
Create	0	0	0	0

20IT602	CRYPTOGRAPHY AND NETWORK SECURITY	L	T	P	C
		3	0	2	4
Nature of Course	Professional Core				
Pre requisites	Computer Networks				

Course Objectives

The course is intended to

1. Apprehend cryptography, algorithms and theorems.
2. Get familiar with symmetric key cryptography concepts..
3. Explore the concepts of public key cryptography and RSA algorithms.
4. Recognize the various message authentication mechanisms and key management.
5. Realize the techniques to build protection mechanisms and to secure computer networks.

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1.	Infer the concepts of cryptography and classical encryption techniques.	Understand
CO2.	Conclude the mathematics behind symmetric key cryptography..	Apply
CO3.	Categorize the various public key cryptosystem.	Analyze
CO4.	Appraise various message authentication mechanisms and key management.	Evaluate
CO5.	Comprehend the concepts of network security.	Understand

Course Contents

Unit I INTRODUCTION 9

Goals of security — Types of attacks-services and mechanisms- Classical Encryption Techniques-Substitution Ciphers-Transposition Ciphers-Stream and Block Ciphers-Steganography.

Unit II SYMMETRIC KEY CRYPTOGRAPHY 9

Mathematics involved -Euclid's Algorithm Integer Arithmetic- Modular Arithmetic-Rings-Fields DES Structure and Analysis-Multiple DES-Strength of DES-AES –Transformations-Key Expansion

Unit III ASYMETRIC KEY CRYPTOGRAPHY 9

Primes-Primality Testing-Factorization-Euler's totient function-Fermat's Theorem-Chinese Remainder Theorem-RSA cryptosystem- ELGAMAL cryptosystem –Elliptic Curve Cryptosystem – Diffie Hellman Key Exchange.

Unit IV MESSAGE AUTHENTICATION AND INTEGRITY 9

Message Authentication-Message Integrity-MAC-Hash Functions-SHA-Digital Signature-Challenge Response Protocols-Kerberos-X.509-Key Management

Unit V NETWORK SECURITY AND SYSTEM SECURITY 9

At Application layer-Email, PGP, S/MIME-IP Security-Web Security-intruders-Malicious Software- Viruses-Fire walls.

Total: 45 Periods

LABORATORY COMPONENTS:

S.No	List of Exercises	CO Mapping	RBT
1	Write a program to perform encryption and decryption using the following algorithms a) Substitution Ciphers b) Transposition Ciphers	CO1	Apply
2	Write a program to implement the DES algorithm logic.	CO2	Analyze
3	Write a program to implement RSA algorithm.	CO3	Analyze
4	Implement the Diffie-Hellman Key Exchange algorithm for a given problem	CO3	Apply
5	Calculate the message digest of a text using the SHA-1 algorithm	CO4	Apply
6	Demonstrate intrusion detection system (ids) using any tool eg. Snort or any other s/w	CO5	Analyze

TEXT BOOKS

1. William Stallings, Cryptography and Network Security: Principles and Practice, PHI 3rd Edition, 2017.

REFERENCE BOOKS

1. C K Shyamala, N Harini and Dr. T R Padmanabhan: Cryptography and Network Security, Wiley India, 2011.
2. BehrouzA.Foruzan, Cryptography and Network Security, Tata McGraw Hill 2007.
3. Charlie Kaufman, Radia Perlman, and Mike Speciner, Network Security: PRIVATE Communication in a PUBLIC World, Prentice Hall, 2002.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1	1	1	3								3	3	
CO2	3	1	1	1	3								3	3	
CO3	3	1	1	1	3								3	2	
CO4	3	2	1	2	3								3	2	
CO5	3	2	1	1	3								3	2	
	3	High				2	Medium					1	Low		

Summative Assessment						
Bloom's Level	Continuous Assessment					Final Examination (Theory) [50]
	Theory				Practicals	
	IAE-I [7.5]	IAE-II [7.5]	IAE-III [10]	Attendance [5]	Rubric based CIA[20]	
Remember	10	10	10			10
Understand	20	20	20		10	20
Apply	20	20	20		20	50
Analyze					20	20
Evaluate						
Create						

20IT603	OBJECT ORIENTED ANALYSIS AND DESIGN	L	T	P	C
		3	0	2	4
Nature of Course	Professional core				
Pre requisites	OOPS Concept				

Course Objectives

The course is intended to

1. Impart the knowledge on the fundamentals of object modeling
2. Differentiate Unified Process from other approaches
3. Design with static UML diagrams
4. Improve the software design with design patterns
5. Test the software against its requirements specification

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1.	Express software design with UML diagrams	Understand
CO2.	Design software applications using OO concepts	Understand
CO3.	Identify various scenarios based on software requirements	Apply
CO4.	Transform UML based software design into pattern based design using design patterns	Analyze
CO5.	Understand the various testing methodologies for OO software	Analyze

Course Contents

UNIT I UNIFIED PROCESS AND USE CASE DIAGRAMS 9

Introduction to OOAD with OO Basics - Unified Process – UML diagrams – Use Case –Case study – the Next Gen POS system, Inception -Use case Modelling – Relating Use cases – include, extend and generalization – When to use Use-cases

UNIT II STATIC UML DIAGRAMS 9

Class Diagram–– Elaboration – Domain Model – Finding conceptual classes and description classes – Associations – Attributes – Domain model refinement – Finding conceptual class Hierarchies – Aggregation and Composition - Relationship between sequence diagrams and use cases – When to use Class Diagrams.

UNIT III IMPLEMENTATION UML DIAGRAMS 9

Dynamic Diagrams – UML interaction diagrams - System sequence diagram – Collaboration diagram – When to use Communication Diagrams - State machine diagram and Modelling –When to use State Diagrams - Activity diagram – When to use activity diagrams. Implementation Diagrams - UML package diagram - When to use package diagrams -Component and Deployment Diagrams – When to use Component and Deployment diagrams

UNIT IV DESIGN PATTERNS 9

GRASP: Designing objects with responsibilities – Creator – Information expert – Low Coupling – High Cohesion – Controller. Design Patterns – creational – factory method – structural – Bridge – Adapter – behavioral –Strategy – observer –Applying GoF design patterns – Mapping design to code

UNIT V TESTING 9

Object Oriented Methodologies – Software Quality Assurance – Impact of object orientation on Testing – Develop Test Cases and Test Plans

Total: 45 Periods

Laboratory Components

S.No	List of experiments	CO Mapping	RBT
1.	Document the Software Requirements Specification (SRS) for the identified system.	CO1	Apply
2.	Identify use cases and develop the Use Case model.	CO2	Apply
3.	Identify the conceptual classes and develop a Domain Model and also derive a Class Diagram from that.	CO3	Apply
4.	Using the identified scenarios, find the interaction between objects and represent them using UML Sequence and Collaboration Diagrams	CO4	Apply
5.	Draw relevant State Chart and Activity Diagrams for the same system.	CO5	Analyze

Total: 30 Periods

SUGGESTED DOMAINS FOR MINI-PROJECT:

1. Passport automation system.
2. Book bank
3. Exam registration
4. Online course reservation system
5. Airline/Railway reservation system
6. Software personnel management system
7. Credit card processing
8. e-book management system
9. Library management system
10. Student information system

TEXT BOOKS:

1. Craig Larman, —Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Developmentll, Third Edition, Pearson Education, 2005
2. Ali Bahrami - Object Oriented Systems Development - McGraw Hill International Edition - 1999

REFERENCE BOOKS:

1. Erich Gamma, a n d Richard Helm, Ralph Johnson, John Vlissides, —Design patterns: Elements of Reusable Object-Oriented Softwarell, Addison-Wesley, 1995.
2. Martin Fowler, —UML Distilled: A Brief Guide to the Standard Object Modeling Languagell, Third edition, Addison Wesley, 2003.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes(PSOs)

COs	POs												PSOs		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	1	1									3	1	
CO2	3	2	2	1	2						2	2	3	1	
CO3	3	2	1	1									3	1	
CO4	3	3	2	1	2	1		1			1	2	3	1	
CO5	3	3	2	2	2	1		1			3	2	3	1	
	3	High				2	Medium					1	Low		

Summative Assessment						
Bloom's Level	**Continuous Assessment**					Final Examination (Theory) [50]
	Theory				Practicals	
	IAE-I [7.5]	IAE-II [7.5]	IAE-III [10]	Attendance [5]	Rubric based CIA[20]	
Remember	10	10	10			10
Understand	20	20	20		10	20
Apply	20	20	20		20	50
Analyze					20	20
Evaluate						
Create						

20IT604	OPEN SOURCE LAB	L	T	P	C
		0	0	4	2
Nature of Course	Professional Core				
Pre requisites	Operating Systems				

Course Objectives

The course is intended to

1. Expose free open source software environment
2. Familiarize the use of open source packages.
3. Create simple GUI applications
4. Import knowledge on Version control systems
5. Perform kernel configuration and virtual environment

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1.	Implement various applications using build systems	Apply
CO2.	Perform installation of various packages in open source operating systems	Apply
CO3.	Create simple GUI applications using Gambas 3	Create
CO4.	Recognize various version control systems	Analyze
CO5.	Implement the kernel configuration and virtual environment	Analyze

Course Contents

1. Kernel configuration, compilation and installation : Download / access the latest kernel source code from kernel.org, compile the kernel and install it in the local system. Try to view the source code of the kernel
2. Virtualization environment (e.g., xen,kqemu or lguest) to test an applications, new kernels and isolate applications. It could also be used to expose students to other alternate OSs like *BSD
3. Compiling from source: learn about the various build systems used like the auto* family, cmake, ant etc. instead of just running the commands. This could involve the full process like fetching from a cvs and also include autoconf, automake etc.,
4. Introduction to packet management system: Given a set of RPM or DEB, how to build and maintain, serve packages over http or ftp. and also how do you configure client systems to access the package repository.
5. Installing various software packages Either the package is yet to be installed or an older version is existing. The student can practice installing the latest version. Of course, this might need internet access.
   Install samba and share files to windows
   Install Common Unix Printing System (CUPS)
6. Write user space drivers using fuse — easier to debug and less dangerous to the system (Writing full-fledged drivers is difficult at student level)
7. GUI programming: a sample programme – using Gambas since the students have VB knowledge. However, one should try using GTK or QT
8. Version Control System setup and usage using RCS, CVS, SVN
9. Text processing with Perl: simple programs, connecting with database e.g., MYSQL
10. Running PHP : simple applications like login forms after setting up a LAMP stack
11. Running Python : some simple exercise – e.g. Connecting with MySql database
12. Set up the complete network interface usinfifconfig command liek setting gateway, DNS, IPtables.

Total: 60Periods

Resources :

An environment like FOSS Lab Server (developed by NRCFOSS containing the various packages)OR Equivalent system with Linux distro supplemented with relevant packages

Note:

Once the list of experiments are finalized, NRCFOSS can generate full lab manuals, complete with exercises, necessary downloads, etc. These could be made available on NRCFOSS web portal.

Hardware:

Minimum Requirements:
– 700 Mhz X86 Processor
– 384 MB of system memory (RAM)
– 40 GB of disk space
– Graphics card capable of 1024*768 resolution
– Sound Card
– Network or Internet Connection

Software:

Latest distribution of Linux

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes(PSOs)															
COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	1	1									3	1	
CO2	3	2	2	1							2	2	3	1	
CO3	3	2	1	1									3	1	
CO4	3	3	2	1				1			1	2	3	1	
CO5	3	3	2	2				1			3	2	3	1	
	3	High				2	Medium					1	Low		

Summative assessment based on Continuous and End Semester Examination		
Bloom's Level	**Rubric based Continuous Assessment [50 marks]**	**End Semester Examination [50 marks]**
Remember		
Understand	10	20
Apply	20	50
Analyze	20	30
Evaluate		
Create		

20IT605	MINI PROJECT	L	T	P	C
		0	0	2	1
Nature of Course	Professional Core				
Pre requisites	Basic Programming Languages				

Course Objectives

The course is intended to

1. Develop their own innovative prototype of ideas.
2. Train the students in preparing mini project reports and examination.

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
1.	Take up their final year project work.	Apply
2.	Find solution by formulating proper methodology.	Evaluate

Course Contents

1. The students in a group of 5 to 6 works on a topic approved by the head of the department and prepares a comprehensive mini project report after completing the work to the satisfaction.
2. The progress of the project is evaluated based on a minimum of two reviews. The review committee may be constituted by the Head of the Department.
3. A mini project report is required at the end of the semester.
4. The mini project work is evaluated based on oral presentation and the mini project report jointly by external and internal examiners constituted by the Head of the Department.

TOTAL: 30 Periods

SEMESTER V

20ITE01	SOFT COMPUTING TECHNIQUES	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Introduction to Artificial Intelligence				

Course Objectives

The course is intended to

1. Describe soft computing techniques and their roles in building intelligent machines.
2. Be familiarize with different classes of neural network architectures
3. Discuss the ideas of fuzzy sets, fuzzy logic and use of heuristics.
4. Understand the genetic algorithm concepts and their applications
5. Acquire knowledge on hybrid control schemes.

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1.	Describe soft computing techniques and their roles in building intelligent machines	Understand
CO2.	Explore the different classes of neural network architectures.	Understand
CO3.	Apply fuzzy logic and reasoning to handle uncertainty and solve various engineering problems.	Apply
CO4.	Apply genetic algorithms to combinatorial optimization problems	Apply
CO5.	Use various tools to solve soft computing problems	Apply

Course Contents

UNIT I Introduction to soft computing and Artificial neural networks 9

Introduction, Comparison with hard computing, Concept of learning and adaptation, Constituents of soft computing, Applications. Artificial Neural Networks: concepts, Biological neuron, Basic building blocks of an artificial neuron, architectures, Activation functions. Learning methods - Supervised, Unsupervised, Reinforcement, Hebbian, Gradient descent, Competitive, Stochastic.

UNIT II Classes of Neural Networks 9

Back-propagation network, Radial basis function network, Hopfield networks, Kohonen self-organizing feature maps, Adaptive resonance Theory (ART1 and ART2), Bi-direction associative memory (BAM).

UNIT III Fuzzy Logic 9

Fuzzy set theory – Fuzzy sets – Operation on fuzzy sets – Scalar cardinality, fuzzy cardinality, union and intersection, complement (Yager and Sugeno), equilibrium points, aggregation, projection, composition, cylindrical extension, fuzzy relation – Fuzzy membership functions. Fuzzy logic controller – Fuzzification – Knowledge base – Decision making logic – Defuzzification – Adaptive fuzzy systems

UNIT IV Genetic Algorithms 9

History of Genetic Algorithm, Basic concepts, Creation of offspring, working principles, encoding, fitness function, reproduction, Genetic modeling: Inheritance operator, crossover, inversion & deletion, mutation operator, Bitwise operator, Generational Cycle, Convergence of GA, Applications & advances, Differences & similarities between GA & other traditional method

UNIT V Hybrid control schemes 9

Fuzzification and rule base using ANN – Neuro fuzzy systems – ANFIS – Fuzzy neuron– GA – Optimization of membership function and rule base using Genetic Algorithm – Introduction to other evolutionary optimization techniques, support vector machine. Tabu Search, Ant colony based optimization, Swarm Intelligence

Total: 45 Periods

TEXT BOOKS

1. Laurence Fausett, "Fundamentals of Neural Networks", Prentice Hall, Englewood Cliffs, N.J., 2008
2. S.N. Sivanandam & S.N. Deepa, Principles of Soft Computing, Wiley Publications,3rd Edition, 2018.
3. S, Rajasekaran & G.A. Vijayalakshmi Pai, Neural Networks, Fuzzy Logic & Genetic Algorithms, Synthesis & applications, PHI Publication, 1st Edition, 2013.

REFERENCE BOOKS

1. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", McGraw Hill Inc., 2000.
2. Goldberg, "Genetic Algorithm in Search, Optimization and Machine learning", Addison Wesley Publishing Company Inc. 1989
3. Millon W.T., Sutton R.S. and Webrose P.J., "Neural Networks for Control", MIT press, 1992

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1										3	1	
CO2	3	2	1										3	1	
CO3	3	2	2										3	1	
CO4	3	2	2										3	1	
CO5	3	2	2										3	1	
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Apply	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE-I (7.5)	**IAE-II (7.5)**	**IAE-III (10)**	
Remember	10	10	10	10
Understand	20	20	20	40
Apply	20	20	20	50
Evaluate	0	0	0	0
Create	0	0	0	0

20ITE02	NATURAL LANGUAGE PROCESSING	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Soft computing				

Course Objectives

The course is intended to

1. Introduce the fundamental concepts and techniques of Natural language Processing
2. Understand analyzing words based on Morphology and CORPUS.
3. Examine the NLP models and interpret algorithms for classification of NLP sentences
4. Get acquainted with the algorithmic description of the main language levels
5. Analyze pragmatics of information retrieval and machine translation applications

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1.	Understand the principles and Process the Human Languages	Understand
CO2.	Build CORPUS linguistics based on digestive approach	Apply
CO3.	Choose a suitable language modeling technique based on the structure of the language.	Apply
CO4.	Check the syntactic and semantic correctness of sentences using grammars and labeling.	Analyze
CO5.	Develop Computational Methods for Real World Applications and explore deep learning based NLP	Analyze

Course Contents

UNIT I INTRODUCTION TO NLP 9

Introduction to various levels of natural language processing - Ambiguities and computational challenges in processing various natural languages. Introduction to Real life applications of NLP such as spell and grammar checkers - information extraction - question answering and machine translation.

UNIT II TEXT PROCESSING & MORPHOLOGY 9

Character Encoding - Word Segmentation - Sentence Segmentation - Introduction to Corpora - Corpora Analysis - Inflectional and Derivation Morphology - Morphological Analysis and Generation using finite state transducers.

UNIT III LEXICAL SYNTAX & LANGUAGE MODELING 9

Introduction to word types - POS Tagging - Maximum Entropy Models for POS tagging - Multiword Expressions - The role of language models - Simple N-gram models - Estimating parameters and smoothing - Evaluating language models.

UNIT IV SYNTAX & SEMANTICS 9

Introduction to phrases, clauses and sentence structure - Shallow Parsing and Chunking - Shallow Parsing with Conditional Random Fields (CRF) - Lexical Semantics - Word Sense Disambiguation - WordNet - Thematic Roles - Semantic Role Labeling with CRFs.

UNIT V APPLICATIONS OF NLP 9

NL Interfaces, Text Summarization, Sentiment Analysis, Machine Translation - Recent Trends in NLP

Total: 45 Periods

TEXTBOOKS

1. Daniel Jurafsky and James H. Martin “Speech and Language Processing”, 3rd edition, Prentice Hall, 2009.
2. James Allen “Natural Language Understanding”, Pearson Publication 8th Edition. 2012

REFERENCE BOOKS

1. NitinIndurkhya, Fred J. Damerau “Handbook of Natural Language Processing”, Second Edition, CRC Press, 2010.
2. Chris Manning and HinrichSchütze, “Foundations of Statistical Natural Language Processing”, 2nd edition, MITPress Cambridge, MA, 2003.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes(PSOs)															
COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	1	1									3	1	
CO2	3	2	2	1	2						2	2	3	1	
CO3	3	2	1	1									3	1	
CO4	3	3	2	1	2	1		1			1	2	3	1	
CO5	3	3	2	2	2	1		1			3	2	3	1	
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom’s Level	**Assessment Component**	**Marks**	**Total marks**
Apply	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom’s Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE-I (7.5)	**IAE-II (7.5)**	**IAE-III (10)**	
Remember	10	10	10	10
Understand	20	20	10	30
Apply	20	20	20	40
Analyze	0	0	10	20
Evaluate				
Create				

20ITE03	SOCIAL INTELLIGENCE	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Artificial intelligence				

Course Objectives

The course is intended to

1. Understand your environment and having a positive influence
2. Create positive connections and increase their influence during social situations
3. Improve social skills through active listening
4. Be confident in their social situations by learning how to express and interpret social cues
5. Use emotions intelligently for gaining managerial effectiveness

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1.	Recognize the environment and having a positive influence	Understand
CO2.	Create positive connections and increase their influence during social situations	Apply
CO3.	Develop social skills through active listening	Apply
CO4.	Realize the social situations by learning how to express and interpret social cues	Analyze
CO5.	Use emotions intelligently for gaining managerial effectiveness	Apply

Course Contents

UNIT I WIRED TO CONNECT **9**

Module The Emotional Economy , A Recipe for Rapport, Neural WiFi, An Instict for Altrusim, What is social Intelligence

UNIT II BROKEN BONDA AND NURTURING NATURE **9**

Introduction the dark Traid, Mindblind, You and It, Genes are not Destiny, A Secure Base, The Set Point for Happiness

UNIT III HEALTHY CONNECTIONS AND SOCIAL CONSEQUENCE **9**

The Biology of Compassion, Stress is Social, Biological Allies, A Prople Prescription, The Sweet Spot for Achievement, The Connectedness Corrective

UNIT IV INTELLIGENCE AND INTERACTION **9**

Primary Process, Then interactive negotiation of meaning in conversation, Genres as tools that shape interaction, Expression of a social bias in intelligence

UNIT V INTERPERSONAL COMMUNICATION **9**

Increase Your Self-Awareness, The Keys to Empathy, Active Listening, Insight on Behavior, Social Cues, Conversation Skills

Total : 45 Periods

TEXT BOOKS

1. Daniel Goleman, Social intelligence : the new science of human relationships, Bantam Dell A Division of Random House, Inc. New York, 2006
2. Esther N. Goody, Social intelligence and interaction, Cambridge University Press 1995

REFERENCE BOOKS

1. Real-Time Computer Control, by Stuart Bennet, 2nd Edn. Pearson Education. 2008.
2. https://www.gprc.ab.ca/files/coned_course_attachments/dsi01_001

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes(PSOs)															
COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	1	1									3	1	
CO2	3	2	2	1	2						2	2	3	1	
CO3	3	2	1	1									3	1	
CO4	3	3	2	1	2	1		1			1	2	3	1	
CO5	3	3	2	2	2	1		1			3	2	3	1	
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Apply	Class room or Online Quiz	5	15
Understand	Class Presentation/Powerpoint presentation	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE-I (7.5)	**IAE-II (7.5)**	**IAE-III (10)**	
Remember	10	10	10	10
Understand	20	20	10	30
Apply	20	20	20	40
Analyze	0	0	10	20
Evaluate	0	0	0	0
Create	0	0	0	0

SEMESTER VI

20ITE04	BUSINESS INTELLIGENCE	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Data Mining				

Course Objectives

The course is intended to

1. Acquire knowledge on BI involving predictive and statistical approach
2. Practice how methodologies are applied to visualize information from raw data
3. Be familiar with BI concepts and techniques
4. Understand how to apply BI Techniques for various situations
5. Implement BI techniques by using various tools and Create data visualization.

Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1.	Interpret the business intelligence concepts involving predictive and statistical approach.	Understand
CO2.	Illustrate how methodologies are applied to visualize information from raw data.	Apply
CO3.	Apply BI Techniques for various situations.	Apply
CO4.	Analyze BI concepts and techniques	Analyze
CO5.	Implement BI techniques by using various tools	Apply

Course Contents

UNIT I INTRODUCTION TO BI **9**

BI concept, BI architecture, BI in today's perspective, BI Process, Applications of BI like Financial analysis, statistical analysis, sales analysis, CRM, result pattern and ranking analysis, Balanced Scorecard, BI in Decision Modeling: Optimization, Decision making under uncertainty. Ethics and business intelligence

UNIT II DATA VISUALIZATION AND DASHBOARD DESIGN **9**

Responsibilities of BI analysts by focusing on creating data visualizations and dashboards. Importance of data visualization, types of basic and composite charts

UNIT III PERFORMANCE DASHBOARD **9**

Measuring, Monitoring and management of Business, KPIs and dashboard, the types of dashboards, the common characteristics of Enterprise dashboard, design of enterprise dashboards, and the common pitfalls of dashboard design.

UNIT IV MODELING AND ANALYSIS **9**

Exploring Excel Modeling capabilities to solve business problems summarize and present selected data, introduction to business metrics and KPIs, creating cubes using Microsoft Excel

UNIT V FUTURE OF BUSINESS INTELLIGENCE **9**

Emerging Technologies, Machine Learning, Predicting the Future with the help of Data Analysis, BI Search & Text Analytics – Advanced Visualization – Rich Report, Future beyond Technology.

Total: 45 Period

TEXT BOOKS

1. Efraim Turban, Ramesh Sharda, Dursun Delen, "Decision Support and Business Intelligence Systems", 9th Edition, Pearson 201
2. David Loshin Morgan, Kaufman, "Business Intelligence: The Savvy Manager"s Guide", Second Edition, 2012

REFERENCE BOOKS

1. Larissa T. Moss, S. Atre, "Business Intelligence Roadmap: The Complete Project Lifecycle of Decision Making", Addison Wesley, 2003
2. Carlo Vercellis, "Business Intelligence: Data Mining and Optimization for Decision Making", Wiley Publications, 2009.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	1	1									3	1	
CO2	3	2	2	1	2						2	2	3	1	
CO3	3	2	1	1									3	1	
CO4	3	3	2	1	2	1		1			1	2	3	1	
CO5	3	3	2	2	2	1		1			3	2	3	1	
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Apply	Class room or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE-I (7.5)	**IAE-II (7.5)**	**IAE-III (10)**	
Remember	10	10	10	10
Understand	20	20	10	30
Apply	20	20	20	40
Analyze	0	0	10	20
Evaluate	0	0	0	0
Create	0	0	0	0

20ITE05	SOCIAL NETWORK ANALYSIS	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Computer Networks				

Course Objectives

The course is intended to

1. Discover the concept of semantic web and related applications.
2. Acquire knowledge representation using ontology.
3. Understand mining communities in social networks
4. Be familiar with human behaviour in social web
5. learn visualization of social networks

Course Outcome

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1.	Describe the semantic web related applications	Understand
CO2.	Represent knowledge using ontology	Understand
CO3.	Analyze the applications and mining extractions	Analyze
CO4.	Predict human behaviour in social web and related communities	Analyze
CO5.	Envisage social networks	Analyze

Course Contents

UNITI INTRODUCTION 9

Introduction to Semantic Web: Limitations of current Web - Development of Semantic 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.

UNITII MODELLING, AGGREGATING AND KNOWLEDGE REPRESENTATION 9

Ontology and their role in the Semantic Web-Ontology languages for the Semantic Web-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.

UNITIII EXRACTION 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.

UNITIV PREDICTING HUMAN BEHAVIOUR AND PRIVACY ISSUES 9

Understanding and predicting human behavior 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 network analysis - Trust transitivity analysis - Combining trust and reputation - Trust derivation based on trust comparisons.

UNITV 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.

Total: 45 Periods

TEXT BOOKS

1. Peter Mika, —Social Networks and the Semantic Web, First Edition, Springer 2007.
2. Borko Furht, —Handbook of Social Network Technologies and Applications, 1st Edition, Springer, 2010.

REFERENCE BOOKS

1. Guandong Xu ,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.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes(PSOs)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1	1									3	1	
CO2	3	2	2	1	2						2	2	3	1	
CO3	3	2	1	1									3	1	
CO4	3	3	2	1	2	1		1			1	2	3	1	
CO5	3	3	2	2	2	1		1			3	2	3	1	
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Apply	Class room or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE-I (7.5)	**IAE-II (7.5)**	**IAE-III (10)**	
Remember	10	10	10	10
Understand	20	20	10	30
Apply	20	20	20	40
Analyze	0	0	10	20
Evaluate				
Create				

20ITE06	COMPUTATIONAL NEUROSCIENCE	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	NIL				

Course Objectives

The course is intended to

1. Impart knowledge of Neural Encoding
2. Gain knowledge of Neural Decoding
3. Learn the Transient Conductance.
4. Develop a clear understanding about Conductance and Morphology.
5. Explore the knowledge on network model.

Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1.	Understand the concepts of Neural Encoding	Understand
CO2.	Understand the concepts of Neural Decoding	Understand
CO3.	Identify the uses of neuro electronics	Understand
CO4.	Summarize about conductances and Morphology	Understand
CO5.	Determine the properties of various network models.	Understand

Course Contents:

Unit I NEURAL ENCODING 9

Introduction - Properties of Neurons-Recording Neuronal Responses. Spikes Trains and Firing Rates - Measuring Firing Rates -Turning curves-Spike count variability. White Noise Stimuli. The Neural Code - Temporal Code.

Unit II NEURAL DECODING 9

Introduction - Discrimination-ROC Curves-ROC Analysis of Motion Discrimination-The Likelihood Ratio Test. Population decoding –Encoding and decoding direction-Fisher information –Train Decoding.

Unit III NEURONS AND NEURAL CIRCUITS 9

Neuro electronics-Introduction - Electrical Properties of Neurons. Single compartment models. Voltage Dependent conductance's-persistent conductance-Transient conductances.The Hodgkin - Huxley Model. Regular and Irregular firing modes.

Unit IV CONDUCTANCES AND MORPHOLOGY 9

Conductance Based Model - The Connor Stevens Model-Morphoelectronic Transform-Multicompartment Models

Unit V NETWORK MODELS 9

Firing Rate Models-Feed Forward Networks- Excitatory-Inhibitory Networks – Olfactory, Bulb - Stochastic Networks.

Total: 45 periods

Text Books:

1. Dayan, Peter, and L. F. Abbott. *Theoretical Neuroscience: Computational and Mathematical Modeling of Neural Systems*. Cambridge, MA: MIT Press, 2001. ISBN: 9780262041997.

Reference Books:

1. Eric Kandel, James Thomas Schwartz, Jessel, Principles of Neural Science,4 th ed. McGraw-Hill, New York.
2. 2. Computational neuroscience: a comprehensive approach, Edited by J. Feng, Chapman & Hall/CRC, 2004.
3. 3. Randall C. O'Reilly, Yuko Munakata, Computational explorations in cognitive neuroscience: understanding the mind, MIT Press, 2000.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1	1									3	1	
CO2	3	2	2	1	2						2	2	3	1	
CO3	3	2	1	1									3	1	
CO4	3	3	2	1	2	1		1			1	2	3	1	
CO5	3	3	2	2	2	1		1			3	2	3	1	
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Apply	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE-I (7.5)	**IAE-II (7.5)**	**IAE-III (10)**	
Remember	10	10	10	10
Understand	20	20	10	30
Apply	20	20	20	40
Analyze	0	0	10	20
Evaluate	0	0	0	0
Create	0	0	0	0

SEMESTER VII

20ITE07	DEEP LEARNING TECHNIQUES	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Artificial Intelligence				

Course Objectives

The course is intended to

1. Learn the Applications in Deep Learning.
2. Get knowledge on various deep learning algorithms.
3. Acquire the knowledge about solving problems with CNN.
4. Learn about unsupervised representational learning
5. Have knowledge about Implementing deep learning models in Image related projects.

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1.	Determine the role of deep learning in machine learning applications	Understand
CO2.	Compare Various deep learning Algorithms	Evaluate
CO3.	Apply various concepts related with Deep Learning to solve Problems	Apply
CO4.	Examine unsupervised representational learning	Analyze
CO5.	Analyze different deep learning models in Image related projects	Analyze

Course Contents

UNIT I INTRODUCTION TO DEEP LEARNING 9

Introduction to deep learning and biological motivation, Applications of deep learning , suitable problems for deep learning, Neurons, Neural Network, Activation Function

UNIT II NEURAL NETWORK 9

Single layer neural network, Stochastic Gradient Descent, Gradient Descent Extensions, Gradient Descent Regularization, Multilayer Perceptron, Back propagation, Chain Rule, Deep Learning Model

UNIT III CONVOLUTIONAL NEURAL NETWORK 9

Introduction with Background and Application, properties of CNN Motivation for Convolutional Layer, CNN Architecture, Training for Deep CNN, Padding and Stride, Computer vision tasks

UNIT IV UNSUPERVISED REPRESENTATIONAL LEARNING 9

Introduction with Motivation and Application, Auto encoder, Neural Language Processing, Word embeddings, Generative models, Generative Adversarial Networks

UNITV RNN, LSTM and GRU 9

RNN, LSTM, GRU- Image Segmentation, Image classification, Object Detection, Automatic Image Captioning, Image generation with Generative Adversarial Networks, LSTM as a classifier Model, Attention Models for Computer Vision

Total: 45 Periods

Text Books

1. Deep learning - Heaton, J. Ian goodfellow, yoshua bengio, and aaron courville, The MIT Press, First Edition
2. Deep learning with Python- Chollet, Francois, New York: Manning Publications, First Edition.

Reference Books

1. Matlab Deep Learning: With Machine Learning, Neural Networks and Artificial Intelligence - Phil Kim, APress, Third Edition.
2. Deep Learning with Applications Using Python, Navin Kumar Manaswi, Apress, First Edition.
3. R Deep Learning Essentials, Joshua F. Wiley, ackt Publications, First Edition.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes(PSOs)															
COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	1	1									3	1	
CO2	3	2	2	1	2						2	2	3	1	
CO3	3	2	1	1									3	1	
CO4	3	3	2	1	2	1		1			1	2	3	1	
CO5	3	3	2	2	2	1		1			3	2	3	1	
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom'sLevel	**Assessment Component**	**Marks**	**Total marks**
Apply	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE-I (7.5)	**IAE-II (7.5)**	**IAE-III (10)**	
Remember	10	10	10	10
Understand	20	20	10	30
Apply	20	20	20	40
Analyze	0	0	10	20
Evaluate	0	0	0	0
Create	0	0	0	0

20ITE08	COGNITIVE SCIENCE	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	NIL				

Course Objectives

The course is intended to

1. To study the basic concepts and approaches in the field of cognitive science
2. To apply the concepts of planning, reasoning and learning models in cognitive applications
3. To analyze language and semantic models of cognitive process.

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1.	Understand the basic concept of cognitive science	Understand
CO2.	Understand the learning model and apply the same to appropriate real world applications	Understand
CO3.	Apply reasoning methodology to real world applications	Apply
CO4.	Apply declarative and logic models	Analyze
CO5.	Acquire knowledge in language processing and understanding	Analyze

Course Contents

UNIT I INTRODUCTION TO COGNITIVE SCIENCE 9

Introduction to the study of cognitive sciences. Neural Network Models- language: definition Affordances Categories and concepts; Concept learning: Linguistic knowledge: Syntax, semantics, (and pragmatics) Direct perception, Logic; Machine learning.

UNIT II CONCEPT HIERARCHIES 9

A brief history of cognitive science. Processing of sensory information in the brain, Linguistic knowledge: Syntax, semantics, Ecological Psychology, Constructing memories Methodological concerns in philosophy, Discretization and generating concept hierarchies, Data Mining System, Generative linguistic, Affordance learning in robotics, Explicit vs. implicit memory

UNIT III ANATOMY OF BRAIN 9

Artificial intelligence and psychology, Brain Imaging, Brain and language, Affordance learning in robotics, Information processing (three-boxes) model of memory Structure and constituents of the brain fMRI, MEG, Language disorders, Development Information processing (three-boxes) model of memory.

UNIT IV MEMORY MODELS 9

Brief history of neuroscience, PET, EEG Lateralization Child and robotic development Sensory memory; Short term memory Mathematical models, Multisensory integration in cortex, Lateralization, Attention and related concepts, long term memory; Rationality

UNITV SENSORY INFORMATION FUSION 9

Mathematical models Information fusion, the great past tense debate, Human visual attention, Bounded rationality; Prospect theory; Heuristics and biases Looking at brain signals

Total: 45 Periods

Text Book

1. Pradeep Kumar Mallick, Samarjeet Borah," Emerging Trends and Applications in Cognitive Computing", 2019, IGI Global Publishers.

Reference Books

1. Jose Luis Bermudez, "Cognitive Science: An Introduction to the Science of the Mind", 2020 Cambridge University Press, New York.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes(PSOs)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1	1									3	1	
CO2	3	2	2	1	2						2	2	3	1	
CO3	3	2	1	1									3	1	
CO4	3	3	2	1	2	1		1			1	2	3	1	
CO5	3	3	2	2	2	1		1			3	2	3	1	
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Apply	Classroom or Online Quiz	5	15
Understand	Class Presentation/Powerpoint presentation	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE-I (7.5)	**IAE-II (7.5)**	**IAE-III (10)**	
Remember	10	10	10	10
Understand	20	20	10	30
Apply	20	20	20	40
Analyze	0	0	10	20
Evaluate	0	0	0	0
Create	0	0	0	0

SEMESTER VIII

20ITE09	CYBERNETICS AND BRAIN SIMULATION	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	NIL				

Course Objectives

The course is intended to

1. Discover the fundamentals of BCI
2. Understand the approaches of BCI
3. Expose the various EEG Feature Extraction Methods
4. Implement the design of EEG Feature Translation Methods
5. Employ the various case studies of BCI

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1.	Represent fundamentals of BCI	Understand
CO2.	Summarize the approaches of BCI	Understand
CO3.	Identify the various EEG Feature Extraction Methods	Apply
CO4.	Explore the design of EEG Feature Translation Methods	Analyze
CO5.	Administer the various case studies of BCI	Apply

Course Contents

UNIT I Introduction To BCI 8

Concept of BCI – Invasive and Non-invasive Types – EEG Standards – Signal Features – Spectral Components – EEG Data Acquisition – Pre-processing – Hardware and Software – Artifacts – Methods to Remove – Near Infrared BCI.

UNIT II BCI Approaches 7

Mu Rhythm – Movement Related EEG Potentials – Mental States – Visual Evoked Potential Based – P300 component.

UNIT III EEG Feature Extraction Methods 10

Time/Space Methods – Fourier Transform – Wavelets – AR models – Band pass filtering PCA – Laplacian Filters – Linear and Non-linear Features.

UNIT IV EEG Feature Translation Methods 10

LDA – Regression – Memory Based – Vector Quantization – Gaussian Mixture Modeling – Hidden Markov Modeling.

UNIT V CASE STUDY 10

Case Study of Problems in BCI Competition III(2005) – Dataset I, II, III, IV and V Solutions. Case Study of Brain Actuated Control of Khepera Mobile Robot.

Total:45 Periods

TEXT BOOK

1. Bishop C.M, “Neural Networks for Pattern Recognition”, Oxford, Clarendon Press, 1995.

REFERENCE BOOKS

1. Wolpaw J.R, N.Birbaumer et al, “Brain control interface for Communication and control”, Clinical Neurophysiology, 113, 2002.
2. S.Coyle, T.Ward et al, “On the suitability of near infra red systems for next generation Brain Computer interfaces”, Physiological Measurement, 25, 2004.
3. Carlo Tomasi, “Estimating Gaussian Mixture Densities with EM – A Tutorial”, Duke University, 2000.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes(PSOs)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1	1									3	1	
CO2	3	2	2	1	2						2	2	3	1	
CO3	3	2	1	1									3	1	
CO4	3	3	2	1	2	1		1			1	2	3	1	
CO5	3	3	2	2	2	1		1			3	2	3	1	
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom’s Level	**Assessment Component**	**Marks**	**Total marks**
Apply	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom’s Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE-I (7.5)	**IAE-II (7.5)**	**IAE-III (10)**	
Remember	10	10	10	10
Understand	20	20	10	30
Apply	20	20	20	40
Analyze	0	0	10	20
Evaluate	0	0	0	0
Create	0	0	0	0

20ITE10	COMPUTER VISION	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Artificial Intelligence				

Course Objectives

The course is intended to

1. Impart knowledge of Image Formation
2. Gain knowledge of Neural Decoding.
3. Learn about Linear filters
4. Develop a clear understanding about Local image features.
5. Explore the knowledge on Texture.

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1.	Understand the concepts of Image Formation	Understand
CO2.	Illustrate the concepts Neural Decoding	Understand
CO3.	Develop the concepts of Linear filters	Apply
CO4.	Summarize clearly about Local image features	Understand
CO5.	Understand about Texture.	Understand

Course Contents:

Unit-I IMAGEFORMATION 9

Geometric Camera models – pinhole perspective camera with Lenses- The Human Eye. Light and Shading-Photometric stereo: Shape from Multiple shaded images. Shape from one shaded image.

Unit - II NEURAL DECODING 9

Human Color perception- Color Matching-Color Receptors. The Physics of Color-The Color of Light Sources-The Color of surfaces. Representing Color-Non-Linear Color spaces. A Model of Image Color-the Diffuse Term-Shadow Removal using Color.

Unit - III LINEAR FILTERS 9

Linear filters and convolutions- shift Invariant Linear Systems-Discrete Convolution-Continous Convolution – Edge Effects in Discrete Convolutions. Sampling and Aliasing – Filters As Templates – The Gaussian pyramid – Applications of Scaled Representation

Unit – IV LOCAL IMAGE FEATURES 9

Representing the Image Gradient – Gradient based Edge Detectors – Orientations – Finding Corners. Describing Neighborhoods with Sift and HOG Features – Computing local features in practice.

Unit - V TEXTURE 9

Local Texture representation using filters – Pooled Texture representation by discovering Textons – Vector Quantization and Textons – K-means clustering for vector Quantization synthesizing Textures and filling holes in images- Synthesis by sampling Local Models – Filling holes in images. Image Denoising-Block matching 3D (BM3D) – Learned sparse coding.

Total: 45 Periods

Text Books:

1. Computer Vision: Algorithms and Applications by Richard Szeliski..
2. Computer Vision: A Modern Approach (Second Edition) by David Forsyth and Jean Ponce..

Reference Books:

1. Elements of Statistical Learning by Trevor Hastie, Robert Tibshirani, and Jerome Friedman.
2. Multiple View Geometry in Computer Vision (Second Edition) by Richard Hartley and Andrew Zisserman.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes(PSOs)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1	1									3	1	
CO2	3	2	2	1	2						2	2	3	1	
CO3	3	2	1	1									3	1	
CO4	3	3	2	1	2	1		1			1	2	3	1	
CO5	3	3	2	2	2	1		1			3	2	3	1	
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Apply	Classroom or Online Quiz	5	15
Understand	Class Presentation/Powerpoint presentation	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE-I (7.5)	**IAE-II (7.5)**	**IAE-III (10)**	
Remember	10	10	10	10
Understand	20	20	10	30
Apply	20	20	20	40
Analyze	0	0	10	20
Evaluate	0	0	0	0
Create	0	0	0	0

SEMESTER V

20ITE21	INFORMATION SECURITY	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Computer Networks				

Course Objectives

The course is intended to

1. Understand the fundamentals of networks, architecture, Threats and Vulnerabilities
2. Get familiar with various Authentication schemes to simulate different applications using APIs
3. Explore different Protocols and standards for various layers and wireless networks.
4. Understand the various types of Intrusions by detection and prevention mechanisms.
5. Infer how to implement different firewalls for different kind of networks.

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1.	Distinguish between threats and attacks.	Understand
CO2.	Enumerate the differences between Key distribution and agreement schemes in Authentication.	Analyze
CO3.	Enlist the steps involved in Intrusion detection process of Worm	Analyze
CO4.	Appraise the scenario for Packet Inspection Firewall.	Apply
CO5.	Realize how Bluetooth provides security in Wireless media.	Understand

Course Contents

Unit I INTRODUCTION 9

OSI Security Architecture- Security Threats-Vulnerabilities-Authentication elements, types, methods-Federated Identity Management-RFID-E Passport.

Unit II PROTOCOLS AND STANDARDS 9

Network Layer: IPSec — – Architecture, Authentication Header, Encapsulating Security Payload, Security Policy- Virtual private Networks – Tunneling Technologies, Security Considerations. Transport Layer: SSL and TLS - Protocols, HTTPS, SSH. Application Layer: Email Security –PGP, S/MIME, DKIM. Electronic Payments

Unit III INTRUSION DETECTION AND PREVENTION 9

Intrusion Detection: Host, Network, and Hybrid based systems, SIV, LFM, Honeypots, Intrusion Prevention: Host and Network based systems. Denial of Service, DDoS – Prevention, Detection, IP Trace back, Malicious Software, Malware Detection – Worm Detection, Worm Signature extraction, Virus Detection. Case Study: Intrusion Detection Tools..

Unit IV FIREWALLS 9

Characteristics, Types – Packet Inspection, VPN, SOHO, NAT Firewalls, Basing, DMZ, Forensics, Services and Limitations

Unit V WIRELESS SECURITY 9

Network infrastructure, Wi-Fi, Standards: IEEE 802.11, Bluetooth, GSM Security, Security in UMTS.

Total: 45 Periods

TEXT BOOKS

1. Joseph Migga Kizza, “Computer Network Security”, Springer, 2005.
2. Douglas R. Stinson, “Cryptography Theory and Practice”, Third Edition, Chapman & Hall/CRC, 2006
3. Network Security and Cryptography, Menezes Bernard, Cengage Learning, New Delhi, 2011

REFERENCE BOOKS

1. Behrouz A.Forouzan, “Cryptography and Network Security”, Tata McGarw Hill, 2007.
2. William Stallings, “Network Security Essentials Applications and Standards”, Pearson Education, Fourth Edition, 2011
3. William Stallings, Lawrie Brown, “Computer Security: Principles and Practice”, First Edition, 2008.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	1	1	1									3	3	
CO2	3	1	1	1									3	3	
CO3	3	1	1	1									3	2	
CO4	3	2	1	2									3	2	
CO5	3	2	1	1									3	2	
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom’s Level	**Assessment Component**	**Marks**	**Total marks**
Apply	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom’s Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE-I (7.5)	**IAE-II (7.5)**	**IAE-III (10)**	
Understand	10	10	10	20
Apply	20	20	20	50
Analyze	20	20	20	20
Evaluate	0	0	0	10
Create	0	0	0	0

20ITE22	CYBER FORENSICS	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Network security				

Course Objectives

The course is intended to

1. Discover the basic concepts and techniques of cyber forensics.
2. Have a thorough understanding of digital evidences
3. Determine what data to collect and analyze
4. Become familiar with forensics tools
5. Discover working with operating systems.

Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1.	Recognize the different roles computer plays in a certain crime.	Understand
CO2.	Provide digital evidences which are obtained from digital media.	Apply
CO3.	Analyze and validate the forensic data.	Analyze
CO4.	Apply various forensic tools for a wide variety of investigations.	Apply
CO5.	Explore working with operating systems	Understand

Course Contents

UNIT I INTRODUCTION 9

Types, The Internet spawns crime, Worms versus viruses, Computers' roles in crimes, Introduction to digital forensics, Introduction to Incident - Incident Response Methodology – Steps - Activities in Initial Response, Phase after detection of an incident

UNIT II EVIDENCE COLLECTION 9

Initial Response and forensic duplication, Initial Response & Volatile Data Collection from Windows system -Initial Response & Volatile Data Collection from Unix system – Forensic Duplication: Forensic duplication: Forensic Duplicates as Admissible Evidence, Forensic Duplication Tool Requirements, Creating a Forensic. Duplicate/Qualified Forensic Duplicate of a Hard Drive

UNIT III FORENSICS ANALYSIS AND VALIDATION 9

Determining what data to collect and analyze, validating forensic data, addressing data-hiding techniques, performing remote acquisitions. Network Forensics: overview, performing live acquisitions, developing standard procedures, using network tools, examining the honeynet project.

UNIT IV CURRENT FORENSIC TOOLS 9

Evaluating computer forensic tool needs, computer forensics software tools, hardware tools, validating and testing forensics software E-Mail Investigations: Exploring the role of e-mail in investigation, exploring the roles of the client and server in e-mail, investigating e-mail crimes and violations, understanding e-mail servers. Cell phone and mobile device forensics: Understanding mobile device forensics, understanding acquisition procedures.

UNIT V WORKING WITH OPERATING SYSTEMS 9

Working with Windows and DOS Systems: understanding file systems, exploring Microsoft File Structures, Examining NTFS disks, Understanding whole disk encryption, windows registry, Microsoft startup tasks,

MS-DOS startup tasks, virtual machines.

Total: 45 Periods

TEXT BOOKS:

1. Kevin Mandia, Chris Prosise, “Incident Response and computer forensics”, Tata McGraw Hill, 2006.
2. Computer Forensics, Computer Crime Investigation by John R. Vacca, Firewall Media, New Delhi.

REFERENCES:

1. Computer Forensics and Investigations by Nelson, Phillips Enfinger, Steuart, CENGAGE Learning
2. Real Digital Forensics by Keith J. Jones, Richard Bejtiich, Curtis W. Rose, Addison- Wesley Pearson Education
3. Forensic Compiling, A Tractitioneris Guide by Tony Sammes and Brian Jenkinson, Springer International edition.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1										3	1	
CO2	3	2	1										3	1	
CO3	3	2	2										3	1	
CO4	3	2	2										3	1	
CO5	3	2	2										3	1	
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom’s Level	**Assessment Component**	**Marks**	**Total marks**
Apply	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom’s Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE-I (7.5)	**IAE-II (7.5)**	**IAE-III (10)**	
Remember	10	10	10	10
Understand	20	20	20	50
Apply	20	20	20	40
Evaluate	0	0	0	0
Create	0	0	0	0

20ITE23	QUANTUM CRYPTOGRAPHY	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Computer Networks				

Course Objectives

The course is intended to

1. Impart knowledge of Post Quantum Cryptography.
2. Gain knowledge about Quantum Computing.
3. Learn the Hash based Digital Signature Schemes.
4. Develop a clear understanding about Code based Cryptography
5. Explore the knowledge on Lattice based Cryptography

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1.	Discover the basics of Quantum Cryptography	Understand
CO2.	Understand the concepts of Quantum computing	Understand
CO3.	Summarize the concepts of Hash based Digital Signature schemes	Analyze
CO4.	Understand the Concepts of Code based cryptography	Understand
CO5.	Determine the knowledge on Lattice based cryptography	Apply

Course Contents:

Unit- I INTRODUCTION TO POST – QUANTUM CRYPTOGRAPHY 9

Cryptography- A taste of Post – Quantum Cryptography – A Hash–based public-key signature system – A code-based Public-key encryption system-challenge in Post-Quantum cryptography Efficiency- Confidence- Usability- Comparison to Quantum Cryptography.

Unit–II QUANTUM COMPUTING 9

Classical Cryptography and Quantum Computing – The Computational Model- The Quantum Fourier Transform- The hidden subgroup problem- The abelian HSP – The non-abelian HSP- Search Algorithms – Outlook.

Unit–III HASH-BASED DIGITAL SIGNATURE SCHEMES 9

Hash-based one-time signature scheme- Lamport – diffle one-time signature scheme. Winternitz one-time signature scheme. Merkles tree authentication scheme – MSS key pair generation- Efficient root computations – MSS Signature generation- MSS Signature verification – security of the Merkles signature scheme.

Unit-IV CODE–BASEDCRYPTOGRAPHY 9

Introduction-cryptosystems-CFS signature-The security of computing syndromes a one-way function-codes and structures-practical aspects-Semantic security for the McEliece scheme Algebraic coding theory – GRS and Goppa codes.

Unit-V LATTICE-BASEDCRYPTOGRAPHY 9

Introduction – Lattice Problems and Algorithms – Lattice-based cryptography – Quantum and Lattices – Finding short vectors in Random q-ary Lattices – The SWIFFT hash function-Digital signature schemes- The GGH and NTRUSIGN signature schemes.

Total: 45 periods

TEXTBOOKS:

1. Post Quantum Cryptography,Daniel J Bernstein,Johannes Buchmann,Erik Dahmen ,Springer.
2. C K Shyamala, N Harini and Dr. T R Padmanabhan: Cryptography and Network Security, Wiley India Pvt.Ltd

REFERENCEBOOKS:

1. BehrouzA.Foruzan, Cryptography and Network Security, Tata McGraw Hill 2007.
2. Charlie Kaufman, Radia Perlman, and Mike Speciner, Network Security: PRIVATE Communication in a PUBLIC World, Prentice Hall, ISBN 0-13-046019-2

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes(PSOs)															
COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	1	1									3	1	
CO2	3	2	2	1									3	1	
CO3	3	2	1	1									3	1	
CO4	3	3	2	1									3	1	
CO5	3	3	2	2									3	1	
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Apply	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE-I (7.5)	**IAE-II (7.5)**	**IAE-III (10)**	
Remember	10	10	10	10
Understand	20	20	10	30
Apply	20	20	20	40
Analyze	0	0	10	20
Evaluate	0	0	0	0
Create	0	0	0	0

SEMESTER VI

20ITE24	ETHICAL HACKING AND NETWORK DEFENSE	L	T	P	C
		2	0	0	2
Nature of Course	Professional Elective				
Pre requisites	Cryptography and Network Security				

Course Objectives

The course is intended to

1. Compare the various types of attacks in the process of monitoring and capturing all data packets passing through a given network using software (an application) or hardware device.
2. Relate the techniques and methodologies used by the attacker to compromise web server.
3. Explore the techniques to evade Intrusion Detection System for any Organization network architecture
4. Understand the different types of computer forensics with traditional systematic approach of computer investigations for cyber attacks
5. Get familiar with how the attacks use stealth scan to bypass firewall rules and logging mechanism.

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1.	Identify the vulnerabilities in a given network infrastructure	Understand
CO2.	Implement real-world hacking techniques to test system security	Apply
CO3.	Apply countermeasures to secure your system against threats.	Apply
CO4.	Use the concepts that enable to investigate to retrieve evidence for use in criminal investigations.	Analyze
CO5.	Apply a number of different computer forensic tools to a given scenario.	Apply

Course Contents

Unit I INTRODUCTION TO ETHICAL HACKING 9

Introduction to Ethical Hacking - Footprinting and Reconnaissance - Scanning Networks - Enumeration - System Hacking - Malware Threats - Sniffing - Social Engineering

Unit II TYPES OF HACKING 9

Denial of Service - Session Hijacking - Hacking Webservers - Hacking Web Applications - SQL Injection - Hacking Wireless Networks - Hacking Mobile Platforms - Evading_IDS, Firewalls and Honeypots - Cloud Computing – Cryptography

Unit III CYBER FORENSICS 9

Computer Forensics and Investigations as a Profession - Understanding Computer Investigations - The Investigator's Office and Laboratory - Data Acquisition - Processing Crime and Incident Scenes

Unit IV NETWORK DEFENSE 9

Computer Forensics Analysis and Validation - Current Computer Forensics Tools - Virtual Machines, Network Forensics, and Live Acquisitions - E-mail Investigations - Cell Phone and Mobile Device Forensics.

Unit V RECONNAISSANCE,GOOGLE HACKING AND DOXING 9

OSINT-Passive vs Active recon - Common tools for recon-Google Hacking - Doxing Introduction-Anti-forensics - Evasion techniques

Total: 45 Periods

TEXT BOOKS

1. CEH official Certfied Ethical Hacking Review Guide, Wiley India Edition, 2015
2. Bill Nelson, Amelia Phillips, Christopher Steuart, “Guide to Computer Forensics and Investigations”, Delmar Cengage Learning, 2015.

REFERENCE BOOKS

1. Ankit Fadia “ Ethical Hacking” second edition Macmillan India Ltd, 2006
2. Kenneth C.Brancik “Insider Computer Fraud” Auerbach Publications Taylor & Francis Group–2008
3. John R. Vacca, “Computer Forensics: Computer Crime Scene Investigation”,2nd Edition, Charles River Media, 2008

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1	1	1	3								3	3	
CO2	3	1	1	1	3								3	3	
CO3	3	1	1	1	3								3	2	
CO4	3	2	1	2	3								3	2	
CO5	3	2	1	1	3								3	2	
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom’s Level	**Assessment Component**	**Marks**	**Total marks**
Apply	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom’s Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE-I (7.5)	**IAE-II (7.5)**	**IAE-III (10)**	
Understand	10	10	10	20
Apply	20	20	20	50
Analyze	20	20	20	20
Evaluate	0	0	0	10
Create	0	0	0	0

20ITE25	WIRELESS SECURITY	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Network security				

Course Objective

The course is intended to

1. Comprehend the fundamental concepts of mobile and wireless network security
2. Identify security threats in wireless networks
3. Design secured network application considering all possible threats for next generation.
4. Design strategies to manage network security
5. Explore various security applications

Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1.	Understand the modern concept and foundation of Wireless security.	Understand
CO2.	Identity various sources of vulnerabilities from Mobile	Understand
CO3.	Classify various next generation networks	Apply
CO4.	Explore network security attacks and its countermeasures.	Analyze
CO5.	Analyze various security issues related to GPRS and 3G.	Analyze

Course Contents

UNIT I INTRODUCTION 9

Security Issues in Mobile Communication: Mobile Communication History, Security – Wired Vs Wireless, Security Issues in Wireless and Mobile Communications, Security Requirements in Wireless and Mobile Communications, Security for Mobile Applications, Advantages and Disadvantages of Application – level Security.

UNIT II SECURITY LEVELS 9

Security of Device, Network, and Server Levels: Mobile Devices Security Requirements, Mobile Wireless network level Security, Server Level Security. Application Level Security in Wireless Networks: Application of WLANs, Wireless Threats, Some Vulnerabilities and Attach Methods over WLANs, Security for 1G Wi-Fi Applications, Security for 2G Wi-Fi Applications.

UNIT III GENERATION OF SECURITY 9

Application Level Security in Cellular Networks: Generations of Cellular Networks, Security Issues and attacks in cellular networks, GSM Security for applications, GPRS Security for applications, UMTS security for applications, 3G security for applications, Some of Security and authentication Solutions.

UNIT IV SECURITY CHALLENGES 9

Application Level Security in MANETs: MANETs, Some applications of MANETs, MANET Features, Security Challenges in MANETs, Security Attacks on MANETs, External Threats for MANET applications, Internal threats for MANET Applications, Some of the Security Solutions.

UNITV APPLICATIONS **9**

Data Center Operations - Security challenge, implement “Five Principal Characteristics of Cloud Computing, Data center Security Recommendations Encryption for Confidentiality and Integrity, Encrypting data at rest, Key Management Lifecycle, Cloud Encryption Standards.

Total: 45 Periods

TEXT BOOKS:

1. Pallapa Venkataram, Satish Babu: “Wireless and Mobile Network Security”, 1st Edition, Tata McGraw Hill,2010.
2. Frank Adelstein, K.S.Gupta : “Fundamentals of Mobile and Pervasive Computing”, 1st Edition, Tata McGraw Hill 2005.

REFERENCES:

1. Randall k. Nichols, Panos C. Lekkas : “Wireless Security Models, Threats and Solutions”, 1st Edition, Tata McGraw Hill, 2006.
2. Bruce Potter and Bob Fleck : “802.11 Security” , 1st Edition, SPD O’REILLY 2005.
3. James Kempf: “Guide to Wireless Network Security, Springer. Wireless Internet Security – Architecture and Protocols”, 1st Edition, Cambridge University Press, 2008.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes(PSOs)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1	1									3	1	
CO2	3	2	2	1	2						2	2	3	1	
CO3	3	2	1	1									3	1	
CO4	3	3	2	1	2	1		1			1	2	3	1	
CO5	3	3	2	2	2	1		1			3	2	3	1	
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom’s Level	**Assessment Component**	**Marks**	**Total marks**
Apply	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom’s Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE-I (7.5)	**IAE-II (7.5)**	**IAE-III (10)**	
Remember	10	10	10	10
Understand	20	20	10	30
Apply	20	20	20	40
Analyze	0	0	10	20
Evaluate	0	0	0	0
Create	0	0	0	0

20ITE26	MACHINE LEARNING FOR CYBER SECURITY	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Cyber security				

Course Objectives

The course is intended to

1. Understand various regression methods.
2. Learn about Supervised Learning algorithms.
3. Deploy deep neural network applications.
4. Study about unsupervised learning algorithms.
5. Illustrate the Q-Learning Algorithm in Reinforcement Learning.

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1.	Compare and Contrast about various regression methods	Understand
CO2.	Illustrate various supervised learning algorithms.	Understand
CO3.	Develop deep neural network applications.	Apply
CO4.	Synthesize the usage of unsupervised learning algorithms	Apply
CO5.	Explore the uses of Reinforcement Learning	Understand

Course Contents

UNIT I STATISTICAL THEORY AND REGRESSION 9

Linear methods for Regression – Gauss-Markov theorem – Multiple regression – Subset selection – Ridge regression – Principal components regression – Partial least squares - Linear discriminant analysis – Logistic regression.

UNIT II SUPERVISED LEARNING 9

Decision Tree Learning - Bayesian Learning - Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier – Bayesian Belief Network – EM Algorithm

UNIT III DEEP LEARNING 9

Neural Network Representation – Problems – Perceptron – Multilayer Networks and Back Propagation Algorithms - Convolutional neural networks - Recurrent neural networks – Create and deploy neural networks using Tensor Flow and Keras**.**

UNIT IV UNSUPERVISED LEARNING 9

Association rules – Cluster analysis – Self organizing maps – Principal components, curves and surfaces – Non-negative matrix factorization – Independent component analysis – Multidimensional scaling–Ensemble learning

UNITV REINFORCEMENT LEARNING 9

Introduction - Single State Case - Elements of Reinforcement Learning – Model Based Learning - Temporal Difference Learning – Q Learning Algorithm – Generalization - Partially Observable States.

Total: 45 Periods

TEXTBOOKS

1. Tom M. Mitchell, “Machine Learning”, McGraw-Hill Education (India) Private Limited, 2013.
2. Trevor Hastie, Robert Tibshirani, Jerome Friedman, “The Elements of Statistical Learning: Data Mining, Inference, and Prediction”, Springer; Second Edition, 2009.

REFERENCE BOOKS

1. Alpaydin Ethem, “Introduction to Machine Learning”, MIT Press, Second Edition, 2010.
2. Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, “An Introduction to Statistical Learning: with Applications in R”, Springer; First Edition 2013

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes(PSOs)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1	1									3	1	
CO2	3	2	2	1									3	1	
CO3	3	2	1	1									3	1	
CO4	3	3	2	1									3	1	
CO5	3	3	2	2									3	1	
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom’s Level	**Assessment Component**	**Marks**	**Total marks**
Apply	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom’s Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE-I (7.5)	**IAE-II (7.5)**	**IAE-III (10)**	
Remember	10	10	10	10
Understand	20	20	10	30
Apply	20	20	20	40
Analyze	0	0	10	20
Evaluate	0	0	0	0
Create	0	0	0	0

SEMESTER VII

20ITE27	**SECURE DATA MANAGEMENT**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
Nature of Course	Professional Elective				
Pre requisites	Database concepts				

Course Objectives

The course is intended to

1. Understand the concepts of database security
2. Perform feasibility study of the projects under Data confidentiality
3. Acquire the knowledge about Data integrity
4. Learn various security threats in Database systems
5. Have knowledge about the Implementing secure database systems.

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1.	Avoid unauthorized data observation and modification	Understand
CO2.	Ensure the data confidentiality.	Understand
CO3.	Prove the data integrity is preserved.	Apply
CO4.	Identify security threats in database systems.	Understand
CO5.	Design and Implement secure database systems	Apply

Course Contents

UNIT I INTRODUCTION 9

Introduction to Databases Security Problems in Databases - Security Controls – Conclusions - Security Models - Introduction Access Matrix Model Take - Grant Model - Acten Model - PN Model - Hartson and Hsiao's Model - Fernandez's Model - Bussolati and Martella's Model for Distributed databases

UNIT II SECURITY MODELS 9

Bell and LaPadula's Model - Biba's Model - Dion's Model - Sea View Model - Jajodia and Sandhu's Model The Lattice Model for the Flow Control - conclusion - Security Mechanisms- Introduction - User Identification/Authentication - Memory Protection - Resource Protection - Control Flow Mechanisms - Isolation Security - Functionalities in Some Operating Systems - Trusted Computer System - Evaluation Criteria

UNIT III SECURITY SOFTWARE DESIGN 9

Introduction - A Methodological Approach to Security Software Design - Secure Operating System Design - Secure DBMS Design - Security Packages- Database Security Design - Statistical Database Protection & Intrusion Detection Systems. Introduction - Statistics Concepts and Definitions - Types of Attacks - Inference Controls - evaluation Criteria for Control - Comparison .Introduction - IDES System - RETISS System - ASES System - Discovery .

UNIT IV NEW GENERATION DATABASE SYSTEMS -1 9

Models For The Protection Of New Generation Database Systems -1 - Introduction - A Model for the Protection of Frame Based Systems - A Model for the Protection of Object Oriented Systems - SORION Model for the Protection of Object-Oriented Databases.

UNITV NEW GENERATION DATABASE SYSTEMS -2 9

Models For The Protection Of New Generation Database Systems -2 ,A Model for the Protection of New Generation Database Systems: the Orion Model Jajodia and Kogan's Model, A Model for the Protection of Active Databases - Conclusions.

Total: 45 Periods

TEXTBOOKS

1. Database Security and Auditing, Hassan A. Afyouni, India Edition, CENGAGE Learning, 2009.
2. Database Security, Castano, Second edition, Pearson Education,1995

REFERENCE BOOKS

1. Database security by alfred basta, melissa zgola, CENGAGE learning,2011

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes(PSOs)															
COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	1	1									3	1	
CO2	3	2	2	1									3	1	
CO3	3	2	1	1									3	1	
CO4	3	3	2	1									3	1	
CO5	3	3	2	2									3	1	
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Apply	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE-I (7.5)	**IAE-II (7.5)**	**IAE-III (10)**	
Remember	10	10	10	10
Understand	20	20	10	30
Apply	20	20	20	40
Analyze	0	0	10	20
Evaluate	0	0	0	0
Create	0	0	0	0

20ITE28	ADVANCED CRYPTOLOGY	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Cryptography and Network Security , Probability theory, Number theory				

Course Objectives

The course is intended to

1. Understand the concepts of public key and private key cryptography.
2. Describe the mathematical background of cryptographical technologies
3. Explore the concepts of quantum cryptography.
4. Understand the algorithms and attacks on elliptic curve cryptography.
5. Get familiar with advanced cryptographic techniques.

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1.	Infer the basic knowledge about Cryptography	Understand
CO2.	Recognize the mathematical background of Cryptography	Understand
CO3.	Categorize the principles of Quantum Cryptography	Analyze
CO4.	Explore the algorithms and attacks of elliptic curve cryptography.	Evaluate
CO5.	Understand the concepts of advanced cryptographic techniques.	Understand

Course Contents

UNIT I OVERVIEW OF CRYPTOGRAPHY 9

Introduction, Information security and cryptography, Basic terminology and concepts, Symmetric key encryption , Digital signatures, Public-key cryptography, Hash functions, Protocols and mechanisms, Key establishment, management, and certification, Pseudorandom numbers and sequences, Classes of attacks and security models.

UNIT II MATHEMATICAL BACKGROUND 9

Cyclotomic extensions, Geometric constructions and Galois theory of Equations (Statement only of Abel Ruffini), Solving Cubic and Bi-quadratic polynomials using radicals.

UNIT III QUANTUM CRYPTOGRAPHY 9

Quantum Computers- dimensional concepts- Shor's algorithm-Quantum Cryptography-Quantum Key distribution and reconciliation-Advantages-Position based quantum cryptography-Applications

UNIT IV ELLIPTIC CURVE CRYPTOGRAPHY 9

Security-Side Channel Attacks-Backdoors-Quantum Computing Attacks-Invalid Curve Attack-Implementation-Domain Parameters, Key Sizes-Applications

UNIT V ADVANCED CRYPTOGRAPHIC HASH ALGORITHMS 9

MD5-SHA3-RIPEMD180-Whirlpool-Blake3-Attacks on Cryptographic hash algorithms and hashed passwords-Bit coin-Block chain.

Total: 45 Periods

TEXT BOOKS

1. Alfred J. Menezes, Paul C. van Oorschot and Scott A. Vanstone, “Handbook of Applied Cryptography” CRC Press,2001
2. Cryptography and Network Security: Principles and Practice (ISBN 0131873164), 4/e, by William Stallings,2005

REFERENCE BOOKS

1. B. Schneier, “Applied Cryptography: Protocols, Algorithms, and Source Code in C”, 2nd Edition, John Wiley & Sons, 1995.
2. Matt Bishop, Computer Security: Art and Science, Addison-Wesley, 2002
3. Mihir Bellare and Phillip Rogaway, “Introduction to Modern Cryptography”,2005

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
COs	**Pos**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	1	1	1									3	3	
CO2	3	1	1	1									3	3	
CO3	3	1	1	1									3	2	
CO4	3	2	1	2									3	2	
CO5	3	2	1	1									3	2	
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom’s Level	**Assessment Component**	**Marks**	**Total marks**
Apply	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom’s Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE-I (7.5)	**IAE-II (7.5)**	**IAE-III (10)**	
Understand	10	10	10	20
Apply	20	20	20	50
Analyze	20	20	20	20
Evaluate	0	0	0	10
Create	0	0	0	0

SEMESTER VIII

20ITE29	MOBILE APPLICATION SECURITY AND PENETRATION TESTING	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	NIL				

Course Objectives

The course is intended to

1. Facilitate students to understand android SDK
2. Gain a basic understanding of Android application development
3. Inculcate working knowledge of Android Studio development tool
4. Acquire knowledge on attacking android applications
5. Explore the security in android applications

Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1.	Identify various concepts of mobile programming that make it unique from programming for other platforms	Understand
CO2.	Differentiate android and iOS architecture	Apply
CO3.	Utilize rapid prototyping techniques for developing testing environment	Apply
CO4.	Perform the mobile applications for the Android operating system that use basic and advanced phone features.	Analyze
CO5.	Deploy the security in Android and iOS applications.	Analyze

Course Contents

UNIT I INTRODUCTION TO MOBILE APPLICATION 9

The smartphone market share-Different types of mobile applications-Public Android and iOS vulnerabilities-The key challenges in mobile application security-The mobile application penetration testing methodology-The OWASP mobile security project**.**

UNIT II SNOOPING AROUND THE ARCHITECTURE 9

The Android architecture-iOS architecture-iOS application programming languages-Apple's iOS security model-Changes in iOS 8 and 9-iOS isolation-The iOS application structure-Jailbreaking-The Mach-O binary file format.

UNIT III BUILDING A TEST ENVIRONMENT 9

Android Studio and SDK-The Android Debug Bridge-Genymotion-Configuring the emulator for HTTP proxy-SSH clients – PuTTy and WinSCP-Emulator, simulators, and real devices-Loading up – Mobile Pentesting Tools: Android security tools-iOS security tools.

UNIT IV ATTACKING ANDROID AND IOS APPLICATIONS 9

Attacking Android Applications: Analyzing the app using drozer-Android components-Attacking WebViews-Man-in-the-Middle (MitM) attacks-Attacking iOS Applications: Storage/archive analysis-Reverse engineering-Static code analysis-Dump decrypted -Client-side injection-Building a remote tracer using LLDB.

UNITV SECURING YOUR ANDROID AND IOS APPLICATIONS 9

Security mind map for developers (iOS and Android)- Device level: Platform (OS) level, Application level-Network level-Server level-OWASP mobile app security checklist-Secure coding best practices-Post-production protection.

Total: 45 Period

TEXTBOOKS

1. Vijay Kumar Velu- Mobile Application Penetration Testing- Published by Packt Publishing Ltd. March 2016.

REFERENCE BOOKS

1. Aditya Gupta — Learning Pentesting for Android Device, Published by Packt Publishing Ltd,2014
2. Georgia Weidman,Penetration Testing: A Hands-On Introduction to Hacking, Publisher:William Pollock,2014

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes(PSOs)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1	1									3	1	
CO2	3	2	2	1									3	1	
CO3	3	2	1	1									3	1	
CO4	3	3	2	1									3	1	
CO5	3	3	2	2									3	1	
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Apply	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE-I (7.5)	**IAE-II (7.5)**	**IAE-III (10)**	
Remember	10	10	10	10
Understand	20	20	10	30
Apply	20	20	20	40
Analyze	0	0	10	20
Evaluate	0	0	0	0
Create	0	0	0	0

20ITE30	BLOCK CHAIN TECHNOLOGY	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Cryptography and Network security				

Course Objectives

The course is intended to

1. Understand the definitions, features, types, and benefits of blockchains along with consensus.
2. Cover the concepts of decentralization and its relationship with blockchain technology.
3. Introduce technical concepts related to bitcoin cryptocurrency.
4. Learn the architecture of the Ethereum blockchain.
5. Represent a discussion about the hyper ledger project from the Linux foundation, which includes different block chain projects introduced by its members mechanisms that are at the core of block chain technology.

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1.	Discover the secure and efficient transactions with crypto-currencies	Understand
CO2.	Experiment with cryptocurrency trading and crypto exchanges	Apply
CO3.	Apply efficient transaction with Bitcoins	Apply
CO4.	Develop private blockchain environment and develop a smart contract on Ethereum	Analyze
CO5.	Build the hyperledger architecture and the consensus mechanism applied in the hyperledger	Apply

Course Contents:

Unit I CRYPTOCURRENCY AND BLOCKCHAIN 9

Blockchain- Introduction, Distinction between databases and blockchain, Distributed ledger- ecosystem - Consensus Algorithms & Types, Blockchain structure, Distributed networks- Distributed Applications (DApps) – Web 3.0 - DApps Ecosystems. Working - Permissioned and permission-less Blockchain – Cross Chain Technologies. – IOT & Blockchain - Digital Disruption in Industries – Banking, Insurance, Supply Chain, Governments, IP rights, Creation of trustless Ecosystems – Block chain as a Service – Open Source Block chains

Unit II CRYPTO CURRENCIES 9

Crypto Currencies - Anonymity and Pseudonymity in Crypto currencies - Digital Signatures – Crypto currency Hash Codes -Need for Crypto Currencies – Crypto Markets – Explore Crypto Currency Ecosystems - ICOs – Crypto Tokens - Atomic Swaps – Crypto Currency Exchanges – Centralised and Decentralized Crypto exchanges – Regulations on Crypto Currencies & exchanges – Downside of non-regulated currencies – crypto Scams – Exchange hacks.

Unit III BITCOIN 9

Bitcoin – history- Bitcoin- usage, storage, selling, transactions, working- Invalid Transactions Parameters that invalidate the transactions- Scripting language in Bitcoin- Applications of Bitcoin script- Nodes and network of Bitcoin- Bitcoin ecosystem.

Unit IV ETHEREUM 9

Ethereum ecosystem, DApps and DAOs - Ethereum working- Solidity- Contract classes, functions, and conditionals- Inheritance & abstract contracts- Libraries- Types & optimization of Ether- Global variables- Debugging- Future of Ethereum- Smart Contracts on Ethereum- different stages of a contract deployment- Viewing Information about blocks in Blockchain- Developing smart contract on private Blockchain- Deploying contract from web and console

Unit V HYPERLEDGER 9

Hyperledger Architecture- Consensus- Consensus & its interaction with architectural layers Application programming interface- Application model -Hyperledger frameworks- Hyperledger Fabric -Various ways to create Hyperledger Fabric Blockchain network- Creating andDeploying a business network on Hyperledger Composer Playground- Testing the business network definition- Transferring the commodity between the participants

Total:45 Periods

TEXTBOOKS:

1. Imran Bashir, “Mastering Blockchain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained”, Second Edition, Packt Publishing, 2018.

REFERENCEBOOKS:

1. Mastering Bitcoin: Unlocking Digital Cryptocurrencies, by Andreas M Antonopoulos 2018
2. Henning Diedrich, Ethereum: Block chains, Digital Assets, Smart Contracts, Decentralized Autonomous Organizations-2016

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes(PSOs)															
COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	1	1									3	1	
CO2	3	2	2	1	2						2	2	3	1	
CO3	3	2	1	1									3	1	
CO4	3	3	2	1	2	1		1			1	2	3	1	
CO5	3	3	2	2	2	1		1			3	2	3	1	
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom’s Level	**Assessment Component**	**Marks**	**Total marks**
Apply	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE-I (7.5)	**IAE-II (7.5)**	**IAE-III (10)**	
Remember	10	10	10	10
Understand	20	20	10	30
Apply	20	20	20	40
Analyze	0	0	10	20
Evaluate	0	0	0	0
Create	0	0	0	0

SEMESTER V

20ITE41	**DATA SCIENCE WITH PYTHON**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
Nature of Course	Professional Elective				
Pre requisites	Basics of Python				

Course Objectives

The course is intended to

1. Recognize the need of Data Science
2. Perform an application with user-defined modules and packages using OOP concept
3. Acquire the knowledge about efficient storage and data operations using NumPy arrays
4. Have knowledge about the powerful data manipulations using Pandas
5. Explore data processing and visualizing using Pandas

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1.	Identify the need for data science and solve basic problems using Python built-in data types and their methods.	Understand
CO2.	Design an application with user-defined modules and packages using OOP concept	Apply
CO3.	Employ efficient storage and data operations using NumPy arrays	Apply
CO4.	Apply powerful data manipulations using Pandas	Apply
CO5.	Perform data preprocessing and visualization using Pandas	Analyze

Course Contents

UNIT I INTRODUCTION TO DATA SCIENCE AND PYTHON PROGRAMMING 9

Introduction to Data Science - Essential Python libraries - Python Introduction- Features, Identifiers, Reserved words, Indentation, Comments, Built-in Data types and their Methods: Strings, List, Tuples, Dictionary, Set - Type Conversion - Operators. Decision Making – Looping - Loop Control statement- Math and Random number functions. User defined functions - function arguments & its types.

UNIT II FILE, EXCEPTION HANDLING AND OOP 9

User defined Modules and Packages in Python- Files: File manipulations, File and Directory related methods- Python Exception Handling. OOPs Concepts -Class and Objects, Constructors – Data hiding- Data Abstraction- Inheritance.

UNIT III INTRODUCTION TO NUMPY 9

NumPy Basics: Arrays and Vectorized Computation- The NumPy ndarray- Creating ndarrays- Data Types for ndarrays- Arithmetic with NumPy Arrays- Basic Indexing and Slicing - Boolean Indexing- Transposing Arrays and Swapping Axes. Universal Functions: Fast Element-Wise Array Functions- Mathematical and Statistical Methods-Sorting-Unique and Other Set Logic.

UNIT IV DATA MANIPULATION WITH PANDAS 9

Introduction to pandas Data Structures: Series, Data Frame, Essential functionality: Dropping Entries- Indexing, Selection, and Filtering- Function Application and Mapping- Sorting and Ranking. Summarizing and Computing Descriptive Statistics- Unique Values, Value Counts, and Membership. Reading and Writing data in Text Format.

UNIT V DATA CLEANING, PREPARATION AND VISUALIZATION 9

Data Cleaning and Preparation: Handling Missing Data - Data Transformation: Removing Duplicates, Transforming Data Using a Function or Mapping, Replacing Values, Detecting and Filtering Outliers- String Manipulation: Vectorized String Functions in pandas. Plotting with pandas: Line Plots, Bar Plots, Histograms and Density Plots, Scatter or Point Plots.

Total: 45 Periods

Text Books :

1. Y. Daniel Liang, “Introduction to Programming using Python”, Pearson,2012
2. Wes McKinney, “Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython”, O’Reilly, 2nd Edition,2018.

Reference Books :

1. Jake Vander Plas, “Python Data Science Handbook: Essential Tools for Working with Data”, O’Reilly,2017
2. Wesley J. Chun, “Core Python Programming”, Prentice Hall,2006
3. Mark Lutz, “Learning Python”, O’Reilly, 4th Edition, 2009.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes(PSOs)															
COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	1									3	2	
CO2	3	3	3	1	2						2	2	3	2	
CO3	3	3	3	1									3	2	
CO4	3	3	3	1	2	1		1			1	2	3	2	
CO5	3	3	3	2	2	1		1			3	2	3	2	
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom’s Level	**Assessment Component**	**Marks**	**Total marks**
Apply	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom’s Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE-I (7.5)	**IAE-II (7.5)**	**IAE-III (10)**	
Remember	10	10	10	10
Understand	20	20	10	30
Apply	20	20	20	40
Analyze	0	0	10	20
Evaluate	0	0	0	0
Create	0	0	0	0

20ITE42	BIG DATA FOR DATA ENGINEERING	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	OOPS Concept				

Course Objectives

The course is intended to

1. Understand the fundamentals of Big Data Analytics
2. Impart Knowledge on mining data streams
3. Acquire knowledge on the fundamentals of Data Engineering
4. Develop the Hadoop Administration
5. Appraise the concepts of Data Engineering

Course Outcomes

On successful completion of the course students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1.	Recognize the fundamentals of Big Data Analytics	Understand
CO2.	Design the various mining data streams	Apply
CO3.	Categorize various scenarios based on Data Engineering	Apply
CO4.	Perform Hadoop Administration.	Analyze
CO5.	Apply the concepts of Data Engineering in real world problems	Apply

Course Contents

UNIT I INTRODUCTION 9

Introduction to big data : Introduction to Big Data Platform – Challenges of Conventional Systems – Intelligent data analysis–Nature of Data- Analytic Processes and Tools-Analysis vs Reporting.

UNIT II DATA STREAMS 9

Mining data streams : 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.

UNIT III INTRODUCTION TO DATA ENGINEERING 9

Overview of Data Engineering; Basic Linux commands, Google Cloud Platform (GCP) and VM

UNIT IV HADOOP ADMINISTRATION 9

Overview of Hadoop. Install, Configure, and Test Hadoop on a 3 Node Cluster on GCP. Relational Databases. Use SQL & PostgreSQL Data Architecture, Data Governance. NoSQL Databases using MongoDB.

UNIT V IMPLEMENTATION OF DATA ENGINEERING 9

Python, Anaconda Python, and API data sources. Python and Pandas.Spark.

Total: 45 Periods

Text Books :

1. Andreas Kretz, "The Data Engineering Cookbook" independent Publisher, 2022

Reference Books :

1. Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, "Understanding Big Data:Analytics for Enterprise Class Hadoop and Streaming Data", McGrawHill Publishing, 2012
2. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes(PSOs)															
COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	1	1									3	1	
CO2	3	2	2	1	2						1	2	3	1	
CO3	3	2	1	1									3	1	
CO4	3	3	2	1	2	1					1	2	3	1	
CO5	3	3	2	2	2	1					2	2	3	1	
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Apply	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE-I (7.5)	**IAE-II (7.5)**	**IAE-III (10)**	
Remember	10	10	10	10
Understand	20	20	10	30
Apply	20	20	20	40
Analyze	0	0	10	20
Evaluate	0	0	0	0
Create	0	0	0	0

20ITE43	R PROGRAMMING	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Basic Programming knowledge				

Course Objectives

The course is intended to

1. Understand the use of basic R programming concepts
2. Automate data analysis, working collaboratively and openly on code
3. Know how to generate dynamic documents
4. Use a continuous test driven development approach
5. Explore on Interacting with digital outputs with python

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1.	Solve the real world problem using R programming language	Apply
CO2.	Design and implement the solution using scalar, vectors , matrices and statistical problems in R program.	Apply
CO3.	Demonstrate with programs for data frame and list to provide the solution for various problem	Apply
CO4.	Implement factors and tables to solve statistical problems.	Analyze
CO5.	Perform Minimize and maximize functions ,simulation and visualization and statistical analysis using R	Analyze

Course Contents

UNIT I INTRODUCTION TO R 9

Overview of R, R data types and objects, reading and writing data, sub setting R Objects, Essentials of the R Language, Complex numbers in R, Rounding, Arithmetic, Modulo and integer quotients, Variable names and assignment, Operators, Integers, Factors, Logical operations, R Data Structures

UNIT II CONTROL STRUCTURES AND VECTORS 9

Control structures, functions, scoping rules, dates and times, Introduction to Function, Character Strings, Matrices, Data Frames, Classes Vectors: Generating sequences, Vectors and subscripts, Extracting elements of a vector using subscripts, Working with logical subscripts, Scalars, Vectors, Arrays, and Matrices, Adding and Deleting Vector Elements, Obtaining the Length of a Vector, Matrices and Arrays as Vectors Vector Arithmetic and Logical Operations, Vector Indexing, Common Vector Operations

UNIT III LISTS 9

Lists: Creating Lists, General List Operations, List Indexing Adding and Deleting List Elements, Getting the Size of a List, Extended Example: Text Concordance Accessing List Components and Values Applying Functions to Lists, Data Frames, Creating Data Frames, Accessing Data Frames, Other Matrix-Like Operations

UNIT IV FACTORS AND TABLES 9

Factors and Levels, Common Functions Used with Factors, Working with Tables, Matrix/Array-Like Operations on Tables , Extracting a Sub table, Finding the Largest Cells in a Table, Math Functions, Calculating a Probability, Cumulative Sums and Products, Minima and Maxima, Calculus, Functions for Statistical Distributions

UNIT V OBJECT-ORIENTED PROGRAMMING 9

S Classes, S Generic Functions, Writing S Classes, Using Inheritance, S Classes, Writing S Classes, Implementing a Generic Function on an S Class, visualization, Simulation, code profiling,

Statistical Analysis with R, data manipulation

Total: 45 Periods

Text Books :

1. Roger D. Peng," R Programming for Data Science ", 2012
2. Norman Matloff," The Art of R Programming- A Tour of Statistical Software Design", 2011

Reference Books:

1. Garrett Grolemund, Hadley Wickham,"Hands-On Programming with R:Write Your Own Functions and Simulations" , 1st Edition, 2014
2. https://swayam.gov.in/nd1_noc19_ma33/preview
3. https://www.r-tutor.com/elemntary-statstics
4. https://www.edx.org/learn/r-programming

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes(PSOs)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1	1									3	1	
CO2	3	2	2	1									3	1	
CO3	3	2	1	1									3	1	
CO4	3	3	2	1									3	1	
CO5	3	3	2	2								2	3	1	
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Apply	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE-I (7.5)	**IAE-II (7.5)**	**IAE-III (10)**	
Remember	10	10	10	10
Understand	20	20	10	30
Apply	20	20	20	40
Analyze	0	0	10	20
Evaluate	0	0	0	0
Create	0	0	0	0

SEMESTER VI

20ITE44	**DATA ANALYTICS AND HADOOP**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
Nature of Course	Professional Elective				
Pre requisites	Big data Analytics				

Course Objectives

The course is intended to

1. Impart knowledge on HDFS file system, MapReduce frameworks
2. Hadoop tools like Hive, and Hbase, which provide interface to relational databases, are also covered as part of this course work To improve the Hadoop Administration
3. Analyzing data with different Hadoop framework
4. Be familiar with Sorting, Map side and Reduce side joins
5. Implement Hive and Mapreduce clients

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	**Course Outcome**	**Bloom's Level**
CO1.	Comprehend the fundamentals of Big cloud and data architectures.	Understand
CO2.	Recognize HDFS file structure and Mapreduce frameworks, and use them to solve complex problems, which require massive computation power.	Understand
CO3.	Use relational data in a Hadoop environment, using Hive and Hbase tools of the Hadoop Ecosystem.	Apply
CO4.	Identify the appropriate Map reduce framework.	Analyze
CO5.	Compare with traditional databases.	Analyze

Course Contents

UNIT I INTRODUCTION 9

Introduction to Big Data. What is Big Data. Why Big Data is Important. Meet Hadoop. Data. Data Storage and Analysis. Comparison with other systems. Grid Computing. A brief history of Hadoop. Apache hadoop and the Hadoop Ecosystem. Linux refresher; VMware Installation of Hadoop.

UNIT II DESIGN OF HDFS 9

HDFS concepts. Command line interface to HDFS. Hadoop File systems. Interfaces. Java Interface to Hadoop. Anatomy of a file read. Anatomy of a file write. Replica placement and Coherency Model. Parallel copying with distcp, Keeping an HDFS cluster balanced.

UNIT III HADOOP FRAMEWORK 9

Introduction. Analyzing data with unix tools. Analyzing data with hadoop. Java MapReduce classes (new API). Data flow, combiner functions, Running a distributed MapReduce Job. Configuration API. Setting up the development environment. Managing configuration. Writing a unit test with MRUnit. Running a job in local job runner. Running on a cluster. Launching a job. The MapReduce WebUI.

UNIT IV MAPREDUCE 9

Classic Mapreduce. Job submission. Job Initialization. Task Assignment. Task execution .Progress and status updates. Job Completion. Shuffle and sort on Map and reducer side. Configuration tuning. MapReduce Types. Input formats. Output formats , Sorting. Map side and Reduce side joins.

UNIT V HIVE **9**

The Hive Shell. Hive services. Hive clients. The meta store. Comparison with traditional databases. HiveQl. Hbasics. Concepts. Implementation. Java and Mapreduce clients. Loading data, web queries.

Total: 45 Periods

Text Books:

1. Tom White, Hadoop, "The Definitive Guide", 3rd Edition, O'Reilly Publications, 2012.

Reference Books:

1. Dirk deRoos, Chris Eaton, George Lapis, Paul Zikopoulos, Tom Deutsch , "Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data" , McGraw- Hill Osborne Media; 2011

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes(PSOs)															
COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	1	1									3	1	
CO2	3	2	2	1									3	1	
CO3	3	2	1	1									3	1	
CO4	3	3	2	1								1	3	1	
CO5	3	3	2	2								1	3	1	
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Apply	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE-I (7.5)	**IAE-II (7.5)**	**IAE-III (10)**	
Remember	10	10	10	10
Understand	20	20	10	30
Apply	20	20	20	40
Analyze	0	0	10	20
Evaluate	0	0	0	0
Create	0	0	0	0

20ITE45	PREDICTIVE ANALYTICS	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	NIL				

Course Objectives

The course is intended to

1. Introduce the fundamental concepts and techniques of Natural language Processing Learn the fundamental principles of analytics for business
2. Visualize and explore data to better understand relationships among variables
3. Recognize the principles and techniques for predictive modeling
4. Examine how predictive analytics can be used in decision making
5. Apply predictive models to generate predictions for new data

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1.	Understand the importance of predictive analytics	Understand
CO2.	Prepare and process data for the models and learn about statistical analysis techniques used in predictive models	Understand
CO3.	Model data and establish baseline performance	Apply
CO4.	Develop regression and classification model on applications for decision making and evaluate the performance	Analyze
CO5.	Build and apply time series forecasting models in a variety of business contexts	Analyze

Course Contents

UNIT I INTRODUCTION **9**

Introduction to predictive analytics – Business analytics: types, applications- Models: predictive models – descriptive models – decision models - applications - analytical techniques

UNIT II PRINCIPLES AND TECHNIQUES **9**

Data types and associated techniques – complexities of data – data preparation, pre-processing – exploratory data analysis - Predictive modeling: Propensity models, cluster models, collaborative filtering, applications and limitations - Statistical analysis: Univariate Statistical analysis, Multivariate Statistical analysis

UNIT III REGRESSION MODELS **9**

Preparing to model the data: supervised versus unsupervised methods, statistical and data mining methodology, cross-validation, overfitting, bias-variance trade-off, balancing the training dataset, establishing baseline performance -Measuring Performance in Regression Models - Linear Regression and Its Cousins - Non-Linear Regression Models - Regression Trees and Rule-Based Models

UNIT IV CLASSIFICATION MODELS **9**

Measuring Performance in Classification Models - Discriminant Analysis and Other Linear Classification Models - Non-Linear Classification Models - Classification Trees and Rule-Based Models – Model Evaluation Techniques

UNIT V TIME SERIES ANALYSIS **9**

Time series Model: ARMA, ARIMA, ARFIMA - Temporal mining - Box Jenkinson method, temporal reasoning, temporal constraint networks

Total: 45 Periods

Text Books :

1. Jeffrey Strickland, Predictive analytics using R, Simulation educators, Colorado Springs, 2015
2. Max Kuhn and Kjell Johnson, Applied Predictive Modeling, 1st edition Springer, 2013

Reference Books :

1. Anasse Bari, Mohamed Chaouchi, Tommy Jung, Predictive analytics for dummies, 2nd edition Wiley, 2016.
2. Dinov, ID., Data Science and Predictive Analytics: Biomedical and Health Applications using R, Springer, 2018.
3. Daniel T.Larose and Chantal D.Larose, Data Mining and Predictive analytics, 2nd edition Wiley, 2015.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes(PSOs)

COs	POs												PSOs		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	1	1									3	1	
CO2	3	2	2	1	2						2	2	3	1	
CO3	3	2	1	1									3	1	
CO4	3	3	2	1	2	1		1			1	2	3	1	
CO5	3	3	2	2	2	1		1			3	2	3	1	
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Apply	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE-I (7.5)	**IAE-II (7.5)**	**IAE-III (10)**	
Remember	10	10	10	10
Understand	20	20	10	30
Apply	20	20	20	40
Analyze	0	0	10	20
Evaluate	0	0	0	0
Create	0	0	0	0

20ITE46	DATA MINING	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Database Management systems				

Course Objectives

The course is intended to

1. Introduce the fundamental processes data warehousing and major issues in data mining
2. Impart the knowledge on various data mining concepts and techniques that can be applied to text mining, web mining etc.
3. Develop the knowledge for application of data mining and social impacts of data mining.
4. Learn the patterns from large amount of data.
5. Be familiar with Data mining Algorithms.

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1.	Interpret the contribution of data mining to the decision-support systems.	Understand
CO2.	Prepare the data needed for data mining using preprocessing techniques and apply the various visualization techniques.	Understand
CO3.	Compute forecasts for a variety of linear methods and models	Apply
CO4.	Discover the patterns from large amounts of data using Association Rule Mining	Analyze
CO5.	Extract useful information from the labeled data using various classifiers and Predictors	Analyze

Course Contents

UNIT I INTRODUCTION TO DATA MINING 9

Data mining-Introduction- Related technologies - Machine Learning, DBMS, OLAP, Statistics, Stages of the Data Mining Process, Data Mining Techniques, Knowledge Representation Methods, Applications.

UNIT II DATA PREPROCESSING 9

Data cleaning, Data transformation, Data reduction, Discretization and generating concept hierarchies, Installing Weka 3 Data Mining System, Experiments with Weka - filters, discretization

UNIT III DATA MINING KNOWLEDGE REPRESENTATION 9

Task relevant data, Background knowledge, Representing input data and output knowledge, Visualization techniques; Attribute-oriented analysis: Attribute generalization, Attribute relevance, Class comparison, Statistical measures.

UNIT IV DATA MINING ALGORITHMS - ASSOCIATION RULES 9

Motivation and terminology, Example: mining weather data, Basic idea: item sets, generating item sets and rules efficiently, Efficient and scalable frequent item set mining methods: Apriori algorithm, FP-Growth algorithm, Correlation analysis

UNITV DATA MINING ALGORITHMS – CLASSIFICATION & PREDICTION 9

Basic learning/mining tasks, inferring rudimentary rules: 1R, algorithm, Decision trees, covering rules; Prediction: The prediction task, Statistical (Bayesian) classification, Bayesian networks, Instance-based methods (nearest neighbor), linear models.

Total: 45 Periods

Text Books :

1. Ian H. Witten, Eibe Frank, and Mark A. Hall, Christopher Pal, “Data Mining: Practical Machine Learning Tools and Techniques” Morgan Kaufmann Publishers, 4th Edition, 2017
2. George E. P. Box, Gwilym M. Jenkins, Gregory C. Reinsel, Greta M. Ljung. “Time Series Analysis, Forecasting and Control”, John Wiley, 5th Edition, 2015.

Reference Books :

1. Jiawei Han and Micheline Kamber, “Data Mining: Concepts and Techniques”, Morgan Kaufmann Publishers, 3rd Edition 2012.
2. 2. A. Colin Cameron and Pravin K. Trivedi, “Regression Analysis of Count Data”, Cambridge University Press, 2nd Edition, 2013

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes(PSOs)															
COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	1	1									3	1	
CO2	3	2	2	1	2						2	2	3	1	
CO3	3	2	1	1									3	1	
CO4	3	3	2	1	2	1		1			1	2	3	1	
CO5	3	3	2	2	2	1		1			3	2	3	1	
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom’s Level	**Assessment Component**	**Marks**	**Total marks**
Apply	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom’s Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE-I (7.5)	**IAE-II (7.5)**	**IAE-III (10)**	
Remember	10	10	10	10
Understand	20	20	10	30
Apply	20	20	20	40
Analyze	0	0	10	20
Evaluate	0	0	0	0
Create	0	0	0	0

SEMESTER VII

20ITE47	**INFORMATION RETRIEVAL TECHNIQUES**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
Nature of Course	Professional Elective				
Pre requisites	Data base Management systems				

Course Objectives

The course is intended to

1. Infer the basics of Information Retrieval.
2. Recognise suitable models for Retrieval evaluation.
3. Get exposed with machine learning techniques for text classification and clustering.
4. Understand various search engine system operations.
5. Explore different techniques of recommender system.

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1.	Comprehend the concepts of Information retrieval.	Understand
CO2.	Identify suitable models for Retrieval evaluation.	Understand
CO3.	Apply appropriate method of classification or clustering.	Apply
CO4.	Use an open source search engine framework and explore its capabilities	Analyze
CO5.	Implement a recommender system.	Understand

Course Contents

UNIT I INTRODUCTION 9

Information Retrieval – Early Developments – The IR Problem – The User's Task – Information versus Data Retrieval - The IR System – The Software Architecture of the IR System – The Retrieval and Ranking Processes - The Web – The e-Publishing Era – How the web changed Search – Practical Issues on the Web – How People Search – Search Interfaces Today – Visualization in Search Interfaces.

UNIT II MODELING AND RETRIEVAL EVALUATION 9

Basic IR Models - Boolean Model - TF-IDF (Term Frequency/Inverse Document Frequency) Weighting - Vector Model – Probabilistic Model – Latent Semantic Indexing Model – Neural Network Model – Retrieval Evaluation – Retrieval Metrics – Precision and Recall – Reference Collection – User-based Evaluation – Relevance Feedback and Query Expansion – Explicit Relevance Feedback.

UNIT III TEXT CLASSIFICATION AND CLUSTERING 9

A Characterization of Text Classification – Unsupervised Algorithms: Clustering – Naïve Text Classification – Supervised Algorithms – Decision Tree – k-NN Classifier – SVM Classifier – Feature Selection or Dimensionality Reduction – Evaluation metrics – Accuracy and Error – Organizing the classes – Indexing and Searching – Inverted Indexes – Sequential Searching – Multi-dimensional Indexing.

UNIT IV WEB RETRIEVAL AND WEB CRAWLING 9

The Web – Search Engine Architectures – Cluster based Architecture – Distributed Architectures – Search Engine Ranking – Link based Ranking – Simple Ranking Functions – Learning to Rank – Evaluations -- Search Engine Ranking – Search Engine User Interaction – Browsing – Applications of a Web Crawler – Taxonomy – Architecture and Implementation – Scheduling Algorithms – Evaluation.

UNIT V RECOMMENDER SYSTEM 9

Recommender Systems Functions – Data and Knowledge Sources – Recommendation Techniques – Basics of Content-based Recommender Systems – High Level Architecture – Advantages and Drawbacks of Content-based Filtering – Collaborative Filtering – Matrix factorization models – Neighbourhood models.

Total: 45 Periods

TEXT BOOKS:

1. Ricardo Baeza-Yates and BerthierRibeiro-Neto, —Modern Information Retrieval: The Concepts and Technology behind Search, Second Edition, ACM Press Books, 2011.
2. Ricci, F, Rokach, L. Shapira, B.Kantor, —Recommender Systems Handbook‖, First Edition, 2011.

REFERENCE BOOKS:

1. C. Manning, P. Raghavan, and H. Schütze, —Introduction to Information Retrieval, Cambridge University Press, 2008.
2. Stefan Buettcher, Charles L. A. Clarke and Gordon V. Cormack, —Information Retrieval: Implementing and Evaluating Search Engines, The MIT Press, 2010.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes(PSOs)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1	1									3	1	
CO2	3	2	2	1									3	1	
CO3	3	2	1	1								2	3	1	
CO4	3	3	2	1							1	2	3	1	
CO5	3	3	2	2									3	1	
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Apply	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE-I (7.5)	**IAE-II (7.5)**	**IAE-III (10)**	
Remember	10	10	10	10
Understand	20	20	10	30
Apply	20	20	20	40
Analyze	0	0	10	20
Evaluate	0	0	0	0
Create	0	0	0	0

20ITE48	ONLINE AND REAL TIME SYSTEMS	L	T	P	C
		3	0	0	3
Nature of Course	Professional Core				
Pre requisites	Operating systems				

Course Objectives

The course is intended to

1. Understand the features of a real-time application
2. Explain different task scheduling algorithms in real-time systems
3. Discuss different fault-tolerance techniques available for real- time systems
4. Explain the use of simulated software to develop and test the fault tolerant models
5. Describe the concept of embedded systems

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1.	Understand the requirements of a real-time application	Understand
CO2.	Analyze the performance of different task scheduling algorithms for real-time systems.	Analyze
CO3.	Understand the basic concepts of fault-tolerance and different fault-tolerance techniques available for real- time systems	Understand
CO4.	Use simulated software to develop and test different fault tolerant models	Apply
CO5.	Understand the concept of embedded systems	Understand

Course Contents

UNIT I INTRODUCTION TO REAL-TIME SYSTEMS 9

Introduction to Real-Time systems, applications of Real-Time systems, basic model of Real-Time systems, characteristics of Real-Time systems, types of Real-Time systems: hard, firm, soft, timing constraints, modelling timing constraints

UNIT II REAL-TIME TASK SCHEDULING 9

Real-Time task scheduling: basic concepts, clock driven scheduling, table driven scheduling, cyclic, schedulers, hybrid schedulers, event driven scheduling, EDF Scheduling, RMA, DMA, resource sharingamong RT tasks, Priority inversion, Priority Inheritance Protocol, Highest Locker Protocol, Priority Ceiling Protocol.

UNIT III FAULT TOLERANT COMPUTING 9

Introduction to Fault Tolerant Computing: Basic concepts and Fault tolerant scheduling of tasks Faults and their manifestations, Fault/error modelling, Reliability, availability and maintainability analysis, System evaluation, performance reliability trade-offs. System level fault diagnosis, Hardware and software redundancy techniques. Fault tolerant system design methods. Fault injection methods, Software fault tolerance, testing of fault tolerant software, fault modeling

UNIT IV REAL-TIME EMBEDDED SYSTEM 9

Real-Time Embedded system, Need of well tested and debugged RTOS, Introduction to C/OS II. Case Studies of programming with RTOS: Smart card embedded system, Hardware and Software co-design: specification and design of an embedded system use of software tools for development of an embedded system. Recent advances in embedded applications.

UNIT V DESIGN OF RTS 9

Design of RTS – General Introduction: Introduction, Specification Document, Preliminary Design, Single-Program Approach, Foreground/Background System. RTS Development Methodologies: Introduction, Yourdon Methodology, Ward and Mellor Method, Hately and Pirbhai Method.

Total: 45 Periods

Text Books :

1. P. A. Laplante, Real-Time Systems Design & Analysis, Willey , 2011
2. R. Mall, Real-Time Systems, Pearson , 2007

Reference Books :

1. Real-Time Computer Control, by Stuart Bennet, 2nd Edn. Pearson Education. 2008.
2. R. Kamal, Embedded System Architecture, Programming and Design, Tata McGraw Hill , 2007
3. S. V. Iyer& P. Gupat, Embedded Real-Time System Programming, Tata McGraw Hill , 2004

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes(PSOs)															
COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	1	1									3	1	
CO2	3	2	2	1									3	1	
CO3	3	2	1	1									3	1	
CO4	3	3	2	1									3	1	
CO5	3	3	2	2									3	1	
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Apply	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE-I (7.5)	**IAE-II (7.5)**	**IAE-III (10)**	
Remember	10	10	10	10
Understand	20	20	10	30
Apply	20	20	20	40
Analyze	0	0	10	20
Evaluate	0	0	0	0
Create	0	0	0	0

SEMESTER VIII

20ITE49	OPTIMIZATION BASED DATA ANALYSIS	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Introduction to data analytics				

Course Objectives

The course is intended to

1. Discover the basic concepts and techniques of optimization theory.
2. Have a thorough understanding of how optimization problems are solved
3. Be familiar with various Stochastic algorithms
4. Acquire knowledge on Regression.
5. Provide the background required to use the methods in research work

Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1.	Recognize the foundations of convex optimization	Understand
CO2.	Apply the appropriate Optimization strategy for any given problem	Apply
CO3.	Suggest the appropriate algorithms for the various types of problem	Apply
CO4.	Identify various regression models	Understand
CO5.	Realize the linear representations	Apply

Course Contents

UNIT I FOUNDATIONS OF CONVEX OPTIMIZATION 9

Convex optimization, Convex sets and functions, duality, optimality conditions, Optimization algorithms, Gradient descent, subgradient method, proximal methods, coordinate descent.

UNIT II SPARSE MODELS AND RANDOM PROJECTIONS 9

Sparse models and denoising, Frequency representations, wavelets, pursuit methods, thresholding, total variation, Random projections: Dimensionality reduction, compressed sensing

UNIT III STOCHASTIC ALGORITHMS 9

Stochastic algorithms, SGD, with and without moment convex, strongly convex, with proofs. Stochastic variance reduced methods (SAGA, SVRG) with numerical tricks: lazy updating, sparse tricks, and Constrained optimization: Duality, dual certificates, compressed sensing, matrix completion

UNIT IV SUPER RESOLUTION AND SPARSE REGRESSION 9

Super-resolution: Prony's method, subspace methods, optimization - based super-resolution - Sparse regression Linear regression, the lasso, the elastic net, the group lasso

UNIT V LEARNING REPRESENTATIONS 9

Learning representations: K means, PCA, nonnegative matrix fact. sparse PCA, dictionary learning **,** Low-rank models: Matrix completion, robust PCA

Total: 45 Periods

Text books:

1. Kalyanmoy, Deb. Optimization for engineering design: Algorithms and examples. Prentice-Hall of India Pvt. Limited, 2012.
2. S. Boyd and L. Vandenberghe, Convex Optimization, Cambridge University Press, 2004.

References:

1. Chong, Edwin KP, and Stanislaw H. Zak. An introduction to optimization. John Wiley & Sons, 2004.
2. Sra, Nowozin, Wright (eds). Optimization for Machine Learning. MIT Press. 2011
3. Bubeck. Convex Optimization: Algorithms and Complexity. In Foundations and Trends in Machine Learning. 2015

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1										3	1	
CO2	3	2	1										3	1	
CO3	3	2	2	1									3	1	
CO4	3	2	2	1									3	1	
CO5	3	2	2	1									3	1	
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Apply	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE-I (7.5)	**IAE-II (7.5)**	**IAE-III (10)**	
Remember	10	10	10	10
Understand	20	20	20	50
Apply	20	20	20	40
Evaluate				
Create				

20ITE50	WEB DATABASE AND INFORMATION SYSTEMS	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Database & Web Technology				

Course Objectives

The course is intended to

1. Understand the fundamentals of Databases
2. Infer the concepts of web architecture
3. Import knowledge on the various scenarios based on Client & Server Side Web Technology
4. implement the design of Databases
5. Recognize the concepts of Transaction Management

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1.	Understand the fundamentals of Databases	Understand
CO2.	Comprehend the concepts of web architecture	Understand
CO3.	Identify various scenarios based on Client & Server Side Web Technology	Apply
CO4.	Use various data base design concepts for specific applications	Analyze
CO5.	Perform suitable Transaction Management	Analyze

Course Contents

UNIT I INTRODUCTION TO DATABASES 9

Introduction to Databases, Physical Level of Data Storage, Structure of relational databases, Review of SQL Create, Insert, Update, Delete and Select Statements, Overview of NoSQL databases

UNIT II WEB ARCHITECTURE & INTRODUCTION 9

Motivation, characteristics and complexities of web applications, Basics, of Web Server and Application server, differences between web application and conventional software, architecture layers.

UNIT III CLIENT & SERVER SIDE WEB TECHNOLOGY 9

Client Side Web Technology - SGML, HTML 5, DHTML, CSS, Java script . Server Side Web Technology - PHP, Database Connectivity with PHP

UNIT IV DATABASE DESIGN 9

Entity type, Attributes, Relation types, Notations, Constraints, Extended ER Features. Relational Model and Structured Query Language - SQL: Data Definition and Data Manipulation, Relational Algebra. Procedural Language - PL/SQL: Stored Procedures, Functions, Cursors, Triggers. Normalisation - Data Dependencies, 2NF, 3NF, BCNF, building normalised databases

UNIT V TRANSACTION MANAGEMENT 9

Transactions, Concurrency, Recovery, Security

Total: 45 Periods

TEXTBOOKS

1. Henry F Korth, Abraham Silberschatz, S. Sudurshan, Database system concepts, 5th Edition, McGraw-Hill,2006
2. Ramez Elmasri , Shamkant B. Navathe , Fundamentals of Database Systems, 4th Edition, Pearson Education, 2006

REFERENCE BOOKS

1. Ramakrishnan, Gehrke, Database Management Systems, Mcgraw-Hill, 3rd Edition, Addison-Wesley,2006
2. "PHP and MYSQL Web Development" by Luke Welling and Laura Thomson(Pearson Education).

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes(PSOs)															
COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	1	1									3	1	
CO2	3	2	2	1									3	1	
CO3	3	2	1	1									3	1	
CO4	3	3	2	1									3	1	
CO5	3	3	2	2									3	1	
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Apply	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE-I (7.5)	**IAE-II (7.5)**	**IAE-III (10)**	
Remember	10	10	10	10
Understand	20	20	10	30
Apply	20	20	20	40
Analyze	0	0	10	20
Evaluate	0	0	0	0
Create	0	0	0	0

SEMESTER V

20ITE61	**PROGRAMMING THE IoT**	**L**	**T**	**P**	**C**
		2	**0**	**2**	**3**
Nature of Course	Professional Elective				
Pre requisites	Introduction to IoT				

Course Objectives

The course is intended to

1. Discuss the characteristics, physical and logical design of IoT.
2. Explore on use of various hardware and sensing technologies to build IoT applications.
3. Be familiar with the architecture of Internet of Things and python.
4. Understand the working with python on intel galileo gen
5. Explore on Interacting with digital outputs with python

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	**Course Outcome**	**Bloom's Level**
CO1.	Illustrate the whole process line of extracting knowledge from data about the Internet of Things.	Understand
CO2.	Design and implementation of methods involved in IoT.	Apply
CO3.	Discover the architecture of Internet of Things and python.	Understand
CO4.	Analyze the Working of python on Intel Galileo gen	Analyze
CO5.	Identify common approaches used for Feature Generation of IoT	Apply

Course Contents

UNIT I INTRODUCTION TO INTERNET OF THINGS (IoT) 9

Definition and characteristics of IoT, physical design of IoT, logical design of IoT, IoT enabling technologies, IoT levels and deployment, domain specific IoTs.

UNIT II IoT AND M2M 9

Introduction, M2M, difference between IoT and M2M, software defined networking (SDN) and network function virtualization (NFV) for IoT, basics of IoT system management with NETCONF-YANG.

UNIT III IOT ARCHITECTURE AND PYTHON 9

IoT Architecture: State of the art introduction, state of the art; Architecture reference model: Introduction, reference model and architecture, IoT reference model. Logical design using Python: Installing Python, Python data types and data structures, control flow, functions, modules, packages, file handling.

UNIT IV WORKING WITH PYTHON ON INTEL GALILEO GEN 9

Setting up the board to work with Python as the programming language, Retrieving the board's assigned IP address, Connecting to the board's operating system, Installing and upgrading the necessary libraries to interact with the board, Installing pip and additional libraries, Invoking the Python interpreter.

UNIT V INTERACTING WITH DIGITAL OUTPUTS WITH PYTHON 9

Turning on and off an onboard component, Prototyping with breadboards, Working with schematics to wire digital outputs, Counting from 1 to 9 with LEDs, Python code and the mraa library, Taking advantage of object-oriented code to control digital outputs, Improving our object-oriented code to provide new features, Isolating the pin numbers to improve wirings, Controlling digital outputs with the wiring-x86 library..

Total : 45 Periods

TEXTBOOKS:

1. Arshdeep Bahga, Vijay Madisetti, —Internet of Things: A Hands-on-Approachǁ, VPT, 2014.
2. Matt Richardson, Shawn Wallace, —Getting Started with Raspberry Piǁ, O'Reilly (SPD), 3rd Edition, 2014

REFERENCE BOOK:

1. Adrian McEwen, Hakim Cassimally, —Designing the Internet of Thingsǁ, John Wiley and Sons, 1st Edition, 2014.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes(PSOs)															
COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	1	1									3	1	
CO2	3	2	2	1	2						2	2	3	1	
CO3	3	2	1	1									3	1	
CO4	3	3	2	1	2	1		1			1	2	3	1	
CO5	3	3	2	2	2	1		1			3	2	3	1	
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Apply	Classroom or Online Quiz	5	15
Understand	Class Presentation / Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE-I (7.5)	**IAE-II (7.5)**	**IAE-III (10)**	
Remember	10	10	10	10
Understand	20	20	10	30
Apply	20	20	20	40
Analyze	0	0	10	20
Evaluate	0	0	0	0
Create	0	0	0	0

20ITE62	DEVELOPING INDUSTRIAL IOT	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Introduction to IOT				

Course Objectives

The course is intended to

1. Acquire knowledge about the Industry 4.0
2. Be familiar with the IoT uses in Industry
3. Develop the knowledge in IOT Analytics
4. Implement IOT in Security
5. Explain the concepts of Service Layer Protocols & Security

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1.	Determine the concepts of Industry 4.0	Understand
CO2.	Apply the IoT uses in Industry	Apply
CO3.	Realize the concept of IOT Analytics	Apply
CO4.	Employ IOT in Security	Analyze
CO5.	Implement the concepts of Service Layer Protocols & Security	Analyze

Course Contents

UNIT 1 INDUSTRY 4.0 **9**

Cyber Physical Systems and Next Generation Sensors, Collaborative Platform and Product Life cycle Management, Augmented Reality and Virtual Reality, Artifical Intelligence, Big Data and Advanced Analysis

UNIT 2 INDUSTRIAL IoT **9**

IIoT-Introduction, Industrial IoT: Business Model and Reference Architecture: IIoT -Business Models, Industrial IoT- Layers: IIoT Sensing, IIoT Processing, IIoT Communication, IIoT Networking

UNTI 3 IoT ANALYTICS **9**

Big Data Analytics and Software Defined Networks, Machine Learning and Data Science, Julia Programming, Data Management with Hadoop.

UNIT 4 IoT SECURITY **9**

Industrial IoT: Security and Fog Computing - Cloud Computing in IIoT, Fog Computing in IIoT, Security in IIoT

UNIT 5 CASE STUDY **9**

Industrial IoT- Application Domains: Oil, chemical and pharmaceutical industry, Applications of UAVs in Industries, Real case studies: Milk Processing and Packaging Industries, Manufacturing Industries

Total : 45 Periods

TEXT BOOKS:

1. Industry 4.0: The Industrial Internet of Things", by Alasdair Gilchrist (Apress), 2017
2. "Industrial Internet of Things: Cyber manufacturing Systems"by Sabina Jeschke, Christian Brecher, Houbing Song, Danda B. Rawat (Springer), 2017

REFERENCES BOOKS:

1. Hands-On Industrial Internet of Things: Create a powerful Industrial IoT by Giacomo Veneri, Antonio Capasso, Packt, 2018

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes(PSOs)															
COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	1	1									3	1	
CO2	3	2	2	1	2						2	2	3	1	
CO3	3	2	1	1									3	1	
CO4	3	3	2	1	2	1		1			1	2	3	1	
CO5	3	3	2	2	2	1		1			3	2	3	1	
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Apply	Class room or Online Quiz	5	15
Understand	Class Presentation/ Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE-I (7.5)	**IAE-II (7.5)**	**IAE-III (10)**	
Remember	10	10	10	10
Understand	20	20	10	30
Apply	20	20	20	40
Analyze	0	0	10	20
Evaluate	0	0	0	0
Create	0	0	0	0

20ITE63	IoT and EMBEDDED SYSTEMS	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Introduction to IoT				

Course Objectives

The course is intended to

1. Learn the internal architecture and programming of an embedded processor.
2. Acquire knowledge on Embedded C programming.
3. Manipulate the evolution of Internet of Things (IoT).
4. Build a small low-cost embedded and IoT system using Arduino/Raspberry Pi/ open platform.
5. Apply the concept of Internet of Things in real world scenario.

Course Outcomes

On successful completion Of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1.	Compare various embedded processors.	Understand
CO2.	Deploy embedded C programming	Apply
CO3.	Design simple embedded applications using IoT.	Apply
CO4.	Implement portable IoT using Arduino/Raspberry Pi /open platform.	Analyze
CO5.	Analyze applications of IoT in real time scenario.	Analyze

CourseContents

UNIT I 8-BIT EMBEDDED PROCESSOR 9

8-Bit Microcontroller – Architecture – Instruction Set and Programming – Programming Parallel Ports – Timers and Serial Port – Interrupt Handling.

UNIT II EMBEDDED C PROGRAMMING 9

Memory and I/O Devices Interfacing – Programming Embedded Systems in C – Need For RTOS – Multiple Tasks and Processes – Context Switching – Priority Based Scheduling Policies.

UNIT III IOT AND ARDUINO PROGRAMMING 9

ARM Processor – Introduction to the Concept of IoT Devices – IoT Devices Versus Computers – IoT Configurations – Basic Components – Introduction to Arduino – Types of Arduino – Arduino Tool chain – Arduino Programming Structure – Sketches – Pins –Input/ Output from Pins Using Sketches – Introduction to Arduino Shields – Integration of Sensors and Actuators with Arduino.

UNIT IV IOT COMMUNICATION AND OPEN PLATFORMS 9

IoT Communication Models and APIs – IoT Communication Protocols – Bluetooth – WiFi –ZigBee – GPS – GSM modules – Open Platform (like Raspberry Pi) – Architecture –Programming – Interfacing – Accessing GPIO Pins – Sending and Receiving Signals Using GPIO Pins – Connecting to the Cloud.

UNIT V APPLICATIONS DEVELOPMENT 9

Complete Design of Embedded Systems – Development of IoT Applications – Home Automation – Smart Agriculture – Smart Cities – Smart Healthcare.

Total:45Periods

TEXT BOOKS:

1. Muhammed Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlay, "The 8051 Microcontroller and Embedded Systems", Pearson Education, Second Edition, 2014.
2. Adrian McEwen, Hakim Cassimally "Designing the Internet of Things", John Wiley &Sons, 2014.

REFERENCE BOOKS:

1. Michael J. Pont, "Embedded C", Pearson Education, 2007.
2. Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry, Gonzalo Salgueiro,
3. "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", CISCO Press, 2017.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes(PSOs)															
COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	1	1									3	1	
CO2	3	2	2	1	2						2	2	3	1	
CO3	3	2	1	1									3	1	
CO4	3	3	2	1	2	1		1			1	2	3	1	
CO5	3	3	2	2	2	1		1			3	2	3	1	
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Apply	Class room or Online Quiz	5	15
Understand	Class Presentation /Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE-I (7.5)	**IAE-II (7.5)**	**IAE-III (10)**	
Remember	10	10	10	10
Understand	20	20	10	30
Apply	20	20	20	40
Analyze	0	0	10	20
Evaluate	0	0	0	0
Create	0	0	0	0

SEMESTER VI

20ITE64	EDGE COMPUTING TECHNOLOGIES	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Introduction to IOT				

Course Objectives

The course is intended to

1. Discover the basic concepts of Edge computing.
2. Make the student to understand the architecture and its components and working of components and its performance
3. Be familiar with RaspberryPi uses and connectivity.
4. Acquire knowledge on interfacing techniques for edge computing.
5. Understand the fog computing terminologies.

Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1.	Comprehend the basic concepts of edge computing	Understand
CO2.	Discover the Architecture and Core IOT modules	Understand
CO3.	Implementation of a typical RaspberryPi IOT system	Apply
CO4.	Identify various interfacing techniques for edge computing	Understand
CO5.	Explore the fog computing features	Apply

Course Contents

UNIT I IOT AND EDGE COMPUTING DEFINITION AND USE CASES 9

Introduction to Edge Computing Scenario's and Use cases - Edge computing purpose and definition, Edge computing use cases-hardware architectures, Edge platforms, Edge vs Fog Computing, Communication Models - Edge, Fog and M2M.

UNIT II IOT ARCHITECTURE AND CORE IOT MODULES 9

A connected ecosystem, IoT versus machine-to-machine versus, SCADA, The value of a network and Metcalfe's and Beckstrom's laws, IoT and edge architecture, Role of an architect, Understanding Implementations with examples-Example use case and deployment, Case study – Telemedicine palliative care, Requirements, Implementation, Use case retrospective.

UNIT III RASPBERRYPi 9

Introduction, RaspberryPi Board: Hardware Layout and Pinouts, Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming RaspberryPi, Connecting Raspberry Pi via SSH, Remote access tools, Interfacing DHT Sensor with Pi, Pi as Web server, Pi Camera, Image & Video Processing using Pi. Edge computing with RaspberryPi, Industrial and Commercial IoT and Edge.

UNIT IV INTERFACING 9

Implementation of Microcomputer RaspberryPi and device Interfacing, Edge to Cloud Protocols, MQTT, MQTT publish-subscribe, MQTT architecture-state transitions-packet structure-data types, MQTT communication formats, MQTT 3.1.1 working example.

UNIT V INTRODUCTION TO FOG COMPUTING 9

Fog Computing, Characteristics, Application Scenarios, Issues and challenges. Fog Computing Architecture: Communication and Network Model, Programming Models, Fog Architecture for smart cities, healthcare and vehicles. Fog Computing Communication Technologies: Introduction ,IEEE 802.11,4G,5G standards, WPAN, Short-Range Technologies, LPWAN and other medium and Long-Range Technologies.

Total: 45 Periods

TEXT BOOKS:

1. IoT and Edge Computing for Architects - Second Edition, by Perry Lea, Packet Publishing, 2020.
2. Raspberry Pi Cookbook, 3rd Edition, by Simon Monk, O'Reilly Media, Inc., 2019

REFERENCE BOOKS:

1. Fog and Edge Computing: Principles and Paradigms by Rajkumar Buyya, Satish Narayana Srirama, wiley publication, 2019.
2. David Jensen, “Beginning Azure IoT Edge Computing: Extending the Cloud to the Intelligent Edge, MICROSOFT AZURE
3. Fog Computing: Theory and Practice by Assad Abbas, Samee U. Khan, Albert Y. Zomaya.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1										3	1	
CO2	3	2	1										3	1	
CO3	3	2	2										3	1	
CO4	3	2	2										3	1	
CO5	3	2	2										3	1	
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom’s Level	**Assessment Component**	**Marks**	**Total marks**
Apply	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom’s Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE-I (7.5)	**IAE-II (7.5)**	**IAE-III (10)**	
Remember	10	10	10	10
Understand	20	20	20	50
Apply	20	20	20	40
Evaluate				
Create				

20ITE65	IOT AI CLOUD	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Introduction to IoT				

Course Objectives

The course is intended to

1. Discover the knowledge on IoT architecture
2. Acquire knowledge on Sensors and Hardware
3. Have broad understanding of artificial intelligence
4. Be exposed to the Cloud Computing concepts
5. Implement about IOT and cloud

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1.	Comprehend the definition and significance of the Internet of Things	Understand
CO2.	Describe the hardware architecture operation of sensors	Understand
CO3.	Identify the importance of Artificial Intelligence	Apply
CO4.	Explore the concepts of Cloud Computing	Understand
CO5.	Implement IOT in the cloud	Analyze

Course Contents

UNIT-1 INTRODUCTION 9

Introduction to IoT – IoT definition – Characteristics – IoT Complete Architectural Stack – IoT enabling Technologies – IoT Challenges.

UNIT-2 SENSORS AND HARDWARE 9

Sensors and hardware for IoT – Hardware Platforms – Arduino, Raspberry Pi, Node MCU. A Case study with any one of the boards and data acquisition from sensors.

UNIT-3 FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE 9

Introduction, A.I. Representation, Non-AI &AI Techniques, Representation of Knowledge, Knowledge Base Systems, State Space Search, Production Systems, Problem Characteristics, types of production systems, Intelligent Agents and Environments, concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation.

UNIT-4 INTRODUCTION TO CLOUD COMPUTING 9

Cloud Computing – Service Model – Deployment Model- Virtualization Concepts – Cloud Platforms – Amazon AWS – Microsoft Azure – Google APIs.

UNIT-5 IOT AND THE CLOUD 9

IOT and cloud– Role of Cloud Computing in IoT – AWS Components – S3 – Lambda – AWS IoT Core - Connecting a web application to AWS IoT using MQTT- AWS IoT Examples.

Total : 45 Periods

TEXT BOOKS:

1. "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", by Pethuru Raj and Anupama C. Raman, CRC Press.
2. Adrian McEwen, Designing the Internet of Things, Wiley, 2013.

REFERENCE BOOKS:

1. Dr Uttam Kumar, Reskilling with IOT Cloud and AI,CNT Books, 2017

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes(PSOs)															
COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	1	1									3	1	
CO2	3	2	2	1	2						2	2	3	1	
CO3	3	2	1	1									3	1	
CO4	3	3	2	1	2	1		1			1	2	3	1	
CO5	3	3	2	2	2	1		1			3	2	3	1	
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Apply	Class room or Online Quiz	5	15
Understand	Class Presentation / Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE-I (7.5)	**IAE-II (7.5)**	**IAE-III (10)**	
Remember	10	10	10	10
Understand	20	20	10	30
Apply	20	20	20	40
Analyze	0	0	10	20
Evaluate	0	0	0	0
Create	0	0	0	0

20ITE66	INDUSTRIAL IOT MARKETS AND SECURITY	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Introduction to IOT				

Course Objectives

The course is intended to

1. Develop the real life IoT applications using off the shelf hardware and software.
2. Understand various IoT Layers and their relative importance.
3. Study various IoT platforms and Security.
4. Realize the importance of Data Analytics in IoT.
5. Understand the concepts of Design Thinking

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1.	Describe Industrial Internet of Things and Cyber Physical manufacturing.	Understand
CO2.	Demonstrate Cyber Physical and Cyber Manufacturing systems	Understand
CO3.	Describe Architectural design patterns for industrial Internet of Things	Apply
CO4.	Analyse AI and data Analytics for Industrial Internet of Things.	Analyze
CO5.	Evaluation of Workforce and Human Machine Interaction and Application of Industrial Internet of Things	Evaluate

Course Contents

UNIT I MARKET OVERVIEW, KEY SKILLS TO DEVELOP 9

Introduction to IOT, IOT Vs. IIOT, History of IIOT, Components - Sensors, Interface, Networks, People &Process, Hype cycle, IOT Market, Trends& future Real life examples, Key terms – IOT Platform, Interfaces, API, clouds, Data Management Analytics, Mining &Manipulation; Role of IIOT in Manufacturing Processes Use of IIOT in plant maintenance practices, Sustainability through Business excellence tools Challenges & Benefits in implementing IIOT

UNIT II ARCHITECTURES 9

Overview of IOT components ;Various Architectures of IOT and IIOT, Advantages & disadvantages, Industrial Internet - Reference Architecture; IIOT System components: Sensors, Gateways, Routers, Modem, Cloud brokers, servers and its integration, WSN, WSN network design for IOT

UNIT III SENSOR AND INTERFACING 9

Introduction to sensors, Transducers, Classification, Roles of sensors in IIOT , Various types of sensors , Design of sensors, sensor architecture, special requirements for IIOT sensors, Role of actuators, types of actuators. Hardwire the sensors with different protocols such as HART, MODBUS-Serial & Parallel, Ethernet, BACNet , Current, M2M etc

UNIT IV PROTOCOLS AND CLOUD 9

Need of protocols; Types of Protocols, Wi-Fi, Wi-Fi direct, Zigbee, Z wave, Bacnet, BLE, Modbus, SPI , I2C, IIOT protocols –COAP, MQTT,6lowpan, lwm2m, AMPQ IIOT cloud platforms : Overview of cots cloud platforms, predix, thingworks, azure etc. Data analytics, cloud services, Business models: Saas, Paas, Iaa

UNIT V PRIVACY, SECURITY AND GOVERNANCE 9

Introduction to web security, Conventional web technology and relationship with IIOT, Vulnerabilities of IoT, Privacy, Security requirements, Threat analysis, Trust, IoT security tomography and layered attacker model, Identity establishment, Access control, Message integrity, Non-repudiation and availability, Security model for IoT, Network security techniques Management aspects of cyber security

Total: 45 Periods

TEXT BOOKS

1. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118-47347-4, Willy Publications 2. Bernd Scholz-Reiter, Florian
2. HakimaChaouchi, " The Internet of Things Connecting Objects to the Web" ISBN : 978-1- 84821-140-7, Willy Publications Olivier Hersent, David Boswarthick, Omar Elloumi,

REFERENCE BOOKS

1. Five thoughts from the Father of the Internet of Things; by Phil Wainewright - Kevin Ashton
2. How Protocol Conversion Addresses IIoT Challenges: White Paper ByRedLion
3. Dr. Guillaume Girardin , Antoine Bonnabel, Dr. Eric Mounier, 'Technologies Sensors for the Internet of Things Businesses & Market Trends 2014 -2024',Yole Development Copyrights ,2014

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1	1	1	3								3	3	
CO2	3	1	1	1	3								3	3	
CO3	3	1	1	1	3								3	2	
CO4	3	2	1	2	3								3	2	
CO5	3	2	1	1	3								3	2	
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Apply	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE-I (7.5)	**IAE-II (7.5)**	**IAE-III (10)**	
Understand	10	10	10	20
Apply	20	20	20	50
Analyze	20	20	20	20
Evaluate	0	0	0	10
Create	0	0	0	0

SEMESTER VII

20ITE67	DEVELOPING SOLUTIONS WITH AZURE	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Cloud Computing				

Course Objectives

The course is intended to

1. Understand the basics of cloud computing with azure..
2. Explore about azure virtual machines.
3. Familiarize various Microsoft azure storage technologies.
4. Understand the difference between sqldb and azure db,cosmos db.
5. Get familiar with the backup and recovery mechanisms.

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1.	Comprehend the concepts of cloud computing with Microsoft Azure.	Understand
CO2.	Implement azure virtual machines in azure portal	Apply
CO3.	Appraise the principles of Microsoft azure storage technologies.	Analyze
CO4.	Categorize azure databases with sql database.	Evaluate
CO5.	Understand Azure backup and recovery mechanisms.	Understand

Course Contents

UNIT I CLOUD COMPUTING AND MICROSOFT AZURE FUNDAMENTALS 9

Introduction to Azure — Different Segments Saas,Paas,Iaas- Azure Regions and data centers, understanding of Microsoft Azure portal - Introduction to azure services-Windows azure subscription-Setting up a trial subscription.

UNIT II AZURE VIRTUAL MACHINES 9

Operating System Images Supported— Virtual Machine instances-Azure VM types and Pricing-Types of provisioning-disks and images-virtual machine management

UNIT III MICROSOFT AZURE STORAGE 9

Overview of Microsoft azure storage – Storage Account- Replication techniques – Protocols and consistency models – Type of azure storage account-Storage services Blob-Table – Queue - File.

UNIT IV AZURE SQL DATABAE 9

Understanding DB as a service - Difference between sql server and azure sql - Advantages - Cosmos db

UNIT V AZURE BACKUP AND SITE RECOVERY 9

Backup overview-Backup configuration - Backup Server-Site Recovery-Disaster Recovery- Recovery services- Migration

Total: 45 Periods

TEXT BOOKS:

1. Michael Collier ,Robin Shahan ,Fundamentals of Azure, 2nd Edition ,. Pearson,2016
2. Henry Y.H.Li ,Introducing Windows Azure –An Introduction to Cloud Computing using Microsoft Windows Azure, Springer,2012

REFERENCE BOOKS:

1. Zoiner Tejada, Michele LeRoux, Bustamante, Ike Ellis ,Developing Microsoft Azure Solutions, Microsoft press,2018
2. Michael Washam, Rick Rainey ,Implementing Microsoft Azure Infrastructure Solutions, Microsoft press,2018

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1	1	1	3								3	3	
CO2	3	1	1	1	3								3	3	
CO3	3	1	1	1	3								3	2	
CO4	3	2	1	2	3								3	2	
CO5	3	2	1	1	3								3	2	
	3	High				2	Medium					1	Low		

Formative assessment

Bloom's Level	Assessment Component	Marks	Total marks
Apply	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment

Bloom's Category	Continuous Assessment Tests			Final Examination (60)
	IAE-I (7.5)	IAE-II (7.5)	IAE-III (10)	
Understand	10	10	10	20
Apply	20	20	20	50
Analyze	20	20	20	20
Evaluate	0	0	0	10
Create	0	0	0	0

20ITE68	DATA ANALYTICS AND STORAGE	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Big data				

Course Objectives

The course is intended to

1. Describe the methods for data preparation and data understanding
2. Learn the different ways of Data Analysis
3. Understand multivariate data by summarizing it through statistical methods and graphical methods
4. Summarize the insurers use of predictive analytics, data science and Data Visualization
5. Discuss the concept of embedded systems

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1.	Handle missing data in the real world data sets by choosing appropriate methods.	Understand
CO2.	Summarize the data using basic statistics. Visualize the data using basic graphs and plots.	Understand
CO3.	Identify the outliers if any in the data set	Apply
CO4.	Choose appropriate feature selection and dimensionality reduction	Analyze
CO5.	Apply suitable techniques for handling multi-dimensional data.	Analyze

Course Contents

UNIT I INTRODUCTION TO DATA ANALYSIS 9

Module content: Data Analytics lifecycle, Exploratory Data Analysis (EDA)– Definition, Motivation, Steps in data exploration, The basic data types Data Type Portability , Module content: Introduction to Missing data, Traditional methods for dealing with missing data, Maximum Likelihood Estimation – Basics, Missing data handling, Improving the accuracy of analysis.

UNIT II PREPROCESSING BAYESIAN ESTIMATION 9

Introduction to Bayesian Estimation ,Multiple Imputation-Imputation Phase, Analysis and Pooling Phase, Practical Issues in Multiple Imputation, Models for Missing Notation Random Data, Module content: Statistical data elaboration, 1-D Statistical data analysis, 2-D Statistical data Analysis, ND Statistical data analysis.

UNIT III OUTLIER ANALYSIS 9

Module content: Introduction, Extreme Value Analysis, Clustering based, Distance Based and Density Based outlier analysis, Outlier Detection in Categorical Data, Module content: Feature selection algorithms: filter methods, wrapper methods and embedded methods, Forward.

UNIT IV DIMENSIONALITY REDUCTION 9

Module content: Introduction, Principal Component Analysis(PCA), Kernel PCA, Canonical Correlation Analysis, Factor Analysis, Multi dimensional scaling, Correspondence Analysis.

UNIT V FRAMEWORKS AND VISUALIZATION 9

MapReduce – Hadoop, Hive, MapR – Sharding – NoSQL Databases - S3 - Hadoop Distributed file systems – Visualizations - Visual data analysis techniques, interaction techniques; Systems and applications.

Total : 45 Periods

TEXT BOOKS:

1. Charu C. Aggarwal ,"Data Mining The Text book", Springer, 2015
2. Inge Koch, "Analysis of Multivariate and High dimensional data", Cambridge University Press, 2014.

REFERENCE BOOKS:

1. David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", Morgan Kaufmann/Elsevier Publishers, 2013.
2. Charu C. Aggarwal, "Data Classification Algorithms and Applications", CRC press, 2015.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes(PSOs)

COs	POs												PSOs		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	1	1									3	1	
CO2	3	2	2	1	2						2	2	3	1	
CO3	3	2	1	1									3	1	
CO4	3	3	2	1	2	1		1			1	2	3	1	
CO5	3	3	2	2	2	1		1			3	2	3	1	
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Apply	Class room or Online Quiz	5	15
Understand	Class Presentation / Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE-I (7.5)	**IAE-II (7.5)**	**IAE-III (10)**	
Remember	10	10	10	10
Understand	20	20	10	30
Apply	20	20	20	40
Analyze	0	0	10	20
Evaluate	0	0	0	0
Create	0	0	0	0

SEMESTER VIII

20ITE69	IOT COMMUNICATION TECHNOLOGIES	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Introduction to IoT				

Course Objectives

The course is intended to

1. Express Architectural Overview of IoT
2. Describe the IoT Reference Architecture and Real World Design Constraints
3. Be familiar with various IoT Protocols (Datalink, Network, Transport, Session, Service)
4. Implement Transport & Session Layer Protocols
5. Explain the concepts of Service Layer Protocols & Security

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1.	Discover the fundamentals of IoT Architectural	Understand
CO2.	Design the concepts of IoT Reference Architecture and Real world design Constraints	Understand
CO3.	Identify various IoT Protocols	Apply
CO4.	Understand the Transport & Session Layer Protocols	Analyze
CO5.	Explore the concepts of Service Layer Protocols & Security	Understand

Course Contents

UNIT I IOT OVERVIEW **9**

IoT-An Architectural Overview– Building an architecture- M2M and IoT Technology Fundamentals - Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service(XaaS), M2M and IoT Analytics, Knowledge Management

UNIT II REFERENCE ARCHITECTURE **9**

Reference Model and architecture, IoT reference Model - IoT Reference Architecture- Architectural Views, Relevant architectural views. Real-World Design Constraints- Introduction, Technical Design constraints-hardware is popular again, Data representation and visualization, Interaction and remote control.

UNIT III IOT DATA LINK LAYER & NETWORK LAYER PROTOCOLS **9**

PHY/MAC Layer(3GPP MTC, IEEE 802.11, IEEE 802.15), Wireless HART,Z- Wave, Bluetooth Low Energy, Zigbee Smart Energy, DASH7 - Network Layer-IPv4, IPv6, 6LoWPAN, 6TiSCH,ND, DHCP, ICMP, RPL, CORPL, CARP

UNIT IV TRANSPORT & SESSION LAYER PROTOCOL **9**

Transport Layer (TCP, MPTCP, UDP, DCCP, SCTP)-(TLS, DTLS) – Session Layer- HTTP, CoAP, XMPP, AMQP, MQTT

UNIT V SERVICE LAYER PROTOCOLS & SECURITY **9**

Service Layer -oneM2M, ETSI M2M, OMA, BBF – Security in IoT Protocols – MAC 802.15.4, 6LoWPAN, RPL, Application Layer

Total:45 Periods

TEXT BOOKS

1. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Aves and, Stamatis Karnouskos, David Boyle, “From Machine-to-Machine to the Internet ofThings: Introduction to a New Age of Intelligence”, 1st Edition, Academic Press,2014.
2. Vijay Madisetti and ArshdeepBahga, “Internet of Things (A Hands-on-Approach)”, 1st Edition, VPT, 2014

REFERENCE BOOKS

1. Peter Waher, “Learning Internet of Things”, PACKT publishing, BIRMINGHAM – MUMBAI
2. Bernd Scholz-Reiter, Florian Michahelles, “Architecting the Internet of Things”, ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer
3. Daniel Minoli, “Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications”, ISBN: 978-1-118-47347-4, Willy Publications

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes(PSOs)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1	1									3	1	
CO2	3	2	2	1	2						2	2	3	1	
CO3	3	2	1	1									3	1	
CO4	3	3	2	1	2	1		1			1	2	3	1	
CO5	3	3	2	2	2	1		1			3	2	3	1	
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom’s Level	**Assessment Component**	**Marks**	**Total marks**
Apply	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom’s Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE-I (7.5)	**IAE-II (7.5)**	**IAE-III (10)**	
Remember	10	10	10	10
Understand	20	20	10	30
Apply	20	20	20	40
Analyze	0	0	10	20
Evaluate	0	0	0	0
Create	0	0	0	0

20ITE70	CYBER SECURITY IN IOT	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Introduction to security				

Course Objective

The course is intended to

1. Learn the concepts of number theory, cryptographic techniques.
2. Understand integrity and authentication process.
3. Familiarize various cyber threats, attacks, vulnerabilities, defensive mechanisms, security policies and practices
4. Exposed to cyber crimes and offenses
5. Acquire knowledge on Cyber attacks and vulnerabilities.

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1.	Determine the fundamental mathematical concepts related to security.	Understand
CO2.	Employ the cryptographic techniques to real time applications.	Understand
CO3.	Comprehend the authenticated process and integrity, and its implementation	Understand
CO4.	Explore the fundamentals of cybercrimes and the cyber offenses	Understand
CO5.	Realize the cyber threats, attacks, vulnerabilities and its defensive mechanism	Apply

Course Contents

UNIT I INTRODUCTION TO NUMBER THEORY 9

Finite Fields and Number Theory: Modular arithmetic, Euclidian Algorithm, Primality Testing: Fermats and Eulers theorem, Chinese Reminder theorem, Discrete Logarithms.

UNIT II CRYPTOGRAPHIC TECHNIQUES 9

Symmetric key cryptographic techniques: Introduction to Stream cipher, Block cipher: DES, AES,IDEA Asymmetric key cryptographic techniques: principles, RSA, ElGamal, Elliptic Curve cryptography, Key distribution and Key exchange protocols**.**

UNIT III INTEGRITY AND AUTHENTICATION 9

Hash functions, Secure Hash Algorithm (SHA)Message Authentication, Message Authentica- tion Code (MAC), Digital Signature Algorithm : RSA ElGamal based, Cryptographic Hash Functions, Message Authentication Codes, SHA-3 algorithm, Digital Signatures -DSA algorithm.

UNIT IV CYBER CRIMES ,CYBER OFFENSES AND CYBER POLICIES 9

Classification of cybercrimes, planning of attacks, social engineering: Human based, Computer based: Cyberstalking, Cybercafe and Cybercrimes, determining the policy needs, writing security policies , Internet and email security policies, Compliance and Enforcement of policies.

UNITV CYBER THREATS, ATTACKS AND PREVENTION 9

Phishing, Password cracking, Keyloggers and Spywares, DoS and DDoS attacks, SQL Injection Identity Theft (ID) : Types of identity theft, Techniques of ID theft.

Total: 45 Periods

TEXT BOOKS:

1. Cryptography and Network security, William Stallings, Pearson Education, 7th Edition, 2016
2. Cyber Security, Understanding cyber crimes, computer forensics and legal perspectives, Nina Godbole, Sunit Belapure, Wiley Publications, Reprint 2016

REFERENCE BOOKS:

1. Cyber security for Dummies, Brian Underdahl, Wiley, 2011.
2. Cryptography and Network security, Behrouz A. Forouzan ,Debdeep Mukhopadhyay, Mcgraw Hill Education, 2 nd Edition, 2011.
3.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes(PSOs)															
COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	1	1									3	1	
CO2	3	2	2	1	2						2	2	3	1	
CO3	3	2	1	1									3	1	
CO4	3	3	2	1	2	1		1			1	2	3	1	
CO5	3	3	2	2	2	1		1			3	2	3	1	
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Apply	Class room or Online Quiz	5	15
Understand	Class Presentation / Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE-I (7.5)	**IAE-II (7.5)**	**IAE-III (10)**	
Remember	10	10	10	10
Understand	20	20	10	30
Apply	20	20	20	40
Analyze	0	0	10	20
Evaluate				
Create				

SEMESTER V

20ITO01	**SMART AGRICULTURE**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
Nature of Course	Open Elective				
Pre requisites	NIL				

Course Objective

The course is intended to

1. Impart detailed knowledge of Agriculture and its allied branches
2. Facilitate detailed study of various agriculture forestry, Livestock and other allied branches required to raise the income of farmers
3. Provide detailed knowledge of agriculture in India and Indian farmers income generating enterprises
4. Acquire Knowledge dissemination regarding various technique of farming and farming system in India
5. Study of market and marketing of agricultural produce

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	**CourseOutcome**	**Bloom's Level**
CO1.	Explain models of production, supply and demand of agricultural and food products on national and international markets	Understand
CO2.	Understand the concepts of consumer choice and how it affects the farm / ranch level agriculture firm.	Understand
CO3.	Use the macroeconomics aspects of the economy as they affect the agricultural sector.	Apply
CO4.	Apply economics principles to understand the conduct and performance of the agricultural industry.	Analyze
CO5.	Analyze law of utility and market structure, different types of market.	Analyze

Course contents

UNIT I SOIL SCIENCE 9

Nature and origin of soil; soil minerals, classification and composition, soil reaction, soil properties including structure, PH, surface tension and soil nutrient.

UNIT II SENSORS 9

Classification and characteristics, Smart sensors, Colorimetry based detection, MEMS Electrochemical Sensors, Dielectric Soil Moisture Sensors, ISFET, Weather sensors, Proximity Sensors, Signal conditioning and converters

UNIT III ACTUATORS FOR TOOL AUTOMATION 9

A.C.-D.C. Motors, Stepper motor, Solenoid actuators, piezoelectric motors, Electric drives, Hydraulic and Pneumatic actuator, Telemetry: Wireless communication modules and topology, Zig-bee, Bluetooth, LORA, Zero power devices, Energy Harvesting technology.

UNIT IV PLANT HEALTH MONITORING 9

Measurement of leaf health, chlorophyll detection, ripeness level, crop mapping, fertilizing, Drone technology for soil field analysis and assistive operations.

UNIT V TECHNOLOGIES FOR FARMING 9

Water quality monitoring, micro-irrigation system, solar pump and lighting system, Fencing, Android based automation, Agricultural Robots, Standards for agriculture.

Total: 45 Periods

TEXT BOOKS:

1. The nature and properties of Soils: Eurasia Publishing House Ltd, New Delhi Brady, Nyle C. 2016.
2. Measurement Systems; Application and Design: Doeblin, D.O. McGraw Hill, 2008.

REFERENCE BOOKS:

1. Smart Agriculture: An Approach towards Better Agriculture Management: Editor: Prof. Dr. Aqeel-ur-Rehman, OMICS Group, 2015.
2. Practical MEMS: Design of microsystems, accelerometers, gyroscopes, RF MEMS, optical MEMS, and micro fluidic systems: Ville Kaajakari, Small Gear Publishing, 2009.
3. Principles of Industrial Instrumentation: Patranabis. D, Tata McGraw Hill, 2008.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	1										3	1	
CO2	3	2	2	1									3	1	
CO3	3	2	1	1									3	1	
CO4	3	3	2	1									3	1	
CO5	3	3	2	2									3	1	
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom'sLevel	**Assessment Component**	**Marks**	**Total marks**
Apply	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE-I (7.5)	**IAE-II (7.5)**	**IAE-III (10)**	
Remember	10	10	10	10
Understand	20	20	10	30
Apply	20	20	20	40
Analyze	0	0	10	20
Evaluate	0	0	0	0
Create	0	0	0	0

20ITO02	APPLICATION OF MACHINE LEARNING IN INDUSTRIES	L	T	P	C
		3	0	0	3
Nature of Course	Open Elective				
Pre requisites	NIL				

Course Objectives

The course is intended to

1. Infer a solid understanding of what the various algorithms do and when to use them
2. Adapt the approaches to meet different needs specific to a project goal.
3. Discover the Supervised Methods
4. Understand the Applications of Active Learning
5. Import knowledge on Reinforcement Learning

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	CourseOutcome	Bloom's Level
CO1.	Discover the various machine learning algorithms uses	Understand
CO2.	Experiment with unsupervised methods	Understand
CO3.	Deploy the Supervised Methods are Learned in a practical way.	Apply
CO4.	Apply active learning in suitable applications	Apply
CO5.	Build the Program with Reinforcement Learning	Apply

Course Contents:

Unit I INTRODUCTION 9

Overview of Machine Learning field with intro to statistics Data Cleaning, imputation, cross-validation, and interpreting results Probability and Statistics Regression

Unit II UNSUPERVISED METHODS 9

Clustering: Distance Metrics, K-Means, leader, Jarvis-Patrick, hierarchical clustering Clustering: Self-organized maps, EM-algorithm Dimensionality Reduction: PCA, LDA, Sammon's.

Unit III SUPERVISED METHODS 9

Classification: K-NN, naïve Bayes, decision trees, boosting and bagging Classification: Ensemble methods, random Forests Support vector machines Neural networks Introduction to Deep learning

Unit IV APPLICATION AREAS 9

Information retrieval and text mining, and n-grams Recommendation systems Outlier detection Active learning Frequent Pattern mining and APRIORI

Unit V REINFORCEMENT LEARNING 9

PAC learning and VC dimension Genetic algorithms and genetic programming

Total: 45 Periods

TEXT BOOKS:

1. Applied Predictive Modeling by Max Kuhn and Kjell Johnson; 2013. I
2. An Introduction to Statistical Learning and Applications in R by James, Witten, Hastie, Tibshirani; 2014.

REFERENCE BOOKS:

1. Pattern Recognition and Machine Learning by Christopher Bishop; 2007

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes(PSOs)															
COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	1	1									3	1	
CO2	3	2	2	1	2								3	1	
CO3	3	2	1	1									3	1	
CO4	3	3	2	1	2	1		1					3	1	
CO5	3	3	2	2	2	1		1					3	1	
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom'sLevel	**Assessment Component**	**Marks**	**Total marks**
Apply	Class room or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE-I (7.5)	**IAE-II (7.5)**	**IAE-III (10)**	
Remember	10	10	10	10
Understand	20	20	10	30
Apply	20	20	20	40
Analyze	0	0	10	20
Evaluate	0	0	0	0
Create	0	0	0	0

20ITO03	DEEP LEARNING FUNDAMENTALS	L	T	P	C
		3	0	0	3
Nature of Course	Open Elective				
Pre requisites	Introduction to Artificial Intelligence				

Course Objectives

The course is intended to

1. Have knowledge of deep networks evolved from neural network fundamentals.
2. Be familiarize with implementation of deep network architectures
3. Learn the specific deep networks
4. Walk through the fundamentals of specific deep network architectures sequence modeling.
5. Understand the fundamental concepts of autoencoders.

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1.	Recognize how deep networks evolved from neural network fundamentals.	Understand
CO2.	Explore the deep network architectures including convolutional and recurrent	Understand
CO3.	Determine how to map specific deep networks to the write problem.	Apply
CO4.	Walk through the fundamentals of specific deep network architectures sequence modeling.	Understand
CO5.	Drive deep into the concepts of autoencoders.	Apply

Course Contents

UNIT I Foundation of Neural networks and deep learning 9

Neural networks, training, activation functions, loss functions, hyper parameters. Architectural principles and building blocks of deep networks.

UNIT II Deep Network architectures 9

Unsupervised Pretrained Networks, Convolutional neural networks, Recurrent and Recursive neural networks, matching deep networks to the write problem.

UNIT III Convolution Neural Networks 9

Introduction to convolution neural networks: stacking, striding and pooling, applications like image, and text classification.

UNIT IV Sequence Modeling 9

Recurrent Nets: Unfolding computational graphs, recurrent neural networks (RNNs), bidirectional RNNs, encoder-decoder sequence to sequence architectures, deep recurrent networks.

UNIT V Auto encoders 9

Under complete Auto encoder, Regularized Auto encoder, stochastic Encoders and Decoders, Denoising and Contractive Auto encoders.

Total: 45 Periods

TEXT BOOKS:

1. Josh Patterson and Adam Gibson, Deep Learning, O'Reilly Media, Inc,2017.
2. Ian Goodfellow, YoshuaBengio, Aaron Courville, Deep Learning, MIT Press, 2016.

REFERENCE BOOKS:

1. Jeff Heaton, Deep Learning and Neural Networks, Heaton Research Inc, 2015.
2. Nikhil Buduma and Nicholas Lacascio, Fundamentals of Deep Learning, O'Reilly Media, Inc,2017.
3. Mindy L Hall, Deep Learning, VDM Verlag, 2011

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1										3	1	
CO2	3	2	1										3	1	
CO3	3	2	2										3	1	
CO4	3	2	2										3	1	
CO5	3	2	2										3	1	
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Apply	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE-I (7.5)	**IAE-II (7.5)**	**IAE-III (10)**	
Remember	10	10	10	10
Understand	30	30	30	60
Apply	10	10	10	30
Evaluate	0	0	0	0
Create	0	0	0	0

SEMESTER VI

20ITO04	DATA ANALYTICS FOR IOT	L	T	P	C
		3	0	0	3
Nature of Course	Open Elective				
Pre requisites	Introduction to Database				

CourseObjectives

Thecourseis intended to

1. Understand the fundamentals of IoT
2. Recognize the concepts of data analytics
3. Be familiar with searching the IoT
4. Realize the development tools for IoT
5. Implement the concepts of Scheduling, Metering and Service Delivery

CourseOutcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1.	Comprehend the fundamentals of IoT	Understand
CO2.	Recognize the data analytics for IoT	Understand
CO3.	Identify various scenarios for searching the IoT	Apply
CO4.	Use the tools for IoT applications	Analyze
CO5.	PerformScheduling, Metering and Service Delivery	Analyze

Course Contents

UNIT I INTRODUCING IOT ANALYTICS 9

Introduction IoT Data and BigData, Challenges of IoT, Analytics ,Applications ,IoT Analytics Lifecycle and Techniques , Cloud-based IoT Platform IaaS, PaaS and SaaS Paradigms Requirements of IoT , BigData Analytics Platform ,Functional Architecture

UNIT II DATA ANALYTICS FOR THE IOT 9

Characteristics of IoT Generated Data Data Analytic Techniques and Technologies Data Collection Using Low-power, Long-range Radios Architecture and Deployment Low-cost LoRa Implementation.

UNIT III SEARCHING THE INTERNET OF THINGS 9

A Search Architecture for Social and Physical Sensors Search engine for Multimedia environment generated contenT (SMART) Challenges in Building an IoT Search Engine Local Event Retrieval Social Sensors for Local Event Retrieval Problem Formulation A Framework for Event Retrieval.

UNIT IV DEVELOPMENT TOOLS FOR IOT ANALYTICS APPLICATIONS 9

The VITAL Architecture for IoT Analytics Applications VITAL Development Environment VITALNodes Development Examples.An Open Source Framework for IoT Analytics as a Service.

UNIT V SCHEDULING, METERING AND SERVICE DELIVERY 9

Scheduler Service Delivery & Utility Manager Sensing-as-a-Service Data Capturing and Flow Description Semantic Annotation of Sensor Data Registering Sensors to LSM Pushing Data to LSM Service Definition and Deployment Using Open IoT Tools Visualizing the

Total: 45 Periods

TEXTBOOKS

1.John Soldatos, "Building Blocks for IoT Analytics - Internet-of-Things Analytics " River Publishing 2017

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes(PSOs)															
COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	1	1									3	1	
CO2	3	2	2	1	2						2	2	3	1	
CO3	3	2	1	1									3	1	
CO4	3	3	2	1	2	1		1			1	2	3	1	
CO5	3	3	2	2	2	1		1			3	2	3	1	
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Apply	Classroom or Online Quiz	5	15
Understand	Class Presentation/ Power point presentation	5	
	Attendance	5	

SummativeAssessment				
Bloom's Category	**ContinuousAssessmentTests**			**Final Examination (60)**
	IAE-I (7.5)	**IAE-II (7.5)**	**IAE-III (10)**	
Remember	10	10	10	10
Understand	20	20	10	30
Apply	20	20	20	40
Analyze	0	0	10	20
Evaluate	0	0	0	0
Create	0	0	0	0

20ITO05	ROBOT LEARING	L	T	P	C
		3	0	0	3
Nature of Course	Open Elective				
Pre requisites	Introduction to Learning				

Course Objectives

The course is intended to

1. Understand the basic concepts associated with the design, functioning, applications and social aspects of robots
2. Acquire knowledge about the electrical drive systems and sensors used in robotics for various applications
3. Import knowledge about analyzing robot kinematics, dynamics through different methodologies and study various design aspects of robot arm manipulator and end-effector
4. Realize various motion planning techniques and the associated control architecture.
5. Discover the implications of AI and other trending concepts of robotics

Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1.	Recognize the concepts of industrial robots in terms of classification, specifications and coordinate systems, along with the need and application of robots & automation	Understand
CO2.	Examine different sensors and actuators for applications like maze solving and self driving cars.	Apply
CO3.	Design a 2R robot & an end-effector and solve the kinematics and dynamics of motion for robots	Apply
CO4.	Identify the navigation and path planning techniques along with the control architectures adopted for robot motion planning.	Understand
CO5.	Describe the impact and progress in AI and other research trends in the field of robotics	Understand

Course Contents

UNIT I FOUNDATION 9

Introduction - brief history, definition, anatomy, types, classification, specification and need based applications; role and need of robots for the immediate problems of the society, future of mankind and automation-ethical issues; industrial scenario local and global, case studies on mobile robot research platform and industrial serial arm manipulator

UNIT II BUILDING BLOCKS OF A ROBOT 9

Types of electric motors - DC, Servo, Stepper; specification, drives for motors - speed & direction control and circuitry, Selection criterion for actuators, direct drives, non-traditional actuators; Sensors for localization, navigation, obstacle avoidance and path planning in known and unknown environments – optical, inertial, thermal, chemical, biosensor, other common sensors; Case study on choice of sensors and actuators for maze solving robot and self driving cars

UNIT III KINEMATICS, DYNAMICS AND DESIGN OF ROBOTS 9

Robot kinematics - Geometric approach for 2R, 3R manipulators, homogenous transformation using D-H representation, kinematics of WMR, Lagrangian formulation for 2R robot dynamics; Mechanical design aspects of a 2R manipulator, WMR; End-effector - common types and design case study.

UNIT IV NAVIGATION, PATH PLANNING AND CONTROL ARCHITECTURE 9

Mapping & Navigation – SLAM, Path planning for serial manipulators; types of control architectures - Cartesian control, Force control and hybrid position/force control, Behaviour based control, application of Neural network, fuzzy logic, optimization algorithms for navigation problems, programming methodologies of a robot

UNIT V RESEARCH TRENDS IN ROBOTICS 9

Application of Machine learning - AI, Expert systems; Tele-robotics and Virtual Reality, Micro & Nanorobots, Unmanned vehicles, Cognitive robotics, Evolutionary robotics, Humanoids

Total: 45 Periods

TEXT BOOKS:

1. Saeed. B. Niku, Introduction to Robotics, Analysis, system, Applications, Pearson educations, 2002
2. Roland Siegwart, Illah Reza Nourbakhsh, Introduction to Autonomous Mobile Robots, MIT Press, 2011

REFERENCES:

1. Richard David Klafter, Thomas A. Chmielewski, Michael Negin, Robotic engineering: an integrated approach, Prentice Hall, 1989
2. Craig, J. J., Introduction to Robotics: Mechanics and Control, 2nd Edition, Addison-Wesley, 1989.
3. K.S. Fu, R.C. Gonzalez and C.S.G. Lee, Robotics: Control, Sensing, Vision and Intelligence, McGraw-Hill, 1987.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1										3	1	
CO2	3	2	1										3	1	
CO3	3	2	2										3	1	
CO4	3	2	2										3	1	
CO5	3	2	2										3	1	
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Apply	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE-I (7.5)	**IAE-II (7.5)**	**IAE-III (10)**	
Remember	10	10	10	10
Understand	20	20	20	50
Apply	20	20	20	40
Evaluate	0	0	0	0
Create	0	0	0	0

20ITO06	AUGMENTED AND VIRTUAL REALITY	L	T	P	C
		2	0	2	3
Nature of Course	Open Elective				
Pre requisites	Introduction to Graphics				

Course Objectives

The course is intended to

1. understand the basic concepts associated with computer vision, computer graphics and human-computer interaction techniques related to VR/AR
2. Acquire knowledge about interactive techniques in Virtual Reality
3. Realize visual computation techniques
4. Be familiar with the various Augmented Reality systems
5. Design and implementation of the hardware that enables VR systems to be built.

Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1.	Comprehend fundamental computer vision, computer graphics and human-computer interaction techniques related to VR/AR.	Understand
CO2.	Recognize geometric modeling and Virtual environment.	Understand
CO3.	Relate and differentiate VR/AR technology	Apply
CO4.	Use various types of Hardware and software in Augmented Reality systems	Analyze
CO5.	Employ Virtual/Augmented Reality applications	Apply

Course Contents

UNIT I INTRODUCTION TO VIRTUAL REALITY 9

Fundamental Concept, Components, Features and Present Development. Computer graphics, Real time CG, Flight Simulation, Virtual environment requirement, benefits, Historical development, Scientific Landmark 3D Computer Graphics: Virtual world space, positioning the virtual observer, perspective projection, human vision, stereo perspective projection, 3D clipping, Colour theory, Simple 3D modelling, Illumination models, Reflection models, Shading algorithms, Radiosity, Hidden Surface Removal, Realism Stereographic image.

UNIT II INTERACTIVE TECHNIQUES 9

Introduction, From 2D to 3D, 3D space curves, 3D boundary representation. Geometrical Transformations: Introduction, Frames of reference, Modeling transformations, Instances, Picking, Flying, Scaling the VE, Collision detection Generic VR system: Virtual environment, Computer environment, VR technology, Model of interaction, VR Systems

UNIT III VISUAL COMPUTATION 9

Animating the Virtual Environment: Introduction, The dynamics of numbers, Linear and Nonlinear interpolation, the animation of objects, linear and non-linear translation, shape & object inbetweening, free from deformation, particle system. Physical Simulation: Introduction, Objects falling in a gravitational field, Rotating wheels, Elastic collisions, projectiles, simple pendulum, springs, Flight dynamics of an aircraft

UNIT IV AUGMENTED AND MIXED REALITY 9

Taxonomy, technology and features of augmented reality, difference between AR and VR, Challenges with AR, AR systems and functionality, Augmented reality methods, visualization techniques for augmented reality, wireless displays in educational augmented reality applications, mobile projection interfaces, marker-less tracking for augmented reality, enhancing interactivity in AR environments, evaluating AR systems

UNIT V DEVELOPMENT TOOLS AND FRAMEWORKS 9

Human factors: Introduction, the eye, the ear, the somatic senses. Hardware: Introduction, sensor hardware, Head-coupled displays, Acoustic hardware, Integrated VR systems. Software: Introduction, Modelling virtual world, Physical simulation, VR toolkits, Introduction to VRML.VR Technology in Film & TV Production

Total: 45 Periods

TEXT BOOKS

1. Burdea, G. C. and P. Coffet. Virtual Reality Technology, Second Edition. Wiley-IEEE Press, 2016.
2. Alan B. Craig, Understanding Augmented Reality, Concepts and Applications, Morgan Kaufmann, 2013.

REFERENCES:

1. Alan Craig, William Sherman and Jeffrey Will, Developing Virtual Reality Applications, Foundations of Effective Design, Morgan Kaufmann, 2009.
2. John Vince, "Virtual Reality Systems ", Pearson Education Asia, 2007.
3. Anand R., "Augmented and Virtual Reality", Khanna Publishing House, Delhi.
4. Adams, "Visualizations of Virtual Reality", Tata McGraw Hill, 2000.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1										3	1	
CO2	3	2	1										3	1	
CO3	3	2	2										3	1	
CO4	3	2	2										3	1	
CO5	3	2	2										3	1	
	3	High				2	Medium					1	Low		

Formative assessment

Bloom's Level	Assessment Component	Marks	Total marks
Apply	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment

Bloom's Category	Continuous Assessment Tests			Final Examination (60)
	IAE-I (7.5)	IAE-II (7.5)	IAE-III (10)	
Remember	10	10	10	10
Understand	20	20	20	50
Apply	20	20	20	40
Evaluate	0	0	0	0
Create	0	0	0	0

SEMESTER VII

20ITO07	WEB DATABASE DEVELOPMENT	L	T	P	C
		2	0	2	3
Nature of Course	Open Elective				
Pre requisites	Database Management systems				

Course Objectives

The course is intended to

1. Discover the basic concepts web database creation.
2. Be familiar with creation of database administrator.
3. Develop a enriched website.
4. Acquire knowledge on database migration.
5. Produce multiple tables and message board.

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1.	Recognize the creation of web page	Understand
CO2.	Produce a database administrator.	Apply
CO3.	Implement a website enrichment	Apply
CO4.	Explore to migrate the database	Understand
CO5.	Build multiple tables and message board	Analyze

Course Contents

UNIT I CREATE WEB PAGE 9

Create and Test a Database and Table, Defining Developer, Administrator, and User- Methods for Developing and Maintaining Databases,Create Web Pages That Interact with Users, Creating the Folder for Holding the Database Pages, Temporary Template, PHP include( ) Function, The Interactive Version of the Template, Connecting to the Database, The PHP Keyword echo,Displaying Error Messages, Hashing the Password, Viewing Members' Records, Users Page,Change and Confirming Password Page.

UNIT II CREATE ADMINISTRATOR 9

Create Login/Logout Functionality for Members andan Administrator-logindb Database and users Table-Removing or Replacing Redundant Menu Buttons-Registration Page and Undesirable Characters-Creating User Levels, Log In, Members-Only Page, Planning Administrator's Role, Login/Logout Function testing,Create an Administration Interface-Revising, editing and deleting, Pagination, planning, search form, final form and editing records.

UNIT III ENRICHING THE WEBSITE 9

Creating a New Database,Importance of Documentation, Extending the Registration Form and Adding a Pull-Down Menu, Adding PayPal Debit/Credit Card Images, Registering Some Members, Amending the Administrator's Header, Searching and Editing Records, Security and Validation: Importing a SQL Dump File, Adding a Title Column to the users Table, Degrees of Security, Validation and Sanitization, A Safer Registration Page.

UNIT IV MIGRATING THE DATABASE 9

Making Last-Minute Changes, A Common Header, Logging Exceptions and Error, Migrating the Database, Backing Up Your Database, Create a Product Catalog, Database and Administration Plan, Connecting to the Database, Displaying the Catalog, Header for the Administrator's Page, Administrator's Search Page.

UNIT V MULTIPLE TABLES AND MESSAGE BOARD 9

Introduction to Multiple Tables, Joining Data from the Two Tables, Printing Online Forms, Create a Message Board, Populating the Members Table, The Form for Posting Quotations, The Comical Quotes Page, Adding Search Facilities, Displaying the Search Results, Enhancing the Message Board.

Total: 45 Periods

TEXT BOOKS:

1. Practical PHP 7,MySQL 8, and MariaDB Website Databases, A Simplified Approach to Developing Database-Driven Websites, Second Edition,—Adrian W. West,Steve Prettyman,2018.

REFERENCE BOOKS:

1. Web Coding & Development All-in-One For Dummies,John Wiley & Sons, Inc ,2018.
2. The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer,Chris Northwood,Manchester, 2018.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1										3	1	
CO2	3	2	1										3	1	
CO3	3	2	2										3	1	
CO4	3	2	2										3	1	
CO5	3	2	2										3	1	
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Apply	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE-I (7.5)	**IAE-II (7.5)**	**IAE-III (10)**	
Remember	10	10	10	10
Understand	20	20	20	50
Apply	20	20	20	40
Evaluate	0	0	0	0
Create	0	0	0	0

20ITO08	SERVICE ORIENTED ARCHITECTURE	L	T	P	C
		3	0	0	3
Nature of Course	Open Elective				
Pre requisites	-				

Course Objectives

The course is intended to

1. Learn fundamentals of XML
2. Provide an overview of Service Oriented Architecture
3. Identify with Web services and their importance
4. Categorize web services standards and technologies
5. Acquire knowledge in service oriented analysis and design for developing SOA based applications

Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1.	Discover the fundamentals of XML	Understand
CO2.	Understand service orientation, benefits of SOA	Understand
CO3.	Realize web services and standards	Understand
CO4.	Use web services extensions to develop solutions	Apply
CO5.	Apply service modeling, service oriented analysis and design for application development	Apply

Course Contents

UNIT I XML **9**

XML document structure – Well-formed and valid documents – DTD – XML Schema – Parsing XML using DOM, SAX – XPath - XML Transformation and XSL – Xquery

UNIT II SERVICE ORIENTED ARCHITECTURE (SOA) BASICS **9**

Characteristics of SOA, Benefits of SOA, Comparing SOA with Client-Server and Distributed architectures –-- Principles of Service Orientation – Service layers

UNIT III WEB SERVICES (WS) AND STANDARDS **9**

Web Services Platform – Service descriptions – WSDL – Messaging with SOAP – Service discovery – UDDI – Service-Level Interaction Patterns – Orchestration and Choreography

UNIT IV WEB SERVICES EXTENSIONS **9**

WS-Addressing - WS-Reliable Messaging - WS-Policy – WS-Coordination – WS -Transactions - WS-Security – Examples

UNIT V SERVICE ORIENTED ANALYSIS AND DESIGN **9**

SOA delivery strategies – Service oriented analysis – Service Modelling – Service oriented design – Standards and composition guidelines -- Service design – Business process design – Case Study

Total: 45 Periods

TEXT BOOKS:

1. Thomas Erl, — Service Oriented Architecture: Concepts, Technology, and Design‖, Pearson Education, 2005
2. Sandeep Chatterjee and James Webber, —Developing Enterprise Web Services: An Architect's Guide‖, Prentice Hall, 2004

REFERENCES:

1. James McGovern, Sameer Tyagi, Michael E Stevens, Sunil Mathew, —Java Web Services Architecture‖, Elsevier, 2003.
2. Ron Schmelzer et al. — XML and Web Services‖, Pearson Education, 2002.
3. Frank P.Coyle, —XML, Web Services and the Data Revolution‖, Pearson Education, 2002

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
COs	**Pos**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	1										3	1	
CO2	3	2	1										3	1	
CO3	3	2	2										3	1	
CO4	3	2	2										3	1	
CO5	3	2	2										3	1	
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Apply	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE-I (7.5)	**IAE-II (7.5)**	**IAE-III (10)**	
Remember	10	10	10	10
Understand	20	20	20	50
Apply	20	20	20	40
Evaluate	0	0	0	0
Create	0	0	0	0

SEMESTER VIII

20ITO09	PATTERN AND ANOMALY DETECTION	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	NIL				

Course Objectives

The course is intended to

1. Understand the concept of a pattern and the basic approach to the development of pattern recognition and machine intelligence algorithms.
2. Apply the knowledge of feature extraction methods, feature evaluation, and data mining on real life.
3. Apply both unsupervised classification methods to detect and characterize patterns in real-world data.
4. Understand the concepts of Neural Networks and Kernel Machine.
5. Perform Anomaly Detection

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	CourseOutcome	Bloom's Level
CO1.	Understand the need and significance of mathematical fundamentals in pattern recognition to solve real-time problems.	Understand
CO2.	Explore on supervised learning algorithms and to apply them for solving problems.	Apply
CO3.	Apply unsupervised techniques for clustering data without prior knowledge	Apply
CO4.	Design pattern recognition models to extract interesting patterns from structured data like graph, syntactic description etc.	Apply
CO5.	Develop the Anomaly Detection system.	Analyze

CourseContents:

Unit I CLASSIFICATION 9

Overview of pattern recognition-Discriminant functions-Supervised learning-Parametric estimation - Maximum likelihood estimation. Bayesian parameter estimation-perceptron algorithm-LMSE algorithm-problems with Bayes approach-Pattern classification by distance functions-Minimum distance pattern classifier.

Unit II UNSUPERVISED CLASSIFICATION 9

Clustering for unsupervised learning and classification-Clustering concept-C-means algorithm-Hierarchical clustering procedures-Graph theoretic approach to pattern clustering Validity of clustering solutions.

Unit III STRUCTURAL PATTERN RECOGNITION 9

Elements off or mal grammars – String generation as pattern description – Recognition of Syntactic description – Parsing - Stochastic grammars and applications – Graph based structural representation.

Unit IV NEURAL NETWORKS AND KERNEL MACHINE 9

Neural network structures for pattern recognition-Neural network based pattern associators– Self organizing networks-Support vector machines (SVM)-Kernel machines, Maximum margin classification, and generalizability and VC (Vapnik – Chervonenkis) dimension.

Unit V ANOMALY DETECTION 9

Developing and Evaluating Anomaly Detection System, Anomaly Detection Vs Supervised Learning; Large Scale Machine Learning: Gradient Descent with Large Dataset: Learning with Large Dataset, Stochastic Gradient Descent, Mini-Batch Gradient Descent, Stochastic Gradient Descent Convergence

Total: 45 Periods

TEXTBOOKS:

1. Duda R.O., and Hart.P.E.,Pattern Classification and Scene Analysis, second edition, Wiley, 2001.
2. Robert J.Schalkoff, Pattern Recognition: Statistical, Structural and Neural Approaches, JohnWiley& Sons Inc., New York, 2007.

REFERENCEBOOKS

1. Trevor H, Robert T,Jerome Friedman, The Elements of Statistical Learning, Springer Series,2017
2. Christopher M Bishop, Pattern Recognition and Machine Learning. Springer. 2011.
3. Statistical pattern Recognition; K. Fukunaga; Academic Press, 2000.
4. Tou and Gonzales, Pattern Recognition Principles, Wesley Publication Company, London, 1974.
5. Morton Nadier and Eric Smith P., Pattern Recognition Engineering, John Wiley & Sons, NewYork, 1993.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes(PSOs)

COs	POs												PSOs		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	1	1									3	1	
CO2	3	2	2	1	2						2	2	3	1	
CO3	3	2	1	1									3	1	
CO4	3	3	2	1	2	1		1			1	2	3	1	
CO5	3	3	2	2	2	1		1			3	2	3	1	
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom'sLevel	**Assessment Component**	**Marks**	**Total marks**
Apply	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE-I (7.5)	**IAE-II (7.5)**	**IAE-III (10)**	
Remember	10	10	10	10
Understand	20	20	10	30
Apply	20	20	20	40
Analyze	0	0	10	20
Evaluate	0	0	0	0
Create	0	0	0	0

20ITO10	BIG DATA AND FOOD SECURITY	L	T	P	C
		3	0	0	3
Nature of Course	Open Elective				
Pre requisites	Introduction to Data science				

Course Objectives

The course is intended to

1. Illustrate initiatives that have encouraged evidence-based decisions in agriculture and food security across the public, private, and academic sectors as well as approaches that have not worked
2. Make the student to understand the food security community assessment
3. Be familiar with data management and mapping tools.
4. Acquire knowledge on food security concepts in big data.
5. Provide insights into how to ensure data collection and its utilization give voice to the people most affected by policies stemming from that data, including farmers and other food producers.

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1.	Comprehend the basic concepts of food security	Understand
CO2.	Realize specific high priority gaps community food security assessment	Apply
CO3.	Identify the barriers impeding quality data collection, analysis, and use in decision-making	Apply
CO4.	Review the various food security concepts in big data	Understand
CO5.	Analyze the food security data and vulnerabilities	Analyze

Course Contents

UNIT I FOOD SECURITY 9

Food security: Hunger and malnutrition, Definition and measurement. Food security model, Food availability. Foreign aid, food aid and development. Global sustainability: environmental impacts of the world food system. Hunger, conflict, government failure and international intervention. Globalization of the food system.

UNIT II COMMUNITY FOOD SECURITY ASSESSMENT 9

Overview of the Assessment Process, Data Collection and Analysis Guide, Profile of Community Socioeconomic and Demographic Characteristics, Profile of Community Socioeconomic and Demographic Characteristics- Profile of Community Food Resources-Assessment of Household Food Security, Food Resource Accessibility, Food Availability, Affordability and Food Production Resources.

UNIT III DATA MANAGEMENT AND MAPPING TOOLS 9

Database and Mapping Systems- Country STAT, DevInfo, GIEWS Workstation, Data Analysis Tools- Markets, Price Volatility and Food Security- Crop Monitoring and Forecasting Tool- Climate Change Impact Too, Data Visualization and Dissemination Tools- Key Indicator Data System (KIDS), Dynamic Atlas- Geo Network Open Source, Methodologies and Initiatives for Food Security Analysis- Integrated Food Security Phase Classifications (IPC). Food Insecurity and Vulnerability Information and Mapping System (FIVIMS).

UNIT IV BIG DATA IN FOOD SAFETY 9

Introduction, Definition, Application of big data in food safety, Data collection in food safety, Data storage and transferring, Data analysis, Examples and future.

UNIT V FOOD SECURITY AND VULNERABILITY 9

Introduction,Comparison of Secondary Sources, Coverage and Limitations,Country-Level Context, Food Security Analysis, Nutrition Analysis, Risk Analysis.

Total: 45 Periods

TEXT BOOKS:

1. Leathers, H.D. and Fosters, P., The World Food Problem: Tackling the Causes of Under nutrition in the Third World, 3rd Edition. Lynne Rienner Publishers, 2004
2. Data management and mapping tools and systems for food security, Paolo Romano Data Management, Analysis and GIS Consultant June 2010, Rome

REFERENCES:

1. Secondary Data Analysis on Food Security and Vulnerability, Wiebke Förch (with Dr. Fouad Fakhoury), World food programme, 2009.
2. Big data in food safety: An overview, Hans J. P. Marvin, Esmée M. Janssen, Yamine Bouzembrak, Peter J. M. Hendriksen & Martijn Staats, Critical Reviews in Food Science and Nutrition,2017
3. Community Food Security Assessment Toolkit By Barbara Cohen, IQ Solutions, Inc. ERS contacts: Margaret Andrews and Linda Kantor. Economic Research Service,2002

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1										3	1	
CO2	3	2	1										3	1	
CO3	3	2	2										3	1	
CO4	3	2	2										3	1	
CO5	3	2	2										3	1	
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Apply	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	**Continuous Assessment Tests**			**Final Examination (60)**
	IAE-I (7.5)	**IAE-II (7.5)**	**IAE-III (10)**	
Remember	10	10	10	10
Understand	20	20	20	50
Apply	20	20	20	40
Evaluate	0	0	0	0
Create	0	0	0	0