

# **B.Tech. Artificial Intelligence and Data Science**

## **CURRICULUM AND SYLLABI**

### **I to VI Semesters**

### **Regulation - 2020**



# **Excêl**

## **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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**DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE**  
**B Tech – Artificial Intelligence and Data Science**  
**REGULATION 2020**  
**I to VIII Semesters Curriculum**

I – SEMESTER									
Code No.	Course	Category	Periods /Week			C	Maximum Marks		
			L	T	P		CA	FE	Total
Theory Course(s)									
20MA103	Mathematics - I for Computing 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
20PH101	Physics for Computing 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	-	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

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II- SEMESTER									
Code No.	Course	Category	Periods /Week			C	Maximum Marks		
			L	T	P		CA	FE	Total
Theory Course(s)									
20MA203	Mathematics - II for Computing Sciences	BS	3	2	0	4	40	60	100
20AI201	Programming and Data Structures	PC	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 Computing Sciences	BS	3	0	2	4	50	50	100
20ME203	Engineering Graphics	ES	1	0	4	3	50	50	100
Practical Course(s)									
20AI202	Programming and Data Structures Laboratory	PC	0	0	4	2	50	50	100
Mandatory Course									
20MC202	Interpersonal Skills	MC	0	0	2	0	100	-	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


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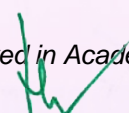
III – SEMESTER									
Code No.	Course	Category	Periods /Week			C	Maximum Marks		
			L	T	P		CA	FE	Total
Theory Course(s)									
20MA303	Discrete Mathematics and Graph Theory	BS	3	2	0	4	40	60	100
20AI301	Foundations of Artificial Intelligence	PC	3	0	0	3	40	60	100
Theory with Practical Course(s)									
20EC306	Digital Logics and Microprocessor	ES	3	0	2	4	50	50	100
20AI302	Operating Systems	PC	3	0	2	4	50	50	100
20AI303	Database Management Systems	PC	3	0	2	4	50	50	100
Practical Course(s)									
20AI304	Intelligent Systems Laboratory	PC	0	0	4	2	50	50	100
Mandatory Course									
20MC301	Environmental Science	MC	2	0	0	0	100	-	100
TOTAL			17	2	10	21	380	320	700

IV – SEMESTER									
Code No.	Course	Category	Periods /Week			C	Maximum Marks		
			L	T	P		CA	FE	Total
Theory Course(s)									
20MA404	Statistical Methods for Data Analysis	BS	3	2	0	4	40	60	100
20AI401	Data warehousing and Data Mining	ES	3	0	0	3	40	60	100
20AI402	Concepts in Data Science	ES	3	2	0	4	40	60	100
20AI403	Formal Languages and Automata Theory	PC	3	0	0	3	40	60	100
20AI404	Object Oriented Programming	PC	3	0	0	3	40	60	100
Practical Course(s)									
20AI405	Data mining Tools Laboratory	PC	0	0	4	2	50	50	100
20AI406	R Programming Laboratory	PC	0	0	4	2	50	50	100
20AI407	Object Oriented Programming Laboratory	PC	0	0	4	2	50	50	100
Mandatory Course									
20MC401	Soft Skills	MC	2	0	0	0	100	-	100
TOTAL			17	4	12	23	450	450	900

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V – SEMESTER									
Code No.	Course	Category	Periods /Week			C	Maximum Marks		
			L	T	P		CA	FE	Total
Theory Course(s)									
20AI501	Data Analytics	PC	3	0	0	3	40	60	100
20AI502	Machine Learning Techniques	PC	3	0	0	3	40	60	100
20AI503	Data Communication and Computer Networks	ES	3	0	0	3	40	60	100
20AIEXX	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)									
20AI504	Object Oriented Analysis and Design	PC	3	0	2	4	50	50	100
Practical Course(s)									
20AI505	Machine Learning Laboratory	PC	0	0	4	2	50	50	100
20AI506	Data Analytics Laboratory	PC	0	0	2	1	50	50	100
20AI507	Data Communication and Computer Networks Laboratory	ES	0	0	4	2	50	50	100
TOTAL			18	0	12	24	400	500	900

VI – SEMESTER									
Code No.	Course	Category	Periods /Week			C	Maximum Marks		
			L	T	P		CA	FE	Total
Theory Course(s)									
20AI601	Professional Ethics and Human Values	HSS	3	0	0	3	40	60	100
20AIEXX	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)									
20AI602	Data Visualization	PC	3	0	2	4	50	50	100
20AI603	IoT Fundamentals and Architecture	PC	3	0	2	4	50	50	100
20AI604	Cloud Computing Services	PC	3	0	2	4	50	50	100
Practical Course(s)									
20AI605	Mini project	EEC	0	0	2	1	50	50	100
20AI606	Internship	EEC	2 Weeks			1	100	-	100
TOTAL			18	0	8	23	420	380	800

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VII – SEMESTER									
Code No.	Course	Category	Periods /Week			C	Maximum Marks		
			L	T	P		CA	FE	Total
Theory Course(s)									
20AI701	Deep Learning Algorithm and Architectures	PC	3	0	0	3	40	60	100
20AI702	Software Testing and Quality Assurance	PC	3	0	0	3	40	60	100
20AIEXX	Professional Elective - III	PE	3	0	0	3	40	60	100
20AIEXX	Professional Elective - IV	PE	3	0	0	3	40	60	100
20YYOXX	Open Elective - III	OE	3	0	0	3	40	60	100
Theory with Practical Course(s)									
20AI703	Cryptography and Network Security	PC	3	0	2	4	50	50	100
Practical Course									
20AI704	Design Project	EEC	0	0	2	1	50	50	100
TOTAL			18	0	4	20	300	400	700

VIII – SEMESTER									
Code No.	Course	Category	Periods /Week			C	Maximum Marks		
			L	T	P		CA	FE	Total
Theory Course(s)									
20AIEXX	Professional Elective - V	PE	3	0	0	3	40	60	100
20AIEXX	Professional Elective - VI	PE	3	0	0	3	40	60	100
Practical Course(s)									
20AI801	Major project	EEC	0	0	20	10	50	50	100
TOTAL			6	0	20	16	130	170	300

  
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Open Electives (OE)									
Code No.	Course	Category	Periods /Week			C	Maximum Marks		
			L	T	P		CA	FE	Total
20AIO01	Game Programming	OE	3	0	0	3	40	60	100
20AIO02	CISCO- Routing and Switching	OE	3	0	0	3	40	60	100
20AIO03	Foundations of Artificial Intelligence	OE	3	0	0	3	40	60	100
20AIO04	Content Based Image and Video Retrieval	OE	3	0	0	3	40	60	100
20AIO05	Mobile Computing	OE	3	0	0	3	40	60	100
20AIO06	Human Computer Interaction	OE	3	0	0	3	40	60	100
20AIO07	Database management System and Administration	OE	3	0	0	3	40	60	100
20AIO08	Advanced Java Programming	OE	3	0	0	3	40	60	100
20AIO09	Soft Computing	OE	3	0	0	3	40	60	100
20AIO10	Data Science for Engineers	OE	3	0	0	3	40	60	100

Professional Electives (PE)									
Stream I : Computer Automation									
Code No.	Course	Category	Periods /Week			C	Maximum Marks		
			L	T	P		CA	FE	Total
20AIE01	Intelligent Information Retrieval	PE	3	0	0	3	40	60	100
20AIE02	Advanced Artificial Intelligence Systems	PE	3	0	0	3	40	60	100
20AIE03	Neural Networks	PE	3	0	0	3	40	60	100
20AIE04	Robotic Process Automation	PE	3	0	0	3	40	60	100
20AIE05	Natural Language Processing	PE	3	0	0	3	40	60	100
20AIE06	Augmented Reality & Virtual Reality	PE	3	0	0	3	40	60	100
20AIE07	Pattern Recognition	PE	3	0	0	3	40	60	100
20AIE08	Statistical Decision Making	PE	3	0	0	3	40	60	100
20AIE09	Computer Vision	PE	3	0	0	3	40	60	100
20AIE10	Geometric Modelling	PE	3	0	0	3	40	60	100



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Stream II : Cyber Security and Forensics									
Code No.	Course	Category	Periods /Week			C	Maximum Marks		
			L	T	P		CA	FE	Total
20AIE21	Cyber Law and Ethics	PE	3	0	0	3	40	60	100
20AIE22	Cyber Forensics	PE	3	0	0	3	40	60	100
20AIE23	Ethical Hacking Fundamentals	PE	3	0	0	3	40	60	100
20AIE24	Secure Cloud Computing	PE	3	0	0	3	40	60	100
20AIE25	Information Security	PE	3	0	0	3	40	60	100
20AIE26	Quantum Cryptography	PE	3	0	0	3	40	60	100
20AIE27	Blockchain and Cryptocurrency Technologies	PE	3	0	0	3	40	60	100
20AIE28	Cyber Crime and Computer Ethics	PE	3	0	0	3	40	60	100
20AIE29	Mobile Application Security	PE	3	0	0	3	40	60	100
20AIE30	Intrusion Detection and Prevention	PE	3	0	0	3	40	60	100

Stream III : Internet of Things									
Code No.	Course	Category	Periods /Week			C	Maximum Marks		
			L	T	P		CA	FE	Total
20AIE41	Principles of Sensors and Signal Conditioning	PE	3	0	0	3	40	60	100
20AIE42	Data Acquisition	PE	3	0	0	3	40	60	100
20AIE43	Wireless sensor Networks	PE	3	0	0	3	40	60	100
20AIE44	EDGE Computing Technologies	PE	3	0	0	3	40	60	100
20AIE45	Mobile Computing	PE	3	0	0	3	40	60	100
20AIE46	Wearable Computing	PE	3	0	0	3	40	60	100
20AIE47	IoT Programming	PE	3	0	0	3	40	60	100
20AIE48	IoT Security and Trust	PE	3	0	0	3	40	60	100
20AIE49	IoT Applications and Web development	PE	3	0	0	3	40	60	100
20AIE50	Industrial IoT	PE	3	0	0	3	40	60	100



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ONE CREDIT COURSES									
Code No.	Course	Category	Periods /Week			C	Maximum Marks		
			L	T	P		CA	FE	Total
20AIA01	Hadoop -Map Reduce	EEC	0	0	2	1	40	60	100
20AIA02	Maya Tool	EEC	0	0	2	1	40	60	100
20AIA03	Tensor Flow	EEC	0	0	2	1	40	60	100
20AIA04	CMS web development	EEC	0	0	2	1	40	60	100
20AIA05	Eclipse	EEC	0	0	2	1	40	60	100
20AIA06	ORANGE Tool	EEC	0	0	2	1	40	60	100
20AIA07	WEKA Tool	EEC	0	0	2	1	40	60	100
20AIA08	Mango DB	EEC	0	0	2	1	40	60	100
20AIA09	Raspberry-Pi	EEC	0	0	2	1	40	60	100
20AIA10	Rapid miner	EEC	0	0	2	1	40	60	100
20AIA11	Embedded Systems in Python	EEC	0	0	2	1	40	60	100
20AIA12	Linux Shell Programming	EEC	0	0	2	1	40	60	100



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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)	14.55%
3	ES	8	3	4	7	5				27 (24)	16.36%
4	PC		5	13	12	13	12	10		65 (48)	39.39%
5	PE					3	3	6	6	18 (18)	10.91%
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%
<b>Total</b>		<b>19</b>	<b>19</b>	<b>21</b>	<b>23</b>	<b>24</b>	<b>23</b>	<b>20</b>	<b>16</b>	<b>165</b>	<b>100.00%</b>

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

  
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<b>20MA103</b>	<b>Mathematics-I for Computing Sciences</b> (Common to CSE, IT and AI & DS)	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>2</b>	<b>0</b>	<b>4</b>
<b>Nature of Course</b>	Basic Sciences				
<b>Pre requisites</b>	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 - Limits 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 Involutives-Envelopes.

#### Unit – IV Ordinary Differential Equations

12

Linear differential equations of second and higher order with constant co-efficient R.H.S is  $\sin x$ ,  $\cos x$ ,  $e^{ax}$ ,  $x^n$  - 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**

  
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**Text Books:**

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

**Reference Books:**

1. Kandasamy P., Thilagavathy K., and Gunavathy K., "Engineering Mathematics", S. Chand & Co.Publishers, 3<sup>rd</sup> Edition, 2019.
2. Weir M.D. and Joel Hass, "Thomas calculus" Pearson Publishers, 12<sup>th</sup> 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	2										3			
CO2	3	3	2										2			
CO3	3	2	2										2			
CO4	3	3	2										3			
CO5	3	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	<b>COMPUTER HARDWARE AND NETWORKING ( Common to CSE, IT and AI)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>Nature of Course</b>	Engineering Sciences				
<b>Pre requisites</b>	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 software. 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 (60)
	IAE1 (7.5)	IAE2 (7.5)	IAE3 (10)	
Remember	10	10	10	20
Understand	20	20	20	50
Apply	20	20	20	30
Analyze				
Evaluate				
Create				

  
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20PH101	<b>Physics for Computing Sciences</b> (Common to CSE, IT and AI & DS)		L	T	P	C
			3	0	2	4
Nature of Course		Basic Sciences				
Pre requisites		Fundamentals of Basic Physics				

**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 elasticity	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**

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**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", 2nd edition, Oxford University Press, 2015.
2. M.N. Avadhanulu, M.N. & Kshirsagar PG. "A Text book of Engineering Physics", 10th edition, S.Chand and company, Ltd., New Delhi, 2014.
3. William D.Callister,Jr and David. G.Bethwisch, "Materials Science and Engineering", 9th edition, John Wiley & Sons, Inc, 2019.

**REFERENCES:**

1. Halliday, D, Resnick, R and Walker, J, "Principles of Physics", 10th edition, Wiley, 2014.
2. Serway, R.A. & Jewett, J.W, "Physics for Scientists and Engineers", 9th edition, Cengage Learning, 2019.
3. Raghavan, V. "Materials Science and Engineering, A First course", 5th edition, PHI Learning, 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	1												
CO2	3	1	1												
CO3	3	2	1												
CO4	3	1	1												
CO5	3		1												
	3	High				2	Medium					1	Low		

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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	30	30	30		-	30
Understand	62	62	62		40	62
Apply	8	8	8		60	8
Analyze						
Evaluate						
Create						



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20CS102	<b>PROBLEM SOLVING USING PYTHON</b> ( Common to all Branches)	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		3	0	2	4
<b>Nature of Course</b>	Engineering Sciences				
<b>Pre requisites</b>	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 Computers & 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 and 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.

  
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**Unit V Tuples, Dictionaries and 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	COMapping	RBT
1	Write a algorithm & draw flowchart for simple computational problems	CO1	Understand
2	Write a program to perform different arithmetic operations on numbers in python.	CO2	Understand
3	Write a python program to implement the various control structures	CO3	Apply
4	Write a python program for computational problems using recursive function.	CO3	Apply
5	Demonstrate use of list for data validation.	CO4	Apply
6	Develop a python program to explore string functions	CO4	Analyze
7	Implement linear search and binary search.	CO4	Apply
8	Develop a python program to implement sorting methods	CO4	Analyze
9	Develop python programs to perform operations on dictionaries.	CO5	Analyze
10	Write a python program to read and write into a file	CO5	Apply

**TOTAL: 30 Periods****Text Books:**

1. ReemaThareja, "Problem Solving and Programming with Python", Oxford University Press, 2018
2. Dr. R. NageswaraRao, "Core Python Programming", Dreamtech Press, 2017 Edition

**Reference Books:**

1. Kenneth A. Lambert, "Fundamentals of Python: First Programs", CENGAGE Learning, 2012
2. Ashok NamdevKamthane, 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

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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 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			20
Understand	20	20	20		30	50
Apply	20	20	20		50	30
Analyze						
Evaluate						
Create						



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20CS103	<b>COMPUTER PRACTICES LABORATORY</b> (Common to CSE , IT and AI)	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>
<b>Nature of Course</b>	Engineering Sciences				
<b>Pre requisites</b>	NA				

**Course Objectives**

The course is intended to

1. Learn the use of basic hardware components
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

**List of Exercises**

S.No	List of Exercises	CO Mapping	RBT
1	Study of mother Board, Power supply, Keyboard and monitors	CO1	Understand
2	Study of Building and Assembling a Desktop PC	CO1	Understand
3	BIOS Setup Utility. Input- Output Ports	CO1	Understand
4	Hard Disk Drive Partitioning and Formatting	CO2	Understand
5	Installing and configuring a DVD Writer	CO3	Apply
6	Installing and configuring Operating System.	CO4	Apply
7	Installing Motherboard Device Drivers OS Platform	CO4	Apply
8	Installing and uninstalling an Application Software.	CO4	Apply
9	Printers and Installation of Printers and scanners and Local Printer sharing	CO5	Apply
10	Workgroup based Network using Operating System.	CO5	Apply

**TOTAL :30 Periods**

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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	3	1									2	3	2
CO2	2	1	3	1									2	3	2
CO3	2	1	3	1									2	3	2
CO4	2	2	3	1									2	3	2
CO5	2	2	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]	Final Examination [50 marks]
Remember		
Understand	20	50
Apply	30	50
Analyze		
Evaluate		
Create		

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20ENE01	<b>COMMUNICATIVE ENGLISH</b> (Common to all B.E. / B.Tech. Programmes)	L	T	P	C
		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 Communication 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 Communication 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, 5<sup>th</sup> Edition, 2007.
2. Board of Editors, "Using English - A Coursebook for Undergraduate Engineers and Technologists", Orient BlackSwan Private Limited, Hyderabad, 2<sup>nd</sup> Edition, 2017.

**Reference Books:**

1. MeenakshiRaman and Sangeetha Sharma, "Technical Communication", Oxford University Press, USA, 10<sup>th</sup> Edition, 2007.
2. John Cunnison Catford, "A Practical Introduction to Phonetics", Clarendon Press, Jamaica, 2<sup>nd</sup> Edition, 2001.
3. Hewings. M, "Advanced English Grammar", Cambridge University Press, Chennai, 3<sup>rd</sup> Edition, 2000.

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4. S P Dhanavel "English and Soft Skills", Orient BlackSwan Private Limited, Hyderabad, 1<sup>st</sup> Edition, 2010.

**Web reference:**

[https://www.googleadservices.com/pagead/aclick?sa=L&ai=DChcSEwjj4dCTucfsAhXE1pYKHch4ABMYABABGgJ0bA&ohost=www.google.com&cid=CAASEuRo76H-Vx9BpazOOBfXeJSKVQ&sig=AOD64\\_3O-HNEnUO4A5sc31MsUfaTBGG-dQ&q&adurl&ved=2ahUKEwjC3ceTucfsAhXBeisKHatIBewQ0Qx6BAgfEAE](https://www.googleadservices.com/pagead/aclick?sa=L&ai=DChcSEwjj4dCTucfsAhXE1pYKHch4ABMYABABGgJ0bA&ohost=www.google.com&cid=CAASEuRo76H-Vx9BpazOOBfXeJSKVQ&sig=AOD64_3O-HNEnUO4A5sc31MsUfaTBGG-dQ&q&adurl&ved=2ahUKEwjC3ceTucfsAhXBeisKHatIBewQ0Qx6BAgfEAE)

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	2		
CO2							1			3	2	2	2		
CO3							1			3	2	2	2		
CO4							1			3	2	2	2		
CO5							1			3	2	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
Analyze						
Evaluate						
Create						

  
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20ENE02	Advanced Communicative English (Common to all B.E./ B.Tech Programmes)	L	T	P	C
		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 - Connotation - 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 Sir. 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: 30Periods**

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**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

**Total: 30 Periods****Text Books**

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

**Reference Books:**

1. Raman M &Sangeetha Sharma, "Technical Communication",Oxford University Press,USA,10<sup>th</sup>Edition,2007.
2. John CunnisonCatford, "A Practical Introduction to Phonetics",Clarendon Press, Jamaica,2<sup>nd</sup> Edition, 2001.
3. Norman Whitby, Business Benchmark - "Pre-Intermediate to Intermediate, Students Book", Cambridge University Press, 1<sup>st</sup> Edition, 2006.
4. DhanavelS. P., "English and Soft Skills", 1<sup>st</sup>Edition,OrientBlackSwan Private Limited, Hyderabad, 1<sup>st</sup> Edition, 2010.

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**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=top\\_button](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=top_button)
2. [blob:https://www.youtube.com/73f7256d-d302-4563-bed5-9e84c94a26ac](https://www.youtube.com/73f7256d-d302-4563-bed5-9e84c94a26ac)

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	2		
CO2										3	1	2	2		
CO3										3	1	2	2		
CO4										3	1	2	2		
CO5										3	1	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						

  
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20MA203	<b>Mathematics – II for Computing Sciences</b> (Common to CSE, IT and AI & DS)	L	T	P	C
		3	2	0	4
<b>Nature of Course</b>	Basic Sciences				
<b>Prerequisites</b>	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**

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**Text Books:**

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

**Reference Books:**

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

**Additional References:**

1. nptel.ac.in/courses/111/105/111105134
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	2	2										1			
CO2	3	2	2										2			
CO3	3	3	2										2			
CO4	3	2	3										2			
CO5	2	3	2										1			
	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				



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<b>20AI201</b>	<b>PROGRAMMING AND DATA STRUCTURES</b> <b>(Common to CSE , IT and AI)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>Nature of Course</b>	Professional Core				
<b>Pre requisites</b>	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

<b>CO.No.</b>	<b>Course Outcome</b>	<b>Bloom's Level</b>
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.

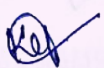
**Unit - IV Non-Linear Data Structures****9**

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**

  
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**Text Books:**

1. Pradip Dey and Manas Ghosh, "Programming in C, Second Edition, Oxford University Press, 2011.
2. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, "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	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				
Create				



20CH201	<b>CHEMISTRY FOR COMPUTING SCIENCES</b> (Common to CSE, IT and AI&DS)	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>2</b>	<b>4</b>
<b>Nature of Course</b>	Basic Sciences				
<b>Prerequisites</b>	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<sub>2</sub>, 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.

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**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, 1<sup>st</sup> Edition, 2017
2. P.C.Jain and Monicka Jain, "Engineering Chemistry", Dhanapat Rai Publishing Company Pvt. Ltd, 2<sup>nd</sup> Edition, 2017.

**Reference Books**

1. B. Sivasankar "Engineering Chemistry" Tata McGraw-Hill Pub.Co.Ltd, New Delhi, 2<sup>nd</sup> Edition, 2009.
2. R. Sivakumar and N. Sivakumar, "Engineering Chemistry" Tata McGraw-Hill Pub.Co.Ltd, New Delhi, 1<sup>st</sup> Edition, 2009.
3. Dr.Sivanesan and Nandagopal, "Engineering Chemistry-I" V. K. Pub. Pvt. Ltd, 2<sup>nd</sup> 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](https://en.wikipedia.org/wiki/Polylactic_acid)


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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	40
Understand	10	20	30		20	40
Apply	10	10	10		10	20
Analyze						
Evaluate						
Create						



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20ME203	Engineering Graphics	L	T	P	C
		1	0	4	3
Nature of Course	Engineering Sciences				
Pre requisites	Nil				

**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
CO 1	Develop the conic sections, special curves, and draw orthographic views from pictorial views.	Apply
CO 2	Apply the principles of orthographic projections of points in all quadrants, lines and planes in first quadrant.	Apply
CO 3	Construct the projections of simple solids like prisms, pyramids, cylinder and cone.	Apply
CO 4	Build the sectional views of solids like cube, prisms, pyramids, cylinders & cones and development of its lateral surfaces.	Apply
CO 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 BOOKS**

1. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 2011
2. Natarajan K.V., "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2012.

**REFERENCE BOOKS**

1. Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 50<sup>th</sup> Edition, 2010.
2. BasantAgarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
3. ParthasarathyN S and Vela Murali, "Engineering Graphics", Oxford University, Press, New Delhi, 2015.

**Web References**

1. [http://nptel.ac.in/courses/112103019/Engineering drawing](http://nptel.ac.in/courses/112103019/Engineering%20drawing)
2. <http://pioneer.netserv.chula.ac.th/~kjiapon/self-practice.html>

**Publication of Bureau of Indian Standards**

1. IS 10711 - 2001: Technical products Documentation - Size and lay out of drawingsheets.
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 only to Final Examinations of 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 (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	2		
CO2	3	2										1	2		
CO3	3	2										1	2		
CO4	3	3										1	2		
CO5	3	2										1	2		
	3	High				2	Medium				1	Low			

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



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20AI202	<b>PROGRAMMING AND DATA STRUCTURES LABORATORY</b> (Common to CSE , IT and AI)				<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
					<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>
<b>Nature of Course</b>	Practical							
<b>Pre requisites</b>	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

**Course Content:****List of Exercises**

S.No	List of Exercises	CO Mapping	RBT
1	Write programs using simple control statements	CO1	Understand
2	Write a program to implement functions and recursive functions.	CO1	Understand
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	Choose an appropriate data structures and create a token system for banking service.	CO3	Analyze
7	Choose an appropriate data structures and create a book rack allocation system in a library.	CO4	Apply
8	Create a C application to get employee information	CO4	Apply
9	Creation of Array and linked list implementation of Stack and Queue ADTs	CO5	Apply
10	Create a food delivering system which allocates the path for delivery of food using appropriate data structures.	CO5	Apply

**TOTAL: 60 Periods**

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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	2									2	3	
CO2	3	3	3	2									2	3	
CO3	3	3	3	2									2	3	
CO4	3	3	3	2									2	3	
CO5	3	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]	Final Examination [50 marks]
Remember		
Understand	10	30
Apply	20	50
Analyze	20	20
Evaluate		
Create		



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<b>20MC202</b>	<b>INTERPERSONAL SKILLS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>0</b>	<b>2</b>	<b>0</b>
<b>Nature of Course</b>	Mandatory, Non Credit				
<b>Pre requisites</b>	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

<b>CO.No</b>	<b>Course Outcome</b>	<b>Bloom's Level</b>
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**

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**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, 1<sup>st</sup> Edition, 2004.
2. Floyd, Kory, "Interpersonal Communication", 2d. Boston: McGraw-Hill, 2<sup>nd</sup> 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, 2<sup>nd</sup> Edition 2009.
2. Vohs, Kathleen D., and Eli J., Finkel, eds, "Self and Relationships: Connecting Intrapersonal and Interpersonal Processes", New York: Guilford Press, 1<sup>st</sup> 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										3	2	1	2		
CO2										3	2	1	2		
CO3										3	2	1	2		
CO4										3	2	1	2		
CO5										3	2	1	2		
	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		



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## III – SEMESTER

20MA303	DISCRETE MATHEMATICS AND GRAPH THEORY (Common to CSE, IT and AI&DS)	L	T	P	C
		3	2	0	4
<b>Nature of Course</b>	Basic Sciences				
<b>Prerequisites</b>	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**

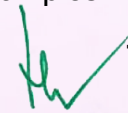
12

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, 6th 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 Hill Pub. Co. Ltd., New Delhi, 3rd Edition, 2010.
3. Douglas B West. "Introduction to Graph Theory", Pearson Education, 2<sup>nd</sup> 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	Online Quiz	5	15
Understand	Tutorial Class/ Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Continuous Assessment Tests			Terminal 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
Analyse				
Evaluate				
Create				

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<b>20AI301</b>	<b>FOUNDATIONS OF ARTIFICIAL INTELLIGENCE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>Nature of Course</b>	<b>Professional core</b>				
<b>Prerequisites</b>	<b>Nil</b>				

### Course Objectives

The course is intended to

1. Familiarize the fundamentals of intelligent agents.
2. Acquire knowledge on problem solving techniques.
3. Analyze the problem and make decisions by interring new knowledge using knowledge representation schemes.
4. Develop planning and acting in real world problem.
5. Gain knowledge in learning algorithms.

### Course Outcomes

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

<b>CO. No.</b>	<b>Course Outcome</b>	<b>Bloom's Level</b>
CO1	Summarize the basics of AI and Intelligent agent	Understand
CO2	Apply and illustrate how search algorithms play vital role in problem solving	Apply
CO3	Construct knowledge representation and knowledge of reasoning for solving real world problems	Apply
CO4	Classify the different ways of planning and acting in the real world	Apply
CO5	Apply suitable learning methodology while designing systems based on their applications	Apply

### Course Contents:

- Unit-I Introduction to AI** **9**  
 Introduction to AI - The Foundations of AI - The History of AI - The State of the art - Agents and Environments - Good Behavior: The Concept of Rationality - The Nature of Environments - The Structure of agents.
- Unit - II Solving Problems by Searching Techniques** **9**  
 Problem-Solving Agents - Example Problems: Toy problems - Searching for solution - Uninformed search strategies - Informed search and Exploration: Heuristic Functions - Constraint Satisfaction Problems: Backtracking search.
- Unit - III Knowledge and Reasoning** **7**  
 Logical Agents: Knowledge based agents - The Wumpus World - Logic -Propositional Logic - First order Logic: Syntax and Semantics of First-order Logic, Introduction to PROLOG.
- Unit - IV Planning and Acting** **9**  
 The Planning Problem - Planning with State-Space Search - Partial- Order Planning - Planning and acting in the real world: Time, Schedules and Resources - Hierarchical Task Network Planning - Conditional Planning - Continuous Planning - MultiAgent Planning.
- Unit – V Uncertain knowledge and Reasoning** **11**  
 Uncertainty: Acting under uncertainty - Basic Probability Notation - The Axioms of Probability - Making Simple decisions: Utility Functions - Decision Networks - Learning systems-supervised learning, unsupervised learning.

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**Text Books:**

1. S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach, Prentice Hall, 4<sup>th</sup> Edition, 2020.
2. I. Bratko, "Prolog Programming for Artificial Intelligence", Addison Wesley Educational Publishers Inc, 4<sup>th</sup> Edition 2011.

**Reference Books:**

1. M. Tim Jones, "Artificial Intelligence: A Systems Approach (Computer Science)", Jones and Bartlett Learning, 2009.
2. Nils J. Nilsson, "The Quest for Artificial Intelligence", Cambridge University Press, 2009.
3. William F. Clocksin and Christopher S. Mellish, "Programming in Prolog: Using the ISO Standard", Springer Science & Business Media, 5<sup>th</sup> Edition 2012.

**Additional / Web References:**

1. <https://nptel.ac.in/courses/106/102/106102220/>
2. <https://nptel.ac.in/courses/106/105/106105078/>
3. <https://nptel.ac.in/courses/106/106/106106126/>

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	2		2							2	2	1	1
CO2	3	2	2		2							2	3	3	3
CO3	3	2	2		2							1	2	2	
CO4	3	3	3		2							1	3	3	3
CO5	3	3	3		2							2	3	3	3
	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			Terminal Examination (60)
	IAE-I (7.5)	IAE-II (7.5)	IAE-III (10)	
Remember	15	15	10	20
Understand	20	15	20	30
Apply	15	20	20	30
Analyse				20
Evaluate				
Create				

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

**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 Exercises	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, 6<sup>th</sup> Edition, 2018.
2. Douglas 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, 10<sup>th</sup> 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		

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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						


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20AI302	<b>OPERATING SYSTEMS</b> (Common to CSE, IT and AI&DS)	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		3	0	2	4
<b>Nature of Course</b>	Professional Core				
<b>Prerequisites</b>	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. Multitasking, 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.

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**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 Exercises	CO Mapping	RBT
1	Hands on Activity for OS Installation.	CO1	Understand
2	Demonstration of fork, exec and wait system calls along with zombie and orphan states.	CO1	Understand
3	Implementing a CPU scheduling policy with FCFS, SJF, Priority and RR algorithms	CO2	Apply
4	Thread synchronization using counting semaphores and mutual exclusion using mutex. Application to demonstrate: producer-consumer problem with counting semaphores and mutex.	CO3	Apply
5	Implement Deadlock Avoidance Using Semaphores	CO3	Apply
6	Develop a C program to simulate Page replacement using FIFO, LRU and Optimal algorithms.	CO4	Analyze
7	Write a C program to simulate the following file allocation strategies. a) Sequential b) Indexed c) Linked	CO4	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.	CO5	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, 9<sup>th</sup> 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, 4<sup>th</sup> Edition, 2014.
3. Gary Nutt, "Operating Systems, Pearson Education, 3<sup>rd</sup> Edition, 2014.


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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						
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						

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20AI303	DATABASE MANAGEMENT SYSTEMS (Common to CSE, IT and AI&DS)	L	T	P	C
		3	0	2	4
<b>Nature of Course</b>	Professional Core				
<b>Prerequisites</b>	Programming and 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.

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**Unit -V Advanced Databases**

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 Exercises	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	CO1	Understand
2	Practicing PL/SQL for a real time application	CO1	Apply
3	Database Design using ER modeling, normalization and Implementation for any application	CO2	Apply
4	Write relational algebra queries for a given set of relations.	CO2	Apply
5	XML database creation and validation	CO5	Analyze
6	Case Study using real life database applications	CO5	Apply

**Total : 30 Periods****Text Books:**

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

**Reference Books:**

1. C. J. Date, A.Kannan, S. Swamynathan, "An Introduction to Database Systems Pearson Education, 8<sup>th</sup> Edition, 2012.
2. Raghu Ramakrishnan, "Database Management Systems, McGraw-Hill College Publications, 4<sup>th</sup> 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							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						


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<b>20AI304</b>	<b>INTELLIGENT SYSTEMS LABORATORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>
<b>Nature of Course</b>	Professional Core				
<b>Prerequisites</b>	Problem Solving Using Python				

**Course Objectives**

The course is intended to

1. Acquire skill in PROLOG
2. Deploy PROLOG programming.
3. Comprehend various search strategies
4. Identify Optimal search algorithm
5. Perceive various Learning algorithm

**Course Outcomes**


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

<b>CO. No.</b>	<b>Course Outcome</b>	<b>Bloom's Level</b>
CO1	Apply PROLOG programming in solving simple problems	Apply
CO2	Apply PROLOG in production based system	Apply
CO3	Apply various search strategies used in solving AI problems	Apply
CO4	Implement Optimal search strategies in real world problem	Apply
CO5	Implement supervised learning and unsupervised learning in AI problem	Apply

**List of Exercises**

<b>S. No</b>	<b>List of Exercises</b>	<b>CO Mapping</b>	<b>RBT</b>
1	Study of PROLOG.	CO1	Understand
2	Write simple fact for the statements using PROLOG.	CO1	Apply
3	Program to demonstrate family relationship.	CO2	Apply
4	Write a program to solve 8 queens problem using PROLOG.	CO2	Apply
5	Solve any problem using depth first search.	CO3	Apply
6	Solve any problem using breadth first search.	CO3	Analyze
7	Implement min max algorithm.	CO4	Analyze
8	Implement alpha beta pruning algorithm	CO4	Analyze
9	Support Vector Machine for classification problem(Supervised learning) using PYTHON	CO5	Analyze
10	K-Means for clustering problems(Unsupervised learning) using PYTHON	CO5	Analyze

  
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**Total : 30 Periods**

Summative assessment based on Continuous and End Semester Examination		
Bloom's Level	Rubric based Continuous Assessment [50 marks]	Final Examination [50 marks]
Remember		
Understand	10	
Apply	20	25
Analyze	20	25
Evaluate		
Create		


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20MC301	ENVIRONMENTAL SCIENCE (Common to All Branches of B.E., / B.Tech.)	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 to control 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 study regarding environmental management	CO5	Apply

Total: 30 periods

  
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**TextBooks:**

1. AnubhaKaushik and C.P. Kaushik, "Environmental Science and Engineering, New Age International Publishers, New Delhi, 2<sup>nd</sup> 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, 2<sup>nd</sup> Edition, 2012.
2. Santosh Kumar Garg and Rajeshwari Garg, "Ecological and Environmental Studies", Khanna Publishers, NaiSarak, Delhi, 2<sup>nd</sup> 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](https://nptel.ac.in/courses/105102089/air%20pollution%20(Civil)/Module-3/3a.htm)
4. [www.vssut.ac.in/lecture\\_notes/lecture1428910296.pdf](http://www.vssut.ac.in/lecture_notes/lecture1428910296.pdf)
5. [nptel.ac.in/courses/120108004/module7/lecture8.pdf](https://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		

loom'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					

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## IV- SEMESTER

20MA404	STATISTICAL METHODS FOR DATA ANALYSIS	L	T	P	C
		3	2	0	4
Nature of Course	Basic Sciences				
Prerequisites	Mathematics-I & II for Computing Sciences				

**Course Objectives**

The course is intended to

1. Acquire the concepts of random variable essential for analog of digital communication.
2. Introduce two dimensional random variables.
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. Learn vector spaces, bases and dimensions.

**Course Outcomes**

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

CO. No.	Course Outcome	Bloom's Level
CO1	Explain the concepts of a random variables and Probability distribution.	Understand
CO2	Examine the functions of Multiple random variable.	Apply
CO3	Interpret the testing of hypothesis for small and large samples.	Understand
CO4	Apply the concepts of design of experiments in the field of engineering.	Apply
CO5	Identify linear independence, dependence of vectors and matrix representation of linear transformations.	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 and Conditional 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 Linear Spaces**

12

Vector spaces – Linear independence and dependence – Bases and dimensions – Linear transformation - Null Spaces and Ranges - Dimension theorem - Matrix representation of linear transformations.

**Total: 60 Periods**

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**Text Books:**

1. Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, 1<sup>st</sup> Edition, 2008.
2. David C. Lay, Steven R. Lay and Judi J. McDonald., "Linear Algebra and its Applications", Prentice Hall of India, New Delhi, 5<sup>th</sup> Edition, 2016.

**Reference Books:**

1. Bali N.P and Manish Goyal, "A Text book of Engineering Mathematics", Lakshmi Publications Pvt Ltd, 10<sup>th</sup> Edition, 2019.
2. D. C. Montgomery and G.C. Runger, "Applied Statistics and Probability for Engineers", John Wiley & Sons, 7<sup>th</sup> Edition, 2018.
3. Friedberg. A. H., Insel . A.J. and Spence .L , "Linear Algebra", Prentice Hall of India, New Delhi, 4<sup>th</sup> Edition ,2015.

**Additional References:**

1. <https://nptel.ac.in/courses/111/102/111102111>
2. <https://nptel.ac.in/courses/111/106/111106051>

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	2	1									1	2		
CO2	3	3	2									1	2		
CO3	3	2	1									1	2		
CO4	3	2	2									1	1		
CO5	3	2	1									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-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				

  
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<b>20AI401</b>	<b>DATA WAREHOUSING AND DATA MINING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>Nature of Course</b>	Engineering Sciences				
<b>Prerequisites</b>	Database Management Systems				

### Course Objectives

The course is intended to

1. Gain knowledge of data warehouse concepts, architecture, business analysis and tools
2. Impart knowledge of data pre-processing and data visualization techniques
3. Learn the algorithms for finding hidden and interesting patterns in data
4. Develop and apply various classification and clustering techniques using tools.
5. Explore the knowledge on Datasets and Associations.

### Course Outcomes

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

<b>CO. No.</b>	<b>Course Outcome</b>	<b>Bloom's Level</b>
CO1	Demonstrate various pre-processing and visualization techniques for data mining techniques	Understand
CO2	Analyze various Data warehouse model and perform business analysis with OLAP tools.	Analyze
CO3	Elaborate frequent pattern and association rule mining techniques for data analysis.	Create
CO4	Evaluate various classification techniques for data mining	Evaluate
CO5	Evaluate various clustering techniques for data mining	Evaluate

### Course Contents:

- Unit- I Introduction** **9**  
 Data mining-On what kinds of Data, what kinds of patterns can be mined, which technologies are used, which kinds of applications are targeted, major issues in Data Mining. Data Preprocessing: An Overview, Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data discretization.
- Unit-II Data Warehouse And OLAP Technology** **9**  
 Data Warehouse: Basic concepts, Data Warehouse Modeling: Data Cube and OLAP, Data Warehouse Implementation, Data cube computation method- Multi way array aggregation for full cube computation.
- Unit-III Mining Frequent Patterns, Association And Correlations** **9**  
 Basic Concepts, Efficient and Scalable Frequent Item set Mining Methods, Pattern Evaluation methods, Pattern Mining in Multilevel, Multi Dimensional Space, Constraint Based Frequent Pattern Mining.
- Unit-IV Classification: Basic Concepts** **9**  
 Classification by Decision Tree Induction, Bayesian Classification, Rule-Based Classification, Classification by Back propagation, Support Vector Machines
- Unit-V Cluster Analysis: Basic Concept** **9**  
 Cluster analysis, Partitioning Methods (k- Means, k- Medoids) Hierarchical Methods: Agglomerative Vs Divisive, (BIRCH), Weka Tool: Basic of WEKA , WEKA data file format , Data visualization in WEKA, Data filtering ,Using the concepts of data mining with WEKA.

**Total: 45 Periods**

**Text Books:**

1. Jiawei Han and Micheline Kamber, "Data Mining Concepts and Techniques", Elsevier, 3<sup>rd</sup> Edition, 2012.
2. Margaret H Dunham, "Data Mining Introductory and advanced topics", Pearson Education, 6<sup>th</sup> Edition, 2009.

**Reference Books:**

1. Alex Berson and Stephen J.Smith, "Data Warehousing, Data Mining & OLAP", Tata McGraw – Hill Edition, 35<sup>th</sup> Reprint 2016.
2. K.P. Soman, Shyam Diwakar and V. Ajay, "Insight into Data Mining Theory and Practice", Prentice Hall of India, Eastern Economy Edition, 2006.
3. Ian H.Witten and Eibe Frank, "Data Mining: Practical Machine Learning Tools and Techniques", Elsevier, 4<sup>th</sup> Edition 2016.

**Additional / Web References:**

1. <https://nptel.ac.in/courses/106/105/106105174/>
2. <https://www.digimat.in/nptel/courses/video/106105174/L01.html>
3. <https://nptel.ac.in/courses/106/106/106106093/>

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	2	1								2	2	2
CO2	2	2	2	1	2								2	3	3
CO3	2	3	2	2	2								2	2	2
CO4	3	2	2	1	3								2	3	3
CO5	2	2	3	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	15	15	10	20
Understand	20	15	20	30
Apply	15	20	20	30
Analyse				20
Evaluate				
Create				

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<b>20AI402</b>	<b>CONCEPTS IN DATA SCIENCE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>2</b>	<b>0</b>	<b>4</b>
<b>Nature of Course</b>	Engineering Sciences				
<b>Prerequisites</b>	Database Management Systems				

**Course Objectives**

The course is intended to

1. Know the fundamental concepts of data sciences
2. Learn about the different techniques used for data preprocessing
3. Analyze and visualize real time data
4. Learn the tools and packages in Python for data science
5. Acquire knowledge in data interpretation and visualization techniques

**Course Outcomes**

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

<b>CO. No.</b>	<b>Course Outcome</b>	<b>Bloom's Level</b>
CO1	Illustrate the data Science Roles and its stages	Understand
CO2	Analyze various preprocessing techniques for data mining	Analyze
CO3	Design a frameworks for exploratory data analytics	Creating
CO4	Demonstrate various tools and packages in Python for data science.	Understand
CO5	Analyze the data visualization using tools.	Analyze

**Course Contents:****Unit – I Introduction****12**

Introduction to Data Science - Evolution of Data Science - Data Science Roles - Stages in a Data Science Project - Applications of Data Science in various fields - Data Security Issues.

**Unit – II Data Collection and Data Pre-Processing****12**

Data Collection Strategies - Data Pre-Processing Overview - Data Cleaning - Data Integration and Transformation - Data Reduction - Data Discretization

**Unit – III Exploratory Data Analytics****12**

Descriptive Statistics - Mean, Standard Deviation, Skewness and Kurtosis - Box Plots - Pivot Table - Heat Map - Correlation Statistics - ANOVA.

**Unit – IV Python for Data Handling****12**

Basics of Numpy arrays - aggregations - computations on arrays - comparisons, masks, boolean logic - fancy indexing - structured arrays - Data manipulation with Pandas - data indexing and selection - operating on data - missing data - hierarchical indexing - combining datasets - aggregation and grouping

**Unit – V Python For Data Visualization****12**

Visualization with matplotlib - line plots - scatter plots - visualizing errors - density and contour plots - histograms, binnings, and density - three dimensional plotting - geographic data - data analysis using statmodels and seaborn - graph plotting using Plotly - interactive data visualization using Bokeh

**Total: 60 Periods**

  
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**Text Books:**

1. David Dietrich, Barry Heller, Beibei Yang, "Data Science and Big data Analytics", Wiley, 2015.
2. Jake VanderPlas, "Python Data Science Handbook", O'Reilly, 2016.

**Reference Books:**

1. Cathy O'Neil and Rachel Schutt, "Doing Data Science", O'Reilly, 2013.
2. Raj, Pethuru, "Handbook of Research on Cloud Infrastructures for Big Data Analytics", IGI Global, 2014.
3. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2014.

**Additional / Web References:**

1. <https://nptel.ac.in/courses/106/106/106106179/>
2. <https://nptel.ac.in/courses/111/104/111104146/>
3. <https://nptel.ac.in/courses/110/106/110106064/>

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	2							2	3	3	3
CO2	2	2	2	2	3							3	3	2	3
CO3	2	2	2	3	2							2	2	3	3
CO4	3	2	3	2	3							3	3	3	2
CO5	3	2	3	2	3							2	3	3	3
	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				
Create				

  
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20AI403	FORMAL LANGUAGES AND AUTOMATA THEORY (Common to CSE and AI&DS)	L	T	P	C
		3	0	0	3
Nature of Course	Professional Core				
Prerequisites	Nil				

**Course Objectives**

The course is intended to

1. Perceive Automata theory and the language hierarchy
2. Learn the concept of automata for any given pattern
3. Enhance the knowledge on a context free grammar for any given language
4. Acquire knowledge on programming techniques of a Turing machines
5. Incorporate the concept of undecidable problems and NP class problems

**Course Outcomes**

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

CO. No.	Course Outcome	Bloom's Level
CO1.	Design Automata for accepting or generating certain languages	Apply
CO2.	Interpret automata and regular expression for any pattern	Apply
CO3.	Formulate Context free grammar and pushdown automata	Apply
CO4.	Analyze the use of Turing Machine and properties of context free grammar	Analyze
CO5.	Analyze the decidability and undecidability of various problem	Analyze

**Course Contents:****Unit - I Automata Fundamentals 9**

Introduction to formal proof – Additional forms of Proof – Inductive Proofs -Finite Automata – Deterministic Finite Automata - Non-deterministic Finite Automata - Finite Automata with Epsilon Transitions

**Unit - II Regular Expressions and Languages 9**

Regular Expressions - FA and Regular Expressions - Proving Languages not to be regular - Closure Properties of Regular Languages - Equivalence and Minimization of Automata - Applications of Regular Expressions.

**Unit - III Context Free Grammar and Languages 9**

CFG – Parse Trees – Ambiguity in Grammars and Languages – Definition of the Pushdown Automata - Languages of a Pushdown Automata - Equivalence of Pushdown Automata and CFG.

**Unit – IV Properties of Context Free Languages 9**

Normal Forms for CFG - Pumping Lemma for CFL - Closure Properties of CFL - Turing Machines - Programming Techniques for TM.

**Unit - V Undecidability 9**

Non-Recursive Enumerable (RE) Language - Undecidable Problem with RE - Undecidable Problems about TM - Post's Correspondence Problem, The Class P and NP.

**Total :45 Periods**

**Text Books:**

1. Hopcroft J.E, Motwani and Ullman.D, "Introduction to Automata Theory, Languages and Computations", Pearson Education, 3<sup>rd</sup> Edition 2017.
2. Micheal Sipser, "Introduction of the Theory and Computation", Thomson Learning, 3<sup>rd</sup> Edition 2018.

  
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**Reference Books:**

1. Lewis H.R and Papadimitriou C.H, "Elements of the theory of Computation", Prentice-Hall of India Pvt. Ltd, 2<sup>nd</sup> Edition 2015.
2. Martin.J, "Introduction to Languages and the Theory of Computation", Tata Mc Graw Hill, New Delhi, 3rd Edition 2020.
3. Kamala Krithivasan and Rama.R, "Introduction to Formal Languages Automata Theory and Computation", Pearson Education, 3<sup>rd</sup> Edition 2018.

**Additional References:**

1. <https://nptel.ac.in/courses/111/103/111103016/>
2. <https://nptel.ac.in/courses/106/106/106106049/>
3. <https://www.digimat.in/nptel/courses/video/111103016/L01.html>

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	2
CO2	3	3	3										3	3	2
CO3	3	3	3										3	3	2
CO4	3	3	3										3	3	2
CO5	3	3	3										3	3	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			Terminal Examination (60)
	IAE – I (7.5)	IAE – II (7.5)	IAE – III (10)	
Remember	10	10	0	20
Understand	20	20	10	20
Apply	10	10	20	40
Analyze	10	10	20	20
Evaluate				
Create				



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<b>20AI404</b>	<b>OBJECT ORIENTED PROGRAMMING</b> <b>(Common to CSE, IT and AI&amp;DS)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>Nature of Course</b>	Professional Core				
<b>Prerequisites</b>	Programming and Data Structures				

### 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

<b>CO.No.</b>	<b>Course Outcome</b>	<b>Bloom's Level</b>
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.

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**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" 11<sup>th</sup> Edition, McGraw Hill Education, 2018.
2. Cay S. Horstmann, Gary Cornell, "Core Java Volume -I Fundamentals" 11<sup>th</sup> Edition, Prentice Hall, 2018.

**Reference Books:**

1. Paul Deitel, Harvey Deitel, "Java How to program,Early Objects", Global Edition, 11<sup>th</sup> 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, 1<sup>st</sup> 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	20
Understand	20	20	10	50
Apply	20	20	20	20
Analyze			10	10
Evaluate				
Create				

  
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<b>20AI405</b>	<b>DATA MINING TOOLS LABORATORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>
<b>Nature of Course</b>	Professional Core				
<b>Prerequisites</b>	Database Management Systems				

### Course Objectives

The course is intended to

1. Learn the use creation of Data Warehouse.
2. Make familiar with the algorithms of data mining,
3. Develop datasets using clustering.
4. Impart knowledge in tools and techniques used for Knowledge Discovery in Databases
5. Be exposed to web mining and text mining.

### Course Outcomes

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

<b>CO.No.</b>	<b>Course Outcome</b>	<b>Bloom's Level</b>
CO1	Interpret the concepts of Data Warehouse creation.	Analyze
CO2	Apply data mining techniques and methods to large data sets.	Apply
CO3	Experiment the Use of data mining tools.	Apply
CO4	Compare and contrast the various classifiers.	Analyze
CO5	Carry out web mining and text mining using commercial applications.	Apply

### Laboratory Components

<b>S.No</b>	<b>List of Exercises</b>	<b>CO Mapping</b>	<b>RBT</b>
1	Creation of a Data Warehouse.	CO1	Analyze
2	Apriori Algorithm.	CO1	Analyze
3	FP-Growth Algorithm.	CO1	Apply
4	K-means clustering.	CO2	Apply
5	One Hierarchical clustering algorithm.	CO3	Apply
6	Bayesian Classification.	CO4	Analyze
7	Decision Tree.	CO4	Apply
8	Support Vector Machines.	CO4	Apply
9	Applications of classification for web mining.	CO5	Apply
10	Case Study on Text Mining or any commercial application.	CO5	Analyze

**Total: 60 Periods**

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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	2	2								2	3	2
CO2	3	2	3	2	2								2	3	2
CO3	3	2	3	2	2								2	3	2
CO4	3	2	3	2	2								2	3	2
CO5	3	2	3	2	2								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]	Final Examination [50 marks]
Remember		
Understand		
Apply	30	50
Analyze	20	50
Evaluate		
Create		



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<b>20AI406</b>	<b>R PROGRAMMING LABORATORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>
<b>Nature of Course</b>	Professional Core				
<b>Prerequisites</b>	Database Management Systems				

**Course Objectives**

The course is intended to

1. Install and use R for simple programming tasks.
2. Understand the functionality of R data types.
3. Learn the concepts of functions and strings in R.
4. Understand visualization effects in R.
5. Understand the regression model in R

**Course Outcomes**

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

<b>CO.No.</b>	<b>Course Outcome</b>	<b>Bloom's Level</b>
CO1	Install and use R for simple programming tasks.	Apply
CO2	Apply operations on different R data types	Apply
CO3	Apply the concepts of functions and strings	Apply
CO4	Apply different visualization effects in R	Apply
CO5	Use simple and multiple linear regressions in R	Apply

**Laboratory Components**

<b>S.No</b>	<b>List of Exercises</b>	<b>CO Mapping</b>	<b>RBT</b>
1	Creating and displaying Data	CO1	Apply
2	Matrix manipulations	CO1	Apply
3	Creating and manipulating a List and an Array	CO2	Apply
4	Creating a Data Frame and Matrix-like Operations on a Data Frame	CO2	Apply
5	Merging two Data Frames	CO2	Apply
6	Applying functions to Data Frames	CO2	Apply
7	Using Functions with Factors	CO3	Apply
8	Accessing the Internet	CO3	Apply
9	String Manipulations	CO3	Apply
10	Visualization Effects	CO4	Apply
11	Plotting with Layers	CO4	Apply
12	Overriding Aesthetics	CO4	Apply
13	Histograms and Density Charts	CO4	Apply

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**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	3	3	3	3							3	3	3	3
CO2	3	3	3	3	3							3	3	3	3
CO3	3	3	3	3	3							3	3	3	3
CO4	3	3	3	3	3							3	3	3	3
CO5	3	3	3	3	3							3	3	3	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]	Final Examination [50 marks]
Remember		
Understand	20	50
Apply	30	50
Analyze		
Evaluate		
Create		

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<b>20AI407</b>	<b>OBJECT ORIENTED PROGRAMMING LABORATORY</b> <b>(Common to CSE, IT and AI&amp;DS)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>
<b>Nature of Course</b>	Practical				
<b>Prerequisites</b>	Programming and Data Structures				

### 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

<b>CO. No.</b>	<b>Course Outcome</b>	<b>Bloom's Level</b>
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

<b>S.No</b>	<b>List of Exercises</b>	<b>CO Mapping</b>	<b>RBT</b>
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**

  
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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		

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20MC401	<b>SOFT SKILLS</b> (Common to All Branches of B.E., / B.Tech.)	L	T	P	C
		2	0	0	0
<b>Nature of Course</b>	Mandatory Course				
<b>Prerequisites</b>	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

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**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/>

<b>Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)</b>															
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		



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20AIA11	<b>Embedded Systems in Python</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>
<b>Nature of course</b>	Employability Enhancement Course				
<b>Prerequisites</b>	Problem Solving Using Python				

**Course Objectives**

The course is intended to

1. Study the architecture of embedded processor, microcontroller and peripheral devices.
2. Learn the concept of DHT11 sensor with Raspberry Pi.

**Course Outcomes**

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

CO. No	Course Outcome	Bloom's Level
CO 1	Apply the various applications of embedded systems.	Apply
CO 2	Apply the various applications of Raspberry Pi.	Apply

**Course Contents****Unit I - Introduction to Embedded Systems and Python Programming****15**

Programming with Python-Variables and Functions- Programming with Python-Conditions, Loops and Lists- Control Raspberry Pi's GPIO with Python- Python Program to make a LED Blink, Python Program to power on the LED when the push button is pressed- Motion Detection with PIR Sensor- Interfacing PIR Sensor with Raspberry Pi, Interfacing Relay module with Raspberry Pi

**Unit II - Interfacing DHT11 Sensor with Raspberry Pi****15**

Temperature and Humidity Measurement- Send an Email with your Python Code- Sending Sensor data and Raspberry Pi events through mail- Interfacing Camera module with Raspberry pi- Take Photos with Python- Take Video with Python- Capturing series of photos with Python- Sending Sensor Data to Things Speak Cloud- Choose which LED/Light to Power on using Telegram Bot- Security Camera for Smart Home using Raspberry Pi- Google Assistance for Home Automation using Raspberry Pi- Capstone Project-1- Capstone Project-2- Capstone Project-3.

**Total: 30 Periods**

<b>Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)</b>																
COs	POs												PSOs			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
CO 1	2	3	3	2	3						3	2	1	3	2	
CO 2	2	3	3	2	3						3	2	1	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		

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20AIA12	Linux Shell Programming	L	T	P	C
		0	0	2	1
<b>Nature of course</b>	Employability Enhancement Course				
<b>Prerequisites</b>	Operating Systems				

**Course Objectives**

1. To be on familiar terms with the role, core structure, functions and services of operating systems.
2. Gain knowledge on Shell programming.

**Course Outcomes**

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

CO. No.	Course Outcome	Bloom's Level
CO 1	Understand the structures, functions and services of operating systems.	Understand
CO 2	Create well documented, modular, efficient, and complex shell scripts.	Create

**Course Contents**

Introduction and Overview -Directory concept - Command Line Tips and Tricks - Customizing Shell - Shell programming Essentials - Variables - Decision Making - BASH I/O - Process Management.

**Total: 30 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
CO 1				2	3								1	3	
CO 2				2	3								1	3	
	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		

  
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**V-SEMESTER**

20AI501	DATA ANALYTICS (Common to CSE, IT and AI&DS)	L	T	P	C
		3	0	0	3
<b>Nature of Course</b>	Professional Core				
<b>Pre requisites</b>	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, Analysing Data with Unix tools, Analysing Data with Hadoop, Hadoop Streaming, Hadoop Echo System, IBM Big Data Strategy, Introduction to Infosphere Big Insights 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 Megastore, 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: 45Periods**
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**TEXT BOOKS:**

1. Seema Acharya, SubhasiniChellappan, "Big Data Analytics" Wiley 2015.
2. Tom White "Hadoop: The Definitive Guide" O'reily Media, 3<sup>rd</sup> Edition 2012.

**REFERENCES:**

1. Jay Liebowitz, "Big Data and Business Analytics" Auerbach Publications, CRC press (2013).
2. AnandRajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.
3. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.

**Additional References:**

1. <https://nptel.ac.in/noc/courses/noc17/SEM2/noc17-mg24/>
2. [https://onlinecourses.nptel.ac.in/noc21\\_cs45/preview](https://onlinecourses.nptel.ac.in/noc21_cs45/preview)
3. <https://nptel.ac.in/courses/110/106/110106072/>

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

  
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<b>20AI502</b>	<b>MACHINE LEARNING TECHNIQUES</b> (Common to CSE, IT and AI&DS)	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>Nature of Course</b>	<b>Professional Core</b>				
<b>Prerequisites</b>	<b>Foundations of Artificial Intelligence</b>				

**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

<b>CO. No.</b>	<b>Course Outcome</b>	<b>Bloom's Level</b>
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 BackPropagation – 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.

**References:**

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

<b>Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)</b>															
<b>COs</b>	<b>Pos</b>												<b>PSOs</b>		
	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>11</b>	<b>12</b>	<b>1</b>	<b>2</b>	<b>3</b>
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		

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

<b>Summative Assessment</b>				
<b>Bloom's Category</b>	<b>Continuous Assessment Tests</b>			<b>Final Examination (60)</b>
	<b>IAE-I (7.5)</b>	<b>IAE-II (7.5)</b>	<b>IAE-III (10)</b>	
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

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20AI503	<b>DATA COMMUNICATION AND COMPUTER NETWORKS</b> (Common to CSE, IT and AI & DS)	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		3	0	0	3
<b>Nature of Course</b>	<b>Engineering Sciences</b>				
<b>Pre requisites</b>	<b>Computer Hardware and Networking</b>				

**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: Internet networking-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.

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**TextBooks**

1. William Stallings, "Data and Computer Communications", Pearson Education, 8<sup>th</sup> Edition, 2019.
2. Behrouz Forouzan, A., "Data Communications and Networking" TATA McGraw Hill Education, 5<sup>th</sup> Edition, 2017

**Reference Books:**

1. Ying-Dar Lin, Ren-Hung Hwang and Fred Baker, "Computer Networks: An Open-Source Approach", McGraw Hill Publisher, 2<sup>nd</sup> Edition 2018.
2. Larry L. Peterson and Bruce S. Davie, "Computer Networks: A Systems Approach", Morgan Kaufmann Publishers Inc., 5<sup>th</sup> Edition, 2016.
3. Ajit Pal, "Data Communication and Computer Networks", PHI Learning, 2<sup>nd</sup> Edition 2015.

**Additional References:**

1. <https://nptel.ac.in/courses/106/105/106105082/>
2. <http://www.nptelvideos.in/2012/11/data-communication.html>
3. <https://nptel.ac.in/courses/106/105/106105183/>

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
Remember	Online Quiz	5	15
Understand	Tutorial/Class/Assignment	5	
	Attendance	5	

Formative 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	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



<b>20AI504</b>	<b>OBJECT ORIENTED ANALYSIS AND DESIGN</b> <b>(Common to CSE , IT &amp; AI&amp;DS)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>2</b>	<b>4</b>
<b>Nature of Course</b>	Professional Core				
<b>Pre requisites</b>	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

<b>CO.No.</b>	<b>Course Outcome</b>	<b>Bloom's Level</b>
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 DYNAMIC AND 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 – behavioural – 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: 45Periods**

**Laboratory Components:**

S.No	List of experiments	CO Mapping	RBT
1.	Identify a software system that needs to be developed.	CO1	Understand
2.	Document the Software Requirements Specification (SRS) for the identified system.	CO2	Understand
3.	Identify use cases and develop the Use Case model.	CO3	Apply
4.	Identify the conceptual classes and develop a Domain Model and also derive a Class Diagram from that.	CO4	Apply
5.	Using the identified scenarios, find the interaction between objects and represent them using UML Sequence and Collaboration Diagrams	CO5	Apply
6.	Draw relevant State Chart and Activity Diagrams for the same system.	CO1	Apply
7.	Implement the system as per the detailed design	CO2	Apply
8.	Test the software system for all the scenarios identified as per the use case diagram	CO3	Apply
9.	Improve the reusability and maintainability of the software system by applying appropriate design patterns.	CO4	Apply
10.	Implement the modified system and test it for various scenarios	CO5	Apply

**Total: 30 Periods**

**Text Books:**

1. Craig Larman, "Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development", Pearson Education, 3rd Edition 2005.
2. Ali Bahrami "Object Oriented Systems Development ", McGraw Hill International Edition – 1999.

**Reference Books:**

1. Martin fowler, "uml distilled: a brief guide to the standard object modeling language", third edition, addison wesley, 2003
2. Erich gamma, a n d richard helm, ralph johnson, john vlissides, "design patterns: elements of reusable object-oriented software", addison-wesley, 1995.

**Additional References:**

1. <https://nptel.ac.in/courses/106/105/106105153/>
2. <https://nptel.ac.in/noc/courses/noc17/SEM2/noc17-cs25/>
3. <https://nptel.ac.in/courses/106/105/106105224/>

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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						



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20AI505	MACHINE LEARNING LABORATORY (Common to CSE, IT and AI&DS)	L	T	P	C
		0	0	4	2
Nature of Course	Professional Core				
Prerequisites	NIL				

### 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

### List of Exercises:

S. No	List of Exercises	CO Mapping	RBT
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.	CO1	Apply
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.	CO1	Apply
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.	CO2	Apply
4	Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.	CO2	Apply
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.	CO3	Apply
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.	CO3	Apply
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.	CO4	Apply

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.	CO4	Apply
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.	CO5	Apply
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.	CO5	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	3
1	3	2	1	1									3	1	
2	3	2	2	1	2						2	2	3	1	
3	3	2	1	1									3	1	
4	3	3	2	1	2	1		1			1	2	3	1	
5	3	3	2	2	2	1		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		

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<b>20AI506</b>	<b>DATA ANALYTICS LABORATORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>
<b>Nature of Course</b>	Professional Core				
<b>Prerequisites</b>	R Programming Laboratory				

### Course Objectives

The course is intended to

1. Study and write simple programs using the basic packages for handling data
2. Implement various sampling and T,Z,Anova test in various samples
3. Perform case study and design a system
4. Demonstrate Time Series Analysis in any real time application
5. Practise knowledge representation using graphical models

### Course Outcomes

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

<b>CO. No.</b>	<b>Course Outcome</b>	<b>Bloom's Level</b>
CO1	Understand various packages in Python	Apply
CO2	Demonstrate the understanding of data distribution with various samples	Apply
CO3	Ability to Implement T-Test ,Anova and Z-Test on sample data sets	Apply
CO4	Understanding of Mathematical models in real world problems	Apply
CO5	Conduct time series analysis and draw conclusion.	Apply

### List of Exercises

<b>S. No</b>	<b>List of Exercises</b>	<b>CO Mapping</b>	<b>RBT</b>
1	Random Sampling	CO1, CO2	Understand
2	Z-test and T-test case study	CO1, CO3	Apply
3	ANOVA case studies	CO3	Apply
4	Regression	CO4	Apply
5	Logistic Regression	CO4	Analyze
6	Time series Analysis	CO5	Analyze



**Total : 15 Periods**

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



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20AI507	<b>DATA COMMUNICATION AND COMPUTER NETWORKS LABORATORY</b> <b>(Common to CSE, IT and AI &amp; DS)</b>	L	T	P	C
		0	0	4	2
Nature of Course	Engineering Sciences				
Prerequisites	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	Learnt 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 webpage 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

**TOTAL: 60 Periods**

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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 [50marks]	End Semester Examination[ 50marks]
Remember		
Understand	10	20
Apply	20	40
Analyze	20	40
Evaluate		
Create		

  
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## VI-SEMESTER

<b>20AI601</b>	<b>PROFESSIONAL ETHICS AND HUMAN VALUES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>Nature of Course</b>	Humanities and Social Sciences				
<b>Pre requisites</b>	Nil				

**Course Objectives**

The course is intended to

1. Create awareness on engineering ethics and human values.
2. Instill Moral and Social Values and Loyalty.
3. Learn about the social responsibility of an engineer.
4. Create awareness on assessment of safety and risk.
5. Judge a global issue by presenting an optimum solution.

**Course Outcomes**

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

<b>CO. No</b>	<b>Course Outcome</b>	<b>Bloom's Level</b>
CO1	Computer engineering ethics theory with sustained lifelong learning.	Understand
CO2	Adopt a good character and follow high professional ethical life.	Understand
CO3	Assess their own ethical values and the social context of problems	Understand
CO4	Confront and resolve moral issues occurred during technological activities.	Understand
CO5	Resolve moral and ethical problems through exploration and assessment by established experiments.	Apply

**Course Contents:****UNIT - I HUMAN VALUES****9**

Morals and Ethics - Honesty - Integrity - Values - Work Ethic - Civic Virtue - Respect for Others - Living Peacefully - Caring and Sharing - Self-Confidence - Courage - Co-operation - Commitment - Empathy.

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

Senses of 'Engineering Ethics' - Variety of moral issues - Types of inquiry - Moral dilemmas - Moral Autonomy - Kohlberg's theory - Gilligan's theory - Consensus and Controversy - Models of professional roles - Theories about right action - Self-interest - Customs and Religion - Uses of Ethical Theories.

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

Engineering as Experimentation - Engineers as responsible Experimenters - Codes of Ethics - A Balanced Outlook on Law.

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

Safety and Risk - Assessment of Safety and Risk - Risk Benefit Analysis and Reducing Risk - Respect for Authority - Collective Bargaining - Confidentiality - Conflicts of Interest - Occupational Crime - Professional Rights - Employee Rights - Intellectual Property Rights (IPR) - Discrimination.

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

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Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership – Code of Conduct – Corporate Social Responsibility.

**Total: 45 Periods**

**Text Books:**

1. Mike W Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill Publishing Company Pvt Ltd, New Delhi, 4th edition, 2014.
2. M.Govindarajan, S. Natarajan and V S Senthil Kumar, "Engineering Ethics", PHI Learning Private Ltd, New Delhi, 2012.

**Reference Books:**

1. Laura P. Hartman and Joe Desjardins, "Business Ethics: Decision Making for Personal Integrity and Social Responsibility" Mc Graw Hill education, India Pvt. Ltd., New Delhi 2013.
2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Cengage Learning, 2009.
3. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.

**Additional References:**

1. <https://nptel.ac.in/courses/109/104/109104068/>
2. [https://www.youtube.com/watch?v=3-UEi\\_djb7w](https://www.youtube.com/watch?v=3-UEi_djb7w)
3. <https://nptel.ac.in/courses/109/106/109106117/>

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	-	2	-	-
CO2	-	-	-	-	-	-	-	2	2	-	2	-	3	-	-
CO3	-	-	-	-	-	-	-	2	2	-	2	-	1	-	-
CO4	-	-	-	-	-	-	-	2	2	-	2	-	1	-	-
CO5	-	-	-	-	-	-	-	2	1	-	3	-	1	-	-
	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)
	IAE – I (7.5)	IAE – II (7.5)	IAE – III (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

<b>20AI602</b>	<b>DATA VISUALIZATION</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>Nature of Course</b>	<b>Professional core</b>				
<b>Prerequisites</b>	<b>Data Analytics</b>				

### Course Objectives

The course is intended to

1. Understand how accurately represent voluminous complex data set in web and from other data sources
2. Understand the methodologies used to visualize large data sets
3. Understand the process involved in data visualization
4. Perform various Interactive Data Visualization with data sets
5. Explore the various security aspects involved in data visualization

### Course Outcomes

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

<b>CO. No.</b>	<b>Course Outcome</b>	<b>Bloom's Level</b>
CO1	Design and use various methodologies present in data visualization	Understand
CO2	Analyze different Visualizing Data Methods	Evaluate
CO3	Examine the operation Visualizing Data Process	Apply
CO4	Explore the knowledge of Interactive Data Visualization	Apply
CO5	Discuss the process involved and security issues present in data visualization	Analyze

  
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**Course Contents:****Unit-I Introduction 9**

Context of data visualization – Definition, Methodology, Visualization design objectives. Key Factors – Purpose, visualization function and tone, visualization design options – Data representation, Data Presentation, Seven stages of data visualization, widgets, data visualization tools.

**Unit - II Visualizing Data Methods 9**

Mapping - Time series - Connections and correlations - Scatterplot maps - Trees, Hierarchies and Recursion - Networks and Graphs, Info graphics.

**Unit - III Visualizing Data Process 9**

Acquiring data, - Where to Find Data, Tools for Acquiring Data from the Internet, Locating Files for Use with Processing, Loading Text Data, Dealing with Files and Folders, Listing Files in a Folder, Asynchronous Image Downloads, Advanced Web Techniques

**Unit - IV Interactive Data Visualization 9**

Drawing with data – Scales – Axes – Updates, Transition and Motion – Interactivity - Layouts – Geomapping – Exporting, Framework – T3, .js, tablo.

**Unit – V Security Data Visualization 9**

Port scan visualization - Vulnerability assessment and exploitation - Firewall log visualization - Intrusion detection log visualization -Attacking and defending visualization systems - Creating security visualization system.

**Total: 45 Periods****Laboratory Components**

S.No	List of Exercises	CO Mapping	RBT
1	Different kinds of plots using Tableau (bar chart, line chart, scatter plot, histogram, dual axis)	CO1	Understand
2	Connecting to real time database using Tableau	CO1	Understand
3	Importing from flat files, excel files, other sources using PowerBI	CO2	Apply
4	PivotTable and PivotChart	CO3	Apply
5	Power View visualizations and Power View filtering options	CO3	Apply
6	Web Visualization Using Plotly with R	CO4	Analyze

**Total : 30 Periods****Text Books:**

1. Scott Murray, "Interactive data visualization for the web", O'Reilly Media, Inc., 2013.
2. Ben Fry, "Visualizing Data", O'Reilly Media, Inc., 2007.

**Reference Books:**

1. Greg Conti, "Security Data Visualization: Graphical Techniques for Network Analysis", No Starch Press Inc, 2007 .
2. Joshua N. Milligan, "Learning Tableau", 2016.
3. Brett Powell, "Mastering Microsoft Power BI", 2018.

**Additional / Web References:**

1. <https://nptel.ac.in/courses/127/101/127101012/>
2. <https://nptel.ac.in/courses/110/106/110106064/>
3. <https://nptel.ac.in/courses/106/107/106107220/>

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

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

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<b>20AI603</b>	<b>IoT FUNDAMENTALS AND ARCHITECTURE</b> (Common to CSE and AI&DS)	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>
<b>Nature of Course</b>	Professional Core				
<b>Pre requisites</b>	Data Communication and Computer Networks				

### Course Objectives

The course is intended to

1. Understand the basics of Embedded System, IoT and the development model.
2. Understand the architecture, Instruction set and work on ARM microcontroller using practical hand-on.
3. Ability to select appropriate hardware and microcontrollers based on need of application.
4. Understand the Internet of Things Standards, Frameworks and Techniques.
5. Apply the tools, techniques and skills acquired towards development of Projects.

### Course Outcomes

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

<b>CO. No.</b>	<b>Course Outcome</b>	<b>Bloom's Level</b>
CO1	Describe the fundamental concepts of IoT and its applications	Understand
CO2	Classify the M2M concepts with protocols.	Understand
CO3	Develop applications using Python Scripting Language.	Apply
CO4	Build real world applications by applying Raspberry PI.	Apply
CO5	Examine web based services.	Analyze

### Course Contents:

#### **UNIT I INTRODUCTION TO EMBEDDED SYSTEMS AND INTERNET OF THINGS (IOT) 9**

Architecture of Embedded Systems, Embedded Systems Development process, Architecture of Internet of Things, Applications of Embedded Systems and IoT, Design Methodology for IOT Products.

#### **UNIT-II OVERVIEW OF OPEN SOURCE HARDWARE AND ITS RELEVANCE TO IOT 9**

Introduction and Programming Arduino Development Board , Working with Sensor Integration, Interfacing Input / Output devices (Pot, LDR, LCD, etc), Introduction to Network Connectivity, Concepts of IP based communication, Client – Server model of communication, Introduction to Wi-Fi communication using ESP8266, ESP8266 in Station & Access Point Mode .

#### **UNIT III FUNDAMENTALS OF PYTHON PROGRAMMING & RASPBERRY PI 9**

Introduction to python programming, Working with functions, classes, REST full Web Services, Client Libraries, Introduction & programming Raspberry Pi3 , Integrating Input Output devices with Raspberry Pi3

#### **UNIT IV IOT PLATFORM 9**

Cloud Computing Platforms for IoT Development (IBM Cloud) IoT Platform Architecture (IBM Internet of Things & Watson Platforms), API Endpoints for Platform Services, Devices Creation and Data Transmission, Introduction to NODE-RED and Application deployment.

#### **UNIT V IOT USECASES: SMARTCITY PROJECT & INDUSTRIAL USECASES 9**

Introduction to SmartCity Project & IOT Usecases, Development of Smartcity Applications, Project Work -1 (Smartcity Usecase), Project Work-2 (Industrial Usecase).



Total: 45 Periods

**Laboratory Components:**

S. No	List of Exercises	CO Mapping	RBT
1	Getting started with Arduino Platform, Integrate Input & Output devices. In this experiment student will setup the environment for programming Arduino UNO development boards. Explore the command set and integrates the sensors like LDR, Potentiometer, LED's, LCD display, Pushbuttons and Servo Motor.	CO1	Understand
2	Explore the sensor datasheet & integrate with Arduino UNO board In this lab experiment student will understand how to read the datasheet of a sensor, its power requirement, connection diagram. The sensors (Temperature Sensor (LM35), Ultrasonic, Digital Temperature & Humidity sensor) will be integrated with Arduino UNO platform and programmed to capture the data.	CO1	Apply
3	Getting Started with ESP8266(NodeMCU) development board, explore client server model of communication In this experiment the student will setup the environment for programming ESP8266 and configures it into station & access point mode. He will convert ESP8266 into a webserver, which receives data and commands from a client in the same network.	CO2	Apply
4	Get hands-on with Raspberry Pi, Build an IoT Gateway with Raspberry Pi This lab is designed to program the raspberry pi GPIO pins, enabling network connection, installing webserver along with database on Rpi.	CO2	Apply
5	The raspberry pi will act as a gateway and receives the data from multiple ESP8266 devices in the network.	CO3	Apply
6	Explore different communication technologies & protocols In this lab experiment we will explore the use of Bluetooth, Zigbee, GSM/GPRS	CO3	Analyze

Total: 30 Periods

**Text Books:**

1. Arsheep Bahga, Vijay Madiseti "Internet of Things: A Hands-On Approach" Orient Blackswan Private Limited - New Delhi, 2015.
2. Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things: Key applications and Protocols", Wiley Publications 2nd Edition, 2011.

**Reference Books:**

1. Jonathan W Valvano "Embedded Systems: Real-Time Interfacing to Arm(r) Cortex-M Microcontrollers", Thomson Publishers, 2015.
2. Adrian McEwen, Hakim Cassimally, "Designing the Internet of Things", Wiley Publications, 2012
3. Dr.K.V.K.K.Prasad, "Embedded Real Time Systems: Concepts, Design and Programming", DreamTech Publication, 2003.

  
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**Additional / Web References:**

1. <http://www.itu.int/en/ITU-T/gsi/iot/Pages/default.aspx>
2. <http://electronicdesign.com/embedded/understanding-protocolsbehind-internet-things>
3. [http://eclipse.org/community/eclipse\\_newsletter/2014/february/article2.php](http://eclipse.org/community/eclipse_newsletter/2014/february/article2.php)

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

<b>Summative Assessment</b>				
<b>Bloom's Category</b>	<b>Continuous Assessment Tests</b>			<b>Terminal Examination (60)</b>
	<b>IAE-I (7.5)</b>	<b>IAE-II (7.5)</b>	<b>IAE-III (10)</b>	
Remember	15	15	10	20
Understand	20	15	20	30
Apply	15	20	20	30
Analyze				20
Evaluate				
Create				

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20AI604	CLOUD COMPUTING SERVICES	L	T	P	C
		3	0	2	4
<b>Nature of Course</b>	Professional Core				
<b>Pre requisites</b>	Data Communication and Computer Networks				

**Course objectives:****The course is intended to**

1. Comprehend the concept of cloud computing.
2. Recognize the underlying principles of virtualization.
3. Gain knowledge on various architectures, services and storage security issues and risk management.
4. Explore the cloud security concerns.
5. Learn the emergence of cloud as the next generation computing paradigm.

**Course Outcomes:**

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

CO.NO	Course Outcome	Bloom's Level
CO1	Describe the different types of cloud models and services for building an efficient cloud computing environment	Understand
CO2	Apply the virtualization technologies and capacity planning techniques to create shared resource pools	Apply
CO3	Analyze the ability to understand and use the architecture of compute and storage cloud, service and delivery models.	Analyze
CO4	Evaluate the core issues of cloud computing such as resource management and security.	Evaluate
CO5	Create and choose the appropriate technologies, algorithms and approaches for implementation and use of cloud.	Create

**Course Contents:****UNIT I INTRODUCTION****9**

Introduction to Cloud Computing – Definition of Cloud – Evolution of Cloud Computing – Underlying Principles of Parallel and Distributed Computing – Cloud Characteristics – Elasticity in Cloud – On-demand Provisioning.

**UNIT II VIRTUALIZATION AND CAPACITY PLANNING****10**

Basics of Virtualization – Types of Virtualization – Implementation Levels of Virtualization – Virtualization Structures – Tools and Mechanisms – Virtualization of CPU – Memory – I/O Devices – Virtualization Support and Disaster Recovery-Capacity Planning: Defining Baseline and Metrics-Networks Capacity.

**UNIT III CLOUD ARCHITECTURE, SERVICES AND STORAGE****8**

Layered Cloud Architecture Design – NIST Cloud Computing Reference Architecture – Public, Private and Hybrid Clouds - IaaS – PaaS – SaaS – Architectural Design Challenges – Cloud Storage – Storage-as-a-Service – Advantages of Cloud Storage – Cloud Storage Providers – S3.

**UNIT IV RESOURCE MANAGEMENT AND SECURITY IN CLOUD****10**

Inter Cloud Resource Management – Resource Provisioning and Resource Provisioning Methods – Global Exchange of Cloud Resources – Security Overview – Cloud Security Challenges – Software-as-a-Service Security – Security Governance – Virtual Machine Security – IAM – Security Standards.

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**UNIT V CLOUD TECHNOLOGIES AND ADVANCEMENTS****8**

Hadoop – Map Reduce – Virtual Box -- Google App Engine – Programming Environment for Google App Engine — Open Stack – Federation in the Cloud – Four Levels of Federation – Federated Services and Applications – Future of Federation, AWS, Microsoft Azure.

**Total: 45 Periods****Laboratory Components**

S.No	List of Experiments	CO Mapping	RBT
1	Install Virtual box/VMware Workstation with different flavors of Linux or windows OS on top of windows7 or 8	CO1	Apply
2	Install a C compiler in the virtual machine created using virtual box and execute Simple Programs.	CO1	Apply
3	Install Google App Engine. Create hello world app and other simple web applications using python/java.	CO2	Apply
4	Use GAE launcher to launch the web applications.	CO2	Apply
5	Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.	CO3	Apply
6	Find a procedure to transfer the files from one virtual machine to another virtual machine.	CO4	Apply
7	Find a procedure to launch virtual machine using try stack (Online Open stack Demo Version).	CO5	Apply
8.	Install Hadoop single node cluster and run simple applications like word count.	CO5	Apply
9.	Establish an AWS account. Use the AWS Management Console to launch an EC2 instance and connect to it.	CO5	Apply

**Total: 30 Periods****Text Books:**

1. Rittenhouse, John W., and James F. Ransome, "Cloud Computing: Implementation, Management and Security", CRC Press, 2017.
2. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.

**References:**

1. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, "Mastering Cloud Computing", Tata McGraw Hill, 2013.
2. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing - A Practical Approach", Tata McGraw Hill, 2009.
3. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice)", O'Reilly, 2009.

**Additional References:**

1. <https://nptel.ac.in/courses/117/105/117105080/>
2. <https://nptel.ac.in/courses/108/105/108105113/>
3. [https://onlinecourses.nptel.ac.in/noc20\\_ee70/preview](https://onlinecourses.nptel.ac.in/noc20_ee70/preview)

  
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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	30	20	10		20	40
Understand	10	20	30		20	40
Apply	10	10	10		10	20
Analyze						
Evaluate						
Create						

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<b>20AI605</b>	<b>MINI PROJECT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>
<b>Nature of Course</b>	EEC				
<b>Pre requisites</b>	Basics of Programming Languages, Software Engineering				

**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

<b>CO.No.</b>	<b>Course Outcome</b>	<b>Bloom's Level</b>
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 prepare 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**



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20AIA01	Hadoop -Map Reduce	L	T	P	C
		0	0	2	1
<b>Nature of course</b>	Employability Enhancement Course				
<b>Prerequisites</b>	Data Analytics				

**Course Objectives**

The course is intended to

1. Understand the concepts of Big Data Analytics with Hadoop
2. Learn the concept of Hadoop Ecosystem.

**Course Outcomes**

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

CO. No	Course Outcome	Bloom's Level
CO 1	Design multi-node clustering in Hadoop for real time applications.	Apply
CO 2	Illustrate working of Hadoop ecosystem tools for big data analysis	Apply

**Course Contents****Unit I - Big Data Analytics with Hadoop****15**

Big data overview, Introduction to Hadoop, Overview of Hadoop Distribution File Systems[HDFS] and Map reduce Operations Clustering types in Hadoop- Standalone mode, Pseudo distributed mode, Fully distributed mode.

**Hands on Sessions :** Verifying Hadoop installation (Pseudo distributed mode) • Java path • Hadoop location • Hadoop configuration files • Name Node setup • Job Tracker • Metadata files • Accessing Hadoop on browser

**Unit II - Hadoop Ecosystem****15**

Hadoop Ecosystem Introduction to SQOOP, Overview of PIG -Standalone mode, cluster mode, when to use PIG latin, Introduction to HIVE, Introduction to HBASE- comparison of Hadoophdfs and HBASE.

**Hands on Sessions:**

- a) Moving data from local file system to Hadoop file system
- b) Performing MAP Reduction operation in Hadoop
- c) Verification of operation results through terminal and browser

**Total: 30 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
CO 1	3	2	2		3				3	2			1	1	2
CO 2	3									2		2	1	1	2
	3	High				2	Medium				1	Low			

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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		



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20AIA06	Orange Tool	L	T	P	C
		0	0	2	1
Nature of course	Employability Enhancement Course				
Prerequisites	Data warehousing and Data Mining				

### Course Objectives

The course is intended to

1. Illustrate working of Data Mining using Orange Tool
2. Gain knowledge on Data Exploration and Visualization

### Course Outcomes

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

CO. No.	Course Outcome	Bloom's Level
CO 1	Understand the functions Orange Tool	Understand
CO 2	Create exploration and visualization model using Orange Tool	Create

### Course Contents

#### Unit I - Orange Data Mining

15

Introduction to Orange Data Mining - features of Orange toolkit -Orange Widgets - Orange Data Mining as python Module - Orange Data Mining visual programming - Setting up your System - Creating your first Workflow - Working with Data

#### Unit II - Data Exploration And Visualization

15

Visualizing Data - Supervised Data Model -Unsupervised Model - Evaluation of Performance of Models -Data exploration and visualization - Clustering, uncovering of groups in data - Classification and predictive modeling - Analysis of survey data, data from marketing, and voting data.

**Total: 30 Periods**

  
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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
CO 1	2	2	1	2	3								1	3	1
CO 2	2	2	1	2	3								1	3	1
	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		



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20AI001	GAME PROGRAMMING	L	T	P	C
		3	0	0	3
Nature of Course	Open Elective I				
Pre requisites	Problem Solving using Python				

**Course Objectives**

The course is intended to

1. Know the basics of 2D and 3D graphics for game development.
2. Know the stages of game development.
3. Understand the basics of game engine.
4. Survey the gaming development environment and toolkits.
5. Learn and develop simple games using Pygame environment.

**Course Outcomes**

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

CO. No.	Course Outcome	Bloom's Level
CO1	Have knowledge on the concepts of 2D and 3D graphics.	Understand
CO2	Know about games and their genres with their origin and history	Apply
CO3	Prepare game design documents	Apply
CO4	Understand the implementation of gaming engines.	Apply
CO5	Survey gaming environments and frameworks. Implement a simple game in Pygame.	Apply

**Course Contents:****UNIT – I 3D Graphics For Game Programming**

9

Game – Definition – Genres of Games, Basics of 2D and 3D Graphics, Game Objects Design – 2D and 3D Transformations – Projections – Colour Models – Illumination and Shader Models – Animation – Controller based Animation.

**UNIT – II Game Design Principles**

9

Character Development, Storyboard Development for Gaming – Script Design – Script Narration – Game Balancing – Core Mechanics – Principles of Level Design – Proposals – Writing for Pre-production, Production and Post-Production.

**UNIT– III Game Engine Design**

9

Rendering Concept – Software Rendering – Hardware Rendering – Spatial Sorting Algorithms – Algorithms for Game Engine – Collision Detection – Game Logic – Game AI – Path Finding.

**UNIT– IV Overview Of Gaming Platforms And Frameworks**

9

Pygame Game development – Unity – Unity Scripts – Mobile Gaming, Game Studio, Unity – Single player and Multi-Player games.

**UNIT– V Game Development Using Pygame**

9

Developing 2D and 3D Interactive Games using Pygame – Avatar Creation – 2D and 3D Graphics Programming – Incorporating Music and Sound – Asset Creations – Game Physics Algorithms Development – Device Handling in

 Total: 45 Periods

  
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**TEXT BOOK:**

1. Sanjay Madhav, "Game Programming Algorithms and Techniques: A Platform Agnostic Approach", Addison-Wesley Professional, 2013.
2. Will McGugan, "Beginning Game Development with Python and Pygame: From Novice to Professional", Apress Publishers, 2007.

**REFERENCES:**

1. Paul Craven, "Python Arcade games", Apress Publishers, 2016.
2. David H. Eberly, "3D Game Engine Design: A Practical Approach to Real-Time Computer Graphics", Second Edition, CRC Press, 2006.
3. Jung Hyun Han, "3D Graphics for Game Programming", Chapman and Hall/CRC, 2011.

**Additional References:**

1. <https://nptel.ac.in/courses/106/102/106102431/>
2. <https://nptel.ac.in/courses/106/105/106105067/>

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	3	3	3										
CO3	3	3	3	3	3										
CO4	3	3	3	3	3										
CO5	3	3	3	3	3										
	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

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20AI002	CISCO- Routing and Switching	L	T	P	C
		3	0	0	3
Nature of Course	Open Elective				
Prerequisites	Nil				

**Course Objectives**

The course is intended to

1. Understand the network models and the protocols of each layer
2. Explore the knowledge on IPv4 and IPv6 Addressing
3. Acquire knowledge on Virtual LANs
4. Familiarize with the basic concept on Spanning tree protocols and Ethernet channel
5. Gain knowledge of Dynamic Host Configuration Protocol

**Course Outcomes**

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

<b>CO. No.</b>	<b>Course Outcome</b>	<b>Bloom's Level</b>
CO1	Compare the network models and the protocols at each layer	Understand
CO2	Construct IP addressing table and perform subnetting in IPv4 and IPv6 network.	Evaluate
CO3	Design logically separate networks using Virtual LANs and IEEE802.1Q trunking protocol.	Apply
CO4	Examine the operation of Spanning tree protocols and Etherchannel for network scalability	Apply
CO5	Analyze Dynamic Host Configuration Protocol (DHCP) operation for scalable networks.	Analyze

**Course Contents****Unit-I Introduction****9**

Networking Today: Network Components, Protocols and Models: The Protocol Suites, Data Link Layer: Purpose of the Data Link Layer, LAN Topologies, Ethernet Switching: Ethernet Frame, Ethernet MAC Address, Network Layer: Network Layer, IPv4 Packet, IPv6 Packet, Router Tables, MAC and IP, ARP.

**Unit – II IP Addressing****9**

IPv4 Addressing: IPv4 Address Structure, IPv4 Unicast, Broadcast, and Multicast, Types of IPv4 Addresses, Network Segmentation, Subnet an IPv4 Network IPv6 Addressing: IPv6 Address Representation, IPv6 Address Types, GUA and LLA Static Configuration, Dynamic Addressing for IPv6 GUAs.

**Unit – III VLAN****9**

VLAN : Overview of VLANs, VLANs in a Multi-Switched Environment, VLAN Configuration, VLAN Trunks, Dynamic Trunking Protocol. Inter-VLAN Routing: Inter-VLAN Routing Operation, Router on-a-Stick Inter-VLAN Routing.

**Unit – IV Spanning Tree Protocol****9**

Spanning Tree Protocol : Purpose of STP, STP Operations, Evolution of STP, RSTP, RSTP+, Portfast, BPDU Guard, EtherChannel: EtherChannel Operation, LACP, PAGP, Passive and Active mode in Etherchannel.

**Unit – V DHCP****9**

DHCPv4: DHCP4 Concepts, Configure a Cisco IOS DHCP4 Server; Configure a DHCP4 Client, SLAAC and DHCPv6: IPv6 Global Unicast Address Assignment, SLAAC, DHCPv6, Configure DHCPv6 Server.

**Total: 45 Periods****Text Books:**

1. CISCO Netacad Course-1 : CCNAv7-Introduction to networks, 2020 (Online Access)
2. CISCO Netacad Course-2 : CCNAv7-Switching, Routing and Wireless Essentials, 2020 (Online Access)

**Reference Books:**

1. CCNA Routing and Switching – Todd Lammle, 2nd Edition, Sybex Publisher (Wiley Brand), 2016
2. Forouzan, "Data Communications and Networking", McGraw Hill, 5th Edition 2017.
3. A. S. Tanenbaum, "Computer Networks", Pearson Education/ PHI, 2003.

**Additional / Web References:**

1. <https://nptel.ac.in/courses/106/105/106105081/>
2. <https://nptel.ac.in/courses/117/105/117105076/>
3. <https://nptel.ac.in/courses/106/105/106105080/>

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	3	3	3	3								1	1	3
CO2	3	3	3	3	3							2	1	1	3
CO3	3	3	3	3	3		2						1	1	3
CO4	3	3	3	3	3		2						1	1	3
CO5	3	3	3	3	3		2					2	1	1	3
	3	High				2	Medium					1	Low		

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

<b>Summative Assessment</b>				
<b>Bloom's Category</b>	<b>Continuous Assessment Tests</b>			<b>Terminal Examination (60)</b>
	<b>IAE-I (7.5)</b>	<b>IAE-II (7.5)</b>	<b>IAE-III (10)</b>	
Remember	15	15	10	20
Understand	20	15	20	30
Apply	15	20	20	30
Analyse				20
Evaluate				
Create				



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<b>20AIO03</b>	<b>FOUNDATIONS OF ARTIFICIAL INTELLIGENCE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>Nature of Course</b>	<b>Professional core</b>				
<b>Prerequisites</b>	<b>Nil</b>				

### Course Objectives

The course is intended to

1. Familiarize the fundamentals of intelligent agents.
2. Acquire knowledge on problem solving techniques.
3. Analyze the problem and make decisions by interring new knowledge using knowledge representation schemes.
4. Develop planning and acting in real world problem.
5. Gain knowledge in learning algorithms.

### Course Outcomes

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

<b>CO. No.</b>	<b>Course Outcome</b>	<b>Bloom's Level</b>
CO1	Summarize the basics of AI and Intelligent agent	Understand
CO2	Apply and illustrate how search algorithms play vital role in problem solving	Apply
CO3	Construct knowledge representation and knowledge of reasoning for solving real world problems	Apply
CO4	Classify the different ways of planning and acting in the real world	Apply
CO5	Apply suitable learning methodology while designing systems based on their applications	Apply

### Course Contents:

#### Unit-I Introduction to AI

**9**

Introduction to AI - The Foundations of AI - The History of AI – The State of the art – Agents and Environments – Good Behavior: The Concept of Rationality – The Nature of Environments – The Structure of agents.

#### Unit - II Solving Problems by Searching Techniques

**9**

Problem-Solving Agents – Example Problems: Toy problems – Searching for solution – Uninformed search strategies - Informed search and Exploration: Heuristic Functions – Constraint Satisfaction Problems: Backtracking search.

#### Unit - III Knowledge and Reasoning

**9**

Logical Agents: Knowledge based agents – The Wumpus World – Logic –Propositional Logic – First order Logic: Syntax and Semantics of First-order Logic, Introduction to PROLOG.



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**Unit - IV Planning and Acting****9**

The Planning Problem – Planning with State-Space Search – Partial- Order Planning – Planning and acting in the real world: Time, Schedules and Resources – Hierarchical Task Network Planning – Conditional Planning – Continuous Planning – MultiAgent Planning.

**Unit – V Uncertain knowledge and Reasoning****9**

Uncertainty: Acting under uncertainty – Basic Probability Notation – The Axioms of Probability – Making Simple decisions: Utility Functions – Decision Networks – Learning systems-supervised learning, unsupervised learning.

**Total : 45 Periods****Text Books:**

1. S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach, Prentice Hall, 4<sup>th</sup> Edition, 2020.
2. I. Bratko, "Prolog Programming for Artificial Intelligence", Addison Wesley Educational Publishers Inc, 4<sup>th</sup> Edition 2011.

**Reference Books:**

1. M. Tim Jones, "Artificial Intelligence: A Systems Approach (Computer Science)", Jones and Bartlett Learning, 2009.
2. Nils J. Nilsson, "The Quest for Artificial Intelligence", Cambridge University Press, 2009.
3. William F. Clocksin and Christopher S. Mellish, "Programming in Prolog: Using the ISO Standard", Springer Science & Business Media, 5<sup>th</sup> Edition 2012.

**Additional / Web References:**

1. <https://nptel.ac.in/courses/106/102/106102220/>
2. <https://nptel.ac.in/courses/106/105/106105078/>
3. <https://nptel.ac.in/courses/106/106/106106126/>

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	2		2							2	2	1	1
CO2	3	2	2		2							2	3	3	3
CO3	3	2	2		2							1	2	2	
CO4	3	3	3		2							1	3	3	3
CO5	3	3	3		2							2	3	3	3
	3	High				2	Medium					1	Low		

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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			Terminal Examination (60)
	IAE-I (7.5)	IAE-II (7.5)	IAE-III (10)	
Remember	15	15	10	20
Understand	20	15	20	30
Apply	15	20	20	30
Analyse				20
Evaluate				
Create				

  
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20AI004	CONTENT BASED IMAGE AND VIDEO RETRIEVAL	L	T	P	C
		3	0	0	3
Nature of Course	Open Elective				
Prerequisites	Nil				

**Course Objectives**

The course is intended to

1. Learn about Content-Based Image Retrieval with user needs
2. Gain knowledge about content-based image and video retrieval system.
3. Provide knowledge of Image Retrieval systems
4. Develop simple Video Retrieval systems
5. Provide knowledge of Video Retrieval systems

**Course Outcomes**

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

CO. No.	Course Outcome	Bloom's Level
CO1	Apply knowledge of content-based image retrieval system	Understand
CO2	Model and design of Retrieval system.	Evaluate
CO3	Develop Content-Based Image Retrieval system with simple case studies.	Apply
CO4	Apply Video Retrieval system with simple case studies.	Apply
CO5	Design Simple customized system	Analyze

**Course Contents:****Unit-I Fundamentals**

9

Fundamentals – Definition of CBIR - A typical CBIVR system architecture-User's perspective-Image use in the community- Users needs for image data

**Unit - II Feature Extraction**

9

Feature extraction and representation- Similarity measurements-Dimension Reduction and High dimensional Indexing

**Unit - III Clustering**

9

Clustering-The Semantic Gap-Learning-Relevance Feedback(RF)- Benchmarking CBIVR solutions

**Unit - IV Video Retrieval**

9

The problem – Video Parsing-Video Abstraction and Summarization-Video content representation, Indexing and Retrieval-Video browsing schemes-Examples of Video Retrieval systems.

**Unit – V Overview of the System**

9

Overview of the System-User's Perspective-The RF modeRFC mode-Experiments and Results

**Total: 45 Periods**

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**Text Books:**

1. Oge Marques, Borgo Furht, "Content Based Image and Video Retrieval", Kluwer Academic Publishers, 2002.
2. Christopher D. Manning, Prabhakar Raghavan and Hinrich Schütze, "Introduction to information Retrieval", Cambridge University Press, 2008

**Reference Books:**

- 1 Rafael C.Gonzalez and Richard E.Woods, "Digital Image Processing", Third Edition, Pearson Education, 2008

**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	2	2	3							2	1	1	3
CO2	3	2	2	2	3							2	1	1	3
CO3	3	2	2	2	3							2	1	1	3
CO4	3	3	3	2	3							2	1	1	3
CO5	3	3	3	2	3							2	1	1	3
	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			Terminal Examination (60)
	IAE-I (7.5)	IAE-II (7.5)	IAE-III (10)	
Remember	15	15	10	20
Understand	20	15	20	30
Apply	15	20	20	30
Analyze				20
Evaluate				
Create				

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20AIO05	MOBILE COMPUTING	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective 2				
Pre requisites	Computer Networks				

**Course Objectives**

The course is intended to

1. Learn the basic concepts of mobile computing
2. To learn the methods of mobile telecommunication system.
3. To be familiar with the mobile network and transport layers
4. To explore in the field of mobile Adhoc wireless networks.
5. To gain knowledge about different mobile platforms and application development

**Course Outcomes**

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

Co.No	Course Outcome	Bloom's Level
CO1.	Explain the basics of mobile telecommunication system	Understand
CO2.	Illustrate the generation of telecommunication systems in wireless network.	Understand
CO3.	Determine the functionality of MAC, network layer and Identify a routing protocol for a given Ad hoc network.	Apply
CO4.	Explain the functionality of mobile adhoc wireless networks	Apply
CO5.	Develop a mobile application using android, blackberry, iOS and Windows	Apply

**Course Contents:****UNIT – I FUNDAMENTALS OF MOBILE COMPUTING****9**

Introduction to Mobile Computing – Mobile Computing Vs Wireless Networking – Mobile Computing Applications - Characteristics of Mobile computing – Structure of Mobile Computing Application– Mobile Wireless Transmission –MAC: SDMA – FDMA – TDMA – CDMA.

**UNIT– II MOBILE TELECOMMUNICATION SYSTEM****9**

Introduction to Cellular Systems – GSM –Services and Architecture – Protocols – Connection Establishment – Frequency Allocation – Routing – Mobility Management – Security – GPRS-UMTS – Architecture – Handover – Security- 3G wireless systems..

**UNIT– III MOBILE NETWORK AND TRANSPORT LAYER****9**

Infra-Red Vs. Radio Transmission – Infrastructure and Adhoc Network – Mobile IP – Mobile Adhoc Networks –Traditional TCP and classical TCP improvements.

**UNIT– IV MOBILE ADHOC WIRELESS NETWORKS****9**

Adhoc Basic Concepts – Characteristics – Applications – Design Issues – Routing – Essential of Traditional Routing Protocols – Popular Routing Protocols – Vehicular Ad Hoc networks (VANET) – MANET Vs VANET – Security.4G Vision – 4G Features and Challenges – Applications of 4G.

**UNIT– V MOBILE PLATFORMS AND APPLICATIONS****9**

Mobile Device Operating Systems – Special Constrains and Requirements – Commercial Mobile Operating Systems – Software Development Kit: Android, BlackBerry, Windows Phone – M-Commerce – Structure – Pros and Cons – Mobile Payment System – Security Issues.

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**Text Books:**

1. Jochen H. Schller, "Mobile Communications", Pearson Education, New Delhi, Second Edition, 2012.
2. Prasant Kumar Pattnaik, Rajib Mall, "Fundamentals of Mobile Computing", PHI Learning Pvt. Ltd, New Delhi, Second Edition, 2012.

**Reference Books:**

1. Vijay Garg K, "Wireless Communications and Networks, Morgan Kaufmann Publishers (Elsevier), Mexico, Second Edition, 2007.
2. Clint Smith and Daniel Collins, "3G Wireless Networks", Tata McGraw Hill, New Delhi, Second Edition, 2007.
3. William.C.Y.Lee, "Mobile Cellular Telecommunications-Analog and Digital Systems", Tata McGraw Hill, India, Second Edition, 2006.

**Additional References:**

1. <https://nptel.ac.in/courses/106/106/106106147/>
2. <https://nptel.ac.in/noc/courses/noc16/SEM2/noc16-cs13/>
3. <https://www.digimat.in/nptel/courses/video/106106147/L16.html>

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	20	40
Apply	20	20	20	50
Evaluate	0	0	0	0
Create	0	0	0	0

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20AIO06	HUMAN COMPUTER INTERACTION	L	T	P	C
		3	0	0	3
<b>Nature of Course</b>	Open Elective I				
<b>Pre requisites</b>	Nil				

**Course Objectives**

The course is intended to

1. Learn the principles and fundamentals of human computer interaction (HCI).
2. Analyze HCI theories, as they relate to collaborative or social software.
3. Understand components of interfaces and screens, including windows, menus and controls.
4. Understand user interface design principles, and apply them to designing an interface.
5. Understand the rationale and guidelines for an effective interface design methodology.

**Course Outcomes**

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

CO. No.	Course Outcome	Bloom's Level
CO1.	Describe typical human-computer interaction (HCI) models and styles, as well as various historic HCI paradigms	Understand
CO2.	Apply an interactive design process and universal design principles to designing HCI systems.	Apply
CO3.	Describe and use HCI design principles, standards and guidelines	Apply
CO4.	Discuss tasks and dialogs of relevant HCI systems based on task analysis and dialog design Develop models for Knowledge Acquisition and Expert System	Apply
CO5.	Design, implement and evaluate effective and usable graphical computer interfaces	Apply

**Course Contents:****UNIT – I Introduction****9**

Importance of User Interface : Definition-Importance of good design-Benefits of good design-Human-centered development and Evaluation-Human Performance models-A Brief history of screen design.

**UNIT – II The Graphical User Interface&Design Process****9**

GUI : Popularity of graphics-The concept of direct manipulation-Graphical system -Characteristics-Web user-Interface Popularity-Characteristics and Principles of User Interface.

Design process : Human Interaction with computers- Importance of Human Characteristics- Human Consideration

**UNIT– III Screen Designing****9**

Design Goals- Screen Planning and Purpose- Organizing Screen Elements- Ordering of Screen Data and Content- Screen-Navigation and Flow- Visually Pleasing Composition- Amount of Information- Focus and Emphasis- Presenting Information-Simply and Meaningfully- Information retrieval on web- Statistical Analysis- Technological considerations in Interface Design.

**UNIT– IV Windows & Components****9**

Windows : New Navigation Schemes-Selection of Window-Selection of Devices Based on Screen Based Controls. Components : Text and Messages- Icons and Increases - Multimedia-Colors - Uses -Problems- Choosing colors.

**UNIT– V Software Tools And Interaction Devices****9**

Specification Methods- Interface Building Tools- Keyboard and Function Keys- Pointing Devices Speech Recognition.

**Total: 45 Periods****Text Books:**

1. Wilbert O Galitz, "The Essential Guide to User Interface Design", Third Edition, Wiley India Pvt., Ltd., 2007.
2. Ben Shneidermann, "Designing the User Interface", Fifth edition, Pearson Education Asia, 2013.(Software Tools And Interaction Devices)

**Reference Books:**

1. Preece, J., Sharp, H., Rogers, Y., "Interaction Design: Beyond Human-Computer Interaction", Fourth Edition, Wiley, 2015.
2. B. Shneiderman, "Designing the User Interface". Addison Wesley, 5th edition, 2004.
3. Alan Dix Janet Finlay Gregory D. Abowd Russel Beale, "Human Computer Interaction" Pearson Education, 3rd edition, 2004.

**Additional References:**

1. <https://nptel.ac.in/courses/106/102/106102562/>
2. <https://nptel.ac.in/courses/106/105/106105089/>

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	3	3	3										
CO3	3	3	3	3	3										
CO4	3	3	3	3	3										
CO5	3	3	3	3	3										
	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

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<b>20AIO07</b>	<b>DATABASE MANAGEMENT SYSTEM AND ADMINISTRATION</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>Nature of Course</b>	<b>Open Elective</b>				
<b>Pre requisites</b>	<b>Database Management system</b>				

### Course Objectives

The course is intended to

1. Understand the basic concepts and the applications of database systems
2. Master the basics of SQL and construct queries using SQL
3. Understand the relational database design principles
4. become familiar with the basic issues of transaction processing and concurrency control
5. become familiar with database storage structures and access techniques

### Course Outcomes

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

<b>Co.No</b>	<b>Course Outcome</b>	<b>Bloom's Level</b>
CO1.	Identify the role of Database Management System for maintenance of Databases	Apply
CO2.	Relational Model to design and manipulate a Database	Apply
CO3.	Convert Entity relationship model into Relational Model.	Apply
CO4.	Design a Database using Normalization techniques.	Evaluate
CO5.	Determine Database transactions as per concurrency and ACID properties.	Evaluate

### Course Contents:

#### UNIT – I Introduction

9

Database system, Characteristics (Database Vs File System), Database Users (Actors on Scene, Workers behind the scene), Advantages of Data base systems, Database applications. Brief introduction of different Data Models; Concepts of Schema, Instance and data independence.

#### UNIT – II Relational model

9

Introduction to relational model, concepts of domain, attribute, tuple, relation, importance of null values, constraints (Domain, Key constraints, integrity constraints) and their importance, Logical Data Base Design. BASIC SQL: Simple Database schema, data types, table definitions (create, alter), different DML operations (insert, delete, update), basic SQL querying (select and project) using where clause.

#### UNIT – III Entity Relationship Model

9

Introduction to ER Model, Data Base Design, Representation of entities, attributes, entity set, relationship, relationship set, Additional Features of ER Model: constraints, sub classes, super class, Strong and Weak entities, inheritance, specialization, generalization, Aggregation. SQL: Creating tables with relationship, implementation of key and integrity constraints, nested queries, sub queries, grouping, aggregation, ordering.

#### UNIT – IV Schema Refinement (Normalization)

9

Purpose of Normalization or schema refinement, concept of functional dependency, normal forms based on functional dependency (1NF, 2NF and 3 NF), concept of surrogate key, Boyce-Codd normal form (BCNF), Lossless join and dependency preserving decomposition, Fourth normal form (4NF).

**UNIT – V Transaction Management And Concurrency Control**

9

Transaction, properties of transactions, transaction log, and transaction management with SQL using commit rollback and savepoint. Concurrency control for lost updates, uncommitted data, inconsistent retrievals. Concurrency control with locking methods: lock granularity, lock types, two phase locking for ensuring serializability, deadlocks, Concurrency control with time stamp ordering: Wait/Die and Wound/Wait Schemes.

**Total: 45 Periods****Text Books:**

1. "Database Management Systems," Raghuram Krishnan, Johannes Gehrke, TMH, 3rd edition, 2003.
2. "Database Management System," Ramez Elmasri, Shamkant B. Navathe, PEA, 6th edition, 2016.

**Reference Books:**

1. "Database System Concepts," Silberschatz, Korth, TMH, 5th edition, 2011.
2. "Introduction to Database Systems," C J Date, PEA, 8th edition, 2004.
3. "The Database book principles & practice using Oracle/MySQL," Narain Gehani, Silicon Press, 2011..

**Additional References:**

1. <http://nptel.ac.in/courses/106106093> (Prof. D. Janakiram, IIT, Madras)

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	20	40
Apply	20	20	20	50
Evaluate	0	0	0	0
Create	0	0	0	0

20AIO08	Advanced Java Programming	L	T	P	C
		3	0	0	3
Nature of Course	Open Elective				
Prerequisites	Object Oriented Programming				

**Course Objectives**

The course is intended to

1. Impart the core language features of Java and its Application Programming Interfaces.
2. Demonstrate the use of threads, exceptions, files and collection frameworks in Java.
3. Familiarize students with GUI based application development and database connectivity.
4. Explore the concepts of RMI
5. Gain Knowledge in JSP

**Course Outcomes**

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

CO. No.	Course Outcome	Bloom's Level
CO1	Discuss Servlet Life Cycle. RMI Applications	Understand
CO2	Describe Java Bean.	Evaluate
CO3	Develop Enterprise applications.	Apply
CO4	Describe the steps to develop	Apply
CO5	Discuss JSP Scripting Elements and Java Mail API.	Apply

**Course Contents:****Unit 1:**

Servlet Overview – Servlet life cycle - The Java Web Server – Simple Servlet – Servlet Packages– Using Cookies - - Session Tracking - Security Issues – using JDBC in Servlets – HTML to Servlet Communication - applet to servlet communication.

9

**Unit 2:**

Java Beans: The software component assembly model- The java bean development kitdeveloping beans – notable beans – using infobus - Glasgow developments - Application Builder tool-JAR files- Introspection-Bound Properties-Persistence-customizers - java beans API.

9

**Unit 3:**

EJB: EJB architecture- EJB requirements – design and implementation – EJB session beans-EJBentity beans-EJB Clients – deployment tips, tricks and traps for building distributed and other systems – implementation and future directions of EJB-Variable in perl- perl control structures and operators – functions and scope

9



**Unit 4:**

RMI – Overview – Developing applications with RMI: Declaring & Implementing remote interfaces- stubs & skeletons, Registering remote objects, writing RMI clients –Pushing data from RMI Servlet – RMI over Inter-ORB Protocol

9

**Unit 5:**

JSP –Introduction JSP-Examining MVC and JSP -JSP scripting elements & directives Working with variables scopes-Error Pages - using Java Beans in JSP Working with Java Mail Understanding Protocols in Java mail-Components-Java mail API-Integrating into J2EEUnderstanding Java Messaging Services-Introducing Java Transactions.

9

**Total: 45 Periods****Text Books:**

- 1) James McGovern, Rahim,Adatia, Yakor Fain, 2003, J2EE 1.4 Bible, Wiley-dreamtech India Pvt. Ltd, New Delhi.
- 2) Herbert Schildt, 2002, Java 2 Complete Reference, 5th Edition, Tata McGraw Hill, New Delhi.
- 3) Jamie Jaworski, 1999, Java 2 Platform – Unleashed, First Edition, Techmedia-SAMS.

**Reference books:**

- (1) K. Moss, 1999, Java Servlets, Second edition, Tata McGraw Hill, New Delhi.
- (2) D. R.Callaway,1999, Inside Servlets, Addison Wesley, Boston
- (3) Joseph O'Neil, 1998, Java Beans from the Ground Up, Tata McGraw Hill, New Delhi.
- (4) T. Valesky, T.C. Valesky, 1999, Enterprise JavaBeans, Addison Wesley.
- (5) Cay S Horstmann& Gary Cornell, 2013, Core Java Vol II Advanced Features, 9th Edition, Addison Wesley.

**Additional / Web References:**

1. [https://onlinecourses.nptel.ac.in/noc20\\_cs17/preview](https://onlinecourses.nptel.ac.in/noc20_cs17/preview)
2. [https://onlinecourses.nptel.ac.in/noc22\\_cs54/preview](https://onlinecourses.nptel.ac.in/noc22_cs54/preview)
3. <https://nptel.ac.in/courses/106/105/106105173/>

**Mapping of Course Outcomes (CO) with Programme Outcomes (PO)**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>CO1</b>	3	3	2	2	2	-	-	-	2	-	1	1
<b>CO2</b>	3	3	2	2	-	-	-	-	1	-	-	1
<b>CO3</b>	3	3	2	2	1	-	-	-	1	-	-	2
<b>CO4</b>	3	3	3	2	2	-	-	-	2	-	-	2
<b>CO5</b>	3	3	3	2	2				1			2

**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	

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Summative Assessment				
Bloom's Category	Continuous Assessment Tests			Terminal Examination (60)
	IAE-I (7.5)	IAE-II (7.5)	IAE-III (10)	
Remember	15	15	10	20
Understand	20	15	20	30
Apply	15	20	20	30
Analyse				20
Evaluate				
Create				



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20AIE08	STATISTICAL DECISION MAKING	L	T	P	C
		3	0	0	3
<b>Nature of Course</b>	Open Elective I				
<b>Pre requisites</b>	Statistical Method for Data Analysis				

### Course Objectives

The course is intended to

1. Learn the basic concepts of Statistics
2. Acquire the concepts of random variables essential for the subsequent and digital communication
3. Study the concepts on types of Forecasting and Time series Analysis
4. Familiarize with the basic concept on types of sampling of survey used in the field of engineering
5. Acquaint with the knowledge of testing of hypothesis for small and large samples

### Course Outcomes

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

CO. No.	Course Outcome	Bloom's Level
CO1.	Illustrate raw data into meaningful information by using statistics as a decision making	Understand
CO2.	Apply appropriate test techniques for one variable, two variable, single population and two population	Apply
CO3.	Relate the skills to handle time series data on excel	Understand
CO4.	Paraphrase the outcomes of empirical analysis	Understand
CO5.	Interpret the testing of hypothesis for small and large sample	Understand

### Course Contents:

#### UNIT – I Statistics, Measures of Central Tendency and Dispersion: 9

Types of statistical methods - Importance and scope of statistics - Types of data, Principles of measurement – Classification of data - Data organization using array – Tabulation of data – Graphical presentation of data – Diagrammatic presentation of data - Requisites of a measure of central tendency - Significance of measuring dispersion - Coefficient of variation

#### UNIT – II Correlation and Regression Analysis: 9

Meaning and types of correlation – Karl Pearson coefficient of correlation – Rank correlation – multiple correlation – Simple linear regression – Multiple regression – Estimation of coefficients – Parameters of regression – R- square.

#### UNIT– III Forecasting and Time series Analysis 9

Introduction – Types of forecasts – Timing of forecasts – Forecasting methods – Steps of forecasting – Time series analysis - Time series decomposition models – Quantitative forecasting methods.

#### UNIT– IV Sampling 9

Introduction – Reason of sample survey – Types of bias during sample survey – Principles of sampling – Random and non – Random sampling methods – Choice of sampling methods.

#### UNIT– V Hypothesis Testing 9

Rationale of hypothesis testing – Significance level – Rejection region – Hypothesis testing procedure – One sample t – test – Independent t-test – Dependent t-test - One sample z – test – Independent z-test

**Total: 45 Periods**



**TEXT BOOK:**

1. Christian S A, Winston W L, " Business Analytics: Data Analysis and Decision Making", Cengage Learning, 6<sup>th</sup> Edition, 2017
2. Nicholas T. Longford, " Statistics for Decision Making" Chapman and Hall/CRC, 1<sup>st</sup> Edition, 2021

**REFERENCES:**

1. Anderson, Sweeney, Williams, " Statistics for Business & Economics", Cengage Learning, 13<sup>th</sup> Edition, 2019.
2. Sharma J K, "Business Statistics", Vikas Publishing, 5<sup>th</sup> Edition, 2019.

**Additional References:**

3. <https://nptel.ac.in/courses/111/102/111102111>
4. <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	3	3	3										
CO2	3	3	3	3	3										
CO3	3	3	3	3	3										
CO4	3	3	3	3	3										
CO5	3	3	3	3	3										
	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

  
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20AIO09	<b>SOFT COMPUTING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>Nature of Course</b>	<b>Open Elective</b>				
<b>Prerequisites</b>	<b>Foundations of Artificial Intelligence</b>				

**Course Objectives**

The course is intended to

1. Understand and analyze the importance and basic concepts of Soft Computing and the use of agents.
2. Identify, explore the complex problem solving approaches and strategies.
3. Explore and analyze the basic concepts of fuzzy logic and learning process.
4. Analyze and use the concept of neural network programming for various domains.
5. Explore the concepts of Genetic Algorithm.

**Course Outcomes**

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

CO. No.	Course Outcome	Bloom's Level
CO1	Recognize the feasibility of applying a soft computing methodology for a particular problem.	Understand
CO2	Categorize fuzzy logic and reasoning to handle uncertainty and solve engineering problems	Evaluate
CO3	Remembering genetic algorithms to solve combinatorial optimization problems.	Apply
CO4	Apply neural networks to pattern classification and regression problems	Apply
CO5	Perform real time applications using Genetic Algorithm	Apply

**Course Contents:****UNIT –I**

AI Problems and Search: AI problems, Techniques, Problem Spaces and Search, Heuristic Search Techniques- Generate and Test, Hill Climbing, Simulated Annealing, Best First Search 186 Problem reduction, Constraint Satisfaction and Means End Analysis.

9

**UNIT-II**

Artificial Neural Networks: Introduction, Basic models of ANN, important terminologies, Supervised Learning Networks, Perceptron Networks, Adaptive Linear Neuron, Back propagation Network. Associative Memory Networks.

9

**UNIT-III**

Unsupervised Learning Network- Introduction, Fixed Weight Competitive Nets, Maxnet, Hamming Network, Kohonen Self-Organizing Feature Maps, Counter Propagation Networks, Adaptive Resonance Theory Networks. Special Networks-Introduction to various networks.

9

**UNIT-IV**

Introduction to Classical Sets (crisp Sets) and Fuzzy Sets- operations and Fuzzy sets. Classical Relations and Fuzzy Relations- Cardinality, Operations, Properties and composition. Tolerance and equivalence relations. Membership functions- Features, Fuzzification, Defuzzification.

9

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**UNIT-V**

Fuzzy Arithmetic and Fuzzy Measures, Fuzzy Rule Base and Approximate Reasoning Fuzzy Decision making Fuzzy Logic Control Systems. Genetic Algorithm- Introduction and basic operators and terminology. Applications: Internet Search Technique.

**9****Total: 45 Periods****Text Books:**

1. Principles of Soft Computing- S N Sivanandam, S N Deepa, Wiley India, 2007.
2. Soft Computing and Intelligent System Design -Fakhreddine O Karray, Clarence D Silva,. Pearson Edition, 2004.

**Reference books:**

1. Artificial Intelligence and Soft Computing- Behavioral and Cognitive Modeling of the Human Brain- Amit Konar, CRC press, Taylor and Francis Group.
2. Artificial Intelligence – Patric Henry Winston – Third Edition, Pearson Education.
3. A first course in Fuzzy Logic-Hung T Nguyen and Elbert A Walker, CRC. Press Taylor and Francis Group.

**Additional / Web References:**

1. [https://onlinecourses.nptel.ac.in/noc20\\_cs17/preview](https://onlinecourses.nptel.ac.in/noc20_cs17/preview)
2. [https://onlinecourses.nptel.ac.in/noc22\\_cs54/preview](https://onlinecourses.nptel.ac.in/noc22_cs54/preview)
3. <https://nptel.ac.in/courses/106/105/106105173/>

**Mapping of Course Outcomes (CO) with Programme Outcomes (PO)**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2	-	-	-	2	-	1	1
CO2	3	3	2	2	-	-	-	-	1	-	-	1
CO3	3	3	2	2	1	-	-	-	1	-	-	2
CO4	3	3	3	2	2	-	-	-	2	-	-	2

**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			Terminal Examination (60)
	IAE-I(7.5)	IAE-II(7.5)	IAE-III(10)	
Remember	15	15	10	20
Understand	20	15	20	30
Apply	15	20	20	30
Analyse				20
Evaluate				
Create				

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20AIO10	DATA SCIENCE FOR ENGINEERS	L	T	P	C
		3	0	0	3
<b>Nature of Course</b>	Open Elective				
<b>Prerequisites</b>	Database Management Systems				

**Course Objectives**

The course is intended to

1. Know the fundamental concepts of data sciences
2. Learn about the different techniques used for data preprocessing
3. Analyze and visualize real time data
4. Gain in-depth knowledge on supervised machine learning techniques
5. Gain in-depth knowledge on unsupervised machine learning techniques

**Course Outcomes**

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

CO. No.	Course Outcome	Bloom's Level
CO1	Illustrate the data Science Roles and its stages	Understand
CO2	Analyze various preprocessing techniques for data mining	Analyze
CO3	Design a frameworks for exploratory data analytics	Creating
CO4	Discuss on the principle operation of various supervised machine learning techniques.	Understand
CO5	Discuss on the principle operation of various unsupervised machine learning techniques	Understand

**Course Contents:****Unit – I Introduction****9**

Introduction to Data Science –Data Science Roles – Stages in a Data Science Project – Applications of Data Science in various fields – Data Security Issues.

**Unit – II Data Collection and Data Pre-Processing****9**

Data Collection Strategies – Data Pre-Processing Overview – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization

**Unit – III Exploratory Data Analytics****9**

Descriptive Statistics – Mean, Standard Deviation, Skewness and Kurtosis – Box Plots – Pivot Table – Heat Map – Correlation Statistics – ANOVA.

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**Unit – IV Supervised Learning****9**

Introduction to machine learning, Types of machine learning, Linear, Multiple, Logistic and Polynomial Regression: Applications in transport, gaming and banking. KNN, Decision Trees: Applications in precision farming and smart building, calculate the performance metrics of regression and classification techniques.

**Unit – V Unsupervised Learning****9**

Clustering, Similarity and Distance measure, K means clustering: sentiment analysis. Agglomerative Clustering: gene expression data analysis, Graph based clustering techniques: smart city application.

**Total: 45 Periods****Text Books:**

1. David Dietrich, Barry Heller, Beibei Yang, "Data Science and Big data Analytics", Wiley, 2015.
2. Jake VanderPlas, "Python Data Science Handbook", O'Reilly, 2016.

**Reference Books:**

1. Cathy O'Neil and Rachel Schutt, "Doing Data Science", O'Reilly, 2013.
2. Raj, Pethuru, "Handbook of Research on Cloud Infrastructures for Big Data Analytics", IGI Global, 2014.
3. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2014.

**Additional / Web References:**

1. <https://nptel.ac.in/courses/106/106/106106179/>
2. <https://nptel.ac.in/courses/111/104/111104146/>
3. <https://nptel.ac.in/courses/110/106/110106064/>

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	2							2	3	3	3
CO2	2	2	2	2	3							3	3	2	3
CO3	2	2	2	3	2							2	2	3	3
CO4	3	2	3	2	3							3	3	3	2
CO5	3	2	3	2	3							2	3	3	3
	3	High				2	Medium				1	Low			

**Formative assessment**

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

**Summative Assessment**

<b>Bloom's Category</b>	<b>Continuous Assessment Tests</b>			<b>Final</b>
	<b>IAE-I (7.5)</b>	<b>IAE-II (7.5)</b>	<b>IAE-III (10)</b>	<b>Examination (60)</b>
Remember	10	10	10	10
Understand	20	20	20	40
Apply	20	20	20	50
Evaluate				
Create				



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**PROFESSIONAL ELECTIVES (PE)****STREAM I: COMPUTER AUTOMATION**

20AIE01	INTELLIGENT INFORMATION RETRIEVAL	L 3	T 0	P 2	C 4
<b>Nature of Course</b>	Professional Elective				
<b>Prerequisites</b>	Database Management Systems				

**Course Objectives**

The course is intended to

1. Learn the fundamentals of Information Retrieval and its various models.
2. Acquire the Knowledge of principles of relevance feed back
3. Apply the information retrieval mechanisms for real time applications
4. Learn the usage and design of Web Search Engines.
5. Understand the role of information retrieval systems in web applications.

**Course Outcomes**

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

CO	Course Outcome	Bloom's Level
CO1	Apply the basic concepts of information retrieval	Understand
CO2	Identify the principles of relevance feed back	Apply
CO3	Solve the different indexing and searching mechanisms	Apply
CO4	Utilize information from complex data types	Apply
CO5	Build steps to develop search engines and evaluate them	Apply

**Course Contents:****Unit - I Introduction and Modeling:****9**

Introduction and Modeling: Information Retrieval –The IR Problem –The IR System –Modeling: Classic Information Retrieval –Set Theoretic, Algebraic and Probabilistic Models –Retrieval Evaluation.

**Unit - II Relevance Feedback and Documents:****9**

Relevance Feedback and Documents: A Framework for feedback methods-Explicit feedback-Implicit feedback through local analysis- Global analysis-Documents: Metadata-Document Formats-Text Properties-Document Preprocessing-Organizing documents-Text Compression.

**Unit -III Queries, Indexing and Searching****9**

Queries, Indexing and Searching: Query Languages-Query Properties-Indexing and Searching: Introduction-Inverted Indexes – Signature Files –Suffix Trees and Suffix Arrays-Sequential Searching – Multidimensional Indexing

**Unit - IV Web Retrieval and Web Crawling****9**

Web Retrieval and Web Crawling: Introduction-The Web-Search Engine Architectures-Ranking-User Interaction-Browsing-Web Crawling.

**Unit - V Structure Text and Multimedia Information Retrieval****9**

Structure Text and Multimedia Information Retrieval: Structured Text Retrieval-Multimedia Information Retrieval-Enterprise Search- Tasks-Architecture-Evaluation.

**Total: 45 Periods**
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**Text Books:**

1. Ricardo Baeza-Yate, Berthier Ribeiro-Neto, "Modern Information Retrieval", 2<sup>nd</sup> Edition, Pearson Education, 2011.
2. Christopher D. Manning, Prabhakar Raghavan, Hinrich Schütze, "Introduction to Information Retrieval", Cambridge University Press, 2008.

**Reference Books:**

1. Chowdhury G.G, "Introduction to Modern Information Retrieval", 2 Edition, Neal-Schuman Publishers, 2003.
2. Daniel Jurafsky and James H. Martin, "Speech and Language Processing", 2 Edition, Prentice Hall, 2008.
3. Ricardo Baeza-Yates, Berthier Ribeiro-Neto, "Modern Information Retrieval: The Concepts and Technology behind Search", Second Edition, ACM Press books, 2011.

**Additional/WebReferences:**

1. <https://www.coursera.org/learn/inf-recommenders>
2. <https://www.coursera.org/specializations/inf>
3. <https://www.coursera.org/learn/inf-intelligence-tools>

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							1		3	1	1
CO2	3	2	1	1							1		3	1	1
CO3	3	2	1	1							1		3	1	1
CO4	3	2	1	1							1		3	1	1
CO5	3	2	1	1							1		3	1	1
	3	High				2	Medium						Low		

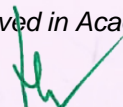
Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

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**Summative Assessment**

<b>Bloom's Category</b>	<b>Continuous Assessment Tests</b>			<b>Terminal Examination (60)</b>
	<b>IAE1 (7.5)</b>	<b>IAE2 (7.5)</b>	<b>IAE3 (10)</b>	
Remember	0	0	0	20
Understand	10	10	10	20
Apply	20	20	20	30
Analyse	20	20	20	30
Evaluate	0	0	0	0
Create	0	0	0	0


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20AIE02	<b>ADVANCED ARTIFICIAL INTELLIGENCE SYSTEMS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>Nature of Course</b>	Professional Electives(PE)				
<b>Prerequisites</b>	Foundations of Artificial Intelligence				

### Course Objectives

The course is intended to

1. Know the underlying structure behind intelligence mathematically.
2. Know the logical implications in probabilistic Reasoning.
3. Know the automated learning techniques.
4. Explore the techniques in Reinforcement Learning.
5. Explore artificial intelligence techniques for Robotics.

### Course Outcomes

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

CO. No.	Course Outcome	Bloom's Level
CO1	Explain the probabilistic reasoning using Bayesian inference	Understand
CO2	Apply appropriate Probabilistic reasoning techniques for solving uncertainty problems	Apply
CO3	Explain use of game theory for decision making..	Apply
CO4	Explain and apply probabilistic models for various use cases	Apply
CO5	Apply AI techniques for robotics	Apply



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**Course Contents:**

<b>Unit-I</b>	<b>Probabilistic Reasoning I</b>	<b>9</b>
Acting under uncertainty – Bayesian inference – naïve bayes models Probabilistic reasoning – Bayesian networks – exact inference in BN – approximate inference in BN – causal networks		
<b>Unit-II</b>	<b>Probabilistic Reasoning II</b>	<b>9</b>
Probabilistic reasoning over time – time and uncertainty – inference in temporal models – Hidden Markov Models – Kalman filters – Dynamic Bayesian networks Probabilistic programming		
<b>Unit-III</b>	<b>Decisions Under Uncertainty</b>	<b>11</b>
Basis of utility theory – utility functions – Multiattribute utility functions – decision networks – value of information – unknown preferences Sequential decision problems – MDPs – Bandit problems – partially observable MDPs Multiagent environments – non-cooperative game theory – cooperative game theory – making collective decisions		
<b>Unit-IV</b>	<b>Learning Probabilistic Models</b>	<b>9</b>
Statistical learning theory – maximum-likelihood parameter learning – naïve bayes models – generative and descriptive models – continuous models – Bayesian parameter learning – Bayesian linear regression – learning Bayesian net structures – density estimation EM Algorithm – unsupervised clustering – Gaussian mixture models – learning Bayes net parameters – learning HMM – learning Bayes net structures with hidden variables		
<b>Unit-V</b>	<b>Reinforcement Learning And Robotics</b>	<b>7</b>
Learning from rewards – passive reinforcement learning – active reinforcement learning – generalization in reinforcement learning – policy search – inverse reinforcement learning – applications Robots – robotic perception – planning movements – reinforcement learning in robotics – robotic frameworks -- applications of robotics Philosophy, ethics, and safety of AI – the future of AI		

**Total: 45Periods****TextBooks:**

1. Stuart Russel and Peter Norvig, "Artificial Intelligence: A Modern Approach", Fourth Edition, Pearson Education, 2020.
2. Dan W. Patterson, "Introduction to AI and ES", Pearson Education, 2007

**ReferenceBooks:**

1. Kevin Night, Elaine Rich, and Nair B., "Artificial Intelligence", McGraw Hill, 2008
2. Patrick H. Winston, "Artificial Intelligence", Third edition, Pearson Edition, 2006
3. Deepak Khemani, "Artificial Intelligence", Tata McGraw Hill Education, 2013

**Additional References:**

1. <https://nptel.ac.in/courses/106/106/106106139/>

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2. <https://nptel.ac.in/courses/106/105/106105152/>3. <https://nptel.ac.in/courses/106/106/106106198/>

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	2	2											3
CO2	3	2	2	2											3
CO3	3	2	2	2											3
CO4	3	3	3	2											3
CO5	3	3	3	2											3
	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			Terminal Examination (60)
	IAE1 (7.5)	IAE2 (7.5)	IAE3 (10)	
Remember	15	15	10	20
Understand	20	15	20	30
Apply	15	20	20	30
Analyse				20
Evaluate				
Create				

20AIE03	Neural Networks	L	T	P	C
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	(Common to CSE, IT and AI&DS)	3	0	0	3
Nature of Course	Professional Elective				
Prerequisites	Familiarity with linear algebra, multivariate calculus, and probability theory				

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Obj**Objectives**

The course is intended to

1. To understand the role of neural networks in engineering, artificial intelligence, and cognitive modeling.
2. To understand the mathematical concepts of the performance surfaces and different methods for optimizations.
3. To understand the concepts, and representation of most common neural network models.
4. To understand the performance of neural networks and implement neural network models for particular applications.
5. Apply neural networks to classification and recognition problems.

**Course Outcomes**

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

CO. No.	Course Outcome	Bloom's Level
CO1	Learn basic neural network architecture	Understand
CO2	Learn basic learning algorithms.	Evaluate
CO3	Understand data pre and post processing	Apply
CO4	Learn training, verification and validation of neural network models	Apply



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**Course Contents:**

**Unit I Basic Learning Algorithms**

Biological Neuron – Artificial Neural Model – Types of Activation Functions – Architecture– Feed Forward and Feedback – Learning Process – Error Correction Learning – Memory Based Learning – Hebbian Learning – Competitive Learning – Boltzman Learning – Supervised and Unsupervised Learning.

9

**Unit II Radial Basis Function Networks and Support Vector Machines**

Cover's Theorem on the Separability of Patterns – Exact Interpolator – Regularization Theory – Generalized Radial Basis Function Networks – Learning in Radial Basis Function Networks.

9

**Unit III A Committee Machines**

Ensemble Averaging – Boosting – Associative Gaussian Mixture Model – Hierarchical Mixture of Experts Model (HME) – Model Selection using a Standard Decision Tree – Apriori and Posteriori Probabilities – Maximum Likelihood Estimation – Learning Strategies for the HME Model.

9

**Unit IVA ttractor Neural Networks**

Associative Learning – Attractor Neural Network Associative Memory – Linear Associative Memory – Hopfield Network – Content Addressable Memory – Strange Attractors and Chaos -Error Performance of Hopfield Networks – Applications of Hopfield Networks – Simulated Annealing – Boltzmann Machine – Bidirectional Associative Memory.

9

**Unit V Self Organizing Maps**

Self-organizing Map – Maximal Eigenvector Filtering – Sanger's Rule – Generalized Learning Law – Competitive Learning – Vector Quantization – Mexican Hat Networks – Self-organizing Feature Maps – Applications PULSED NEURON MODELS.

9

**Total: 45 Periods**

**TEXT BOOKS:**

1. Satish Kumar, —Neural Networks, A Classroom ApproachII, Tata McGraw -Hill, 2004.
2. Simon Haykin, —Neural Networks, A Comprehensive FoundationII, 2nd Edition, Addison Wesley Longman,2001.

**REFERENCES:**

1. Martin T.Hagan, Howard B. Demuth and Mark Beale, —Neural Network DesignII, Thomson Learning, 2003.
2. James A. Freeman and David M. Skapura, —Neural Networks Algorithms, Applications and programming TechniquesII, Pearson Education, 2003.

**Additional / Web References:**

1. <https://www.coursera.org/courses?query=neural%20networks>
2. <https://nptel.ac.in/courses/117/105/117105084/>
3. <https://nptel.ac.in/courses/106/106/106106184/>



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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	2	3	3							3	3	3	
CO2	3	3	2	3	3								2	2	
CO3	3	3	3	2	3								2	2	
CO4	3	3	3	3	3								2	2	
CO5	3	3	3	3	2								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			Terminal Examination (60)
	IAE-I (7.5)	IAE-II (7.5)	IAE-III (10)	
Remember	15	15	10	20
Understand	20	15	20	30
Apply	15	20	20	30
Analyse				20
Evaluate				
Create				

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<b>20AIE04</b>	<b>ROBOTIC PROCESS AUTOMATION</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>Nature of Course</b>	Professional Elective				
<b>Prerequisites</b>	Foundations of Artificial Intelligence				

**Course Objectives**

The course is intended to

1. Understanding basic components of robotic system.
2. Analysing the robotic drive systems and the sensors in robots.
3. Applying the knowledge of Artificial intelligence and designing the robot hand.
4. Applying the knowledge of robot kinematics to create computer programs that control mobile robots and robot arms
5. Applying the Industrial Robotics knowledge to create computer programs that enabling the robots to recognize and manipulate objects

**Course Outcomes**

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

<b>CO. No.</b>	<b>Course Outcome</b>	<b>Bloom's Level</b>
CO1	Understand the fundamentals of robots and basic components of robotic system.	Understand
CO2	Understand and analyse the robotic drive systems and the sensors in robots	Analyze
CO3	Apply the knowledge of Artificial intelligence and designing the robot hand, soft computing.	Apply
CO4	Apply the knowledge of robot kinematics to control mobile robots and robot arms.	Apply
CO5	Create computer programs that enabling the robots to recognize and manipulate objects and navigate their environments	Apply

**Course Contents:****Unit-I Fundamentals of Robotics****9**

Introduction History of robots - Classification of robots - Present status and future trends - Basic components of robotic system - Basic terminology- Accuracy, Repeatability, Resolution- Degree of freedom - Mechanisms and transmission - End effectors- Grippers-different methods of gripping, Mechanical grippers-Slider crank mechanism, Screw type, Rotary actuators- Cam type gripper, Magnetic grippers- Vacuum grippers, Air operated grippers- Specifications of robot.

**Unit-II Drive systems and Sensors****9**

Drive system- hydraulic- pneumatic and electric systems Sensors in robot – Touch sensors- Tactile sensor, Proximity and range sensors- Robotic vision sensor- Force sensor- Light sensors- Pressure sensors


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**Unit-III Sensors and Intelligent Robots****9**

Artificial Intelligence and Automated Manufacturing- AI and Robotics- Need for Sensing Systems- Sensory Devices- Robot Vision Systems- Design and Control of Sensor Integrated Dexterous Robot Hand- Soft Computing.

**Unit-IV Robot Control****9**

Robot Controls-Point to point control - Continuous path control - Intelligent robot- Control system for robot joint- Control actions - Feedback devices- Encoder, Resolver- LVDT- Motion Interpolations, Adaptive control.

**Unit-V Robotic Programming****9**

Introduction to Robotic Programming- On-line and off-line programming- programming examples- Robot applications-Material handling- Machine loading and unloading- assembly- Inspection- Welding, Spray painting.

Total: 45Periods

**TextBooks:**

1. Mikell P Groover, "Industrial Robotics, Technology programming and Applications", McGraw Hill, 2<sup>nd</sup> Edition, 2012.
2. S.R. Deb, "Robotics Technology and flexible automation", Tata McGraw-Hill Education, 2<sup>nd</sup> Edition, 2009.

**ReferenceBooks:**

- 1 Craig. J. J., "Introduction to Robotics mechanics and control", Pearson,, 3<sup>rd</sup> Edition, 2009.
- 2 Mikell P.Grover, "Automation, Production Systems and Computer Integrated Manufacturing", Pearson Education Asia, 4<sup>th</sup> Edition, 2016.
- 3 C.Ray Asfahl, "Robots and manufacturing Automation" John Wiley & Sons, 2<sup>nd</sup> Edition, 1992

**Additional References:**

1. <https://nptel.ac.in/courses/112/101/112101098/>
2. <https://nptel.ac.in/courses/107/106/107106090/>
3. <https://nptel.ac.in/courses/112/107/112107289/>

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	2	3	3							2	1	1	3
CO2	3	2	2	3	3							2	1	1	3
CO3	3	2	2	3	3							1	1	1	3
CO4	3	3	3	3	3							1	1	1	3

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CO5	3	3	3	3	3						2	1	1	3
	3	High				2	Medium				1	Low		

**Formativeassessment**

Bloom'sLevel	AssessmentComponent	Marks	Total marks
Apply	ClassroomorOnline Quiz	5	15
Understand	ClassPresentation/Powerpointpresentation	5	
	Attendance	5	

**SummativeAssessment**

Bloom'sCategory	ContinuousAssessmentTests			Terminal Examination (60)
	IAE-I(7.5)	IAE-II(7.5)	IAE-III(10)	
Remember	15	15	10	20
Understand	20	15	20	30
Apply	15	20	20	30
Analyse				20
Evaluate				
Create				


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20AIE05	NATURAL LANGUAGE PROCESSING	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Prerequisites	Nil				

**Course Objectives**

The course is intended to

1. Learn the fundamentals of natural language processing.
2. Understand the use of CFG and PCFG in NLP.
3. Understand the role of semantics of sentences and pragmatics.
4. Apply the NLP techniques to IR applications
5. Compare the statistical approaches for different types of NLP applications.

**Course Outcomes**

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

CO. No.	Course Outcome	Bloom's Level
CO1.	Understand a given text with basic Language features	Understand
CO2.	Solve an innovative application using NLP components	Apply
CO3.	Implement a rule based system to tackle morphology/syntax of a language	Apply
CO4.	Categorize the set of statistical processing for real-time applications	Analyze
CO5.	Compare and contrast the use of different statistical approaches for different types of NLP applications.	Analyze

**Course Contents:****UNIT - I INTRODUCTION OF NATURAL LANGUAGE PROCESSING****9**

Origins and challenges of NLP – Language Modeling: Grammar-based LM, Statistical LM – Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance

**UNIT – II WORD LEVEL ANALYSIS****9**

Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Part-of-Speech Tagging, Rule-based, Stochastic and Transformation-based tagging, Issues in PoS tagging – Hidden Markov and Maximum Entropy models.

**UNIT – III SYNTACTIC ANALYSIS****9**

Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Shallow parsing – Probabilistic CFG and CYK, Probabilistic Lexicalized CFGs – Feature structures, Unification of feature structures.

**UNIT – IV SEMANTICS AND PRAGMATICS****9**

Requirements for representation, First-Order Logic, Description Logics – Syntax-Driven Semantic analysis and attachments – selectional restrictions – Word Sense Disambiguation, WSD using Supervised, Bootstrapping methods – Word Similarity using Thesaurus and Distributional methods.

**UNIT – V DISCOURSE ANALYSIS AND LEXICAL RESOURCES****9**

Discourse segmentation, Coherence – Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm – Coherence Resolution – Resources: Penn Treebank, Brill's Tagger, Word Net, Brown Corpus, British National Corpus (BNC).

**Total: 45 Periods**
  
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**Text Books:**

1. Daniel Jurafsky, James H. Martin "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech", Pearson Publication, 2014.
2. James Allen. "Natural Language Understanding", Addison Wesley, 1994.

**Reference Books:**

1. Breck Baldwin, "Language processing with Java and LingPipe Cookbook", Atlantic Publisher, 2015.
2. Richard M Reese, "Natural Language Processing with Javall", O'Reilly Media, 2015.
3. Nitin Indurkha and Fred J. Damerau, "Handbook of Natural Language Processing", Second Edition, Chapman and Hall/CRC Press, 2010.

**Additional References:**

1. <https://nptel.ac.in/courses/111/103/111103016/>
2. <https://nptel.ac.in/courses/106/106/106106049/>
3. <https://www.digimat.in/nptel/courses/video/111103016/L01.html>

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	2
CO2	3	3	3										3	3	2
CO3	3	3	3										3	3	2
CO4	3	3	3										3	3	2
CO5	3	3	3										3	3	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			Terminal Examination (60)
	IAE – I (7.5)	IAE – II (7.5)	IAE – III (10)	
Remember	10	10	0	20
Understand	20	20	10	20
Apply	10	10	20	40
Analyze	10	10	20	20
Evaluate				
Create				


  
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20AIE06	AUGMENTED REALITY & VIRTUAL REALITY	L	T	P	C
		3	0	0	3
<b>Nature of Course</b>	Professional Elective				
<b>Pre requisites</b>	Computer Networks				

### Course Objectives

The course is intended to

1. Learn the basic concepts of Virtual reality
2. Learn the methods of mobile telecommunication system.
3. Familiar with the mobile network and transport layers
4. Explore in the field of mobile Adhoc wireless networks.
5. Gain knowledge about different mobile platforms and application development

### Course Outcomes

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

CO. No.	Course Outcome	Bloom's Level
CO1.	Understand fundamental computer vision, computer graphics and human-computer interaction techniques related to VR/AR	Understand
CO2.	Understand Computer graphics and geometric modeling	Understand
CO3.	Learn about virtual environment	Apply
CO4.	To relate and differentiate VR/AR technology	Apply
CO5.	To use various types of Hardware and software in virtual Reality systems	Apply

### Course Contents:

#### Unit -I INTRODUCTION TO VIRTUAL REALITY

9

Virtual Reality and Virtual Environment: Introduction, Computer graphics, Real time computer graphics, Flight Simulation, Virtual environment requirement, benefits of virtual reality, Historical development of VR, Scientific Landmark.

#### Unit – II COMPUTER GRAPHICS AND GEOMETRIC MODELING

9

Introduction, The Virtual world space, positioning the virtual observer, the perspective projection, human vision, stereo perspective projection, Color theory, Conversion From 2D to 3D, 3D space curves, 3D boundary representation, Simple 3D modeling, 3D clipping, Illumination models, Reflection models. Shading algorithms. Geometrical Transformations: Introduction, Frames of reference, Modeling transformations, Instances, Picking, Flying, Scaling the VE, Collision detection.

#### Unit - III VIRTUAL ENVIRONMENT

9

Input: Tracker, Sensor, Digital Gloves, Movement Capture, Video-based Input, 3D Menus & 3D Scanner etc. Output: Visual /Auditory / Haptic Devices. Generic VR system: Introduction, Virtual environment, Computer environment, VR technology, Model of interaction, VR Systems. Animating the Virtual Environment: Introduction, The dynamics of numbers, Linear and Nonlinear interpolation, the animation of objects, linear and non-linear translation, shape & object in between, free from deformation, particle system

#### Unit - IV AUGMENTED 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, 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, Modeling virtual world, Physical simulation, VR toolkits, Introduction to VRML.

**Total: 45 Periods**

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**Text Books:**

1. Grigore C. Burdea, Philippe Coiffet, "Virtual Reality Technology", Wiley 2016.
2. Alan B. Craig, "Understanding Augmented Reality, Concepts and Applications", Morgan Kaufmann, 2013.

**Reference Books:**

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 2007.

**Additional References:**

1. <https://www.digimat.in/nptel/courses/video/106105195/L13.html>
2. <https://nptel.ac.in/noc/courses/noc18/SEM1/noc18-ge08/>
3. <https://nptel.ac.in/courses/121/106/121106013/>

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	20	40
Apply	20	20	20	50
Evaluate	0	0	0	0
Create	0	0	0	0



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20AIE07	PATTERN RECOGNITION	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Prerequisites	Basic knowledge in engineering mathematics, Linear Algebra fundamentals of probability theory and statistics, programming knowledge.				

### Course Objectives

The course is intended to

1. Introduce to fundamental concept, statistical approach to pattern recognition.
2. Learn how to design optimal classifier and focus on related techniques of parameter estimation.
3. Know about non parametric procedures used with arbitrary distribution, various procedures for determining discriminate function.
4. To learn unsupervised procedure that used unlabelled sample.
5. Introduce to various methodologies for identification and verification of a person

### Course Outcomes

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

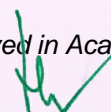
CO. No.	Course Outcome	Bloom's Level
CO1	Classify patterns using Bayesian Decision Theory.	Understand
CO2	Classify patterns using Parametric and Non-Parametric techniques.	Evaluate
CO3	Perform Subspace analysis for classification problems and compare with other classification algorithms.	Apply
CO4	Choose between single Gaussian and mixture models for classification based on the applications.	Apply

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**Course Contents:****Unit 1 INTRODUCTION AND BAYESIAN DECISION THEORY****9**

Machine perception, an example; Pattern Recognition System; The Design Cycle; Learning and Adaptation. Introduction to Bayesian Decision Theory; Continuous Features, Minimum error rate, classification, classifiers, discriminate functions, and decision surfaces.

**Unit 2 MAXIMUM-LIKELIHOOD TECHNIQUES****9**

Introduction to Maximum-likelihood estimation; Bayesian Estimation; Bayesian parameter estimation: Gaussian Case, general theory; Hidden Markov Models. Introduction to Non Parametric Techniques.

**Unit 3 LINEAR DISCRIMINANT FUNCTIONS:****9**

Introduction; Linear Discriminant Functions and Decision Surfaces; Generalized Linear Discriminant Functions; The Two-Category Linearly Separable case; Minimizing the Perception Criterion Functions; Relaxation Procedures; Non-separable Behavior; Minimum Squared-Error procedures.

**Unit 4 UNSUPERVISED LEARNING AND CLUSTERING****9**

Introduction; Mixture Densities and Identifiability; Maximum-Likelihood Estimates; Application to Normal Mixtures; Unsupervised Bayesian Learning; Data Description and Clustering; Criterion Functions for Clustering.

**Unit 5 INTRODUCTION TO BIOMETRICS:****9**

Biometric methodologies: finger prints, hand geometry, facial recognition, Iris scanning, retina scanning, identification & verification – the distinction, performance criterion.

**Total: 45 Periods****Text Books:**

1. Richard O.Duda, Peter E.Hart, David G. Stork, "Pattern Classification", John Wiley publication, 2nd edition, 2001.

**Reference Books:**

1. Robert Schalkoff, "Pattern Recognition: Statistical, Structural and Neural Approaches", John Wiley & Sons, Inc.1992.
2. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer publication, 2006.
3. K.Jain, R.Bolle, S.Pankanti, "Biometric: Personal Identification in network society", Kluwer academic publishers, 1999.

**Additional / Web References:**

1. <https://nptel.ac.in/courses/106/106/106106046/>
2. <https://nptel.ac.in/courses/117/105/117105101/#>
3. <https://www.coursera.org/courses?query=pattern%20recognition>

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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	3	1	2		2		2		
CO2		3	1			2	2	1	2		2		2		
CO3		3	2		2	2	3	1	2		2	1	2		
CO4				3		2	1				2		2		
CO5		3		2	2	2	2				2	2	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			Terminal Examination (60)
	IAE-I (7.5)	IAE-II (7.5)	IAE-III (10)	
Remember	15	15	10	20
Understand	20	15	20	30
Apply	15	20	20	30
Analyze				20
Evaluate				
Create				

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20AIE08	STATISTICAL DECISION MAKING	L	T	P	C
		3	0	0	3
Nature of Course	Open Elective I				
Pre requisites	Statistical Method for Data Analysis				

**Course Objectives**

The course is intended to

1. Learn the basic concepts of Statistics
2. Acquire the concepts of random variables essential for the subsequent and digital communication
3. Study the concepts on types of Forecasting and Time series Analysis
4. Familiarize with the basic concept on types of sampling of survey used in the field of engineering
5. Acquaint with the knowledge of testing of hypothesis for small and large samples

**Course Outcomes**

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

CO. No.	Course Outcome	Bloom's Level
CO1.	Illustrate raw data into meaningful information by using statistics as a decision making	Understand
CO2.	Apply appropriate test techniques for one variable, two variable, single population and two population	Apply
CO3.	Relate the skills to handle time series data on excel	Understand
CO4.	Paraphrase the outcomes of empirical analysis	Understand
CO5.	Interpret the testing of hypothesis for small and large sample	Understand

**Course Contents:****UNIT – I Statistics, Measures of Central Tendency and Dispersion: 9**

Types of statistical methods - Importance and scope of statistics - Types of data, Principles of measurement – Classification of data - Data organization using array – Tabulation of data – Graphical presentation of data – Diagrammatic presentation of data - Requisites of a measure of central tendency - Significance of measuring dispersion - Coefficient of variation.

**UNIT – II Correlation and Regression Analysis: 9**

Meaning and types of correlation – Karl Pearson coefficient of correlation – Rank correlation – multiple correlation – Simple linear regression – Multiple regression – Estimation of coefficients – Parameters of regression – R- square

**UNIT– III Forecasting and Time series Analysis 9**

Introduction – Types of forecasts – Timing of forecasts – Forecasting methods – Steps of forecasting – Time series analysis - Time series decomposition models – Quantitative forecasting methods.

**UNIT– IV Sampling 9**

Introduction – Reason of sample survey – Types of bias during sample survey – Principles of sampling – Random and non – Random sampling methods – Choice of sampling methods.

**UNIT– V Hypothesis Testing 9**

Rationale of hypothesis testing – Significance level – Rejection region – Hypothesis testing procedure – One sample t – test – Independent t-test – Dependent t-test - One sample z– test – Independent z-test

**Total: 45 Periods**

**TEXT BOOK:**

1. Christian S A, Winston W L, " Business Analytics: Data Analysis and Decision Making", Cengage Learning, 6<sup>th</sup> Edition, 2017
2. Nicholas T. Longford, " Statistics for Decision Making" Chapman and Hall/CRC, 1<sup>st</sup> Edition, 2021

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**REFERENCES:**

1. Anderson, Sweeney, Williams, "Statistics for Business & Economics", Cengage Learning, 13<sup>th</sup> Edition, 2019.
2. Sharma J K, "Business Statistics", Vikas Publishing, 5<sup>th</sup> Edition, 2019.

**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	3	3	3										
CO2	3	3	3	3	3										
CO3	3	3	3	3	3										
CO4	3	3	3	3	3										
CO5	3	3	3	3	3										
	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

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<b>20AIE09</b>	<b>COMPUTER VISION</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
20AIE04	<b>Professional Elective</b>				
<b>Prerequisites</b>	<b>Foundations of Artificial Intelligence</b>				

### Course Objectives

The course is intended to

1. Analyzing fundamental image processing techniques
2. Applying boundary tracking techniques, chain codes and other region descriptors.
3. Applying Hough Transform for Object detection and location
4. Gain knowledge in 3D vision and motion techniques
5. Analyze the applications of computer vision.

### Course Outcomes

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

<b>CO. No.</b>	<b>Course Outcome</b>	<b>Bloom's Level</b>
CO1	Analyze fundamental image processing techniques required for computer vision.	Understand
CO2	Outline shape and region analysis methods.	Evaluate
CO3	Apply Hough Transform for line, circle, and ellipse detections.	Apply
CO4	Apply 3D vision and motion related techniques.	Apply
CO5	Summarize the applications of computer vision.	Analyze

### Course Contents:

#### Unit-I Image Processing Foundations

9

Review of image processing techniques – classical filtering operations – thresholding techniques – edge detection techniques – corner and interest point detection – mathematical morphology – texture.

#### Unit - II Shapes and Regions

9

Binary shape analysis – connectedness – object labeling and counting – size filtering – distance functions – skeletons and thinning – deformable shape analysis – boundary tracking procedures – active contours – shape models and shape recognition – centroidal profiles – handling occlusion – boundary length measures – boundary descriptors – chain codes – Fourier descriptors – region descriptors – moments.

#### Unit - III Hough Transform

9

Line detection – Hough Transform (HT) for line detection – foot-of-normal method – line localization – line fitting – RANSAC for straight line detection – HT based circular object detection – accurate center location – speed problem – ellipse detection – Case study: Human Iris location – hole detection – generalized Hough Transform (GHT) – spatial matched filtering – GHT for ellipse detection – object location – GHT for feature collation.

#### Unit - IV 3D Vision and Motion

9

Methods for 3D vision – projection schemes – shape from shading – photometric stereo – shape from texture – shape from focus – active range finding – surface representations – point-based

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representation – volumetric representations – 3D object recognition – 3D reconstruction – introduction to motion – triangulation – bundle adjustment – translational alignment – parametric motion – spline-based motion – optical flow – layered motion.

## Unit – V Applications

9

Photo album – Face detection – Face recognition – Eigen faces – Active appearance and 3D shape models of faces Application: Surveillance – foreground-background separation – particle filters – Chamfer matching, tracking, and occlusion – combining views from multiple cameras – human gait analysis Application: In-vehicle vision system: locating roadway – road markings – identifying road signs – locating pedestrians.

Total: 45 Periods

### Text Books:

1. R. Szeliski, —Computer Vision: Algorithms and Applications, Springer 2011.
2. E. R. Davies, —Computer & Machine Vision, Fourth Edition, Academic Press, 2012.

### Reference Books:

1. Jan Erik Solem, —Programming Computer Vision with Python: Tools and algorithms for analyzing images, O'Reilly Media, 2012.
2. Mark Nixon and Alberto S. Aquado, —Feature Extraction & Image Processing for Computer Vision, Third Edition, Academic Press, 2012.
3. Simon J. D. Prince, —Computer Vision: Models, Learning, and Inference, Cambridge University Press, 2012.

### Additional / Web References:

1. <https://nptel.ac.in/courses/108/103/108103174/>
2. <https://nptel.ac.in/courses/106/105/106105216/>
3. <https://nptel.ac.in/courses/106/106/106106224/>

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	3			2							2	1	2	2
CO2	2	3	1		2							2	1	2	2
CO3	2	3	1		2							2	1	2	2
CO4	2	3	1		2							2	1	2	2
CO5	2	3	1		2								1	2	2
	3	High				2	Medium					1	Low		

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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			Terminal Examination (60)
	IAE-I (7.5)	IAE-II (7.5)	IAE-III (10)	
Remember	15	15	10	20
Understand	20	15	20	30
Apply	15	20	20	30
Analyse				20
Evaluate				
Create				



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20AIE10	Geometric Modelling	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Prerequisites	Engineering Mathematics				

### Course Objectives

The course is intended to

1. Emphasizes problem-solving methodologies, algorithm designs and developments and computer programming skills.
2. The intention is to provide sufficient depth in these topics to enable candidates to achieve better understanding of problem solving using computers.
3. Besides the written papers, lab-based examinations are included as part of the assessment requirements for the study.
4. The lab-based examinations will test the candidate's ability to develop computer-programming solutions for a series of programming tasks of varying complexity.
5. The modules in the syllabus reflect solving general problems via programming solution.

### Course Outcomes

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

CO. No.	Course Outcome	Bloom's Level
CO1	Explain the coordinate system for the development of geometric models	Understand
CO2	Develop and manipulate the curves and surfaces using parametric equations	Apply
CO3	Develop and manipulate the solid models using different modeling approaches	Apply
CO4	Apply the transformation and projection principles over the given geometric models	Apply



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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	1	1	1			1							
CO2	3	2	1	1	1			1							
CO3	3	2	1	1				1							
CO4	3	2	1	1	1			1							
CO5	3	2	1	1	1			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			Terminal Examination (60)
	IAE-I (7.5)	IAE-II (7.5)	IAE-III (10)	
Remember	15	15	10	20
Understand	20	15	20	30
Apply	15	20	20	30
Analyse				20
Evaluate				
Create				

  
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**PROFESSIONAL ELECTIVES (PE)****STREAM II : CYBER SECURITY AND FORENSICS**

<b>20AIE21</b>	<b>CYBER LAW AND ETHICS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>Nature of Course</b>	Professional Elective				
<b>Pre requisites</b>	NIL				

**Course Objectives**

The course is intended to

1. Understanding concepts related to cyber world and cyber law in general.
2. Develop competitive edge on various facets of cyber crimes.
3. Problems arising out of online transactions and provoke them to find solutions Intellectual property. Issues in the cyber space and the growth and development of the law.
4. Regulation of cyber space at national and international level.
5. Upholding ethical standards in cyber laws and intellectual property issues.

**Course Outcomes**

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

<b>CO. No.</b>	<b>Course Outcome</b>	<b>Bloom's Level</b>
CO1	Understand Cyber laws	Understand
CO2	Describe Information Technology act	Understand
CO3	Interpreted knowledge about Cyber law and Related Legislation	Understand
CO4	Demonstrate Electronic business and legal issues	Understand
CO5	Interpret Cyber Ethics	Understand

**Course Contents:****UNIT I INTRODUCTION TO CYBER LAW****9**

Evolution of computer Technology, emergence of cyber space. Cyber Jurisprudence, Jurisprudence and law, Doctrinal approach, Consensual approach, Real Approach, Cyber Ethics, Cyber Jurisdiction, Hierarchy of courts, Civil and criminal jurisdictions, Cyberspace Web space, Web hosting and web Development agreement, Legal and Technological Significance of domain Names, Internet as a tool for global access.

**UNIT II INFORMATION TECHNOLOGY ACT****9**

Overview of IT Act, 2000, Amendments and Limitations of IT Act, Digital Signatures, Cryptographic Algorithm, Public Cryptography, Private Cryptography, Electronic Governance, Legal Recognition of Electronic Records, Legal Recognition of Digital Signature, Certifying Authorities, Cyber Crime and Offences, Network Service Providers Liability, Cyber Regulations Appellate Tribunal, Penalties and Adjudication.

**UNIT III CYBER LAW AND RELATED LEGISLATION****9**

Patent Law, Trademark Law, Copyright, Software – Copyright or Patented, Domain Names and Copyright disputes, Electronic Data Base and its Protection, IT Act and Civil Procedure Code, IT Act and Criminal Procedural Code, Relevant Sections of Indian Evidence Act, Relevant Sections of Bankers Book Evidence Act, Relevant Sections of Indian Penal Code, Relevant Sections of Reserve Bank of India Act, Law Relating To Employees And Internet, Alternative Dispute Resolution , Online Dispute Resolution (ODR).

**UNIT IV ELECTRONIC BUSINESS AND LEGAL ISSUES****9**

Evolution and development in E-commerce, paper vs paper less contracts E-Commerce models- B2B, B2C, E security. Business, taxation, electronic payments, supply chain, EDI, E-markets, Emerging Trends.

**UNIT V CYBER ETHICS****9**

The Importance of Cyber Law, Significance of cyber Ethics, Need for Cyber regulations and Ethics. Ethics in Information society, Introduction to Artificial Intelligence Ethics: Ethical Issues in AI and core Principles, Introduction to Block chain Ethics.

**Total: 45 periods****Text Books:**

1. Mark Grabrowser, Eric P. Robinson, "Cyber Law and Ethics Regulation of the Connected World", Routledge publication, 1<sup>st</sup> Edition July 13, 2021.
2. Kenneth C. Laudon, "E-Commerce: Business, Technology", Society publication, 2016.

**Reference Books:**

1. Kenneth J. Knapp, "Cyber Security and Global Information Assurance: Threat Analysis and Response Solutions", IGI Global, 2009.
2. Debby Russell and Sr. G. T Gangemi, "Computer Security Basics (Paperback)", O Reilly Media, 2<sup>nd</sup> Edition 2006.
3. Thomas R. Peltier, "Information Security policies and procedures": A Practitioners Reference, Prentice Hall, 2nd Edition 2004.

**Additional References:**

1. [https://onlinecourses.swayam2.ac.in/nou19\\_cs08/preview](https://onlinecourses.swayam2.ac.in/nou19_cs08/preview)
2. [https://youtu.be/dX\\_I1ugkp6l](https://youtu.be/dX_I1ugkp6l)
3. <https://youtu.be/ZFHCZt5VnMs>

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	1
CO2	3	2	1	1									3	1	1
CO3	3	3	2	1									3	1	1
CO4	3	3	2	1									3	1	1
CO5	3	2	2	1									3	1	1
	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	

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Summative Assessment				
Bloom’s Category	Internal Assessment Examinations			Terminal Examination (60)
	IAE – I (7.5)	IAE – II (7.5)	IAE – III (10)	
Remember	0	0	0	0
Understand	10	10	10	20
Apply	20	20	20	30
Analyze	20	20	20	30
Evaluate				20
Create				


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<b>20AIE22</b>	<b>CYBER FORENSICS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>Nature of Course</b>	Professional Elective				
<b>Pre requisites</b>	NIL				

**Course Objectives**

The course is intended to

1. Describe the general concept of computer forensics
2. State the evidence collection and Forensics tools
3. Analyze and validate the forensics data
4. Demonstrate the ethical hacking to identify the vulnerabilities and malware threats.
5. Describe the real world ethical hacking and web applications.

**Course Outcomes**

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

<b>CO. No.</b>	<b>Course Outcome</b>	<b>Bloom's Level</b>
CO1	Understand the basics of computer forensics	Understand
CO2	Apply a number of different computer forensic tools to a given scenario	Apply
CO3	Analyze and validate forensics data	Analyze
CO4	Evaluate the vulnerabilities in a given network infrastructure	Evaluate
CO5	Create the real-world hacking techniques to test system security	Create

**Course Contents:****UNIT I INTRODUCTION TO COMPUTER FORENSICS****9**

Introduction to Traditional Computer Crime, Traditional problems associated with Computer Crime. Introduction to Identity Theft & Identity Fraud. Types of CF techniques - Incident and incident response methodology - Forensic duplication and investigation. Preparation for IR: Creating response tool kit and IR team. - Forensics Technology and Systems - Understanding Computer Investigation – Data Acquisition.

**UNIT II EVIDENCE COLLECTION AND FORENSICS TOOLS****9**

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

**UNIT III ANALYSIS AND VALIDATION****9**

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

**UNIT IV ETHICAL HACKING****9**

Introduction to Ethical Hacking - Foot printing and Reconnaissance - Scanning Networks - Enumeration - System Hacking - Malware Threats – Sniffing.

**UNIT V ETHICAL HACKING IN WEB****9**

Social Engineering - Denial of Service - Session Hijacking - Hacking Web servers - Hacking Web Applications – SQL Injection - Hacking Wireless Networks - Hacking Mobile Platforms-Future Issues.

**Total: 45 periods**
  
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**Text Books**

1. Black Hex Paperback, "Digital Forensic Engineering", Digital Forensic Press publication, 2<sup>nd</sup> Edition 2021.
2. Deje, Murugan (IPS), "Cyber Forensics", Oxford University Press publication, 2018.

**Reference Books:**

1. MarjieT.Britz, "Computer Forensics and Cyber Crime an Introduction", 3rd Edition, Prentice Hall, 2013.
2. AnkitFadia, "Ethical Hacking", publication Macmillan India Ltd, 2nd Edition 2006.
3. John R.Vacca, "Computer Forensics", Cengage Learning publication, 2005.

**Additional References:**

1. [https://onlinecourses.swayam2.ac.in/cec21\\_ge10/preview](https://onlinecourses.swayam2.ac.in/cec21_ge10/preview)
2. <https://youtu.be/vMyRjm4KEXs>
3. <https://youtu.be/gDzr9vcRNBg>

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	1									3	1	1
CO2	3	2	1	1									3	1	1
CO3	3	3	2	1									3	1	1
CO4	3	3	2	1									3	1	1
CO5	3	2	2	1									3	1	1
	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			Terminal Examination (60)
	IAE – I (7.5)	IAE – II (7.5)	IAE – III (10)	
Remember	0	0	0	0
Understand	10	10	10	20
Apply	20	20	20	30
Analyze	20	20	20	30
Evaluate				20
Create				

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<b>20AIE23</b>	<b>ETHICAL HACKING FUNDAMENTALS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>Nature of Course</b>	Professional Elective				
<b>Pre requisites</b>	Nil				

**Course Objectives**

The course is intended to

1. Plan a vulnerability assessment and penetration test for a network.
2. Execute a penetration test using standard hacking tools in an ethical manner.
3. Report on the strengths and vulnerabilities of the tested network.
4. Identify legal and ethical issues related to vulnerability and penetration testing
5. Implement penetration testing for malwares

**Course Outcomes**

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

<b>CO. No</b>	<b>Course Outcome</b>	<b>Bloom's Level</b>
CO1	Understand the concept of Ethical Hacking and Cryptographic techniques.	Understand
CO2	Identify the techniques of combinatorial analysis.	Analyze
CO3	Analyze the packets and able to find the intruders.	Analyze
CO4	Summarize the Vulnerabilities in a web application and servers	Evaluate
CO5	Invent the Pentest tools.	Create

**Course Contents:****UNIT – I ETHICAL HACKING BASICS****9**

Introduction to Ethical Hacking –Types of hacking –Phases of Ethical hacking. Cryptography: Cryptography and encryption – PKI, Digital certificates and digital signature – Encrypted communication and Cryptography attacks.

**UNIT-II RECONNAISSANCE AND SCANNING****9**

Foot printing: Foot printing with DNS – Determining Network Range. Scanning for targets: Identify Active machines – Port Scanning. Enumeration: Windows Security basics – Enumeration Techniques.

**UNIT – III SYSTEM ATTACK****9**

System Attack: Windows system hacking – Password Cracking – Exploiting privileges. Social Engineering: Human Based attack – Computer based attack.

**UNIT – IV WEB BASED AND WIRELESS HACKING****9**

Physical Security. Web Server Hacking: Web service architecture –Web attacks. Web Applications: Web applications attack – Web resources protection. Wireless Attacks – Bluetooth attacks.

**UNIT-V MALWARES AND PENETRATION TESTING****9**

Malware Attacks: Trojans, viruses and worms. Penetration Testing: Types of Penetration testing – Penetration testing methodologies – Penetration test tools.

**Total periods: 45**
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**Text Books:**

1. Matt Walker, "CEH- Certified Ethical Hackers Guide", McGraw-Hill Education, 4th Edition 2019.
2. Michael Gregg, "Certified Ethical Hacker (CEH) Version 9 Cert Guide", Pearson Education, 2nd Edition, 2018.

**Reference Books:**

1. Parteek Sharma, "Hacking Revealed", White Falcon Publishing, 1st Edition, 2018.
2. Reginald Wong, "Mastering Reverse Engineering: Re-engineer your ethical hacking skills", Packt, Publishing, 2018.
3. Patrick Engebretson, "The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy", Elsevier, 2nd Edition, 2013.

**Additional References:**

1. [https://onlinecourses.nptel.ac.in/noc22\\_cs13/preview](https://onlinecourses.nptel.ac.in/noc22_cs13/preview)
2. <https://nptel.ac.in/courses/106/105/106105217/>
3. <https://nptel.ac.in/noc/courses/noc22/SEM1/noc22-cs13/>

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	1	3	2	2	2	3	2	-	-	-	-	1	2	3	-
CO2	2	3	2	2	3	3	2	-	-	-	-	1	3	2	-
CO3	2	2	2	2	3	3	1	-	-	-	-	1	2	2	-
CO4	2	1	2	3	2	3	2	-	-	-	-	1	2	3	-
CO5	2	2	2	3	2	3	2	-	-	-	-	1	2	3	-
	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)
	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				

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20AIE24	SECURE CLOUD COMPUTING	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 different types of cloud models and services for building an efficient cloud Computing environment
2. Analyze the software security design principles
3. Determine the cloud risk management issues and security policies
4. Explore the cloud security architecture
5. Examine the lifecycle issues of cloud computing.

**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 cloud computing techniques.	Understand
CO2	Identify the fundamental security techniques.	Analyze
CO3	Analyze the risks involved in cloud computing.	Analyze
CO4	Evaluate the cloud architecture	Evaluate
CO5	Organize the cloud computing life cycle issues	Create

**Course Contents:****UNIT – I CLOUD COMPUTING FUNDAMENTALS****9**

Cloud Computing- Essential Characteristics- Cloud Delivery Models- Cloud Deployment Models- Service Models-Essential Characteristics of Cloud Computing-Benefits of Cloud Computing-

**UNIT-II CLOUD COMPUTING SOFTWARE SECURITY FUNDAMENTALS****9**

Cloud Security Services - Cloud Security Design Principles- Secure Cloud Software Requirements- Secure Development Practices- Secure Cloud Software Testing- Cloud Penetration Testing

**UNIT– III CLOUD RISK MANAGEMENT****9**

Cloud Computing Risk Issues: The CIA Triad-Threats to Infrastructure, Data and Access Control-Cloud Service Provider Risks-Cloud Computing Security Challenges: Security Policy Implementation-Virtualization Security Management.

**UNIT – IV CLOUD COMPUTING SECURITY ARCHITECTURE****9**

Information classification -Trusted Cloud Computing - Identity Management and Access Control Access control- Autonomic Security- Cloud Computing and Business Continuity Planning/Disaster Recovery.

**UNIT–V CLOUD COMPUTING LIFE CYCLE ISSUES****9**

Cloud security standards: - Layered Security and IDS - Intrusion Detection and issues- Security Incident Notification Process - Encryption and Key Management- Hardware Protection- Software-Based Protection- VM Life Cycle.

**Total periods: 45**

  
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**Text Books:**

1. Ronald L. Krutz, Russell Dean Vines "Cloud Security "A Comprehensive Guide to Secure Cloud Computing", Wiley Publishing Inc, 2010
2. Tim Mather, Subra Kumaraswamy, and Shahed Latif oreilly "Cloud Security and Privacy" First Edition September 2009.

**Reference Books:**

1. Lawrence Miller, "Cloud Security & Compliance Palo Alto Networks" John Wiley & Sons, 2019.
2. Zeal Vora "Enterprise Cloud Security and Governance", Packt Publishing Ltd Dec, 2017.
3. Frank Kim, Rob Lee, John Pescatore "Practical Guide to Security in the AWS cloud", Sans Publishers, second edition 2014.

**Additional References:**

1. <https://nptel.ac.in/courses/106/105/106105167/>
2. <https://nptel.ac.in/noc/courses/noc21/SEM2/noc21-cs62/>
3. <https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs20/>

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	1	3	2	2	2	3	2	-	-	-	-	1	2	3	-
CO2	2	3	2	2	1	3	1	-	-	-	-	1	3	2	-
CO3	2	2	2	1	1	3	2	-	-	-	-	1	2	2	-
CO4	2	1	2	3	2	3	2	-	-	-	-	1	2	3	-
CO5	2	2	2	3	2	3	1	-	-	-	-	1	2	3	-
	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)
	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				



20AIE25	INFORMATION SECURITY	L	T	P	C
		3	0	0	3
<b>Nature of Course</b>	Professional Elective				
<b>Pre requisites</b>	Cryptography and Network Security				

**Course Objectives**

The course is intended to

1. Understand the basics of Information Security.
2. Know the legal, ethical and professional issues in Information Security.
3. Know the aspects of risk management.
4. Know the aspects of e-mail privacy.
5. Know the technological aspects of Information Security.

**Course Outcomes**

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

CO. No.	Course Outcome	Bloom's Level
CO1	Understand the basics of information security	Understand
CO2	Illustrate the legal, ethical and professional issues in information security	Apply
CO3	Demonstrate the aspects of risk management.	Apply
CO4	Analyze the different techniques in the e-mail privacy.	Analyze
CO5	Identify technological aspects of information security.	Analyze

**Course Contents:****UNIT - I INTRODUCTION****9**

The Security Problem in Computing: The meaning of computer Security, Computer Criminals, Methods of Defense, Elementary Cryptography: Substitution Ciphers, Transpositions, Making "Good" Encryption algorithms, The Data Encryption Standard, The AES Encryption Algorithms, Public Key Encryptions, Uses of Encryption.

**UNIT - II SECURITY INVESTIGATION****9**

Need for Security, Business Needs, Threats, Attacks, Legal, Ethical and Professional Issues -An Overview of Computer Security – Access Control Matrix, Policy-Security policies, Confidentiality policies, Integrity policies and Hybrid policies

**UNIT- III SECURITY ANALYSIS****9**

Risk Management: Identifying and Assessing Risk, Assessing and Controlling Risk -Systems: Access Control Mechanisms, Information Flow and Confinement Problem

**UNIT - IV EMAIL PRIVACY****9**

Pretty good privacy (pgp) and s/mime, PGP Notations, PGP Operation- Authentication, PGP Operation- Confidentiality, PGP Operation – Email Compatibility, PGP Operation – Segmentation/ Reassembly, Cryptographic Keys and Key Rings.

**UNIT – V PHYSICAL DESIGN****9**

Security Technology, IDS, Scanning and Analysis Tools, Cryptography, Access Control Devices, Physical Security, Security and Personnel.

**Total: 45 periods**

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**Text Books:**

1. SanilNadkarni, "Fundamentals of Information Security: A Complete Go-to Guide for Beginners to Understand All the Aspects of Information Security" BPB Publication, November 2020.
2. Michael E Whitman and Herbert J Mattord, "Principles of Information Security", Vikas Publishing House, New Delhi, 2003.

**Reference Books:**

1. Micki Krause, Harold F. Tipton, "Handbook of Information Security Management", Vol 1-3 CRCPress LLC, 2004.
2. Stuart McClure, Joel Scrambray, George Kurtz, "Hacking Exposed", Tata McGraw-Hill, 2003.
3. Matt Bishop, Computer Security Art and Science, Pearson/PHI, 2002.

**Additional References:**

1. <https://nptel.ac.in/courses/106/106/106106129/>
2. <https://nptel.ac.in/courses/106/106/106106141/>
3. <https://nptel.ac.in/courses/106/106/106106178/>

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	1									3	1	
CO2	3	2	1	2									3	1	
CO3	3	3	2	2									3	1	
CO4	3	3	2	2									3	1	
CO5	3	2	2	2									3	1	
	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			Terminal Examination (60)
	IAE – I (7.5)	IAE – II (7.5)	IAE – III (10)	
Remember	0	0	0	0
Understand	10	10	10	20
Apply	20	20	20	30
Analyze	20	20	20	30
Evaluate				20
Create				



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<b>20AIE26</b>	<b>QUANTUM CRYPTOGRAPHY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>Nature of Course</b>	Professional Elective				
<b>Pre requisites</b>	Cryptography and Network Security				

**Course Objectives**

The course is intended to

1. Introduce the concepts of quantum cryptography.
2. Learn the basic concepts of quantum key distribution.
3. Provide the concepts of quantum key distribution tools.
4. Compare the various QKD protocols.
5. Create the attacks and future in QKD.

**Course Outcomes**

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

<b>CO. No</b>	<b>Course Outcome</b>	<b>Bloom's Level</b>
CO1	Identify the basic cryptography concept.	Remember
CO2	Understand basics of quantum Cryptography.	Understand
CO3	Identify tools and information of Quantum Cryptography.	Apply
CO4	Distinguish the properties of Quantum Key distribution protocols.	Analyze
CO5	Produce the security attacks and proofs	Create

**Course Contents:****UNIT-I OVERVIEW OF CRYPTOGRAPHY**

9

Basic Concepts of Cryptography – Types of Cryptographic Functions - Attacks on Cryptography - Cryptographic Techniques - Symmetric Crypto Algorithms (Shared or Secret Key Crypto) - Asymmetric Crypto Algorithms (Public Key Crypto) – Digital Signatures -Sniffing, Snooping, Spoofing

**UNIT -II INTRODUCTION TO QUANTUM CRYPTOGRAPHY**

9

Introduction – Quantum Cryptography Fundamentals – Importance of Quantum Cryptography - Quantum Key Distribution – The Security of QKD – Quantum Secret Sharing – Post Quantum Cryptography.

**UNIT -III QUANTUM INFORMATION AND TOOLS**

9

Introduction and overview on quantum information – classical bits vs quantum bits – Measuring quantum bits - Performing operations on qubits – Quantum tools density operator, tensor products of mixed states, partial trace, POVM.

**UNIT –IV QUANTUM KEY DISTRIBUTION**

9

Quantum Key Exchange – Prepare and measure protocols - Entanglement based protocols – BB84 protocol – E91 protocol – Information reconciliation and privacy amplification – Challenges of QKD.

**UNIT –V ATTACKS AND SECURITY PROOFS**

9

Intercept and resend – Man-in-the-middle attack – The phase remapping attack - Photon number splitting attack – Denial of service - Trojan-horse attacks – Security proofs – Quantum Hacking – Future of QKD.

**Total: 45 Periods**

  
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**Text Books:**

1. Grasselli, Federico, "Quantum Cryptography: From Key Distribution to Conference Key Agreement (Quantum Science and Technology)", Springer; 1st ed. 2021 edition.
2. William Stallings., "Cryptography and Network Security", By Pearson, 7th Edition, 2017.

**Reference Books:**

1. Ramona Wolf., "Quantum Key Distribution", Springer, 2021.
2. Gilbert, Michael, Yaakov S Weinstein, "Quantum Cryptography", World Scientific Publishing Co Pte Ltd, Edition 2018.
3. Forouzan "Cryptography And Network Security", Mc Graw Hill India, 3Rd Edition 2015.

**Additional References:**

1. <https://nptel.ac.in/courses/115/101/115101092/https://youtu.be/7WSe4QA8Gts>
2. <https://nptel.ac.in/courses/106/106/106106232/>
3. [https://onlinecourses.nptel.ac.in/noc21\\_cs103/preview](https://onlinecourses.nptel.ac.in/noc21_cs103/preview)

<b>Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)</b>															
<b>Cos</b>	<b>Pos</b>												<b>PSOs</b>		
	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	-	2	-	-	-	-	-	-	1	1	-	-
CO4	2	1	1	-	2	-	-	-	-	-	-	1	1	-	-
CO5	3	2	2	-	-	-	-	-	-	-	-	1	1	-	-
	3	High				2	Medium					1	Low		

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

<b>Summative Assessment</b>				
<b>Bloom's Category</b>	<b>Internal Assessment Examinations</b>			<b>Terminal Examination (60)</b>
	<b>IAE – I (7.5)</b>	<b>IAE – II (7.5)</b>	<b>IAE – III (10)</b>	
Remember	0	0	0	0
Understand	10	10	10	20
Apply	20	20	20	30
Analyze	20	20	20	30
Evaluate				20
Create				

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20AIE27	BLOCK CHAIN AND CRYPTO CURRENCY TECHNOLOGIES	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 mechanism of Block chain and Crypto currency
2. Acquire knowledge on the functionality of current implementation of block chain technology
3. Recognize the required cryptographic background
4. Explore the applications of Block chain to crypto currencies and understanding limitations of current Block chain.
5. Exposure towards recent research.

**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 Cryptography in Crypto currency	Understand
CO2	Gain knowledge about various operations associated with the life cycle of Block chain and Crypto currency	Understand
CO3	Deal with the methods for verification and validation of Bit coin transactions	Apply
CO4	Demonstrate the general ecosystem of several Crypto currency	Apply
CO5	Educate the principles, practices and policies associated Bit coin business	Apply

**Course Contents:****UNIT I INTRODUCTION TO CRYPTOGRAPHY AND CRYPTOCURRENCIES****9**

Cryptographic Hash Functions, Hash Pointers and Data Structures, Digital Signatures, Public Keys as Identities, A Simple Cryptocurrency. Decentralization-Centralization vs. Decentralization-Distributed consensus, Online Wallets and Exchanges, Payment Services, Transaction Fees, Currency Exchange Markets.

**UNIT II MECHANICS AND MINING OF BITCOIN****9**

Bitcoin transactions, Bitcoin Scripts, Applications of Bitcoin scripts, Bitcoin blocks, The Bit- coin network, Limitations and improvements, The task of Bitcoin miners, Mining Hardware, Energy consumption and ecology, Mining pools, Mining incentives and strategies.

**UNIT III BITCOIN AND ANONYMITY****7**

Anonymity Basics, How to De-anonymize Bitcoin, Mixing, Decentralized Mixing, Zerocoin and Zerocash.

**UNIT IV COMMUNITY, POLITICS, AND REGULATION****11**

Consensus in Bitcoin, Bitcoin Core Software, Stakeholders: Who's in Charge, Roots of Bitcoin, Governments Notice on Bitcoin, Anti Money Laundering Regulation, New York's Bit License Proposal. Bitcoin as a Platform: Bitcoin as an Append only Log, Bitcoins as Smart Property, Secure Multi Party Lotteries in Bitcoin, Bitcoin as Public Randomness, Source-Prediction Markets, and Real World Data Feeds.

**UNIT V ALTCOINS AND THE CRYPTOCURRENCY ECOSYSTEM****9**

Altcoins: History and Motivation, A Few Altcoins in Detail, Relationship Between Bitcoin and Altcoins, Merge Mining-Atomic Crosschain Swaps-6 Bitcoin Backed Altcoins, Side Chains, Ethereum and Smart Contracts.

**Total: 45 Periods****Text Books:**

1. Narayanan, A., Bonneau, J., Felten, E., Miller, A., and Goldfeder, S. "Bitcoin and crypto currency technologies: a comprehensive introduction", Princeton University Press 2016.
2. Antonopoulos, A. M. , "Mastering Bitcoin: unlocking digital crypto currencies", O'Reilly Media, Inc., 2014.

**Reference Books:**

1. Franco, P." Understanding Bit coin: Cryptography, engineering and economics", John Wiley and Sons 2014.

**Additional References:**

1. <https://nptel.ac.in/courses/106/104/106104220/>
2. <https://nptel.ac.in/courses/106/105/106105184/>
3. [https://onlinecourses.nptel.ac.in/noc19\\_cs63/preview](https://onlinecourses.nptel.ac.in/noc19_cs63/preview)

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

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

<b>Summative Assessment</b>				
<b>Bloom's Category</b>	<b>Internal Assessment Examinations</b>			<b>Final Examination (60)</b>
	<b>IAE – I (7.5)</b>	<b>IAE – II (7.5)</b>	<b>IAE – III (10)</b>	
Remember	15	15	10	20
Understand	20	15	20	30
Apply	15	20	20	30
Analyze	0	0	0	20
Evaluate	0	0	0	0
Create	0	0	0	0

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<b>20AIE28</b>	<b>CYBER CRIME AND COMPUTER ETHICS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>Nature of Course</b>	Professional Elective				
<b>Pre requisites</b>	Nil				

**Course Objectives**

The course is intended to

1. Learn the basic concepts related to cyber world and cyber crime in general
2. Describe the competitive edge on various facts of cyber crimes
3. Problems arising out of cyber terrorism and provoke them to find solutions Intellectual issues in the cyber crime and the growth and National Security awareness
4. Regulation of computer ethics at national and international level.
5. Upholding general ethical standard and security awareness.

**Course Outcomes**

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

<b>CO. No.</b>	<b>Course Outcome</b>	<b>Bloom's Level</b>
CO1	Define the Cyber crime	Remember
CO2	Describe Investigating cyber crime	Understand
CO3	Interpreted knowledge about cyber terrorism	Understand
CO4	Demonstrate Computer Ethics	Apply
CO5	Categorize the Computer Ethics and Security	Analyze

**Course Contents:****UNIT I INTRODUCTION CYBER CRIME****9**

Cyber Crimes and Cyber Laws- Introduction to IT laws & Cyber Crimes – Internet, Hacking, Cracking, Viruses, Virus Attacks, Pornography, Software Piracy, Intellectual property, Legal System of Information Technology, Social Engineering, Mail Bombs, Bug Exploits, and Cyber Security

**UNIT II INVESTIGATING CYBERCRIME****9**

Digital Evidence and Computer Forensics, Interception, Search and Seizure, and Surveillance, Cyber Crime and Offences, Network Service Providers Liability

**UNIT III INFORMATION ACT****9**

Information Warfare, Cyber terrorism, and Hacktivism, Terrorism, Radicalization, and The War of Ideas, Trade Secret Theft and Economic Espionage, National Security

**UNIT IV COMPUTER ETHICS****9**

The Importance of Cyber Law, Significance of cyber Ethics, Need for Cyber regulations and Ethics. Ethics in Information society, Introduction to Artificial Intelligence Ethics: Ethical Issues in AI and core Principles, Introduction to Block chain Ethics.

**UNIT V COMPUTER ETHICS AND SECURITY****9**

Ethics, Legal Developments, Cyber security in Society, Security in computer ethics case studies, General security awareness and Cyber Law-a Swift Analysis.

**Total: 45 periods**
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**Text Books:**

1. Mark Grabrowser, Eric P. Robinson, "Cyber Law and Ethics Regulation of the Connected World", Routledge publication, 1<sup>st</sup> Edition 2021.
2. Matthew Richardsaa, "Cyber Crime: Law and Practice Hardcover", Wildy, Simmonds and Hill publications, 2<sup>nd</sup> Edition November 2019.

**Reference Books:**

1. Kenneth J. Knapp, "Cyber Security and Global Information Assurance: Threat Analysis and Response Solutions", IGI Global, 2009.
2. Jack Balkin, et al. eds, "CYBERCRIME: Digital Cops in a Networked World", 1st Edition NYU Press 2007.
3. Debby Russell and Sr. G. T Gangemi, "Computer Security Basics (Paperback)", O Reilly Media, 2nd Edition 2006.

**Additional References:**

1. [https://onlinecourses.swayam2.ac.in/nou19\\_cs08/preview](https://onlinecourses.swayam2.ac.in/nou19_cs08/preview)
2. [https://onlinecourses.swayam2.ac.in/cec22\\_cs03/preview](https://onlinecourses.swayam2.ac.in/cec22_cs03/preview)
3. <https://youtu.be/GAXXQTuhaPk>

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	1
CO2	3	2	1	1									3	1	1
CO3	3	3	2	1									3	1	1
CO4	3	3	2	1									3	1	1
CO5	3	2	2	1									3	1	1
	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			Terminal Examination (60)
	IAE – I (7.5)	IAE – II (7.5)	IAE – III (10)	
Remember	0	0	0	0
Understand	10	10	10	20
Apply	20	20	20	30
Analyze	20	20	20	30
Evaluate				20
Create				

<b>20AIE29</b>	<b>MOBILE APPLICATION SECURITY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>Nature of Course</b>	Professional Elective				
<b>Pre requisites</b>	Mobile Computing				

**Course Objectives**

The course is intended to

1. Learn the Mobile issues and development strategies.
2. Illustrate the WAP and Mobile security issues.
3. Discover the Bluetooth security issues.
4. Identify the SMS security issues.
5. Create the Enterprise security on Mobile OS.

**Course Outcomes**

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

<b>CO. No</b>	<b>Course Outcome</b>	<b>Bloom's Level</b>
CO1	Basic Knowledge on Mobile Issues	Understand
CO2	Choose the security protocols	Apply
CO3	Discover the overview of Bluetooth Security	Apply
CO4	Identify various SMS Security	Analyze
CO5	Design the various Encryption Technologies	Create

**Course Contents:****UNIT – I TOP MOBILE ISSUES AND DEVELOPMENT STRATEGIES:****9**

Top Issues Facing Mobile Devices, Physical Security, Secure Data Storage (on Disk), Multiple-User Support with Security, Safe Browsing Environment, Information Disclosure, Virus, Worms, Trojans, Spyware and Malware.

**UNIT – II WAP AND MOBILE HTML SECURITY:****9**

WAP and Mobile HTML Basics, Authentication on WAP/Mobile HTML Sites, Encryption, Application Attacks on Mobile HTML Sites, Cross-Site Scripting, SQL Injection, Cross-Site Request Forgery, HTTP Redirects, Phishing.

**UNIT – III BLUETOOTH SECURITY:****9**

Overview of the Technology, Bluetooth Technical Architecture, Radio Operation and Frequency, Bluetooth Network Topology, Device Identification, Modes of Operation, Bluetooth Stack, Bluetooth Profiles, Bluetooth Security.

**UNIT - IV SMS SECURITY:****9**

Overview of Short Message Service, Wireless Application Protocol (WAP), Protocol Attacks, Abusing Legitimate Functionality, Attacking Protocol Implementations, Application Attacks, iPhone Safari, Windows Mobile MMS.

**UNIT - V ENTERPRISE SECURITY ON THE MOBILE OS:****9**

Device Security Options, PIN, Remote, Apple iPhone and Keychain, Security Policy Enforcement, Encryption, Full Disk Encryption, E-mail Encryption, File Encryption Buffer Overflow Protection, Windows Mobile, iPhone, Android, BlackBerry.

**Total: 45 Periods**

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**Text Books:**

1. Gerardus Blokdyk, "Mobile Application Security Testing", Kindle edition, 2018.
2. Himanshu Dwivedi, Chris Clark, David Thiel, "Mobile Application Security", TATA McGraw hill, 2012.

**Reference Books:**

1. Pattnaik Prasant Kumar and Mall Rajib, "Fundamentals of Mobile Computing", Kindle edition 2015.
2. Sakthivel Rajendran, "Mobile Application Security with Opensource Tools", EMC Publications, 2015.
3. Giridhara Chitrapadi, "Mobile Application Security Testing", Mphasis Publications, 2010.

**Additional References:**

1. [nptel.ac.in/courses/106/106/106106156/](https://nptel.ac.in/courses/106/106/106106156/)
2. [nptel.ac.in/courses/106/106/106106147/](https://nptel.ac.in/courses/106/106/106106147/)
3. [nptel.ac.in/courses/106/106/106106222/](https://nptel.ac.in/courses/106/106/106106222/)

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
Remember	Online 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				



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<b>220AIE30</b>	<b>INTRUSION DETECTION AND PREVENTION</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>Nature of Course</b>	Professional Elective				
<b>Pre requisites</b>	Computer Networks				

**Course Objectives**

The course is intended to

1. Understand the vulnerabilities and detection techniques of various attacks.
2. Understand the network intrusion detection & prevention mechanisms.
3. Expose the advanced detection method and prevention techniques.
4. Study the various architectures in IPS.
5. Explore Various Attacks using IDP tools.

**Course Outcomes**

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

<b>CO. No.</b>	<b>Course Outcome</b>	<b>Bloom's Level</b>
CO1	Understand the physical location, the operational characteristics and the various functions performed by the intrusion detection and prevention system.	Understand
CO2	Describe how components in different layers inter-operate in the intrusion detection and prevention system.	Understand
CO3	Learn new techniques and to align new security technologies to existing network infrastructure.	Understand
CO4	Understand the current and effective architecture to deal with network security threats.	Understand
CO5	Apply intrusion detection alerts and logs to distinguish attack by using SNORT tool.	Apply

**Course Contents:****UNIT - I INTRODUCTION****9**

History of Intrusion detection, Audit, Concept and definition, Internal and external threats to data, attacks, Need and types of IDS, Information sources Host based information sources, Network based information sources.

**UNIT - II INTRUSION DETECTION AND NETWORK TRAFFIC SIGNATURE****9**

Components of IDS, Steps of implementation and monitoring, Host- and network-based IDS, Implementing and evaluating IDS, intrusion detection versus intrusion prevention, Signature analysis, Detecting traffic signatures, Identifying suspicious events, Creating custom traffic signatures, Common Vulnerability and Exposures (CVE) standards.

**UNIT- III INTRUSION DETECTION AND PREVENTION TECHNIQUES****9**

Host-based intrusion detection system (IDS) / intrusion prevention system (IPS), network based IDS/IPS. Data collection for IDS/IPS. Intrusion detection techniques, misuse detection: pattern matching, rule-based and state-based; anomaly detection: statistical based, machine learning based, data mining based; hybrid detection.

**UNIT - IV IDS and IPS ARCHITECTURE****9**

Tiered architectures, single-tiered, multi-tiered, peer-to-peer. Sensor: sensor functions, sensor deployment and security. Agents: agent functions, agent deployment and security. Manager component: manager functions, manager deployment and security. Information flow in IDS and IPS,

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defending IDS/IPS.

## UNIT – V IDP TOOLS

9

Introduction to Snort, Snort Installation Scenarios, Installing Snort, Running Snort on Multiple Network Interfaces, Snort Command Line Options. Step-By-Step Procedure to Compile and Install Snort Location of Snort Files, Snort Modes Snort Alert Modes.

**Total: 45 periods**

### Text Books:

1. Ali A. Ghorbani, Network intrusion detection and prevention concepts and techniques, Springer, 2010.
2. C.Endorf, E. Schultz and J. Mellander, Intrusion Detection & Prevention, McGraw Hill/Oberne, 2004.
3. Rafeeq Rehman : " Intrusion Detection with SNORT, Apache, MySQL, PHP and ACID," 1<sup>st</sup> Edition, Prentice Hall, 2003.

### Reference Books:

1. Christopher Kruegel, Fredrik Valeur, Giovanni Vigna: "Intrusion Detection and Correlation Challenges and Solutions", 1st Edition, Springer, 2005.
2. Carl Endorf, Eugene Schultz and Jim Mellander "Intrusion Detection & Prevention", Tata McGraw-Hill 1st Edition, 2004.
3. Stephen Northcutt, Judy Novak: "Network Intrusion Detection", New Riders Publishing, 3<sup>rd</sup> Edition 2002.

### Additional References:

1. <https://www.youtube.com/watch?v=RyB4cG8G2xo>
2. [https://nptel.ac.in/content/storage2/courses/downloads\\_new/106106141/W1A1.pdf](https://nptel.ac.in/content/storage2/courses/downloads_new/106106141/W1A1.pdf)
3. <https://www.youtube.com/watch?v=2YGUVopGkQc>

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	3	2		2	3	3		3	3	2	3			
CO2	3	2	2	2	3	2	2		3	3	2	2			
CO3	3	2	2		2				3	3	2				
CO4	3	3	2	2	3				3	3					
CO5	3	3	3	2	3				3	3	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	

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



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**PROFESSIONAL ELECTIVES (PE)****STREAM III: INTERNET OF THINGS**

<b>20AIE41</b>	<b>PRINCIPLES OF SENSORS AND SIGNAL CONDITIONING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>Nature of Course</b>	Professional Elective				
<b>Pre requisites</b>	NIL				

**Course Objectives**

The course is intended to

1. Learn the various types sensor based measurement systems.
2. Understand various technologies associated in manufacturing of sensors.
3. Acquire knowledge about types of sensors used in modern digital systems.
4. Familiarize the Digital and intelligent sensors.
5. Get acquainted about material properties required to make sensors.

**Course Outcomes**

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

<b>CO. No</b>	<b>Course Outcome</b>	<b>Bloom's Level</b>
CO1	Appreciate various types of sensors and their construction	Understand
CO2	Describe the manufacturing process of sensors	Understand
CO3	Design systems integrated with sensors	Apply
CO4	Use sensors specific to the end use application	Apply
CO5	Classify the material properties required to make sensor	Analyze

**Course Contents:****Unit-I INTRODUCTION TO SENSOR BASED MEASUREMENT SYSTEMS****9**

General concepts and terminology, sensor classification, primary sensors, material for sensors, micro sensor technology, magneto resistors, light dependent resistors, resistive hygrometers, resistive gas sensors, liquid conductivity sensors, Capacitive Sensors, Inductive Sensors, Electromagnetic Sensors.

**Unit-II SIGNAL CONDITIONING FOR REACTANCE VARIATION SENSORS****9**

Problems and Alternatives, ac Bridges Carrier Amplifiers, Coherent Detection, Specific Signal Conditioners for Capacitive Sensors, Resolver-to-Digital and Digital-to-Resolver Converters.

**Unit-III SELF GENERATING SENSOR****9**

Thermoelectric sensor, piezoelectric sensor, Pyroelectric sensor, photoelectric sensor, Electrochemical sensor.

**Unit-IV DIGITAL AND INTELLIGENT SENSORS****9**

position encoders, resonant sensors, sensors based on quartz resonators, SAW sensors, Vibrating wire strain gages, vibrating cylinder sensors, Digital flow meters.

**Unit-V SENSORS BASED ON SEMICONDUCTOR JUNCTIONS****9**

Thermometers based on semiconductor junctions, magneto diodes and magneto transistors, photodiodes and phototransistors, sensors based on MOSFET transistors, charge-coupled sensors: types of CCD imaging sensors, ultrasonic-based sensors.

**Total: 45 Periods**

**Text Books:**

1. Clarence W. de Silva, "Sensor Systems-Fundamentals and Applications", CRC Press, Edition 2016.
2. Ramon PallasAreny, John G. Webster, "Sensors and Signal conditioning", John Wiley and Sons 2nd edition, 2000.

**Reference Books:**

1. Jon. S. Wilson, "Sensor Technology Hand Book", Elsevier Netherland, 1st edition 2011.
2. Jacob Fraden, "Handbook of Modern Sensors" Springer; 4th edition 2010
3. Patranabis D, "Sensors and Transducers" Prentice Hall India Learning Private Limited, 2nd edition, 2003.

**Additional References:**

1. <https://nptel.ac.in/content/storage2/courses/112103174/pdf/mod2.pdf>
2. <https://www.coursera.org/lecture/intelligent-machining/signal-processing-iFBoY>
3. <https://nptel.ac.in/courses/108/108/108108147/>

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	3	3		1	2	2				2	3	2	3	2
CO2	3	3	3		1	2	2				2	3	2	3	2
CO3	3	3	3		1	2	2				2	3	2	3	2
CO4	3	3	3		1	2	2				2	3	2	3	2
CO5	3	3	3		1	2	2				2	3	2	3	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)
	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				



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<b>20AIE42</b>	<b>DATA ACQUISITION</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>Nature of Course</b>	Professional Elective				
<b>Pre requisites</b>	Database Management System				

**Course Objectives**

The course is intended to

1. Understand the basic concepts of data Warehouse and data mining.
2. Explore the fundamental concepts of data pre-processing, extraction, cleaning, annotation, integration.
3. Familiarize the various visualization techniques.
4. Understand the various data visualization tools.
5. Recognize data productization using Internet of thing.

**Course Outcomes**

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

<b>CO. No</b>	<b>Course Outcome</b>	<b>Bloom's Level</b>
CO1	Recognize the fundamental concepts of data warehouse ,data mining ,data analysis	Understand
CO2	Apply of data pre-processing, extraction, cleaning, annotation, integration on data	Apply
CO3	Explore the basic concept of data visualization	Analyze
CO4	Classify the suitable visualization techniques to output analytical results	Analyze
CO5	Explore on applications using Internet of things	Analyze

**Course Contents:****Unit-I INTRODUCTION TO DATA WAREHOUSE & DATA MINING****9**

Introduction to Data Warehouse- OLTP and OLAP concepts, Introduction to Data Mining, Data Objects and Attribute Type, Basic Statistical Descriptions of Data, Exploratory Data analysis, Measuring Data Similarity and Dissimilarity, Graphical representation of data.

**Unit-II INTRODUCTION TO DATA ACQUISITION****9**

Introduction to Data Acquisition, Applications, Process, Data Extraction, Data Cleaning and Annotation, Data Integration, Data Reduction, Data Transformation, Data Discretization and Concept Hierarchy Generation.

**Unit-III DATA VISUALIZATION****9**

Visualization-Introduction, Terminology, Basic Charts and Plots, Multivariate Data Visualization, Data Visualization Techniques, Pixel, Oriented Visualization Techniques, Geometric Projection Visualization Techniques, Icon-Based Visualization Techniques, Hierarchical Visualization Techniques, Visualizing Complex Data and Relations.

**Unit-IV DATA VISUALIZATION TOOLS****9**

Introduction to Data Visualization Tools- Rank Analysis Tools, Trend Analysis Tools, Multivariate Analysis Tools, Distribution Analysis Tools, Correlation Analysis Tools, Geographical Analysis Tools.

**Unit-V DATA PRODUCTIZATION USING INTERNET OF THINGS****9**

IoT Overview, IoT Design methodology, Semantic Web Infrastructure, Intelligence Applications, Programming Framework for IoT, Distributed Data Analysis for IoT, Security and Privacy in IoT,

Applied IoT, Cloud Based Smart Facilities Management. Virtualization on Embedded Boards IoT, Stream Processing in IoT, Internet of Vehicles and Applications, Case study on Data Acquisition using Dashboards, Android and iOS apps..

**Total: 45 Periods**

**Text Books:**

1. Arshdeep Bahga, Vijay Madiseti, "Internet of Things -A hands-on approach", Universities Press, 2015.
2. Han, Jiawei, Jian Pei, and Micheline Kamber, "Data mining: concepts and techniques", 3rd Edition, Elsevier, 2011.

**Reference Books:**

1. Rajkumar Buyya, Amir Vahid Dastjerdi, "Internet of Things: Principles and Paradigms", Elsevier, 2016.
2. Karl Pover, "Learning Qlikview Data Visualization", Packt, 2013.
3. Margaret H. Dunham, "Data Mining: Introductory and Advanced Topics", Pearson Education, 2012.

**Web reference:**

1. <https://freevideolectures.com/course/4943/nptel-industrial-automation-control-course-sponsored-aricent/7>
2. <http://nitttrc.edu.in/nptel/courses/video/108105088/L07.html>
3. [https://www.youtube.com/watch?v=l\\_9Pwyxhe40](https://www.youtube.com/watch?v=l_9Pwyxhe40)

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

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

<b>Summative Assessment</b>				
<b>Bloom's Category</b>	<b>Internal Assessment Examinations</b>			<b>Final Examination (60)</b>
	<b>IAE – I (7.5)</b>	<b>IAE – II (7.5)</b>	<b>IAE – III (10)</b>	
Remember	10	10	10	20
Understand	30	30	30	60
Apply	10	10	10	20
Analyze				
Evaluate				
Create				

<b>20AIE43</b>	<b>WIRELESS SENSOR NETWORKS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>Nature of Course</b>	Professional Elective				
<b>Pre requisites</b>	NIL				

**Course Objectives**

The course is intended to

1. Understand the concepts of wireless sensor networks
2. Acquire knowledge on the architecture for WSN and design WSN to analyze its performance
3. Recognize the layer approach in sensor networks
4. Establish the new infrastructure model
5. Exposure to mote programming platforms and tools.

**Course Outcomes**

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

<b>CO. No</b>	<b>Course Outcome</b>	<b>Bloom's Level</b>
CO1	Understand the basics of Wireless Sensor Networks and its design principles	Understand
CO2	Gain knowledge on the architecture and placement strategies of Sensors	Understand
CO3	Apply the knowledge to identify appropriate layer protocols with the suitable routing algorithm based on the network and user requirement	Apply
CO4	Demonstrate the establishment of the networking infrastructure	Apply
CO5	Build basic modules and be familiar with the OS used in Wireless Sensor Networks	Apply

**Course Contents:****UNIT I INTRODUCTION OF WIRELESS SENSOR NETWORKS****9**

Challenges for wireless sensor networks, Comparison of sensor network with ad hoc network, Single node architecture, Hardware components, Energy consumption of sensor nodes, Network architecture, Sensor network scenarios, Design principles.

**UNIT II ARCHITECTURES****9**

Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes, Operating Systems and Execution Environments, Network Architecture - Sensor Network Scenarios, Optimization Goals and Figures of Merit, Gateway Concepts.

**UNIT III NETWORKING SENSORS****9**

Physical Layer and Transceiver Design Considerations, MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols and Wakeup Concepts - S-MAC, The Mediation Device Protocol, Wakeup Radio Concepts, Address and Name Management, Assignment of MAC Addresses, Routing Protocols- Energy-Efficient Routing, Geographic Routing.

**UNIT IV INFRASTRUCTURE ESTABLISHMENT****9**

Topology Control, Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control.

**UNIT V SENSOR NETWORK PLATFORMS AND TOOLS****9**

Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms –



TinyOS, nesC, CONTIKIOS, Node-level Simulators – NS2 and its extension to sensor networks, COOJA, TOSSIM, Programming beyond individual nodes – State centric programming.

**Total: 45 Periods**

**Text Books:**

1. Holger Karl & Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley, 2007.
2. Feng Zhao & Leonidas J. Guibas, "Wireless Sensor Networks- An Information Processing Approach", Elsevier, 2007.

**Reference Books:**

1. Anna Hac, "Wireless Sensor Network Designs", John Wiley, 2017.
2. Sitharama Iyengar S, Nandan Parmeshwaran, Balkrishnan N and Chuka D, "Fundamentals of Sensor Network Programming, Applications and Technology", John Wiley & Sons, 2011.
3. Fei Hu and Xiaojun Cao, "Wireless Sensor Networks Principles and Practice", CRC Press, 2010

**Web reference:**

1. <https://nptel.ac.in/courses/106/105/106105160/>
2. <https://nptel.ac.in/noc/courses/noc18/SEM1/noc18-cs09/>
3. <https://www.digimat.in/nptel/courses/video/106105160/L26.html>

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

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

<b>Summative Assessment</b>				
<b>Bloom's Category</b>	<b>Internal Assessment Examinations</b>			<b>Final Examination (60)</b>
	<b>IAE – I (7.5)</b>	<b>IAE – II (7.5)</b>	<b>IAE – III (10)</b>	
Remember	15	15	10	20
Understand	20	15	20	30
Apply	15	20	20	30
Analyze	0	0	0	20
Evaluate	0	0	0	0
Create	0	0	0	0

<b>20AIE44</b>	<b>EDGE COMPUTING TECHNOLOGIES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>Nature of Course</b>	Professional Elective				
<b>Pre requisites</b>	NIL				

**Course Objectives**

The course is intended to

1. Understand the concepts of IoT
2. Acquire knowledge of IoT and M2M communication
3. Recognize the protocols and standards of IoT
4. Identify the Fog computing Architecture and its components
5. Exposure the integration of Fog and Cloud Computing.

**Course Outcomes**

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

<b>CO. No</b>	<b>Course Outcome</b>	<b>Bloom's Level</b>
CO1	Understand the concepts of IoT	Understand
CO2	Apply the M2M protocol in IoT	Apply
CO3	Habitual with Fog computing in IoT	Apply
CO4	Familiarize with IoT standard and protocols	Apply
CO5	Apprise with Fog and Cloud computing in IoT	Apply

**Course Contents:****UNIT I INTRODUCTION TO IOT****9**

Technologies in IoT, IoT Applications- Smart Home, Wearable, Connected Cars, Industrial IoT, Smart Cities, Agriculture, Smart Retail, smart Grid, Healthcare, Challenges in IoT- Delivering Value to Customers, Hardware Compatibility Issues, Data Connectivity Issues, Introduction to Edge Computing, Need for Edge Computing- Improved Performance , Compliance, Data Privacy, And Data Security.

**UNIT II IOT ARCHITECTURE****9**

IoT Architecture Data Acquisition, Data Aggregation and Data Analysis, IoT Protocols- COAP, MQTT, XMPP, AMQP, Low power Lossy Network routing, Communication Methods- Bluetooth, Zigbee, Wireless Fidelity, 4G Sigfox, NeU, 5G.

**UNIT III FOG COMPUTATIONAL MODEL****9**

Fog Simulators, iFogSim, FogTorch, Cisco IoX and Fog Application, Contiki/Cooja, NS3 PVFOG simulator.

**UNIT IV BIG DATA****9**

Data Types in Big data, Characteristics of BIG DATA, Benefits of Big Data, Big Data Application, Layered Big Data Architecture- Data Ingestion, Data collection, Data Processing Layer, Data storage, Data Query and Visualization Layer, Big Data Implementation- Hortonworks, Cloudera, MAP R, Edge Computing for Big Data.

**UNIT V RECENT TRENDS****9**

Case Study-1: Edge analytics in Irrigation System -Machine Learning in Edge for automation in Irrigation system. Case study 2: Edge analytics for Water Quality Monitoring- Machine Learning in

Edge for automation in water quality monitoring Case Study 3 IoT-Edge for Smart Energy, Case Study 4: IoT- Edge for water demand forecasting.

**Total: 45 Periods**

**Text Books:**

1. K.Anithakumari, G.Sudha Sadasivam, D.Dharani, M.Nirjanamurthy "Edge Computing Fundamentals, Advances and Applications", CRC press Published December 23, 2021.
2. Reem Abdul Rahman and Babar Shah, "Security analysis of IoT protocols: A focus in CoAP," MEC International Conference on Big Data and Smart City, 2016.

**Reference Books:**

1. D. Airehrour, J. Gutierrez and S. K. Ray, "Secure routing for internet of things: A survey," Journal of Network and Computer Applications, 2016.
2. Maria Rita Palattella et al., "Standardized protocol stack for the internet of (important) things," IEEE Communications Surveys and Tutorials, 2013.
3. Ashton Kevin, "That Internet of Things Thing," RFID Journal, 2009.

**Additional References:**

1. <https://nptel.ac.in/courses/106/105/106105167/>
2. <https://www.youtube.com/watch?v=rifFwHPiOrs>
3. [https://onlinecourses.nptel.ac.in/noc19\\_cs64/preview](https://onlinecourses.nptel.ac.in/noc19_cs64/preview)

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

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

<b>Summative Assessment</b>				
<b>Bloom's Category</b>	<b>Internal Assessment Examinations</b>			<b>Terminal Examination (60)</b>
	<b>IAE – I (7.5)</b>	<b>IAE – II (7.5)</b>	<b>IAE – III (10)</b>	
Remember	15	15	10	20
Understand	20	15	20	30
Apply	15	20	20	30
Analyze	0	0	0	20
Evaluate	0	0	0	0
Create	0	0	0	0

Passed in Board of studies Meeting

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20AIE45	MOBILE COMPUTING	L	T	P	C
		3	0	0	3
<b>Nature of Course</b>	Professional Elective				
<b>Pre requisites</b>	Computer Networks				

### Course Objectives

The course is intended to

1. Learn the basic concepts of mobile computing
2. Discuss the methods of mobile telecommunication system.
3. Familiar with the mobile network and transport layers
4. Explore in the field of mobile Adhoc wireless networks.
5. Gain knowledge about different mobile platforms and application development

### Course Outcomes

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

Co.No	Course Outcome	Bloom's Level
CO1.	Explain the basics of mobile telecommunication system	Understand
CO2.	Illustrate the generation of telecommunication systems in wireless network.	Understand
CO3.	Determine the functionality of MAC, network layer and Identify a routing protocol for a given Ad hoc network.	Apply
CO4.	Explain the functionality of mobile adhoc wireless networks	Apply
CO5.	Develop a mobile application using android, blackberry, iOS and Windows	Apply

### Course Contents:

#### UNIT – I FUNDAMENTALS OF MOBILE COMPUTING

9

Introduction to Mobile Computing – Mobile Computing Vs Wireless Networking – Mobile Computing Applications - Characteristics of Mobile computing – Structure of Mobile Computing Application– Mobile Wireless Transmission –MAC: SDMA – FDMA – TDMA – CDMA.

#### UNIT – II MOBILE TELECOMMUNICATION SYSTEM

9

Introduction to Cellular Systems – GSM –Services and Architecture – Protocols – Connection Establishment – Frequency Allocation – Routing – Mobility Management – Security – GPRS-UMTS – Architecture – Handover – Security- 3G wireless systems..

#### UNIT – III MOBILE NETWORK AND TRANSPORT LAYER

9

Infra-Red Vs. Radio Transmission – Infrastructure and Adhoc Network – Mobile IP – Mobile Adhoc Networks –Traditional TCP and classical TCP improvements.

#### UNIT – IV MOBILE ADHOC WIRELESS NETWORKS

9

Adhoc Basic Concepts – Characteristics – Applications – Design Issues – Routing – Essential of Traditional Routing Protocols – Popular Routing Protocols – Vehicular Ad Hoc networks (VANET) – MANET Vs VANET – Security.4G Vision – 4G Features and Challenges – Applications of 4G. 4G Technologies – LTE FDD Vs TDD comparison–5G wireless systems.

#### UNIT – V MOBILE PLATFORMS AND APPLICATIONS

9

Mobile Device Operating Systems – Special Constrains and Requirements – Commercial Mobile Operating Systems – Software Development Kit: Android, BlackBerry, Windows Phone – M-Commerce – Structure – Pros and Cons – Mobile Payment System – Security Issues

**Total: 45 Periods****Text Books:**

1. Jochen H. Schller, "Mobile Communications", Pearson Education, New Delhi, Second Edition, 2012.
2. Prasant Kumar Pattnaik, Rajib Mall, "Fundamentals of Mobile Computing", PHI Learning Pvt. Ltd, New Delhi, Second Edition, 2012.

**Reference Books:**

1. Vijay Garg K, "Wireless Communications and Networks, Morgan Kaufmann Publishers (Elsevier), Mexico, Second Edition, 2007.
2. Clint Smith and Daniel Collins, "3G Wireless Networks", Tata McGraw Hill, New Delhi, Second Edition, 2007.
3. William.C.Y.Lee, "Mobile Cellular Telecommunications-Analog and Digital Systems", Tata McGraw Hill, India, Second Edition, 2006.

**Additional References:**

1. <https://nptel.ac.in/courses/106/106/106106147/>
2. <https://nptel.ac.in/noc/courses/noc16/SEM2/noc16-cs13/>
3. <https://www.digimat.in/nptel/courses/video/106106147/L16.html>

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	20	40
Apply	20	20	20	50
Evaluate	0	0	0	0
Create	0	0	0	0


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<b>20AIE46</b>	<b>WEARABLE COMPUTING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>Nature of Course</b>	Professional Elective				
<b>Pre requisites</b>	Computer Networks				

**Course Objectives**

The course is intended to

1. Learn advanced and emerging technologies in wearable computing.
2. Understand how to use software programs to perform varying and complex tasks.
3. Expand upon the knowledge learned and apply it to solve real world problems.
4. Identify the requirement's to design the Frameworks.
5. Apply I/O Communication Protocols.

**Course Outcomes**

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

<b>CO. No.</b>	<b>Course Outcome</b>	<b>Bloom's Level</b>
CO1.	Understand the basics of Wearable Components	Understand
CO2.	Develop Android and Wear applications for Android phone and wearable device	Understand
CO3.	Enable to explore innovations with Wearable's	Apply
CO4.	Learn about the requirement's to design Frameworks for Wearable Computing	Apply
CO5.	Able to learn about I/O communication protocols	Apply

**Course Contents:****UNIT – I INTRODUCTION TO WEARABLE COMPONENTS****9**

Introduction – History - Open Source Platforms – PIC - Arduino, Sketch, Raspberry Pi, Iterative coding methodology – Python Programming - Mobile phones and similar devices - Arm Devices - Basic Electronics (circuit theory, measurements, parts identification).

**UNIT – II BUILDING BLOCKS FOR WEARABLE COMPUTING****9**

Bluetooth Low Energy (BLE), Embedded Software Programming, Sensors for Wearables, Data from Wearable Device Android Wear, Apple WatchKit, Cloud Services, Google Fit, Apple Health Kit.

**UNIT – III INNOVATION WITH WEARABLES****9**

Process for Lifestyle Innovation, Prototyping and Modelling, Working with a Wearable Device, Three-Tier Architecture for Wearables, Useful Design Patterns and Methods, Multithreading and Concurrency for Wearables, Performance Tuning Retrieval and Analysis of Sensor Data.

**UNIT – IV FRAMEWORKS FOR WEARABLE COMPUTING****9**

Software: open Frameworks (C/C++) - "Arduino" Language (C/C++) - Hardware: Desktop / Laptop / Raspberry Pi - Representing "reality" with computers. Digital vs. Analog circuits, audio, communication, Analog to Digital Conversion - Digital to Analog Conversion)– Microcontrollers - Communication – Serial & Parallel - Hardware to Hardware Communication - I2C/IIC (InterIntegrated Circuit) - SPI (Serial Peripheral Interface).

**UNIT – V BODY AREA NETWORKS****9**

Typical m-Health System Architecture- Hardware Architecture of a Sensor Node- Communication Medium, Power Consumption Considerations, Communication Standards- Network Topologies Commercial Sensor Node Platforms- Bio-physiological Signals and Sensors, BSN Application Domains- Developing BSN Applications- Programming Abstractions- Requirements for BSN Frameworks- BSN Programming Frameworks.

**Total: 45 Periods**

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**Text Books:**

1. Fortino, Giancarlo, Raffaele Gravina, and Stefano Galzarano, "Wearable computing: from modeling to implementation of wearable systems based on body sensor networks", John Wiley & Sons, 1st edition, 2018.
2. Linowes Jonathan, "Augmented Reality for Developers", Packt Publishing Limited, 1 st edition, 2017.

**Reference Books:**

1. Stephan Lukosch, Sang-Won Leigh et.al," Fundamentals of Wearable Computers and Augmented Reality", Excelic Press, 2019.
2. Simon Monk, "Programming the Raspberry Pi: Getting Started with Python" McGraw-Hill 2nd edition, 2016.
3. Barfield, Woodrow, "Fundamentals of wearable computers and augmented reality", CRC press, 1st edition 2015.

**Additional References:**

1. <https://nptel.ac.in/courses/106/105/106105163/>
2. <https://nptel.ac.in/courses/106/105/106105166/>
3. <https://www.youtube.com/watch?v=yQwYobTllr0>

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	20	40
Apply	20	20	20	50
Evaluate	0	0	0	0
Create	0	0	0	0

<b>20AIE47</b>	<b>IoT PROGRAMMING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>Nature of Course</b>	Professional Elective				
<b>Pre requisites</b>	Computer Networks				

**Course Objectives**

The course is intended to

1. Identify the basics of Smart Objects and IoT Architectures.
2. Apply the various IOT-related protocols
3. Build simple IoT Systems using Arduino and Raspberry Pi.
4. Comprehend data analytics and cloud in the context of IoT.
5. Develop IoT infrastructure for popular applications.

**Course Outcomes**

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

<b>CO. No</b>	<b>Course Outcome</b>	<b>Bloom's Level</b>
CO1	Interpret the concept of IoT.	Understand
CO2	Solve the various protocols for IoT.	Apply
CO3	Design a PoC of an IoT system using Raspberry Pi/Arduino.	Apply
CO4	Apply data analytics and use cloud offering related to IoT.	Apply
CO5	Analyze applications of IoT in real time scenario.	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 – Simplified IoT Architecture and Core IoT Functional Stack – Fog, Edge and Cloud in IoT – Functional blocks of an IoT ecosystem – Sensors, Actuators, Smart Objects and Connecting Smart Objects.

**Unit- II IoT PROTOCOLS****9**

IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN – 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 – Django – AWS for IoT – System Management with NETCONF-YANG.

**Unit-V CASE STUDIES/INDUSTRIAL APPLICATIONS****9**

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

**Total: 45 Periods****Text Books:**

1. Sudeep Mishra, Anandarupmukherjee and Arijit Roy, "Introduction to IoT", New Delhi: University Cambridge Press, 2021.
2. 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 Madiseti, "Internet of Things – A hands-on approach", Universities Press, 2015.
2. Jan Ho" Iler, Vlasios Tsiatsis, Catherine Mulligan, Stamatis, Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2014.
3. Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things – Key applications and Protocols", Wiley, 2012.

**Additional References:**

1. [https://onlinecourses.nptel.ac.in/noc21\\_cs17/preview](https://onlinecourses.nptel.ac.in/noc21_cs17/preview)
2. <https://nptel.ac.in/courses/106/105/106105166/>
3. [https://onlinecourses.nptel.ac.in/noc20\\_cs69/preview](https://onlinecourses.nptel.ac.in/noc20_cs69/preview)

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

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



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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	-	-	2	-	-	-	-	-	2	2	2	2
CO2	3	2	2	-	-	2	-	-	-	-	-	2	2	2	2
CO3	3	2	2	-	2	2	-	-	-	-	-	2	2	2	2
CO4	3	2	2	-	-	2	-	-	-	-	-	2	2	2	2
CO5	3	2	2	-	-	2	-	-	-	-	-	2	3	3	3
	3	High				2	Medium					1	Low		



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<b>20AIE48</b>	<b>IOT SECURITY AND TRUST</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>Nature of Course</b>	Professional Elective				
<b>Pre requisites</b>	IoT Fundamentals and Architecture				

**Course Objectives**

The course is intended to

1. Acquire knowledge about the fundamentals of encryption.
2. Learn the concepts of IoT security and wireless networks.
3. Gain knowledge about key elements in IoT
4. Explore on various access control schemes and concepts
5. Compose the various hacking laws and forensics.

**Course Outcomes**

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

<b>CO. No</b>	<b>Course Outcome</b>	<b>Bloom's Level</b>
CO1	Understand the basics of encryption	Understand
CO2	Identify the concepts of security and wireless network	Apply
CO3	Explore the models of management tools	Apply
CO4	Distinguish the concepts of access control schemes	Analyze
CO5	Design the various hacking methods	Create

**Course Contents:****UNIT- I FUNDAMENTALS OF ENCRYPTION FOR CYBER SECURITY****9**

Cryptography – Need and the Mathematical basics- History of cryptography, symmetric ciphers, and block ciphers, DES – AES. Public-key cryptography: RSA, Diffie-Hellman Algorithm, Elliptic Curve Cryptosystems, Algebraic structure, Triple Data Encryption Algorithm (TDEA).

**UNIT- II IOT SECURITY FRAMEWORK****9**

IIOT security frame work, Security in hardware, Boot process, OS & Kernel application and Runtime environment and containers. Need and methods of Edge Security, Network Security: Internet, Intranet, LAN, Wireless Networks, Wireless cellular networks, Cellular Networks and VOIP.

**UNIT- III ELEMENTARY BLOCKS OF IOT SECURITY****9**

Vulnerability of IoT and elementary blocks of IoT Security, Threat modeling. – Key elements. Identity management Models and Identity management in IoT, Approaches. Using User-centric, Device-centric and Hybrid.

**UNIT- V ACCESS CONTROL IN IOT AND LIGHT WEIGHT CRYPTOGRAPHY****9**

Capability-based access control schemes, Concepts, identity-based and identity-driven, light weight cryptography, need and methods, IoT use cases.

**UNIT- V CYBER CRIMES, HACKERS AND FORENSICS****9**

Cyber Crimes and Laws – Hackers – Dealing with the rise tide of Cyber Crimes - Cyber forensics and incident Response – Network Forensics.

**TOTAL: 45 PERIODS**

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**Text Books:**

1. Alasdair Gilchrist, "IoT security Issues", O'Reilly publications, 2017.
2. Parikshit Narendra Mahalle, Poonam N. Railkar, "Identity Management for Internet of Things", River Publishers, 2015.
3. John R. Vacca, "Computer and Information Security Handbook", Elsevier, 2013.

**Reference Books:**

1. Maryline Laurent, Samia Bouzeffrane, "Digital Identity Management", Elsevier, 2015.
2. William Stallings, "Cryptography and Network security: Principles and Practice", Pearson Education, 5th Edition, 2014 India.
3. Christ of Paar and Jan Pelzl, "Understanding Cryptography – A Textbook for Students and Practitioners", Springer, 2014.

**Additional References:**

1. [nptel.ac.in/courses/106/106/106106146/](https://nptel.ac.in/courses/106/106/106106146/)
2. [nptel.ac.in/courses/106/105/106105166/](https://nptel.ac.in/courses/106/105/106105166/)
3. <https://www.youtube.com/watch?v=sMquG8gxRh4>

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	2	2	2
CO2	3	3	2	1	3	-	-	-	-	-	-	1	3	2	1
CO3	3	2	2	1	1	-	-	-	-	-	-	1	2	2	2
CO4	2	1	1	1	3	-	-	-	-	-	-	1	2	2	1
CO5	3	2	2	1	3	-	-	-	-	-	-	1	1	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)
	IAE – I (7.5)	IAE – II (7.5)	IAE – III (10)	
Remember	20	20	20	20
Understand	20	20	15	60
Apply	10	10	15	20
Analyze				
Evaluate				
Create				



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<b>20AIE49</b>	<b>IOT APPLICATION AND WEB DEVELOPMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>Nature of Course</b>	Professional Elective				
<b>Pre requisites</b>	IoT Fundamentals and Architecture				

**Course Objectives**

The course is intended to

1. Identify various applications pertaining to Industrial IoT.
2. Impart knowledge on IoT for healthcare.
3. Explore agricultural applications of IoT.
4. Acquire specific scripting knowledge to develop interactive applications.
5. Create the basics of android application development.

**Course Outcomes**

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

<b>CO. No</b>	<b>Course Outcome</b>	<b>Bloom's Level</b>
CO1	Understand role of IoT in Industry	Understand
CO2	Identify the healthcare applications of IoT	Apply
CO3	Identify the agricultural applications of IoT	Apply
CO4	Apply scripting language knowledge for development	Analyze
CO5	Invent the mobile application using android SDK	Create

**Course Contents:****UNIT - I INDUSTRIAL INTERNET APPLICATION****9**

IIoT Fundamentals and Components - Industrial Manufacturing - Monitoring, Control, Optimization and Autonomy - Introduction to Hadoop and big data analytics

**UNIT-II HEALTH CARE APPLICATIONS****9**

Architecture of IoT for Healthcare - Multiple views coalescence - SBC-ADL to construct the system architecture. Use Cases: Wearable devices for Remote monitoring of Physiological parameter - ECG, EEG - Diabetes and Blood Pressure.

**UNIT- III APPLICATIONS IN AGRICULTURE****9**

Smart Farming: Weather monitoring - Precision farming, Smart Greenhouse - Drones for pesticides.

**UNIT-IV SCRIPTING LANGUAGE****9**

Introduction to JavaScript, Function – DOM - Forms and Event Handlers - Object Handlers - Input validation - J2ME - application design using J2ME - IoT development using Real time rules – platforms - alerts

**UNIT- V ANDROID PROGRAMING FRAMEWORK****9**

Mobile app development: Android Development environment - Simple UI Layouts and layout properties - GUI objects - Event Driven Programming - opening and closing a Database

**Total: 45 Periods****Text Books:**

1. John Dean, "Web Programming with HTML5, CSS and JavaScript", Jones and Bartlett Publishers Inc., 2018.
2. DiMarzio J. F., "Beginning Android Programming with Android Studio", Wiley, 4<sup>TH</sup> Edition, 2016.

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**Reference Books:**

1. Fadi Al-Turjman, "Intelligence in IoT- enabled Smart Cities", CRC Press, 1st edition 2019.
2. Giacomo Veneri, and Antonio Capasso, "Hands-on Industrial Internet of Things: Create a powerful industrial IoT infrastructure using Industry 4.0", Packt Publishing, 2018.
3. Subhas Chandra Mukhopadhyay, "Smart Sensing Technology for Agriculture and Environmental Monitoring", Springer, 2012.

**Additional References:**

1. <https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-e28/>
2. <https://nptel.ac.in/courses/106/105/106105166/>
3. <https://nptel.ac.in/courses/106/105/106105195/>

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	1	-	-
CO4	2	1	1	-	2	-	-	-	-	-	-	1	1	-	-
CO5	3	2	2	-	3	-	-	-	-	-	-	1	1	-	-
	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)
	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				



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<b>20AIE50</b>	<b>INDUSTRIAL IoT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>Nature of Course</b>	Professional Elective				
<b>Pre requisites</b>	IoT Fundamentals and Architecture				

**Course Objectives**

The course is intended to

1. Understand the role of Internet of things.
2. Identify the sensor networks and roles of embedded PC in IIoT.
3. Report on the strengths and vulnerabilities of the tested network.
4. Identify legal and ethical issues related to vulnerability and penetration testing
5. Implement penetration testing for malwares

**Course Outcomes**

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

<b>CO. No</b>	<b>Course Outcome</b>	<b>Bloom's Level</b>
CO1	Understand the concept of Industrial IoT (IIoT) Systems	Understand
CO2	Analyze the Implementation systems of IoT	Analyze
CO3	Analyze the data monitoring and control techniques.	Analyze
CO4	Point out next generation sensors	Analyze
CO5	Analyze the applications of IIoT	Analyze

**Course Contents:****UNIT – I INTRODUCTION TO INDUSTRIAL IOT (IIOT) SYSTEMS: 9**

The Various Industrial Revolutions, Role of Internet of Things (IoT) & Industrial Internet of Things (IIoT) in Industry, Industry 4.0 revolutions, Support System for Industry 4.0, Smart Factories.

**UNIT-II IMPLEMENTATION SYSTEMS FOR IIOT 9**

Sensors and Actuators for Industrial Processes, Sensor networks, Process automation and Data Acquisitions on IoT Platform, Microcontrollers and Embedded PC roles in IIoT, Wireless Sensor nodes with Bluetooth, WiFi, and LoRa Protocols and IoT Hub systems.

**UNIT – III IIoT DATA MONITORING & CONTROL 9**

IoT Gate way, IoT Edge Systems and It's Programming, Cloud computing, Real Time Dashboard for Data Monitoring, Data Analytics and Predictive Maintenance with IIoT technology.

**UNIT – IV CYBER PHYSICAL SYSTEMS 9**

Next Generation Sensors, Collaborative Platform and Product Lifecycle management, Augmented Reality and Virtual Reality, Artificial Intelligence, Big Data and Advanced Analysis.

**UNIT-V INDUSTRIAL IOT- APPLICATIONS 9**

Healthcare, Power Plants, Inventory Management & Quality Control, Plant Safety and Security (Including AR and VR safety applications), Facility Management..

**Total periods: 45**

  
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**Text Books:**

1. Alasdair Gilchris, "Industry 4.0: The Industrial Internet of Things" Gilchrist Publications, 2016.
2. Bartodziej, Christoph Jan "The Concept Industry 4.0 An Empirical Analysis of Technologies and Applications in Production Logistics" Springer: Publication, Edition 2016.

**Reference Books:**

1. Alasdair Gilchrist "Industry 4.0: The Industrial Internet of Things", Apress Publication, 2017.
2. Sabina Jeschke, Christian Brecher, Houbing Song, Danda B. Rawat "Industrial Internet of Things: Cyber manufacturing Systems" (Springer), Edition 2017.
3. Dr. Peter Friess, "Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems", River Publishers, Edition 2013.

**Additional References:**

1. <https://nptel.ac.in/courses/106/105/106105195/>
2. [https://onlinecourses.nptel.ac.in/noc20\\_cs66/preview](https://onlinecourses.nptel.ac.in/noc20_cs66/preview)
3. [https://onlinecourses.nptel.ac.in/noc21\\_cs17/preview](https://onlinecourses.nptel.ac.in/noc21_cs17/preview)

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	2		-	-	-	1	2	3	-
CO2	3	2	2	1	3	3	1		-	-	-		3	2	-
CO3	3	2	2	2	3	3			-	-	2	1	2	2	-
CO4	3	3	2	1		3	3	1	-	-	-		2	3	-
CO5	3	2	2	3	2	3	2	1	-	-	1	1	2	3	-
	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)
	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				



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