AL-AMEEN ENGINEERING COLLEGE

(Autonomous)

(Accredited by NAAC with "A" Grade : An ISO Certified Institution)
(Affiliated to Anna University, Chennai & Approved by AICTE, New Delhi)
Karundevanpalayam, NanjaiUthukkuli Post, Erode – 638 104, Tamilnadu, INDIA.

CURRICULUM & SYLLABI

SEMESTERS – I to VIII

(Regulations 2020)

CHOICE BASED CREDIT SYSTEM

B.Tech. Artificial Intelligence and Data Science

Applicable to the Students admitted from the AY 2022-23 onwards

KNOWLEDGE LEVELS (BLOOM'S TAXONOMY)

Notation	Knowledge Levels
K1	Remembering
K2	Understanding
K3	Applying
K4	Analysing
K5	Evaluating
K6	Creating

VISION	
	The department of Information Technology aspires to become a **school of excellence** in providing **quality education, constructive research** and **professional opportunities in Information Technology**.

MISSION	
	To provide academic programs that engage, enlighten and empower the students to **learn technology through practice, service and outreach.** To educate the students about **social responsibilities and entrepreneurship** To encourage **research through continuous improvement** in infrastructure, curriculum and faculty development in collaboration with industry and institutions.

[PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)	
PEO 1	Graduates will have progressive learning and successful career in Information, Communication Technologies and their applications.
PEO 2	Graduates will be leaders in their chosen field.
PEO 3	Graduates will utilize the acquired technical skills and knowledge for the benefit of society.

PROGRAM OUTCOMES (POs)	
PO 1	**Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/Development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs

	with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO 6	**The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

PROGRAM SPECIFIC OUTCOMES (PSOs)	
PSO 1	**Technical Skills:** Apply the fundamental knowledge to **develop computer based solutions** in the areas related to information management and networking.
PSO 2	**Leadership Skills:** Demonstrate **professionalism and ethics** in managing academic/ non-academic activities as a team and an individual.

CURRICULUM

SEMESTER I

Sl. No.	Course Code	Course Title	Category	CIA	ESE	L	T	P	C
THEORY COURSES									
1	20MA1T1	Engineering Mathematics I	BS	40	60	3	1	0	4
2	20CY1T2	Engineering Chemistry	BS	40	60	3	0	0	3
3	20EN1T3	Communicative English I	HS	40	60	3	1	0	4
4	20PH1T4	Engineering Physics	BS	40	60	3	0	0	3
5	20CS1T5	Fundamentals of Computing and Programming	ES	40	60	3	0	0	3
LABORATORY COURSES									
6	20GE1L1	Physics and Chemistry Laboratory	BS	60	40	0	0	3	1.5
7	20CS1L2	Computer Practices Laboratory	ES	60	40	0	0	3	1.5
MANDATORY COURSES									
8		Universal Human Values I- Induction Programme	MC	-	-	-	-	-	-
Total						**15**	**2**	**6**	**20**

SEMESTER II

Sl. No.	Course Code	Course Title	Category	CIA	ESE	L	T	P	C
THEORY COURSES									
1.	20MA2T1	Engineering Mathematics II	BS	40	60	3	1	0	4
2	20EN2T3	Communicative English II	HS	40	60	3	0	0	3
3	20EE2T4	Basics of Electrical Engineering	ES	40	60	3	0	0	3
4	20CSCT5	Python Programming	ES	40	60	3	0	0	3
LABORATORY COURSES									
5	20EM2L1	Engineering Practices Laboratory	ES	60	40	0	0	3	1.5
6	20ME2L2	Engineering Drawing Laboratory	ES	60	40	0	0	3	1.5
7	20CS2L3	Python Programming Laboratory	ES	60	40	0	0	3	1.5
MANDATORY COURSES									
8	20CY2T2	Environmental Sciences	MC	100	0	3	0	0	0
Total						**15**	**1**	**9**	**17.5**

SEMESTER III

Sl. No.	Course Code	Course Title	Category	CIA	ESE	L	T	P	C
THEORY COURSES									
1	20MA3T1	Probability and Queueing Theory	BS	40	60	3	1	0	4
2	20AD3T2	Fundamentals of Operating Systems	PC	40	60	3	1	0	4
3	20AD3T3	Database Management Systems	PC	40	60	3	1	0	4
4	20AD3T4	Foundations of Artificial Intelligence	PC	40	60	3	0	0	3
5	20CS3T5	Object Oriented Programming with Java	PC	40	60	3	0	0	3
LABORATORYCOURSES									
6	20AD3L1	Intelligent Systems Laboratory	PC	60	40	0	0	3	1.5
7	20CS3L2	Object Oriented Programming with Java Laboratory	PC	60	40	0	0	3	1.5
8	20CS4L2	Database Management Systems Laboratory	EEC	60	40	0	0	3	1.5
MANDATORY COURSES									
9	20HSCT1	Universal Human Values 2: Understanding Harmony	HS	100	0	2	1	0	3
Total						**17**	**4**	**9**	**25.5**

SEMESTER IV

Sl. No.	Course Code	Course Title	Category	CIA	ESE	L	T	P	C
THEORY COURSES									
1	20CS6E1	Data warehousing and Data Mining	PC	40	60	3	0	0	3
2	20AD4T3	Introduction to Computer Network	ES	40	60	3	0	0	3
3	20AD4T4	Concepts in Data Science	PC	40	60	3	1	0	4
4	20CS6T2	Software Engineering	PC	40	60	3	0	0	3
5		Professional Elective - I	PE	40	60	3	0	0	3
6		Open Elective - I	OE	40	60	3	0	0	3
LABORATORY COURSES									
7	20ENCL1	Communication Skills Laboratory	HS	60	40	0	0	2	1
8	20AD4L2	Data mining Tools Laboratory	PC	60	40	0	0	3	1.5
9	20AD4L3	Networks Laboratory	PC	60	40	0	0	3	1.5
MANDATORY COURSES									
10	20MCCT1	Constitution of India	MC	100	-	3	0	0	0
Total						**21**	**1**	**8**	**23**

SEMESTER V

Sl. No.	Course Code	Course Title	Category	CIA	ESE	L	T	P	C
THEORY COURSES									
1	20AD5T1	Data Visualization	PC	40	60	3	1	0	4
2		Professional Elective - II	PE	40	60	3	0	0	3
3		Open Elective - II	OE	40	60	3	0	0	3
THEORY COURSE WITH LABORATORY COMPONENTS									
4	20AD5LT1	Data Analytics	PC	50	50	2	0	4	4
5	20AD5LT2	Design and Analysis of Algorithms	PC	50	50	2	0	4	4
6	20AD5LT3	Data Science Using R	PC	50	50	2	0	4	4
EMPLOYABILITY EHANCEMENT COURSE									
7	20PT5T1	Career Guidance - I	EEC	100	--	2	1	0	0
Total						**20**	**1**	**8**	**22**

SEMESTER VI

Sl. No.	Course Code	Course Title	Category	CIA	ESE	L	T	P	C
THEORY COURSES									
1	20CS6E7	Software Project Management	PC	40	60	3	0	0	3
2		Professional Elective - III	PE	40	60	3	0	0	3
3		Professional Elective - IV	PE	40	60	3	0	0	3
4		Open Elective – III	OE	40	60	3	0	0	3
THEORY COURSE WITH LABORATORY COMPONENTS									
5	20AD6LT1	AI in Natural Language Processing	PC	50	50	2	0	4	4
6	20AD6LT2	Deep Learning and its Applications	PC	50	50	2	0	4	4
EMPLOYABILITY EHANCEMENT COURSE									
7	20PT6T1	Career Guidance - II	EEC	100	-	2	1	0	0
Total						**18**	**1**	**8**	**20**

SEMESTER VII

Sl. No.	Course Code	Course Title	Category	CIA	ESE	L	T	P	C
THEORY COURSES									
1	20AD7T1	Software Testing and Quality Assurance	PC	40	60	3	0	0	3
2	20HSCT2	Professional Ethics	HS	40	60	3	0	0	3
3		Professional Elective - V	PE	40	60	3	0	0	3
THEORY COURSE WITH LABORATORY COMPONENTS									
4	20AD7LT1	IoT Fundamentals and Architecture	PC	50	50	2	0	4	4
5	20CS7LT2	Cloud Computing	PC	50	50	2	0	4	4
EMPLOYABILITY ENHANCEMENT COURSE									
6	HX8001	Professional Readiness for Innovation, Employability and Entrepreneurship	EEC	100	-	0	0	6	3
Total						**13**	**0**	**14**	**20**

SEMESTER VIII

Sl. No.	Course Code	Course Title	Category	CIA	ESE	L	T	P	C
LABORATORY COURSES									
1	20AD8L1	Project Work	EEC	60	40	0	0	20	10
2	20AD8L2	Industrial Training / Internship	EEC	100	-	4 Weeks			3
Total						**0**	**0**	**20**	**13**

Total Credits: 161

HUMANITIES AND SOCIAL SCIENCES INCLUDING MANAGEMENT (HS)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	20EN1T3	Communicative English I	3	1	0	4
2	20EN2T3	Communicative English II	3	0	0	3
3.	20HSCT1	Universal Human Values 2: Understanding Harmony	2	1	0	3
4.	20ENCL1	Communication Skills Laboratory	0	0	2	1

BASIC SCIENCES (BS)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	20MA1T1	Engineering Mathematics – I	3	1	0	4
2.	20CY1T2	Engineering Chemistry	3	0	0	3
3.	20PH1T4	Engineering Physics	3	0	0	3
4.	20GE1L1	Physics and Chemistry Laboratory	0	0	3	1.5
5.	20MA2T1	Engineering Mathematics – II	3	1	0	4
6.	20MA3T1	Probability and Queueing Theory	3	1	0	4

ENGINEERING SCIENCES (ES)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	20CS1T5	Fundamentals of Computing and Programming	3	0	0	3
2	20CS1L2	Computer Practices Laboratory	0	0	3	1.5
3	20EE2T4	Basics of Electrical Engineering	3	0	0	3
4	20CSCT5	Python Programming	3	0	0	3

5	20EM2L1	Engineering Practices Laboratory	0	0	3	1.5
6	20ME2L2	Engineering Drawing Laboratory	0	0	3	1.5
7	20CS2L3	Python Programming Laboratory	0	0	3	1.5
8	20AD4T3	Introduction to Computer Network	3	0	0	3

PROFESSIONAL CORE (PC)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	20AD3T2	Fundamentals of Operating Systems	3	1	0	4
2.	20AD3T3	Database Management Systems	3	1	0	4
3.	20AD3T4	Foundations of Artificial Intelligence	3	0	0	3
4.	20CS3T5	Object Oriented Programming with Java	3	0	0	3
5.	20AD3L1	Intelligent Systems Laboratory	0	0	3	1.5
6.	20CS3L2	Object Oriented Programming with Java Laboratory	0	0	3	1.5
7.	20AD4T1	Data warehousing and Data Mining	3	0	0	3
8.	20AD4T3	Concepts in Data Science	3	1	0	4
9.	20CS6T2	Software Engineering	3	0	0	3
10.	20AD4L2	Data mining Tools Laboratory	0	0	3	1.5
11.	20AD4L3	Networks Laboratory	0	0	3	1.5
12.	20AD5T1	Data Visualization	3	1	0	4
13.	20AD5LT1	Data Analytics	2	0	4	4
14.	20AD5LT2	Design and Analysis of Algorithms	2	0	4	4
15.	20AD5LT3	Data Science Using R	2	0	4	4
16.	20CS6E7	Software Project Management	3	0	0	3

17.	20AD6LT1	AI in Natural Language Processing	2	0	4	4
18.	20AD6LT2	Deep Learning and its Applications	2	0	4	4
19.	20AD7T1	Software Testing and Quality Assurance	3	0	0	3
20.	20AD7LT1	IoT Fundamentals and Architecture	2	0	4	4
21.	20CS7LT2	Cloud Computing	2	0	4	4

PROFESSIONAL ELECTIVES (PE)

Semester – IV (Elective I)						
Sl. No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	20AD4E1	Advanced Artificial Intelligence Systems	3	0	0	3
2	20AD4E2	Ethics in Data Science	3	0	0	3
3	20AD4E3	Cognitive Systems	3	0	0	3
4	20AD4E4	Principles of computer graphics	3	0	0	3

Semester – V (Elective II)						
Sl. No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	20ECCE1	Digital Image Processing	3	0	0	3
2	20AD5E2	Artificial neural networks and its applications	3	0	0	3
3	20AD5E3	Intelligent Data Base System	3	0	0	3
4	20AD5E4	Cyber Law and Ethics	3	0	0	3

Semester – VI (Elective III)						
Sl. No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	20AD6E1	AI for Cyber Security	3	0	0	3
2	20AD6E2	Data Science Applications of NLP	3	0	0	3

3	20CS7E7	Distributed Systems	3	0	0	3
4	20AD6E3	Social Network Analytics	3	0	0	3

Semester – VI (Elective IV)						
Sl. No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	20AD6E4	Game Theory for AI and DS	3	0	0	3
2	20AD6E5	Data Science for Engineers	3	0	0	3
3	20AD6E6	Web and Social media Mining	3	0	0	3
4	20AD6E8	Block Chain and Cryptography	3	0	0	3

Semester – VII (Elective V)						
Sl. No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	20AD7E1	Introduction to Brain and Neuroscience	3	0	0	3
2	20AD7E2	Database Security and Auditing	3	0	0	3
3	20AD7E3	Biosensor Technology	3	0	0	3
4	20IT7E7	Computer Vision	3	0	0	3

OPEN ELECTIVES (OE)

Sl. No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1.	20CSO01	Object Oriented Programming	3	0	0	3
2.	20CSO02	Computer Architecture	3	0	0	3
3.	20CSO03	Data Structures	3	0	0	3
4.	20CSO04	Operating Systems	3	0	0	3
5	20CSCT5	Python Programming	3	0	0	3

6	20CSO06	Cloud Computing	3	0	0	3
7	20CSO07	Artificial Intelligence	3	0	0	3
8	20IT6T1	Big Data Analytics	3	0	0	3
9	20CSO09	Internet of Things	3	0	0	3

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

Sl. No.	Course Code	Course Title	L	T	P	C
1	20CS4L2	Database Management Systems Laboratory	0	0	3	1.5
2	20PT5T1	Career Guidance - I	2	1	0	0
3	20PT6T1	Career Guidance - II	2	1	0	0
4	HX8001	Professional Readiness for Innovation, Employability and Entrepreneurship	0	0	6	3
5	20AD8L1	Project Work	0	0	20	10
6	20AD8L2	Industrial Training / Internship	4 Weeks			3

MANDATORY COURSES (MC)

Sl. No.	Course Code	Course Title	L	T	P	C
1.		Universal Human Values 1 - Induction Programme	0	0	0	0
2.	20CY2T2	Environmental Sciences	3	0	0	0
3.	20MCCT1	Constitution of India	3	0	0	0

VALUE ADDED COURSES (VAC)

Sl. No.	Course Code	Course Title	Credit
1.	20CSV01	J2EE	
2.	20CSV02	PHP,MYSQL	
3.	20CSV03	Android Application Development	
4.	20CSV04	3D Studio Max,Maya	
5.	20CSV05	Hardware And Network Trouble Shooting	
6.	20CSV06	Ethical Hacking	
7.	20CSV07	Block Chain Technology	

CURRICULUM BREAKDOWN STRUCTURE

Subject	AICTE suggested breakdown of credits	Total number of credits	Curriculum Content (% of total number of credits of the program)
Humanities and Social Sciences including Management (HS)	**12**	**14**	**8.6**
Basic Sciences (BS)	**24**	**19.5**	**12.1**
Engineering Sciences (ES)	**29**	**18**	**11.1**
Professional Core (PC)	**49**	**68**	**42.2**
Program Electives (PE)	**18**	**15**	**9.3**
Open Electives (OE)	**12**	**9**	**5.5**
Employability Enhancement Courses (EEC) – Practical Courses and Project Work	**15**	**17.5**	**10.8**
Mandatory Courses (MC)	**0**	**0**	**0**
Total	**159**	**161**	**100.00**

CREDIT SUMMARY

Sl. No.	Subject Area	Credits per Semester								Total Credits	AICTE Suggested Credits
		I	II	III	IV	V	VI	VII	VIII		
1	**HS**	4	3	3	1			3		**14**	12
2	**BS**	11.5	4	4						**19.5**	24
3	**ES**	4.5	10.5		3					**18**	29
4	**PC**			17	13	16	11	11		**68**	49
5	**PE**				3	3	6	3		**15**	18
6	**OE**				3	3	3			**9**	12
7	**EEC**			1.5			-	3	13	**17.5**	15
8	**MC**	-	-	-	-		-		-	**-**	-
TOTAL		**20**	**17.5**	**25.5**	**23**	**22**	**20**	**20**	**13**	**161**	**159**

HS – Humanities and Social Sciences including Management
BS– Basic Sciences
ES– Engineering Sciences
PC– Professional Core
PE– Professional Electives
OE– Open Electives
EEC – Employability Enhancement Courses
MC – Mandatory Courses

SEMESTER I

Sl. No.	Course Code	Course Title	Category	CIA	ESE	L	T	P	C
THEORY COURSES									
1	20MA1T1	Engineering Mathematics I	BS	40	60	3	1	0	4
2	20CY1T2	Engineering Chemistry	BS	40	60	3	0	0	3
3	20EN1T3	Communicative English I	HS	40	60	3	1	0	4
4	20PH1T4	Engineering Physics	BS	40	60	3	0	0	3
5	20CS1T5	Fundamentals of Computing and Programming	ES	40	60	3	0	0	3
LABORATORY COURSES									
6	20GE1L1	Physics and Chemistry Laboratory	BS	60	40	0	0	3	1.5
7	20CS1L2	Computer Practices Laboratory	ES	60	40	0	0	3	1.5
MANDATORY COURSES									
8		Universal Human Values I- Induction Programme	MC	-	-	-	-	-	-
Total						**15**	**2**	**6**	**20**

Semester	Programme	Course Code	Course Name	L	T	P	C
I	B.E. / B.Tech., Common to all	20MA1T1	ENGINEERING MATHEMATICS I	3	1	0	4

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Identify Eigen values and Eigenvectors and apply orthogonal diagonalization to convert quadratic form to canonical form.	K3	1
CO2	Apply differentiation and integration technique to solve algebraic and transcendental function	K3	2
CO3	Evaluate the total derivative of the function, expand the given as series and locate the maximum and minimum for multivariate function	K5	3
CO4	Solve first order Ordinary Differential Equations and apply them to certain physical situations	K3	4
CO5	Choose appropriate integral techniques to find area and volume of the given region	K5	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
Cos	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3		3				1	3	3		3		
CO2	3	3		3				1	3	3		3		
CO3	3	3		3				1	3	3		3		
CO4	3	3		3				1	3	3		3	2	
CO5	3	3		3				1	3	3		3		

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignments and Tutorials
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**MATRICES**	**9 + 3**
Eigen values and Eigen vectors of a real matrix – properties of Eigen values and Eigen vectors (without proof) – Cayley-Hamilton theorem (statement and applications) – orthogonal transformation of a symmetric matrix to diagonal form (concept only) – Reduction of quadratic form to canonical form by an orthogonal transformation		
Topic - 2	**DIFFERENTIATION AND INTEGRATION**	**9 + 3**
Basic differentiation formula for algebraic and transcendental functions – derivatives – differentiability rules and properties (without proof) – basic integral formula for algebraic and transcendental functions – integration by parts – partial fraction methods.		
Topic - 3	**FUNCTIONS OF SEVERAL VARIABLES**	**9 + 3**
Total derivatives – Taylor's series expansion – maxima and minima – Lagrange's multipliers method – Jacobian's method		
Topic - 4	**FIRST ORDER ORDINARY DIFFERENTIAL EQUATION**	**9 + 3**
Leibnitz's equations – Bernoulli's equation – equation of first order and higher degree – Clairaut's form – Linear first order differential equations and its applications.		
Topic - 5	**MULTIPLE INTEGRALS**	**9 + 3**
Double integrals: Double integration in Cartesian co-ordinates – change of order of integration – area as a double integration in Cartesian – volume as a triple integral in Cartesian co-ordinates (simple problems)		

THEORY	**45**		**TUTORIAL**	**15**		**PRACTICAL**	**0**		**TOTAL**	**60**

BOOK REFERENCES	
1	Jain R.K and Iyengar S.R.K, "Advanced Engineering Mathematics", 3rd Edition, Narosa Publishing House, New Delhi, Reprint 2009.
2	Ramana B.V., "Higher Engineering Mathematics", Tata Mcgraw Hill Publishing Company, New Delhi, 2008.
3	Kreyszig E., "Advanced Engineering Mathematics", 9th Edition, John Wiley Sons, 2012.
4	Glyn James., "Advanced Modern Engineering Mathematics", Pearson Education Limited, 2007.
5	N P Bali, Manish Goyal, "A Text Book of Engineering Mathematics", 3rd Edition, Laxmi Publication Private Limited, 2009.

OTHER REFERENCES	
1	https://www.slideshare.net/mailrenuka/matrices-and-application-of-matrices
2	https://www.slideshare.net/mailrenuka/matrices-and-application-of-matrices
3	https://youtu.be/wtuq1oSButE
4	https://www.slideshare.net/abhinavsomani3/applications-of-maths-in-our-daily-life-41607055

Semester	Programme	Course Code	Course Name	L	T	P	C
I	B.E. / B.Tech., Common to all	20CY1T2	ENGINEERING CHEMISTRY	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Explain the properties & working techniques along with potential applications.	K2	1
CO2	Choose the appropriate method for specific application in engineering technology.	K3	2
CO3	Analyse new solutions to problems in materials and energy usage in daily life	K4	3
CO4	Identify the structure of unknown/new compounds with their properties.	K3	4
CO5	Categorize the important features of various materials and methods for burgeoning society.	K4	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
Cos	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3		2					1	3	3		3		
CO2	3	2						1	3	3		3		
CO3	3	2						1	3	3		3		
CO4	3		2					1	3	3		3	2	
CO5	3	2	2					1	3	3		3		

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignment
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**WATER CHEMISTRY**	**9**
Hardness of water – types – units –boiler troubles (scale and sludge) – treatment of boiler feed water – Internal treatment (phosphate, colloidal, carbonate and calgon conditioning) external treatment – Ion exchange process, zeolite process – desalination of brackish water – Reverse Osmosis.		
Topic - 2	**FUELS AND COMBUSTION**	**9**
Fuels: Introduction - classification of fuels – Combustion- coal – Analysis of coal - carbonization - manufacture of metallurgical coke (Otto Hoffmann method) - petroleum - knocking - octane number - diesel oil - cetane number - natural gas - compressed natural gas (CNG) - liquefied petroleum gases (LPG) - power alcohol.		
Topic - 3	**ENERGY STORAGE DEVICES**	**9**
Batteries - Types of batteries – primary battery - dry cell. Secondary battery - lead acid battery, Nickel-Cadmium battery, fuel cells – Hydrogen -Oxygen fuel cell. - Solar energy conversion - solar cells – Application.		
Topic - 4	**SPECTROSCOPY**	**9**
Introduction – Laws of spectroscopy - Block diagram, Instrumentation, Working and application of Visible spectroscopy and Ultra Violet spectroscopy – Infrared spectroscopy – Flame photometry – Atomic adsorption spectroscopy.		
Topic - 5	**ENGINEERING MATERIALS**	**9**
Polymer – Types of polymerization – Preparation, properties, uses of Nylon(6,6), Poly Vinyl Chloride (PVC). Plastics – Types - Rubbers – SBR – Nanomaterial – Synthesis and its applications of Nanomaterial. Abrasives – Classification, Properties- Manufacture of SiC.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	S.S Dara and S.S. Umare ‘Engineering Chemistry’, S.Chand Publication, 2013
2	Jain & Jain ‘Engineering chemistry’ DhanpatRai Publishing Company, 2012
3	ShikhaAgarwal , Engineering Chemistry, Cambridge University Press, 2015 edition
4	ManasSenapati, Advanced Engineering Chemistry, Firewall Media, 2006

OTHER REFERENCES	
1	https://www.freebookcentre.net/chemistry-books-download
2	https://nptel.ac.in/course.html
3	https://www2.chemistry.msu.edu/faculty/reusch/virttxtjml/polymers.htm
4	https://edu.rsc.org/resources/collections/analytical-chemistry-introductions

Semester	Programme	Course Code	Course Name	L	T	P	C
I	B.E. / B.Tech., Commontoall	20EN1T3	COMMUNICATIVE ENGLISH I	3	1	0	4

COURSELEARNINGOUTCOMES(COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Apply the rules of grammar to parts of speech, tenses, voices, degrees of comparison, compound nouns and articles	K3	1
CO2	Interpret graphical representation for composing passages and paraphrase technical texts	K4	2
CO3	Analyze different spoken discourses like, short talks, comprehend different dialogues, practice conversation for speaking skills	K4	3
CO4	Examine grammatical errors using correct vocabulary and generating ideas logically on a topic	K5	4
CO5	Develop language and vocabulary effectively for our real-life contexts	K6	5

PRE-REQUISITE	NIL

CO/POMAPPING(1–Weak,2–Medium, 3 –Strong)														
COs	Programme LearningOutcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						3			2	3		3		
CO2						2			2	3		2		
CO3						3			2	2		1		
CO4						2			2	3		2	2	
CO5						3			1	3		2		

COURSEASSESSMENTMETHODS		
DIRECT	1	Continuous Assessment Tests
	2	Grammar Quizzes
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic-1	**GRAMMARANDVOCABULARY**	**9 +3**
WordformationwithPrefixandSuffix–PartsofSpeech–Tenses-Voices–Degreesofcomparison–CompoundNouns-BasicVocabulary –Homonyms and Homophones–Articles- Idioms–Phrasal verbs –Subject-Verb Agreement.		
Topic-2	**LISTENING**	**9 +3**
Introduction to Listening–Listening Comprehension –Extensive and Intensive listening –Pronunciation –Intonation– Stress – Pause– Rhythm– Short and Long conversations.		
Topic-3	**SPEAKING**	**9 +3**
An introduction to Speech sounds– Verbal and Non-verbal Communication –Describing places, people, Technical Processes–Telephonic skills–Different types of Interview –Group Discussions–Debates.		
Topic-4	**READING**	**9 +3**
SkimmingandScanning–ReadingNewspaperarticles–Readingdifferenttypesoftexts–SpeedReading–ReadingtoidentifyStylisticFeatures(Syntax,Lexis,SentenceStructures)–Comprehension.		
Topic-5	**WRITING**	**9 +3**
Introduction to aspects of technical writing – Letter writing – Formal Letters – Job application letter with CV and Resume - Official letters- Business letters- Circular letters- Employment letters – Punctuation –Writing reviews on books and movies–recommendations – Creative writing– email writing.		

THEORY	**45**		**TUTORIAL**	**15**		**PRACTICAL**	**0**		**TOTAL**	**60**

BOOKREFERENCES	
1	Board of Editors, Using English, Orient BlackSwan,2015.
2	PracticalEnglishUsage,MichaelSwan,OUP1995.
3	CommunicativeEnglish,J.AnbazhaganVijay,GlobalPublishers–Chennai2018.
4	EffectiveCommunication,Adair,John.London:PanMacmillanLtd.,2003.
5	BrilliantCommunicationSkills,Hasson,Gill.GreatBritain:PearsonEducation,2012.

OTHERREFERENCES	
1	http://networketiquette.net/
2	http://www.englishdaily626.com/c-errors.php
3	http://www.dailywritingtips.com/

Semester	Programme	Course Code	Course Name	L	T	P	C
I	B.E. / B.Tech., Common to all	20PH1T4	ENGINEERING PHYSICS	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Classify the extensive properties of solid materials to use in current field.	K2	1
CO2	Identify and develop the knowledge of atoms in solid crystals to apply recent engineering fields.	K3	2
CO3	Describe the fundamentals of lasers, laser systems, their characteristics and diversified applications including industry and medicine.	K4	3
CO4	Demonstrate a mastery of the core knowledge base in thermal physics.	K3	4
CO5	Evaluate the nano materials and its fabrication with behaviour by using advanced technical methods.	K5	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
Cos	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2			1	3	2	3	3	3	3	3		
CO2	2	1				3	2	3	3	3	3	3		
CO3	3	2	2			3	2	3	3	3	3	3		
CO4	2					3	2	3	3	3	3	3		
CO5	3	2				3	2	3	3	3	3	3	3	

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Mini Project
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**PROPERTIES OF MATTER**	**9**
Hooke's Law - Stress-Strain Diagram - Elastic moduli - Poisson's Ratio - Expression for bending moment of beam and depression of Cantilever - Expression for Young's modulus by Non-uniform bending and its experimental determination.		
Topic - 2	**CRYSTAL PHYSICS**	**9**
Single crystalline, polycrystalline and amorphous materials – single crystals: unit cell, crystal systems, Bravais lattices, directions and planes in a crystal, Miller indices – inter-planar distances - coordination number and packing factor for SC, BCC, FCC, HCP and diamond structures - growth of single crystals: solution and melt growth techniques.		
Topic - 3	**LASER TECHNOLOGY**	**9**
Introduction – principle of spontaneous emission and stimulated emission, population inversion, pumping mechanism. Laser characteristics - Einstein's A and B coefficients derivation. Two, three and four level systems. Threshold gain coefficient- Component of laser. Solid state laser(Nd:YAG). Diode lasers – Application of laser in science and engineering.		
Topic - 4	**THERMAL PHYSICS**	**9**
Transfer of heat energy - thermal conduction, convection and radiation – heat conductions in solids – thermal conductivity - Lee's disc method - theory and experiment - conduction through compound media (series and parallel) – thermal insulation – applications: heat exchangers, refrigerators, ovens and solar water heaters.		
Topic - 5	**NANO TECHNOLOGY**	**9**
Introduction to Nano materials- Moore's law- Properties of Nano materials- Quantum well, wire and dot- Fullerene, Carbon Nanotubes- Application of Nanotechnology in industry.		

THEORY	**45**		**TUTORIAL**	**00**		**PRACTICAL**	**00**		**TOTAL**	**45**

BOOK REFERENCES	
1	Serway and Jewett, "Physics for Scientists and Engineers with Modern Physics", 6th Edition, Thomson Brooks Cole, 2008
2	Charles P. Poole and Frank J.Owens, "Introduction to Nanotechnology", 2nd Edition, Wiley, Delhi, 2008.
3	S.O. Pillai, "Solid state Physics", 6th Edition, New Age International Publishers, 2008.

OTHER REFERENCES	
1	https://nptel.ac.in/courses/115/105/115105099/
2	https://nptel.ac.in/courses/115/106/115106061/
3	https://www.youtube.com/watch?v=_JOchLyNO_w
4	https://www.journals.elsevier.com › Journals
5	https://nptel.ac.in/courses/118/104/118104008/

Semester	Programme	Course Code	Course Name	L	T	P	C
I	B.E. / B.Tech., Common to all	20CS1T5	FUNDAMENTALS OF COMPUTING AND PROGRAMMING	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Understand the word processing tools with text documents	K2	1
CO2	Organize spreadsheet manipulation tools with sheets also describe the presentation and sliding with layouts	K3	2
CO3	Develop C program using managing input and output operations.	K3	3
CO4	Discover array and string implementation in C	K4	4
CO5	Examine the function and structure concepts in C	K4	5

PRE-REQUISITE	C PROGRAMMING

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
Cos	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3				3		3	1	3	3		3		
CO2	3		2		2			1	3	3		3		
CO3	3		2		3			1	3	3		3		
CO4	3							1	3	3		3		
CO5	3				2			1	3	3		3	2	

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignments
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION TO MS-WORD AND MS-EXCEL**	**9**
Introduction to word – Creating, editing, saving and printing text documents - Font and paragraph formatting - Simple character formatting -Inserting tables, smart art, page breaks -Using lists and styles- Working with images -Using Spelling and Grammar check -Understanding document properties Introduction to Spreadsheet basics - Creating, editing, saving and printing spreadsheets -Working with functions & formulas -Modifying worksheets with colour & auto formats -Graphically representing data : Charts & Graphs - Data Menu, Subtotal, Filtering Data -Formatting worksheets -Securing & Protecting spreadsheets		
Topic - 2	**MS-POWERPOINT AND INTERNET**	**9**
Introduction to PowerPoint- Opening, viewing, creating, and printing slides -Applying auto layouts - Adding custom animation -Using slide transitions -Graphically representing data : Charts & Graphs - Creating Professional Slide for Presentation. Internet - Understanding how to search/Google -bookmarking and Going to a specific website -Copy and paste Internet content into your word file and emails -Understanding social media platforms such as Facebook & Many more -learn with best practices		
Topic - 3	**C PROGRAMMING BASICS**	**9**
Problem formulation – Problem Solving - Introduction to ‘ C’ programming –fundamentals – 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 – solving simple scientific and statistical problems.		
Topic - 4	**ARRAYS AND STRINGS**	**9**
Arrays – Initialization – Declaration – One dimensional and Two dimensional arrays. String- String operations – String Arrays. Simple programs- sorting- searching – matrix operations.		
Topic - 5	**FUNCTIONS, STRUCTURES AND UNIONS**	**9**
Function – definition of function – Declaration of function – Pass by value – Pass by reference – Recursion - Structure – need for structure data type – structure definition – Structure declaration – Structure within a structure - Union - Programs using structures and Unions – Storage classes, Pre-processor directives.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Microsoft Office 2010 In Depth 1st Edition byJoeHabraken(Author) ,2010
2	Byron S Gottfried, “Programming with C”, Schaum’s Outlines, Second Edition, Tata McGraw-Hill,2006.
3	“Computer basics absolute beginners”9thEdition, Michale Miller,2019

OTHER REFERENCES	
1	https://youtu.be/ZXAPCy2c33o
2	https://courses.lumenlearning.com/wm-compapp/chapter/internet-and-powerpoint/
3	https://www.geeksforgeeks.org/c-language-set-1-introduction/
4	https://www.studytonight.com/c/string-and-character-array.php
5	https://www.geeksforgeeks.org/difference-structure-union-c/

Semester	Programme	Course Code	Course Name	L	T	P	C
I	B.E. / B.Tech., Common to all	20GE1L1	PHYSICS & CHEMISTRY LABORATORY	0	0	3	1.5

COURSE LEARNING OUTCOMES (COs)		
After Successful completion of the course, the students should be able to		RBT Level
CO1	State the aim and develop the procedure to conduct the experiment / exercise in the Physics & Chemistry laboratory Course	K3
CO2	Demonstrate skills at the level of precision (reliably, quickly, smoothly, and accurately with negligible guidance) in performing the experiment / exercise	K3
CO3	Draw inferences from the experiment / exercise conducted and present it professionally	K4
CO4	Demonstrate professionally the results obtained through the experiment / exercise and present conclusions	K4
CO5	Demonstrate an understanding of the concepts, procedures, and applications through verbal and written communication	K3
CO6	Demonstrating an attitude at the level of valuing (attaching values and expressing personal opinions by showing some definite involvement and commitment)	K3

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
Cos	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3								3	3				
CO2	3				3			2	3		1			
CO3	3	2		2		1				3				
CO4	3									3				
CO5	3									3		1		
CO6						2		2	2	2		1		

COURSE ASSESSMENT METHODS		
DIRECT	1	Laboratory Record
	2	Model Practical Examinations
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

LIST OF EXPERIMENTS	
PHYSICS LABORATORY **(Any Five Experiments)**	
1	Torsional pendulum - determination of moment of inertia and rigidity modulus
2	Determination of young's modulus by non- uniform bending
3	(a) Determination of Wavelength, and particle size using Laser (b) Determination of acceptance angle in an optical fiber.
4	Determination of velocity of sound and compressibility of liquid – Ultrasonic Interferometer.
5	Air wedge – determination of thickness of a thin wire.
6	Determination of band gap of a semiconductor.
LIST OF EXPERIMENTS	
CHEMISTRY LABORATORY **(Any Five Experiments)**	
1	Determination of total, temporary and permanent hardness of water by EDTA method.
2	Estimate the dissolved oxygen content of the given water sample by Winkler's method.
3	Determine the chloride content of the given potassium chloride sample using standardized silver nitrate solution.
4	Determination of iron content of the given solution using a potentiometer
5	Determination of strength of acid using conductivity meter.
6	Using conductance measurements, determine the strength of acids in a mixture.

THEORY	0		TUTORIAL	0		PRACTICAL	45		TOTAL	45

BOOK REFERENCES	
1	C. Ramesh Kumar & Y. Devakumari, "Physics Laboratory Manual", Al-Ameen Publications, 2020.
2	N. Jafarulla& C. Krishna Moorthy C "Chemistry Laboratory Manual", Al-Ameen Publications, 2020.

Semester	Programme	Course Code	Course Name	L	T	P	C
I	B.E. / B.Tech., Common to all	20CS1L2	COMPUTER PRACTICES LABORATORY	0	0	3	1.5

COURSE LEARNING OUTCOMES (COs)		
After Successful completion of the course, the students should be able to		RBT Level
CO1	State the aim and develop the procedure to conduct the experiment / exercise in the Computer Practices Laboratory Course	K3
CO2	Demonstrate skills at the level of precision (reliably, quickly, smoothly, and accurately with negligible guidance) in performing the experiment / exercise	K3
CO3	Draw inferences from the experiment / exercise conducted and present it professionally	K4
CO4	Demonstrate professionally the results obtained through the experiment / exercise and present conclusions	K4
CO5	Demonstrate an understanding of the concepts, procedures, and applications through verbal and written communication	K3
CO6	Demonstrating an attitude at the level of valuing (attaching values and expressing personal opinions by showing some definite involvement and commitment)	K3

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
Cos	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3								3	3				
CO2	3				3			2	3		1			
CO3	3	2		2		1				3				
CO4	3									3				
CO5	3									3		1		
CO6						2		2	2	2		1		

COURSE ASSESSMENT METHODS		
DIRECT	1	Laboratory Record
	2	Model Practical Examinations
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

LIST OF EXPERIMENTS	
1	Study Experiment a) Hardware specification and PC Assembly b) Getting connected to internet
2	Word processing a) Documentation creation, Text Manipulation with scientific notation b) Table Creation, Table Formatting and Conversion c) Mail Merge d) Flow Chart Preparation.
3	Spread Sheet a) Charts- Bar Chart, Pie Chart, Line Chart, X,Y-Chart b) Object Inclusion, Picture and Graphics c) Protecting the Document
4	Power Point Presentation and Access a) Creation of Presentation b) Generation of Report Using Access
5	C Programming a) Simple C Program with Data Types, Expressions and Comment Lines b) Programming with Conditional Statements c) Programming with Branching and Looping Statements d) Programming with Arrays and String e) Programming with Function and Structure

THEORY	0		TUTORIAL	0		PRACTICAL	45		TOTAL	45

BOOK REFERENCES	
1	Computer Practices Laboratory manual, Al - Ameen Publications 2020
2	Microsoft Office 2008 In Depth 2nd Edition by Joe(Author) , 2010

OTHER REFERENCES	
1	https://youtu.be/ftyWKjT20S4
2	https://nptel.ac.in/about_nptel.html
3	https://nptel.ac.in/courses/106/106/106106092/

SEMESTER II

Sl. No.	Course Code	Course Title	Category	CIA	ESE	L	T	P	C
THEORY COURSES									
1.	20MA2T1	Engineering Mathematics II	BS	40	60	3	1	0	4
2	20EN2T3	Communicative English II	HS	40	60	3	0	0	3
3	20EE2T4	Basics of Electrical Engineering	ES	40	60	3	0	0	3
4	20CSCT5	Python Programming	ES	40	60	3	0	0	3
LABORATORY COURSES									
5	20EM2L1	Engineering Practices Laboratory	ES	60	40	0	0	3	1.5
6	20ME2L2	Engineering Drawing Laboratory	ES	60	40	0	0	3	1.5
7	20CS2L3	Python Programming Laboratory	ES	60	40	0	0	3	1.5
MANDATORY COURSES									
8	20CY2T2	Environmental Sciences	MC	100	0	3	0	0	0
Total						**15**	**1**	**9**	**17.5**

Semester	Programme	Course Code	Course Name	L	T	P	C
II	B.E. / B.Tech., Common to all	20MA2T1	ENGINEERING MATHEMATICS II	3	1	0	4

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Solve higher order differential equations and apply them to certain physical situations	K3	1
CO2	Apply various integral theorems for solving engineering problems involving cubes and parallelepipeds.	K3	2
CO3	Solve linear differential equations using Laplace transform techniques.	K3	3
CO4	Construct analytic function of complex variables and transform functions from z- plane to w- plane and vice-versa using conformal mappings. .	K3	4
CO5	Apply the techniques of complex integration to evaluate real and complex integrals over suitable closed paths or contours	K3	5

PRE-REQUISITE	ENGINEERING MATHEMATICS I

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3		3				1	3	3		3		
CO2	3	3		3				1	3	3		3		
CO3	3	3		3				1	3	3		3		
CO4	3	3		3				1	3	3		3		
CO5	3	3		3				1	3	3		3	2	

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignments and Tutorials
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**SECOND AND HIGHER ORDER ORDINARY DIFFERENTIAL EQUATIONS**	**9 + 3**
Second order linear differential equations with constant co-efficient – Cauchy equation – Euler equation– Cauchy –Legendre equation– Method of variation of parameters– Solution of simultaneous equation with constant coefficients		
Topic - 2	**VECTOR CALCULUS**	**9 + 3**
Introduction– gradient–directional derivative–divergence and curl–angel between the surfaces–solenoidal and irrotational vector fields–Green's theorem in a plane–Gauss divergence theorem–Stoke's theorem (without proof).		
Topic - 3	**LAPLACE TRANSFORMS**	**9 + 3**
Condition for existence– Transform of elementary function– Basic properties(without proof)– Derivatives and integrals of transforms– Transform of unit step function– Initial and final value theorem(statement only)– Transform of a periodic function– Inverse Laplace transform– Partial fractions method– convolution theorem(statement only)– Solution of linear ODE of second order with constant co-efficients.		
Topic - 4	**ANALYTIC FUNCTIONS**	**9 + 3**
Analytic function – Necessary and sufficient condition – Cauchy Rieman equation (without proof) – Properties of analytic function (statement only) – Harmonic function – Constructions of analytic function – Bilinear transformation – Conformal mappings $w = z + a$, $w = az$, $w = \frac{1}{z}$		
Topic - 5	**COMPLEX INTEGRATION**	**9 + 3**
Cauchy's integral theorem (without proof) –Cauchy integral formula –Taylor's and Laurent's series (without proof) – Singularities –Cauchy's residue theorem – Contour Integration: Circular and Semi circular contour (excluding polar on real axis).		

THEORY	**45**		**TUTORIAL**	**15**		**PRACTICAL**	**0**		**TOTAL**	**60**

BOOK REFERENCES	
1	GrewalB.S., "Higher Engineering Mathematics", 42nd Edition,Khanna Publications New Delhi, 2011
2	JainR.K and Iyengar S.R.K, "Advanced Engineering Mathematics",4th Edition, NarosaPublishing House, New Delhi, Reprint 2014.
3	Ramana B.V., "Higher Engineering Mathematics",TataMcgraw Hill Publishing Company, New Delhi, 2011.
4	Kreyszig E., "Advanced Engineering Mathematics", 10th Edition, John Wiley Sons, 2010..

Semester	Programme	Course Code	Course Name	L	T	P	C
II	B.E. / B.Tech. Common to all (Except Civil)	20EN2T3	COMMUNICATIVE ENGLISH II	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Initiate and sustain a discussion maintaining appropriate group behavior, for a given communication scenario.	K5	1
CO2	Speak effectively and express opinions clearly for a given communicative context.	K3	2
CO3	Read different technical and professional texts, infer implied meanings and critically analyses evaluate the ideas presented.	K4	3
CO4	Use functional grammar for improving employment oriented skills. Use appropriate vocabulary and grammatical forms to complete a passage.	K3	4
CO5	Comprehend different spoken experts critically and infer spoken and implied meaning.	K6	5

PRE-REQUISITE	COMMUNICATIVE ENGLISH I

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						3			3	3		3		
CO2						2			3	3		3		
CO3						3			3	3		3		
CO4						2			3	3		3	2	
CO5						3			3	3		3		

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Grammar Quizzes
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1		**9**
Listening: Listening practice – different types of conversation and answering questions – gap exercises **Speaking:** Introduce one self and others – Opening a conversation **Reading:** Reading a novel, itinerary, Magazine and News papers **Writing:** Formal Letters – Job application letter with CV and Resume **Grammar:** Kinds of Sentences – Sentence Pattern (Parts/ Patterns/ Column Analysis).		
Topic - 2		**9**
Listening: Short texts – Listening to situation based dialogues – Listening to talks on engineering - **Speaking:** Sharing information of a personal kind – greeting – taking leave– **Reading:** Comprehension Questions (multiple choice questions and short questions) – short narrative stories - **Writing:** Paragraph Writing – Filling Forms – Basics of Business writing – Placing Orders, Letter of Complaint - **Grammar:** Asking Questions in the Simple Present – Using reference words, Yes/No type questions.		
Topic - 3		**9**
Listening: Listening to academic lectures and live speech – advertisements and announcements –**Speaking:** Giving and Justifying opinions – apologizing – Introduction to Presentation – **Reading:** Reading Blogs – Website articles – Paragraphing – **Writing:** Tweets – Texting and SMS language – Use ofSequence Words - **Grammar:** Using Past Tense to make correct sentences – WH questions.		
Topic - 4		**9**
Listening: Listening to a telephone conversation – Documentaries and making notes – **Speaking:** Giving Instructions – Role play – Asking about routine actions – **Reading:** Reading detailed comprehension - **Writing:** Writing Reports – Preparing Checklist - **Grammar:** Make sentences from Future Tense and their Usages (Compare the sentences with Degrees of Comparison).		
Topic - 5		**9**
Listening: Viewing a model group discussion and reviewing the performance of each participant – Casual Conversation - **Speaking:** Participating in a Group Discussion – Speeches for special Occasions– **Reading:** Making notes from long passage or any form of written materials – providing a suitable title – **Writing:** Brainstorming **–** Writing short essays - **Grammar:** Numerical Adjectives – Misspelled Words – Direct and Indirect speech – Spot the Errors.		

THEORY	45	TUTORIAL	0	PRACTICAL	0	TOTAL	45

BOOK REFERENCES	
1	Dr. Elango et al. "Resonance: English for Engineers and Technologist", Foundation, Chennai, 2013.
2	Anderson, Paul V., "Technical Communication: A Reader-Centered Approach", Cengage.
3	Sharma, Sangeetha and Binod Mishra**,** "Communication Skills for Engineers and Scientists", PHI Learning , New Delhi, 2009.
4	"Exercises in Spoken English Part I –III". EFLU, Hyderabad, OUP, 2014.
5	Raman, Meenakshi, &Sangeeta Sharma. Technical Communication: Principles and Practice, Second Edition. New Delhi: Oxford University Press, 2011.

OTHER REFERENCES	
1	http://www.owlnet.rice.edu/
2	http://zzyx.ucsc.edu/archer/intro.html
3	http://www.indiabix.com/group-discussion/topics-with-answers/

Semester	Programme	Course Code	Course Name	L	T	P	C
II	B.E. MECH, CSE & IT	20EE2T4	BASICS OF ELECTRICAL ENGINEERING	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Demonstrate and articulate the basic concepts related electrical machines.	K2	1
CO2	Apply the laws of electromagnetic & electric circuits in electrical machines.	K3	2
CO3	Compare electrical machines to rate their performance.	K4	3
CO4	Analyze electrical machines to infer their limitations.	K4	4
CO5	Evaluate a machines based on a set of criteria / applications and recommend a suitable electrical systems.	K5	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	2			1	3	3		3		2
CO2	3	3	2	2	3	3		1	3	3		3		2
CO3	3	3	2		2			1	3	3		3		
CO4	3	2	3			2		1	3	3		3		
CO5	3	2	2					1	3	3		3		

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignments
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**ELECTRICAL CIRCUITS & MEASURMENTS**	**9**
Ohm's Law – Kirchoff's Laws — Introduction to AC Circuits – Operating Principles of Moving Coil and Moving Iron Instruments, Dynamometer type Wattmeter and Energy meters		
Topic - 2	**DC MACHINES**	**9**
Construction, Principle of Operation and Characteristics of DC Generators, DC Motors, Single Phase Transformer.		
Topic - 3	**AC MACHINES**	**9**
Construction, Principle of Operation of AC Generators (Sailent& Non Sailent), Synchronous motor, Single and three phase induction Motors.		
Topic - 4	**STARTING METHODS**	**9**
Types of DC Motor starters (Two point, Three point & Four point) –Soft starter - Three phase squirrel cage and slip ring induction motors. (DOL Starter, Auto Transformer Starter, Rotor resistance Starter and Star/Delta Starter)		
Topic - 5	**CONVENTIONAL AND SOLID STATE SPEED CONTROL OF DC. & AC DRIVES**	**9**
Armature and field control, Ward Leonard Scheme, Single phase rectifier controllers (half and Full), Slip power recovery scheme, Single phase voltage regulator.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	A.K.Shawney, "A Course in Electrical and Electronics Measurements & Instrumentation", DhanpatRai& Co. 2010.
2	Bhattacharya, "Electrical Machines", Tata McGraw Hill, 2013.
3	Bakshi, "Electrical Machines –II", Technical Publications , Pune, 2015.
4	Dubey, "Fundamental of Electrical Drives", Narosa Publications, New Delhi, 2011.

OTHER REFERENCES	
1	https://youtu.be/u1gAh0cznp4
2	https://youtu.be/zs4MnEx7wTQ
3	https://youtu.be/shJAV59NS6k
4	https://youtu.be/j_F4limaHYI
5	https://youtu.be/AQqyGNOP_3o

Semester	Programme	Course Code	Course Name	L	T	P	C
II	B.E. / B.Tech., Common to CSE/IT	20CSCT5	PYTHON PROGRAMMING	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Classify and make use of python programming elements to solve and debug simple logical problems.	K2	1
CO2	Experiment with the various control statements in Python.	K3	2
CO3	Develop python programs using functions and strings.	K3	3
CO4	Experiment with the usage of pointers and functions.	K3	4
CO5	Analyze a problem and use appropriate packages and modules to solve it.	K4	5

PRE-REQUISITE	C PROGRAMMING

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		3			2	3	2	3	3	3	3	3		
CO2			2			3	2	3	3	3	3	3		
CO3			2			3	2	3	3	3	3	3		2
CO4			2		2	3	2	3	3	3	3	3	2	2
CO5	3	3	2			3	2	3	3	3	3	3		

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Mini Project
	3	End Semester Examinations
INDIRECT	1	Course End Survey

COURSE CONTENT		
Topic - 1	**BASICS OFPYTHONPROGRAMMING**	**9**
Introduction - Python Interpreter - Interactive and script mode -Values and types, operators, expressions, statements, precedence of operators, Multiple assignments, comments.		
Topic - 2	**CONTROL STATEMENTS AND FUNCTIONS IN PYTHON**	**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.		
Topic - 3	**DATA STRUCTURES: STRINGS,LISTSAND SETS**	**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, Sets - creating sets, set operations		
Topic - 4	**DATASTRUCTURESTUPLES,DICTIONARIES**	**9**
Tuples - Tuple assignment, Operations on Tuples, lists and tuples, Tuple as return value – Dictionaries - operations and methods, Nested Dictionaries.		
Topic - 5	**FILES,MODULES,PACKAGES**	**9**
Files and Exception - Text files, reading and writing files, format Operator – Modules - Python Modules - Creating own Python Modules - packages, Introduction to exception handling.		

THEORY	**45**	**TUTORIAL**	**0**	**PRACTICAL**	**0**	**TOTAL**	**45**

BOOK REFERENCES	
1	Ashok NamdevKamthane,Amit Ashok Kamthane, “Programming andProblem Solving with Python” , Mc-Graw Hill Education,2018.
2	Allen B. Downey, “Think Python: How to Think Like a Computer Scientist”, Second edition, Updated for Python 3, Shroff / O’Reilly Publishers,2016.
3	Robert Sedgewick, Kevin Wayne, Robert Dondero, “Introduction to Programming in Python: An Inter-disciplinary Approach”, Pearson India Education Services Pvt.Ltd.,2016.
4	Timothy A. Budd,” Exploring Python”, Mc-Graw Hill Education (India) Private Ltd.,2015.
5	Kenneth A. Lambert, “Fundamentals of Python: First Programs”, CENGAGE Learning,2012.

OTHER REFERENCES	
1	https://www.coursera.org/specializations/python
2	https://www.youtube.com/watch?v=rfscVS0vtbw
3	https://nptel.ac.in/courses/106/106/106106212/

Semester	Programme	Course Code	Course Name	L	T	P	C
II	B.E. / B.Tech., (Common to all)	20EM2L1	ENGINEERING PRACTICES LABORATORY	0	0	3	1.5

COURSE LEARNING OUTCOMES (COs)		
After Successful completion of the course, the students should be able to		RBT Level
CO1	State the aim and develop the procedure to conduct the experiment / exercise in the Engineering Practices Laboratory Course	K3
CO2	Demonstrate skills at the level of precision (reliably, quickly, smoothly, and accurately with negligible guidance) in performing the experiment / exercise	K3
CO3	Draw inferences from the experiment / exercise conducted and present it professionally	K4
CO4	Demonstrate professionally the results obtained through the experiment / exercise and present conclusions	K4
CO5	Demonstrate an understanding of the concepts, procedures, and applications through verbal and written communication	K3
CO6	Demonstrating an attitude at the level of valuing (attaching values and expressing personal opinions by showing some definite involvement and commitment)	K3

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3								3	3				
CO2	3				3			2	3		1			
CO3	3	2		2		1				3				
CO4	3									3				
CO5	3									3		1		
CO6						2		2	2	2		1		

COURSE ASSESSMENT METHODS		
DIRECT	1	Laboratory Record
	2	Model Practical Examinations
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

LIST OF EXPERIMENTS	
1	**GROUP A (CIVIL & MECHANICAL)I.CIVILENGINEERINGPRACTICE** **Buildings:** a) Study of plumbing and carpentry components of residential and industrial buildings safetyaspects. **Plumbing Works:** a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in householdfittings. b) Preparation of plumbing line sketches for water supply and sewageworks. c) Hands-on-exercise: Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components. d) Demonstration of plumbing requirements of high-risebuildings. **Carpentry using manual and power tools:** a) Study of the joints in roofs, doors, windows andfurniture. b) Hands-on-exercise: Wood work, joints by sawing, planning and cutting.
2	**II.MECHANICAL ENGINEERINGPRACTICE** **Welding:** a) Preparation of butt joints, lap joints and T- joints by Shielded metal arc welding. b) Gas weldingpractice **Basic Machining:** a) Simple Turning and Taperturning b) DrillingPractice **Sheet Metal Work:** a) Forming &Bending b) Model making – Trays andfunnels. c) Different type ofjoints. **Machine Study practice:** a)Study of centrifugalpump b) Study of airconditioner
3	**GROUP B (ELECTRICAL AND ELECTRONICS)** **III.ELECTRICAL ENGINEERINGPRACTICE** 1. Testing and connection of Fluorescent lampwiring. 2. Stair casewiring. 3. Measurement of energy using single phase energymeter. 4. Assembly of Residential housewiring. 5. Measurement of earth resistance of an electrical equipment usingmeggar.
4	**IV.ELECTRONICS ENGINEERING PRACTICE** 1. Resistor colour coding & Measurement of AC signalparameters (Peak-Peak, RMS period, Frequency) usingCRO. 2. Study of logic gates AND, OR, EX-OR andNOT. 3. Measurement of ripple factor of HWR andFWR. 4. Soldering practice for Components, Devices and Circuits. **5.** Generation of Clock Signal.

THEORY	**0**		**TUTORIAL**	**0**		**PRACTICAL**	**45**		**TOTAL**	**45**

BOOK REFERENCES	
1	"Engineering Practices Laboratory", Al-Ameen Publications, 2020.

Semester	Programme	Course Code	Course Name	L	T	P	C
II	B.E. / B.Tech., (Common to all)	20ME2L2	ENGINEERING DRAWINGLABORATORY	0	0	3	1.5

COURSE LEARNING OUTCOMES (COs)		
After Successful completion of the course, the students should be able to		RBT Level
CO1	State the aim and develop the procedure to conduct the experiment / exercise in the Engineering Drwaing Laboratory Course	K3
CO2	Demonstrate skills at the level of precision (reliably, quickly, smoothly, and accurately with negligible guidance) in performing the experiment / exercise	K3
CO3	Draw inferences from the experiment / exercise conducted and present it professionally	K4
CO4	Demonstrate professionally the results obtained through the experiment / exercise and present conclusions	K4
CO5	Demonstrate an understanding of the concepts, procedures, and applications through verbal and written communication	K3
CO6	Demonstrating an attitude at the level of valuing (attaching values and expressing personal opinions by showing some definite involvement and commitment)	K3

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3								3	3				
CO2	3				3			2	3		1			
CO3	3	2		2		1				3				
CO4	3									3				
CO5	3									3		1		
CO6						2		2	2	2		1		

COURSE ASSESSMENT METHODS		
DIRECT	1	Laboratory Record
	2	Model Practical Examinations
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

LISTOFEXPERIMENTS	
1	Drawing three problems based on projection of lines using Drawing sheet
2	Drawing three problems based on projection of planes using Drawing sheet
3	Drawing three problems based on projection of solids using Drawing sheet
4	Drawing three problems based on Orthographic projection using Software Package
5	Drawing three problems based on Isometric projection using Software Package
6	Detailed Study Of Drawing sheet, Drawing Board, Drawing Instruments.
7	Detailed Study Of Dimensioning, Arrow Head, Lettering

THEORY	0		TUTORIAL	0		PRACTICAL	45		TOTAL	45

BOOKREFERENCES	
1	R.K.Dhawan,“AtextbookofEngineeringDrawing”,S.ChandPublishers,Delhi,2010.
2	Dhananjay.A.Jolhe,“EngineeringDrawingwithanintroductiontoAutoCAD”,TataMcGrawHill Publishing Company Ltd., Delhi,2008.
3	BasantAgarwalandAgarwal.C.M.,“EngineeringDrawing”TataMcGrawHillPublishingCompanyLtd. , Delhi,2008.

Semester	Programme	Course Code	Course Name	L	T	P	C
II	B.E. / B.Tech., Common to CSE/IT	20CS2L3	PYTHON PROGRAMMING LABORATORY	0	0	3	1.5

COURSE LEARNING OUTCOMES (COs)		
After Successful completion of the course, the students should be able to		RBT Level
CO1	State the aim and develop the procedure to conduct the experiment / exercise in the Python Programming Laboratory Course	K3
CO2	Demonstrate skills at the level of precision (reliably, quickly, smoothly, and accurately with negligible guidance) in performing the experiment / exercise	K3
CO3	Draw inferences from the experiment / exercise conducted and present it professionally	K4
CO4	Demonstrate professionally the results obtained through the experiment / exercise and present conclusions	K4
CO5	Demonstrate an understanding of the concepts, procedures, and applications through verbal and written communication	K3
CO6	Demonstrating an attitude at the level of valuing (attaching values and expressing personal opinions by showing some definite involvement and commitment)	K3

PRE-REQUISITE	C PROGRAMMING

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3								3	3				
CO2	3				3			2	3		1			
CO3	3	2		2		1				3				
CO4	3									3				
CO5	3									3		1		
CO6						2		2	2	2		1		

COURSE ASSESSMENT METHODS		
DIRECT	1	Laboratory Record
	2	Model Practical Examinations
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

LIST OF EXPERIMENTS	
1	Implement simple python programs using interactive and script mode.
2	Develop python programs using id( ) and type( )functions
3	Implement range ( ) function in python
4	Implement various control statements in python.
5	Develop python programs to perform various string operations like concatenation, slicing, indexing.
6	Demonstrate string functions using python.
7	Implement user defined functions using python.
8	Develop python programs to perform operations on list
9	Implement dictionary and set in python
10	Develop programs to work with Tuples.
11	Create programs to solve problems using various data structures in python.
12	Implement python program to perform file operations.
13	Implement python programs using modules and packages

THEORY	0		TUTORIAL	0		PRACTICAL	45		TOTAL	45

BOOK REFERENCES	
1	"Python Programming Laboratory Manual",Al-AmeenPublications,2020
2.	Ashok NamdevKamthane,Amit Ashok Kamthane, "Programming and Problem Solving with Python", Mc-Graw Hill Education, 2018.
3.	Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", Second edition, Updated for Python 3, Shroff / O'Reilly Publishers,2016.
4.	Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-disciplinary Approach", Pearson India Education Services Pvt.Ltd.,2016.
5.	Timothy A. Budd," Exploring Python", Mc-Graw Hill Education (India) Private Ltd.,2015.

OTHER REFERENCES	
1	https://www.coursera.org/specializations/python

Semester	Programme	Course Code	Course Name	L	T	P	C
II	B.E. / B.Tech., Common to all	20CY2T2	ENVIRONMENTAL SCIENCES	3	0	0	0

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Demonstrate the importance of interdisciplinary nature of environment and health risk assessment.	K2	1
CO2	Discuss the ecosystem and their importance in the environment and conservation of biodiversity.	K2	2
CO3	Design the rain water harvesting system in their living area.	K6	3
CO4	Analyze the impact of pollution and hazardous waste in a global and societal context.	K4	4
CO5	Understand contemporary issues that result in environmental degradation that would attempt to provide solutions to overcome the problems.	K3	5

PRE-REQUISITE	Engineering Chemistry

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1					2	1	3	3		3		
CO2	2	2					1	1	3	3		3		
CO3	3	1	1					1	3	3		3		
CO4	3	2	1					1	3	3		3		
CO5	3	1					2	1	3	3		3		

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignment
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**ENVIRONMENT AND ECOSYSTEMS**	**9**
Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs – Introduction, types, characteristic features, structure and function of the forest ecosystem aquatic ecosystems (ponds, river and marine). Activity: Study of the ecosystem structure in Cauvery River.		
Topic - 2	**BIODIVERSITY**	**9**
Introduction to biodiversity definition: genetic, species and ecosystem diversity –value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity– endangered and endemic species of India – In-situ and ex- situ conservation of biodiversity. Activity: Study of common plants, insects, birds.		
Topic - 3	**ENVIRONMENTAL POLLUTION**	**9**
Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Thermal pollution (d) Noise pollution – solid waste management: causes, effects and control measures of municipal solid wastes – Hazardous and biomedical waste management -pollution case studies. Activity: Study of air and water pollution in industry.		
Topic - 4	**NATURAL RESOURCES**	**9**
Forest resources: over-exploitation, deforestation, – Water resources: Rain water harvesting-watershed management - utilization of surface and ground water, conflicts over water, dams-benefits and problems Food resources: effects of modern agriculture, fertilizer-pesticide problems - Principles of Green Chemistry- Case studies Activity: Tree plantation and maintenance within the campus.		
Topic - 5	**SUSTAINABILITY AND POPULATION**	**9**
From unsustainable to sustainable development – environmental Impact Assessment (EIA) – environmental ethics: Issues and possible solutions – climate change, acid rain, ozone layer depletion, and case studies – environment production act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act - environment and human health – value education – HIV / AIDS – women and child welfare. Activity: Small group meetings about environment and human health in local area peoples and making poster and short films about HIV / AIDS – women and child welfare.		

THEORY	**45**	**TUTORIAL**	**00**	**PRACTICAL**	**00**	**TOTAL**	**45**

BOOK REFERENCES	
1	ErachBharucha,"Textbook of Environmental Studies", Universities Press(I) Pvt, Ltd, Hydrabad,2015.
2	Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, 2005.
3	Benny Joseph, "Environmental Science and Engineering", Tata McGraw-Hill Education, 2014.

OTHERREFERENCES	
1	https://www.onlinebiologynotes.com/food-chain-food-web-and-ecological-pyramids/
2	https://vikaspedia.in/energy/environment/biodiversity-1/conservation-of-biodiversity
3	https://www.sciencedirect.com/topics/earth-and-planetary-sciences/ozone-layer-depletion

SEMESTER III

Sl. No.	Course Code	Course Title	Category	CIA	ESE	L	T	P	C
THEORY COURSES									
1	20MA3T1	Probability and Queueing Theory	BS	50	50	3	1	0	4
2	20AD3T2	Fundamentals of Operating Systems	PC	50	50	3	1	0	4
3	20AD3T3	Database Management Systems	PC	50	50	3	1	0	4
4	20AD3T4	Foundations of Artificial Intelligence	PC	50	50	3	0	0	3
5	20CS3T5	Object Oriented Programming with Java	PC	50	50	3	0	0	3
LABORATORYCOURSES									
6	20AD3L1	Intelligent Systems Laboratory	PC	50	50	0	0	3	1.5
7	20CS3L2	Object Oriented Programming with Java Laboratory	PC	50	50	0	0	3	1.5
8	20CS4L2	Database Management Systems Laboratory	EEC	50	50	0	0	3	1.5
MANDATORY COURSES									
9	20HSCT1	Universal Human Values 2: Understanding Harmony	HS	100	0	2	1	0	3
Total						**17**	**4**	**9**	**25.5**

Semester	Programme	Course Code	Course Name	L	T	P	C
III	B.E. CSE & B.Tech.IT	20MA3T1	PROBABILITY AND QUEUEING THEORY	3	1	0	4

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Classify different types of random processes and use it to find whether it is SSS or WSS.	K2	3
CO2	Relate and apply the concept of probability and random variables and predict probabilities of events in models following normal distribution.	K3	1
CO3	Analyse the situation and select an appropriate queuing model techniques for solving problems based on Little's formula.	K4	4
CO4	Compute correlation between variables, and predict unknown values using regression.	K3	2
CO5	Choose the appropriate methods in a queue discipline to develop a relationship between the queue length and service time distribution Laplace transforms for M/G/1 queue.	K5	5

PRE-REQUISITE	ENGINEERING MATHEMATICS I & ENGINEERING MATHEMATICS II

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO1	PO1	PO1	PSO	PSO
CO	3	3		3				1	3	3		3		
CO	3	3		3				1	3	3		3		
CO	3	3		3				1	3	3		3		
CO	3	3		3				1	3	3		3		
CO	3	3		3				1	3	3		3		

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignments and Tutorials
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**PROBABILITY AND RANDOM VARIABLES**	**9+3**
Basic concepts of probability – Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Exponential and Normal distributions.		
Topic - 2	**TWO – DIMENSIONAL RANDOM VARIABLES**	**9+3**
Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables – Central limit theorem (statement only).		
Topic - 3	**RANDOM PROCESSES**	**9+3**
Classification – Stationary process – Markov process – Poisson process – Discrete parameter Markov chain – Chapman Kolmogorov equations – Limiting distributions		
Topic - 4	**QUEUEING MODELS**	**9+3**
Markovian queues – Birth and death processes – Single and multiple server queuing models – Little's formula		
Topic - 5	**ADVANCED QUEUEING MODELS**	**9+3**
Finite source models – M/G/1 queue – Pollaczekkhinchin formula – M/D/1 and M/EK/1 as special cases – Series queues – Open Jackson networks.		

THEORY	**45**		**TUTORIAL**	**15**		**PRACTICAL**	**0**		**TOTAL**	**60**

BOOK REFERENCES	
1	Miller. S.L. and Childers. D.G., —"Probability and Random Processes with Applications to Signal Processing and Communications ", Academic Press, 2013.
2	Peebles, P.Z., "Probability, Random Variables and Random Signal Principles ", Tata McGraw Hill, 4th Edition, New Delhi, 2011.
3	Oliver . C. Lbe., "Fundamentals of applied probability and random processes" Academic Press, 2007.
4	Taha, H.A., "Operations Research", 8th Edition, Pearson India Education Services, Delhi, 2009.
5	Donald Gros, John F. Shortle, James M .Thomson, Carl M. Haris.,"Fundamentals of Queueing theory",4th Edition, Wiley India Pvt Ltd,2013.

OTHER REFERENCES	
1	https://www.cuemath.com/learn/mathematics/probability-in-real-life/
2	https://sciencing.com/examples-of-real-life-probability-12746354.html
3	http://www.iraj.in/journal/journal_file/journal_pdf/14-358-149822091462-64.pdf
4	https://www.cuemath.com/learn/mathematics/probability-in-real-life/
5	https://sciencing.com/examples-of-real-life-probability-12746354.html

Semester	Programme	Course Code	Course Name	L	T	P	C
III	B.Tech.- AI & DS	20AD3T2	FUNDAMENTALS OF OPERATING SYSTEMS	3	1	0	4

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Apply the concepts of CPU scheduling and Process synchronization.	K3	1
CO2	Assume the creation of different virtual machines in a hypervisor	K4	2
CO3	Identify the principles of memory management	K3	3
CO4	Analyze appropriate file system and disk organizations for a variety of computing scenario	K4	4
CO5	Build the features of various open source operating systems.	K3	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2						1	3	3		3	2	
CO2		3			3			1	3	3		3		
CO3	3				2			1	3	3		3		2
CO4	3	3						1	3	3		3		
CO5	3	3						1	3	3		3		

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignments and Tutorials
	3	Group Presentation & Cooperative Learning Report
	4	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION PROCESS CONCEPT**	9 + 3
Operating System Structure-Evolution Of Operating System-Operating System Operations-Process Management-Memory Management-Storage Management-Production And Security-System Structure: Operating System Services And System Calls-Types Of System Calls System Program-Operating System Generation		
Topic - 2	**MULTITHREADED PROGRAMMING AND PROCESS SCHEDULING**	9 + 3
Overview Of Threads-Multicore Programming-Multi Threading Models-Threading Issues-Basic Concept Of Process Scheduling-Cpu Scheduling-Scheduling Algorithm-Multiple Process Scheduling-Semaphores-Classic Synchronization-Monitors		
Topic - 3	**DEAD LOCK AND MEMORY MANAGEMENT STRATEGY**	9 + 3
I/O System-System Model-Deadlock Characteristics-Methods For Handling Dead Lock-Dead Lock Prevention-Deadlock Avoidance-Deadlock Lock Detection-Recovery From Dead Lock-Swapping-Segmentation-Contiguous Memory Allocation, Paging-Structure Of The Page Table		
Topic - 4	**VIRTUAL MEMORY MANAMENT AND FILE SYSTEMS**	9 + 3
Demand Paging-Copy OnWrite-Page Replacement-Allocation Of Frames-File Concepts-Access Methods-File Sharing-Production		
Topic - 5	**IMPLEMENTING FILE STYSTEM AND SECONDARY STORAGE STRUCTURES**	9 + 3
File System Structures-File System Implementation-Directory Implementation-Allocation Methods-Free Space Method Disk Structure-Disk Scheduling-Disk Management – Swap – Space Management		

THEORY	**45**		**TUTORIAL**	**15**		**PRACTICAL**	**0**		**TOTAL**	**60**

BOOK REFERENCES	
1	WilliamStallings,"OperatingSystemsInternalsandDesignPrinciples",9th Edition,PearsonPublications,2017.
2	Abraham Silberschatz, Peter B. Galvin, Greg Gagne, "Operating System Concepts", 10th Edition, JohnWiley,2018
3	Andrew S. Tanenbaum,Modern Operating Systems 5th Edition, Pearson Education, 2016.
4	D.M Dhamdhere, "Operating Systems"- A Concept based Approach, 3rd Edition, McGraw Hill, 2017.

OTHER REFERENCES	
1	https://nptel.ac.in/courses
2	https://www.w3schools.in › intro
3	https://www.smartzworld.com/notes/operating system
4	https://www.ncertbooks.guru/operating-system-pdf/
5	https://www.tutorialspoint.com/operating_system/operating_system_tutorial.pdf

Semester	Programme	Course Code	Course Name	L	T	P	C
III	B.Tech.- AI & DS	20AD3T3	DATABASE MANAGEMENT SYSTEMS	3	1	0	4

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Compare File Processing System with Database Systems in terms of performance, scalability and data storage for efficient access of data.	K4	1
CO2	Develop a Database schema using E-R model, Relational model and apply relational algebra operations like selection, projection, join and Cartesian product to solve the given problem.	K3	2
CO3	Develop SQL queries using aggregate functions, nested sub queries, joins and views for the given problem.	K3	3
CO4	Apply Suitable normalization and query optimization techniques to normalize the given relation and to optimize the query for efficient access of data.	K3	4
CO5	Simply serialization and concurrency control mechanisms to avoid deadlock problem in transaction processing.	K4	5

PRE-REQUISITE	PYTHON PROGRAMMING

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-		3	2	3	3	3	3	3		2
CO2	3	3	2	2		3	2	3	3	3	3	3		2
CO3	3	2	3	2		3	2	3	3	3	3	3	2	
CO4	3	3	2	2		3	2	3	3	3	3	3		
CO5	3	2				3	2	3	3	3	3	3		

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Mini project
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**DATABASE SYSTEM**	**9+3**
Overview of File Processing System – Purpose of Database System – view of data – Data Models-Database Languages – Database System Architecture – Database users and Administrator.		
Topic - 2	**DATABASEDESIGN**	**9+3**
Database design & E-R Model: Entity-Relationship model (E-R Model)-E-R Diagram-Constraints-Extended E-R features. Introduction to Relational Model: Database schema-Keys-Schema Diagrams-Relational Query Languages –Relational Operations.		
Topic - 3	**SQL**	**9+3**
SQL Standards-Data types- Structure of SQL queries-Additional basic operations –set operation-null values-aggregate function- nested sub queries-modification of the database. Intermediate SQL: Joins-Views -Transactions-Integrity constraints-Authorization-Advanced SQL		
Topic - 4	**NORMALIZATION AND QUERY OPTIMIZATION**	**9+3**
Relational database design: Functional Dependencies - Normalization and its normal forms-Denormalization-Data Storage:RAID - Tertiary Storage - File organization - Organization of records in files.Query processing-Query optimization.		
Topic - 5	**TRANSATION MANAGEMENT**	**9+3**
Transaction concepts - Transaction recovery - Properties of Transaction-Serializability - Concurrency Control - Locking Mechanisms - Two Phase Commit Protocol - Dead lock .Case study: Database connectivity using SQL.		

THEORY	**45**		**TUTORIAL**	**15**		**PRACTICAL**	**0**		**TOTAL**	**60**

BOOK REFERENCES	
1	Abraham silberschatz,Henry F.Korth,S.Sundharshan,"Database system concepts",sixthedition,Tata McGraw hill,2011
2	C.J.Date,A.Kannan,S.Swamynathan, "An Introduction to Database System",EighthEdition,pearson Education,2006
3	RamezElmasri and Shamkant B.Navathe, "Fundamentals of Database Systems", Fourth Edition, Pearson Addisionwesley, 2007
4	Atul Kahate,"Introdution to database Management system", Pearson Education, New Delhi,2006

OTHER REFERENCES	
1	https://onlinecourses.nptel.ac.in/noc17_cs33/course
2	http://www.db-book.com
3	http://nptel.ac.in/courses/IIT-MADRAS/Intro_to_Database_Systems_Design
4	http://www.iitg.ernet.in/awekar/teaching/cs344fall11/
5	www.w3schools.com/sql/

Semester	Programme	Course Code	Course Name	L	T	P	C
III	B.Tech.- AI & DS	20AD3T4	FOUNDATIONS OF ARTIFICIAL INTELLIGENCE	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
Upon completion of the course, students will be able to		**RBT Level**	**Topics Covered**
CO1	Apply a suitable set of production rules or apply constraint satisfaction technique to solve a given problem in AI.	K3	1,2
CO2	Discover the appropriate search strategy to find an optimal solution for a given AI problem.	K4	2
CO3	Apply resolution procedure to derive conclusion from the given set of statements in knowledge representation	K3	3
CO4	Inspect Bayesian theory, Bayesian networks, Dumpster Shafer theory for probabilistic reasoning to handle uncertainty.	K4	4
CO5	Explain the ability of AI to solve problems in the areas of Natural Language Processing and Robotics.	K2	5

PRE-REQUISITE	PYTHON PROGRAMMING

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	**Programme Learning Outcomes (POs)**												**PSOs**	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2				1	1	3	3		3	2	3
CO2	3	3		2				1	3	3		3		
CO3	3	2				2	1	1	3	3		3		
CO4	2	3		2			1	1	3	3		3		
CO5	2	2						1	3	3		3	2	2

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Seminar
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTIONTOAI**	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		
Topic - 2	**SOLVING PROBLEMSBY SEARCHINGTECHNIQUES**	9
Problem-Solving Agents – Example Problems: Toy problems – Searching for solution – Un informed search strategies InformedsearchandExploration:HeuristicFunctions–ConstraintSatisfaction Problems: Back tracking search.		
Topic - 3	**KNOWLEDGEANDREASONING**	9
LogicalAgents:Knowledgebasedagents–TheWumpusWorld–Logic–Propositional Logic – First order Logic :Syntax and Semantics of First-order Logic, Introduction to PROLOG		
Topic - 4	**PLANNING ANDACTING**	9
The Planning Problem –Planning with State- Space Search–Partial-Order Planning–Planningandactingintherealworld:Time,SchedulesandResources–Hierarchical Task Network Planning –Conditional Planning–Continuous Planning–Multi Agent Planning		
Topic - 5	**UNCERTAINKNOWLEDGEAND 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		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach, Prentice Hall, 4th Edition, 2020.
2	I.Bratko,"Prolog Programming for Artificial Intelligence", Addison Wesley Educational Publishers Inc, 4th Edition2011
3	M.TimJones,"ArtificialIntelligence:ASystemsApproach(ComputerScience)",JonesandBartlettLearning, 2009
4	NilsJ. Nilsson,"TheQuestforArtificialIntelligence",CambridgeUniversityPress,2009
5	WilliamF.ClocksinandChristopherS.Mellish,"ProgramminginProlog:UsingtheISOStandard",SpringerScience&BusinessMedia,5thEdition2012

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=yaL5ZMvRRqE
2	https://www.geeksforgeeks.org/difference-between-informed-and-uninformed-search-in-ai/
3	https://www.javatpoint.com/the-wumpus-world-in-artificial-intelligence
4	https://pages.mtu.edu/~nilufer/classes/cs5811/2012-fall/lecture-slides/cs5811-ch11b-htn.pdf

Semester	Programme	Course Code	Course Name	L	T	P	C
III	B.E. CSE, B.Tech.- IT, AI & DS	20CS3T5	OBJECT ORIENTED PROGRAMMING WITH JAVA	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Analyze a problem and identify classes, objects and the relationships among them	K3	1
CO2	Develop applications using various types of Inheritance and Interfaces	K3	2
CO3	Develop applications or programs using exception handling and multithreading.	K3	3
CO4	Analyze an application and make use of object oriented concepts for its implementation	K4	4
CO5	Develop programs using collections, files and streams in java	K3	5

PRE-REQUISITE	C PROGRAMMING

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2			3	2	3	3	3	3	3	2	2
CO2			2			3	2	3	3	3	3	3		3
CO3		2				3	2	3	3	3	3	3		
CO4	3	3			2	3	2	3	3	3	3	3	2	2
CO5			2			3	2	3	3	3	3	3		

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Mini Project
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION TO OBJECT ORIENTED PROGRAMMING AND JAVA**	**9**
Introduction to OOP– Java Fundamentals - Data Types, Variables, and Arrays Operators - Control Statements – Classes – Methods –Constructors- Garbage Collection.		
Topic - 2	**INHERITANCE ANDEXCEPTIONHANDLING**	**9**
Inheritance –Packages and Interfaces - Exception Handling Fundamentals – Java's Built-in Exceptions-Creating new Exception subclasses.		
Topic - 3	**POLYMORPHISM AND MULTITHREADING IN JAVA**	**9**
Polymorphism- Abstract classes and methods-Overloading-Overriding-final methods and classes – Multithreaded programming –The Thread class and the Runnable Interface- Creating multiple threads-Synchronization-Auto boxing and Annotations (Metadata).		
Topic - 4	**STRING HANDLING ANDCOLLECTION FRAMEWORK**	**9**
String Constructors-String Operations-Generic classes and methods-The Collection Framework-Collections-List-ArrayList, LinkedList, Set-HashzSet, Linked HashSet, Queue-PriorityQueue, Map-HashMap, SortedMap, TreeMap.		
Topic - 5	**FILES AND STREAMSIN JAVA**	**9**
Files and streams – Byte Stream-I/O Stream, File I/O Stream, ByteArray I/O Stream - Character Stream - File Reader and Writer, CharArrayReader and Writer - Serialization.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	HerbertSchildt, "Java the Complete Reference", Ninth edition Tata McGrawHills, 2014.
2	Paul Deitel and Harvey Deitel, —"Java How to Program (Early Objects)", TenthEdition, Pearson Prentice Hall2014.
3	Timothy Budd, —"An Introduction to Object-Oriented Programming", ThirdEdition, Pearson Education,2008.
4	E.Balaguruswamy,"Programming with Java", Sixth Edition, TMH,2019.
5	Dr.G.TThambi, "Object-Oriented Programming with java", First Edition, Kogent Learning Solutins, 2009.

OTHER REFERENCES	
1	https://www.w3schools.com
2	https://www.javatpoint.com/java-oops-concepts
3	https://www.youtube.com/watch?v=l-yoxklZwfM
4	https://www.youtube.com/playlist?list=PL9ooVrP1hQOHb4bxoHauWVwNg4FweDItZ
5	https://www.geeksforgeeks.org/object-oriented-programming-oops-concept-in-java/

Semester	Programme	Course Code	Course Name	L	T	P	C
III	B.Tech.- AI & DS	20AD3L1	INTELLIGENT SYSTEMS LABORATORY	0	0	3	1.5

COURSE LEARNING OUTCOMES (COs)		
After Successful completion of the course, the students should be able to		RBT Level
CO1	State the aim and develop the procedure to conduct the experiment / exercise in the Intelligent Systems Laboratory Course	K3
CO2	Demonstrate skills at the level of precision (reliably, quickly, smoothly, and accurately with negligible guidance) in performing the experiment / exercise	K3
CO3	Draw inferences from the experiment / exercise conducted and present it professionally	K4
CO4	Demonstrate professionally the results obtained through the experiment / exercise and present conclusions	K4
CO5	Demonstrate an understanding of the concepts, procedures, and applications through verbal and written communication	K3
CO6	Demonstrating an attitude at the level of valuing (attaching values and expressing personal opinions by showing some definite involvement and commitment)	K3

PRE-REQUISITE	PYTHON PROGRAMMING

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3								3	3				
CO2	3				3			2	3		1			
CO3	3	2		2		1				3				
CO4	3									3				
CO5	3									3		1		
CO6						2		2	2	2		1		

COURSE ASSESSMENT METHODS		
DIRECT	1	Laboratory Record
	2	Model Practical Examinations
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

LIST OF EXPERIMENTS	
1	Utilize an writing tool in AI for paraphrasing and text manipulations
2	Demonstrate an image generator AI tool to induce the user creativity
3	Construct an Art tool in AI for inducing the user creativity
4	Implement an Logo generator tool in AI for various logo creations
5	Apply a website developing AI tool for creating an appealing website for a customer:
6	Choose any SEO tool to create a beneficial blog for the viewers
7	Analyze Breadth First Search using PYTHON program(BFS)
8	Develop a PYTHON program to implement Depth First Search (DFS)
9	Implement Backtracking Search using PYTHON program
10	Create a PYTHON program for job scheduling

THEORY	0		TUTORIAL	0		PRACTICAL	45		TOTAL	45

BOOK REFERENCES	
1	Intelligent SystemsLaboratory Manual, Al-Ameen Publications, 2020
2	https://onlinelibrary.wiley.com/toc/26404567/2022/4/4

OTHER REFERENCES	
1	https://www.iitk.ac.in/ee/intelligent-systems-laboratory
2	https://mksaad.wordpress.com/2019/02/05/artificial-intelligence/
3	https://mrcet.com/LaboratoryManuals.html

Semester	Programme	Course Code	Course Name	L	T	P	C
III	B.E. CSE, B.Tech.- IT, AI & DS	20CS3L2	OBJECT ORIENTED PROGRAMMING WITH JAVA LABORATORY	0	0	3	1.5

COURSE LEARNING OUTCOMES (COs)		
After Successful completion of the course, the students should be able to		RBT Level
CO1	State the aim and develop the procedure to conduct the experiment / exercise in the Object Oriented Programming With Java Laboratory Course	K3
CO2	Demonstrate skills at the level of precision (reliably, quickly, smoothly, and accurately with negligible guidance) in performing the experiment / exercise	K3
CO3	Draw inferences from the experiment / exercise conducted and present it professionally	K4
CO4	Demonstrate professionally the results obtained through the experiment / exercise and present conclusions	K4
CO5	Demonstrate an understanding of the concepts, procedures, and applications through verbal and written communication	K3
CO6	Demonstrating an attitude at the level of valuing (attaching values and expressing personal opinions by showing some definite involvement and commitment)	K3

PRE-REQUISITE	C PROGRAMMING

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3								3	3				
CO2	3				3			2	3		1			
CO3	3	2		2		1				3				
CO4	3									3				
CO5	3									3		1		
CO6						2		2	2	2		1		

COURSE ASSESSMENT METHODS		
DIRECT	1	Laboratory Record
	2	Model Practical Examinations
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

LIST OF EXPERIMENTS	
1	Write a program to find the factorial of a given number.
2	Write a program to print numbers in sorting order.
3	Create a class Odometer that displays the number of kilometers a vehicle run. Give samples as trip information like number of kilometers travelled, fuel consumption per litre. The task is to find the mileage of the vehicle running at different samples of trip information.
4	Create a class Day that represents day, month and year of the calendar day. The class Day should be able to accept the date, update the date, delete the date from a calendar list of activities. Create a class Time that represents hours, minutes, seconds of a clock. The class Time should accept the time, update the time, delete the time from a list of events created for a day using the DayClass.
5	Write a program on illustration of use ofpackages
6	Write a program to implementinterfaces.
7	Write a program that implements a stack ADT that converts infix expression into postfix expression.
8	Write a program to read a file and displays the file on the screen within line number before eachline.
9	Write a program to copy contents of a file into another file using Filestreams.
10	Write a program for handling Array Index Out of Bounds Exception and Divide-by-zeroException.
11	Write a program for custom exception creation.
12	Write a program on multi-threading showing how CPU time is shared among all the threads.
13	Write a program for Producer-Consumer problem using threads.
14	Write an applet to handle the mouse events and keyboardevents.
15	Write a program to develop a simple calculator. Using Grid layout arrange buttons for the digits and +,-,* % operations. The computation should be performed with a button click “Compute”. Display the result on a text field.

THEORY	0		TUTORIAL	0		PRACTICAL	45		TOTAL	45

BOOK REFERENCES	
1	ObjectOrientedProgramming with Java Laboratory Manual,Al-AmeenPublications,2020
2.	HerbertSchildt, “Java the Complete Reference”, Ninth edition Tata McGrawHills, 2014.
3.	Paul Deitel and Harvey Deitel, —”Java How to Program (Early Objects)”, TenthEdition, Pearson Prentice Hall2014.
4.	Timothy Budd, —”An Introduction to Object-Oriented Programming”, ThirdEdition, Pearson Education,2008.
5.	E.Balaguruswamy,“Programming with Java”, Sixth Edition, TMH,2019.

OTHER REFERENCES	
1	https://www.w3resource.com/java-exercises/
2	https://www.csie.ntu.edu.tw/~d00922011/java/320/java.html

Semester	Programme	Course Code	Course Name	L	T	P	C
III	B.E. CSE, B.Tech.- IT, AI & DS	20CS4L2	DATABASE MANAGEMENT SYSTEMS LABORATORY	0	0	3	1.5

COURSE LEARNING OUTCOMES (COs)		
After Successful completion of the course, the students should be able to		RBT Level
CO1	State the aim and develop the procedure to conduct the experiment / exercise in the Database Management Systems Laboratory Course	K3
CO2	Demonstrate skills at the level of precision (reliably, quickly, smoothly, and accurately with negligible guidance) in performing the experiment / exercise	K3
CO3	Draw inferences from the experiment / exercise conducted and present it professionally	K4
CO4	Demonstrate professionally the results obtained through the experiment / exercise and present conclusions	K4
CO5	Demonstrate an understanding of the concepts, procedures, and applications through verbal and written communication	K3
CO6	Demonstrating an attitude at the level of valuing (attaching values and expressing personal opinions by showing some definite involvement and commitment)	K3

PRE-REQUISITE	PYTHON PROGRAMMING

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3								3	3				
CO2	3				3			2	3		1			
CO3	3	2		2		1				3				
CO4	3									3				
CO5	3									3		1		
CO6						2		2	2	2		1		

COURSE ASSESSMENT METHODS		
DIRECT	1	Laboratory Record
	2	Model Practical Examinations
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

LIST OF EXPERIMENTS	
1	Working basic SQL commands (DDL and DML).
2	Demonstrate Transaction control commands and aggregate functions
3	Implementing Join operation and Nested Queries
4	Implementing SQL queries on Integrity constraints and Views
5	Design a database using first and second normal form
6	Apply the concepts of High level programming language extensions (Control structures and Exceptions).
7	Create Cursors and Triggers
8	Demonstrate Procedures and Function in PL/SQL block.
9	Database Design and implementation with any one front end tool (Mini Project)
	Sample list of Projects:
1	Airline Reservation systems
2	Food Ordering System
3	Accident Management System
4	Grade Report System
5	Smart Health Consulting system etc

THEORY	0		TUTORIAL	0		PRACTICAL	45		TOTAL	45

BOOK REFERENCES	
1	Database Management Systems Laboratory Manual, Al-Ameen Publications, 2020.
2.	Abraham Silberschatz, Henry Korth, and S. Sudarshan, “Database System Concepts”, Sixth Edition, McGraw-Hill.2016.
3.	R. Elmasri and S. Navathe, “Fundamentals of Database Systems”, Sixth Edition, Pearson Education, 2011.
4.	Raghu Ramakrishnan, Johannes Gehrke, Database Management Systems, 3nd Edition, McGraw Hill, 2003.
5.	Thomas M. Connolly and Carolyn E. Begg, “Database Systems - A Practical Approach to Design, Implementation and Management”, Fifth edition, Pearson Education, 2010.

OTHER REFERENCES	
1	www.w3schools.com
2	www.w3resource.com
3	https://www.scribd.com/document/474661494/CA-01-DBMS-LAB-Reference-manual

Semester	Programme	Course Code	Course Name	L	T	P	C
III	BE/B.Tech., - Common to all	20HSCT1	UNIVERSAL HUMAN VALUES 2: UNDERSTANDING HARMONY	2	1	0	3

COURSE CONTENT		
Topic - 1	**Course Introduction - Need, Basic Guidelines, Content And Process For Value Education**	**6+3**

1. Purpose and motivation for the course, recapitulation from Universal Human Values-I

2. Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration

3. Continuous Happiness and Prosperity- A look at basic Human Aspirations

4. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority0020

5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario

6. Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

Topic - 2	**Understanding Harmony in the Human Being - Harmony in Myself!**	**6+3**

7. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'

8. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility

9. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)

10. Understanding the characteristics and activities of 'I' and harmony in 'I'

11. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail

12. Programs to ensure Sanyam and Health.

Topic - 3	**Understanding Harmony in the Family and Society- Harmony in Human Relationship**	**6+3**

13. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship

14. Understanding the meaning of Trust; Difference between intention and competence

15. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship

16. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals

17. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

Topic - 4	Understanding Harmony in the Nature and Existence - Whole existence asCoexistence	6+3

18. Understanding the harmony in the Nature

19. Interconnectedness and mutual fulfilment among the four orders of naturerecyclability and self regulation in nature

20. Understanding Existence as Co-existence of mutually interacting units in allpervasive space

21. Holistic perception of harmony at all levels of existence.

Topic - 5	Implications of the above Holistic Understanding of Harmony on Professional Ethics	6+3

22. Natural acceptance of human values

23. Definitiveness of Ethical Human Conduct

24. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order

25. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.

26. Case studies of typical holistic technologies, management models and production systems

27. Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations

28. Sum up

THEORY	30		TUTORIAL	15		PRACTICAL	0		TOTAL	45

BOOK REFERENCES	
1	JeevanVidya: E.K. Parichaya, A Nagaraj, JeevanVidyaPrakashan, Amarkantak, 1999.
2	Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004
3	The Story of Stuff (Book)by Annie Leonard , 2011
4	The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5	Small is Beautiful - E. F Schumacher.
6	Slow is Beautiful - Cecile Andrews
7	Economy of Permanence - J C Kumarappa
8	India Wins Freedom - Maulana Abdul Kalam Azad
9	Vivekananda - Romain Rolland (English)
10	Gandhi - Romain Rolland (English)

SEMESTER IV

Sl. No.	Course Code	Course Title	Category	CIA	ESE	L	T	P	C
THEORY COURSES									
1	20CS6E1	Data warehousing and Data Mining	PC	50	50	3	0	0	3
2	20CS6T2	Software Engineering	PC	50	50	3	0	0	3
3	20AD4T3	Introduction to Computer Network	ES	50	50	3	0	0	3
4	20AD4T4	Concepts in Data Science	PC	50	50	3	1	0	4
5		Professional Elective - I	PE	50	50	3	0	0	3
6		Open Elective - I	OE	50	50	3	0	0	3
LABORATORY COURSES									
7	20ENCL1	Communication Skills Laboratory	HS	50	50	0	0	2	1
8	20AD4L2	Data mining Tools Laboratory	PC	50	50	0	0	3	1.5
9	20AD4L3	Networks Laboratory	PC	50	50	0	0	3	1.5
MANDATORY COURSES									
10	20MCCT1	Constitution of India	MC	100	-	3	0	0	0
Total						**21**	**1**	**8**	**23**

Semester	Programme	Course Code	Course Name	L	T	P	C
IV	B.Tech.- AI & DS	20CS6E1	DATA WARE HOUSING AND DATA MINING	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Dissect about the necessity of preprocessing and its procedure.	K4	1
CO2	Apply the association rules for mining applications.	K3	2
CO3	Identify an appropriate Classification technique for various problems with high dimensional data.	K3	3
CO4	Assume an appropriate Clustering techniques for various problems with high dimensional data	K4	4
CO5	Build the various mining techniques on complex data objects.	K3	5

PRE-REQUISITE	DATABASE MANAGEMENT SYSTEMS

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	-	-	-	1	3	3	-	2	3	-
CO2	3	2	2	-	-	-	-	1	3	3	-	2	3	-
CO3	3	3	3	-	-	-	-	1	3	3	2	3	-	3
CO4	3	3	3	-	-	-	-	1	3	3	2	3	-	3
CO5	3	-	2	-	-	-	-	1	3	3	-	2	3	-

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Other Assessments (Assignment, Quiz etc.)
	3	End Semester Examinations
INDIRECT	1	Course End Survey

COURSE CONTENT		
Topic - 1	**DATA WAREHOUSING AND BUSINESS ANALYSIS**	**9**
Data warehousing Components –Building a Data warehouse – Mapping the Data Warehouse to a Multiprocessor Architecture – DBMS Schemas for Decision Support – Data Extraction, Cleanup, and Transformation Tools –Metadata – reporting – Query tools and Applications – Online Analytical Processing (OLAP) – OLAP and Multidimensional Data Analysis.		
Topic - 2	**DATA MINING PRIMITIVES AND CONCEPT DESCRIPTION**	**9**
Data mining primitives – Data mining query language - concept description – Data generalization and characterization – Analytical characterization – Mining Descriptive statistical measures in large databases.		
Topic - 3	**CLASSIFICATION AND PREDICTION**	**9**
Introduction – Decision Tree Induction – Bayesian Classification – Back propagation – Lazy Learners – Other classification methods – Prediction – Evaluating the accuracy		
Topic - 4	**CLUSTERING AND ASSOCIATION**	**9**
Similarity and Distance Measures – Hierarchical Algorithms – Partitional Algorithms – Outlier Analysis – Mining Frequent Patterns, Associations, and Correlations		
Topic - 5	**ADVANCED TOPICS**	**9**
Web Mining – Web Content Mining – Structure and Usage Mining – Spatial Mining – Time Series and Sequence Mining – Graph Mining.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Vipin Kumar, Michael Steinbach," Introduction to Data Mining", Second Edition, Addison Wesley, 2005
2	Jiawei. Han, Micheline Kamber, "Data Mining: Concepts and Techniques", Second Edition, Elsevier, New Delhi, 2008.
3	Alex Berson and Stephen J. Smith "Data Warehousing, Data Mining & OLAP", Tata McGraw– Hill Edition, Tenth Reprint 2007.

OTHER REFERENCES	
1	http://www.information-management-architect.com/process-architecture.html
2	http://www.cs.ccsu.edu/~markov/ccsu_courses/DataMining-1.html
3	http://www.tutorialspoint.com/data_mining/dm_cluster_analysis.htm
4	http://study.com/academy/lesson/data-warehousing-and-data-mining-information-for-business-intelligence.html

Semester	Programme	Course Code	Course Name	L	T	P	C
IV	B.Tech.- AI & DS	20CS6T2	FUNDAMENTALS OF SOFTWARE ENGINEERING	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Apply the software product using suitable software process models for the given specification.	K3	1
CO2	Analyze the requirements for real-time problem specification and devise a SRS pertaining to industry standards.	K4	2
CO3	Examine the system model using the appropriate design engineering procedure for a given SRS	K4	3
CO4	Classify the software model using black box testing, white box testing, unit testing and integration testing to produce error free product.	K4	4
CO5	Examine the development cost, schedule a risk free work plan for a given project model using appropriate tool.	K4	5

PRE-REQUISITE	PROFESSIONAL ETHICS

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2					2	2	3	3		3	1	3
CO2	3	2					2	2	3	3		3		
CO3	3	2	2	2			2	2	3	3		3	2	3
CO4	3	2	2	2			2	2	3	3		3	2	3
CO5	3	2	2	2			2	2	3	3		3	2	3

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Other Assessments (Assignment, Quiz etc.)
	3	End Semester Examinations
INDIRECT	1	Course End Survey

COURSE CONTENT		
Topic - 1	**SOFTWARE PROCESS AND AGILE DEVELOPMENT**	**9**
Software Process -Software Process models- Waterfall Model-Incremental Process Models -Evolutionary Process Models- Prototyping-Spiral Model- Introduction to Agility-Agile process.		
Topic - 2	**REQUIREMENTS ANALYSIS AND SPECIFICATION**	**9**
Software Requirements: Functional and Non-Functional, User requirements, System requirements, Software Requirements Document – Requirement Engineering Process: Feasibility Studies, Requirements elicitation and analysis, requirements validation, requirements management-Classical analysis: Structured system Analysis - Data Dictionary.		
Topic - 3	**SOFTWARE DESIGN**	**9**
Design process – Design Concepts-Design Model–Architectural Design - User Interface Design: Interface analysis, Interface Design –Component level Design: Designing Class based components, traditional Components.		
Topic - 4	**SOFTWARE TESTING**	**9**
Software testing fundamentals-Internal and external views of Testing-white box testing - basis path testingcontrol structure testing-black box testing- Regression Testing – Unit Testing – Integration Testing – Validation Testing – System Testing and Debugging.		
Topic - 5	**PROJECT MANAGEMENT**	**9**
Software Project Management: Estimation – LOC, FP Based Estimation, Make/Buy Decision COCOMO Model – Project Scheduling – Scheduling, Earned Value Analysis Planning – Project Plan, Planning Process, RFP Risk Management – Identification, Projection - Risk Management-Risk Identification-RMMM Plan-CASE TOOLS.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Rajib Mall, Fundamentals of Software Engineering, Third Edition, PHI Learning Private Limited, 2009.
2	Pankaj Jalote, Software Engineering, A Precise Approach, Wiley India, 2010.
3	Kelkar S.A., Software Engineering, Prentice Hall of India Pvt Ltd, 2007.
4	Roger S. Pressman, Software Engineering – A Practitioners Approach, Seventh Edition, Mc Graw-Hill International Edition, 2010.
5	Ian Sommerville, Software Engineering, 9th Edition, Pearson Education Asia, 2011.

OTHER REFERENCES	
1	https://nptel.ac.in/courses/106101061/
2	https://nptel.ac.in/downloads/106105087/
3	https://en.wikipedia.org/wiki/Software_engineering
4	https://youtu.be/cDQ34z0oqnQ

Semester	Programme	Course Code	Course Name	L	T	P	C
IV	B.Tech.- AI & DS	20AD4T3	INTRODUCTION TO COMPUTER NETWORK	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Identify the key benefits of block chain for a business or a network environment.	K2	1
CO2	Classify the components of block chain, the roles of the components in developing block chain system and build a new revenue streams to a given business scenario.	K4	2
CO3	Develop the core components of Bit coin Network with the necessary scriplets and Design a Bit coin Wallet for a given P2P network specification.	K3	3
CO4	Assess the Ethereum Eco system, Ethereum Virtual Machine and Encoding schemes and Develop a DApp for a given business model.	K3	4
CO5	Apply the given business model and critique the strengths and flaws of block chain implementation.	K4	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	-	3	2	3	3	3	3	3	-	-
CO2	2	2	-	-	-	3	2	3	3	3	3	3	-	2
CO3	3	-	2	-	-	3	2	3	3	3	3	3	-	-
CO4	2	3	-	-	-	3	2	3	3	3	3	3	2	-
CO5	3	3	2	2	-	3	2	3	3	3	3	3	-	1

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Other Assessments (Assignment, Quiz etc.)
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**DATA COMMUNICATIONS**	**9**
Data Communication-Networks–The OSI Model– Layers in the OSI Model – TCP/IP Protocol Suite – Addressing – Transmission Media.		
Topic - 2	**DATA LINK LAYER**	**9**
Framing – Error Detection and Correction– IEEE Standards(802.3,802.5,802.11)– MAC protocols and types.		
Topic - 3	**NETWORK LAYER**	**9**
Internetworking: Switching and Bridging – Basic Internetworking-IPv4 - IPv6 – Routing Techniques: Distance vector (RIP) – Link state (OSPF) — Interdomain Routing (BGP).		
Topic - 4	**TRANSPORT LAYER**	**9**
Congestion Control and Resource Allocation: TCP Congestion Control – Congestion Avoidance Mechanisms – Quality of Service: Integrated Services – Differentiated Services.		
Topic - 5	**APPLICATION LAYER**	**9**
Domain Name System - File Transfer – Web Services and SNMP - HTTP - Electronic Mail (SMTP, POP3, IMAP, MIME).		

THEORY	**45**	**TUTORIAL**	**0**	**PRACTICAL**	**0**	**TOTAL**	**45**

BOOK REFERENCES	
1	William Stallings, “Data Communication and Networks”, Pearson Education, Tenth edition, 2014.
2	James .F. Kurouse& W. Rouse, “Computer Networking: A Topdown Approach Featuring”,Sixth edition, Pearson Education, 2013.
3	William Stallings, “Data Communication and Networks”, Pearson Education, Tenth edition, 2014.

OTHER REFERENCES	
1	http://www.nptel.ac.in/downloads/106105080, Computer Networks, Prof.Sujoy Ghosh, IIT Kharagpu.
2	https://www.elsevier.com/journals/subjects/computer-science.

Semester	Programme	Course Code	Course Name	L	T	P	C
IV	B.Tech.- AI & DS	20AD4T4	CONCEPTS IN DATA SCIENCE	3	1	0	4

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Analyze data science fundamentals and apply them to day-to-day business and industrial needs	K4	1
CO2	Analyze appropriate probability and statistical tests using R	K4	2
CO3	Apply supervised and unsupervised algorithms in clustering	K3	3
CO4	Develop the mathematical models for data analysis and also perform mining in text data	K3	4
CO5	Apply the visualization models using Tableau and d3.js tools	K3	5

PRE-REQUISITE	PYTHON AND DBMS

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2					1	3	3		3		2
CO2		2	1	2	2		2	1	3	3	1	3	1	
CO3		1						1	3	3	3	3	2	3
CO4	1		1	3			2	1	3	3		3	2	2
CO5	1	2	3		3		2	1	3	3	1	3		1

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Other Assessments (Assignment, Quiz etc.)
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION TO DATA SCIENCE**	**9+3**
Data Science Fundamentals, Exploring data engineering pipelines, Applying data science and data warehousing to business and industry		
Topic - 2	**INTRODUCTION TO PROBABILITY AND R**	**9+3**
Introduction to Probability, Conditional Probability, Random Variable, Statistical Modelling, Probability Distribution, R Introduction, Data Structures in R, Working with Data in R		
Topic - 3	**SUPERVISED AND UNSUPERVISED LEARNING**	**9+3**
Linear Regressions, Classification- Decision Tree, Naive Bayes, K-Nearest Neighbors, ClusteringIdentifying Clusters, K-Means Clustering, Hierarchical Clustering		
Topic - 4	**MATHEMATICAL MODELLING**	**9+3**
Association Rule Mining, Time Series Analysis, Dimensionality Reduction, Principal Component Analysis, Linear Discriminator Analysis, Sentiment Analysis on text data		
Topic - 5	**VISUALIZATION TOOLS**	**9+3**
Introduction to Visualization - Types of visualizations, Working with Tableau, Creating views in Tableau, using d3.js for data visualization		

THEORY	**45**		**TUTORIAL**	**15**		**PRACTICAL**	**0**		**TOTAL**	**60**

BOOK REFERENCES	
1	Jain R.K and Iyengar S.R.K, "Advanced Engineering Mathematics", 3rd Edition, Narosa Publishing House, New Delhi, Reprint 2009.
2	Ramana B.V., "Higher Engineering Mathematics", Tata Mcgraw Hill Publishing Company, New Delhi, 2008.
3	Kreyszig E., "Advanced Engineering Mathematics", 9th Edition, John Wiley Sons, 2012.
4	Glyn James., "Advanced Modern Engineering Mathematics", Pearson Education Limited, 2007.
5	N P Bali, Manish Goyal, "A Text Book of Engineering Mathematics", 3rd Edition, Laxmi Publication Private Limited, 2009.

OTHER REFERENCES	
1	Lillian Pierson, Data Science for Dummies, John Wiley,2015
2	Garrett Grolemund, Hadley Wickham, R for Data Science, O Reilly in January 2017.
3	Andrie de Vries, Joris Meys, R For Dummies, John Wiley and Sons, 2012
4	David Baldwin, Mastering Tableau, Packt Publishing, 2016.

Semester	Programme	Course Code	Course Name	L	T	P	C
IV	B.Tech – AI & DS	20AD4E1	ADVANCED ARTIFICIAL INTELLIGENCE SYSTEMS	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
Upon completion of the course, students will be able to		**RBT Level**	**Topics Covered**
CO1	Apply a suitable set of production rules or apply constraint satisfaction technique to solve a given problem in AI.	K3	1
CO2	Discover the appropriate search strategy to find an optimal solution for a given AI problem.	K4	2
CO3	Apply resolution procedure to derive conclusion from the given set of statements in knowledge representation	K3	3
CO4	Inspect Bayesian theory, Bayesian networks, Dumpster Shafer theory for probabilistic reasoning to handle uncertainty.	K4	4
CO5	Explain the ability of AI to solve problems in the areas of Natural Language Processing and Robotics.	K2	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	**Programme Learning Outcomes (POs)**												**PSOs**	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2				1	1	3	3		3	2	3
CO2	3	3		2				1	3	3		3		
CO3	3	2				2	1	1	3	3		3		
CO4	2	3		2			1	1	3	3		3		
CO5	2	2						1	3	3		3	2	2

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Other Assessments (Assignment, Quiz etc.)
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**INTELLIGENT AGENTS**	**9**
Introduction- What is AI-Why AI? -Foundation of AI- History of AI- Intelligent Agents: Agents and Environments - Characteristics–Structure of Agents. Problem formulation-Production systems-Problem characteristics-Production system characteristics- Constraints Satisfaction Problems.		
Topic - 2	**PROBLEM SOLVING METHODS**	**9**
Search Strategies- Uninformed Search strategies :BFS-Uniform-cost search-DFS-Iterative Deepening DFS Bidirectional Search. Informed Search strategies: Greedy BFS-A* search– Local Search Algorithms and Optimization Problems.		
Topic - 3	**KNOWLEDGE REPRESENTATION**	**9**
Knowledge Representation -Using Predicate logic :Representing simple facts-Representing instance and ISA re relationships-Computable functions and predicates- Resolution – Forward chaining - Backward chaining.		
Topic - 4	**UNCERTAINITY AND PROBABLISTIC REASONING**	**9**
Uncertainty: Acting under Uncertainty-Inference using Full Joint Distributions -Bayes' rule. Probabilistic Reasoning: Semantics of Bayesian networks-Exact Inference- Dempster- Shafer theory-Fuzzy set and fuzzy logic		
Topic - 5	**AI APPLICATIONS**	**9**
Natural Language Processing: Information Retrieval- Information Extraction–Speech Recognition .Robotics : Hardware – Perception – Planning – Moving.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Stuart Russel and Peter Norvig "Artificial Intelligence – A Modern Approach", 3rd Edition, Pearson Education.
2	Kevin Night and Elaine Rich, Nair B., "Artificial Intelligence (SIE)", 3 rd Edition, McGraw Hill-2008
3	Deepak Khemani ,"A First Course in Artificial Intelligence", Tata McGraw Hill Education 2013.
4	Nils J. Nilsson, ―The Quest for Artificial Intelligence‖, Cambridge University Press, 2009.
5	" M. Tim Jones, ―Artificial Intelligence: A Systems Approach(Computer Science)‖, Jones and Bartlett Publishers, Inc.; First Edition, 2008.

OTHER REFERENCES	
1	http://nptel.ac.in/courses/106106126/1,"Introduction, State space search, Heuristic search, problem decomposition, Planning, Constraint satisfaction", Prof. Deepak Khemani, Department of Computer Science and Engineering, IIT, Madras.

Semester	Programme	Course Code	Course Name	L	T	P	C
IV	B.Tech – AI & DS	20AD4E2	ETHICS IN DATA SCIENCE	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Analyze data science fundamentals and apply them to day-to-day business and industrial needs	K4	1
CO2	Analyze appropriate probability and statistical tests using R	K4	2
CO3	Apply supervised and unsupervised algorithms in clustering	K3	3
CO4	Develop the mathematical models for data analysis and also perform mining in text data	K3	4
CO5	Apply the visualization models using Tableau and d3.js tools	K3	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2					1	3	3		3		2
CO2		2	1	2	2		2	1	3	3	1	3	1	
CO3		1						1	3	3	3	3	2	3
CO4	1		1	3			2	1	3	3		3	2	2
CO5	1	2	3		3		2	1	3	3	1	3		1

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Other Assessments (Assignment, Quiz etc.)
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION TO DATA SCIENCE**	**9**
Data Science Fundamentals, Exploring data engineering pipelines, Applying data science and data warehousing to business and industry		
Topic - 2	**INTRODUCTION TO PROBABILITY AND R**	**9**
Introduction to Probability, Conditional Probability, Random Variable, Statistical Modelling, Probability Distribution, R Introduction, Data Structures in R, Working with Data in R		
Topic - 3	**SUPERVISED AND UNSUPERVISED LEARNING**	**9**
Linear Regressions, Classification- Decision Tree, Naive Bayes, K-Nearest Neighbors, ClusteringIdentifying Clusters, K-Means Clustering, Hierarchical Clustering		
Topic - 4	**MATHEMATICAL MODELLING**	**9**
Association Rule Mining, Time Series Analysis, Dimensionality Reduction, Principal Component Analysis, Linear Discriminator Analysis, Sentiment Analysis on text data		
Topic - 5	**VISUALIZATION TOOLS**	**9**
Introduction to Visualization - Types of visualizations, Working with Tableau, Creating views in Tableau, using d3.js for data visualization		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Jain R.K and Iyengar S.R.K, "Advanced Engineering Mathematics", 3rd Edition, Narosa Publishing House, New Delhi, Reprint 2009.
2	Ramana B.V., "Higher Engineering Mathematics", Tata Mcgraw Hill Publishing Company, New Delhi, 2008.
3	Kreyszig E., "Advanced Engineering Mathematics", 9th Edition, John Wiley Sons, 2012.
4	Glyn James., "Advanced Modern Engineering Mathematics", Pearson Education Limited, 2007.
5	N P Bali, Manish Goyal, "A Text Book of Engineering Mathematics", 3rd Edition, Laxmi Publication Private Limited, 2009.

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1	Lillian Pierson, Data Science for Dummies, John Wiley,2015
2	Garrett Grolemund, Hadley Wickham, R for Data Science, O Reilly in January 2017.
3	Andrie de Vries, JorisMeys, R For Dummies, John Wiley and Sons, 2012
4	David Baldwin, Mastering Tableau, Packt Publishing, 2016.

Semester	Programme	Course Code	Course Name	L	T	P	C
IV	B.Tech – AI & DS	20AD4E3	COGNITIVE SYSTEM	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Compare the enabling technologies and communication models of internet of things.	K2	1
CO2	Relate the machine-to-machine communication model and IoT reference model for end to end communication.	K2	2
CO3	Analyze the IoT protocols for various layers and apply for developing real time IoT applications	K4	3
CO4	Develop applications using microcontrollers for addressing real world needs.	K4	4
CO5	Develop applications for smart cities using Raspberry Pi.	K4	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1						2	1	3	3		3		3
CO2	2	1	3				2	1	3	3		3		
CO3	3	2					2	1	3	3	2	3	3	
CO4	2	1					2	1	3	3	3	3	-	
CO5	1	2					2	1	3	3	3	3	3	

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Other Assessments (Assignment, Quiz etc.)
	3	End Semester Examinations
INDIRECT	1	Course End Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION TO INTERNET OF THINGS**	**9**
Characteristics of IoT, Physical and Logical Design of IoT - IoT Enabling Technologies - Wireless Sensor Networks - Cloud Computing - Big Data Analytics - Communication Protocols - Embedded Systems - Functional Blocks - Communication Models and APIs - IoT Levels and Deployment Templates - Overview of Microcontroller, Basics of Sensors and Actuators - Examples and Working Principles of Sensors and Actuators.		
Topic - 2	**M2M AND IOT ARCHITECTURE**	**9**
Building Architecture - An IoT Architecture Outline - M2M and IoT Technology Fundamentals: Devices and Gateways, Local and Wide Area Networking, Data management, Everything as a Service, M2M and IoT Analytics, Knowledge Management - IoT Reference Model.		
Topic - 3	**IOT PROTOCOLS**	**9**
PHY/MAC Layer: 3GPP MTC, IEEE 802.15 - WirelessHART- Z-Wave, BLE- Zigbee - DASH7 - Network Layer: 6LoWPAN - 6TiSCH - RPL - CORPL - CARP - Transport Layer: TCP - MPTCP - UDP- DCCP- Session Layer: HTTP- CoAP- XMPP- AMQP- MQTT.		
Topic - 4	**PROTOTYPING IOT OBJECTS USING MICROCONTROLLER**	**9**
Introduction - Equivalent Microcontroller Platform - Setting up the Board - Programming for IoT - Reading from Sensors, Communication: Connecting Microcontroller with Mobile devices - Communication through Bluetooth, WiFi, and Ethernet.		
Topic - 5	**PROTOTYPING IOT OBJECTS USING RASPBERRY PI**	**9**
Introduction to Raspberry Pi - About the board - Raspberry Pi Interfaces - Programming Raspberry Pi with Python - Interfacing external gadgets - Controlling Output, Reading Input from Pins. IoT Physical Servers & Cloud Offerings		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle, From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence, 1st Edition, Academic Press, 2014.
2	Daniel Minoli, Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications, ISBN: 978-1-118-47347-4, Willy Publications.
3	Vijay Madisetti and ArshdeepBahga, Internet of Things (A Hands-on-Approach), 1st Edition, VPT, 2014.
4	Francis daCosta, Rethinking the Internet of Things: A Scalable Approach to Connecting Everything, 1st Edition, Apress Publications, 2013.
5	Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things: Key Applications and Protocols, Wiley, 2012.

OTHER REFERENCES	
1	https://builtin.com/internet-things
2	https://www.youtube.com/watch?v=LlhmzVL5bm8
3	https://www.youtube.com/watch?v=6mBO2vqLv38
4	https://www.youtube.com/watch?v=KeaeuUcw02Q
6	https://www.youtube.com/watch?v=Fj02iTrWUx0

Semester	Programme	Course Code	Course Name	L	T	P	C
IV	B.Tech – AI & DS	20AD4E4	PRINCIPLE OF COMPUTER GRAPHICS	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Understand the structure of modern computer graphics systems and primitives.	K2	1
CO2	Classify various algorithms to scan, convert the basic geometrical primitives, transformations, Area filling, clipping.	K2	2
CO3	Develop 3D UI computer graphics programs using OpenGL	K3	3
CO4	Compare various algorithms used for modelling and rendering graphical 3D data.	K2	4
CO5	Analyze interactive animations using various animation techniques.	K4	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2				3	2	1	3	3	3	3		
CO2		2		3		3	2	1	3	3	3	3		
CO3		2			3	3	2	1	3	3	3	3		
CO4		1		2		3	2	1	3	3	3	3		
CO5					1	3	2	1	3	3	3	3		

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests.
	2	Other Assessments (Assignment, Quiz etc.)
	3	End Semester Examinations.
INDIRECT	1	Course End Survey.

COURSE CONTENT		
Topic - 1	**INTRODUCTION TO COMPUTER GRAPHICS AND GRAPHICS PRIMITIVES**	**9**
Basic of Computer Graphics- Applications of computer graphics, Display devices, Random and Raster scan systems, Graphics input devices, Graphics software and standards.		
Topic - 2	**2D TRANSFORMATION AND VIEWING**	**9**
Transformations (translation, rotation, scaling), matrix representation, homogeneous coordinates, composite transformations, reflection and shearing, viewing pipeline and coordinates system, window-to viewport transformation, clipping including point clipping, line clipping (cohen-sutherland, liang-bersky, NLN), polygon clipping.		
Topic - 3	**INTRODUCTION TO 3D GRAPHICS**	**9**
Introduction to 3D graphics: 3D display methods, polygon surfaces, tables, equations, meshes, curved lies and surfaces, quadric surfaces, spline representation, Bazier curves and surfaces, B-spline curves and surfaces.		
Topic - 4	**3D TRANSFORMATION AND VIEWING**	**9**
Visible surface detection methods: back-face detection - depth sorting- BSP tree methods. Translation,rotation, scaling, reflection and shear transformations, composite transformations, 3-D viewing: Viewing pipeline, viewing coordinates, view volume and general projection transforms and clipping.		
Topic - 5	**ILLUMINATION MODELS AND COMPUTER ANIMATION**	**9**
Basic illumination models- Light intensities- Radiosity lighting model. Computer animation: Design ofanimation sequence, raster animation, computer animation languages, key frame systems, motion specifications.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Edward Angel, Interactive Computer Graphics: A Top-Down Approach with OpenGL, 4th edition, Addison-Wesley, 2005.
2	SumantaGuha, Computer Graphics Through OpenGL: From Theory to Experiments, 3rd edition,2018
3	Fabio Ganovelli, et.al, Introduction to Computer Graphics: A Practical Learning Approach, Taylor and Francis group, 2015
4	Donald Hearn, M. Pauline Baker, Computer Graphics, 2nd edition, C version, Prentice Hall, 1996
5	Peter Shirley, Michael Ashikhmin, Michael Gleicher, Stephen R Marschner, Erik Reinhard, Kelvin Sung, and AK Peters, Fundamental of Computer Graphics, CRC Press, 2010.

OTHER REFERENCES	
1	https://www.coursera.org/learn/introtoalice
2	https://nptel.ac.in/courses/106103224
3	https://www.springer.com/journal/11042
4	https://www.amazon.in/Computer-Graphics-Foley-Feiner-Hughes/dp/0321399528
5	https://www.amazon.com/Animation-Beginners-Principles-Graphics-Learning/dp/1686282702?tag=uuid10-20

Semester	Programme	Course Code	Course Name	L	T	P	C
IV	Common To B.E. &B.Tech	20ENCL1	COMMUNICATION SKILLS LABORATORY	0	0	2	1

COURSE LEARNING OUTCOMES (COs)		
After Successful completion of the course, the students should be able to		RBT Level
CO1	State the aim and develop the procedure to conduct the experiment / exercise in the Communication Skills Laboratory Course	K3
CO2	Demonstrate skills at the level of precision (reliably, quickly, smoothly, and accurately with negligible guidance) in performing the experiment / exercise	K3
CO3	Draw inferences from the experiment / exercise conducted and present it professionally	K4
CO4	Demonstrate professionally the results obtained through the experiment / exercise and present conclusions	K4
CO5	Demonstrate an understanding of the concepts, procedures, and applications through verbal and written communication	K3
CO6	Demonstrating an attitude at the level of valuing (attaching values and expressing personal opinions by showing some definite involvement and commitment)	K3

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3								3	3				
CO2	3				3			2	3		1			
CO3	3	2		2		1				3				
CO4	3									3				
CO5	3									3		1		
CO6						2		2	2	2		1		

COURSE ASSESSMENT METHODS		
DIRECT	1	Laboratory Record
	2	Model Practical Examinations
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

LIST OF EXPERIMENTS	
1	Laboratory Practice Sessions
2	Conversation Practice Sessions (To be done as real life interactions)
3	Group Discussion Sessions
4	Interview Sessions
5	Presentation

THEORY	**0**		**TUTORIAL**	**0**		**PRACTICAL**	**30**		**TOTAL**	**30**

BOOK REFERENCES	
1	Baul Emmerson and Nick Hamilton, 'Five Minute Activities for Business English', Cambridge University Press, New York, 2005.
2.	Arthur Brookes and Peter Grundy, 'Beginning to Write: Writing Activities for Elementary and Intermediate Learners', Cambridge University Press, New York, 2003.
3.	George, Livingston. 'Using Communication Skills Lab in Enhancing Speaking Skills of Engineering Students' 2018.
4.	NiraKonar: English Language Laboratory: A Comprehensive Manual, PHI Learning, 2011.
5.	Pandey, Dr.Meenu. 'A Practical Book of Communication Skills', NIRALI Prakashan advancement of knowledge, second edition 2018.

OTHER REFERENCES	
1	Khan Academy Videos on English Speaking and Writing
2	https://learningenglish.britishcouncil.org/en/listening
3	Adrian Duff et.al. (ed.): Cambridge Skills for Fluency
4	Mark Hancock: English Pronunciation in Use
5	Audio Cassettes/CD'S OUP 2004

Semester	Programme	Course Code	Course Name	L	T	P	C
IV	B.Tech.- AI & DS	20AD4L2	DATA MINING TOOLS LABORATORY	0	0	3	1.5

COURSE LEARNING OUTCOMES (COs)		
After Successful completion of the course, the students should be able to		**RBT Level**
CO1	State the aim and develop the procedure to conduct the experiment / exercise in the Data Mining Tools Laboratory Course	K3
CO2	Demonstrate skills at the level of precision (reliably, quickly, smoothly, and accurately with negligible guidance) in performing the experiment / exercise	K3
CO3	Draw inferences from the experiment / exercise conducted and present it professionally	K4
CO4	Demonstrate professionally the results obtained through the experiment / exercise and present conclusions	K4
CO5	Demonstrate an understanding of the concepts, procedures, and applications through verbal and written communication	K3
CO6	Demonstrating an attitude at the level of valuing (attaching values and expressing personal opinions by showing some definite involvement and commitment)	K3

PRE-REQUISITE	Intelligent systems & DBMS Lab

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	**Programme Learning Outcomes (POs)**												**PSOs**	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3								3	3				
CO2	3				3			2	3		1			
CO3	3	2		2		1				3				
CO4	3									3				
CO5	3									3		1		
CO6						2		2	2	2		1		

COURSE ASSESSMENT METHODS		
DIRECT	1	Laboratory Record
	2	Model Practical Examinations
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

LIST OF EXPERIMENTS	
1	Creation of a Data Warehouse.
2	Apriori Algorithm.
3	FP-Growth Algorithm.
4	K-means clustering.
5	One Hierarchical clustering algorithm.
6	Bayesian Classification.
7	Decision Tree.
8	Support Vector Machines.
9	Applications of classification for web mining.
10	Case Study on Text Miningorany commercial application.

THEORY	0		TUTORIAL	0		PRACTICAL	45		TOTAL	45

BOOK REFERENCES	
1	Data Minig ToolsLaboratory Manual, Al-Ameen Publications, 2020
2	https://www.javatpoint.com/data-mining-techniques

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=J326LIUrZM8
2	https://www.youtube.com/watch?v=oNYtYm0tFso
3	https://slideplayer.com/slide/11908256/

Semester	Programme	Course Code	Course Name	L	T	P	C
IV	B.Tech.- AI & DS	20AD4L3	NETWORKS LABORATORY	0	0	3	1.5

COURSE LEARNING OUTCOMES (COs)		
After Successful completion of the course, the students should be able to		RBT Level
CO1	State the aim and develop the procedure to conduct the experiment / exercise in the Networks Laboratory Course	K3
CO2	Demonstrate skills at the level of precision (reliably, quickly, smoothly, and accurately with negligible guidance) in performing the experiment / exercise	K3
CO3	Draw inferences from the experiment / exercise conducted and present it professionally	K4
CO4	Demonstrate professionally the results obtained through the experiment / exercise and present conclusions	K4
CO5	Demonstrate an understanding of the concepts, procedures, and applications through verbal and written communication	K3
CO6	Demonstrating an attitude at the level of valuing (attaching values and expressing personal opinions by showing some definite involvement and commitment)	K3

PRE-REQUISITE	Intelligent systems

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3								3	3				
CO2	3				3			2	3		1			
CO3	3	2		2		1				3				
CO4	3									3				
CO5	3									3		1		
CO6						2		2	2	2		1		

COURSE ASSESSMENT METHODS		
DIRECT	1	Laboratory Record
	2	Model Practical Examinations
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

LIST OF EXPERIMENTS	
1	Learn to use commands like tcpdump, netstat, ifconfig, lookup and trace route. Capture ping and trace route PDUs using a network protocol analyzer and examine.
2	Write a code for error correction and detection (like CRC).
3	Implement Flow control mechanisms in Data link control
4	Write a code simulating ARP /RARP protocols.
5	Study of Network simulator (NS) and Simulation of Congestion Control Algorithms using NS.
6	Simulation of Distance Vector/Link State Routing algorithm.
7	Write a HTTP web client program to download a webpage using TCP sockets.
8	Applications using TCP sockets like : a)Echo client and echo server , b)Chat ,C)File Transfer
9	Study of TCP/UDP performance using Simulation tool.
10	Simulation of DNS using UDP sockets.

THEORY	0		TUTORIAL	0		PRACTICAL	45		TOTAL	45

BOOK REFERENCES	
1	NetworksLaboratory Manual, Al-Ameen Publications, 2020
2	James .F. Kurouse& W. Rouse, "Computer Networking: A Topdown Approach Featuring",Sixth edition, Pearson Education, 2013.

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=M4yzxOAtn7k
2	https://www.youtube.com/watch?v=6T6eXk2mAx8
3	https://www.youtube.com/watch?v=u5xzWZFLgm4

Semester	Programme	Course Code	Course Name	L	T	P	C
IV	B.E/B.Tech.- Common to all	20MCCT1	CONSTITUTION OF INDIA	3	0	0	0

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Understand and abide the rules of the Indian constitution.	K2	1
CO2	Understand the functions of Central government.	K2	2
CO3	Understand the function of state government.	K2	3
CO4	Understand the various constitutional functions and laws.	K2	4
CO5	Understand the different culture among the people of India	K2	5

PRE-REQUISITE	UHV

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						2	2	2	3	3		3		1
CO2						1	2	2	3	3		3		1
CO3						1	2	2	3	3		3		1
CO4						1	2	2	3	3		3		1
CO5						1	2	2	3	3		3		1

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Other Assessments (Assignment, Quiz etc.)
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION**	**9**
Historical Background – Constituent Assembly of India – Philosophical foundations of the Indian Constitution – Preamble – Fundamental Rights – Directive Principles of State Policy – Fundamental Duties – Citizenship – Role of the Election Commission.		
Topic - 2	**STRUCTURE AND FUNCTION OF CENTRAL AND STATE GOVERNMENT**	**9**
Union Government – Structures of the Union Government and Functions – President – Vice President– Prime Minister – Cabinet – Parliament – Supreme Court of India – Judicial Review. State Government – Structure and Functions – Governor – Chief Minister – Cabinet – State Legislature – Judicial System in States – High Courts and other Subordinate Courts.		
Topic - 3	**CONSTITUTION FUNCTIONS OF INDIA AND INDIAN SOCIETY**	**9**
Indian Federal System – Central – State Relations – President's Rule – Constitutional Amendments – Constitutional Functionaries - Assessment of working of the Parliamentary System in India. Society : Nature, Meaning and definition; Indian Social Structure; Caste, Religion, Language in India; Constitutional Remedies for citizens – Political Parties and Pressure Groups; Right of Women, Children and Scheduled Castes and Scheduled Tribes and other Weaker Sections		
Topic - 4	**POLICIES AND ACTS – GENERAL**	**9**
Insurance and Bonding – Laws Governing Sale, Purchase and use of Urban and Rural Land – Land Revenue Codes – Tax Laws – Income Tax, Sales Tax , Excise and Custom duties and their Influence on Construction Cost – Legal Requirements for Planning – Property Law– Agency Law – Local Government Laws for Approval.		
Topic - 5	**POLICIES AND ACTS ON INFRASTRUCTURE DEVELOPMENT**	**9**
A Historical Review of the Government Policies on Infrastructure – Current Public Policies on Transportations – Power and telecom Sector – Plans for Infrastructure Development – Legal framework for Regulating Private Participation in Roads and Highways – Ports and Airport and Telecom.		

THEORY	**45**	**TUTORIAL**	**0**	**PRACTICAL**	**0**	**TOTAL**	**45**

BOOK REFERENCES	
1	Durga Das Basu, "Introduction to the Constitution of India", Prentice Hall of India, New Delhi,2018.
2	R.C.Agarwal, "Indian Political System", S.Chand and Company, New Delhi, 2004
3	Maciver and Page, "Society: An Introduction Analysis", Mac Milan India Ltd., New Delhi,2007
4	K.L.Sharma, "Social Stratification in India: Issues and Themes", Jawaharlal Nehru University, New Delhi,2006.

OTHER REFERENCES	
1	https://nptel.ac.in/courses/106/105/106105034/
2	https://www.youtube.com/watch?v=6XTYoZymbwE
3	https://www.youtube.com/watch?v=MP6VlAE_7WY

SEMESTER V

Sl. No.	Course Code	Course Title	Category	CIA	ESE	L	T	P	C
THEORY COURSES									
1	20AD5T1	Data Visualization	PC	40	60	3	1	0	4
2		Professional Elective - II	PE	40	60	3	0	0	3
3		Open Elective - II	OE	40	60	3	0	0	3
THEORY COURSE WITH LABORATORY COMPONENTS									
4	20AD5LT1	Data Analytics	PC	50	50	2	0	4	4
5	20AD5LT2	Design and Analysis of Algorithms	PC	50	50	2	0	4	4
6	20AD5LT3	Data Science Using R	PC	50	50	2	0	4	4
EMPLOYABILITY EHANCEMENT COURSE									
7	20PT5T1	Career Guidance - I	EEC	100	--	2	1	0	0
Total						**20**	**1**	**8**	**22**

Semester	Programme	Course Code	Course Name	L	T	P	C
V	B.Tech.- AI & DS	20AD5T1	DATA VISUALIZATION	3	1	0	4

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Understand and abide the Visualization design objectives.	K2	1
CO2	Identify the Visualizing data methods.	K2	2
CO3	Analyse Visualizing Data Process	K4	3
CO4	Plan the Interactive Data Visualization	K3	4
CO5	Discover the security visualization system.	K4	5

PRE-REQUISITE	Concepts in Data Science

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2					2	2	3	3		3	1	3
CO2	3	2					2	2	3	3		3		
CO3	3	2	2	2			2	2	3	3		3	2	3
CO4	3	2	2	2			2	2	3	3		3	2	3
CO5	3	2	2	2			2	2	3	3		3	2	3

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Other Assessments (Assignment, Quiz etc.)
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION**	**9+3**
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.		
Topic - 2	**VISUALIZING DATA METHODS**	**9+3**
Mapping - Time series - Connections and correlations - Scatterplot maps - Trees, Hierarchies and Recursion - Networks and Graphs, Info graphics.		
Topic - 3	**VISUALIZING DATA PROCESS**	**9+3**
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.		
Topic - 4	**INTERACTIVE DATA VISUALIZATION**	**9+3**
Drawing with data – Scales – Axes – Updates, Transition and Motion – Interactivity - Layouts – Geo mapping – Exporting, Framework – T3, .js, tablo.		
Topic - 5	**SECURITY DATA VISUALIZATION**	**9+3**
Port scan visualization - Vulnerability assessment and exploitation - Firewall log visualization - Intrusion detection log visualization -Attacking and defending visualization systems - Creating security visualization system.		

THEORY	**45**		**TUTORIAL**	**15**		**PRACTICAL**	**0**		**TOTAL**	**60**

BOOK REFERENCES	
1	Scott Murray, “Interactive data visualization for the web”, O“Reilly Media, Inc., 2013.
2	Ben Fry, “Visualizing Data”, O“Reilly Media, Inc., 2007.
3	Greg Conti, “Security Data Visualization: Graphical Techniques for Network Analysis”, No Starch Press Inc, 2007 .
4	Joshua N. Milligan, “Learning Tableau”, 2016.
5	Brett Powell ,”Mastering Microsoft Power BI”, 2018.

OTHER REFERENCES	
1	https://flowingdata.com/2019/10/17/techniques-for-adding-context-to-visualization/
2	https://www.youtube.com/watch?v=VolIkTkYqMw
3	https://www.manageengine.com/vulnerability-management/vulnerability-assessment.html

Semester	Programme	Course Code	Course Name	L	T	P	C
VI	B.E. ECE	20ECCE1	DIGITAL IMAGE PROCESSING	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Explain the fundamental concepts of a digital image processing.	K2	1
CO2	Compare various Image Transform Techniques.	K3	2
CO3	Apply enhancement and restoration algorithms for image analysis.	K3	3
CO4	Choose appropriate segmentation algorithms for given application.	K4	4
CO5	Compare various Image compression techniques.	K5	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2						1	3	3		3	2	
CO2	1		3					1	3	3		3	2	
CO3	2		1			1		1	3	3		3	2	
CO4	1	2	3					1	3	3		3	2	
CO5	1	2	3					1	3	3		3	2	

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Other Assessments (Assignment, Quiz etc.)
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**DIGITAL IMAGE FUNDAMENTALS**	**9**
Elements of visual perception – Image sensing and acquisition – Image Formation Model, Image Sampling and Quantization, Representation of Digital Images, Spatial and Gray level Resolution, Zooming and Shrinking of Digital Images, Basic relationship between pixels		
Topic - 2	**IMAGE TRANSFORMS**	**9**
1D and 2D image transforms - Separable Transforms - One dimensional Fourier Transform - DFT – Two-dimensional Fourier Transform-Discrete Cosine Transform-Walsh–Hadamard Transform – Wavelet transform –discrete and continuous - Haar transform– Properties.		
Topic - 3	**IMAGE ENHANCEMENT AND RESTORATION**	**9**
Image Enhancement: Spatial Domain Methods. Image subtraction–Image averaging– Spatial filtering - Smoothing, Sharpening filters–First and Second Derivatives–Histogram–Histogram–Equalization Frequency Domain Methods–Filtering-Smoothing and Sharpening–Butterworthfilter Image Restoration: Model of image Degradation / Restoration process.		
Topic - 4	**IMAGE SEGMENTATION AND REPRESENTATION**	**9**
Detection of discontinuities - Point, Line and Edge detection – Gradient operators - Edge linking – Graph theoretic technique – Thresholding – global and adaptive –Region - based segmentation. Boundary representation – chain codes - Polygonal approximation–Signatures–skeletons.		
Topic - 5	**IMAGE COMPRESSION**	**9**
Introduction to image compression – Lossy and Lossless compression–Sequential and Progressive Compression – Rate / Distortion optimization – compression metrics – Huffman coding–Run Length Coding – Predictive coding – DPCM - Transformcoding – Vector quantization-Image compression standards.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	R.C.Gonzalez,R.E.Woods,"Digital ImageProcessing",Pearson Educationl,4th Edition,2017.
2	AnilK.Jain,"FundamentalsofDigitalImageProcessing"Pearson Education,1st edition, 2015.
3	DavidSalomon,"DataCompression",SpringerVerlagNewYorkInc.,4thEdition,2006.

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=Lgdr9WLto4A&list=PL1CE5B4FFFA997E5D
2	https://www.youtube.com/watch?v=FtEShPAFpek&list=PL_mruqjnuVd87sjSDVS9wuit9CSpgIIfx
3	https://www.youtube.com/watch?v=UWQuMnWcmwc
4	https://www.youtube.com/watch?v=W1cTpqM9DaU
5	https://www.youtube.com/watch?v=8kcvyoHsXrw

Semester	Programme	Course Code	Course Name	L	T	P	C
V	B.Tech.- AI & DS	20AD5E2	ARTIFICIAL NEURAL NETWORKS AND ITS APPLICATIONS	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Understand the working of Unsupervised Learning and Supervised Learning Neural Network.	K2	1
CO2	Apply Regression and Classification predictive models for function approximation.	K3	2
CO3	Apply the Probability theory a mathematical framework for representing uncertain statements	K3	3
CO4	Analyze and Design the Convolutional Neural Network models to recognize, model, and solve problems in the analysis and design of information systems.	K4	4
CO5	Apply the Recurrent Neural Network models to recognize, model, and solve problems in the analysis and design of information systems.	K3	5

PRE-REQUISITE	NILL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2			2		2	1	3	3		3		
CO2	3	2			2		2	1	3	3		3		
CO3	3	2			2		2	1	3	3		3		
CO4	3	3			3		2	1	3	3		3		2
CO5	3	2			2		2	1	3	3		3		

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Other Assessments (Assignment, Quiz etc.)
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**NEURAL NETWORKS**	**9**
Neural Network- Multilayer neural networks-Unsupervised Learning-Supervised Learning- Boltzmann Machine- Optimization using Hopfield Network- Genetic Algorithm- Applications of Neural Networks.		
Topic - 2	**AI AND MACHINE LEARNING**	**9**
Intelligent agents, Agents and environments, Structure of agents - Problem Solving - Problem solving agent-Machine Learning-Supervised and Unsupervised learning-Regression and Classification-K-Means Clustering.		
Topic - 3	**DEEP LEARNING TECHNIQUES**	**9**
Introduction-History of Deep Learning-Linear Model Regression-Deep Learning Working-PerceptronBack Propagation-Probability and Information Theory: Random variable and distributed Probability - Bayes Rule - Information Theory and structured probabilistic models.		
Topic - 4	**CONVOLUTIONAL NEURAL NETWORK**	**9**
. Convolutional Neural Network-Architecture- Back propagation- ConvNets for spatial localization-Object detection.		
Topic - 5	**RECURRENT NEURAL NETWORK**	**9**
Recurrent Neural Networks (RNN)-Long Short Term Memory (LSTM)-RNN language models-Image captioning.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	. Bengio, Yoshua, Ian J. Goodfellow, and Aaron Courville. "Deep learning." An MIT Press book (2015).
2	Mishra R B, Artificial Intelligence, PHI Learning Pvt. Ltd., New Delhi, 2011
3	Bengio, Yoshua. "Learning deep architectures for AI." Foundations and trends in Machine Learning 2.1 (2009): 1127.
4	Kevin Knight, Elaine Rich and Nair, Artificial Intelligence, Tata McGraw Hill, New Delhi, 2008
5	Russell, S. and Norvig, N. Artificial Intelligence: A Modern Approach. Prentice Hall Series in Artificial Intelligence. 2003.

OTHER REFERENCES	
1	https://www.techtarget.com/searchenterpriseai/definition/deep-learning-deep-neural-network
2	https://www.googleadservices.com/pagead/aclk?sa=L&ai=DChcSEwifqu3Wj7H3AhU3lGYC
3	https://www.youtube.com/watch?v=VyWAvY2CF9c
4	https://www.youtube.com/watch?v=O5xeyoRL95U

Semester	Programme	Course Code	Course Name	L	T	P	C
V	B.Tech.- AI & DS	20AD5E3	INTELLIGENT DATABASE SYSTEM	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Compare File Processing System with Database Systems in terms of performance, scalability and data storage for efficient access of data.	K4	1
CO2	Develop a Database schema using E-R model, Relational model and apply relational algebra operations like selection, projection, join and Cartesian product to solve the given problem.	K3	2
CO3	Develop SQL queries using aggregate functions, nested sub queries, joins and views for the given problem.	K3	3
CO4	Apply Suitable normalization and query optimization techniques to normalize the given relation and to optimize the query for efficient access of data.	K3	4
CO5	Simply serialization and concurrency control mechanisms to avoid deadlock problem in transaction processing.	K4	5

PRE-REQUISITE	NILL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-		3	2	1	3	3	3	3		2
CO2	3	3	2	2		3	2	1	3	3	3	3		2
CO3	3	2	3	2		3	2	1	3	3	3	3	2	
CO4	3	3	2	2		3	2	1	3	3	3	3		
CO5	3	2				3	2	1	3	3	3	3		

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Other Assessments (Assignment, Quiz etc.)
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**DATABASE SYSTEM**	**9**
Overview of File Processing System – Purpose of Database System – view of data – Data Models-Database Languages – Database System Architecture – Database users and Administrator.		
Topic - 2	**DATABASEDESIGN**	**9**
Database design & E-R Model: Entity-Relationship model (E-R Model)-E-R Diagram-Constraints-Extended E-R features. Introduction to Relational Model: Database schema-Keys-Schema Diagrams-Relational Query Languages –Relational Operations.		
Topic - 3	**SQL**	**9**
SQL Standards-Data types- Structure of SQL queries-Additional basic operations –set operation-null values-aggregate function- nested sub queries-modification of the database. Intermediate SQL: Joins-Views -Transactions-Integrity constraints-Authorization-Advanced SQL		
Topic - 4	**NORMALIZATION AND QUERY OPTIMIZATION**	**9**
Relational database design: Functional Dependencies - Normalization and its normal forms-Denormalization-Data Storage:RAID - Tertiary Storage - File organization - Organization of records in files.Query processing-Query optimization.		
Topic - 5	**TRANSATION MANAGEMENT**	**9**
Transaction concepts - Transaction recovery - Properties of Transaction-Serializability - Concurrency Control - Locking Mechanisms - Two Phase Commit Protocol - Dead lock .Case study: Database connectivity using SQL.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Abraham silberschatz,Henry F.Korth,S.Sundharshan,"Database system concepts",sixthedition,Tata McGraw hill,2011
2	C.J.Date,A.Kannan,S.Swamynathan, "An Introduction to Database System",EighthEdition,pearson Education,2006
3	RamezElmasri and ShamkantB.Navathe, "Fundamentals of Database Systems", Fourth Edition, Pearson Addisionwesley, 2007
4	AtulKahate,"Introdution to database Management system", Pearson Education, New Delhi,2006

OTHER REFERENCES	
1	https://onlinecourses.nptel.ac.in/noc17_cs33/course
2	http://www.db-book.com
3	http://nptel.ac.in/courses/IIT-MADRAS/Intro_to_Database_Systems_Design
4	http://www.iitg.ernet.in/awekar/teaching/cs344fall11/

Semester	Programme	Course Code	Course Name	L	T	P	C
V	B.Tech.- AI & DS	20AD5E4	CYBER LAW AND ETHICS	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Construct the concept of cybercrime in mobile devices.	K3	1
CO2	Illustrate the cyber security challenges in the modern devices.	K2	2
CO3	Analyze the working principle of cyber security tools and methods.	K4	3
CO4	Apply the concept of cyber forensics to set a cyber-forensics laboratory	K3	4
CO5	Discover the process of cyber security systems in the organizations.	K4	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2		2		2		2	1	3	3		3		2
CO2	3	2	2				2	1	3	3		3	2	
CO3	2	2	2	3			2	1	3	3	3	3	3	
CO4	3	2					2	1	3	3		3	2	2
CO5	2	3	2	3			2	1	3	3		3	2	3

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Other Assessments (Assignment, Quiz etc.)
	3	End Semester Examinations
INDIRECT	1	Course End Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTIONTO CYBERCRIME**	**9**
Cybercrime- definition and origins of the world- Cybercrime and information security Classifications of cybercrime- Cybercrime and the Indian ITA 2000 - A Global Perspective on cybercrimes- Cloud Computing- Proliferation of Mobile and Wireless Devices- Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era.		
Topic - 2	**CYBER SECURITY CHALLENGES IN MODERN DEVICES**	**9**
Security Challenges Posed by Mobile Devices- Registry Settings for Mobile Devices Authentication Service Security- Attacks on Mobile/Cell Phones, Mobile Devices, - Security Implications for Organizations- Organizational Measures for Handling Mobile-Devices-Related Security Issues Organizational Security Policies and Measures in Mobile Computing Era,Laptops.		
Topic - 3	**TOOLS AND METHODS**	**9**
Tools and Methods Used in Cyber line Proxy Servers and Anonymizers- Phishing -Password Cracking, Key loggers and Spywares, - Virus and Worms, Steganography - DoSDDoS Attacks - SQL Injection, Buffer Over Flow - Attacks on Wireless Networks, Phishing, Identity Theft (ID Theft) - The Legal Perspectives - Cyberlaw: The Indian Context - The Indian IT Act.		
Topic - 4	**CYBER FORENSICS**	**9**
Understanding Computer Forensics - Historical Background of Cyber forensics - Digital Forensics Science - The Need for Computer Forensics -Cyber forensics and Digital Evidence - Forensics Analysis of Email - Digital Forensics Lifecycle - Chain of Custody Concept - Network Forensics - Approaching a Computer Forensics Investigation - Setting of a Computer Forensics Laboratory: Understanding the Requirements, Computer Forensics and Steganography.		
Topic - 5	**ORGANIZATIONS IMPLICATIONS**	**9**
Organizational Implications Cost of Cybercrimes and IPR Issues: - Lesson for Organizations Web Treats for Organizations: The Evils and Perils - Security and Privacy Implications from Cloud Computing - Social Media Marketing: Security Risk and Perils for Organization - Social Computing and the Associated Challenges for Organizations - Protecting People- Privacy in the Organization, Organizational Guidelines for Internet Usage - Safe Computing Guidelines and Computer Usage Policy.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Nina Godbole, SunitBelapure, Cyber Security, Wiley India, New Delhi 2012
2	Harish Chander, cyber laws & IT protection, PHI learning pvt.ltd, 2012.
3	Dhiren R Patel, Information security theory &practice,PHI learning pvt ltd,2010
4	MS.M.K.Geetha&Ms.SwapneRaman Cyber Crimes and Fraud Management, MACMILLAN,2012.
5	PankajAgarwal : Information Security & Cyber Laws (Acme Learning), Excel, 2013.

OTHER REFERENCES	
1	https://youtu.be/xR02CQCgcNM
2	https://youtu.be/sLzGlFfbU7E
3	https://youtu.be/OkFj1ePW2cU

Semester	Programme	Course Code	Course Name	L	T	P	C
V	B.Tech.- AI & DS	20AD5LT1	DATA ANALYTICS	2	0	4	4

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Explain the fundamentals of sampling distributions Hypothesis testing	K2	1
CO2	Infer the fundamentals of confidence interval	K2	2
CO3	Develop about the statistical hypotheses	K3	3
CO4	Analysis of Variance	K4	4
CO5	Illustrate various Predictive Analytics	K2	5

PRE-REQUISITE	Data Warehousing and Data Mining

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2						1	3	3		3		
CO2	3	2						1	3	3		3		
CO3	3	3	3		2			1	3	3		3	2	2
CO4	3	2			1			1	3	3		3		
CO5	3	2	3		2			1	3	3		3		2

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Laboratory Record and Model Practical Examinations (Laboratory Component)
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**INFERENTIAL STATISTICS I**	**6**
Populations – samples – random sampling – probability and statistics Sampling distribution – creating asampling distribution – mean of all sample means – standard error of the mean – other samplingdistributions Hypothesis testing – z-test – z-test procedure – statement of the problem – null hypothesis –Alternate hypotheses – decision rule – calculations – decisions – interpretations.		
Topic - 2	**INFERENTIAL STATISTICS II**	**6**
Why hypothesis tests? – strong or weak decisions – one-tailed and two-tailed tests – case studies Influence of sample size – power and sample size Estimation – point estimate – confidence interval – level of confidence – effect of sample size		
Topic - 3	**T-TEST**	**6**
t-test for one sample – sampling distribution of t – t-test procedure – degrees of freedom – estimating thestandard error – case studies t-test for two independent samples – statistical hypotheses – samplingdistribution – test procedure – p-value – statistical significance – estimating effect size – meta analysis ttest for two related samples.		
Topic - 4	**ANALYSIS OF VARIANCE**	**6**
F-test – ANOVA – estimating effect size – multiple comparisons – case studies Analysis of variance with repeated measures Two-factor experiments – three f-tests – two-factor ANOVA – other types of ANOVA Introduction to chi-square tests.		
Topic - 5	**PREDICTIVE ANALYTICS**	**6**
Linear least squares – implementation – goodness of fit – testing a linear model – weighted re-sampling Regression using Stats Models – multiple regression – nonlinear relationships – logistic regression – estimating parameters – accuracy Time series analysis – moving averages – missing values – serial correlation – auto correlation Introduction to survival analysis.		

THEORY	**30**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**30**

LIST OF EXPERIMENTS
1. Random Sampling. 2. Z-test case study. 3. T-test case studies. 4.F-test case study 5. ANOVA case studies 6. Chi-square tests. 7. Regression Case Study. 8. Multiple Regressions. 9. Logistic Regression. 10. Time series Analysis. 11. Serial correlation. 12. Survival analysis.

THEORY	**0**		**TUTORIAL**	**0**		**PRACTICAL**	**60**		**TOTAL**	**60**

BOOK REFERENCES	
1	Robert S. Witte and John S. Witte, Statistics, Eleventh Edition, Wiley Publications, 2017.
2	Allen B. Downey, Think Stats: Exploratory Data Analysis in Python, Green Tea Press, 2014.
3	David Spiegelhalter, The Art of Statistics: Learning from Data, Pelican Books, 2020.
4	Charles R. Severance, Python for Everybody: Exploring Data in Python 3, Shroff Publishers, 2017.
5	Andrie de Vries and JorisMeys, "R For Dummies" Wiley, 2012.
6	Rob Kabacoff, "R in Action", Manning Publications, August 2011.
7	Jared P. Lander, "R for Everyone: Advanced Analytics and Graphics",SecondEdition,Addison-Wesley Professional, 23 September 2013.

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=sonXfzE1hvo
2	https://www.statisticshowto.com/probability-and-statistics/hypothesis-testing/anova/
3	https://www.youtube.com/watch?v=GUq_tO2BjaU

Semester	Programme	Course Code	Course Name	L	T	P	C
V	B.Tech.- AI & DS	20AD5LT2	DESIGN AND ANALYSIS OF ALGORITHMS	2	0	4	4

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Classify the fundamentals of Algorithmic problem solving methods based on Data Structures	K2	1
CO2	Analyse the algorithm efficiency by means of mathematical notations	K4	2
CO3	Develop different types of sorting and searching algorithms.	K3	3
CO4	Analyse the different techniques in the design of Graph Algorithms	K4	4
CO5	Distinguish algorithms design techniques of NP complete with NP hard problems	K4	5

PRE-REQUISITE	Python Programming

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2						1	3	3		3		
CO2	3	2						1	3	3		3		
CO3	3	3	3		2			1	3	3		3	2	2
CO4	3	2			1			1	3	3		3		
CO5	3	2	3		2			1	3	3		3		2

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Laboratory Record and Model Practical Examinations (Laboratory Component)
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION**	**6**
Introduction Fundamentals of Algorithmic Problem Solving Important Problem types: Sorting problem-searching problems - string processing - graph problems - combinatorial problems- Geometric Problems - Numerical problems Fundamental Data structures-Trees and Graphs.		
Topic - 2	**FUNDAMENTALSOF THE ANALYSIS OF ALGORITHM EFFICIENCY**	**6**
Analysis Framework - Asymptotic notations - Basic Efficiency classes - Mathematical Analysis of Nonrecursive Algorithm - Mathematical Analysis of Recursive Algorithm - Example: Fibonacci Numbers - Empirical Analysis of Algorithms-Algorithm visualization		
Topic - 3	**ANALYSIS OF SORTING AND SEARCHING ALGORITHMS**	**6**
Brute Force Strategy: Selection Sort and Bubble Sort, Sequential Search and Brute-force string matching - Divide and conquer: Merge sort, Quick Sort, Binary Search, Binary tree Traversal and Related Properties Decrease and Conquer: Insertion Sort, Depth first Search and Breadth First Search-Pair and Convex-Hull		
Topic - 4	**ANALYSIS OF GRAPH ALGORITHMS**	**6**
Transform and conquer: Presorting, Balanced Search trees AVL Trees, Heaps and Heap sort Dynamic Programming: Warshalls and Floyd Algorithm, Optimal Binary Search trees Greedy Technique: Prims Algorithm, Kruskals Algorithm, Dijkstra Algorithm Huffman trees-The Simplex Method-The Maximum-Flow Problem Ã¢?? Maximum Matching in Bipartite Graphs- The Stable marriage Problem		
Topic - 5	**ALGORITHM DESIGN TECHNIQUES TO NP COMPLETE AND NP HARD PROBLEMS**	**6**
NP Complete problems Backtracking: n-Queens Problem Hamiltonian Circuit problem Subset-Sum problem Branch and bound: Assignment problem, Knapsack problem Traveling salesman problem-Approximation algorithms for NP hard problems: Travelling salesman and knapsack problem-Limitations of Algorithm Power-Lower-Bound Arguments-Decision Trees-P, NP and NP-Complete Problems-Coping with the Limitations.		

THEORY	**30**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**30**

LIST OF EXPERIEMENTS
1. Study of Algorithmic Problem Solving. 2. Numerical problems 3. Study of Data structures 4.Implementation of Trees 5. Implementation of Graphs 6. Empirical Analysis of Algorithms 7. Brute Force Strategy: Selection Sort 8. Implementation of Bubble Sort. 9. Implementation of Merge sort, 10. Implementation of Quick Sort, 11. Implementation of Binary Search, 12. Implementation of Binary tree

THEORY	**0**		**TUTORIAL**	**0**		**PRACTICAL**	**60**		**TOTAL**	**60**

BOOK REFERENCES	
1	Anany Levitin, Introduction to the Design and Analysis of Algorithms, Third Edition, Pearson Education Asia, 2011
2	T.H. Cormen, C.E. Leiserson, R.L. Rivest and C. Stein, Introduction to Algorithms, PHI Pvt. Ltd., 2009
3	Sara Baase and Allen Van Gelder, Computer Algorithms Introduction to Design and Analysis, Pearson Education Asia, 2010
4	A.V.Aho, J.E. Hopcroft and J.D.Ullman, The Design and Analysis of Computer Algorithms, Pearson Education Asia, 2003

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=VJ8LN63XNV4
2	https://www.youtube.com/watch?v=7dz8Iaf_weM
3	https://www.youtube.com/watch?v=Gc4mWrmJBsw

Semester	Programme	Course Code	Course Name	L	T	P	C
V	B.Tech.- AI & DS	20AD5LT3	DATA SCIENCE USING R	2	0	4	4

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Build the Concepts of R language	K3	1
CO2	Relate Data Analysis And Visualization	K2	2
CO3	Identify the data science statistics	K2	3
CO4	Experiment with modelling of Data science	K3	4
CO5	Categorize Various search techniques	K4	5

PRE-REQUISITE	Concepts in Data Science

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2				3	2	3	3	3	3	3	1	3
CO2	3					3	2	3	3	3	3	3		
CO3	2	2	2	2		3	2	3	3	3	3	3	2	3
CO4	3		2	2		3	2	3	3	3	3	3	2	3
CO5	3	2	2	2		3	2	3	3	3	3	3	2	3

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Laboratory Record and Model Practical Examinations (Laboratory Component)
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT

Topic - 1	INTRODUCTION TO R	6
Overview of R Language - Data Types - Variable - Operators - Decision Making - Loop control - Array – String.		
Topic - 2	**DATA ANALYSIS AND VISUALIZATION**	**6**
Function - Vector - Lists - Matrices - Factors - Data Frames - Packages - Data and File Management - Charts & Graphs.		
Topic - 3	**STATISTICS**	**6**
Introduction to data science - Data visualization - A grammar for graphics - Data Preprocessing – Data wrangling on one table - Data wrangling on multiple tables - Tidy data – Iteration.		
Topic - 4	**MODELING**	**6**
Statistical foundations - Predictive modeling - Supervised learning - Unsupervised learning. **Case study:** Fit a series of supervised learning models to predict arrival delays for flights from New York to SFO using the nycflights13 package.		
Topic - 5	**SEARCH TECHNIQUES**	**6**
Uninformed search strategies: breadth first search, depth first search, depth limited search, bidirectional search. Heuristic search strategies: Greedy best-first search, A* search, AO* search, memory bounded heuristic search, Optimization problems: Hill climbing search, simulated annealing search, local beam search.		

THEORY	30	TUTORIAL	0	PRACTICAL	0	TOTAL	30

LIST OF EXPERIMENTS
1. Getting Used to R: Describing Data
2. Creating and displaying Data.
3. Creating and manipulating a List and an Array
4. Creating a Data Frame and Matrix-like Operations on a Data Frame
5. String Manipulations
6. Data transpose operations in R
7. Probability Distributions.
8. Basic Statistics in R
9. Visualizing Data - Tables, charts and plots
10.Creating models for prediction
11. Uninformed search strategies - bidirectional search
12. Greedy best-first search

THEORY	0	TUTORIAL	0	PRACTICAL	60	TOTAL	60

BOOK REFERENCES	
1	Benjamin S. Baumer, Daniel T. Kaplan, and Nicholas J. Horton, “Modern Data Science with R” 2nd edition, CRC Press, July 28, 2021.
2	Hadley Wickham & Garrett Grolemund "R for Data Science - Import, Tidy, Transform, Visualize, and Model Data", O'Reilly , 1st edition, December 2016.
3	Tilman M. Davies, "The Book of R", No Starch Press, 1st edition, July 16 2016.
4	Andrie de Vries and JorisMeys, "R For Dummies" Wiley, 2012.
5	Rob Kabacoff, "R in Action", Manning Publications, August 2011.
6	Jared P. Lander, "R for Everyone: Advanced Analytics and Graphics",SecondEdition,Addison-Wesley Professional, 23 September 2013.
7	Joel Grus, "Data Science from Scratch", O'Reilly, 1st edition, April 2015.

OTHER REFERENCES	
1	https://www.analytixlabs.co.in/blog/r-programming-language-basics/
2	https://www.youtube.com/watch?v=Ybw_oaSAQbQ
3	https://www.youtube.com/watch?v=Xt5Aq2JBau0
4	https://www.techtarget.com/searchenterpriseai/definition/predictive-modeling

Semester	Programme	Course Code	Course Name	L	T	P	C
V	B.E. / B. Tech. Common to All	20PT5T1	Career Guidance - I	2	1	0	0

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Understand the basic concepts of logical reasoning Skills	K1	1
CO2	Understand the basic concepts of Quantitative Aptitude.	K2	2
CO3	Understandtheimportanceandtypeofcommunicationinpersonalandprofessionalenvironment.	K3	3
CO4	Toprovideinsightintomuchneededtechnicalandnon-technicalqualitiesincareerplanning.	K4	4

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						3			3	3		3		
CO2						2			3	3		2		
CO3						3			3	2		1		
CO4						2			3	3		2		

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Other Assessments (Assignment, Quiz etc.)
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**LOGICAL REASONING**	**5**
LR 1: Series,Odd man out, Analogy LR 2: Coding and Decoding LR 3: Direction,Ranking and Ordering LR 4: Blood Relation LR 5: Venn Diagram, Decision Making LR 6: Syllogism		
Topic - 2	**QUANTITATIVE APTITUDE**	**12**
NR 1: Average NR 2: Percentage NR 3: Profit and Loss NR 4: Ages NR 5: Ratio and Proportion NR 6: Allegation and Mixture NR 7: Time and Work NR 8: Time, Speed and Distance NR 9: Trains, Boats and Streams		
Topic - 3	**VERBAL REASONING & BUSINESSES COMMUNICATION**	**3**
VR 1:Preposition & Conjunction VR 2: Synonyms, Antonyms & Tenses BS1: Art of Introduction, Communication Barriers, Personal Interview.		
Topic - 4	**TECHNICAL CODING**	**10**
TECH 1: I/O,Operaters TECH 2: Conditional statement (branching and jumping statement) TECH 3: Control statements and patterns programming TECH 4: 1D and pointers.		

THEORY	**20**		**TUTORIAL**	**10**		**PRACTICAL**	**0**		**TOTAL**	**30**

BOOK REFERENCES	
1	Logical Reasoning and Data Interpretation for CAT by Nishit K. Sinha
2	Quantitative Aptitude for Competitive Examinations (5th Edition) - Abhjit Guha
3	A Modern Approach To Verbal Reasoning by R S Aggarwal.
4	Computer Programming for Beginners: Fundamentals of Programming Terms and Concepts - Nathan Clark

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=x0WkptLF6oE&list=PLpyc33gOcbVADMKqylI__O_O_RMeHTyNK
2	https://www.youtube.com/watch?v=LMY7GoAMcDI
3	https://www.youtube.com/watch?v=K7sj1yzXzng
4	https://www.youtube.com/watch?v=fyzmCU931QE
5	https://www.youtube.com/c/TechnicalCoding

SEMESTER VI

Sl. No.	Course Code	Course Title	Category	CIA	ESE	L	T	P	C
THEORY COURSES									
1	20CS6E7	Software Project Management	PC	40	60	3	0	0	3
2		Professional Elective - III	PE	40	60	3	0	0	3
3		Professional Elective - IV	PE	40	60	3	0	0	3
4		Open Elective – III	OE	40	60	3	0	0	3
THEORY COURSE WITH LABORATORY COMPONENTS									
5	20AD6LT1	AI in Natural Language Processing	PC	50	50	2	0	4	4
6	20AD6LT2	Deep Learning and its Applications	PC	50	50	2	0	4	4
EMPLOYABILITY EHANCEMENT COURSE									
7	20PT6T1	Career Guidance - II	EEC	100	-	2	1	0	0
Total						**18**	**1**	**8**	**20**

Semester	Programme	Course Code	Course Name	L	T	P	C
VI	B.E. CSE B. Tech. IT, AI&DS	20CS6E7	SOFTWARE PROJECT MANAGEMENT	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Analyze activities, methodologies for project planning and project evaluation to develop a successful project using Cost-benefit Evaluation Techniques.	K4	1
CO2	Assess the quality of software using agile methods, extreme programming and scrum for a given project and estimate the effort and cost for software development activity using COSMIC Full function points and COCOMO II metrics.	K5	2
CO3	Apply critical path method and precedence networks for a given project to identify the critical activities that affect the target completion time.	K3	3
CO4	Explain the need for the continuous monitoring and control of a project for a given project plan to complete the project on time.	K5	4
CO5	Discuss how to manage people, ways to increase staff motivation and team working using Oldham-Hackman job characteristic model for the successful Completion of a project	K6	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2		2	2	3	2	2	2	3	3		3	2	
CO2		2		2	3	3	2	2	3	3		3		2
CO3	2				3		2	2	3	3		3	2	
CO4	2			2	3	2	2	2	3	3		3	2	
CO5			2			3	2	2	3	3		3		2

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Other Assessments (Assignment, Quiz etc.)
	3	End Semester Examinations
INDIRECT	1	Course End Survey

COURSE CONTENT		
Topic - 1	**PROJECT EVALUATION AND PROJECT PLANNING**	**9**
Importance of Software Project Management – Activities Methodologies – Categorization of Software Projects – Stakeholders - Setting objectives – Management Principles – Management Control – Project portfolio Management – Cost–Benefit analysis - Evaluation techniques – Strategic program Management – Stepwise Project Planning		
Topic - 2	**PROJECT LIFE CYCLE AND EFFORT ESTIMATION**	**9**
Software process and Process Models – Choice of Process models - mental delivery – Rapid Application development – Agile methods – Extreme Programming – SCRUM –Agile Tools: JIRA Agile - Axosoft - Managing interactive processes – Basics of Software estimation – Effort and Cost estimation techniques – COSMIC Full function points - COCOMO II A Parametric Productivity Model - Staffing Pattern – Case Study : Task Manager Application - Evaluation of the Cost Estimation Models.		
Topic - 3	**ACTIVITY PLANNING AND RISK MANAGEMENT**	**9**
Objectives of Activity planning – Project schedules – Activities – Sequencing and scheduling – Network Planning models – Forward Pass & Backward Pass techniques – Critical path (CPM) method – Risk identification – Assessment – Monitoring – PERT technique – Monte Carlo simulation – Resource Allocation – Creation of critical patterns – Cost schedules. Case Study: Analyzing CPM and PERT methods for project scheduling in a construction company.		
Topic - 4	**PROJECT MANAGEMENT AND CONTROL**	**9**
Framework for Management and control – Collection of data Project termination – Visualizing progress – Cost monitoring – Earned Value Analysis- Project tracking – Change control- Software Configuration Management – Managing contracts – Contract Management.		
Topic - 5	**STAFFING IN SOFTWARE PROJECTS**	**9**
Managing people – Organizational behaviour – Best methods of staff selection – Motivation – The OldhamHackman job characteristic model – Ethical and Programmed concerns – Working in teams – Decision making – Team structures – Virtual teams – Communications genres.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Bob Hughes, Mike Cotterell and Rajib Mall, “Software Project Management”, Tata McGraw Hill, Fifth Edition, New Delhi, 2012.

OTHER REFERENCES	
1	Robert K. Wysocki “Effective Software Project Management” – Wiley Publication, 2011.
2	Walker Royce: “Software Project Management”- Addison-Wesley, 1998.
3	Gopalaswamy Ramesh, “Managing Global Software Projects” – McGraw Hill Education (India), Fourteenth Reprint 2013.

Semester	Programme	Course Code	Course Name	L	T	P	C
VI	B.Tech – AI & DS	20AD6E1	AI FOR CYBER SECURITY	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Construct the concept of AI for cyber security in mobile devices.	K3	1
CO2	Construct the concept of cybercrime in mobile devices.	K3	2
CO3	Illustrate the cyber security challenges in the modern devices.	K3	3
CO4	Analyze the working principle of cyber security tools and methods.	K4	4
CO5	Discover the process of cyber security systems in the organizations.	K4	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2		2		2		2	1	3	3		3		2
CO2	3	2	2				2	1	3	3		3	2	
CO3	2	2	2	3			2	1	3	3	3	3	3	
CO4	3	2					2	1	3	3		3	2	2
CO5	2	3	2	3			2	1	3	3		3	2	3

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Other Assessments (Assignment, Quiz etc.)
	3	End Semester Examinations
INDIRECT	1	Course End Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTIONTO AI FOR CYBER SECURITY**	**9**
Introduction- What is AI-Why AI? -Foundation of AI- History of AI- Intelligent Agents: Agents and Environments - Characteristics–Structure of Agents. Problem formulation-Production systems-Problem characteristics-Production system characteristics- Constraints Satisfaction Problems.		
Topic - 2	**CYBERCRIME**	**9**
Cybercrime- definition and origins of the world- Cybercrime and information security Classifications of cybercrime- Cybercrime and the Indian ITA 2000 - A Global Perspective on cybercrimes- Cloud Computing- Proliferation of Mobile and Wireless Devices- Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era.		
Topic - 3	**CYBER SECURITY CHALLENGES IN MODERN DEVICES**	**9**
Security Challenges Posed by Mobile Devices- Registry Settings for Mobile Devices Authentication Service Security- Attacks on Mobile/Cell Phones, Mobile Devices, - Security Implications for Organizations- Organizational Measures for Handling Mobile-Devices-Related Security Issues Organizational Security Policies and Measures in Mobile Computing Era,Laptops.		
Topic - 4	**TOOLS AND METHODS**	**9**
Tools and Methods Used in Cyber line Proxy Servers and Anonymizers- Phishing -Password Cracking, Key loggers and Spywares, - Virus and Worms, Steganography - DoSDDoS Attacks - SQL Injection, Buffer Over Flow - Attacks on Wireless Networks, Phishing, Identity Theft (ID Theft) - The Legal Perspectives - Cyberlaw: The Indian Context - The Indian IT Act.		
Topic - 5	**ORGANIZATIONS IMPLICATIONS**	**9**
Organizational Implications Cost of Cybercrimes and IPR Issues: - Lesson for Organizations Web Treats for Organizations: The Evils and Perils - Security and Privacy Implications from Cloud Computing - Social Media Marketing: Security Risk and Perils for Organization - Social Computing and the Associated Challenges for Organizations - Protecting People- Privacy in the Organization, Organizational Guidelines for Internet Usage - Safe Computing Guidelines and Computer Usage Policy.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Nina Godbole, SunitBelapure, Cyber Security, Wiley India, New Delhi 2012
2	Harish Chander, cyber laws & IT protection, PHI learning pvt.ltd, 2012.
3	Dhiren R Patel, Information security theory &practice,PHI learning pvt ltd,2010
4	MS.M.K.Geetha&Ms.SwapneRaman Cyber Crimes and Fraud Management, MACMILLAN,2012.
5	PankajAgarwal : Information Security & Cyber Laws (Acme Learning), Excel, 2013.

OTHER REFERENCES	
1	https://youtu.be/xR02CQCgcNM
2	https://youtu.be/sLzGlFfbU7E
3	https://youtu.be/OkFj1ePW2cU

Semester	Programme	Course Code	Course Name	L	T	P	C
VI	B.Tech – AI & DS	20AD6E2	DATA SCIENCE APPLICATIONS OF NLP	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Examine the fundamental concepts of data science	K4	1
CO2	Utilize the data analysis techniques for applications handling large data	K3	2
CO3	Classify the various machine learning algorithms used in data science process	K2	3
CO4	Examinethe applications of AI: namely Game Playing, Theorem Proving, and Natural Language Processing	K4	4
CO5	Discover to work in uncertain environments using probabilistic reasoning techniques.	K4	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2		2		2		2	1	3	3		3		2
CO2	3	2	2				2	1	3	3		3	2	
CO3	2	2	2	3			2	1	3	3	3	3	3	
CO4	3	2					2	1	3	3		3	2	2
CO5	2	3	2	3			2	1	3	3		3	2	3

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Other Assessments (Assignment, Quiz etc.)
	3	End Semester Examinations
INDIRECT	1	Course End Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION TO CORE CONCEPTS AND TECHNOLOGIES**	**9**
Introduction to core concepts and technologies: Introduction, Terminology, data science process, data science toolkit, Types of data, Example applications, Mathematical Foundations for Data Science: linear algebra; Analytical and numerical solutions of linear equations;		
Topic - 2	**DATA COLLECTION AND MANAGEMENT**	**9**
Data collection and management: Introduction, Sources of data, Data collection and APIs, Exploring and fixing data, Data storage and management, using multiple data sources		
Topic - 3	**DATA ANALYSIS**	**9**
Data analysis: Introduction, Terminology and concepts, Introduction to statistics, Central tendencies and distributions, Variance, Distribution properties and arithmetic, Samples/CLT, Basic machine learning algorithms, Linear regression, SVM, Naive Bayes..		
Topic - 4	**NATURAL LANGUAGE PROCESSING**	**9**
Planning, Language of planning problems, planning with state space search, forward and backward state space search, Heuristics for state space search, partial order planning, planning graphs, planning with propositional logic		
Topic - 5	**UNCERTAINTY AND REASONING**	**9**
Uncertainty, Handing uncertain knowledge, rational decisions, basics of probability, axioms of probability, inference using full joint distributions, independence, Baye's Rule and conditional independence, Bayesian networks, Semantics of Bayesian networks, Exact and Approximate inference in Bayesian Networks.		

THEORY	45	TUTORIAL	0	PRACTICAL	0	TOTAL	45

BOOK REFERENCES	
1	Cathy O'Neil, Rachel Schutt, Doing Data Science, Straight Talk from The Frontline. O'Reilly, 2013.
2	Introducing Data Science, Davy Cielen, Arno D. B. Meysman, Mohamed Ali, Manning Publications Co., 1st edition, 2016
3	An Introduction to Statistical Learning: with Applications in R, Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, Springer, 1st edition, 2013

OTHER REFERENCES	
1	https://youtu.be/CMrHM8a3hqw
2	https://youtu.be/fLvJ8VdHLA0
3	https://youtu.be/QpzMWQvxXWk

Semester	Programme	Course Code	Course Name	L	T	P	C
VI	B.Tech – AI & DS	20CS7E7	DISTRIBUTED SYSTEMS	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Discover resource sharing principles, trends and challenges in a distributed system using World Wide Web as a case study...	K4	1
CO2	Illustrate process communication using remote method invocation for a given distributed environment.	K2	2
CO3	Describe the file systems for a distributed environment using distributed file service implementations.	K2	3
CO4	Apply suitable concurrency control method to ensure multiple transactions to maintain ACID property and serializability in the schedules..	K3	4
CO5	Explain process and resource management policies for a given distributed environment using scheduling algorithms	K2	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3						2	1	3	3		3		
CO2	3		3		2		2	1	3	3		3		
CO3	3						2	1	3	3		3		
CO4	3		3		2		2	1	3	3		3		
CO5	3						2	1	3	3		3		

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Other Assessments (Assignment, Quiz etc.)
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION**	**9**
Examples of Distributed Systems–Trends in Distributed Systems – Focus on resource sharing – Challenges. Case study: World Wide Web- System models-Physical model-Architectural model-Fundamental model.		
Topic - 2	**COMMUNICATION IN DISTRIBUTED SYSTEM**	**9**
Inter process Communication - the API for internet protocols – External data representation and marshallingRemote Invocation – Request-reply protocols - Remote procedure call - Remote method invocation. Case study: Java RMI – Group communication - Publish-subscribe systems - Message queues - Shared memory approaches.		
Topic - 3	**DISTRIBUTED FILE SYSTEM AND NAME SERVICES**	**9**
Distributed File Systems –Introduction – File service architecture – Andrew File system. Case study: Google File system. Naming - Introduction-Name services and domain name system-Directory Services-Peer to peer Systems-Napster-Peer to peer middleware- Routing overlays.		
Topic - 4	**DISTRIBUTED TRANSACTIONS AND CONCURRENCY CONTROL**	**9**
. Introduction - Clocks, events and process states - Synchronizing physical clocks- Logical time and logical clocks– Coordination and Agreement – Introduction - Distributed mutual exclusion algorithms – Election algorithms – Distributed Transactions– Flat and nested distributed transactions-Atomic Commit protocols – Concurrency control in Distributed systems- Distributed deadlocks-Transaction Recovery.		
Topic - 5	**PROCESS & RESOURCE MANAGEMENT**	**9**
Process Management: Process Migration: Features, Mechanism - Threads: Models, Issues, Implementation. Resource Management: Introduction- Features of Scheduling Algorithms –Task Assignment Approach – Load Balancing Approach – Load Sharing Approach.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	George Coulouris, Jean Dollimore and Tim Kindberg, “Distributed Systems Concepts and Design”, Fifth Edition, Pearson Education, 2012.
2	Pradeep K Sinha, "Distributed Operating Systems: Concepts and Design", Prentice Hall of India, 2012
3	Tanenbaum A.S., Van Steen M., “Distributed Systems: Principles and Paradigms”, Pearson Education, 2012.

OTHER REFERENCES	
1	. https://nptel.ac.in/courses/106106107/, “Inter process Communication”, Prof. Ananthanarayana VS, Department of Information Technology, NITK ,Surathkal.
2	https://onlinecourses.nptel.ac.in/, ”Time and global states”, Dr. Rajiv Misra, Department of Computer Science and Engineering, IIT, Patna.
3	Tanenbaum A.S., Van Steen M., ―Distributed Systems: Principles and Paradigms‖, Pearson Education, 2007.
4	Nancy A Lynch, ―Distributed Algorithms‖, Morgan Kaufman Publishers, USA, 2003.

Semester	Programme	Course Code	Course Name	L	T	P	C
VI	B.Tech – AI & DS	20AD6E3	SOCIAL NETWORK ANALYTICS	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Apply best practices in web and social media analysis that can be used to process data in information technology and social science domains	K3	1
CO2	Develop skills to use online forums for communication	K3	2
CO3	Apply knowledge for current web development in the era of Social Web	K3	3
CO4	Examine the tools and an algorithm for mining in social networks	K4	4
CO5	Analyze appropriate information visualization technique to gain insights into large Data sets	K4	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2		2		2		2	1	3	3		3		2
CO2	3	2	2				2	1	3	3		3	2	
CO3	2	2	2	3			2	1	3	3	3	3	3	
CO4	3	2					2	1	3	3		3	2	2
CO5	2	3	2	3			2	1	3	3		3	2	3

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Other Assessments (Assignment, Quiz etc.)
	3	End Semester Examinations
INDIRECT	1	Course End Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION**	**9**
Overview: Social network data-Formal methods- Paths and Connectivity-Graphs to represent social relations-Working with network data- Network Datasets -Strong and weak ties - Closure, Structural Holes, and Social Capital		
Topic - 2	**SOCIAL INFLUENCE**	**9**
Homophily : Mechanisms Underlying Homophily, Selection and Social Influence, Affiliation, Tracking Link Formation in OnLine Data, Spatial Model of Segregation - Positive and Negative Relationships - Structural Balance - Applications of Structural Balance, Weaker Form of Structural Balance		
Topic - 3	**INFORMATION NETWORKS AND THE WORLD WIDE WEB**	**9**
Structure of Web - World Wide Web- Information Networks, Hypertext, and Associative Memory- Web as a Directed Graph, Bow-Tie Structure of the Web- Link Analysis and Web Search- Searching the Web: Ranking, Link Analysis using Hubs and Authorities- Page Rank- Link Analysis in Modern Web Search, Applications, Spectral Analysis, Random Walks, and Web Search		
Topic - 4	**SOCIAL NETWORK MINING**	**9**
Clustering of Social Network graphs: Betweenness, Girvan newman algorithm-Discovery of communities-Cliques and Bipartite graphs-Graph partitioning methods-Matrices-Eigen values- Simrank		
Topic - 5	**VISUALIZATION AND APPLICATIONS OF SOCIAL NETWORKS**	**9**
Graph Theory-Centrality-Clustering -Node-Edge Diagrams,Matrix representation, Visualizing Online Social Networks,Visualizing Social Networks with Matrix-Based Representations-Matrix Node- Link Diagrams, Hybrid Representations -Applications -Covert Networks-Community Welfare -Collaboration Networks		

THEORY	45	TUTORIAL	0	PRACTICAL	0	TOTAL	45

BOOK REFERENCES	
1	Easley, Kleinberg, "Networks, Crowds and Markets: Reasoning about a highly connected world",3rd Edition,CambridgeUniv Press, 2010
2	Jure Leskovec, AnandRajaraman, Milliway Labs, Jeffrey D. Ullman, "Mining of Massive Datasets",2nd Edition,Cambridge University Press,2014
3	Borgatti,Everett MG, Johnson J, "Analyzing social networks",1st Edition, SAGE Publications Ltd, 2013

OTHER REFERENCES	
1	https://youtu.be/KRX8MqtPI4g
2	https://youtu.be/Q_ky7CP7hZM
3	https://youtu.be/o5-o1EPSWZg

Semester	Programme	Course Code	Course Name	L	T	P	C
VI	B.Tech – AI & DS	20AD6E4	GAME THEORY FOR AI AND DS	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Explain the essential 2D graphical and mathematical techniques for game programming.	K2	1
CO2	Illustrate 3D graphics like co ordinate spaces, lighting and shading, z-buffering,and quaternions	K2	2
CO3	Apply artificial intelligence techniques in game design.	K3	3
CO4	Construct a basic game engine using UI and scripting languages.	K2	4
CO5	Develop code for sample games.	K3	5

PRE-REQUISITE	NILL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2		2		2		2	1	3	3		3		2
CO2	3	2	2				2	1	3	3		3	2	
CO3	2	2	2	3			2	1	3	3	3	3	3	
CO4	3	2					2	1	3	3		3	2	2
CO5	2	3	2	3			2	1	3	3		3	2	3

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Other Assessments (Assignment, Quiz etc.)
	3	End Semester Examinations
INDIRECT	1	Course End Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION**	**9**
Evolutionofvideogameprogramming-TheGameLoop-Timeandgames-Gameobjects-2DrenderingFoundations-Sprites-Scrolling-TileMaps-Vectors–Matrices		
Topic - 2	**3DGRAPHICSFORGAMES**	**9**
3Dgraphics-Basics-Coordinate-spaces-LightingandShading-visibility-InputDevices-Eventbased - inputsystem-MobileInput-Basicsound-3Dsound-DigitalSignalProcessing-Physics-Planes,Rays, and line segments-Collision Geometry-Collision Detection-Physic base movement-Physics middleware.		
Topic - 3	**GAMEDESIGNANDAI**	**9**
Cameras-Types of cameras-Perspective projection-Camera implementation-Camera supportalgorithm-RealAIversusGame AI-Pathfinding-Statebasedbehaviours-Strategyand planning.		
Topic - 4	**USERINTERFACEANDSCRIPTINGLANGUAGES**	**9**
Menu system-HUD elements-Radar-other UI considerations-Scripting Languages-Implementing ascripting language-Tokenization-Syntax Analysis-Code Execution or Generation-Data Formats-CasestudyUImods in worldof warcraft.		
Topic - 5	**NETWORKEDGAMES**	**9**
Protocols-NetworkTopology-Server/Client-Peer-to-Peer-Cheating-Samplegame-SidescrollerforiOS,TowerdefenseforPC/Mac-CodeAnalysis.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	SanjayMadhav,GameProgrammingAlgorithmsandTechniques:Aplatform-Agnostic Approach-GameDesign,1st Edition,Addison-WesleyProfessional,2013.
2	JouniSmed,HarriHakonen, Algorithms and Networking forComputerGames, 2nd Edition,WileyPublications, 2017.
3	ErnestAdamsandAndrewRollings,"FundamentalsofGameDesign",PrenticeHall3rdEdition,2014.

OTHER REFERENCES	
1	https://youtu.be/3inrzbyUveI
2	https://youtu.be/WZbJfDA-yE8
3	https://youtu.be/AzUZiUz-Wpc?list=PL_xRyXins84-dTmpL68AKv7UFAEvIeIr1

Semester	Programme	Course Code	Course Name	L	T	P	C
VI	B.Tech – AI & DS	20AD6E5	DATA SCIENCE FOR ENGINEERS	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Analyze data science fundamentals and apply them to day-to-day business and industrial needs	K4	1
CO2	Analyze appropriate probability and statistical tests using R	K4	2
CO3	Apply supervised and unsupervised algorithms in clustering	K3	3
CO4	Develop the mathematical models for data analysis and also perform mining in text data	K3	4
CO5	Apply the visualization models using Tableau and d3.js tools	K3	5

PRE-REQUISITE	DATA STRUCTURES AND ALGORITHM

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO1	PO1	PO1	PSO	PSO
CO	3	3	2					1	3	3		3		2
CO		2	1	2	2		2	1	3	3	1	3	1	
CO		1						1	3	3	3	3	2	3
CO	1		1	3			2	1	3	3		3	2	2
CO	1	2	3		3		2	1	3	3	1	3		1

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Other Assessments (Assignment, Quiz etc.)
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION TO DATA SCIENCE**	**9**
Data Science Fundamentals, Exploring data engineering pipelines, Applying data science and data warehousing to business and industry		
Topic - 2	**INTRODUCTION TO PROBABILITY AND R**	**9**
Introduction to Probability, Conditional Probability, Random Variable, Statistical Modelling, Probability Distribution, R Introduction, Data Structures in R, Working with Data in R		
Topic - 3	**SUPERVISED AND UNSUPERVISED LEARNING**	**9**
Linear Regressions, Classification- Decision Tree, Naive Bayes, K-Nearest Neighbors, ClusteringIdentifying Clusters, K-Means Clustering, Hierarchical Clustering		
Topic - 4	**MATHEMATICAL MODELLING**	**9**
Association Rule Mining, Time Series Analysis, Dimensionality Reduction, Principal Component Analysis, Linear Discriminator Analysis, Sentiment Analysis on text data		
Topic - 5	**VISUALIZATION TOOLS**	**9**
Introduction to Visualization - Types of visualizations, Working with Tableau, Creating views in Tableau, using d3.js for data visualization		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Jain R.K and Iyengar S.R.K, "Advanced Engineering Mathematics", 3rd Edition, Narosa Publishing House, New Delhi, Reprint 2009.
2	Ramana B.V., "Higher Engineering Mathematics", Tata Mcgraw Hill Publishing Company, New Delhi, 2008.
3	Kreyszig E., "Advanced Engineering Mathematics", 9th Edition, John Wiley Sons, 2012.
4	Glyn James., "Advanced Modern Engineering Mathematics", Pearson Education Limited, 2007.
5	N P Bali, Manish Goyal, "A Text Book of Engineering Mathematics", 3rd Edition, Laxmi Publication Private Limited, 2009.

OTHER REFERENCES	
1	Lillian Pierson, Data Science for Dummies, John Wiley,2015
2	Garrett Grolemund, Hadley Wickham, R for Data Science, O Reilly in January 2017.
3	Andrie de Vries, JorisMeys, R For Dummies, John Wiley and Sons, 2012
4	David Baldwin, Mastering Tableau, Packt Publishing, 2016.

Semester	Programme	Course Code	Course Name	L	T	P	C
VI	B.Tech AI & DS	20AD6E6	WEB & SOCIAL MEDIA MINING	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
Upon completion of the course, students will be able to		**RBT Level**	**Topics Covered**
CO1	Define Mining Concepts and Neural Networks	K1	1
CO2	Analyze Web mining and Data Mining	K4	2
CO3	Develop the Mining data Streams	K3	3
CO4	Examine Emerging Trends and Challenges in Social Media	K4	4
CO5	Demonstrate the social Networking Mining	K2	5

PRE-REQUISITE	Data Warehousing and Data Mining

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	**Programme Learning Outcomes (POs)**												**PSOs**	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3				3		3	1	3	3		3		
CO2	3		2		2			1	3	3		3		
CO3	3		2		3			1	3	3		3		
CO4	3							1	3	3		3		
CO5	3				2			1	3	3		3	2	

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Other Assessments (Assignment, Quiz etc.)
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION**	**9**
Mining-concept description, Mining frequent patterns, Associations, and Correlations - Classification and Prediction - Cluster Analysis - Artificial Neural Network -OLAP Technology -Data warehousing-examples of Data mining-the Data mining process- Different data mining techniques.		
Topic - 2	**WEB MINING**	**9**
Web Mining- Types of Web Mining –Comparison Web Mining Data Mining -Applications of Web Mining: E-Commerce,Search Engine Optimization, Fraud Detection, Sentiment Analysis,Healthcare - Process of Web Mining: Soft Computing :Soft Computing In Web Mining, Multimedia Data- Multimedia Mining, Web Mining Taxonomy, Mining Multimedia Databases- Models For Multimedia Mining- Classification Models- Clustering Models		
Topic - 3	**MINING DATA STREAMS**	**9**
The data stream model – stream queries-sampling data in a stream-general streaming problem-filtering streams-analysis of filtering- dealing with infinite streams- Counting Distance Elements in a Stream – Estimating Moments – Counting Ones in Window – Decaying Windows.		
Topic - 4	**SOCIAL MEDIA**	**9**
Objectives, Social Media - Overview, Online Networking, Social Media Marketing, Impact of Social Media on Business-Emerging Trends and Challenges in Social Media-Future of Social Media - Case Studies - Social Media - Opportunities		
Topic - 5	**SOCIAL NET WORK MINING**	**9**
Detecting and Discovering Communities in Social Network: Evaluating Communities – Methods for Community Detection – Applications of Community Mining Algorithms –Ethical Practices in Social Network Mining – Understanding and Predicting Human Behaviour for Social Communities – Decentralized Online Social Networks – Multi-Relational Characterization of Dynamic Social Network Communities – Inferential Methods in Social Network Analysis.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Jiawei Han, Micheline Kamber and Jian Pei, Data Mining Concepts and Techniques, Third Edition, Elsevier, 2012.
2	GuandongXu, Yanchun Zhang, Lin Li, “Web Mining and Social Networking Techniques and Applications”, Springer,2011.
3	Jure Leskovec, Anand Rajaraman, Jeffrey D. Ullman, Mining of Massive Datasets, Cambridge University Press, 2014.

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=aircAruvnKk
2	https://www.youtube.com/watch?v=YI4y3Z1Tp8Y
3	https://slideplayer.com/slide/7346259/

Semester	Programme	Course Code	Course Name	L	T	P	C
VI	B.Tech – AI & DS	20AD6E8	BLOCK CHAIN AND CRYPTOGRAPHY	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Identify the key benefits of block chain for a business or a network environment.	K3	1
CO2	Classify the components of block chain, the roles of the components in developing block chain system and build a new revenue streams to a given business scenario.	K4	2
CO3	Develop the core components of Bit coin Network with the necessary scriplets and Design a Bit coin Wallet for a given P2P network specification.	K3	3
CO4	Identify the types of symmetric ciphers and its principles	K3	4
CO5	Classify the types of Asymmetric ciphers and its principles	K2	5

PRE-REQUISITE	NILL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	-	-	-	1	3	3	-	3	-	-
CO2	2	-	-	-	-	-	-	1	3	3	-	3	-	2
CO3	3	-	2	-	-	-	-	1	3	3	-	3	-	-
CO4	-	3	-	-	-	-	-	1	3	3	-	3	2	-
CO5	3	-	2	2	-	-	-	1	3	3	2	3	-	1

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Other Assessments (Assignment, Quiz etc.)
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**GETTING STARTED WITH BLOCK CHAIN**	9
What is Block chain – Centralized Vs. Decentralized Systems – Layers of Blockchain – Why is Block chain Important – Block chain uses and Use Cases.		
Topic - 2	**WORKING OF BLOCK CHAIN**	9
Block chain foundation – Cryptography – Game Theory – Merkle Trees – Properties of Block chain solutions – Block chain Transactions – Distributed Consensus Mechanisms – Block chain Applications – Scaling Block chain		
Topic - 3	**WORKING OF BITCOIN**	9
History of Money – Dawn of Bit coin – The Bit coin Block chain – The Bit coin Network – Bit coin Scripts – Full Nodes vs SPVs – Bit coin Wallets.		
Topic - 4	**ASYMMETRIC CIPHERS AND KEY MANAGEMENT**	9
Primary numbers – testing for primality – public key cryptography RSA – distribution of public keys –key management and distribution – public key infrastructure – symmetric key distribution using asymmetric encryption-Block cipher operation-electronic code book		
Topic - 5	**CRYPTOGRAPHIC DATA INTEGRITY ALGORITHMS**	9
Cryptographic hash functions – application – two simple hash functions – requirements and security hash functions based on cipher block chaining –secure hash algorithm (SHA) – SHA – 3 – message authentication codes-Digital principle and authentication protocols.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	KirankalyanKulkarni, Essentials of Bitcoin and Blockchain, Packt Publishing
2	AnshulKaushik, Block Chain & Crypto Currencies, Khanna Publishing House.
3	Tiana Laurence, Blockchain for Dummies, 2nd Edition 2019, John Wiley & Sons.
4	Charles P.Fleeger, Shari Lawrence P.Fleeger, Security in computing, Prentice Hall of India, 2009
5	W. Mao, Modern Cryptography Ã¢?? Theory and Practice, Pearson Education, 2007

OTHER REFERENCES	
1	Blockchain: Blueprint for a New Economy by Melanie Swan, Shroff Publisher O'Reilly Publisher Media; 1st edition (2015).
2	https://www.notesforgeeks.in/2021/07/cs8792-cryptography-and-network-security-syllabus-2017-regulation.html

Semester	Programme	Course Code	Course Name	L	T	P	C
VI	B.Tech.- AI & DS	20AD6LT1	AI IN NATURAL LANGUAGE PROCESSING	2	0	4	4

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Apply the fundamentals of natural language processing	K3	1
CO2	Plan word level analysis.	K3	2
CO3	Analyze the syntax using various methods.	K4	3
CO4	Understand the role of semantics and pragmatics	K2	4
CO5	Examine discourse algorithms and various lexical resources	K4	5

PRE-REQUISITE	Foundation of Artificial Intelligence

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2				3	2	3	3	3	3	3	1	3
CO2	3	2				3	2	3	3	3	3	3		
CO3	3	2	2	2		3	2	3	3	3	3	3	2	3
CO4	3	2	2	2		3	2	3	3	3	3	3	2	3
CO5	3	2	2	2		3	2	3	3	3	3	3	2	3

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Laboratory Record and Model Practical Examinations (Laboratory Component)
	3	End Semester Examinations
INDIRECT	1	Course End Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION**	**6**
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.		
Topic - 2	**WORD LEVEL ANALYSIS**	**6**
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.		
Topic - 3	**SYNTACTIC ANALYSIS**	**6**
Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Shallow parsing – Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs - Feature structures, Unification of feature structures.		
Topic - 4	**SEMANTICS AND PRAGMATICS**	**6**
Requirements for representation, First-Order Logic, Description Logics – Syntax-Driven Semantic analysis, Semantic attachments – Word Senses, Relations between Senses, Thematic Roles, selectional restrictions – Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods – Word Similarity using Thesaurus and Distributional methods.		
Topic - 5	**DISCOURSE ANALYSIS AND LEXICAL RESOURCES**	**6**
Discourse segmentation, Coherence – Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm – Coreference Resolution – Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brill's Tagger, WordNet, PropBank, FrameNet, Brown Corpus, British National Corpus (BNC).		

THEORY	**30**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**30**

LIST OF EXPERIMENTS
1.Implement NLP Application to understand Twitter sentiment.
2. Implement of Detecting and Correcting Spelling Errors
3. Evaluating of N-grams
4. Implement NLP in PoS [Part-of-Speech]
5. Implementation of Context-Free Grammars.
6. Implementation of Dynamic Programming parsing
7. Implementation of Driven Semantic Analysis.
8. Develop an Probabilistic Lexicalized CFGs
9. Implement of WSD using Supervised
10. Implementation of Anaphora Resolution Using Hobbs.
11. Implementation of Anaphora Resolution using Centering Algorithm
12. Implement British National Corpus (BNC)

THEORY	**0**		**TUTORIAL**	**0**		**PRACTICAL**	**60**		**TOTAL**	**60**

BOOK REFERENCES	
1	Daniel Jurafsky, James H. Martin, “Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech”, Pearson Publication, 2019.
2	Steven Bird, Ewan Klein and Edward Loper, “Natural Language Processing with Python”, First Edition, O’Reilly Media, 2009.
3	Breck Baldwin, “Language Processing with Java and LingPipe Cookbook”, Atlantic Publisher, 2015.
4	Richard M Reese, “Natural Language Processing with Java”, O’Reilly Media, 2015.

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=sQVpMzNXdco
2	https://www.youtube.com/watch?v=Xq0n9-IZ-Ps
3	https://www.coursera.org/lecture/clinical-natural-language-processing/nlp-fundamentals-sematics-pragmatics-IVRrL
4	https://www.youtube.com/watch?v=HeERR5ZCptw

Semester	Programme	Course Code	Course Name	L	T	P	C
VI	B.Tech. – AI & DS	20AD6LT2	DEEP LEARNING AND ITS APPLICATIONS	2	0	4	4

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Explain the basic mathematical and conceptual background of deep learning.	K2	1
CO2	Demonstrate the deep neural network architecture and the optimization.	K2	2
CO3	Apply CNN and RNN and its variants for suitable applications.	K3	3
CO4	Examine performance metrics and evaluate the model.	K4	4
CO5	Apply auto encoders and generative models for suitable application	K3	5

PRE-REQUISITE	Foundation of Artificial Intelligence & Python

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2					1	3	3		3		2
CO2		2	1	2	2		1	1	3	3	1	3	1	
CO3		1						1	3	3	3	3	2	3
CO4	1		1	3			1	1	3	3		3	2	2
CO5	1	2	3		3		1	1	3	3	1	3		1

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Laboratory Record and Model Practical Examinations (Laboratory Component)
	3	End Semester Examinations
INDIRECT	1	Course End Survey

COURSE CONTENT		
Topic - 1	**DEEP NETWORKS**	**6**
Challenges motivating deep learning - Deep feedforward networks - Learning XOR - Gradient based learning - Hidden Units – Architecture Design – Back Propagation – Regularization – Parameter Norm Penalties – Constrained Optimization – Under-Constrained Problems – Dataset Augmentation – Noise Robustness – Semi-Supervised Learning – Multi-Task Learning – Early Stopping – Parameter Tying and Sharing – Bagging and Other Ensemble methods – Dropout – Adversarial Training.		
Topic - 2	**OPTIMIZATION FOR TRAINING DEEP MODELS**	**6**
Pure optimization – Challenges – Basic Algorithms – Parameter initialization Strategies – Algorithms with Adaptive Learning Rates – Approximate Second-Order methods – Optimization Strategies and Meta Algorithms.		
Topic - 3	**CONVOLUTIONAL AND RECURRENT NEURAL NETWORKS**	**6**
Convolution Operation – motivation – Pooling – Infinitely Strong prior – Variants – Structured Output – Data Types – Efficient Convolutional Algorithms – Random or Unsupervised features – Neuroscientific Basis - Deep Learning – Sequence Modeling - Computational Graphs - RNN - Bidirectional RNN – Encoder-Decoder - Sequence to Sequence RNN - Deep Recurrent Networks - Recursive Neural Networks -- Long Term Dependencies; Leaky Units – Strategies for multiple time scales – LSTM and Gated RNNs – Optimization for Long Term Dependencies.		
Topic - 4	**AUTO ENCODERS**	**6**
Auto encoders: Under complete auto encoders - Regularized auto encoders – Power, Layer Size and Depth - Stochastic encoders and decoders – Denoising Auto encoders - Learning with auto encoders – contractive Auto encoders – Applications of auto encoders.		
Topic - 5	DEEP GENERATIVE MODELS	**6**
Boltzmann Machine – Restricted Boltzmann Machine – Deep Belief Networks – Deep Boltzmann Machines - Boltzmann Machines for Real-Valued Data – Convolutional Boltzmann Machines - Boltzmann Machine for Structured or Sequential Outputs – Directed Generative Nets – Evaluating Generative Models.		

THEORY	**30**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**30**

LIST OF EXPERIMENTS	
1	Implement Simple Programs like vector addition in TensorFlow
2	Implement a simple problem like regression model in Keras
3	Implement a perceptron in TensorFlow/Keras Environment.
4	Implement a Feed-Forward Network in TensorFlow/Keras.
5	Implement an Image Classifier using CNN in TensorFlow/Keras.
6	Implement a Transfer Learning concept in Image Classification.
7	Implement an Autoencoder in TensorFlow/Keras.
8	Implement a Simple LSTM using TensorFlow/Keras.
9	Implement an Opinion Mining in Recurrent Neural network.
10	Implement an Object Detection using CNN.

THEORY	0		TUTORIAL	0		PRACTICAL	60		TOTAL	60

BOOK REFERENCES	
1	Ian Goodfellow, Yoshua Bengio, Aaron Courville, ``Deep Learning", MIT Press, 2016.
2	Charu C. Aggarwal, ``Neural Networks and Deep Learning: A Textbook", Springer International Publishing, 2018.
3	Francois Chollet, ``Deep Learning with Python", Manning Publications Co, 2018.
4	Navin Kumar Manaswi, “Deep Learning with Applications Using Python”, Apress, 2018.
5	Deep Learning LaboratoryManual, Al-Ameen Publications, 2020.

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=HPjBY1H-U4U
2	https://www.youtube.com/watch?v=_VTtrSDHPwU
3	https://towardsdatascience.com/deep-transfer-learning-for-image-classification-f3c7e0ec1a14

Semester	Programme	Course Code	Course Name	L	T	P	C
VI	B.E. / B. Tech. Common to all	20PT6T1	Career Guidance - II	2	1	0	0

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Analyze the Problems logically and approach the problems in a different manner	K3	1
CO2	Solve the problems easily by using Short-cut method with time management which will be helpful to them to clear the competitive exams for better job opportunity.	K5	2
CO3	Effectively communicate through verbal/oral communication and improve the listening skills	K3	3
CO4	Develop skills in ideation, innovation in algorithmic thinking, and be able to apply them in problem solving	K4	4

PRE-REQUISITE	SOFTSKILL COURSE - I

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						3			3	3		3		
CO2						2			3	3		2		
CO3			2			3			3	2		1		
CO4		3	3			2			3	3		2		

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Other Assessments (Assignment, Quiz etc.)
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**LOGICAL REASONING**	**5**
LR 1: Seating Arrangement LR 2: Critical Reasoning LR 3: Coded Inequality and Condition Grouping LR 4: Cubes and Verbal Reasoning LR 5: Clocks and Calendars		
Topic - 2	**QUANTITATIVE APTITUDE**	**12**
NR 1: Simple Interest and Compound Interest NR 2: Logarithms NR 3: Permutation NR 4: Combination NR 5: Probability NR 6: Number System NR 7: HCF and LCM		
Topic - 3	**VERBAL REASONING & BUSINESSES COMMUNICATION**	**3**
VR 1: Voices & Speech, Parajumbles, Error Spotting VR 2: Reading Comprehension BS1: Effective Communication, Personal Etiquettes,Group Discussion, Resume Writing.		
Topic - 4	**TECHNICAL CODING**	**10**
TECH 1: 2D array TECH 2: String functions and functions TECH 3: structure and union, DS intro TECH 4 : Array list, linked list and it's implementation		

THEORY	**20**		**TUTORIAL**	**10**		**PRACTICAL**	**0**		**TOTAL**	**30**

BOOK REFERENCES	
1	Logical Reasoning and Data Interpretation for CAT by Nishit K. Sinha
2	Quantitative Aptitude for Competitive Examinations (5th Edition) - Abhjit Guha
3	A Modern Approach To Verbal Reasoning by R S Aggarwal.
4	Computer Programming for Beginners: Fundamentals of Programming Terms and Concepts - Nathan Clark

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=4WCq6leqnHs
2	https://www.youtube.com/watch?v=tnc9ojITRg4&list=PLpyc33gOcbVA4qXMoQ5vmhefTruk5t9lt
3	https://www.youtube.com/watch?v=tWN_-ieZVZU
4	https://www.youtube.com/watch?v=HAnw168huqA
5	https://www.youtube.com/watch?v=HIj8wU_rGIU

SEMESTER VII

Sl. No.	Course Code	Course Title	Category	CIA	ESE	L	T	P	C
THEORY COURSES									
1	20AD7T1	Software Testing and Quality Assurance	PC	40	60	3	0	0	3
2	20HSCT2	Professional Ethics	HS	40	60	3	0	0	3
3		Professional Elective - V	PE	40	60	3	0	0	3
THEORY COURSE WITH LABORATORY COMPONENTS									
4	20AD7LT1	IoT Fundamentals and Architecture	PC	50	50	2	0	4	4
5	20CS7LT2	Cloud Computing	PC	50	50	2	0	4	4
EMPLOYABILITY ENHANCEMENT COURSE									
6	HX8001	Professional Readiness for Innovation, Employability and Entrepreneurship	EEC	100	-	0	0	6	3
Total						**13**	**0**	**14**	**20**

Semester	Programme	Course Code	Course Name	L	T	P	C
VII	B.Tech. – AI & DS	20AD7T1	SOFTWARE TESTING AND QUALITY ASSURANCE	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Apply the concept of Software Testing and its application	K3	1
CO2	Build the Testing Strategies and Techniques	K3	2
CO3	Develop the web Page fundamentals	K3	3
CO4	Analyse the software quality assurance	K4	4
CO5	Categorize Software Engineering Standards	K5	5

PRE-REQUISITE	SOFTWARE ENGINEERING

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3							1	3	3		3	2	
CO2	3				3			1	3	3	1	3	2	
CO3	3	2		2		1		1	3	3		3	2	
CO4	3							1	3	3		3	2	
CO5	3							1	3	3		3	2	

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Other Assessments (Assignment, Quiz etc.)
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION TO SOFTWARE TESTING**	9
Introduction, Definition of a Bug, Role of a Software Tester, Software Development Model, Software Testing Axioms, Software Testing Terms and Definitions.		
Topic - 2	**FUNDAMENTALS OF SOFTWARE TESTING**	9
Testing Strategies and Techniques, Structural and Functional testing, Static Black Box and Dynamic Black Box Testing Techniques.		
Topic - 3	**WEB SITE TESTING**	**9**
Web Page Fundamentals, Black Box Testing, White Box Testing and Gray Box Testing, Configuration and Compatibility Testing		
Topic - 4	**SOFTWARE QUALITY ASSURANCE**	**9**
Definition of Quality, Testing and Quality Assurance at Workplace, Test Management and Organizational Structure, Software Quality Assurance Metrics, Quality Management in IT.		
Topic - 5	**ORGANIZATIONAL STRUCTURE**	**9**
: CMM (Capability Maturity Model), ISO 9000, Software Engineering Standards		

THEORY	**45**	**TUTORIAL**	**0**	**PRACTICAL**	**0**	**TOTAL**	**45**

BOOK REFERENCES	
1	Dr.K.V.K.K.Prasad , “Software Testing and Quality Assurance”, DreamTech Publication, 2003.
2	Jonathan W Valvano “Software Testing and Quality Assurance”, Thomson Publishers, 2015.

OTHER REFERENCES	
1	https://www.techtarget.com/whatis/definition/software-testing
2	https://www.youtube.com/watch?v=nPQJhHmJzB4
3	https://www.youtube.com/watch?v=X9uk5p7qCyM
4	https://huddle.eurostarsoftwaretesting.com/grood-testing-volume-3-the-role-of-test-manager-it-depends/

Semester	Programme	Course Code	Course Name	L	T	P	C
VII	B.E., B.Tech Common	20HSCT2	PROFESSIONAL ETHICS	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Develop completion of the course; the student should be able to apply ethics in society.	K3	1
CO2	Discover the ethical issues related to engineering and realize the responsibilities and rights in the society.	K4	2
CO3	Dissect how engineering is applied in association with ethics based onengineering experimentation.	K4	3
CO4	Explain the engineering ethics based safety, responsibilities and rights.	K2	4
CO5	Identify the global issues of professional ethics in engineering.	K3	5

PRE-REQUISITE	CONSTITUTION OF INDIA

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	1	2	2	3	3	-	3	-	-
CO2	-	-	-	-	-	-	2	2	3	3	-	3	-	-
CO3	-	-	-	-	-	-	2	2	3	3	-	3	-	-
CO4	-	-	-	-	-	3	2	2	3	3	-	3	-	-
CO5	-	-	-	-	-	2	2	2	3	3	-	3	-	-

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Other Assessments (Assignment, Quiz etc.)
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**HUMAN VALUES**	**10**
Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation –Commitment – Empathy – Self-confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.		
Topic - 2	**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.		
Topic - 3	**ENGINEERING AS SOCIAL EXPERIMENTATION**	**9**
Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics –A Balanced Outlook on Law.		
Topic - 4	**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.		
Topic - 5	**GLOBAL ISSUES**	8
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.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Subramanian R., Professional ethics, Oxford University press, 2010
2	Manoharan P.K., Education and Personality Development, APH Publishing Corporation, New Delhi, 2008
3	Megan J. Murphy (Editor), Lorna Hecker (Editor), Ethics and Professional Issues in Couple and Family Therapy.
4	Andrew Belsey (Editor), Ruth Chadwick (Editor), Ethical Issues in Journalism and the Media (Professional Ethics).
5	Warwick Fox (Editor), Ethics and the Built Environment (Professional Ethics)

OTHER REFERENCES	
1	Ruchika Nath, Value Education, APH Publishing Corporation, New Delhi, 2008.
2	https://www.edulearn.net.in/wp-content/uploads/2021/06/PE-1.pdf

Semester	Programme	Course Code	Course Name	L	T	P	C
VII	B.Tech – AI & DS	20AD7E1	INTRODUCTION TO BRAIN AND NEUROSCIENCE	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Discover the power of quantitative reasoning to unravel fundamental organizing principles of brain function	K4	1
CO2	Examine key neuroscience concepts and the relevant parameter space at the cellular and systems level	K4	2
CO3	Develop the fundamental understanding of the biophysical basis of neuronal computation	K3	3
CO4	Analyze the knowledge about advanced experimental neurotechniques	K4	4
CO5	Utilize the concept of engineering principles are applied to interface with the nervous system in health and disease	K3	5

PRE-REQUISITE	NILL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2		2		2		2	1	3	3		3		2
CO2	3	2	2				2	1	3	3		3	2	
CO3	2	2	2	3			2	1	3	3	3	3	3	
CO4	3	2					2	1	3	3		3	2	2
CO5	2	3	2	3			2	1	3	3		3	2	3

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Other Assessments (Assignment, Quiz etc.)
	3	End Semester Examinations
INDIRECT	1	Course End Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION**	**9**
Introduction: Elements and principles; the neuroengineering approach; reasoning with models; neuroethics.		
Topic - 2	**SINGLE-CELL BIOPHYSICS**	**9**
Single-cell biophysics: Basic principles of electricity; ion transport; diffusion; ion current in an electric field; modeling passive membranes as RC circuits.		
Topic - 3	**RESTING MEMBRANE POTENTIAL**	**9**
Single-cell biophysics: Resting membrane potential; Nernst potential; the Goldman-Hodgkin-Katz equation; electrical neutrality; equivalent electrical circuit.		
Topic - 4	**THE ACTION POTENTIAL**	**9**
Single-cell biophysics: The action potential; single channel properties, HodgkinHuxley model. Chemical synapses in the equivalent circuit		
Topic - 5	**MULTI-COMPARTMENT MODELS**	**9**
Single-cell biophysics: Signal propagation in axon and dendrites; Rall's cable theory; multi-compartment models. the Integrateand-fire mode		

THEORY	**45**	**TUTORIAL**	**0**	**PRACTICAL**	**0**	**TOTAL**	**45**

BOOK REFERENCES	
1	"Principles of Computational Modelling in Neuroscience" by Sterratt, Graham, Gilles, Willshaw
2	"Vander's Human Physiology: The Mechanisms of Body Function" by Widmaier, Raff, Strang
3	"Mathematical Foundations of Neuroscience" by Ermentrout and Terman

OTHER REFERENCES	
1	https://nba.uth.tmc.edu/neuroscience/m/index.htm
2	https://www.coursera.org/learn/medical-neuroscience
3	https://www.brainfacts.org/

Semester	Programme	Course Code	Course Name	L	T	P	C
VII	B.Tech – AI & DS	20AD7E2	DATABASE SECURITY AND AUDITING	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Analyse the Databases Security Problems	K4	1
CO2	Develop The Security Models And Mechanisms	K3	2
CO3	Discover the Security Software Design	K4	3
CO4	Illustrate The Protecting Data Integrity	K2	4
CO5	Plan the database protection & intrusion detection systems	K3	5

PRE-REQUISITE	NILL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2				1	1	3	3		3	2	3
CO2	3	3		2				1	3	3		3		
CO3	3	2				2	1	1	3	3		3		
CO4	2	3		2			1	1	3	3		3		
CO5	2	2						1	3	3		3	2	2

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Other Assessments (Assignment, Quiz etc.)
	3	End Semester Examinations
INDIRECT	1	Course End Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION**	**9**
Introduction to Databases Security Problems in Databases Security Controls Conclusions Security Models -1: Introduction Access Matrix Model Take-Grant Model Acten Model PN Model Hartson and Hsiao's Model Fernandez's Model Bussolati and Martella's Model for Distributed databases		
Topic - 2	**SECURITY MODELS AND MECHANISMS**	**9**
Bell and LaPadula's Model Biba's Model Dion's Model Sea View Model Jajodia and Sandhu's Model The Lattice Model for the Flow Control conclusion. Security Mechanisms: Introduction User Identification/Authentication Memory Protection Resource Protection Control Flow Mechanisms Isolation Security Functionalities in Some Operating Systems Trusted Computer System Evaluation Criteria.		
Topic - 3	**SECURITY SOFTWARE DESIGN**	**9**
Introduction A Methodological Approach to Security Software Design Secure Operating System Design Secure DBMS Design Security Packages Database Security Design.		
Topic - 4	**PROTECTING DATA INTEGRITY**	**9**
Definitions- Auditing Activities - Auditing Process- Audit Classifications- Benefits and Side Effects of Auditing - Auditing Models - Auditing Applications Actions Model- C2 Security- DML Action Auditing Architecture- Oracle Triggers- Fine-grained Auditing (FGA) with Oracle- DML Action Auditing with Oracle-		
Topic - 5	**DATABASE PROTECTION & INTRUSION**	**9**
Introduction Statistics Concepts and Definitions Types of Attacks Inference Controls evaluation Criteria for Control Comparison .Introduction IDES System RETISS System ASES System Discovery.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Database Security, Castano, Second edition, Pearson Education.
2	Database Security, Alfred Basta, melissa zgola, CENGAGE learning.
3	Database Security and Auditing: Protecting Data Integrity and Accessibility, Author Hassan A.Afyouni,Publisher Cengage Learning ,2006,Digitized 12 Jan 2010

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=Sc9MucC0cX4
2	https://www.youtube.com/watch?v=-UvcVm64OX0
3	https://www.youtube.com/watch?v=LE4b8HON2A4

Semester	Programme	Course Code	Course Name	L	T	P	C
VII	B.Tech – AI & DS	20AD7E3	BIOSENSOR TECHNOLOGY	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Apply principles and concepts of biology and engineering to design biosensors	K3	1
CO2	Apply principles and concepts of electronics and electrochemistry to design electrochemical biosensors	K3	2
CO3	Discover different types of transducers, and their application in biosensor design	K4	3
CO4	Apply principles and concepts of sensing and engineering to be able to evaluate quality of biosensors	K3	4
CO5	Apply engineering tools to evaluate parameters needed for point-of-care health screening and mobile-health	K3	5

PRE-REQUISITE	NILL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2		2		2		2	1	3	3		3		2
CO2	3	2	2				2	1	3	3		3	2	
CO3	2	2	2	3			2	1	3	3	3	3	3	
CO4	3	2					2	1	3	3		3	2	2
CO5	2	3	2	3			2	1	3	3		3	2	3

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Other Assessments (Assignment, Quiz etc.)
	3	End Semester Examinations
INDIRECT	1	Course End Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION**	**9**
Biosensors- Advantages and limitations, various components of biosensors Biocatalysis based biosensors, Bioaffinity based biosensors & Microorganisms based biosensors, Biologically active material and analyte. Types of membranes used in biosensor constructions.		
Topic - 2	**TRANSDUCERS IN BIOSENSORS:**	**9**
Various types of transducers; principles and applications - Calorimetric, Optical, Potentiometric / Amperometric, Conductometric / Resistometric, Piezoelectric, Semiconductor, Impedimetric, Chemiluminiscene - based Biosensors.		
Topic - 3	**APPLICATION AND USES OF BIOSENSORS:**	**9**
Biosensors in clinical chemistry, medicine and health care, biosensors for veterinary, agriculture and food Low cost - biosensor for industrial processes for online monitoring; biosensors for environmental monitoring.		
Topic - 4	**BIOELECTRONICS :**	**9**
Potential advantages & Developments towards a biomolecular computer, development of molecular arrays as memory stores; molecular wires and switches; mechanisms of unit assembly		
Topic - 5	**DESIGN FOR A BIOMOLECULAR PHOTONIC COMPUTER:**	**9**
Assembly of photonic biomolecular memory store; Information processing; commercial prospects for biomolecular computing systems.		

THEORY	45		TUTORIAL	0		PRACTICAL	0		TOTAL	45

BOOK REFERENCES	
1	Elizabeth A Hall - Biosensors, First Edition, Open University, Milton Keynes, 1990
2	Graham Ramsay - Commercial Biosensors, First edition, John Wiley & Sons, Inc. 1998.
3	Tran Minh Canh - Sensor Physics & Technology - Biosensors , First Edition, Champan& Hall, 1993.

OTHER REFERENCES	
1	https://youtu.be/k5ZBUNqx2yI
2	https://youtu.be/dmSlTHXrWdQ
3	https://www.youtube.com/watch?v=tnRMlHgedrs

Semester	Programme	Course Code	Course Name	L	T	P	C
VII	B.Tech – IT, AI & DS	20IT7E7	COMPUTER VISION	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Demonstrate different image representation, their mathematical representation and differenttheir data structures used.	K2	1
CO2	Compare different segmentation algorithm for given input.	K2	2
CO3	Choose 3D object from given set of images.	K3	3
CO4	Plan a moving object in video using the concept of motion analysis.	K3	4
CO5	Examine the object using the concept of computer vision.	K4	5

PRE-REQUISITE	NILL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3		2		2		2	1	3	3		3	3	3
CO2	3	3		3	2		2	1	3	3		3	2	
CO3	3	3		3			2	1	3	3		3		2
CO4	3	3	2	3			2	1	3	3		3	3	
CO5	3	3		3			2	1	3	3		3	2	3

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Other Assessments (Assignment, Quiz etc.)
	3	End Semester Examinations
INDIRECT	1	Course End Survey

COURSE CONTENT		
Topic - 1	**IMAGE ITS REPRESENTATIONS AND PROPERTIES**	**9**
The image, its representations and properties – image representations a fewconcepts, Image digitization, Digital image properties, Color images, Camera's : anoverview.Mathematical and physical background – Linear integral transforms, Images asstochastic processes, Image formation physics.		
Topic - 2	**DATA STRUCTURES FOR IMAGE ANALYSIS**	**9**
Data structures for image analysis- levels of image data representation, traditionalimage data structures, and Hierarchical data structures. Image understanding-fitting viarandom sample consensus, point distribution model.		
Topic - 3	**SEGMENTATION II**	**9**
Segmentation II – Mean Shift Segmentation , Active contour models – snakes,Geometric deformable model – level sets and geodesic active contours, Fuzzyconnectivity, Towards 3D graph – based image segmentation, Graph cut segmentation.		
Topic - 4	**3D VISION GEOMETRY**	**9**
3 D Vision Geometry – 3 D Vision tasks, basics of projective geometry, A Singleperspective camera, Scene reconstruction from multiple views, two camera stereopsis,Use of 3D vision Shape from X, Full 3D objects, 3D model-based vision, 2D viewbased representations of a 3D scene.		
Topic - 5	**MOTION ANALYSIS**	**9**
Motion Analysis- Different Motion Analysis methods, Optical flow, analysis based oncorrespondence of interest points, Detection of specific motion patterns, video tracking.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Milan Sonka, Vaclav Hlavac, Roger Boyle, "Digital Image Processing and Computer Vision" Cengage Learning, 1st Edition, 2008.
2	Digital image processing, by Gonzales Woods 3rd Edition, Pearson Education.
3	Fundamental of Digital Image Processing by Anil K. Jain, PHI Pub.

OTHER REFERENCES	
1	https://onlinecourses.nptel.ac.in/noc21_ee23/preview
2	https://www.youtube.com/watch?v=xhr_o4S-_zg
3	https://www.youtube.com/watch?v=pRSpp4EUL3A
4	https://www.youtube.com/watch?v=OcycT1Jwsns
5	https://www.youtube.com/watch?v=715uLCHt4jE

Semester	Programme	Course Code	Course Name	L	T	P	C
VII	B.Tech– AI & DS	20AD7LT1	IOT FUNDAMENTALS AND ARCHITECTURE	2	0	4	4

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Assume specific scripting knowledge to develop interactive applications	K4	1
CO2	Understand basis of android application development	K2	2
CO3	Apply the programming skills in developing application in Agricore	K3	3
CO4	Develop the programming skills in developing application to enable smart cities.	K3	4
CO5	Apply the programming skills in developing application in Healthcare	K3	5

PRE-REQUISITE	PYTHON PROGRAMMING

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	-	-	-	2	2	3	3	2	3	-	-
CO2	1	2	3	2	2	-	2	2	3	3	-	3	-	2
CO3	3	2	2	-	-	-	2	2	3	3	2	3	-	2
CO4	1	3	2	2	-	-	2	2	3	3	-	3	2	-
CO5	3	2	-	-	-	-	2	2	3	3	3	3	-	2

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Laboratory Record and Model Practical Examinations (Laboratory Component)
	3	End Semester Examinations
INDIRECT	1	Course End Survey

COURSE CONTENT		
Topic - 1	**FUNDAMENTALS OF IOT**	**6**
Introduction , Definitions&Characteristics of IOT,IOT Architectures ,Physical & Logical Design of IOT ,Enabling Technologies in IOT , History of IOT, About things in IOT, The identifiers in IOT, About the Internet in IOT , IOT frameworks, IOT and M2M		
Topic - 2	**INDUSTRIAL INTERNET APPLICATIONS**	**6**
Industrial internet application:- IOT Fundamentals and components , industrial Manufacturing , monitoring , control , optimization and autonomy , introduction to Hadoop and big data analytics.		
Topic - 3	**APPLICATIONS IN AGRICULTURE**	**6**
Applications in agriculture :- Smart Farming : Weather monitoring , Precision farming , Smart Greenhouse , Drones for pesticides		
Topic - 4	**APPLICATIONS IN IOT**	**6**
Introduction :- Applications in iot enabled smart cities :- Energy consumption , smart energy meters, Home automation , smart grid and solar grid energy harvesting , intelligent parking data lake services scenarios		
Topic - 5	**HEALTH CARE APPLICATIONS**	**6**
Introduction: Architecture of iot for health care, Multiple views coalescence, SBC –ADL to construct the system architecture. Use Cases Wearable devices for remote monitoring of Physiological, ECG, EEG, Diabetes and Blood pressure.		

THEORY	**30**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**30**

COURSE CONTENT	
Experiment-1	Implement a program to Blink LED using Arduino.
Experiment-2	Implement a program to control intensity light using Arduino.
Experiment-3	Implement a program for Buzzer indicator using Arduino.
Experiment-4	Implement a program for LDR using Arduino.
Experiment-5	Implement a program for servo motor control using Arduino.
Experiment-6	Implement Measurement and transmission of room temperature with date and time to web server using WiFi module.
Experiment-7	Detection of ethanol and carbon-dioxide in the air using Gas sensors.
Experiment-8	Detection of obstacles using infrared sensors and measure the distance using ultrasonic sensors.
Experiment-9	Tracking the location of a particular object through GPS module and find the speed of a

	moving object using accelerometer sensor.
Experiment-10	Creation of dashboard to monitor the Smart Lighting using Freedboard io/ PubNub cloud server.
Experiment-11	Program for RGB LED using Arduino
Experiment-12	Experiment on HTTP-to-CoAP semantic mapping Proxy in IoT Toolkit

THEORY	**0**		**TUTORIAL**	**0**		**PRACTICAL**	**60**		**TOTAL**	**60**

BOOK REFERENCES	
1	Muthusubramanian R, Salivahanan S and Muraleedaharan K A . : "Basic Electrical , Electronics and Computer Engineering ",Tata McgrawHill,second Edition.(2006
2	Olivier Hersent , David Boswarthick, Omar Elloumi , " The Internet of Things : Key applications and protocols " Willey Publications 2nd edition,2013.
3	Marco Schwartz – Internet od Things with the Arduino Yun,Packt Publishing ,2014
4	Adrian McEwen,Hakimcassimally, "Designing the Internet of Things ",Willey Publications 2012.

OTHER REFERENCES	
1	https://en.wikipedia.org/wiki/Internet_of_things
2	https://builtin.com/internet-things
3	https://youtu.be/LlhmzVL5bm8
4	https://youtu.be/6mBO2vqLv38?t=3

Semester	Programme	Course Code	Course Name	L	T	P	C
VII	B.E.CSE	20CS7LT2	CLOUD COMPUTING	2	0	4	4

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Analyze the main concepts, key technologies, strengths and limitations of cloud computing.	K4	1
CO2	Apply the key and enabling technologies that help in the development of cloud.	K3	2
CO3	Develop the ability to understand and use the architecture of compute and storage cloud, service and delivery models.	K3	3
CO4	Inference the core issues of cloud computing such as resource management and security.	K4	4
CO5	Assume the emergence of cloud as the next generation computing paradigm.	K4	5

PRE-REQUISITE	COMPUTER NETWORKS

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3					3	2	3	3	3	3	3		3
CO2	3	2	3	3		3	2	3	3	3	3	3	3	2
CO3	3	2	2	2		3	2	3	3	3	3	3		
CO4	3	3	3	3		3	2	3	3	3	3	3	2	2
CO5	3	3	2			3	2	3	3	3	3	3	3	2

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Laboratory Record and Model Practical Examinations (Laboratory Component)
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION**	6
Introduction to Cloud Computing – Definition of Cloud – Evolution of Cloud Computing – Underlying Principles of Parallel and Distributed Computing – Cloud Characteristics – Elasticity in Cloud – Ondemand Provisioning.		
Topic - 2	**CLOUD ENABLING TECHNOLOGIES**	6
Service Oriented Architecture – REST and Systems of Systems – Web Services – Publish-Subscribe Model – Basics of Virtualization – Types of Virtualization – Implementation Levels of Virtualization – Virtualization Structures – Tools and Mechanisms – Virtualization of CPU – Memory – I/O Devices –Virtualization Support and Disaster Recovery.		
Topic - 3	**CLOUD ARCHITECTURE, SERVICES AND STORAGE**	**6**
Layered Cloud Architecture Design – NIST Cloud Computing Reference Architecture – Public, Private and Hybrid Clouds - laaS – PaaS – SaaS – Architectural Design Challenges – Cloud Storage – Storage-as-a-Service – Advantages of Cloud Storage – Cloud Storage Providers – S3.		
Topic - 4	**RESOURCE MANAGEMENT AND SECURITY IN CLOUD**	**6**
Inter Cloud Resource Management – Resource Provisioning and Resource Provisioning Methods – Global Exchange of Cloud Resources – Security Overview – Cloud Security Challenges – Software-asa-Service Security – Security Governance – Virtual Machine Security – IAM – Security Standards.		
Topic - 5	**CLOUD TECHNOLOGIES AND ADVANCEMENTS**	**6**
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.		

THEORY	**30**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**30**

LIST OF EXPERIMENTS	
1	Install Virtualbox/VMware Workstation with different flavours of linux or windows OS on top of windows7 or 8.
2	Install a C compiler in the virtual machine created using virtual box and execute Simple Programs
3	Install Google App Engine.
4	Use GAE to Create hello world app and other simple web applications using python/java.

5	Use GAE launcher to launch the web applications.
6	Simulate a cloud scenario using CloudSim
7	Simulate a cloud scenario and run a scheduling algorithm that is not present in CloudSim.
8	Find a procedure to transfer the files from one virtual machine to another virtual machine.
9	Install Openstack
10	Find a procedure to launch virtual machine using trystack (Online Openstack Demo Version)
11	Install Hadoop single node cluster
12	Use Hadoop to run simple applications like word count.

THEORY	**0**		**TUTORIAL**	**0**		**PRACTICAL**	**60**		**TOTAL**	**60**

BOOK REFERENCES	
1	Kai Hwang, Geoffrey C. Fox and Jack J. Dongarra, "Distributed and Cloud Computing from Parallel Processing to the Internet of Things", Morgan Kaufmann, Elsevier, 2012
2	Tim Mather, Subra Kumaraswamy, and Shahed Latif, "Cloud Security and Privacy
3	Enterprise Perspective on Risks and Compliance", O'Reilly 2009
4	Bernard Golden, "Amazon Web Services for Dummies", John Wiley & Sons, 2013.
5	Barrie Sosinsky, "Cloud Computing Bible" John Wiley & Sons, Wiley publishing, Inc. 2011

OTHER REFERENCES	
1	https://easyexamnotes.com/p/cloud-computing
2	https://gomindsight.com/ cloud-computing
3	https://azure.microsoft.com/en-in/overview/what-is-cloud-computing/
4	https://www.investopedia.com/terms/c/cloud-computing.asp
5	https://www.javatpoint.com/cloud-computing-tutorial

Semester	Programme	Course Code	Course Name	L	T	P	C
		20CSO01	OBJECT ORIENTED PROGRAMMING USING JAVA	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
Upon completion of the course, students will be able to		**RBT Level**	**Topics Covered**
CO1	Apply a Java program for the given problem statement using operator, arrays, classes and methods.	K3	1
CO2	Develop solution for a given problem using Inheritance and Packages to achieve reusability and implement exception handling code to handle the run time errors.	K3	2
CO3	InspectaJava code for the given problem statement using String handling functions and I/O streams.	K4	3
CO4	Compare an applet for a given scenario to embed dynamic content in the web page	K4	4
CO5	Apply a simple GUI application for a given scenario using AWT components and to access the backend Database using JDBC.	K3	5

PRE-REQUISITE	NILL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	**Programme Learning Outcomes (POs)**												**PSOs**	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2					1	3	3		3		2
CO2		2	1	2	2		1	1	3	3	1	3	1	
CO3		1						1	3	3	3	3	2	3
CO4	1		1	3			1	1	3	3		3	2	2
CO5	1	2	3		3		1	1	3	3	1	3		1

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Other Assessments (Assignment, Quiz etc.)
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**OVERVIEW OF JAVA**	**9**
Concepts of Object Oriented Programming – An Overview of Java – Data types, Variables and Arrays – Operators – Control statements – Classes – Methods..		
Topic - 2	**INHERITANCE AND EXCEPTION HANDLING**	**9**
Inheritance: Basics – Super keyword – Method Overriding – Dynamic Method dispatch – Abstract classes – final keyword. Packages and Interfaces: Packages – Access protection – Importing Packages – Interfaces - Exception Handling		
Topic - 3	**STRING HANDLING AND I/O**	**9**
Multithreading - String Handling: String Constructors – Special String Operations – Character Extraction – String comparison – Searching and Modifying a String – StringBuffer – StringTokenizer. Input/Output: The Stream Classes – The Byte Streams – The Character Streams – Serialization..		
Topic - 4	**COLLECTIONS**	**9**
Collections: List –ArrayList – Set – HashSet –TreeSet- Queue – PriorityQueue - Map – HashMap – Iterator – Enumerator- Wrapper Classes- Autoboxing and Unboxing- Regular Expressions.		
Topic - 5	**STREAM API AND JDBC**	**9**
Lambda Expression – Lambda Parameters - Functional Interfaces - Creating Thread- Stream API – Creating Java streams - Intermediate Operations: map – filter – sort – Terminal Operations: Collect – reduce – foreach - try with resources. Java Database Connectivity - Manipulating Databases with JDBC.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Herbert Schildt, “Java - The Complete Reference”, Ninth Edition, McGraw-Hill Education, 2014.
2	Rajkumar Buyya, S Thamarai Selvi, Xingchen Chu, “Object Oriented Programming with Java – Essentials and Applications”, McGraw-Hill Education, 2009..
3	Paul Deitel, Harvey Deitel, “Java How to Program”, Prentice Hall, Tenth Edition, 2014
4	Kathy Sierra, Bert Bates, “Head First Java”, Second Edition, O'Reilly Media, 2005..
5	“Java 6 Programming Black Book”, Kogent Learning Solutions Inc.,2007.

OTHER REFERENCES	
1	http://www.nptelvideos.com/video.php?id=1471&c=15
2	http://nptel.ac.in/courses/106105084/30,Java Programming,Prof. IndraNILL Sengupta, IIT kharagpur

Semester	Programme	Course Code	Course Name	L	T	P	C
		20CSO02	COMPUTER ARCHITECTURE	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
Upon completion of the course, students will be able to		**RBT Level**	**Topics Covered**
CO1	Analyze the performance and describe the instruction set using different addressing modes for a given computer architecture and organization.	K4	1
CO2	Develop the arithmetic operations involving addition, subtraction, division, multiplication and floating point number operations for a given computer organization.	K3	2
CO3	Classify the data path and describe the effect of data hazard, control hazard for a given pipeline processor.	K4	3
CO4	Apply the memory hierarchy and analyze the operation of cache memory for a given computer organization	K3	4
CO5	Compare the standard I/O interfaces and data transfer techniques to access I/O devices for the given computer system.	K4	5

PRE-REQUISITE	NILL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	**Programme Learning Outcomes (POs)**												**PSOs**	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2					1	3	3		3		2
CO2		2	1	2	2		1	1	3	3	1	3	1	
CO3		1						1	3	3	3	3	2	3
CO4	1		1	3			1	1	3	3		3	2	2
CO5	1	2	3		3		1	1	3	3	1	3		1

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Other Assessments (Assignment, Quiz etc.)
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**BASIC STRUCTURE OF COMPUTERS**	**9**
Functional Units – Basic Operational Concepts– Bus Structures - Instruction Set Architecture–RISC – CISC – Instructions and Instruction Sequencing– Addressing modes– Performance and Metrics.		
Topic - 2	**ARITHMETIC OPERATIONS**	**9**
Addition and Subtraction – Design of Fast Adders – Signed operand Multiplication – Fast Multiplication - Integer Division – Floating Point Numbers and Operations		
Topic - 3	**PROCESSOR AND CONTROL UNIT**	**9**
Basic concepts –Role of Cache Memory – Pipelining Performance – Types of Hazards- Data hazards – Instruction Hazards (prediction) – Data path and Control Considerations.		
Topic - 4	**MEMORY SYSTEMS**	**9**
Memory hierarchy – Speed , Size and Cost – Semiconductor RAM – ROM–Cache Memory – Mapping FUNCTIONS – Replacement Algorithms – Measuring Cache Performance.		
Topic - 5	**I/O ORGANIZATION**	**9**
Accessing I/O devices – Programmed Input / Output – Interrupts – Direct Memory Access –Buses – Interface circuits – Standard I/O Interfaces (PCI, SCSI, USB).		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	V.CarlHamacher, ZvonkoVaranesic and SafwatZaky, “Computer Organization“, 5 thEdition, McGraw-Hill Inc, 2012.
2	David A. Patterson and John L. Hennessey, “Computer organization and design“, Morgan Kauffman/ Elsevier, 5 th Edition, 2014.
3	M. Morris Mano, “Computer System Architecture”, 3rd Edition Pearson Education, 2017
4	William Stallings “Computer Organization and Architecture”, 10th Edition, Pearson Education, 2015.

OTHER REFERENCES	
1	http://nptel.ac.in/courses/106102062/1, “Computer Architecture”, Prof. Anshul Kumar, IIT- Delhi. .
2	http://nptel.ac.in/courses/106105084/30,Java Programming,Prof. IndraNILL Sengupta, IIT kharagpur

Semester	Programme	Course Code	Course Name	L	T	P	C
		20CSO03	DATA STRUCTURES	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
Upon completion of the course, students will be able to		**RBT Level**	**Topics Covered**
CO1	List ADT for a given list or table using array and linked list implementation by ensuring the ordering of data elements.	K4	1
CO2	Develop stack and queue ADT for a given list using array and linked list implementation and apply specific ADT for a given application	K3	2
CO3	Examine a tree for a given list of data by ensuring tree properties and analyze inorder, preorder, postorder traversal for a constructed tree.	K4	3
CO4	Discover a suitable shortest path algorithm for a given graph such that the sum of the edges weights is minimum.	K4	4
CO5	Apply a suitable searching and hashing algorithms for a given list of data considering the size and ordering of data.	K3	5

PRE-REQUISITE	NILL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	**Programme Learning Outcomes (POs)**												**PSOs**	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2					1	3	3		3		2
CO2		2	1	2	2		1	1	3	3	1	3	1	
CO3		1						1	3	3	3	3	2	3
CO4	1		1	3			1	1	3	3		3	2	2
CO5	1	2	3		3		1	1	3	3	1	3		1

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Other Assessments (Assignment, Quiz etc.)
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**LISTS**	**9**
Abstract Data Types (ADT) – List ADT – Array-Based Implementation – Linked List Implementation– Singly Linked Lists- Circularly Linked Lists -Doubly-Linked Lists – Applications of Lists...		
Topic - 2	**STACKS AND QUEUES**	**9**
Stack ADT – Queue ADT – Circular Queue – Applications of Stacks and Queues.		
Topic - 3	**TREES**	**9**
Preliminaries - Binary Trees - Binary Tree Traversal - Binary Search Trees- Expression Trees - AVL Trees-Binary Heap - Heap Sort		
Topic - 4	**GRAPHS**	**9**
Definitions–Graph Traversal- Topological Sort– Shortest-Path Algorithms: Unweighted Shortest PathsDijikstra‟s Algorithm– Minimum Spanning Tree– Prim‟s and Kruskal‟s Algorithms– Undirected Graphs		
Topic - 5	**SEARCHING AND HASHING**	**9**
Searching: Linear Search – Binary Search. Hashing – General idea-Hash Function- Separate Chaining – Open Addressing: Linear Probing – Quadratic Probing- Double Hashing.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	M. A. Weiss, “Data Structures and Algorithm Analysis in C”, Second Edition, Pearson Education, 2015..
2	Richard F. Gilberg, and Behrouz A. Forouzan, “Data Structures - A Pseudocode Approach with C”, Second Edition, Thomson Brooks/cole, 2011.
3	Reema Thareja, “Data Structures Using C”, First Edition,Oxford University Press, 2011
4	ISRD Group, “Data Structures Using C”, First Edition, McGraw Hill Education (India) Private Limited, New Delhi, 2007.
5	“ Data Structures through C, Yashwant Kanetkar, BPB Publications.

OTHER REFERENCES	
1	http://www.nptel.ac.in/courses/106102064, Introduction to data structure, Mr.Varma, IIT Bombay
2	http://nptel.ac.in/courses/106102064, Video Lectures, Data Structures and Algorithms, IIT Delhi.

Semester	Programme	Course Code	Course Name	L	T	P	C
		20CSO04	OPERATING SYSTEM	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
Upon completion of the course, students will be able to		**RBT Level**	**Topics Covered**
CO1	Construct the structure and functions of Operating Systems for multiuser environment considering Linux process and thread management as a case study.	K3	1
CO2	Evaluate the process scheduling algorithms for a given set of process considering the arrival time, burst time and resources	K5	2
CO3	Analyze the memory allocation techniques and page replacement algorithms for a given reference strings with minimum page fault...	K4	3
CO4	Analyze file allocation methods for efficient file organization considering Linux virtual file system as a case study.	K4	4
CO5	Examine the disk scheduling algorithms with minimum seek time for a given disk request and analyze the architecture of iOS and Android Mobile Operating Systems.	K4	5

PRE-REQUISITE	NILL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	**Programme Learning Outcomes (POs)**												**PSOs**	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3		1					1	3	3		3		1
CO2		3		3			1	1	3	3	1	3	2	
CO3			2		3		1	1	3	3		3		3
CO4	2					2		1	3	3	2	3	2	
CO5		1					1	1	3	3	3	3		1

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Other Assessments (Assignment, Quiz etc.)
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	OPERATING SYSTEMS AND PROCESS MANAGEMENT	**9**
Operating System Overview: Objectives and Functions – Evolution of Operating Systems – Computer Organization – Operating System Operations – Services – System Calls – System Programs – Operating System Structure – OS Generation – System Boot. Processes: Process concept – Process scheduling – Operations on processes – Inter process communication – Threads: Overview – Multicore Programming – Multithreading Models. Case Study: Linux Process and Thread Managementds..		
Topic - 2	PROCESS SCHEDULING AND SYNCHRONIZATION	**9**
CPU Scheduling: Concepts – Scheduling criteria – Scheduling algorithms. Process Synchronization: The criticalsection problem – Synchronization hardware – Semaphores – Classic problems of synchronization – Monitors. Deadlocks: System model – Deadlock characterization – Methods for handling deadlocks – Deadlock prevention – Deadlock avoidance – Deadlock detection – Recovery from deadlock. Case Study: Linux Scheduling		
Topic - 3	MEMORY MANAGEMENT	**9**
Main Memory: Background – Swapping – Contiguous memory allocation – Paging – Segmentation. Virtual Memory: Background – Demand paging – Page replacement – Allocation of frames – Thrashing. Case Study: Linux Memory Management.		
Topic - 4	FILE SYSTEMS	**9**
File-System Interface: File concept – Access methods – Directory and disk structure – File-system mounting – Sharing and Protection. File-System Implementation: Structure and Implementation – Directory implementation – Allocation methods – Free-space management. Case Study: Linux Virtual File System.		
Topic - 5	I/O SYSTEMS	**9**
I/O Systems: I/O Hardware - Mass Storage Structure: Overview, Disk Structure and Attachment - Disk Scheduling and Management – Swap-space management – RAID. Mobile OS:iOS and Android – Architecture and SDK Framework, Media Layer, Services Layer, Core OS Layer, File System.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Abraham Silberschatz, Peter Baer Galvin, and Greg Gagne, “Operating System Concepts”, 9th Edition, John Wiley and Sons Inc., 2013.
2	William Stallings, “Operating Systems – Internals and Design Principles”, 7th Edition, Prentice Hall, 2011.
3	Andrew S. Tanenbaum, “Modern Operating Systems”, Third Edition, Pearson Education, 2009.
4	Harvey M. Deital, “Operating Systems”, Third Edition, Pearson Education, 2004.
5	D M Dhamdhere, “Operating Systems: A Concept-Based Approach”, 3rd Edition, Tata McGraw-Hill Education, 2007

OTHER REFERENCES	
1	http://nptel.ac.in/courses/106108101/ “Introduction to operating system”, Prof P.C.P. Bhatt , IISc-Bangalore

Semester	Programme	Course Code	Course Name	L	T	P	C
		20CSCT5	PYTHON PROGRAMMING	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Classify and make use of python programming elements to solve and debug simple logical problems.	K2	1
CO2	Experiment with the various control statements in Python.	K3	2
CO3	Develop python programs using functions and strings.	K3	3
CO4	Experiment with the usage of pointers and functions.	K3	4
CO5	Analyze a problem and use appropriate packages and modules to solve it.	K4	5

PRE-REQUISITE	NILL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		3			2	3	2	3	3	3	3	3		
CO2			2			3	2	3	3	3	3	3		
CO3			2			3	2	3	3	3	3	3		2
CO4			2		2	3	2	3	3	3	3	3	2	2
CO5	3	3	2			3	2	3	3	3	3	3		

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Other Assessments (Assignment, Quiz etc.)
	3	End Semester Examinations
INDIRECT	1	Course End Survey

COURSE CONTENT		
Topic - 1	**BASICS OFPYTHONPROGRAMMING**	**9**
Introduction - Python Interpreter - Interactive and script mode -Values and types, operators, expressions, statements, precedence of operators, Multiple assignments, comments.		
Topic - 2	**CONTROL STATEMENTS AND FUNCTIONS IN PYTHON**	**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.		
Topic - 3	**DATA STRUCTURES: STRINGS,LISTSAND SETS**	**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, Sets - creating sets, set operations		
Topic - 4	**DATASTRUCTURESTUPLES,DICTIONARIES**	**9**
Tuples - Tuple assignment, Operations on Tuples, lists and tuples, Tuple as return value – Dictionaries - operations and methods, Nested Dictionaries.		
Topic - 5	**FILES,MODULES,PACKAGES**	**9**
Files and exception: text files, reading and writing files format operator-Command line arguments-errors and exceptions-handling exceptions –Modules-Packages-illustrative programs-word count-copy file.		

THEORY	**45**	**TUTORIAL**	**0**	**PRACTICAL**	**0**	**TOTAL**	**45**

BOOK REFERENCES	
1	Ashok NamdevKamthane,Amit Ashok Kamthane, “Programming andProblem Solving with Python” , Mc-Graw Hill Education,2018.
2	Allen B. Downey, “Think Python: How to Think Like a Computer Scientist”, Second edition, Updated for Python 3, Shroff / O’Reilly Publishers,2016.
3	Robert Sedgewick, Kevin Wayne, Robert Dondero, “Introduction to Programming in Python: An Inter-disciplinary Approach”, Pearson India Education Services Pvt.Ltd.,2016.
4	Timothy A. Budd,” Exploring Python”, Mc-Graw Hill Education (India) Private Ltd.,2015.
5	Kenneth A. Lambert, “Fundamentals of Python: First Programs”, CENGAGE Learning,2012.

OTHER REFERENCES	
1	https://www.coursera.org/specializations/python
2	https://www.youtube.com/watch?v=rfscVS0vtbw
3	https://nptel.ac.in/courses/106/106/106106212/

Semester	Programme	Course Code	Course Name	L	T	P	C
		20CSO06	CLOUD COMPUTING	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
Upon completion of the course, students will be able to		**RBT Level**	**Topics Covered**
CO1	Analyze and identify a specific cloud deployment model and delivery model to adopt for any given cloud application.	K4	1
CO2	List the role of data center, virtualization, web, multitenant and service technologies in providing resilient, elastic and cost-efficient computing for a given cloud system..	K4	2
CO3	Plan and identify the required cloud computing mechanisms to deploy in cloud architectures when developing a given cloud application	K3	4
CO4	Explain and evaluate the ability of cloud computing architectures to meet a set of requirements for a given business application	K2	5
CO5	Inspect suitable security mechanism to provide security for a given cloud application.	K4	3

PRE-REQUISITE	NILL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	**Programme Learning Outcomes (POs)**												**PSOs**	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	2		2			1	3	3		3		2
CO2	2		1	2	1	1	1	1	3	3	1	3	2	
CO3		3						1	3	3	3	3	2	1
CO4	1		1	1			1	1	3	3		3	1	2
CO5	1	2			3	2	1	1	3	3	1	3		3

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Other Assessments (Assignment, Quiz etc.)
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**UNDERSTANDING CLOUD COMPUTING**	**9**
Introduction to Cloud Computing – Definition of Cloud – Evolution of Cloud Computing – Underlying Principles of Parallel and Distributed Computing – Cloud Characteristics – Elasticity in Cloud – Ondemand Provisioning.		
Topic - 2	**CLOUD ENABLING TECHNOLOGY**	**9**
ServiceOriented Architecture–RESTandSystemsofSystems– Web Services–Publish-Subscribe Model – Basics of Virtualization – Types of Virtualization – Implementation Levels ofVirtualization–VirtualizationStructures–ToolsandMechanisms–VirtualizationofCPU–Memory–I/ODevices–VirtualizationSupportand DisasterRecovery.		
Topic - 3	**CLOUD COMPUTING MECHANISM**	**9**
Layered Cloud Architecture Design – NIST Cloud Computing Reference Architecture – Public, Private and Hybrid Clouds - laaS – PaaS – SaaS – Architectural Design Challenges – Cloud Storage – Storage-as-a-Service – Advantages of Cloud Storage – Cloud Storage Providers – S3.		
Topic - 4	**CLOUD COMPUTING ARCHITECTURE**	**9**
Inter Cloud Resource Management – Resource Provisioning and Resource Provisioning Methods – Global Exchange of Cloud Resources – Security Overview – Cloud Security Challenges – Software-asa-Service Security – Security Governance – Virtual Machine Security – IAM – Security Standards.		
Topic - 5	**SECURITY IN THE CLOUD**	**9**
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.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Thomas Erl, ZaighamMahood, Ricardo Puttini, “Cloud Computing, Concept, Technology and Architecture”, Prentice Hall, 2013..
2	K.Chandrasekaran, “Essentials of Cloud Computing”, CRC Press, 2015.
3	Kai Hwang, Geoffrey C Fox, Jack J.Dongarra, “Distributed and Cloud Computing, From Parallel Processing to the Internet of Things”, Morgan Kaufmann Publishers,2012
4	Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, ―Mastering Cloud Computing‖, Tata McGrawHill, 2013.
5	“ ArshdeepBahga, Vijay Madisetti, ―Cloud Computing: A Hands-On Approach‖, Universities Press, 2014..

Semester	Programme	Course Code	Course Name	L	T	P	C
		20CSO07	ARTIFICIAL INTELLIGENCE	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
Upon completion of the course, students will be able to		**RBT Level**	**Topics Covered**
CO1	Apply a suitable set of production rules or apply constraint satisfaction technique to solve a given problem in AI.	K3	1
CO2	Discover the appropriate search strategy to find an optimal solution for a given AI problem.	K4	2
CO3	Apply resolution procedure to derive conclusion from the given set of statements in knowledge representation	K3	3
CO4	Inspect Bayesian theory, Bayesian networks, Dumpster Shafer theory for probabilistic reasoning to handle uncertainty.	K4	4
CO5	Explain the ability of AI to solve problems in the areas of Natural Language Processing and Robotics.	K2	5

PRE-REQUISITE	NILL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	**Programme Learning Outcomes (POs)**												**PSOs**	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2				1	1	3	3		3	2	3
CO2	3	3		2				1	3	3		3		
CO3	3	2				2	1	1	3	3		3		
CO4	2	3		2			1	1	3	3		3		
CO5	2	2						1	3	3		3	2	2

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Other Assessments (Assignment, Quiz etc.)
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**INTELLIGENT AGENTS**	**9**
Introduction- What is AI-Why AI? -Foundation of AI- History of AI- Intelligent Agents: Agents and Environments - Characteristics–Structure of Agents. Problem formulation-Production systems-Problem characteristics-Production system characteristics- Constraints Satisfaction Problems.		
Topic - 2	**PROBLEM SOLVING METHODS**	**9**
Search Strategies- Uninformed Search strategies :BFS-Uniform-cost search-DFS-Iterative Deepening DFS Bidirectional Search. Informed Search strategies: Greedy BFS-A* search– Local Search Algorithms and Optimization Problems.		
Topic - 3	**KNOWLEDGE REPRESENTATION**	**9**
Knowledge Representation -Using Predicate logic :Representing simple facts-Representing instance and ISA re relationships-Computable functions and predicates- Resolution – Forward chaining - Backward chaining.		
Topic - 4	**UNCERTAINITY AND PROBABLISTIC REASONING**	**9**
Uncertainty: Acting under Uncertainty-Inference using Full Joint Distributions -Bayes' rule. Probabilistic Reasoning: Semantics of Bayesian networks-Exact Inference- Dempster- Shafer theory-Fuzzy set and fuzzy logic		
Topic - 5	**AI APPLICATIONS**	**9**
Natural Language Processing: Information Retrieval- Information Extraction–Speech Recognition .Robotics : Hardware – Perception – Planning – Moving.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Stuart Russel and Peter Norvig "Artificial Intelligence – A Modern Approach", 3rd Edition, Pearson Education.
2	Kevin Night and Elaine Rich, Nair B., "Artificial Intelligence (SIE)", 3 rd Edition, McGraw Hill-2008
3	Deepak Khemani ,"A First Course in Artificial Intelligence", Tata Mc Graw Hill Education 2013.
4	NILLs J. NILLsson, ―The Quest for Artificial Intelligence‖, Cambridge University Press, 2009.
5	" M. Tim Jones, ―Artificial Intelligence: A Systems Approach(Computer Science)‖, Jones and Bartlett Publishers, Inc.; First Edition, 2008.

OTHER REFERENCES	
1	http://nptel.ac.in/courses/106106126/1,"Introduction, State space search, Heuristic search, problem decomposition, Planning, Constraint satisfaction", Prof. Deepak Khemani, Department of Computer Science and Engineering, IIT, Madras.

Semester	Programme	Course Code	Course Name	L	T	P	C
		20IT6T1	BIG DATA ANALYTICS	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
Upon completion of the course, students will be able to		**RBT Level**	**Topics Covered**
CO1	Identify the type of data based on the characteristics of datasets, compare trivial data with big data and explain the lifecycle of data analytics for real world applications.	K2	1
CO2	Discover the storage and processing techniques for big data and apply them for a given scenario using Hadoop..	K4	2
CO3	Analyze big data using quantitative, qualitative and machine learning approaches and implement regression, clustering and classification algorithm for a given big data application.	K4	3
CO4	Build data models and computing models used for data analytics and apply predictive modeling for processing unstructured data.	K3	4
CO5	Develop analytical models for financial services, banking and recommender systems using marketing analysis, sentiment analysis and predictive analysis	K3	5

PRE-REQUISITE	NILL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	**Programme Learning Outcomes (POs)**												**PSOs**	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2						1	3	3		3		
CO2	3	2						1	3	3		3		
CO3	3	3	3		2			1	3	3		3	2	2
CO4	3	2			1			1	3	3		3		
CO5	3	2	3		2			1	3	3		3		2

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Other Assessments (Assignment, Quiz etc.)
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**FUNDAMENTALS OF BIG DATA**	**9**
Understanding Big Data: Concepts and Terminology, Big Data Characteristics, Different Types of Data – Big Data Analytics Lifecycle - Enterprise Technologies and Big Data Business Intelligence. Case Study: Identifying data characteristics and types of data.		
Topic - 2	**STORING AND PROCESSING BIG DATA**	**9**
Big Data Storage Concepts: Clusters, File Systems and Distributed File Systems, NoSQL, Sharding, Replication, CAP Theorem, ACID, BASE - Big Data Processing Concepts: Parallel Data Processing, Distributed Data Processing, Hadoop, Processing Workloads, Cluster, Processing in Batch Mode, Processing in Realtime Mode - Big Data Storage Technology: On-Disk Storage Devices, In-Memory Storage Devices..		
Topic - 3	**BIG DATA ANALYSIS**	**9**
Quantitative Analysis – Qualitative Analysis – Data Mining – Statistical Analysis – Machine Learning – Semantic Analysis – Visual Analysis – Case Study : Correlation – Regression – Time Series Plot – Clustering – Classification.		
Topic - 4	**ANALYTICS MODELS – PREDICTIVE MODELING**	**9**
Introduction – Data Models – Computing Models. Predictive Modeling for Unstructured Data: Introduction – Applications of Predictive Modeling – Featured Engineering – Pattern Mining.		
Topic - 5	**APPLICATIONS FOR BIG DATA ANALYTICS**	**9**
Big Data Analytics for Financial Services and Banking: Introduction – Customer insights and marketing analysis – Sentiment Analysis – Predictive Analytics – Model Building – Fraud detection and Risk Management – Integration of Big Data Analytics into operations. Big Data Analytics and Recommender Systems: Introduction – Background – Overview – Evaluations of Recommenders – Issues..		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	C.S.R. Prabhu, Aneesh SreevallabhChivukula, Aditya Mogadala, Rohit Ghosh, L.M. JeNILLa, “Big Data Analytics: Systems, Algorithms, Applications”, First edition, Springer, 2019.
2	Paul Buhler, Wajid Khattak, Thomas Erl, “Big Data Fundamentals: Concepts, Drivers & Techniques”, Second Edition, Prentice Hall, 2016.
3	ANILL Maheshwari, “Data Analytics” , First Edition, Tata Mcgraw Hill, 2017.
4	Venkat Ankam, “Big Data Analytics”, First Edition, Packt Publishing Limited, 2016.
5	Seema Acharya, Subhashini Chellappan, “Big Data and Analytics”, First Edition, Wiley, 2015.

OTHER REFERENCES	
1	https://onlinecourses.nptel.ac.in/noc16_mg06, “Introduction to Data Analytics”, Dr. Nandan Sudarsanam, Dr. Balaraman Ravindran, IIT- Madras
2	https://nptel.ac.in/courses/106104135/48, “Big Data”, Prof.ArnabBhattaacharya, IIT-Kanpur.
3	https://lecturenotes.in/subject/884/big-data-analysis-bda/note
4	https://www.youtube.com/watch?v=pkPdhznqEI4

Semester	Programme	Course Code	Course Name	L	T	P	C
		20CSO09	INTERNET OF THINGS	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Classify the basics of Electrical circuits and Electronic devices	K2	1
CO2	Identify the IQT characteristics and its essential components	K3	2
CO3	Determine Arduino processor and working of Analog and Digital I/O pins	K5	3
CO4	Outline the basic of designing an IOT applications using Rasperry Pi.	K3	4
CO5	Analyse and categorize and know to implement various sensors.	K4	5

PRE-REQUISITE	NILL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	-	-	-	2	2	3	3	2	3	-	-
CO2	1	2	3	2	2	-	2	2	3	3	-	3	-	2
CO3	3	2	2	-	-	-	2	2	3	3	2	3	-	2
CO4	1	3	2	2	-	-	2	2	3	3	-	3	2	-
CO5	3	2	-	-	-	-	2	2	3	3	3	3	-	2

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Other Assessments (Assignment, Quiz etc.)
	3	End Semester Examinations
INDIRECT	1	Course End Survey

COURSE CONTENT		
Topic - 1	**BASIC ELECTRICAL CIRCUITS AND ELECTRONICS**	**9**
Introduction – Current, voltage and resistance – Analog and Digital Signal – Basic Electronics components – Ohm's law – Colour coding for a resistor – LED – LCD – LDR.		
Topic - 2	**INTRODUCTION TO INTERNET OF THINGS**	**9**
Introduction – Definition and characteristics of Internet of Things – General block diagram and essential of IOT – Role of microprocessor & Micro controller – communication of things – IOT connection with internet		
Topic - 3	**ARDUINO PROCESSOR**	**9**
Introduction to Arduino processor – General block diagram – Working of Analog and Digital I/O pins, I2C Communications and SPI communication – Prototyping basics – Technical description – Introduction to Arduino programming.		
Topic - 4	**RASPERRY PI**	**9**
Technical Description of Raspberry Pi – comparison of Raspberry Pi Vs Arduino – Operating Systems for RPi – Preparing SD card for Pi – Connecting Raspberry Pi Environment – Logical design using Python		
Topic - 5	**APPLICATIONS OF IOT**	**9**
Various Real time applications of IOT – Automation – Smart parking – Environment : Weather monitoring system – Agriculture : Smart irrigation – Domain Specific applications		

THEORY	**45**	**TUTORIAL**	**0**	**PRACTICAL**	**0**	**TOTAL**	**45**

BOOK REFERENCES	
1	Muthusubramanian R, Salivahanan S and Muraleedaharan K A . : "Basic Electrical , Electronics and Computer Engineering ",Tata McgrawHill,second Edition.(2006
2	Olivier Hersent , David Boswarthick, Omar Elloumi , " The Internet of Things : Key applications and protocols " Willey Publications 2nd edition,2013.
3	Marco Schwartz – Internet od Things with the Arduino Yun,Packt Publishing ,2014
4	Adrian McEwen,Hakimcassimally, "Designing the Internet of Things ",Willey Publications 2012.

OTHER REFERENCES	
1	https://en.wikipedia.org/wiki/Internet_of_things
2	https://builtin.com/internet-things
3	https://youtu.be/LlhmzVL5bm8
4	https://youtu.be/6mBO2vqLv38?t=3