



# **NEW HORIZON COLLEGE OF ENGINEERING**

Autonomous College, Affiliated to VTU | Approved by AICTE New Delhi & UGC  
Accredited by NAAC with 'A' Grade & Accredited by NBA



**DEPARTMENT OF  
ARTIFICIAL INTELLIGENCE AND MACHINE  
LEARNING  
BATCH:2020-24  
CREDITS:175  
[2018 Scheme]**



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**DEPARTMENT OF  
ARTIFICIAL INTELLIGENCE  
AND  
MACHINE LEARNING**

**1<sup>st</sup> to 8<sup>th</sup> Semester Scheme & Syllabus  
Academic Year 2023-2024**

**BATCH:2020-24**

**CREDITS:175**

**[2018 Scheme]**

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	h) Data Visualization Lab	
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# **INSTITUTION**

## **Vision**

**To emerge as an institute of eminence in the fields of engineering, technology and management in serving the industry and the nation by empowering students with a high degree of technical, managerial and practical competence.**

## **Mission**

**To strengthen the theoretical, practical and ethical dimensions of the learning process by fostering a culture of research and innovation among faculty members and students.**

**To encourage long-term interaction between the academia and industry through their involvement in the design of curriculum and its hands-on implementation.**

**To strengthen and mould students in professional, ethical, social and environmental dimensions by encouraging participation in co-curricular and extracurricular activities.**

## **Quality Policy**

**To provide educational services of the highest quality both curricular and co-curricular to enable students integrate skills and serve the industry and society equally well at global level**

## **Values**

- ❖ Academic Freedom
- ❖ Innovation
- ❖ Integrity
- ❖ Professionalism
- ❖ Inclusiveness
- ❖ Social Responsibility

## DEPARTMENT OF AI & ML

### Vision

To develop an outstanding AI and ML professionals with profound practical, research & managerial skills to meet ever changing Industrial Social and Technological needs of the Society

### Mission

To provide strong theoretical foundations and hands-on competence in Artificial Intelligence and Machine Learning, fostering research, innovation, and technical excellence in alignment with industry and national needs.

To establish sustainable academia–industry collaboration for curriculum enrichment, real-time problem solving, internships, and emerging AI technology implementation.

To develop ethically responsible, socially conscious, and environmentally aware AI professionals through holistic learning and active participation in co-curricular and professional activities.

### Program Educational Objectives (PEOs)

<b>PEO1</b>	Graduates will build successful careers in Artificial Intelligence and Machine Learning by applying strong theoretical foundations, analytical skills, and modern tools to solve complex industrial and societal problems.
<b>PEO2</b>	Graduates will pursue higher education, research, entrepreneurship, or leadership roles in emerging AI technologies through continuous learning, innovation, and industry collaboration.
<b>PEO3</b>	Graduates will demonstrate ethical responsibility, environmental awareness, and social consciousness while developing and deploying AI solutions for sustainable societal impact.

### PEO to Mission Statement Mapping

Mission Statements	PEO1	PEO2	PEO3
To provide strong theoretical foundations and hands-on competence in Artificial Intelligence and Machine Learning, fostering research, innovation, and technical excellence in alignment with industry and national needs.	✓	✓	-
To establish sustainable academia–industry collaboration for curriculum enrichment, real-time problem solving, internships, and emerging AI technology implementation	✓	✓	-
To develop ethically responsible, socially conscious, and environmentally aware AI professionals through holistic learning and active participation in co-curricular and professional activities.	-	-	✓

## Program Outcomes (POs) with Graduate Attributes

- P01** **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- P02** **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems in reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- P03** **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.
- P04** **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.
- P05** **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.
- P06** **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.
- P07** **Environment and Sustainability:** Understand the impact of the professional engineering solution in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- P08** **Ethics:** Apply ethical principles and commit to professional ethics, responsibilities, and norms of the Engineering practice.
- P09** **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- P010** **Communication Skills:** Communicate effectively on complex engineering activities with the engineering community and with society, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- P011** **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.
- P012** **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)

**A graduate of the Artificial Intelligence and Machine Learning Program will demonstrate:**

**PSO1:** Ability to design, develop, and deploy intelligent systems using machine learning algorithms, deep learning architectures, data analytics, and AI frameworks to address real-world applications.

**PSO2:** Ability to analyze large-scale data, interpret model outcomes, and implement responsible, secure, and ethical AI solutions aligned with industry standards and societal needs.

**I SEMESTER – PHYSICS  
CYCLE**

S.No	Course Code	Course	BOS	Credit Distribution				Overall Credits	Contact Hours	Marks		
				L	T	P	S			CIE	SEE	Total
1	19MAT11A	Applied Mathematics-I	BS	2	1	0	0	3	4	50	50	100
2	19PHY12A	Engineering Physics	BS	3	0	0	0	3	3	25	25	50
3	19MEE13A	Elements of Mechanical Engineering	HSS	3	0	0	0	3	3	25	25	50
4	19CIV14A	Elements of Civil Engineering	CV	3	0	0	0	3	3	50	50	100
5	19EEE15A	Basic Electrical Engineering	EE	3	0	0	0	3	3	50	50	100
6	19PHL16A	Engineering Physics Lab	BS	0	0	2	0	2	4	50	50	100
7	19PEE17A	Basic Electrical Engineering Lab	EE	0	0	2	0	2	4	25	25	50
8	19HSS171A	Essential English	HSS	Mandatory Course			0	0	2	25	25	50
<b>Total</b>								<b>19</b>	<b>26</b>	<b>325</b>	<b>325</b>	<b>650</b>

## II SEMESTER- CHEMISTRY CYCLE

S.No	Course Code	Course	BOS	Credit Distribution				Overall Credits	Contact Hours	Marks			
				L	T	P	S			CIE	CEE	SEE	Total
1	19MAT21A	Applied Mathematics-II	BS	2	1	0	0	3	4	50	50	50	100
2	19CHE22A	Engineering Chemistry	BS	3	0	0	0	3	3	50	50	50	100
3	19CSE23A	Introduction to Programming with C	CSE	3	0	0	0	3	3	50	50	50	100
4	19MEE24A	Computer Aided Engineering Drawing	ME	1	0	2	0	3	5	50	50	50	100
5	19ECE25A	Basic Electronics	ECE	3	0	0	0	3	3	50	50	50	100
6	19CHL27A	Engineering Chemistry Lab	BS	0	0	2	0	2	4	25	25	25	50
7	19CSL28A	Programming with C Lab	CSE	0	0	2	0	2	4	25	25	25	50
8	19HSS271A	Professional Communication	HSS	2	0	0	0	2	2	25	25	25	50
9	19HSS272A	Constitution of India and Professional Ethics	HSS	Mandatory Course			0	0	2	25	25	25	50
<b>Total</b>								<b>21</b>	<b>30</b>	<b>350</b>	<b>350</b>	<b>350</b>	<b>700</b>

### III SEMESTER-SCHEME

S.No	Course Code	Course	BOS	Credit Distribution				Overall Credits	Contact Hours	Marks		
				L	T	P	S			CIE	SEE	Total
1	20AIM31A	Applied Mathematics-III	BS	2	1	0		3	4	50	50	100
2	20HSS324/ 20HSS325	Aadalitha Kannada / Vyavaharika Kannada	HSS	1	0	0	0	1	2	25	25	50
3	20HSS321A	Economics for Engineers	HSS	2	0	0	0	2	2	25	25	50
4	20AIM33A	Digital Electronics	AI&ML	3	0	0		3	3	50	50	100
5	20AIM34A	Data Structures using C	AI&ML	3	0	0		3	3	50	50	100
6	20AIM35A	Python Programming	AI&ML	3	0	0	0	3	3	50	50	100
7	20AIL36A	Digital Electronics Lab	AI&ML	0	0	2		2	4	25	25	50
8	20AIL37A	Data Structures using C Lab	AI&ML	0	0	2		2	4	25	25	50
9	20AIL38A	Python Programming Lab	AI& ML	0	0	2	0	2	4	25	25	50
10	20AIM39A	Mini Project - I	AI& ML	0	0	2	0	2	0	25	25	50
11	20DMAT31 A*	Basic Applied Mathematics-1	BS	0	0	0	0	0	2	25	25	50
12	19HSS171*	Essential English	BS	0	0	0	0	0	2	25	25	50
<b>Total</b>								<b>23</b>	<b>29/33*</b>	<b>350/ 400*</b>	<b>350/ 400*</b>	<b>700/ 800*</b>

\*For Lateral Entry Students Only

### IV SEMESTER-SCHEME

S.No	Course Code	Course	BOS	Credit Distribution				Overall Credits	Contact Hours	Marks		
				L	T	P	S			CIE	SEE	Total
1	20AIM41A	Mathematical Statistics	BS	2	1	0	0	3	4	50	50	100
2	20HSS422A	Life skills for Engineers	HSS	3	0	0	0	3	3	50	50	100
3	20HSS423A	Environmental Science and Awareness	HSS	Mandatory Course				0	2	25	25	50
4	20AIM43A	Introduction to Data Science	AI&ML	3	0	0	0	3	3	50	50	100
5	20AIM44A	Object Oriented Programming with Java	AI&ML	3	0	0	0	3	3	50	50	100
6	20AIM45A	Database Management System	AI&ML	3	0	0	0	3	3	50	50	100
7	20AIL46A	Object Oriented Programming with Java Lab	AI&ML	0	0	2	0	2	4	25	25	50
8	20AIL47A	Database Management System Lab	AI&ML	0	0	2	0	2	4	25	25	50
9	20AIM48A	Mini Project - II	AI&ML	0	0	2	0	2	0	25	25	50
10	20DMAT41A*	Basic Applied Mathematics-2	BS	0	0	0	0	0	2	25	25	50
11	19HSS272*	Constitution of India & Professional Ethics	BS	0	0	0	0	0	2	25	25	50
<b>Total</b>								<b>21</b>	<b>26/30*</b>	<b>350/400*</b>	<b>350/400*</b>	<b>700/800*</b>

\*For Lateral Entry Students Only

### V SEMESTER

S.No	Course Code	Course	BOS	Credit Distribution				Overall Credits	Contact Hours	Marks		
				L	T	P	S			CIE	SEE	Total
1	20AIM51A	Machine Learning	AI&ML	3	0	0	0	3	4	50	50	100
2	20AIM52A	Operating system	AI&ML	3	0	0	0	3	4	50	50	100
3	20AIM53A	Big data Technologies	AI&ML	3	0	0	0	3	4	50	50	100
4	20AIM54XA	Professional Elective - I	AI&ML	3	0	0	0	3	4	50	50	100
5	20AIM55XA	Professional Elective- II	AI&ML	3	0	0	0	3	4	50	50	100
6	20AIM56A	Design and Analysis of Algorithm	AI&ML	3	0	0	0	3	4	50	50	100
7	20AIL57A	Machine Learning Laboratory	AI&ML	0	0	2	0	2	4	25	25	50
8	20AIL58A	Design and Analysis of Algorithm Laboratory	AI&ML	0	0	2	0	2	4	25	25	50
9	20AIM59A	Mini Project - III	AI&ML	0	0	2	0	2	2	25	25	50
<b>Total</b>								<b>24</b>	<b>34</b>	<b>375</b>	<b>375</b>	<b>750</b>

S. NO	COURSE CODE	PROFESSIONAL ELECTIVE-1	S. NO	COURSE CODE	PROFESSIONAL ELECTIVE-2
1	20AIM541A	Information Storage and Retrieval	1	20AIM551A	Speech Synthesis and Recognition
2	20AIM542A	Introduction to sensor and IOT	2	20AIM552A	Embedded Systems
3	20AIM543A	Theory of Computation	3	20AIM553A	Software Engineering
4	20AIM544A	Parallel Processing	4	20AIM554A	Cryptography and Network Security

## VI SEMESTER

S.No	Course Code	Course	BOS	Credit Distribution				Overall Credits	Contact Hours	Marks		
				L	T	P	S			CIE	SEE	Total
1	20AIM61A	Deep Learning Techniques	AI&ML	3	0	0	0	3	4	50	50	100
2	20AIM62A	Data Visualization	AI&ML	3	0	0	0	3	4	50	50	100
3	20AIM63A	Artificial Intelligence	AI&ML	3	0	0	0	3	4	50	50	100
4	20NHOPXX	Open Elective - I	AI&ML	2	0	1	0	3	4	50	50	100
5	20AIM64XA	Professional Elective - III	AI&ML	3	0	0	0	3	4	50	50	100
6	20AIM65XA	Professional Elective - IV	AI&ML	3	0	0	0	3	4	50	50	100
7	20AIL66A	Deep Learning Laboratory	AI&ML	0	0	2	0	2	4	25	25	50
8	20AIL67A	Data Visualization Laboratory	AI&ML	0	0	2	0	2	4	25	25	50
9	20AIM68A	Mini Project - IV	AI&ML	0	0	2	0	2	2	25	25	50
<b>Total</b>								<b>24</b>	<b>34</b>	<b>375</b>	<b>375</b>	<b>750</b>

Professional Elective - III		Open Elective - I	
Course Code	Course	Course Code	Course
20AIM641A	Biometrics	NHOP01	Big Data Analytics using HP Vertica-1
20AIM642A	Soft Computing	NHOP02	VM Ware Virtualization Essentials-1
20AIM643A	Compiler Design	NHOP04	Big Data Analytics using HP Vertica-2
20AIM644A	Computer Networks	NHOP05	VM Ware Virtualization Essentials-2

Professional Elective - IV		NHOP07	SAP
20AIM651A	Augmented & Virtual Reality	NHOP08	Schneider-Industrial Automation
20AIM652A	Pattern Recognition & Image Processing	NHOP09	Cisco-Routing and Switching-1
20AIM653A	Advanced Java	NHOP10	Data Analytics
20AIM654A	Block chain Technologies	NHOP12	CISCO-Routing and switching-2
		NHOP13	IIOT Embedded Systems
		NHOP14	Block chain
		NHOP15	Product Life Cycle Management

## VII SEMESTER

S. No	Course Code	Course	BOS	Credit Distribution				Overall Credits	Contact Hours	Marks		
				L	T	P	S			CIE	SEE	Total
1	20AIM71A	Cloud Computing	AI&ML	3	0	0	0	3	4	50	50	100
2	20AIM72A	Web Technology	AI&ML	3	0	0	0	3	4	50	50	100
3	20AIM73A	Natural Language processing	AI&ML	3	0	0	0	3	4	50	50	100
4	20AIM74X	Professional Elective - V	AI&ML	3	0	0	0	3	4	50	50	100
5	20AIM75X	Professional Elective - VI	AI&ML	3	0	0	0	3	4	50	50	100
6	20AIL76A	Cloud Computing Laboratory	AI&ML	0	0	2	0	2	4	25	25	50
7	20AIL77A	Web Technology Lab	AI&ML	0	0	2	0	2	4	25	25	50
8	20AIM78A	Project Phase – I	AI&ML	0	0	2	0	2	0	25	25	50
9	20NHOPX X	Open Elective - II	AI&ML	3	0	0	0	3	4	50	50	100
<b>Total</b>								<b>24</b>	<b>32</b>	<b>375</b>	<b>375</b>	<b>750</b>

Professional Elective – V		Open Elective - II	
Course Code	Course	Course Code	Course
20AIM741A	Recommender System	20NHOP701	Big Data Analytics using HP Vertica-1
20AIM742A	Streaming Analytics	20NHOP702	VM Ware Virtualization Essentials-1
20AIM743A	Information Security	20NHOP704	Big Data Analytics using HP Vertica-2
20AIM744A	Human Computer Interaction	20NHOP707	SAP

Professional Elective – VI			
20AIM751A	Quantum Computing	20NHOP708	Schneider-Industrial Automation
20AIM752A	Software Testing	20NHOP709	CISCO-Routing and Switching-1
20AIM753A	Social Network Analysis	20NHOP712	CISCO-Routing and switching-2
20AIM754A	Cyber Security	20NHOP714	Block chain
		20NHOP715	Product Life Cycle Management
		20NHOP720A	Robotic Process Automation
		20NHOP721A	Industry 4.
		20NHOP722A	Programming of Industrial Robot
		20NHOP723A	5G Communication
		20NHOP725A	VLSI Physical Design -1
		20NHOP726A	VLSI Physical Design -2
		20NHOP727A	Juniper Network Operating System
		20NHOP728A	Database Administration using DB2

## VIII SEMESTER

S. No	Course Code	Course	BOS	Credit Distribution				Overall Credits	Contact Hours	Marks		
				L	T	P	S			CIE	SEE	Total
1	20AIM81A	Reinforcement learning	AI&ML	3	0	0	0	3	4	50	50	100
2	20AIM82A	Internship Viva	AI&ML	0	0	4	0	4	0	50	50	100
3	20AIM83A	Project Phase - II	AI&ML	0	0	12	0	12	0	100	100	200
<b>Total</b>								<b>19</b>	<b>04</b>	<b>200</b>	<b>200</b>	<b>400</b>

III SEMESTER-SCHEME												
S.No	Course Code	Course	BOS	Credit Distribution				Overall Credits	Contact Hours	Marks		
				L	T	P	S			CIE	SEE	Total
1	20AIM31A	Applied Mathematics-III	BS	2	1	0		3	4	50	50	100
2	20HSS324/ 20HSS325	Aadalitha Kannada / Vyavaharika Kannada	HSS	1	0	0	0	1	2	25	25	50
3	20HSS321A	Economics for Engineers	HSS	2	0	0	0	2	2	25	25	50
4	20AIM33A	Digital Electronics	AI&ML	3	0	0		3	3	50	50	100
5	20AIM34A	Data Structures using C	AI&ML	3	0	0		3	3	50	50	100
6	20AIM35A	Python Programming	AI&ML	3	0	0	0	3	3	50	50	100
7	20AIL36A	Digital Electronics Lab	AI&ML	0	0	2		2	4	25	25	50
8	20AIL37A	Data Structures using C Lab	AI&ML	0	0	2		2	4	25	25	50
9	20AIL38A	Python Programming Lab	AI& ML	0	0	2	0	2	4	25	25	50
10	20AIM39A	Mini Project - I	AI& ML	0	0	2	0	2	0	25	25	50
11	20DMAT31 A*	Basic Applied Mathematics-1	BS	0	0	0	0	0	2	25	25	50
12	19HSS171*	Essential English	BS	0	0	0	0	0	2	25	25	50
<b>Total</b>								<b>23</b>	<b>29/33*</b>	<b>350/ 400*</b>	<b>350/ 400*</b>	<b>700/ 800*</b>

\*For Lateral Entry Students Only

## APPLIED MATHEMATICS – III

Course Code : 20AIM31A  
 L: T: P : 2: 1: 0  
 Exam Hours: : 3

Credits: 3  
 CIE Marks: 50  
 SEE Marks: 50

Course Outcomes:	At the end of the Course, the Student will be able to:
CO#	COURSE OUTCOME
20AIM31A.1	Use appropriate numerical methods to solve algebraic equations and transcendental equations
20AIM31A.2	Solve initial value problems using appropriate numerical methods and also Evaluate definite integrals numerically
20AIM31A.3	Express the periodic functions as Fourier series expansion analytically and numerically.
20AIM31A.4	Solve the Continuous model problems using Fourier transforms. Solve the discrete model problems using Z-transforms
20AIM31A.5	Solve the discrete model problems using Fast Fourier transform
20AIM31A.6	Fit a suitable curve by the method of least squares and determine the lines of regression for a set of statistical data

Mapping of Course Outcomes to Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM31A.1	3	3	3	3	3	-	3	-	-	-	3	3		3
20AIM31A.2	3	3	3	3	3	-	3	-	-	-	3	3		3
20AIM31A.3	3	3	3	3	3	-	-	-	-	-	3	3		3
20AIM31A.4	3	3	3	3	3	-	-	-	-	-	3	3		3
20AIM31A.5	3	3	3	3	3	-	-	-	-	-	3	3		3
20AIM31A.6	3	3	3	3	3	1	3	-	-	-	3	3		3
Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)														

Module No	Module Contents	Hours	CO S
1	<b>Numerical Methods-1:</b> Numerical solution of algebraic and transcendental equations: Regula-falsi method and Newton- Raphson Method-Problems. Interpolation: Newton's forward and backward formulae for equal intervals, Newton divided difference and Lagrange's formulae for unequal intervals (without proofs)-Problems.	9	CO1
2	<b>Numerical Methods 2:</b> Numerical solution of ordinary differential equations of first order and of first degree: Modified Euler's method and Runge-Kutta method of fourth- order-Problems. Milne's predictor and corrector methods- Problems. Numerical integration: Simpson's 1/3 <sup>rd</sup> rule, Simpson's 3/8 <sup>th</sup> rule, Weddle's rule (without proofs)- Problems. <b>Applications:</b> Application of numerical integration to velocity of a particle and volume of solids.	9	CO2
3	<b>Fourier series:</b> Periodic function, Dirichlet's conditions, Fourier series of periodic functions of period $2\pi$ and arbitrary period $2l$ , half range series. Fourier series and half Range Fourier series of periodic square wave, half wave rectifier, full wave rectifier, Saw-tooth wave with graphical representation, practical harmonic analysis	9	CO3

4	<b>Fourier Transforms:</b> Infinite Fourier transforms, Fourier Sine and Cosine transforms, Inverse Fourier transform. <b>Z - Transform:</b> Definition, Z-transforms of some standard functions, properties, damping rule, shifting rule(without proof), initial and final value theorems, inverse Z- transforms. <b>Applications:</b> Solving difference equations using Z-transform.	9	CO4
5	<b>Discrete Fourier Transform and Fast Fourier Transform:</b> Definition of N-Point DFT, problems for 4-points and inverseDFT for four points only. FFT algorithm to compute theFourier transforms 4-point only. <b>Statistical Methods:</b> Fitting of the curves of the form $y = a + b x$ , $y = a + b x + c x^2$ , $y = a e^{bx}$ , $y = a x^b$ , and $y = a b^x$ by the method of least square, Correlation and Regression, Regression coefficients, line of regression – Problems.	9	CO5 CO6

**Text Books:**

1. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley-India Publishers, 10<sup>th</sup> Edition, 2014, ISBN: 978-81-265-5423-2.
2. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 43<sup>rd</sup> Edition, 2014, ISBN: 978-81-7409-195-5.

**Reference Books:**

1. Glyn James, Modern Engineering Mathematics, Prentice Hall, 4<sup>th</sup> Edition, 2015, ISBN: 978-0-273-73409-3
2. B. V. Ramana, Higher Engineering Mathematics, McGraw Hill Education (India) Private Limited, 4<sup>th</sup> Edition, 2016, ISBN: 978-0-07-063419-0.
3. H. K. Dass, Advanced Engineering Mathematics, S. Chand & Company Ltd., 28<sup>th</sup> Edition, 2012, ISBN: 81-219-0345-9.
4. P. Bali and Manish Goyal, A Text Book of Engineering Mathematics, Laxmi Publications (P) Ltd., 9<sup>th</sup> Edition, 2014, ISBN: 978-81-318-0832-0.

**CIE- Continuous Internal Evaluation (50 Marks)**

Bloom's Category	Tests (25 marks)	Assignment 1 (7.5 Marks )	Assignment 2 (7.5Marks)	Quiz1 (05Marks)	Quiz2 (05 Marks )
Remember	5	2.5	2.5	-	-
Understand	5	2.5	2.5	-	-
Apply	10	2.5	2.5	05	05
Analyze	2.5	-	-	-	-
Evaluate	2.5	-	-	-	-
Create	-	-	-	-	-

**SEE- Semester End Examination (50Marks)**

Bloom's Category	Questions (50 marks)
Remember	10
Understand	10
Apply	20
Analyze	5
Evaluate	5
Create	-

**ಆಡಳಿತ ಕನ್ನಡ**  
(Kannada for administration)

Course Code : 20HSS324/424	Credits : 01
L: T: P : 1:0:0	CIE Marks : 25
Exam Hours : 2	SEE Marks : 25

**ಆಡಳಿತ ಕನ್ನಡ ಅಧ್ಯಯನದ ಕಲಿಕಾಂಶಗಳು**

- C01 ವಿದ್ಯಾರ್ಥಿಗಳು ಕನ್ನಡ ವ್ಯಾಕರಣದ ಬಗ್ಗೆ ಹಾಗೂ ಭಾಷಾ ರಚನೆ ನಿಯಮಗಳನ್ನು ಅರ್ಥೈಸಿಕೊಳ್ಳುತ್ತಾರೆ  
 C02 ಕನ್ನಡ ಭಾಷಾ ಬರಹದಲ್ಲಿನ ದೋಷಗಳು, ನಿವಾರಣೆ ಮತ್ತು ಲೇಖನ ಚಿಹ್ನೆಗಳನ್ನು ಅರಿತುಕೊಳ್ಳುವರು  
 C03 ಸರ್ಕಾರಿ ಮತ್ತು ಅರೆ ಸರ್ಕಾರಿ ಪತ್ರ ವ್ಯವಹಾರದ ಬಗ್ಗೆ ತಿಳುವಳಿಕೆ ಪಡೆಯುವರು  
 C04 ಭಾಷಾಂತರ ಮತ್ತು ಪ್ರಬಂಧ ರಚನೆ ಬಗ್ಗೆ ಆಸಕ್ತಿ ವಹಿಸಿಕೊಳ್ಳುವರು

**CO - PO Mapping:**

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

**ಪರಿವಿಡಿ (ಪಠ್ಯ ಪುಸ್ತಕದಲ್ಲಿರುವ ವಿಷಯಗಳ ಪಟ್ಟಿ)**

- ಅಧ್ಯಾಯ -1 ಕನ್ನಡ ಭಾಷೆ-ಸಂಕ್ಷಿಪ್ತ ವಿವರಣೆ  
 ಅಧ್ಯಾಯ -2 ಭಾಷಾ ಪ್ರಯೋಗದಲ್ಲಾಗುವ ಲೋಪದೋಷಗಳು ಮತ್ತು ಅವುಗಳ ನಿವಾರಣೆ  
 ಅಧ್ಯಾಯ -3 ಲೇಖನ ಚಿಹ್ನೆಗಳು ಮತ್ತು ಅವುಗಳ ಉಪಯೋಗ  
 ಅಧ್ಯಾಯ -4 ಪತ್ರ ವ್ಯವಹಾರ  
 ಅಧ್ಯಾಯ -5 ಆಡಳಿತ ಪತ್ರಗಳು  
 ಅಧ್ಯಾಯ -6 ಸರ್ಕಾರದ ಆದೇಶ ಪತ್ರಗಳು  
 ಅಧ್ಯಾಯ -7 ಸಂಕ್ಷಿಪ್ತ ಪ್ರಬಂಧ ರಚನೆ (ಪ್ರಿಸೈಸ್ ರೈಟಿಂಗ್), ಪ್ರಬಂಧ ಮತ್ತು ಭಾಷಾಂತರ  
 ಅಧ್ಯಾಯ -8 ಕನ್ನಡ ಶಬ್ದ ಸಂಗ್ರಹ  
 ಅಧ್ಯಾಯ -9 ಕಂಪ್ಯೂಟರ್ ಹಾಗೂ ಮಾಹಿತಿ ತಂತ್ರಜ್ಞಾನ  
 ಅಧ್ಯಾಯ -10 ಪಾರಿಭಾಷಿಕ ಆಡಳಿತ ಕನ್ನಡ ಪದಗಳು ಮತ್ತು ತಾಂತ್ರಿಕ /ಕಂಪ್ಯೂಟರ್ ಪಾರಿಭಾಷಿಕ ಪದಗಳು

**ಆಡಳಿತ ಕನ್ನಡ ಪಠ್ಯಪುಸ್ತಕದ ಲೇಖಕರು**

ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ, ಪ್ರೊ. ವಿ. ಕೇಶವಮೂರ್ತಿ, ಪ್ರಕಟಣೆ : ಪ್ರಸಾರಾಂಗ, ಬಿ.ತಾ.ವಿ.ಬೆಳಗಾವಿ

**ಪರೀಕ್ಷೆಯ ವಿಧಾನ:**

ನಿರಂತರ ಆಂತರಿಕ ಮೌಲ್ಯಮಾಪನ (Continuous Internal Evaluation) : 25 ಅಂಕಗಳು  
 ಸೆಮಿಸ್ಟರ್ ಪರೀಕ್ಷೆ (Semester End Examination) : 25 ಅಂಕಗಳು

Blooms Category	CIE (25)	SEE (25)
Remember	12	12
Understand	13	13

**Vyavaharika Kannada  
(Kannada for use)**

**Course Code : 20HSS325**  
**L: T: P : 2: 0**  
**Exam Hours: : 2**

**Credits: 1**  
**CIE Marks: 25**  
**SEE Marks: 25**

<b>Course Outcomes:</b>	<b>At the end of the Course, the Student will be able to</b>
CO#	COURSE OUT COME
CO1	Understand Kannada Language.
CO2	Communicate in Kannada Language
CO3	Read simple Kannada words
CO4	Pronounce Kannada words correctly

<b>Mapping of Course Outcomes to Program Outcomes</b>														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	3	-	-	-	-
Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)														

<b>Module No</b>	<b>Module Contents</b>	<b>Hours</b>	<b>Cos</b>
1	Chapter – 1: Vyavaharika Kannada – Parichaya (Introducton to Vyavaharika Kannada)		
2	Chapter – 2: Kannada Aksharamalehaaguuchharane (Kannada Alphabets and Pronunciation)		
3	Chapter – 3: SambhashanegaagiKanandaPadagalu (Kannada Vocabulary for Communication)		
4	Chapter – 4: Kannada in Conversations (Sambhashaneyalli Kannada)		
5	Chapter – 5: Activities in Kannada. (Kannada SambhashanegaagiChatuvatikegalu)		

**Text Books:**

1. Vyavaharika Kannada by Dr. L. Thimmesh, Prof. V. Keshavamurthy, published by: VTU, Belagavi

**CIE- Continuous Internal Evaluation (25 Marks)**

<b>Bloom's Category</b>	<b>CIE(25)</b>	<b>SEE(25)</b>
Remember	12	12
Understand	13	13

## ECONOMICS FOR ENGINEERS

Course Code : 21HSS321A  
 L: T: P : 2: 0: 0  
 Exam Hours: : 2

Credits: 2  
 CIE Marks: 25  
 SEE Marks: 25

Course Outcomes:	At the end of the Course, the Student will be able to
CO#	COURSE OUTCOME
20AIM421.1	Summarize the knowledge of economics and its importance in business decision making.
20AIM421.2	Make use of economic concepts in business.
20AIM421.3	Examine the impact of market forces on business.
20AIM421.4	Interpret the role of market structure in the economic development of a country.
20AIM421.5	Evaluate the role of budgeting in business decisions.

Mapping of Course Outcomes to Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM421.1	0	1	0	1	1	3	3	3	3	1	2	3		
20AIM421.2	1	1	1	1	2	2	1	2	2	2	3	3		
20AIM421.3	3	2	3	1	1	2	2	3	1	1	2	2		
20AIM421.4	1	2	1	2	1	3	1	2	2	2	2	2		
20AIM421.5	3	2	3	2	2	1	1	2	1	1	3	1		
Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)														

Module No	Module Contents	Hours	Cos
1	Introduction to Economics: Role of Engineer as an Economist, Types and problem of economies, Basics of economics (GDP, National income, inflation, business cycle, fiscal and monetary policies, balance of payment).	4	CO1
2	Basic concepts of Microeconomics: concept of Demand & Elasticity of Demand. Concept of Supply & Elasticity of Supply, Meaning of Production and factors of production, Production Possibility Curve, Law of variable proportions and returns to scale. Relevance of Depreciation towards industry, Depreciation computing methods.	4	CO2
3	Concepts of cost of production: different types of cost; accounting cost, sunk cost, marginal cost and opportunity cost. Break even analysis, Make or Buy decision. Cost estimation, Elements of cost as Direct Material Costs, Direct Labor Costs, Fixed Over-Heads, Factory cost, Administrative Over-Heads.	4	CO3
4	Market structure: Perfect Competition: Features, Determination of Price under Perfect Competition - Monopoly: Features, Pricing under Monopoly, Oligopoly: Features, Kinked Demand Curve, Cartel,	5	CO4

	Price Leadership – Monopolistic Competition: Features, Pricing under Monopolistic Competition, Product Differentiation.		
5	Capital budgeting: Traditional and modern methods, Payback period method, IRR, ARR, NPV, PI. . Interest and Interest factors: Interest rate, Simple interest, Compound interest, Cash - flow diagrams, Personal loans and EMI Payment. Present worth, Future worth.	7	CO5

**Text Books:**

1. Riggs J.L, Engineering Economy, TMH, 2012 edition
2. Jain T.R., Economics for Engineers, VK Publications,2008 Edition
3. IM PANDEY, Financial Management, Vikas Pub. House, 2018 Edition
4. D N Dwivedi, Managerial Economics ,Vikas Pub. House, 2018 Edition
5. Dr. A.R Sainath, Sasikala Devi, Engineering Economics and Financial accounting, CharulathaPublications,2015 edition

**Reference Books:**

1. Thuesen H.G, Engineering Economy. PHI,1984

**CIE- Continuous Internal Evaluation (25 Marks)**

Bloom's Category	Tests (15 marks)	Assignments (10 marks)
Remember	5	-
Understand	5	-
Apply	5	-
Analyze	-	5
Evaluate	-	5
Create	-	-

**SEE- Semester End Examination (50Marks)**

Bloom's Category	Questions (50 marks)
Remember	-
Understand	20
Apply	30
Analyze	-
Evaluate	-
Create	-

## DIGITAL ELECTRONICS FOR AI

**Course Code** : 20AIM33A  
**L: T: P** : 3: 0: 0  
**Exam Hours** : 3

**Credits**: 3  
**CIE Marks**: 50  
**SEE Marks**: 50

Course Outcomes:	At the end of the Course, the Student will be able to
CO#	COURSE OUTCOME
20AIM33A.1	Describe the significance and basic principles of the digital circuits
20AIM33A.2	Apply the concepts of minimization techniques to realize digital circuits
20AIM33A.3	Analyse different types of combinational and sequential circuits for given specifications
20AIM33A.4	Design efficient combinational and sequential logic circuit from functional description of digital systems
20AIM33A.5	Use CAD/HDL tools to simulate and verify Digital circuits
20AIM33A.6	Construct and verify CAD/HDL tools to simulate and verify Digital circuits

Mapping of Course Outcomes to Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM33A.1	-	-	-	-	-	-	-	-	-	-	-	-	3	-
20AIM33A.2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
20AIM33A.3	-	3	-	-	-	-	-	-	-	-	-	-	3	-
20AIM33A.4	-	-	3	-	-	-	-	-	-	-	-	-	3	-
20AIM33A.5	-	-	-	-	3	-	-	-	-	-	-	3	3	-
20AIM33A.6														
Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)														

Module No	Module Contents	Hours	COs
1	<b>Simplification of Boolean Functions:</b> Review of Boolean algebra, logic gates, canonical forms, Three Variable K – Maps, Four Variable K – Maps, Quine- McCluskey minimization technique, Reduced prime implicants Tables, Map Entered Variables.	9	CO1, CO2
2	<b>Combinational Logic Circuits:</b> Introduction, Adders, Subtractors, Carry Look Ahead Adder, Parallel Adder, Magnitude Comparator, Priority Encoders, Decoders, Multiplexers, Read Only memories (ROM), Programmable Logic Arrays (PLAs)	9	CO1, CO2, CO3, CO4
3	<b>Sequential Logic Circuits:</b> The Basic Flip-flop circuit, Clocked Flip-flops, Triggering of Flip-flops, types of Flip-flop, Master Slave Flip-Flops, Conversion of Flip-flops, types of Shift Registers, applications of shift register.	9	CO2, CO3, CO4
4	<b>Analysis of Sequential Circuit:</b> Binary ripple counters, synchronous binary counters, Design of a synchronous mod-n counter using clocked T, JK , D and SR flip-flops, Verilog implementation of counters, Mealy and Moore Models, State Reduction and Assignment, Design Procedure, Design with State Equations.	9	CO2, CO3, CO4

<b>5</b>	<b>Introduction to HDL:</b> Basic Concepts, data types,	<b>9</b>	<b>CO1,</b>
	Compiler directives. Modules and Ports, Module definition, port declaration, connecting ports, Different types of modelling style, Verilog implementation of combinational circuits, Verilog implementation of sequential circuits, Verilog implementation Moore and Mealy.		<b>CO2, CO3, CO4, CO5, CO6</b>

**Text Books:**

1. Donald P Leach and Albert Paul Malvino , Digital Principles and Applications, , 8<sup>th</sup>Edition, Tata McGraw Hill, 2014
2. Anil K Maini, Varsha Agarwal ,Electronic Devices and Circuits, , 1<sup>st</sup> Edition, Wiley,2009

**Reference Books:**

1. Digital Design: with an Introduction to Verilog HDL, M Morris Mano and Michael DCiletti, 5th Edition, 2013, Pearson Education

**CIE- Continuous Internal Evaluation (50 Marks)**

<b>Bloom's Category</b>	<b>Tests (25 marks)</b>	<b>Assignments (15 marks)</b>	<b>Quizzes (10 marks)</b>
Remember	05	-	5
Understand	05	-	5
Apply	10	7.5	-
Analyze	10	7.5	-
Evaluate	-	-	-
Create	-	-	-

**SEE- Semester End Examination (50Marks)**

<b>Bloom's Category</b>	<b>Questions (50 marks)</b>
Remember	05
Understand	10
Apply	20
Analyze	15
Evaluate	-
Create	-

## DATA STRUCTURES USING C

Course Code : 20AIM34A  
 L: T: P : 3: 0: 0  
 Exam Hours: : 3

Credits: 3  
 CIE Marks: 50  
 SEE Marks: 50

Course Outcomes:	At the end of the Course, the Student will be able to
CO#	COURSE OUTCOME
20AIM34A.1	Understand the fundamentals of data structure and its applications.
20AIM34A.2	Apply dynamic memory allocation techniques for designing data structure
20AIM34A.3	Analyse the concepts of sorting, linear and non-linear data structure for problem solving.
20AIM34A.4	Investigate the literature about linear data structure and submit report in a team
20AIM34A.5	Prepare an effective written documentation about nonlinear data structures
20AIM34A.6	Demonstrate different tree data structures used for machine algorithms

Mapping of Course Outcomes to Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM34A.1	-	-	-	-	3	-	-	-	-	-	-	3	3	2
20AIM34A.2	3	-	-	-	3	-	-	-	-	-	-	3	3	2
20AIM34A.3	-	3	-	-	3	-	-	-	-	-	-	3	3	2
20AIM34A.4	-	-	-	2	3	-	-	-	2	2	-	3	3	2
20AIM34A.5	-	-	-	-	3	-	-	-	-	3	-	3	3	2
20AIM34A.6	3	-	-	-	3	-	-	-	-	-	-	3	3	2

Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)

Module No	Module Contents	Hours	Cos
1	<b>Introduction to Data Structures:</b> Arrays and Pointers revisited, Sparse matrix, transpose of a sparse matrix, dynamic memory management. Introduction to Data Structures, Classification of Data Structures, Abstract Data Types, Insertion sort, Quick sort, Shell sort, Radix sort.	9	CO1, CO2
2	<b>Stacks &amp; Queues: Stacks:</b> Definition, Stack representation, Primitive operations on stack, array representation of stacks. <b>Applications of stacks:</b> Recursion, Fibonacci series, Tower of Hanoi problem, Conversion of expressions, Evaluation of postfix expression, Iteration v/s recursion. <b>Queues:</b> Definition, Queue representation, Primitive operations on queue, array representation of queues, Circular queue, Priority queue, Double ended queue, Applications of queues.	9	CO1, CO2, CO3, CO4
3	<b>Linked Lists:</b> Dynamic memory allocation revisited – malloc, calloc, realloc, free, Introduction to linked list, Representation of linked list in memory, primitive operations on linked list, searching a linked list, circular linked list, doubly linked list, header linked list. <b>Applications of linked list:</b>	9	CO1, CO3, CO4

	Josephus problem, addition of two long integers, addition of two polynomials, Linked representation of stack, Linked representation of queue.		
4	<b>Trees-I:</b> Introduction, Binary tree – strictly binary tree, complete binary tree, representing binary tree in memory, traversing a binary tree, binary Search tree, insertion and deletion in binary search tree, threaded binary tree. Expression trees, construction of an expression tree from prefix and postfix, Heap tree, creation of heap tree, insertion in heap, Deletion from heap.	9	CO1, CO3, CO5, CO6
5	<b>Trees-II &amp; Graphs:</b> AVL Trees, Rotations in AVL tree, Insertion and deletion in an AVL tree, Huffman's algorithm. <b>Introduction to Graph,</b> Graph theory terminologies, sequential representation of a graph, adjacency matrix and path matrix, Warshall's algorithm, Linked representation of a graph, Operations on a graph, Traversing a graph, Topological sorting	9	CO1, CO3, CO5, CO6

**Text Books:**

1. Seymour Lipschutz, Data Structures with C Special Indian Edition, Thirteenth reprint 2015, McGrawHill Education
2. Aaron M. Tanenbaum, Yedidyah Langsam & Moshe J. Augenstein, Data Structures using C, Thirteenth Impression 2014, Pearson Education

**Reference Books:**

1. Richard F. Gilberg and Behrouz A. Forouzan, Data Structures – A Pseudo code Approach with C, Second edition, Fifth Indian Reprint 2015, Cengage Learning.

**CIE- Continuous Internal Evaluation (50 Marks)**

Bloom's Category	Tests (25 marks)	Assignments (15 marks)	Quizzes (10 marks)
Remember	-	-	-
Understand	5	-	5
Apply	5	7.5	5
Analyze	15	7.5	-
Evaluate	-	-	-
Create	-	-	-

**SEE- Semester End Examination (50 Marks)**

Bloom's Category	Questions (50 marks)
Remember	10
Understand	10
Apply	30
Analyze	-
Evaluate	-
Create	-

## PYTHON PROGRAMMING

Course Code : 20AIM35A  
 L: T: P : 3: 0: 0  
 Exam Hours: : 3

Credits: 3  
 CIE Marks: 50  
 SEE Marks: 50

Course Outcomes:	At the end of the Course, the Student will be able to
CO#	COURSE OUTCOME
20AIM35A.1	Understand the fundamentals of data structure and its applications.
20AIM35A.2	Apply dynamic memory allocation techniques for designing data structure
20AIM35A.3	Analyse the concepts of sorting, linear and non-linear data structure for problem solving.
20AIM35A.4	Investigate the literature about linear data structure and submit report in a team
20AIM35A.5	Prepare an effective written documentation about nonlinear data structures
20AIM35A.6	Demonstrate different python packages used for Data science

Mapping of Course Outcomes to Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM35A.1	-	-	-	-	3	-	-	-	-	-	-	3	3	2
20AIM35A.2	3	-	-	-	3	-	-	-	-	-	-	3	3	2
20AIM35A.3	-	3	-	-	3	-	-	-	-	-	-	3	3	2
20AIM35A.4	-	-	-	2	3	-	-	-	2	2	-	3	3	2
20AIM35A.5	-	-	-	-	3	-	-	-	-	3	-	3	3	2
20AIM35A.6	3	-	-	-	3	-	-	-	-	-	-	3	3	2

Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)

Module No	Module Contents	Hours	Cos
1	<b>Introduction To Data, Expressions, Statements:</b> Introduction to Python and installation, variables, expressions, statements, Numeric datatypes: Int, float, Boolean, string. Basic data types: list--- list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters. Tuple --- tuple assignment, tuple as return value, tuple methods. Sets: operations and methods. Dictionaries: operations and methods.	10	CO1, CO2
2	<b>Control Flow Loops:</b> Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: statements break, continue.	7	CO1, CO2
3	<b>Advanced Functions, Arrays:</b> Functions---Function and its use, pass keyword, flow of execution, parameters and arguments, Fruitful functions: return values, parameters, local and global scope, function composition, recursion Advanced Functions: lambda, map, filter, reduce, basic data type comprehensions. Python arrays: Create an array, Access the Elements of an Array, array methods.	10	CO2, CO3

<b>4</b>	<b>Files, Exceptions:</b> Reading files, Writing files in python, Understanding read functions, read(), readline(), readlines(). Understanding write functions, write() and writelines() Manipulating file pointer using seek Programming, using file operations. <b>Exception handling</b>	<b>9</b>	<b>CO2, CO4</b>
<b>5</b>	<b>Python Packages:</b> Python packages: Simple programs using the built-in functions of packages Matplotlib, numpy, pandas, Lamda etc. <b>GUI Programming:</b> Tkinter introduction, Tkinter and Python Programming, Tk Widgets, Tkinter examples. Python programming with IDE.	<b>9</b>	<b>CO2, CO5 CO6</b>

**Text Books:**

1. J. Jayalakshmi , D. Stalin Alex , B. Mahesh Prabhu, S. , Problem Solving and Python Programming , Chand publication,1 January 2018
2. Wesley J. Chun, Core Python Applications Programming, 3rd Edition , Pearson Education, 2016
3. Carles Dierbach, Introduction to Computer Science using Python, Wiley, 2015

**Reference Books:**

1. Jeeva Jose & P.Sojan Lal, “Introduction to Computing and Problem Solving with PYTHON”, Khanna Publishers, New Delhi, 2016

**CIE- Continuous Internal Evaluation (50 Marks)**

<b>Bloom’s Category</b>	<b>Tests (25 marks)</b>	<b>Assignments (15 marks)</b>	<b>Quizzes (10 marks)</b>
Remember	-	-	5
Understand	10	-	5
Apply	15	7.5	-
Analyze	-	7.5	-
Evaluate	-	-	-
Create	-	-	-

**SEE- Semester End Examination (50Marks)**

<b>Bloom’s Category</b>	<b>Questions (50 marks)</b>
Remember	10
Understand	10
Apply	30
Analyze	-
Evaluate	-
Create	-

## DIGITAL ELECTRONICS LAB

**Course Code : 20AIL36A**  
**L: T: P : 0: 0: 2**  
**Exam Hours : 3**

**Credits: 2**  
**CIE Marks: 25**  
**SEE Marks: 25**

Course Outcomes:	At the end of the Course, the Student will be able to
CO#	COURSE OUTCOME
20AIL36A.1	Apply the concepts of minimization techniques to realize the digital circuits
20AIL36A.2	Analyse different methods to realize the logic circuits
20AIL36A.3	Simulate logic circuits using HDL tool
20AIL36A.4	Demonstrate the specific application of digital electronics using suitable digital ICs/ Multisim/Xlinx/ FPGA board/- etc

Mapping of Course Outcomes to Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIL36A.1	3	-	-	-	-	-	-	-	-	-	-	-	3	2
20AIL36A.2	-	3	-	-	-	-	-	-	-	-	-	-	3	2
20AIL36A.3	-	-	3	-	-	-	-	-	-	-	-	-	3	2
20AIL36A.4	-	-	-	-	3	-	-	-	-	-	-	-	3	2
Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)														

Ex. No	Experiments	Hours	COs
1.	Verify (a) Demorgan's Theorem for 2 variables. (b) The sum-of product and product-of-sum expressions using universal gates.	4	CO1, CO2, CO4
2.	Design and implement (a) Full Adder using basic logic gates. (b) Full Subtractor using basic logic gates.	4	CO1, CO2, CO4
3.	Realize the different shift registers using IC7474	4	CO2, CO4
4.	Given a 4-variable logic expression, simplify it using Entered Variable Map and realize the simplified logic expression using 8:1 multiplexer IC. Simulate and verify its working using Verilog code	4	CO2, CO4
5.	Perform n bit addition / subtraction using 4-bit full adder IC. Simulate and verify its working using Verilog code.	4	CO2, CO4
6.	Design and implement BCD to seven-segment decoder. Simulate and verify given decoder using VERILOG code.	4	CO3,

7.	Design and implement Ring counter and Johnson counter using 4 bit shift register and demonstrate its working. Simulate and verify the working using VERILOG code.		CO4
8.	Design and implement a mod-n ( $n < 8$ ) synchronous up or down counter using J-K Flip-Flop ICs and demonstrate its working. Simulate and verify mod 8 synchronous up or down counter using VERILOG code.	4	CO3, CO4
9.	Design and implement an asynchronous counter using decade counter IC to count from 0 to n ( $n \leq 9$ ) and demonstrate its working.		
10.	Design and implement a sequence generator (3 bits) using Moore model and JK flip flop. Simulate and verify the working using VERILOG code.	2	CO3, CO4

**Text Books:**

1. Stephen Brown and Zvonko Vranesic ,Fundamentals of Digital Logic with Verilog Design , Tata McGraw Hill , 2017
2. M Morris Mano and Michael D, Ciletti , Digital Design: with an Introduction to Verilog HDL, 5th Edition, Pearson Education , 2013

**CIE- Continuous Internal Evaluation (25 Marks)**

Bloom's Category	Tests (25 marks)
Remember	-
Understand	5
Apply	5
Analyze	10
Evaluate	5
Create	-

**SEE- Semester End Examination (25Marks)**

Bloom's Category	Questions (50 marks)
Remember	-
Understand	5
Apply	5
Analyze	10
Evaluate	5
Create	-

## DATA STRUCTURES PROGRAMMING LAB USING C

**Course Code** : 20AIL37A  
**L: T: P** : 0: 0: 2  
**Exam Hours** : 3

**Credits**: 3  
**CIE Marks**: 25  
**SEE Marks**: 25

Course Outcomes:	At the end of the Course, the Student will be able to
CO#	COURSE OUTCOME
20AIL37A.1	Apply Data structure techniques to solve the problem
20AIL37A.2	Analyse the output for a given problem
20AIL37A.3	Conduct experiments as individual by using C programming language
20AIL37A.4	Prepare an effective report based on experiments

Mapping of Course Outcomes to Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIL37A.1	3	-	-	-	-	-	-	-	-	-	-	3	3	2
20AIL37A.2	-	3	-	-	-	-	-	-	-	-	-	3	3	2
20AIL37A.3	-	-	-	-	3	-	-	-	-	-	-	3	3	2
20AIL37A.4	-	-	-	-	-	-	-	-	-	3	-	3	3	2

Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)

Ex. No	Experiments	Hours	Cos
1.	Write a C program to sort numbers a. Insertion sort b. Shell sort c. Quick sort	4	CO1, CO2, CO3, CO4
2.	Develop a program for STACK that performs following primitive operations: push, pop and display	4	CO1, CO2, CO3, CO4
3.	Develop a program a. To convert INFIX notation to POSTFIX b. Evaluation of POSTFIX notation	4	CO1, CO2, CO3, CO4
4.	Develop a program for QUEUE that performs following primitive operations: insert, delete and display	4	CO1, CO2, CO3, CO4
5.	Develop a program for CIRCULAR QUEUE that performs following primitive operations: insert, delete and display	4	CO1, CO2, CO3, CO4
6.	Write a menu driven program to perform the following primitive operations on single linked list Create a list with one node a. Insertion at front, rear ,after any given node b. Deletion at front,, rear ,after any given node c. Display	4	CO1, CO2, CO3,

7.	Write a Menu driven program to perform the following primitive operations in double linked list a. Insertion b. Deletion c.Display		CO4
8.	Develop a program to traverse a tree using in-order, pre-order and post order.	4	CO1, CO2, CO3, CO4
9.	Develop a program to perform insertion, deletion and traversal of a binary search tree		
10.	Develop a program to implement BFS and DFS traversal of graph	2	CO1, CO2, CO3, CO4

**Text Books:**

1. Seymour Lipschutz, Data Structures with C Special Indian Edition, Thirteenth reprint 2015, McGrawHill Education
2. Aaron M. Tanenbaum, Yediyah Langsam & Moshe J. Augenstein, Data Structures using C, Thirteenth Impression 2014, Pearson Education

**CIE- Continuous Internal Evaluation (25 Marks)**

Bloom's Category	Tests (25 marks)
Remember	-
Understand	5
Apply	15
Analyze	5
Evaluate	-
Create	-

**SEE- Semester End Examination (25 Marks)**

Bloom's Category	Questions (50 marks)
Remember	-
Understand	5
Apply	15
Analyze	5
Evaluate	-
Create	-

## PYTHON PROGRAMMING LAB

**Course Code : 20AIL38A**  
**L: T: P : 0: 0: 2**  
**Exam Hours: : 3**

**Credits: 2**  
**CIE Marks: 25**  
**SEE Marks: 25**

Course Outcomes:	At the end of the Course, the Student will be able to
CO#	COURSE OUTCOME
20AIL38A.1	Apply python programming concepts to solve the problem
20AIL38A.2	Analyse the output for a given problem
20AIL38A.3	Solve experiments using python programming language individually
20AIL38A.4	Prepare an effective report based on experiments

Mapping of Course Outcomes to Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIL38A.1	3	-	-	-	-	-	-	-	-	-	-	3	3	2
20AIL38A.2	-	3	-	-	-	-	-	-	-	-	-	3	3	2
20AIL38A.3	-	-	-	-	3	-	-	-	-	-	-	3	3	2
20AIL38A.4	-	-	-	-	-	-	-	-	-	3	-	3	3	2

Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)

E.No	List of Programs	Hours	COs
1	A) Create a list and perform the following methods 1) insert() 2) remove() 3) append() 4) len() 5) pop() 6) clear()	4	CO1, CO2, CO3, CO4
	B) Create a dictionary and apply the following methods 1) Print the dictionary items 2) access items 3) use get() 4)change values 5) use len()		
	C) Create a tuple and perform the following methods 1) Add items 2) len() 3) check for item in tuple 4)Access items		
2	A) Write a python program to add two numbers.	4	CO1, CO2, CO3, CO4
	B) Write a python program to print a number is positive/negative using if-else.		
	C) Write a python program to find largest number among three numbers.		
	D) Write a python Program to read a number and display corresponding day using if_elif_else?		
3	A) Write a program to create a menu with the following options 1. To perform addition 2. To perform subtraction 3. To perform multiplication 4. To perform division Accepts users input and perform the operation accordingly. Use functions with arguments.	4	CO1, CO2, CO3, CO4
	B) Write a python program to check whether the given string is palindrome or not.		
	C) Write a python program to find factorial of a given number using functions		

	D) Write a Python function that takes two lists and returns True if they are equal otherwise false		
4	A) Write a program to double a given number and add two numbers using lambda()?	4	CO1, CO2, CO3, CO4
	C) Write a program for map() function to double all the items in the list?		
	D) Write a program to find sum of the numbers for the elements of the list by using reduce ()?		
5	A) Demonstrate a python code to implement abnormal termination?	4	CO1, CO2, CO3, CO4
	B) Demonstrate a python code to print try, except and finally block statements		
	C) Write a python program to open and write “hello world” into a file?		
	D) Write a python program to write the content “hi python programming” for the existing file.		
6	A) Write a python program to get python version.	4	CO1, CO2, CO3, CO4
	B) Write a python program to open a file and check what are the access permissions acquired by that file using module?		
	C) Write a python program to display a particular month of a year using calendar module.		
	D) Write a python program to print all the months of given year.		
7	A) Write a python program to print date, time for today and now.	4	CO1, CO2, CO3, CO4
	B) Write a python program to add some days to your present date and print the date added.		
	C) Write a python program to print date, time using date and time functions		
	D) Write a python program, which accepts the radius of a circle from user and computes the area (use math module).		
8	A) Using a numpy module create an array and check the following: 1. Type of array 2. Axes of array 3. Shape of array 4. Type of elements in array	4	CO1, CO2, CO3, CO4
	B) Using a numpy module create array and check the following: 1. List with type float 2. 3*4 array with all zeros 3. From tuple 4. Random values		
	C) Using a numpy module create array and check the following: 1. Reshape 3X4 array to 2X2X3 array 2. Sequence of integers from 0 to 30 with steps of 5 3. Flatten array		
9	A) Write a python program to create a package (college),sub-package (alldept),modules(it,cse) and create admin and cabin function to module? B) Write a python program to create a package (Engg),sub-package (years),modules (sem) and create staff and student function to module?		
10	Program to develop calculator using tKinter	2	CO1, CO2, CO3, CO4

**Text Books:**

1. J. Jayalakshmi , D. Stalin Alex , B. Mahesh Prabhu,S. , Problem Solving and Python Programming , Chand publication,1 January 2018
2. Wesley J. Chun, Core Python Applications Programming, 3rd Edition , Pearson Education, 2016

**CIE- Continuous Internal Evaluation (25 Marks)**

<b>Bloom's Category</b>	<b>Tests (25 marks)</b>
Remember	-
Understand	5
Apply	15
Analyze	5
Evaluate	-
Create	-

**SEE- Semester End Examination (25Marks)**

<b>Bloom's Category</b>	<b>Questions (25 marks)</b>
Remember	-
Understand	5
Apply	15
Analyze	5
Evaluate	-
Create	-

## MINI PROJECT - I

Course Code : 20AIL39A  
 L: T: P : 0: 0: 2  
 Exam Hours: : 3

Credits: 2  
 CIE Marks: 25  
 SEE Marks: 25

Course Outcomes:	At the end of the Course, the Student will be able to
CO#	COURSE OUTCOME
20AIL39A.1	Illustrate the technological needs and/ or societal needs and sustainability of the environment
20AIL39A.2	Design application using high level programming language
20AIL39A.3	Analyse and evaluate the outcome of the project
20AIL39A.4	Test, validate and communicate the identified solutions in a structured way.

Mapping of Course Outcomes to Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIL39A.1	-	-	-	-	-	3	2	3	-	-	-	3	3	2
20AIL39A.2	-	-	3	-	3	-	-	-	-	-	-	3	3	2
20AIL39A.3	-	3	-	-	-	-	-	-	-	-	-	3	3	2
20AIL39A.4	-	-	-	3	-	-	-	-	3	3	3	3	3	2
Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)														

Each team capable of identifying a problem and carry out a mini project on the problem defined. A panel of experts will review the code developed towards the project during the course of the semester. Plagiarized projects will automatically get an “F” GRADE and the student will be liable for further disciplinary action. At the completion of a project, the team will submit a project report, which will be evaluate by duly appointed examiner(s).

### Sample Mini project includes:

- 1) Tic-Tac-Toe Game
- 2) Quiz Game
- 3) Library Management
- 4) Telecom Billing Management system
- 5) ERP application etc.,

### CIE- Continuous Internal Evaluation (25 Marks)

Bloom's Category	Review (25marks)
Remember	-
Understand	-
Apply	10
Analyze	10
Evaluate	5
Create	-

### SEE- Semester End Examination (25Marks)

Bloom's Category	Review (25marks)
Remember	-
Understand	-
Apply	10
Analyze	10
Evaluate	5
Create	-

### IV SEMESTER-SCHEME

S.No	Course Code	Course	BOS	Credit Distribution				Overall Credits	Contact Hours	Marks		
				L	T	P	S			CIE	SEE	Total
1	20AIM41A	Mathematical Statistics	BS	2	1	0	0	3	4	50	50	100
2	20HSS422A	Life skills for Engineers	HSS	3	0	0	0	3	3	50	50	100
3	20HSS423A	Environmental Science and Awareness	HSS	Mandatory Course				0	2	25	25	50
4	20AIM43A	Introduction to Data Science	AI&ML	3	0	0	0	3	3	50	50	100
5	20AIM44A	Object Oriented Programming with Java	AI&ML	3	0	0	0	3	3	50	50	100
6	20AIM45A	Database Management System	AI&ML	3	0	0	0	3	3	50	50	100
7	20AIL46A	Object Oriented Programming with Java Lab	AI&ML	0	0	2	0	2	4	25	25	50
8	20AIL47A	Database Management System Lab	AI&ML	0	0	2	0	2	4	25	25	50
9	20AIM48A	Mini Project - II	AI&ML	0	0	2	0	2	0	25	25	50
10	20DMAT41A*	Basic Applied Mathematics-2	BS	0	0	0	0	0	2	25	25	50
11	19HSS272*	Constitution of India & Professional Ethics	BS	0	0	0	0	0	2	25	25	50
<b>Total</b>								<b>21</b>	<b>26/30*</b>	<b>350/400*</b>	<b>350/400*</b>	<b>700/800*</b>

\*For Lateral Entry Students Only

## MATHEMATICAL STATISTICS

**Course Code : 20AIM41A**  
**L: T: P : 2: 1: 0**  
**Exam Hours : 3**

**Credits: 3**  
**CIE Marks: 50**  
**SEE Marks: 50**

Course Outcomes:	At the end of the Course, the Student will be able to
CO#	COURSE OUTCOME
20AIM41A.1	Calculate and interpret the various measures of Dispersion, Skewness and Kurtosis.
20AIM41A.2	Solve the problems related to Combinatorics and Probability
20AIM41A.3	Gain ability to use probability distributions to analyse and solve real time problems
20AIM41A.4	Apply the stochastic process and Markov chain in prediction of future events
20AIM41A.5	Apply the concept of sampling distribution to solve engineering problems
20AIM41A.6	Use the concepts to analyse the data to make decision about the hypothesis

Mapping of Course Outcomes to Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM41A.1	3	3	3	2	2	-	-	-	1	1	-	1	-	-
20AIM41A.2	3	3	3	2	2	-	-	-	1	1	-	1	-	-
20AIM41A.3	3	3	3	2	2	-	-	-	1	1	-	1	-	-
20AIM41A.4	3	3	3	2	2	-	-	-	1	1	-	1	-	-
20AIM41A.5	3	3	3	2	2	-	-	-	1	1	-	1	-	-
20AIM41A.6	3	3	3	2	2	-	-	-	1	1	-	1	-	-
Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)														

Module No	Module Contents	Hours	COs
1	<b>Measures of Dispersion, Skewness and Kurtosis:</b> Dispersion, Measures of dispersion, Percentile, Range, Quartile deviation, Mean deviation, Coefficient of dispersion, Coefficient of variation, Moments, Skewness, Kurtosis.	9	CO1
2	<b>Combinatorics and Probability:</b> Random variable Permutations and Combinations, Probability, Axioms probability, Events, Addition rule, Conditional probability Multiplication rule, Bayes theorem.	9	CO2
3	<b>Probability Distributions:</b> Random variables (discrete and continuous), probability density functions. Discrete Probability distributions: Binomial and Poisson Distributions-Problems. Continuous Probability distributions: Exponential and Normal Distributions-Problems.	9	CO3

<b>4</b>	<b>Joint Probability Distributions and Stochastic process:</b> Concept of joint probability-Joint probability distribution, Discrete and Independent random variables. Expectation, Covariance, Correlation coefficient. Probability vectors, Stochastic matrices, Fixed points, Regular stochastic matrices. Markov chains, Higher transition probabilities. Stationary distribution of regular Markov chains and absorbing states.	<b>9</b>	<b>CO4</b>
<b>5</b>	<b>Sampling Theory:</b> Sampling, Sampling distributions, test of hypothesis of large samples for means and proportions, Central limit theorem (without proof), confidence limits for means, Student's t-distribution, F-distribution and Chi-square distribution for test of goodness of fit for small samples.	<b>9</b>	<b>CO5, CO6</b>

**Text Books:**

1. S. C. Gupta and V. K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand and Sons, Tenth Revised Edition, 2002, ISBN: 81-7014-791-3.
2. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers and Keying Ye, Probability and Statistics for Engineers & Scientists, Prentice Hall, Ninth Edition, 2012, ISBN: 978-0-321-62911-1.

**Reference Books:**

1. Murray R. Spiegel, John J. Schiller and R. Alu Srinivasan, Probability and Statistics, Schaum's Outline Series, McGraw-Hill company, Fourth Edition, 2013, ISBN: 978-0-07-179557-9
2. T. Veerarajan, Probability, Statistics and Random Processes, Tata McGraw-Hill Publishing Company, Limited, Third Edition, 2008, ISBN: 978-0-07-066925-3
3. Athanasios Papoulis and Unni Krishna Pillai, Probability, Random Variables and Stochastic Processes, Tata McGraw-Hill Publishing Company Limited, Fourth Edition, 2002, ISBN: 0-07-112256-7
4. Sheldon M. Ross, Stochastic Processes, John Wiley & Sons. Inc., Second Edition, 1996, ISBN: 0-471-12062-6

**CIE- Continuous Internal Evaluation (50 Marks)**

<b>Bloom's Category</b>	<b>Tests (25 Marks)</b>	<b>Assignment-1 (7.5 Marks)</b>	<b>Assignment-2 (7.5 Marks)</b>	<b>Quiz-1 (05 Marks)</b>	<b>Quiz-2 (05 Marks)</b>
Remember	5	2.5	2.5	-	-
Understand	5	2.5	2.5	-	-
Apply	10	2.5	2.5	05	05
Analyze	2.5	-	-	-	-
Evaluate	2.5	-	-	-	-
Create	-	-	-	-	-

**SEE- Semester End Examination (50Marks)**

<b>Bloom's Category</b>	<b>Questions (50 marks)</b>
Remember	10
Understand	10
Apply	20
Analyze	5
Evaluate	5
Create	-

## LIFE SKILLS FOR ENGINEERS

**Course Code : 20HSS422A**

**L: T: P : 3: 0: 0**

**Exam Hours: :**

**Credits: 2**

**CIE Marks: 50**

**SEE Marks: 50**

<b>Course Outcomes:</b>	<b>At the end of the Course, the Student will be able to</b>
CO#	COURSE OUTCOME
20AIM422.1	Set personal and professional goals
20AIM422.2	Develop critical and creative thinking skills and practise leadership.
20AIM422.3	Demonstrate and understand personal and professional responsibility
20AIM422.4	Apply the concepts of personality development and grooming in corporate life
20AIM422.5	Understand self and work with groups
20AIM422.6	Articulate and convey ideas and thoughts with clarity and focus

<b>Mapping of Course Outcomes to Program Outcomes</b>														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM422.1	-	-	-	-	-	-	-	-	3	-	3	3	-	-
20AIM422.2	-	-	-	-	-	2	-	2	3	-	2	3	-	-
20AIM422.3	-	-	-	-	-	2	2	3	3	-	-	3	-	-
20AIM422.4	-	-	-	-	-	-	-	-	3	3	-	3	-	-
20AIM422.5	-	-	-	-	-	-	-	-	3	-	3	3	-	-
20AIM422.5	-	-	-	-	-	2	2	-	3	3	2	3	-	-

Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)

<b>Module No</b>	<b>Module Contents</b>	<b>Hours</b>	<b>Cos</b>
<b>1</b>	Goal Setting: Importance of Goals: Achiever's goal - Creating SMART for personal and professional life, Right action at right time, career planning, overcoming fear and face uncertainty, Mind Mapping. Communication – Intellectual preparation/Idea generation.	<b>6</b>	<b>CO1 CO6</b>
<b>2</b>	You are the creator - Taking Ownership, Being Responsible and Accountable. Meaning of Ownership, Responsibility and Accountability, Practicing these philosophies in course, career. Social responsibility. Communication – Organising thought flow.	<b>6</b>	<b>CO3 CO6</b>
<b>3</b>	Self-Awareness and Self-Management: Emotional Intelligence, Know yourself- understanding personality, perception, techniques to understand self – Johari window and SWOT, reason for fall and opportunities to grow. Individual behaviour, attitude towards change and work, being proactive and positive. Interpersonal skills - Knowing others, working well with others. Communication – Structured articulation	<b>9</b>	<b>CO5 CO6</b>

<b>4</b>	Leadership, meaning, self - motivation, coming out of comfort zone, mental preparation - accepting failure and resilience, decision making, thinking skills – critical and creative, six thinking hats, watchfulness - proactive risk management, problem solving mind set. Communication – Tips for Jam session, GD and Presentation	<b>9</b>	<b>CO2, CO6</b>
<b>5</b>	Personality Development and Grooming: - Expectations from the industry, building personal presence, corporate grooming, corporate etiquettes, Personal branding and image management. Communication – Mock GD sessions	<b>6</b>	<b>CO4 CO6</b>

**Reference Books:**

1. The 7 – Habits of Highly Effective People, Stephen R Covey, Neha Publishers
2. Seven Habits of Highly Effective Teens, Convey Sean, New York, Fireside Publishers, 1998.
3. Emotional Intelligence, Daniel Coleman, Bantam Book, 2006.
4. How to win friends and influence people Dale Carnegie
5. The Bhagavad-Gita for college students Sandeepa Guntreddy

**CIE- Continuous Internal Evaluation (50 Marks)**

<b>Bloom's Category</b>	<b>Tests</b>	<b>Assignments</b>	<b>Self-Study</b>	<b>Peer Evaluation</b>
<b>Marks (out of 50)</b>	<b>10</b>	<b>15</b>	<b>15</b>	<b>10</b>
Remember	-	-	-	-
Understand	-	-	-	-
Apply	5	5	-	5
Analyse	-	-	5	-
Evaluate	-	-	-	-
Create	5	10	10	5

**SEE- Semester End Examination (50Marks)**

<b>Bloom's Category</b>	<b>Questions (50 marks)</b>
Remember	5
Understand	10
Apply	10
Analyze	10
Evaluate	5
Create	10

## ENVIRONMENTAL SCIENCE AND AWARENESS

Course Code : 20HSS423A  
 L: T: P : 0: 0: 0  
 Exam Hours : 2

Credits: 0  
 CIE Marks: 25  
 SEE Marks: 25

Course Outcomes:	At the end of the Course, the Student will be able to
CO#	COURSE OUTCOME
20HSS323A.1	Explain the concepts of environment, ecosystem and biodiversity.
20HSS323A.2	Analyze the use of natural resources for sustainability.
20HSS323A.3	Understand the control measures of Environmental pollution, the role of Government and NGO in solving Socio-Environmental issues.
20HSS323A.4	Apply the Environmental ethics, acts and amendments in protecting Environment and human health.

Mapping of Course Outcomes to Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
19HSS323.1	-	-	-	-	-	3	3	-	-	-	-	-	-	-
19HSS323.2	-	-	-	-	-	3	3	-	-	-	-	3	3	-
19HSS323.3	-	-	-	-	-	3	3	3	-	3	-	3	3	-
19HSS323.4	-	-	-	-	-	3	3	3	-	3	-	3	3	-

Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)

Module No	Module Contents	Hours	Cos
1	<b>Introduction to Environment, Ecosystem and biodiversity:</b> Environment - Components of Environment, Scope and importance of Environmental studies, Ecosystem: Types & Structure of Ecosystem, Energy flow in the ecosystem, Food chains – food webs & ecological pyramids. Biodiversity – Definition, Hot-spots of biodiversity, Threats to biodiversity, Conservation of biodiversity.	05	CO1
2	<b>Natural Resources:</b> Renewable and non-renewable resources – Natural resources and associated problems. Role of an individual in conservation of natural resources. Water conservation, rain water harvesting. Balanced use of resources for sustainable lifestyle – strategies.	04	CO2

3	<b>Environmental Pollution:</b> Definition, Causes, effects and control measures of Air Pollution, Water Pollution, Soil Pollution, Marine Pollution, Noise pollution, Thermal Pollution and Nuclear hazards. Role of an individual in prevention of pollution - Waste management – urban and industrial wastes.	04	CO3
4	<b>Social Issues and Environment:</b> Environmental ethics – issues and possible solutions. Environment protection act – Air (prevention and Control of pollution) act & Water (prevention and Control of pollution) act. Role of government: Swatch Bharat Abhiyan, National Mission for Clean Ganga (NMCG), River rejuvenation, Role of Non-governmental Organizations (NGOs), Global warming and climate change.	04	CO3 CO4
5	<b>Human Population and Environment:</b> Population growth & explosion, Family welfare programme. Environment and human health, Human rights, Value education. Role of Technology in protecting environment and human health.	05	CO4

**Text Books:**

1. “Environmental Studies: Basic Concepts” by Ahluwalia, V. K The Energy and Resources Institute (TERI) Publication, 2<sup>nd</sup> edition, 2016, ISBN: 817993571X, 9788179935712.
2. “Textbook of Environmental Studies for Undergraduate Courses of all branches of Higher Education” by Bharucha, Erach for UGC, New Delhi, 2004. ISBN: 8173715408, 9788173715402.

**Reference Books:**

1. Digital Design: with an Introduction to Verilog HDL, M Morris Mano and Michael DCiletti, 5th Edition, 2013, Pearson Education
2. Handbook of Environmental Engineering by Rao Surampalli, Tian C. Zhang, Satinder Kaur Brar, Krishnamoorthy Hegde, Rama Pulicharla, MausamVerma; McGraw Hill Professional, 2018. ISBN: 125986023X, 9781259860232
3. Environmental Science and Engineering by P. Venugopala, Prentice Hall of India Pvt. Ltd, New Delhi, 2012 Edition. ISBN: 978-81-203-2893-8.
4. Environmental Science- Working with the earth by G Taylor Miller Jr, Brooks Cole Thompson Publications, 10<sup>th</sup>Edition ,ISBN: 10: 0534424082

**CIE- Continuous Internal Evaluation (25 Marks).**

<b>Bloom's Category</b>	<b>Tests (15 marks)</b>	<b>Assignments (5 marks)</b>	<b>Quizzes (5 marks)</b>
Remember	2	0	0
Understand	5	0	2
Apply	4	2	3
Analyze	4	3	0
Evaluate	0	0	0
Create	0	0	0

**SEE- Semester End Examination (25 Marks)**

<b>Bloom's Category</b>	<b>Questions (25 marks)</b>
Remember	5
Understand	10
Apply	5
Analyze	5
Evaluate	0
Create	0

## INTRODUCTION TO DATA SCIENCE

**Course Code : 20AIM43A**

**L: T: P : 3: 0: 0**

**Exam Hours: : 3**

**Credits: 3**

**CIE Marks: 50**

**SEE Marks: 50**

<b>Course Outcomes:</b>	<b>At the end of the Course, the Student will be able to</b>
CO#	COURSE OUTCOME
20AIM43A.1	Explore predictive modeling techniques with necessary python packages
20AIM43A.2	Apply predictive modeling and descriptive statistics concepts for data preparation
20AIM43A.3	Examine and use appropriate methods for data wrangling
20AIM43A.4	Inspect and submit efficient solution for the given data source as a team.
20AIM43A.5	Prepare an effective written documentation about significance of feature selection
20AIM43A.6	Demonstrate Big data tools used for analytics

<b>Mapping of Course Outcomes to Program Outcomes</b>														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM43A.1	-	-	-	-	3	-	-	-	-	-	-	3	3	-
20AIM43A.2	3	-	-	-	3	-	-	-	-	-	-	3	3	-
20AIM43A.3	-	3	-	-	3	-	-	-	-	-	-	3	3	-
20AIM43A.4	-	-	-	3	3	-	-	-	2	2	-	3	3	-
20AIM43A.5	-	-	-	-	3	-	-	-	-	-	-	3	3	-
20AIM43A.6	3	-	-	-	3	-	-	-	-	-	-	3	3	-

Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)

<b>Module No</b>	<b>Module Contents</b>	<b>Hours</b>	<b>COs</b>
<b>1</b>	<b>Basic Concepts:</b> Predictive Modeling , Data preparation, Importance of Data preparation , Data Cleaning , Feature selection , Data Transform , Feature selection , Dimensionality reduction, K-fold cross validation , Data Leakage and avoidance measure <b>Python Packages:</b> Numpy , Matplotlib , pandas , scipy , scikit , Data frame , Loading Machine Learning data	<b>9</b>	<b>CO1, CO2</b>
<b>2</b>	<b>Descriptive Statistics:</b> Mean Standard Deviation, Skewness and Kurtosis – Box Plots – Pivot Table – Heat Map Correlation Statistics – ANOV. <b>Data Preparation:</b> Need for Data Pre-processing, Data Transforms, and Rescale Data Standardize Data, Normalize Data, Binarize Data, Univariate Selection, Recursive Feature Elimination, Principal Component Analysis.	<b>9</b>	<b>CO1, CO2, CO4, CO6</b>

<b>3</b>	<b>Data Cleaning:</b> Basic data cleaning, Outlier Identification and Removal , How to Mark and Remove Missing Data , Statistical Imputation, KNN Imputation , Iterative Imputation. <b>Feature Selection:</b> Statistics for feature selection, Methods for categorical input, Methods for Numerical input, Select Features for Numerical Output, RFE for Feature Selection, Significance of feature selection.	<b>9</b>	<b>CO1, CO3, CO4</b>
<b>4</b>	<b>Data Transforms:</b> Scaling data source, min-max scalar and standard scaler, Scale data with outliers, Encode categorical data, Make Distributions More Gaussian, Approach for Numerical Data Distributions, Deriving new input variables. <b>Dimensionality reduction :</b> Techniques for Dimensionality Reduction , Linear Discriminant Analysis , PCA Dimensionality Reduction , SVD Dimensionality Reduction		<b>CO1, CO3, CO4, CO6</b>
<b>5</b>	<b>Other Transforms:</b> Transform numerical to categorical , Transform Numerical and Categorical Data , Transform the Target in Regression , Save and load the transformation , case studies for Binary classification, Multi classification and regression		<b>CO1, CO4, CO5, CO6</b>

**Text Books:**

1. Data Preparation for Machine Learning by Jason Brownlee , 2020
2. Master Machine Learning Algorithms Discover How They Work and Implement Them From Scratch by Jason Brownlee, 2016.

**Reference Books:**

1. Data Mining Concepts and Techniques, Han, Kamber, 3rd Edition, Morgan Kaufmann Publishers, 2016

**CIE- Continuous Internal Evaluation (50 Marks)**

<b>Bloom's Category</b>	<b>Tests (25 marks)</b>	<b>Assignments (15 marks)</b>	<b>Quizzes (10 marks)</b>
Remember	5	-	5
Understand	5	-	5
Apply	10	7.5	-
Analyze	5	7.5	-
Evaluate	-	-	-
Create	-	-	-

**SEE- Semester End Examination (50Marks)**

<b>Bloom's Category</b>	<b>Questions (50 marks)</b>
Remember	10
Understand	10
Apply	20
Analyze	10
Evaluate	-
Create	-

## OBJECT ORIENTED PROGRAMMING USING JAVA

Course Code : 20AIM44A

L: T: P : 3: 0: 0

Exam Hours: : 3

Credits: 3

CIE Marks: 50

SEE Marks: 50

Course Outcomes:	At the end of the Course, the Student will be able to
CO#	COURSE OUTCOME
20AIM44A.1	Describe the object oriented concepts of Java
20AIM44A.2	Apply OOP's concept to implement a given problem using Java.
20AIM44A.3	Analyze the flow of a program is correct according to OOP's principles
20AIM44A.4	Investigate the concept of Multithreading in concurrent programming available in literature and submit report in a team
20AIM44A.5	Prepare an effective written documentation about significance of various packages
20AIM44A.6	Demonstrate the web based applications development using java.

Mapping of Course Outcomes to Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM44A.1	-	-	-	-	3	-	-	-	-	-	-	3	3	2
20AIM44A.2	3	-	-	-	3	-	-	-	-	-	-	3	3	2
20AIM44A.3	-	3	-	-	3	-	-	-	-	-	-	3	3	2
20AIM44A.4	-	-	3	-	3	-	-	-	2	2	-	3	3	2
20AIM44A.5	-	-	3	-	3	-	-	-	-	2	-	3	3	2
20AIM44A.6	3	-	-	-	3	-	-	-	-	-	-	3	3	2
Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)														

Module No	Module Contents	Hours	COs
<b>1</b>	<b>Introduction to Java:</b> Basics of Java programming - Dissecting the "Hello, World" Program, Compiling and Running a Java Program, Data types, Variables, Operators, Control structures including selection, Looping, Java methods, Math class, Arrays in java	<b>9</b>	<b>CO1 CO2</b>
<b>2</b>	<b>Objects and Classes:</b> Working with Objects, Implementing Classes, Object Construction, Static Variables and Methods, Constructors, Overloading Visibility modifiers, Methods and objects, Inbuilt classes like String, Character, String Buffer, this reference, nested classes.	<b>9</b>	<b>CO1, CO2, CO6</b>
<b>3</b>	<b>Inheritance and Polymorphism:</b> Inheritance and types, Super and sub class, Overriding, Polymorphism, Dynamic binding, Casting objects, Instance of operator, Abstract class, Interface, Package , Object class	<b>9</b>	<b>CO1, CO2, CO6</b>

4	<b>Exception Handling:</b> Exception Types, Uncaught Exceptions, using try and catch, Multi catch clauses, Nested try statements, throw, throws, finally, Java's Built-in Exceptions. <b>Threads:</b> The java Thread Model, The main Thread,	9	CO1, CO2, CO3, CO4, CO6
	Creating a Thread, Creating multiple Threads, Thread Priorities, Synchronization, Inter thread Communication, Suspending, resuming and Stopping Threads, using Multithreading.		
5	<b>I/O basics:</b> Reading input, writing output, Reading and Writing files <b>The Collections Framework:</b> Collections Overview, The Collection Interfaces- The List Interface, The Set Interface, The Queue Interface, The Collection Classes – Array List Class, Linked List Class, Tree set Class	9	CO1, CO2, CO5, CO6

**Text Books:**

1. Herbert Schildt, Java™: The Complete Reference, McGraw-Hill, Tenth Edition,2018
2. Cay S.Horstmann, Core Java®SE9fortheImpatient, Addison Wesley, Second Edition,2018

**Reference Books:**

1. Cay S. Horstmann, Core Java™ Volume I—Fundamentals, Prentice Hall, Tenth Edition,2015
2. Rogers Cedenhead and Leura, Lemay SAMS teach yourself Java– 2, 3rd Edition by Pub. Pearson Education, 2004
3. Ken Kousen, Modern Java Recipes, O'Reilly Media, Inc.,2017

**CIE- Continuous Internal Evaluation (50 Marks)**

Bloom's Category	Tests (25 marks)	Assignments (15 marks)	Quizzes (10 marks)
Remember	-	-	5
Understand	10	-	5
Apply	10	7.5	-
Analyze	5	7.5	-
Evaluate	-	-	-
Create	-	-	-

**SEE- Semester End Examination (50Marks)**

Bloom's Category	Questions (50 marks)
Remember	-
Understand	10
Apply	30
Analyze	10
Evaluate	-
Create	-

## DATABASE MANAGAEMENT SYSTEM

**Course Code** : 20AIM45A  
**L: T: P** : 3: 0: 0  
**Exam Hours** : 3

**Credits**: 3  
**CIE Marks**: 50  
**SEE Marks**: 50

Course Outcomes:	At the end of the Course, the Student will be able to
CO#	COURSE OUTCOME
20AIM45A.1	Describe the concepts of DataBase Management Systems
20AIM45A.2	Analyse the various database concepts using ER diagram
20AIM45A.3	Make use of Relational Database techniques for solving real world problems
20AIM45A.4	Construct database for the structured data by applying normalization techniques
20AIM45A.5	Design database for the unstructured data with effective documentation report as a team
20AIM45A.6	Demonstrate the databases used for big data

Mapping of Course Outcomes to Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM45A.1	-	-	-	-	3	-	-	-	-	-	-	3	3	2
20AIM45A.2	-	3	-	-	3	-	-	-	-	-	-	3	3	2
20AIM45A.3	3	-	-	-	3	-	-	-	-	-	-	3	3	2
20AIM45A.4	3	-	-	-	3	-	-	-	-	-	-	3	3	2
20AIM45A.5	3	-	-	-	3	-	-	-	3	3	-	3	3	2
20AIM45A.6	3	-	-	-	3	-	-	-	-	-	-	3	3	2

Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)

Module No	Module Contents	Hours	COs
1	<b>Introduction to Databases:</b> Definition of database, DBMS; Characteristics of Database approach; Advantages of using DBMS approach; when not to use a DBMS <b>Database Concept and Architecture:</b> Data models, schemas and instances; Data Abstraction; Three-schema architecture and data independence; Components of a DBMS - Database Designer- Database Administrator - Database Users. <b>Introduction to Entity-Relationship Model:</b> Entity Types, Attributes and Keys; Relationship types, Roles and Structural Constraints; Weak Entity Types; ER Diagrams, Naming Conventions and Design Issues; Relationship types of degree higher than two; Reduction of an E-R schema to relational Tables	10	CO1, CO2

2	<b>Introduction to Logical Design and Relational Model:</b> Domains, Attributes, Tuples, and Relations; Relational Model Constraints; Relational Database Schemas; <b>SQL-1:</b> Overview of SQL language; SQL Data Definition and Data Types; Schema change statements in SQL; Enforcing basic constraints in SQL; Basic structure of SQL queries	10	CO1, CO3
	Joins; Logical connectives - AND, OR and NOT; Addition basic operations ; Set operations; Aggregate function; Comparisons Involving NULL and Three-Valued Logic; SQL modification language; Select, Delete, Update clause		
3	<b>SQL -2:</b> Introduction to Nested Queries; Correlated Nested Queries; Introduction to Views: creation, implementation, update of views; Introduction to Assertion and Trigger	7	CO1, CO2, CO3
4	<b>Index Structures:</b> Indexes on Sequential Files: dense, sparse index; multilevel indexing; Hash Based Indexing: Static Hashing and dynamic hashing. <b>Database Refinement:</b> Informal Design Guidelines for Relation Schemas; Functional Dependencies; Normalization on Relational Data Base:1NF,2NF,3NF, BCNF; Transaction Management: The ACID Properties; Transactions and Schedules	9	CO1, CO2, CO4
5	<b>NOSQL Databases:</b> What is NoSQL, Need of NOSQL, Features OF NOSQL, CAP Theorem, ACID v/s BASE, Advantages & Disadvantages of NOSQL, Types of NOSQL: Key-Value database- Document-based database- Column-based database- Graph based database. <b>Introduction to Cassandra:</b> Architecture, Gossip protocol, Snitches, Virtual Nodes, write consistency level and write process, read consistency level and read data operation, indexing, compaction, Anti-entropy, Tombstones	9	CO1, CO5, CO6

**Text Books:**

1. Ramez Elmasri and Shamkant B. Navathe: Fundamentals of Database Systems, 7th Edition, Pearson , 2016.
2. Abraham Silberschatz , Henry F. Korth , S. Sudarshan, ” Database System Concepts”, 6th Edition, McGrawHill, 2011
3. Pramod J. Sadalage, Martin Fowler, “NoSQL Distilled”, Pearson education Inc, Nov 2014

**Reference Books:**

1. Johannes Gehrke, Raghu Ramakrishnan, Database Management Systems 3rd Edition, McGraw Hill Education, 2014.
2. Shashank Tiwari, “Professional NoSQL”, John Wiley & Sons, Inc, 2011

**CIE- Continuous Internal Evaluation (50 Marks)**

<b>Bloom's Category</b>	<b>Tests (25 marks)</b>	<b>Assignments (15 marks)</b>	<b>Quizzes (10 marks)</b>
Remember	5	-	-
Understand	5	-	5
Apply	10	7.5	5
Analyze	5	7.5	-
Evaluate	-	-	-
Create	-	-	-

**SEE- Semester End Examination (50Marks)**

<b>Bloom's Category</b>	<b>Questions (50 marks)</b>
Remember	10
Understand	10
Apply	20
Analyze	10
Evaluate	-
Create	-

## OBJECT ORIENTED PROGRAMMING USING JAVA LAB

Course Code : 20AIL46A  
 L: T: P : 0: 0: 2  
 Exam Hours: : 3

Credits: 2  
 CIE Marks: 25  
 SEE Marks: 25

Course Outcomes:	At the end of the Course, the Student will be able to
CO#	COURSE OUTCOME
20AIL46A.1	Apply OOP concepts with basic Java constructs to solve the given problem.
20AIL46A.2	Analyze the output for the programs in Java.
20AIL46A.3	Conduct experiments as individual by using modern tools like JDK
20AIL46A.4	Prepare an effective report based on experiments

Mapping of Course Outcomes to Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIL46A.1	-	-	-	-	-	-	-	-	-	-	-	-	3	2
20AIL46A.2	3	-	-	-	-	-	-	-	-	-	-	-	3	2
20AIL46A.3	-	3	-	-	-	-	-	-	3	-	-	3	3	2
20AIL46A.4	-	-	-	-	-	-	-	-	3	3	-	-	3	2

Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)

Ex. No	Experiments	Hours	COs
1.	Write a Java Program to demonstrate math class and arrays	4	CO1
2.	Write a Java Program to define a class, describe its constructor, overload the Constructors and instantiate its object, and use static members.		CO2 CO3 CO4
3.	Write a Java program to demonstrate String class, String Buffer class and its Methods	4	CO1 CO2
4.	Write a Java program to demonstrate nested classes and array of objects		CO3 CO4
5.	Write a Java Program to implement inheritance and demonstrate use of method overriding	4	CO1 CO2 CO3 CO4
6.	Write a Java Program to implement multilevel inheritance by applying various access controls to its data members and methods		
7.	Write a program to demonstrate use of implementing interfaces	4	CO1 CO2 CO3 CO4
8.	Write a program to demonstrate use of extending interfaces		
9.	Write a Java program to implement the concept of importing classes from user defined package and creating packages Write a Java Program to demonstrate dynamic binding, generic programming	4	CO1 CO2 CO3

10.	Write a program to implement the concept of threading by extending Thread Class		CO4
11.	Write a program to implement the concept of threading by implementing Runnable Interface	4	CO1 CO2 CO3 CO4
12.	Write a java program that implements a multi-thread application that has three threads. First thread generates random integer every 1 second and if the value is even, second thread computes the square of the number and prints .If the value is odd, the third thread will print the value of cube of the number		
13.	Write a program to implement the concept to of Exception Handling using pre-defined exception	4	CO1 CO2 CO3 CO4
14.	Write a program to implement the concept of Exception Handling by creating user defined exceptions		
15.	a) Write a program to demonstrate File I/O Operations b) Write a program to demonstrate Array List Class, Linked List Class, Tree set Class	2	CO1 CO2 CO3 CO4

**Text Books:**

1. Herbert Schildt, Java™: The Complete Reference, McGraw-Hill, Tenth Edition,2018
2. Cay S. Horstmann, Core Java® SE 9 for the Impatient, Addison Wesley, Second Edition, 2018

**CIE- Continuous Internal Evaluation (25 Marks)**

Bloom's Category	Tests (25 marks)
Remember	-
Understand	5
Apply	15
Analyze	5
Evaluate	-
Create	-

**SEE- Semester End Examination (25Marks)**

Bloom's Category	Questions (50 marks)
Remember	-
Understand	5
Apply	15
Analyze	5
Evaluate	-
Create	-

## DATABASE MAGAGEMENT SYSTEM LAB

**Course Code : 20AIL47A**  
**L: T: P : 0: 0: 2**  
**Exam Hours: : 3**

**Credits: 2**  
**CIE Marks: 25**  
**SEE Marks: 25**

Course Outcomes:	At the end of the Course, the Student will be able to
CO#	COURSE OUTCOME
20AIL47A.1	Apply database management techniques to solve the problem
20AIL47A.2	Analyse database for the given problem
20AIL47A.3	Conduct experiments as individual by using MySQL/Oracle
20AIL47A.4	Make an effective report based on experiments

Mapping of Course Outcomes to Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIL47A.1	3	-	-	-	-	-	-	-	-	-	-	3	3	2
20AIL47A.2	-	3	-	-	-	-	-	-	-	-	-	3	3	2
20AIL47A.3	-	-	-	-	3	-	-	-	-	-	-	3	3	2
20AIL47A.4	-	-	-	-	-	-	-	-	-	3	-	3	3	2

Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)

Ex. No	Experiments	Hours	COs
1.	Draw E-R diagram and convert entities and relationshipsto relation table for a given scenario. a. Two assignments shall be carried out i.e. consider twodifferent scenarios (eg. bank, college)	3	CO1,CO2, CO3,, CO4
2.	Write relational algebra queries a. Viewing all databases, Creating a Database, b. Viewing all Tables in a Database, c. Creating Tables (With and Without Constraints), d. Inserting/Updating/Deleting e. Records in a Table, Saving (Commit) and Undoing(rollback)	3	CO1,CO2, CO3,CO4
3.	Write relational algebra queries a. Altering a Table, b. Dropping/Truncating/Renaming Tables, c. Backing up / Restoring a Database.	3	CO1, CO2, CO3,CO4
4.	Consider the following database for student enrolment forcouse: STUDENT (snum: integer, sname: string, major: string,level: string, age: integer) CLASS (name: string, meets at: time, room: string, fid:integer) ENROLLED (snum: integer, cname: string) FACULTY (fid: integer, fname: string, deptid: integer) The meaning of these relations is straightforward; for example, Enrolled has one record per student-class pair such that the student is enrolled in the class. Level is a two	3	CO1, CO2, CO3,CO4

	character code with 4 different values (example: Junior: JR		
	<p>etc)</p> <p>Write the following queries in SQL. No duplicates should be printed in any of the answers.</p> <ol style="list-style-type: none"> <li>i. Find the names of all Juniors (level = JR) who are enrolled in a class taught by</li> <li>ii. Find the names of all classes that either meet in room R128 or have five or more Students enrolled.</li> <li>iii. Find the names of all students who are enrolled in two classes that meet at the same time.</li> <li>iv. Find the names of faculty members who teach in every room in which some class is taught.</li> <li>v. Find the names of faculty members for whom the combined enrolment of the courses that they teach is less than five.</li> <li>vi. Find the names of students who are not enrolled in any class.</li> <li>vii. For each age value that appears in Students, find the level value that appears most often. For example, if there are more FR, level students aged 18 than SR, JR, or SO students aged 18, you should print the pair (18, FR).</li> </ol>		
5.	<p>Consider the following database that keeps track of airline flight information:</p> <p>FLIGHTS (flno: integer, from: string, to: string, distance: integer, departs: time, arrives: time, price: integer)</p> <p>AIRCRAFT (aid: integer, aname: string, cruisingrange: integer)</p> <p>CERTIFIED (eid: integer, aid: integer)</p> <p>EMPLOYEE (eid: integer, ename: string, salary: integer)</p> <p>Note that the Employees relation describes pilots and other kinds of employees as well; Every pilot is certified for some aircraft, and only pilots are certified to fly.</p> <p>Write each of the following queries in SQL.</p> <ol style="list-style-type: none"> <li>i. Find the names of aircraft such that all pilots certified to operate them have salaries more than Rs.80,000.</li> <li>ii. For each pilot who is certified for more than three aircrafts, find the eid and the maximum cruising range of the aircraft for which she or he is certified.</li> <li>iii. Find the names of pilots whose salary is less than the price of the cheapest route from Bengaluru to Frankfurt.</li> <li>iv. For all aircraft with cruising range over 1000 Kms, find the name of the aircraft and the average salary of all pilots certified for this aircraft.</li> <li>v. Find the names of pilots certified for some Boeing aircraft.</li> <li>vi. Find the aids of all aircraft that can be used on routes from Bengaluru to New Delhi.</li> <li>vii. A customer wants to travel from Madison to New York with no more than two changes of flight. List the</li> </ol>	3	CO1, CO2, CO3,CO4

	choice of departure times from Madison if the customer wants to arrive in New York by 6 p.m.		
	viii. Print the name and salary of every non-pilot whose salary is more than the average salary for pilots.		
6.	<p>Consider the following relations for an Order Processing database application in a company.</p> <p>CUSTOMER (CUST #: int, cname: String, city: String)</p> <p>ORDER (order #: int, odate: date, cust #: int, ord-Amt: int)</p> <p>ITEM (item #: int, unit-price: int)</p> <p>ORDER-ITEM (order #: int, item #: int, qty: int)</p> <p>WAREHOUSE (warehouse #: int, city: String)</p> <p>SHIPMENT (order #: int, warehouse #: int, ship-date: date)</p> <p>i. Create the above tables by properly specifying the primary keys and the foreign keys and the foreign keys.</p> <p>ii. Enter at least five tuples for each relation.</p> <p>iii. Produce a listing: CUSTNAME, #of orders, AVG_ORDER_AMT, where the middle column is the total numbers of orders by the customer and the last column is the average order amount for that customer.</p> <p>iv. List the order# for orders that were shipped from all warehouses that the company has in a specific city.</p> <p>v. Demonstrate how you delete item# 10 from the ITEM table and make that field null in the ORDER_ITEM table.</p>	3	CO1, CO2, CO3,CO4
7.	<p>The following tables are maintained by a book dealer:</p> <p>AUTHOR(author-id: int, name: String, city: String, country: String)</p> <p>PUBLISHER(publisher-id: int, name: String, city: String, country: String)</p> <p>CATALOG (book-id: int, title: String, author-id: int, publisher-id: int, category-id: int, year: int, price: int)</p> <p>CATEGORY(category-id: int, description: String)</p> <p>ORDER-DETAILS(order-no: int, book-id: int, quantity: int)</p> <p>i. Create the above tables by properly specifying the primary keys and the foreign keys.</p> <p>ii. Enter at least five tuples for each relation.</p> <p>iii. Give the details of the authors who have 2 or more books in the catalog and the price of the books in the catalog and the year of publication is after 2000.</p> <p>iv. Find the author of the book, which has maximum sales.</p> <p>v. Demonstrate how you increase the price of books published by a specific publisher by 10%.</p>	3	CO1, CO2, CO3,CO4

8.	<p>Consider the following database of student enrollment incourses and books adopted for each course.</p> <p>STUDENT (regno: String, name: String, major: String, bdate: date)</p> <p>COURSE (course #: int, cname: String, dept: String)</p> <p>ENROLL (regno: String, cname: String, sem: int, marks:int)</p> <p>BOOK_ADOPTION (course #: int, sem: int, book-ISBN:int)</p>	3	CO1, CO2, CO3,CO4
	<p>TEXT(book-ISBN:int, book-title:String, publisher:String, author:String)</p> <p>i. Create the above tables by properly specifying the primary keys and the foreign keys.</p> <p>ii. Enter at least five tuples for each relation.</p> <p>iii. Demonstrate how you add a new textbook to the database and make this book be adopted by some department.</p> <p>iv. Produce a list of textbooks (include Course #, Book-ISBN, Book-title) in the alphabetical order for courses offered by the 'AIML' department that use more than two books.</p> <p>v. List any department that has all its adopted books published by a specific publisher.</p>		
9.	<p>Consider the schema for Movie Database:</p> <p>ACTOR(Act_id, Act_Name, Act_Gender)</p> <p>DIRECTOR(Dir_id, Dir_Name, Dir_Phone)</p> <p>MOVIES(Mov_id, Mov_Title, Mov_Year, Mov_Lang, Dir_id)</p> <p>MOVIE_CAST(Act_id, Mov_id, Role)</p> <p>RATING(Mov_id, Rev_Stars)</p> <p>Write SQL queries to</p> <p>i. List the titles of all movies directed by 'Hitchcock'.</p> <p>ii. Find the movie names where one or more actors acted in two or more movies.</p> <p>iii. List all actors who acted in a movie before 2000 and in a movie after 2015 (use JOIN operation).</p> <p>iv. Find the title of movies and number of stars for each movie that has at least one rating and find the highest number of stars that movie received. Sort the result by movie title.</p> <p>v. Update rating of all movies directed by 'Steven Spielberg' to 5.</p>	3	CO1, CO2, CO3,CO4
10.	<p>Consider the schema for College Database:</p> <p>STUDENT(USN, SName, Address, Phone, Gender)</p> <p>SEMSEC(SSID, Sem, Sec)</p> <p>CLASS(USN, SSID)</p> <p>SUBJECT(Subcode, Title, Sem, Credits)</p> <p>IAMARKS(USN, Subcode, SSID, Test1, Test2, Test3,</p>		

FinalIA) Write SQL queries to i. List all the student details studying in fourth semester 'C' section. ii. Compute the total number of male and female students in each semester and in each section. iii. Create a view of Test1 marks of student USN '1NH20AI101' in all subjects. iv. Calculate the FinalIA (average of best two test marks) and update the corresponding table for all students. v. Categorize students based on the following criterion:	3	CO1, CO2, CO3,CO4
If FinalIA = 17 to 20 then CAT = 'Outstanding' If FinalIA = 12 to 16 then CAT = 'Average' If FinalIA < 12 then CAT = 'Weak' Give these details only for 8th semester A, B, and C-section students.		

**Text Books:**

1. Ramez Elmasri and Shamkant B. Navathe: Fundamentals of Database Systems, 7th Edition, Pearson, 2016.
2. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, "Database System Concepts", 6th Edition, McGrawHill, 2011

**CIE- Continuous Internal Evaluation (25 Marks)**

Bloom's Category	Tests (25 marks)
Remember	-
Understand	5
Apply	15
Analyze	5
Evaluate	-
Create	-

**SEE- Semester End Examination (25Marks)**

Bloom's Category	Questions (50 marks)
Remember	-
Understand	5
Apply	15
Analyze	5
Evaluate	-
Create	-

## MINI PROJECT - II

**Course Code : 20AIL48A**  
**L: T: P : 0: 0: 2**  
**Exam Hours: : 3**

**Credits: 2**  
**CIE Marks: 25**  
**SEE Marks: 25**

Course Outcomes:	At the end of the Course, the Student will be able to
CO#	COURSE OUTCOME
20AIL48A.1	Illustrate the technological needs and/ or societal needs and sustainability of the environment
20AIL48A.2	Design application using high level language
20AIL48A.3	Analyse and evaluate the outcome of the project
20AIL48A.4	Test, validate and communicate the identified solutions in a structured way.

Mapping of Course Outcomes to Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIL48A.1	-	-	-	-	-	3	2	3	-	-	-	3	3	2
20AIL48A.2	-	-	3	-	3	-	-	-	-	-	-	3	3	2
20AIL48A.3	-	3	-	-	-	-	-	-	-	-	-	3	3	2
20AIL48A.4	-	-	-	3	-	-	-	-	3	3	3	3	3	2
Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)														

Each team capable of identifying a problem and carry out a mini project on the problem defined. A panel of experts will review the code developed towards the project during the course of the semester. Plagiarized projects will automatically get an **“F” GRADE** and the student will be liable for further disciplinary action. At the completion of a project, the team will submit a project report, which will be evaluate by duly appointed examiner(s).

### CIE- Continuous Internal Evaluation (25 Marks)

Bloom's Category	Review (25marks)
Remember	-
Understand	-
Apply	10
Analyze	10
Evaluate	5
Create	-

### SEE- Semester End Examination (25Marks)

Bloom's Category	Review (25marks)
Remember	-
Understand	-
Apply	10
Analyze	10
Evaluate	5
Create	-

V SEMESTER												
S.No	Course Code	Course	BOS	Credit Distribution				Overall Credits	Contact Hours	Marks		
				L	T	P	S			CIE	SEE	Total
1	20AIM51A	Machine Learning	AI&ML	3	0	0	0	3	4	50	50	100
2	20AIM52A	Operating system	AI&ML	3	0	0	0	3	4	50	50	100
3	20AIM53A	Big data Technologies	AI&ML	3	0	0	0	3	4	50	50	100
4	20AIM54XA	Professional Elective - I	AI&ML	3	0	0	0	3	4	50	50	100
5	20AIM55XA	Professional Elective- II	AI&ML	3	0	0	0	3	4	50	50	100
6	20AIM56A	Design and Analysis of Algorithm	AI&ML	3	0	0	0	3	4	50	50	100
7	20AIL57A	Machine Learning Laboratory	AI&ML	0	0	2	0	2	4	25	25	50
8	20AIL58A	Design and Analysis of Algorithm Laboratory	AI&ML	0	0	2	0	2	4	25	25	50
9	20AIM59A	Mini Project - III	AI&ML	0	0	2	0	2	2	25	25	50
<b>Total</b>								<b>24</b>	<b>34</b>	<b>375</b>	<b>375</b>	<b>750</b>

S. NO	COURSE CODE	PROFESSIONAL ELECTIVE-1	S. NO	COURSE CODE	PROFESSIONAL ELECTIVE-2
1	20AIM541A	Information Storage and Retrieval	1	20AIM551A	Speech Synthesis and Recognition
2	20AIM542A	Introduction to sensor and IOT	2	20AIM552A	Embedded Systems
3	20AIM543A	Theory of Computation	3	20AIM553A	Software Engineering
4	20AIM544A	Parallel Processing	4	20AIM554A	Cryptography and Network Security

## MACHINE LEARNING

**Course Code** : 20AIM51A  
**L: T: P: S:** : 3: 0: 0: 0:  
**Exam Hours:** : 3

**Credits:** 3  
**CIE Marks:** 50  
**SEE Marks:** 50

Course Outcomes:	At the end of the Course, the Student will be able to:
<b>CO#</b>	<b>COURSE OUTCOME ( Student will be able to)</b>
20AIM51A.1	Apply the basic principles of Machine learning
20AIM51A.2	Analyze and formulate the Machine Learning concepts
20AIM51A.3	Design a model using supervised/unsupervised machine learning algorithms for classification/prediction/clustering
20AIM51A.4	Evaluate performance of various machine learning algorithms on various data sets of a domain.
20AIM51A.5	Use python/R for implementing machine learning algorithms to solve a given problem.

### Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM51A.1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
20AIM51A.2	-	3	-	-	3	-	-	-	-	-	-	-	3	2
20AIM51A.3	-	-	3	-	-	-	-	-	-	-	-	-	3	3
20AIM51A.4	-	-	-	3	3	-	-	-	-	-	-	-	3	3
20AIM51A.5	-	-	-	-	3	-	-	-	-	-	-	-	3	3

Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)

Module No	Module Contents	Hours	COs
1	<b>Introduction:</b> Terminologies in machine learning, Applications, Types of machine learning: supervised, unsupervised, semi-supervised learning, Reinforcement Learning. Features: Types of Data (Qualitative and Quantitative), Scales of Measurement (Nominal, Ordinal, Interval, Ratio), Concept of Feature, Feature construction, Feature Selection and Transformation, Curse of Dimensionality. Linear discriminant Analysis (LDA).	9	CO1 CO3
2	<b>Supervised Learning I:</b> Binary Classification: Linear Classification model, Performance Evaluation-Confusion Matrix, Accuracy, Precision, Recall, ROC Curves, F-Measure. Support Vector Machines- Large margin classifiers, Nonlinear SVM, kernel Functions. Multi-class Classification: Model, Performance Evaluation Metrics –Multiclass Classification techniques -One vs. One, One vs. Rest	9	CO1 CO2 CO3 CO5
3	<b>Supervised Learning II:</b> Decision Trees: Concepts and Terminologies, Classification and Regression Tree (CART) Regression: Introduction, Univariate Regression – Least-Square Method, Model Representation, Cost Functions: MSE, MAE, R-Square, Performance Evaluation, Estimating the values of the regression coefficients. Multivariate Regression: Model Representation. Naïve Bayes Classifier. K-Nearest Neighbour for Classification. Over fitting and Under fitting, Bias and Variance	9	CO2, CO3 CO5

4	<b>Unsupervised learning :</b> Distance Based Models: Distance Metrics (Euclidean, Manhattan, Hamming, Minkowski Distance Metric), Clustering as Learning task: K-means clustering Algorithm-with example, k-medoid algorithm-with example. Principal Component analysis (PCA).	9	CO3, CO4 CO5
5	<b>Reinforcement learning:</b> Learning from rewards – passive reinforcement learning – active reinforcement learning – generalization in reinforcement learning – policy search – inverse reinforcement learning – application Learning Task, Q-learning, Value function approximation, Temporal difference learning	9	CO3 CO5

**Text Books:**

1. Tom Mitchell, “Machine Learning”, McGraw Hill, 1997
2. E. Alpaydin, “Introduction to Machine Learning”, PHI, 2005.

**Reference Books:**

1. Aurélien Geron, ”Hands-On Machine Learning with Scikit-Learn and TensorFlow, Shroff/O’Reilly”, 2017
2. Andreas Müller and Sarah Guido, ”Introduction to Machine Learning with Python: A Guide for Data Scientists”, Shroff/O’Reilly, 2016

**CIE- Continuous Internal Evaluation (50 Marks)**

Bloom’s Category	Tests (25 marks)	Assignment 1 (7.5 Marks )	Assignment 2 (7.5Marks)	Quiz1 (05Marks)	Quiz2 (05 Marks )
Remember	5	2.5	2.5	-	-
Understand	5	2.5	2.5	-	-
Apply	10	2.5	2.5	05	05
Analyze	2.5	-	-	-	-
Evaluate	2.5	-	-	-	-
Create	-	-	-	-	-

**SEE- Semester End Examination (50Marks)**

Bloom’s Category	Questions (50 marks)
Remember	10
Understand	10
Apply	20
Analyze	5
Evaluate	5
Create	-

## OPERATING SYSTEM

**Course Code** : 20AIM52A  
**L: T: P: S:** : 3: 0: 0: 0:  
**Exam Hours:** : 3

**Credits:** 3  
**CIE Marks:** 50  
**SEE Marks:** 50

Course Outcomes:	At the end of the Course, the Student will be able to:
CO#	COURSE OUTCOME
20AIM52A.1	Apply the functions of traditional and modern operating systems
20AIM52A.2	Analyze the concept of process and its management which includes process scheduling algorithms.
20AIM52A.3	Evaluate the problems related to concurrency, different synchronization mechanisms and deadlock handling.
20AIM52A.4	Compare and contrast various memory management techniques.
20AIM52A.5	Evaluate the various file implementation techniques.

Mapping of Course Outcomes to Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM52A.1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
20AIM52A.2	-	3	-	-	-	-	-	-	-	-	-	-	3	3
20AIM52A.3	-	3	3	-	-	-	-	-	-	-	-	-	3	3
20AIM52A.4	-	-	-	3	-	-	-	-	-	-	-	-	3	3
20AIM52A.5	-	-	3	-	-	-	-	-	-	-	-	-	3	3
Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)														

Module No	Module Contents	Hours	COs
1	<b>Introduction and Operating System Services:</b> Basics of Operating Systems: Definition - Operating System structure; Operating System operations – Dual-Mode and Multi- Mode; Kernel Data Structure – Lists, Stacks, and Queues, Trees; Computing Environments – Mobile Computing, Distributed Systems, Client-Server Computing, Peer-to-Peer, Virtualization, Cloud Computing, Real-Time Embedded Systems. Operating System Services; System Calls; Types of System Calls; Operating System Design and Implementation – Design Goals – Mechanisms and Policies – Implementation; Operating System structure – Layered Structure – Microkernels, Modules, Hybrid Systems – Mac OS X, iOS, Android.	9	CO1 CO2
2	<b>Process Management:</b> <b>Process:</b> Process Concept – The Processes, Process States, PCB; Process Scheduling – Scheduling Queues, Schedulers, Context Switch; Operation; Operation on Process; Inter-Process Communication – Shared-Memory System, Message Passing System. <b>CPU Scheduling:</b> Basic Concepts, CPU-I/O Burst Cycle; CPUScheduler – Pre-emptive Scheduling, Dispatcher; Scheduling Criteria; Scheduling Algorithms – FCFS Scheduling, SJFScheduling, Round-Robin Scheduling, Priority Scheduling. Synchronization: The	9	CO2 CO3

3	<p><b>Process Synchronization:</b> Background, The Critical Section Problem, Peterson's solution; Synchronization Hardware; Locks; Semaphores –Semaphore Usage, Semaphore Implementation, Deadlock and Starvation. Classical Problems of Synchronization – The Reader- Writer Problem, Dining-Philosopher Problem.</p> <p><b>Deadlocks:</b> System Model; Deadlock Characterization – Necessary Conditions, Resource-Allocation Graph; Methods for Handling Deadlocks; Deadlock Prevention; Deadlock Avoidance; Deadlock Detection and Recovery.</p>	10	CO3
4	<p><b>Memory Management:</b></p> <p><b>Main Memory:</b> Background; Swapping; Contiguous Memory Allocation–Memory Protection, Memory Allocation, Fragmentation; Paging – Basic Method, Hardware Support, Protection; Structure of Page Table – Hierarchical Paging, Hash- Page Table; Segmentation – Basic Method, Segmentation Hardware.</p> <p><b>Virtual Memory:</b> Background; Demand Paging; Page Replacement – Basic Page Replacement – FIFO Page Replacement, Optimal Page Replacement, LRU Page Replacement; Allocation of Frames – Minimum Number of Frames, Allocation Algorithms, Global Vs Local; Thrashing – Causes of Thrashing</p>	9	CO3 CO4
5	<p><b>File System Interface and Implementation:</b></p> <p><b>File-System Interface:</b> File Structure; Access methods – Sequential Access, Direct Access, Other Access Methods; <b>Implementation:</b> Overview, Partitions and Mounting, Directory Implementation – Linear List, Hash Table; Allocation Methods –Contiguous Allocation, Linked Allocation, Indexed Allocation; Free Space Management – Bit-Vector, Linked List, Grouping, Counting.</p> <p><b>Mass Storage Structures:</b> Overview; Disk Structure; Disk Scheduling–FCFS, SSTF, SCAN Scheduling, CSCAN Scheduling, LOOK Scheduling, Selection of Disk Scheduling Algorithm.</p> <p><b>Process Synchronization:</b> Background; The Critical Section Problem; Peterson's Solution; Synchronization Hardware; Mutex</p>	8	CO4 CO5

**CIE- Continuous Internal Evaluation (50 Marks)**

<b>Bloom's Category</b>	<b>Tests (25 marks)</b>	<b>Assignment 1 (7.5 Marks )</b>	<b>Assignment 2 (7.5Marks)</b>	<b>Quiz1 (05Marks)</b>	<b>Quiz2 (05 Marks )</b>
Remember	5	2.5	2.5	-	-
Understand	5	2.5	2.5	-	-
Apply	10	2.5	2.5	05	05
Analyze	2.5	-	-	-	-
Evaluate	2.5	-	-	-	-
Create	-	-	-	-	-

**SEE- Semester End Examination (50Marks)**

<b>Bloom's Category</b>	<b>Tests</b>
Remember	10
Understand	20
Apply	20
Analyze	-
Evaluate	-
Create	-

## BIG DATA TECHNOLOGIES

**Course Code** : 20AIM53A  
**L: T: P: S:** : 3: 0: 0: 0:  
**Exam Hours:** : 3

**Credits** : 3  
**CIE Marks:** 50  
**SEE Marks:** 50

Course Outcomes:	At the end of the Course, the Student will be able to:
CO#	COURSE OUTCOME
20AIM53A.1	Apply the Big Data concepts and identify its Business Implications.
20AIM53A.2	Analyze the components of Hadoop and Hadoop Eco-System
20AIM53A.3	Design and Process Data on Distributed File System
20AIM53A.4	Manage Job Execution in Hadoop Environment
20AIM53A.5	Develop Big Data Solutions using Hadoop Eco System

Mapping of Course Outcomes to Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM53A.1	3	-	-	-	-	-	-	-	-	-	-	3	-	-
20AIM53A.2	-	3	-	-	-	-	-	-	-	-	-	3	3	3
20AIM53A.3	-	3	3	-	-	-	-	-	-	-	-	3	3	3
20AIM53A.4	-	-	-	3	-	-	-	-	-	-	-	3	3	3
20AIM53A.5	-	-	-	3	3	-	-	-	-	-	-	3	3	3
Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)														

Module No	Module Contents	Hours	COs
1	INTRODUCTION TO BIG DATA AND HADOOP Types of Digital Data, Introduction to Big Data, Big Data Analytics, History of Hadoop, Apache Hadoop, Analysing Data with Unix tools, Analysing Data with Hadoop, Hadoop Streaming, Hadoop Echo System, IBM Big Data Strategy, Introduction to Infosphere BigInsights and Big Sheets.	9	CO1 CO2
2	HDFS(Hadoop Distributed File System) The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Data flow, Data Ingest with Flume and Scoop and Hadoop archives, Hadoop I/O: Compression, Serialization, Avro and File-Based Data structures.	9	CO2 CO3
3	Map Reduce Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features.	9	CO3 CO3
4	Hadoop Eco System Pig : Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators.	9	CO4 CO2
5	Hive : Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, Querying Data and User Defined Functions. Hbase : HBasics, Concepts, Clients, Example, Hbase Versus RDBMS. Introduction to Big SQL.	9	CO4 CO5

**Text Books:**

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

**Reference Books:**

1. Jay Liebowitz, “Big Data and Business Analytics” Auerbach Publications, CRC press (2013)
2. Paul Zikopoulos ,Dirk DeRoos , Krishnan Parasuraman , Thomas Deutsch , James Giles , David Corigan , "Harness the Power of Big Data The IBM Big Data Platform ", Tata McGraw Hill Publications, 2012.

**CIE- Continuous Internal Evaluation (50 Marks)**

<b>Bloom’s Category</b>	<b>Tests (25 marks)</b>	<b>Assignment 1 (7.5 Marks )</b>	<b>Assignment 2 (7.5Marks)</b>	<b>Quiz1 (05Marks)</b>	<b>Quiz2 (05 Marks )</b>
Remember	5	2.5	2.5	-	-
Understand	5	2.5	2.5	-	-
Apply	10	2.5	2.5	05	05
Analyze	2.5	-	-	-	-
Evaluate	2.5	-	-	-	-
Create	-	-	-	-	-

**SEE- Semester End Examination (50Marks)**

<b>Bloom’s Category</b>	<b>Tests</b>
Remember	10
Understand	20
Apply	20
Analyze	-
Evaluate	-
Create	-

## DESIGN AND ANALYSIS OF ALGORITHM

Course Code : 20AIM56A  
 L: T: P: S: : 3: 0: 0: 0:  
 Exam Hours: : 3

Credits: 3  
 CIE Marks: 50  
 SEE Marks: 50

Course Outcomes:	At the end of the Course, the Student will be able to:
CO#	COURSE OUTCOME
20AIM56A.1	Apply the algorithms to solve complex problems by determining various design techniques
20AIM56A.2	Identify appropriate algorithms to assess and formulate solution
20AIM56A.3	Design a strategy to solve graph and knapsack Problems
20AIM56A.4	Develop a design technique to solve searching and sorting problems
20AIM56A.5	Apply backtracking and branch & bound technique to assess an algorithm and formulate Solution

Mapping of Course Outcomes to Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM56A.1	3	3	-	-	-	-	-	-	-	-	-	-	3	3
20AIM56A.2	-	3	-	-	-	-	-	-	-	-	-	-	3	3
20AIM56A.3	-	-	3	-	-	-	-	-	-	-	-	-	3	3
20AIM56A.4	-	-	3	3	-	-	-	-	-	-	-	-	3	3
20AIM56A.5	-	-	-	-	3	-	-	-	-	-	-	-	3	3
Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)														

Module No	Module Contents	Hours	COs
1	<b>INTRODUCTION TO ALGORITHMS &amp; GROWTH OF FUNCTIONS</b> Introduction to Algorithms, Role of algorithms in computing, Fundamentals of Algorithmic problem solving, Fundamentals of Analysis of Algorithms, Analysis Framework, Asymptotic notations, Standard notations and common functions, Important problem types – Searching, sorting, string processing, graph problems.	9	CO1
2	<b>DIVIDE &amp; CONQUER:</b> General method, Binary search, Recurrence equation for divide and conquer, Finding the maximum and minimum, Merge sort, Quick sort, Strassen's matrix multiplication, Advantages and Disadvantages of divide and conquer.	9	CO2
3	<b>GREEDY METHOD &amp; DYNAMIC PROGRAMMING</b> <b>GREEDY METHOD:</b> Introduction, Job scheduling problem, Minimum Spanning tree algorithms – Kruskals & Prims, Shortest Path algorithm – Dijkstra's,	9	CO3
	Huffman Trees, Knapsack problems, Travelling Salesman problem <b>DYNAMIC PROGRAMMING:</b> Introduction, Computing Binomial Coefficients, Transitive closure - Warshall's and Floyds algorithm		

<b>4</b>	<b>DECREASE &amp; CONQUER, TRANSFORM &amp; CONQUER</b> <b>DECREASE &amp; CONQUER:</b> Introduction – Decrease by constant, decrease by constant factor, variable size decrease, Breadth First search traversal, Depth First search traversal, Topological sorting <b>TRANSFORM &amp; CONQUER:</b> Introduction, Balanced Search trees – AVL trees & 2-3 trees, Red Black Trees	<b>9</b>	<b>CO4</b>
<b>5</b>	<b>Backtracking, Branch and Bound</b> <b>BACKTRACKING:</b> Introduction, N Queens problem, subset sum problem, <b>BRANCH &amp; BOUND:</b> Introduction, Travelling Salesman problem, Knapsack problem, Assignment problem, NP-Complete and NP-Hard problems: Basic concepts, non- deterministic algorithms, P, NP, NP-Complete problems.	<b>9</b>	<b>CO5</b>

**Text Books:**

1. Anany Levitin, “Introduction to the Design & Analysis of Algorithms”, SECOND Edition, PEARSON Education

**Reference Books:**

1. Thomas H Cormen, Charles E Leiserson, Ronald R Rivest & Clifford Stein, “Introduction to Algorithms”, THIRD Edition, Eastern Economy Edition

**CIE- Continuous Internal Evaluation (50 Marks)**

<b>Bloom’s Category</b>	<b>Tests (25 marks)</b>	<b>Assignment 1 (7.5 Marks )</b>	<b>Assignment 2 (7.5Marks)</b>	<b>Quiz1 (05Marks)</b>	<b>Quiz2 (05 Marks )</b>
Remember	5	2.5	2.5	-	-
Understand	5	2.5	2.5	-	-
Apply	10	2.5	2.5	05	05
Analyze	2.5	-	-	-	-
Evaluate	2.5	-	-	-	-
Create	-	-	-	-	-

**SEE- Semester End Examination (50Marks)**

<b>Bloom’s Category</b>	<b>Tests</b>
Remember	10
Understand	20
Apply	20
Analyze	-
Evaluate	-
Create	-

## MACHINE LEARNING LABORATORY

**Course Code** : 20AIL57A  
**L: T: P: S:** : 0: 0: 2: 0:  
**Exam Hours:** : 3

**Credits** : 2  
**CIE Marks:** 25  
**SEE Marks:** 25

Course Outcomes:	At the end of the Course, the Student will be able to
CO#	COURSE OUTCOME
20AIL57A.1	Understand the implementation of procedures for machine learning algorithms.
20AIL57A.2	Design Java/Python programs for various Learning algorithms.
20AIL57A.3	Analyze and apply the appropriate data sets for Machine Learning algorithms.
20AIL57A.4	Identify and apply Machine Learning algorithms to solve real world problems.

### Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIL57A.1	3	-	-	-	-	-	-	-	-	-	-	3	3	2
20AIL57A.2	-	3	-	-	-	-	-	-	-	-	-	3	3	2
20AIL57A.3	-	-	-	-	3	-	-	-	-	-	-	3	3	2
20AIL57A.4	-	-	-	3	3	-	-	-	-	-	-	3	3	2

Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)

Ex. No	Experiments	Hours	COs
1.	Implement and demonstrate the Linear discriminant Analysis (LDA).	4	CO1, CO2, CO3, CO4
2.	Develop a Support Vector Machine model considering a Sample Dataset and evaluate the model.	4	CO1, CO2, CO3, CO4
3.	Write a program to demonstrate the working of the decision tree Based CART algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new Sample.	4	CO1, CO2, CO3, CO4
4.	Develop a simple regression model for the given dataset and evaluate its performance.	4	CO1, CO2, CO3, CO4
5.	Apply multivariate regression model using suitable library function to make necessary predictions.	4	CO1, CO2, CO3, CO4
6.	Implement a program in python to illustrate the Bias Variance Trade-off in a machine learning model	4	CO1, CO2, CO3, CO4
7.	Apply k-means algorithm to generate clusters for the given dataset and evaluate its performance.		
8.	Implement and demonstrate the Principal Component analysis (PCA)	4	CO1, CO2, CO3, CO4

9.	Implement Reinforcement learning with suitable example.	4	CO1, CO2, CO3, CO4
10.	Implement text classification model using suitable algorithm.	4	CO1, CO2, CO3, CO4

**Text Books:**

1. Tom Mitchell, "Machine Learning", McGraw Hill, 1997
2. E. Alpaydin, "Introduction to Machine Learning", PHI, 2005.

**Reference Books:**

1. AurolienGeron, "Hands-On Machine Learning with Scikit-Learn and TensorFlow, Shroff/O'Reilly", 2017
2. Andreas Muller and Sarah Guido, "Introduction to Machine Learning with Python: A Guidefor DataScientists", Shroff/O'Reilly, 2016

**CIE- Continuous Internal Evaluation (25 Marks)**

Bloom's Category	Review (25marks)
Remember	-
Understand	-
Apply	10
Analyze	10
Evaluate	5
Create	-

**SEE- Semester End Examination (25Marks)**

Bloom's Category	Review (25marks)
Remember	-
Understand	-
Apply	10
Analyze	10
Evaluate	5
Create	-

## DESIGN AND ANALYSIS OF ALGORITHM LABORATORY

**Course Code** : 20AIL58A  
**L: T: P: S:** : 0: 0: 2: 0:  
**Exam Hours:** : 3

**Credits:** 2  
**CIE Marks:** 25  
**SEE Marks:** 25

Course Outcomes:	At the end of the Course, the Student will be able to
CO#	COURSE OUTCOME
20AIL58A.1	Analyze the complexities of various applications in different domains
20AIL58A.2	Implement efficient algorithms to solve problems in various domains
20AIL58A.3	Use suitable design technique to develop efficient algorithms
20AIL58A.4	Compare, implement and understand when to apply various design techniques

Mapping of Course Outcomes to Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIL58A.1	3	-	-	-	-	-	-	-	-	-	-	3	3	2
20AIL58A.2	-	3	3	3	-	-	-	-	-	-	-	3	3	2
20AIL58A.3	-	-	-	3	3	-	-	-	-	-	-	3	3	2
20AIL58A.4	-	-	-	3	3	-	-	-	-	-	-	3	3	2
Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)														

Exp. No	Experiment	Hours	CO
1	Write a program to find GCD of two numbers using differential Algorithms	4	CO1
2	Write a program to implement string matching using Brute force	4	CO1
3	Write a program to implement Merge Sort	4	CO2, CO3
4	Write a program to implement Quick Sort	4	CO2, CO3
5	Write a program to obtain minimum cost spanning tree using Prim's Algorithm	4	CO2, CO3
6	Write a program to obtain minimum cost spanning tree using Kruskal's Algorithm	4	CO2, CO3
7	Write a program to obtain shortest path using Dijkstra's algorithm	4	CO2, CO3
8	Write a program to obtain shortest path using Floyd's algorithms	4	CO2, CO3
9	Write a program to compute Transitive closure using Warshall's Algorithm	4	CO2, CO3
10	Write a program to implement Topological sorting	4	CO2, CO3
11	Write a program to implement Subset Sum problem using Backtracking	4	CO4
12	Write a program to implement N Queens problem using Backtracking	4	CO4

**Text Book:**

1. Anany Levitin, "Introduction to the Design & Analysis of Algorithms", SECOND Edition, PEARSON Education

**Reference Book:**

1. Thomas H Cormen, Charles E Leiserson, Ronald R Rivest & Clifford Stein, "Introduction to Algorithms", THIRD Edition, Eastern Economy Edition

**CIE- Continuous Internal Evaluation (25 Marks)**

<b>Bloom's Category</b>	<b>Review (25marks)</b>
Remember	-
Understand	-
Apply	10
Analyze	10
Evaluate	5
Create	-

**SEE- Semester End Examination (25Marks)**

<b>Bloom's Category</b>	<b>Review (25marks)</b>
Remember	-
Understand	-
Apply	10
Analyze	10
Evaluate	5
Create	-

### MINI PROJECT -III

**Course Code : 20AIM59A**

**L: T: P: S: : 0: 0: 2: 0:**

**Exam Hours: : 3**

**Credits: 2**

**CIE Marks: 25**

**SEE Marks: 25**

<b>Course Outcomes: At the end of the Course, the Student will be able to</b>	
CO#	COURSE OUTCOME
20AIM59.1	Understand the technological needs and/ or societal needs and sustainability of the environment
20AIM59.2	Design application using Big Data Technologies
20AIM59.3	Analyse and evaluate the outcome of the project
20AIM59.4	Develop, Test, validate and communicate the identified solutions in a structured way.

<b>Mapping of Course Outcomes to Program Outcomes</b>														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM59.1	-	-	-	-	-	3	2	3	-	-	-	3	3	2
20AIM59.2	-	-	3	-	3	-	-	-	-	-	-	3	3	2
20AIM59.3	-	3	-	-	-	-	-	-	-	-	-	3	3	2
20AIM59.4	-	-	-	3	-	-	-	-	3	3	3	3	3	2
Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)														

Each team capable of identifying a problem and carry out a mini project on the problem defined. A panel of experts will review the code developed towards the project during the course of the semester. Plagiarized projects will automatically get an **“F” GRADE** and the student will be liable for further disciplinary action. At the completion of a project, the team will submit a project report, which will be evaluate by duly appointed examiner(s).

#### **CIE- Continuous Internal Evaluation (25 Marks)**

<b>Bloom’s Category</b>	<b>Review (25marks)</b>
Remember	-
Understand	-
Apply	10
Analyze	10
Evaluate	5
Create	-

#### **SEE- Semester End Examination (25Marks)**

<b>Bloom’s Category</b>	<b>Review (25marks)</b>
Remember	-
Understand	-
Apply	10
Analyze	10
Evaluate	5
Create	-

## INFORMATION STORAGE AND RETRIEVAL

**Course Code** : 20AIM541A

**Credits:** 3

**L: T: P: S:** : 3: 0: 0: 0:

**CIE Marks:** 50

**Exam Hours:** : 3

**SEE Marks:** 50

<b>Course Outcomes:</b>	<b>At the end of the Course, the Student will be able to</b>
CO#	COURSE OUTCOME
20AIM541A.1	Understand and apply the concept of Information retrieval
20AIM541A.2	Analyze the storage and retrieval process of text and multimedia data
20AIM541A.3	Evaluate the performance of any information retrieval system
20AIM541A.4	Know the importance of recommender system.
20AIM541A.5	Use modern tools for information retrieval in multimedia and distributed systems.

<b>Mapping of Course Outcomes to Program Outcomes</b>															
20AIM541A.1	3	-	-	-	-	-	-	-	-	-	-	-	3	3	3
20AIM541A.2	-	3	-	-	-	-	-	-	-	-	-	-	-	3	3
20AIM541A.3	-	-	3	3	-	-	-	-	-	-	-	-	-	3	3
20AIM541A.4	-	-	-	3	-	-	-	-	-	-	-	-	3	3	3
20AIM541A.5	-	-	-	-	3	-	-	-	-	-	-	-	3	3	3
20AIM541A.1	3	-	-	-	-	-	-	-	-	-	-	-	3	3	3
Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)															

<b>Module No</b>	<b>Module Contents</b>	<b>Hours</b>	<b>COs</b>
<b>1</b>	Basic Concepts of IR, Data Retrieval & Information Retrieval, text mining and IR relation, IR system block diagram. Automatic Text Analysis: Luhn's ideas, Conflation Algorithm, Indexing and Index Term Weighing, Probabilistic Indexing Inverted file, Suffix trees & suffix arrays, Signature Files, Scatter storage or hash addressing, Clustered files, Hypertext and XML data structures.	<b>9</b>	<b>CO1 CO2</b>
<b>2</b>	Retrieval strategies: Vector Space model, Probabilistic retrieval strategies, Language models, Inference networks, Extended boolean retrieval, Latentsemantic indexing, neural networks, Fuzzy set retrieval Retrieval utilities: Relevance feedback, Cluster Hypothesis, Clustering Algorithms: Single PassAlgorithm, Single Link Algorithm.	<b>9</b>	<b>CO1 CO2</b>
<b>3</b>	Performance evaluation: Precision and recall, MRR, F-Score, NDCG, user oriented measures, cross fold evaluation. Visualisation in Information System: Starting points, document context, User relevance judgement, Interface support for search process.	<b>9</b>	<b>CO3 CO4</b>
<b>4</b>	Distributed IR: Introduction, Collection Partitioning, Source Selection Query Processing, web issues. MULTIMEDIA IR: Introduction, Data Modeling, Query languages, Generic multimedia indexing approach, One dimensional time series, two dimensional color images, Automatic feature extraction	<b>9</b>	<b>CO4 CO3</b>

5	Searching the Web: Challenges, Characterizing the Web, Search Engines, Browsing, Meta-searchers, Web crawlers, Meta-crawler, Web data mining, Finding needle in the Haystack, Searching using Hyperlinks, Page ranking algorithms: Page rank, Rank SVM	9	CO4 CO5
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**Text Books:**

1. David A. Grossman, Ophir Frieder, Information Retrieval – Algorithms and Heuristics, Springer, 2nd Edition ( Distributed by Universal Press), 2004

**Reference Books:**

1. Soumen Chakrabarti, Mining the Web: Discovering Knowledge from Hypertext Data, Morgan –Kaufmann Publishers, 2002.
2. Gerald J Kowalski, Mark T Maybury Information Storage and Retrieval Systems: Theory and Implementation, Springer, 2004.

**CIE- Continuous Internal Evaluation (50 Marks)**

Bloom's Category	Tests (25 marks)	Assignment 1 (7.5 Marks )	Assignment 2 (7.5Marks)	Quiz1 (05Marks)	Quiz2 (05 Marks )
Remember	5	2.5	2.5	-	-
Understand	5	2.5	2.5	-	-
Apply	10	2.5	2.5	05	05
Analyze	2.5	-	-	-	-
Evaluate	2.5	-	-	-	-
Create	-	-	-	-	-

**SEE- Semester End Examination (50Marks)**

Bloom's Category	Tests
Remember	10
Understand	20
Apply	20
Analyze	-
Evaluate	-
Create	-

## INTRODUCTION TO SENSOR AND IOT

Course Code : 20AIM542A  
 L: T: P: S: : 3: 0: 0: 0:  
 Exam Hours: : 3

Credits : 3  
 CIE Marks: 50  
 SEE Marks: 50

Course Outcomes:	At the end of the Course, the Student will be able to:
CO#	COURSE OUTCOME
20AIM542A.1	Identify and apply various types of sensors used in IOT
20AIM542A.2	Analyze and display the connection of sensors to processing devices.
20AIM542A.3	Define and explain basic issues, policy and challenges in the IoT
20AIM542A.4	Illustrate Mechanism and Key Technologies in IoT
20AIM542A.5	Use the latest technologies that are Standards of the IoT

Mapping of Course Outcomes to Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM542A.1	3	-	-	-	-	-	-	-	-	-	-	-	3	3
20AIM542A.2	-	3	3	-	-	-	-	-	-	-	-	3	3	3
20AIM542A.3	-	-	3	-	-	-	-	-	-	-	-	-	-	3
20AIM542A.4	-	-	-	3	-	-	-	-	-	-	-	-	3	-
20AIM542A.5	-	-	-	3	3	-	-	-	-	-	-	3	3	-

Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)

Module No	Module Contents	Hours	COs
1	Introduction: What are sensors/transducers, Principles, Classification, Parameters, Environmental Parameters & Characteristics. Mechanical and Electromechanical Sensors: Introduction, Resistive Potentiometer, Strain gauge, Inductive Sensors, Capacitive Sensors, Force/Stress sensors, Ultrasonic Sensors.	9	CO1 CO2
2	Thermal Sensors: Introduction, Gas Thermometric Sensors, Thermal Expansion type thermometric sensors, Dielectric constant and refractiveindex thermo sensors, magnetic thermometer, resistance change type thermometric sensors, thermosemf sensors, thermal radiation sensors, Quartz crystal thermoelectric sensors, Spectroscopic thermometry, noisethermometry, heat flux sensors. Magnetic sensors: Introduction, Sensors and principles, magneto resistive sensors, Hall effect sensors, inductive and eddy current sensors, Angular/Rotary movement sensors, Eddy current sensors, Electromagnetic flowmeter, SQUID sensors.	9	CO2 CO3
3	Introduction to Internet of Things(IoT): What is The Internet of Things? Overview and Motivations, Examples of Applications, IPV6 Role, Areas of Development and Standardization, Scope of the Present Investigation. Internet of Things Definitions and frameworks:-IoT Definitions, IoT Frameworks, Basic Nodal Capabilities. Internet of Things Application Examples:-Overview, Smart Metering/Advanced Metering Infrastructure e-Health/Body Area Networks, City Automation, Automotive Applications, Home Automation, Smart Cards.	9	CO2 CO3

4	Fundamental IoT Mechanism and Key Technologies: -Identification of IoT Object and Services, Structural Aspects of the IoT, Key IoT Technologies. Evolving IoT Standards: -Overview and Approaches, IETF IPV6 Routing Protocol for RPL Roll, Constrained Application Protocol, Representational State Transfer, ETSI M2M, Third Generation Partnership Project Service Requirements for Machine-Type Communications, CENELEC, IETF IPv6 Over Low power WPAN, Zigbee IP(ZIP), IPSO.	9	CO2 CO4
5	Layer 12 Connectivity: Wireless Technologies for the IoT-WPAN Technologies for IoT/M2M, Cellular and Mobile Network Technologies for IoT/M2M. Layer 3 Connectivity: IPv6 Technologies for the IoT: Overview and Motivations. Address Capabilities, IPv6 Protocol Overview, IPv6 Tunneling, IPsec in IPv6, Header Compression Schemes, Quality of Service in IPv6, Migration Strategies to IPv6.	9	CO4 CO5

**Text Books:**

1. Patranabis D, "Sensors and Transducers," Prentice Hall of India, 2004
2. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", Wiley, 2013.
3. Arshdeep Bahga, Vijay Madiseti, "Internet of Things: A Hands on Approach" Universities Press., 2015

**Reference Books:**

1. Callaway EH, "Wireless Sensor Networks : Architecture and Protocols," Auerbach Publications
2. Michael Miller, "The Internet of Things", First Edition, Pearson, 2015.

**CI - Continuous Internal Evaluation (50 Marks)**

Bloom's Category	Tests (25 marks)	Assignment 1 (7.5 Marks )	Assignment 2 (7.5Marks)	Quiz1 (05Marks)	Quiz2 (05 Marks )
Remember	5	2.5	2.5	-	-
Understand	5	2.5	2.5	-	-
Apply	10	2.5	2.5	05	05
Analyze	2.5	-	-	-	-
Evaluate	2.5	-	-	-	-
Create	-	-	-	-	-

**SEE - Semester End Examination (50Marks)**

Bloom's Category	Tests
Remember	10
Understand	10
Apply	20
Analyze	5
Evaluate	5
Create	-

## THEORY OF COMPUTATION

**Course Code** : 20AIM543A  
**L: T: P: S:** : 3: 0: 0: 0:  
**Exam Hours:** : 3

**Credits** : 3  
**CIE Marks:** 50  
**SEE Marks:** 50

<b>Course Outcomes:</b>		<b>At the end of the Course, the Student will be able to:</b>
<b>CO#</b>	<b>COURSE OUTCOME</b>	
20AIM543A.1	Apply and design a finite automaton to accept a set of strings of a language.	
20AIM543A.2	Analyze and tell whether the given language is regular or not.	
20AIM543A.3	Design context free grammars to generate strings of context free language	
20AIM543A.4	Design push down automata and the equivalent context free grammars and Design Turing machine.	
20AIM543A.5	Interpret the difference between computability and non-computability, Decidability and un-decidability.	

### Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM543A.1	3	-	-	-	-	-	-	-	-	-	-	3	3	3
20AIM543A.2	-	3	2	-	-	-	-	-	-	-	-	3	3	3
20AIM543A.3	-	-	3	2	-	-	-	-	-	-	-	3	3	3
20AIM543A.4	-	-	-	3	3	-	-	-	-	-	-	3	3	3
20AIM543A.5	-	-	-	-	3	-	-	-	-	-	-	3	3	3

Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)

<b>Module No</b>	<b>Module Contents</b>	<b>Hours</b>	<b>COs</b>
<b>1</b>	The Theory Of Automata: Introduction to automata theory, Examples of automata machine, Finite automata as a language acceptor and translator, Deterministic finite automata. Non-deterministic finite automata, finite automata with output (Mealy Machine. Moore machine), Finite automata with $\epsilon$ moves, Minimizing number of states of a DFA, My hill Nerode theorem, Properties and limitation of FSM, Application of finite automata.	<b>9</b>	<b>CO1 CO2</b>
<b>2</b>	Regular Expressions: Alphabet, String and Languages, Regular expression, Properties of Regular Expression, Finite automata and Regular expressions, Arden's Theorem Regular Expression to DFA conversion & vice versa Pumping lemma for regular sets Application of pumping lemma, Regular sets and Regular grammar, Closure properties of regular sets. Decision algorithm for regular sets and regular grammar.	<b>9</b>	<b>CO2 CO1</b>
<b>3</b>	Grammars: Definition and types of grammar, Chomsky hierarchy of grammar, Relation between types of grammars, Context free grammar, Left most & rightmost derivation trees, Ambiguity in grammar, Simplification of context free grammar, Chomsky Normal Form, Greibach Normal Form, properties of context free language, Pumping lemma for context free language, Decision algorithm for context tree language.	<b>9</b>	<b>CO2 CO3</b>

4	Push Down Automata And Turing Machine: Basic definitions, Deterministic push down automata and non-deterministic push down automata, Acceptance of push down automata, Push down automata and context free language, Turing machine model, Representation of Turing Machine, Construction of Turing Machine for simple problem's, Universal Turing machine and other modifications .Church's Hypothesis, , Halting problem of Turing Machine	9	CO3 CO4
5	Computability: Introduction and Basic concepts, Recursive function, Partial recursive function, Initial functions, Composition of functions, Ackerman's function, Recursively Enumerable and Recursive languages, Decidable and undecidable problem, Post correspondence problem, Space and time complexity.	9	CO4 CO5

**Text Books:**

1. Theory of Computer Science (Automata Language & Computation), K.L.P. Mishra and N. Chandrasekran, PHI.
2. Introduction to Automata theory. Language and Computation, John E. Hopcroft & Jeffery D. Ullman, Narosa, Publishing House.

**Reference Books:**

1. John Martin, "Introduction to Languages and the Theory of Computation", Tata McGraw Hill
2. Kamala Krithivasan, Rama R., "Introduction to Formal Languages Automata Theory and computation", 2<sup>nd</sup> Edition, Pearson Education.

**CIE- Continuous Internal Evaluation (50 Marks)**

Bloom's Category	Tests (25 marks)	Assignment 1 (7.5 Marks)	Assignment 2 (7.5Marks)	Quiz1 (05Marks)	Quiz2 (05 Marks)
Remember	5	2.5	2.5	-	-
Understand	5	2.5	2.5	-	-
Apply	10	2.5	2.5	05	05
Analyze	2.5	-	-	-	-
Evaluate	2.5	-	-	-	-
Create	-	-	-	-	-

**SEE- Semester End Examination (50Marks)**

Bloom's Category	Tests
Remember	10
Understand	20
Apply	20
Analyze	-
Evaluate	-
Create	-



## PARALLEL PROCESSING

**Course Code** : 20AIM544A  
**L: T: P: S:** : 3: 0: 0: 0:  
**Exam Hours:** : 3

**Credits:** 3  
**CIE Marks:** 50  
**SEE Marks:** 50

Course Outcomes:	At the end of the Course, the Student will be able to:
<b>CO#</b>	<b>COURSE OUTCOME</b>
20AIM544A.1	Understanding and apply the parallel computer architecture and different models for parallel computing
20AIM544A.2	To analyze the concepts related to memory consistency models, cache coherence, interconnection networks, and latency tolerating techniques.
20AIM544A.3	Develop structural intuition of how the hardware and the software work, starting from simple systems to complex shared resource architectures.
20AIM544A.4	Know the current practical implementations of parallel architectures.
20AIM544A.5	Using latest tools to design parallel programs and to evaluate their execution

Mapping of Course Outcomes to Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM544A.1	3	-	-	-	-	-	-	-	-	-	-	3	3	3
20AIM544A.2	-	3	-	-	--	-	-	-	-	-	-	3	3	3
20AIM544A.3	-	3	3	-	-	-	-	-	-	-	-	3	3	3
20AIM544A.4	-	-	-	3	-	-	-	-	-	-	-	3	3	3
20AIM544A.5	-	-	-	3	3	-	-	-	-	-	-	3	3	3
Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)														

Module No	Module Contents	Hour	COs
1	Introduction & Technique of Parallelism: Trends towards parallel computing, parallelism in Uniprocessor systems, Architectural classification schemes, Amdahl's law, Moore's law, Principles of Scalable Performance, Parallel Processing in Memory, Parallel Algorithms, Parallel Algorithm Complexity, Models of Parallel Processing, Cache coherence, Cache coherence Protocols	9	CO1 CO2
2	Pipeline & Vector Processing: Conditions of Parallelism: Data & Resource dependencies, Program flow mechanisms: Control-flow vs. Data flow computers Principle of pipelining and vector processing: principles of linear pipelining, classification of pipeline processors. General pipelines and reservation tables. Instruction and arithmetic pipelines, vector processing, architecture of Cray -1, Pipeline hazards, VLIW computers, Array Processing.	9	CO1 CO2
3	Parallel Models & Mesh-Based Architectures: PRAM and Basic Algorithms, Data Broadcasting, Parallel Prefix Computation, Shared- Memory Algorithms, Parallel Selection Algorithm, Sorting and Selection Networks, Circuit-Level Examples, Tree-Structured Dictionary Machine, Sorting on a 2D Mesh or Torus, Routing on a 2D Mesh or Torus, Other Mesh-Related Architectures, Meshes of Trees, Low-Diameter Architectures, Hyper-cubes and Their Algorithms, The Cube Connected Cycles Network , Shuffle and Shuffle-Exchange Networks.	9	CO2 CO3

4	Multiprocessor architecture and Programming: Emulation and Scheduling Emulations among Architectures, Distributed Shared Memory, Data Storage Input, and Output, Multithreading and Latency Hiding, Parallel I/ Technology, Defect-Level Methods, Fault-Level Methods, Error-Lev Methods, Parallel Programming Parallel Operating Systems, Parallel File Systems.	9	CO3 CO4
5	Parallel System Implementations: Shared-Memory MIMD Machine Variations in Shared Memory, MIN-Based BBN Butterfly, Vector-Parall Cray Y-MP, CC-NUMA Stanford DASH, Message-Passing MIMD Machines. Data-Parallel SIMD Machines, Processor and Memory Technologies.	9	CO3 CO5

**Text Books:**

1. Computer Architecture & Parallel processing - Kai Hwang 7 Briggs.(MGH)
2. Parallel Computers: Arch.& Prog., Rajaraman & Siva Ram Murthy, PHI.

**Reference Books:**

1. Parallel Computer 2 –Arch.& Algo., Adam Hilger, R.W. Hockney, C.R. Jesshope,.
2. Parallel computing- Theory and practice - Michael J Quinn- Mc Graw Hill.

**CIE- Continuous Internal Evaluation (50 Marks)**

Bloom's Category	Tests (25 marks)	Assignment 1 (7.5 Marks )	Assignment 2 (7.5Marks)	Quiz1 (05Marks)	Quiz2 (05 Marks )
Remember	5	2.5	2.5	-	-
Understand	5	2.5	2.5	-	-
Apply	10	2.5	2.5	05	05
Analyze	2.5	-	-	-	-
Evaluate	2.5	-	-	-	-
Create	-	-	-	-	-

**SEE- Semester End Examination (50Marks)**

Bloom's Category	Tests
Remember	10
Understand	20
Apply	20
Analyze	-
Evaluate	-
Create	-

## SPEECH SYNTHESIS AND RECOGNITION

Course Code : 20AIM551A  
 L: T: P: S: : 3: 0: 0: 0:  
 Exam Hours: : 3

Credits: 3  
 CIE Marks: 50  
 SEE Marks: 50

Course Outcomes:	At the end of the Course, the Student will be able to:
CO#	COURSE OUTCOME
20AIM551A.1	Understand and apply the speech production and perception process
20AIM551A.2	Analyze speech signals in time and frequency domain.
20AIM551A.3	Design and implement algorithms for processing speech signals.
20AIM551A.4	Build a simple speech recognition/TTS system.
20AIM551A.5	Use latest multimedia tools for speech synthesis and processing

### Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM544A.1	3	-	-	-	-	-	-	-	-	-	-	3	3	3
20AIM544A.2	-	3	-	-	-	-	-	-	-	-	-	3	3	3
20AIM544A.3	-	-	3	-	-	-	-	-	-	-	-	3	3	3
20AIM544A.4	-	-	-	3	-	-	-	-	-	-	-	3	3	3
20AIM544A.5	-	-	-	3	3	-	-	-	-	-	-	3	3	3

Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)

Module No	Module Contents	Hour	COs
1	Basic Concepts: Speech Fundamentals: Articulatory Phonetics – Production and Classification of Speech Sounds; Acoustic Phonetics – acoustics of speech production; Review of Digital Signal Processing concepts; Short- Time Fourier Transform, Filter-Bank and LPC Methods.	9	CO1 CO2
2	Speech Analysis: Features, Feature Extraction and Pattern Comparison Techniques: Speech distortion measures – mathematical and perceptual – Log Spectral Distance, Cepstral Distances, Weighted Cepstral Distances and Filtering, Likelihood Distortions, Spectral Distortion using a Warped Frequency Scale, LPC, PLP and MFCC Coefficients, Time Alignment and Normalization – Dynamic Time Warping, Multiple Time – Alignment Paths.	9	CO2 CO3
3	Speech Modeling: Hidden Markov Models: Markov Processes, HMMs – Evaluation, Optimal State Sequence – Viterbi Search, Baum-Welch Parameter Re-estimation, Implementation issues.	9	CO3
4	Speech Recognition: Large Vocabulary Continuous Speech Recognition: Architecture of a large vocabulary continuous speech recognition system – acoustics and language models – ngrams, context dependent sub-word units; Applications and present status.	9	CO3 CO4
5	Speech Synthesis: Text-to-Speech Synthesis: Concatenative and waveform synthesis methods, subword units for TTS, intelligibility and naturalness – role of prosody, Applications and present status.	9	CO4 CO5

**Text Books:**

1. Lawrence Rabiner and Biing-Hwang Juang, "Fundamentals of Speech Recognition", Pearson Education, 2003.
2. Daniel Jurafsky and James H Martin, "Speech and Language Processing – An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition", Pearson Education.

**Reference Books:**

1. Steven W. Smith, "The Scientist and Engineer's Guide to Digital Signal Processing", California Technical Publishing
2. Thomas F Quatieri, "Discrete-Time Speech Signal Processing – Principles and Practice", Pearson Education.

**CIE- Continuous Internal Evaluation (50 Marks)**

<b>Bloom's Category</b>	<b>Tests (25 marks)</b>	<b>Assignment 1 (7.5 Marks )</b>	<b>Assignment 2 (7.5Marks)</b>	<b>Quiz1 (05Marks)</b>	<b>Quiz2 (05 Marks )</b>
Remember	5	2.5	2.5	-	-
Understand	5	2.5	2.5	-	-
Apply	10	2.5	2.5	05	05
Analyze	2.5	-	-	-	-
Evaluate	2.5	-	-	-	-
Create	-	-	-	-	-

**SEE- Semester End Examination (50Marks)**

<b>Bloom's Category</b>	<b>Tests</b>
Remember	10
Understand	20
Apply	20
Analyze	-
Evaluate	-
Create	-

## EMBEDDED SYSTEMS

Course Code : 20AIM552A  
 L: T: P: S: : 3: 0: 0: 0:  
 Exam Hours: : 3

Credits : 3  
 CIE Marks: 50  
 SEE Marks: 50

Course Outcomes:	At the end of the Course, the Student will be able to:
CO#	COURSE OUTCOME
20AIM552A.1	Understand and apply the Fundamentals of embedded computer systems.
20AIM552A.2	Design and development of communication bus network
20AIM552A.3	Analyze how device driver routine works
20AIM552A.4	Design and develop modules using RTOS.
20AIM552A.5	Use modern tools with error free software to obtain target system

### Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM552A.1	3	-	-	-	-	-	-	-	-	-	-	3	3	2
20AIM552A.2	-	-	3	3	-	-	-	-	-	-	-	3	3	2
20AIM552A.3	-	3	-	-	-	-	-	-	-	-	-	3	3	2
20AIM552A.4	-	-	-	3	-	-	-	-	-	-	-	3	3	2
20AIM552A.5	-	-	-	-	3	-	-	-	-	-	-	3	3	2

Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)

Module No	Module Contents	Hours	COs
1	<b>Introduction to embedded systems:</b> Embedded systems, Processor embedded into a system, Embedded hardware units and device in a system, Embedded software in a system, Examples of embedded systems, Design process in embedded system, Formalization of system design, Design process and design examples, Classification of embedded systems, skills required for an embedded system designer.	9	CO1 CO2
2	<b>Devices and communication buses for devices network:</b> IO types and example, Serial communication devices, Parallel device ports, Sophisticated interfacing features in device ports, Wireless devices, Timer and counting devices, Watchdog timer, Real time clock, Networked embedded systems, Serial bus communication protocols, Parallel bus device protocols-parallel communication internet using ISA, PCI, PCI-X and advanced buses, Internet enabled systems network protocols, Wireless and mobile system protocols	9	CO2 CO3
3	<b>Device drivers and interrupts and service mechanism:</b> Programming-I/O busy-wait approach without interrupt service mechanism, ISR concept, Interrupt sources, Interrupt servicing (Handling) Mechanism, Multiple interrupts, Context and the periods for context switching, interrupt latency and deadline, Classification of processors interrupt service mechanism from Context-saving angle, Direct memory access, Device driver programming.	9	CO2 CO3 CO4
4	<b>Real-time operating systems:</b> OS Services, Process management, Timer functions, Event functions, Memory management, Device, file and IO subsystems management, Interrupt routines in RTOS environment and handling of interrupt source calls, Real-time operating systems, Basic design using an RTOS, RTOS taskscheduling models, interrupt latency and response of the tasks as performance metrics, OS security issues. Introduction to embedded software development process and tools, Host and target machines, Linking and location software.	9	CO3 CO4
5	<b>Embedded Software Development Tools:</b> Host and Target machines, Linker/Locators for Embedded Software, Getting Embedded Software into the Target System; <b>Debugging Techniques:</b> Testing on Host Machine, Using	9	CO3 CO5

	Laboratory Tools, An Example System.		
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**Text Books:**

1. Raj Kamal, “Embedded Systems: Architecture, Programming, and Design” 2nd / 3<sup>rd</sup> edition , TataMcGraw hill-2013.
2. An Embedded Software Primer, David E. Simon, Pearson Education

**Reference Books:**

1. Marilyn Wolf, “Computer as Components, Principles of Embedded Computing System Design” 3<sup>rd</sup> edition, Elsevier-2014.

**CIE- Continuous Internal Evaluation (50 Marks)**

<b>Bloom’s Category</b>	<b>Tests (25 marks)</b>	<b>Assignment 1 (7.5 Marks )</b>	<b>Assignment 2 (7.5Marks)</b>	<b>Quiz1 (05Marks)</b>	<b>Quiz2 (05 Marks )</b>
Remember	5	2.5	2.5	-	-
Understand	5	2.5	2.5	-	-
Apply	10	2.5	2.5	05	05
Analyze	5	-	-	-	-
Evaluate	-	-	-	-	-
Create	-	-	-	-	-

**SEE- Semester End Examination (50Marks)**

<b>Bloom’s Category</b>	<b>Questions (50 marks)</b>
Remember	10
Understand	10
Apply	20
Analyze	10
Evaluate	-
Create	-

## SOFTWARE ENGINEERING

Course Code : 20AIM553A  
 L: T: P: S: : 3: 0: 0: 0:  
 Exam Hours: : 3

Credits : 3  
 CIE Marks: 50  
 SEE Marks: 50

Course Outcomes:	At the end of the Course, the Student will be able to:
CO#	COURSE OUTCOME
20AIM553A.1	Apply software engineering principles in real life projects
20AIM553A.2	Analyze for appropriate software development model in developing systems
20AIM553A.3	Develop software requirement sheet for a real life project, keeping in mind the properties of an SRS document
20AIM553A.4	Interpret mathematical models for calculating the size, cost and duration of real life projects
20AIM553A.5	Use latest tools in software engineering to test the developed system using different testing techniques

Mapping of Course Outcomes to Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM553A.1	3	-	-	-	-	-	-	-	-	-	-	3	3	3
20AIM553A.2	-	3	-	-	-	-	-	-	-	-	-	3	3	3
20AIM553A.3	-	-	3	-	-	-	-	-	-	-	-	3	3	3
20AIM553A.4	-	-	-	3	-	-	-	-	-	-	-	3	3	3
20AIM553A.5	-	-	-	-	3	-	-	-	-	-	-	3	3	3
Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)														

Module No	Module Contents	Hours	COs
1	<b>Introduction:</b> The Software And Software Engineering Problem, Approach and Goals of Software Engineering. Software Processes and Models: Processes, Projects And Products, Component Software Processes, Characteristics Of A Software Process, Software Development Process, Project Management Process, Software Configuration Management Process. Models: Linear Sequential, Prototyping, Rad, Incremental, Spiral, Winwin Spiral, Concurrent Development Model	9	CO1 CO2 CO3
2	<b>Software requirement Analysis and Specification:</b> Software requirement Feasibility study, need for SRS, characteristics and component of SRS specification languages, structured analysis, object oriented modeling, Requirement analysis DFD, Structure of a requirement document, validation of SRS, requirement reviews, Cost estimation, uncertainties in cost estimation, building cost estimation Size estimation:- COCOMO model.	9	CO1 CO2
3	Function Oriented design: Design principles, coupling, cohesion, design notation and specification, structured design technology, verification. Object Oriented Design : Overview of Object oriented design, UML diagram, Use CASE diagram, class diagram, interaction diagram (Sequence and collaboration diagram), Activity diagram Connected Cycles Network ,Shuffle and Shuffle–Exchange Networks.	9	CO2 CO3 CO4

4	Software Testing techniques and strategies: Software testing objectives & principles, test case design, white box testing, black box testing.: A Strategic Approach to software testing, strategic issues, unit, integration testing, validation testing, system testing, object oriented program testing, debugging	9	CO4 CO2
5	<b>Software Re-engineering:</b> Software reengineering, software maintenance, a software reengineering process model, reverse engineering, restructuring code, data restructuring, forward engineering, the Economics of reengineering .Computer Aided software Engineering: What is CASE, building blocks for CASE, taxonomy of CASE tools, integrated CASE environment, the integration architecture, the case repository. Component Based Software Engineering: CBSE process, domain engineering, Component based development, economics of CBSE.	9	CO4 CO5 CO1

**Text Books:**

1. Pressman Roger, Software Engineering: A Practitioner’s Approach TMH, Delhi.
2. Jalote Pankaj: An Integrated Approach to software Engineering, Narosa, Delhi.

**Reference Books:**

1. R.E. Fairly, Software Engineering Concepts, McGraw Hill, Inc 1985
2. Rajib Mall, “Fundamental of Software Engineering” , PHI.

**CIE- Continuous Internal Evaluation (50 Marks)**

Bloom’s Category	Tests (25 marks)	Assignment 1 (7.5 Marks )	Assignment 2 (7.5Marks)	Quiz1 (05Marks)	Quiz2 (05 Marks )
Remember	5	2.5	2.5	-	-
Understand	5	2.5	2.5	-	-
Apply	10	2.5	2.5	05	05
Analyze	2.5	-	-	-	-
Evaluate	2.5	-	-	-	-
Create	-	-	-	-	-

**SEE- Semester End Examination (50Marks)**

Bloom’s Category	Tests
Remember	10
Understand	20
Apply	20
Analyze	-
Evaluate	-
Create	-

## CRYPTOGRAPHY AND NETWORK SECURITY

Course Code : 20AIM554A  
 L: T: P: S: : 3: 0: 0: 0:  
 Exam Hours: : 3

Credits: 3  
 CIE Marks: 50  
 SEE Marks: 50

Course Outcomes:	At the end of the Course, the Student will be able to:
<b>CO#</b>	<b>COURSE OUTCOME</b>
20AIM554A.1	Understand and apply the cryptography algorithms and its principles
20AIM554A.2	Analyze the standard algorithms used to provide confidentiality, integrity and Authenticity
20AIM554A.3	Illustrate Public and Private key cryptography
20AIM554A.4	Design and analyze the authentication and hashing techniques
20AIM554A.5	Develop strong password methods

Mapping of Course Outcomes to Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM554A.1	3	-	-	-	-	-	-	-	-	-	-	-	3	2
20AIM554A.2	-	3	-	-	-	-	-	-	-	-	-	-	3	2
20AIM554A.3	-	-	3	2	-	-	-	-	-	-	-	-	3	2
20AIM554A.4	-	-	-	3	-	-	-	-	-	-	-	-	3	2
20AIM554A.5	-	-	-	3	2	-	-	-	-	-	-	-	3	2
Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)														

Module No.	Module Contents	Hours	COs
1	<b>Introduction to security attacks</b> Services and mechanism, classical encryption techniques- substitution ciphers and transposition ciphers, cryptanalysis, stream and block ciphers. Modern Block Ciphers: Block ciphers principals, Shannon's theory of confusion and diffusion, data encryption standard (DES), block cipher modes of operations, triple DES.	9	CO1, CO2, CO3
2	<b>Encryption Technique</b> AES, RC6, random number generation. S-box theory: Boolean Function, S-box design criteria, Bent functions, Propagation and nonlinearity, construction of balanced functions, S-box design.	9	CO1, CO2, CO3
3	<b>Public Key Cryptosystems</b> Principles of Public Key Cryptosystems, RSA Algorithm, security analysis of RSA Modular Arithmetic. Key Management in Public Key Cryptosystems: Distribution of Public Keys, Distribution of Secret keys using Public Key Cryptosystems, Diffie-Hellman Key Exchange	9	CO1, CO2, CO3

4	<b>Message Authentication and Hash Function</b> Authentication requirements, authentication functions, message authentication code, hash functions, birthday attacks, security of hash functions and MAC, MD5 message digest algorithm, Secure hash algorithm(SHA). Digital Signatures: Digital Signatures, authentication protocols, digital signature standards (DSS), proof of digital signature algorithm	9	CO1, CO2, C04
5	<b>Pretty Good Privacy</b> IP Security: Overview, IP Security Architecture, Authentication Header, Encapsulation Security Payload in Transport and Tunnel mode with multiple security associations. Strong Password Protocols: Lamport's Hash, Encrypted Key Exchange.	9	CO1, CO5,

#### Text Books:

1. Stalling Williams: Cryptography and Network Security: Principles and Practices, 4th Edition, Pearson Education, 2006.

#### Reference Books:

1. Kaufman Charlie et.al; Network Security: Private Communication in a Public World, 2nd Ed., PHI/Pearson, 2002
2. Trappe & Washington, Introduction to Cryptography, 2nd Ed. Pearson, 2006

#### CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Tests (25 marks)	Assignment 1 (7.5 Marks )	Assignment 2 (7.5Marks)	Quiz1 (05Marks)	Quiz2 (05 Marks )
Remember	5	2.5	2.5	-	-
Understand	5	2.5	2.5	-	-
Apply	10	2.5	2.5	05	05
Analyze	2.5	-	-	-	-
Evaluate	2.5	-	-	-	-
Create	-	-	-	-	-

#### SEE- Semester End Examination (50Marks)

Bloom's Category	Tests
Remember	10
Understand	20
Apply	20
Analyze	-
Evaluate	-
Create	-

### VI SEMESTER

S.No	Course Code	Course	BOS	Credit Distribution				Overall Credits	Contact Hours	Marks		
				L	T	P	S			CIE	SEE	Total
1	20AIM61A	Deep Learning Techniques	AI&ML	3	0	0	0	3	4	50	50	100
2	20AIM62A	Data Visualization	AI&ML	3	0	0	0	3	4	50	50	100
3	20AIM63A	Artificial Intelligence	AI&ML	3	0	0	0	3	4	50	50	100
4	20NHOPXX	Open Elective - I	AI&ML	2	0	1	0	3	4	50	50	100
5	20AIM64XA	Professional Elective - III	AI&ML	3	0	0	0	3	4	50	50	100
6	20AIM65XA	Professional Elective - IV	AI&ML	3	0	0	0	3	4	50	50	100
7	20AIL66A	Deep Learning Laboratory	AI&ML	0	0	2	0	2	4	25	25	50
8	20AIL67A	Data Visualization Laboratory	AI&ML	0	0	2	0	2	4	25	25	50
9	20AIM68A	Mini Project - IV	AI&ML	0	0	2	0	2	2	25	25	50
<b>Total</b>								<b>24</b>	<b>34</b>	<b>375</b>	<b>375</b>	<b>750</b>

Professional Elective - III		Open Elective - I	
Course Code	Course	Course Code	Course
20AIM641A	Biometrics	NHOP01	Big Data Analytics using HP Vertica-1
20AIM642A	Soft Computing	NHOP02	VM Ware Virtualization Essentials-1
20AIM643A	Compiler Design	NHOP04	Big Data Analytics using HP Vertica-2
20AIM644A	Computer Networks	NHOP05	VM Ware Virtualization Essentials-2

Professional Elective - IV		NHOP07	SAP
20AIM651A	Augmented & Virtual Reality	NHOP08	Schneider-Industrial Automation
20AIM652A	Pattern Recognition & Image Processing	NHOP09	Cisco-Routing and Switching-1
20AIM653A	Advanced Java	NHOP10	Data Analytics
20AIM654A	Block chain Technologies	NHOP12	CISCO-Routing and switching-2
		NHOP13	IIOT Embedded Systems
		NHOP14	Block chain
		NHOP15	Product Life Cycle Management

## DEEP LEARNING TECHNIQUES

**Course Code** : 20AIM61A  
**L: T: P: S:** : 3: 0: 0: 0:  
**Exam Hours:** : 3

**Credits** : 3  
**CIE Marks:** 50  
**SEE Marks:** 50

Course Outcomes:	At the end of the Course, the Student will be able to:
CO#	COURSE OUTCOME
20AIM61A.1	Understand the concepts of Neural networks, its main functions, operations and the execution pipeline
20AIM61A.2	Apply deep learning algorithms, neural networks and traverse the layers of data abstraction which will empower the student to understand data more precisely.
20AIM61A.3	Analyze deep learning models in Tensor Flow and interpret the results
20AIM61A.4	Design convolutional neural networks, training deep networks and high-level interfaces
20AIM61A.5	Use the language and fundamental concepts of artificial neural networks to solve real world problems.

Mapping of Course Outcomes to Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM61A.1	2	-	-	-	-	-	-	-	-	-	-	3	3	3
20AIM61A.2	3	-	-	-	-	2	-	-	-	-	-	-	3	-
20AIM61A.3	-	3	-	-	-	-	-	-	-	-	-	-	3	2
20AIM61A.4	-	-	3	-	-	-	-	-	-	-	-	-	3	3
20AIM61A.5	-	-	-	-	3	-	-	-	-	-	-	-	3	3

Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)

Module No	Module Contents	Hours	COs
1	BASICS OF NEURAL NETWORKS: Basic concept of Neurons – Perceptron Algorithm – Feed Forward and Back Propagation Networks.	9	CO1
2	INTRODUCTION TO DEEP LEARNING : Feed Forward Neural Networks, Gradient Descent, Back Propagation Algorithm: Vanishing Gradient problem – Mitigation – ReLU Heuristics for Avoiding Bad Local Minima – Heuristics for Faster Training – Nestors Accelerated Gradient Descent – Regularization – Dropout.	9	CO2
3	CONVOLUTIONAL NEURAL NETWORKS : CNN Architectures – Convolution – Pooling Layers – Transfer Learning – Image Classification using Transfer Learning	9	CO2, CO3
4	MORE DEEP LEARNING ARCHITECTURES : LSTM, GRU, Encoder/Decoder Architectures – Autoencoders – Standard- Sparse – Denoising – Contractive- Variational Autoencoders – Adversarial Generative Networks – Autoencoder and DBM	9	CO2, CO3, CO4
5	APPLICATIONS OF DEEP LEARNING 9 Image Segmentation – Object Detection – Automatic Image Captioning – Image generation with Generative Adversarial Networks – Video to Text with LSTM Models – Attention Models for Computer Vision.	9	CO2, CO3, CO4 CO5

**Text Books:**

1. Ian Good Fellow, Yoshua Bengio, Aaron Courville, “Deep Learning”, MIT Press, 2017.
2. Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw-Hill Education, 2004.
3. Francois Chollet, “Deep Learning with Python”, Manning Publications, 2018

**Reference Books:**

1. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009
2. Golub, G.,H., and Van Loan,C.,F., Matrix Computations, JHU Press,2013.

**CIE- Continuous Internal Evaluation (50 Marks)**

<b>Bloom's Category</b>	<b>Tests (25 marks)</b>	<b>Assignment 1 (7.5 Marks )</b>	<b>Assignment 2 (7.5Marks)</b>	<b>Quiz1 (05Marks)</b>	<b>Quiz2 (05 Marks )</b>
Remember	5	2.5	2.5	-	-
Understand	5	2.5	2.5	-	-
Apply	10	2.5	2.5	05	05
Analyze	2.5	-	-	-	-
Evaluate	2.5	-	-	-	-
Create	-	-	-	-	-

**SEE- Semester End Examination (50Marks)**

<b>Bloom's Category</b>	<b>Tests</b>
Remember	10
Understand	20
Apply	20
Analyze	-
Evaluate	-
Create	-

## DATA VISUALIZATION

**Course Code** : 20AIM62A  
**L: T: P: S:** : 3: 0: 0: 0:  
**Exam Hours:** : 3

**Credits:** 3  
**CIE Marks:** 50  
**SEE Marks:** 50

<b>Course Outcomes:</b>		<b>At the end of the Course, the Student will be able to:</b>
<b>CO#</b>	<b>COURSE OUTCOME</b>	
20AIM62A.1	Understand the key techniques and theory behind data visualization	
20AIM62A.2	Apply visualization techniques for various data analysis tasks.	
20AIM62A.3	Analyze effectively the various visualization structures (like tables, spatial data, tree and network etc.)	
20AIM62A.4	Design and build data visualization systems	
20AIM62A.5	Evaluate information visualization systems and other forms of visual presentation for their effectiveness	

<b>Mapping of Course Outcomes to Program Outcomes</b>														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM62A.1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
20AIM62A.2	3	-	-	-	-	-	-	-	-	-	-	-	3	3
20AIM62A.3	-	3	-	-	3	-	-	-	-	-	-	-	3	2
20AIM62A.4	-	-	3	-	-	-	-	-	-	-	-	-	3	3
20AIM62A.5	-	-	-	3	3	-	-	-	-	-	-	-	3	3
Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)														

<b>Module No</b>	<b>Module Contents</b>	<b>Hours</b>	<b>COs</b>
<b>1</b>	Value of Visualization – What is Visualization and Why do it: External representation – Interactivity – Difficulty in Validation. Data Abstraction: Dataset types – Attribute types – Semantics. Task Abstraction – Analyze, Produce, Search, Query. Four levels of validation – Validation approaches – Validation examples. Marks and Channels	<b>9</b>	<b>CO1</b>
<b>2</b>	Rules of thumb – Arrange tables: Categorical regions – Spatial axis orientation – Spatial layout density. Arrange spatial data: Geometry – Scalar fields – Vector fields – Tensor fields.	<b>9</b>	<b>CO1, CO2, CO3</b>
<b>3</b>	Arrange networks and trees: Connections, Matrix views – Containment. Map color: Color theory, Color maps and other channels.	<b>9</b>	<b>CO2, CO3</b>
<b>4</b>	Manipulate view: Change view over time – Select elements – Changingviewpoint – Reducing attributes.	<b>9</b>	<b>CO3, CO4</b>
<b>5</b>	Facet into multiple views: Juxtapose and Coordinate views – Partition into views – Static and Dynamic layers – Reduce items and attributes: Filter – Aggregate. Focus and context: Elide – Superimpose – Distort – Case studies.	<b>9</b>	<b>CO4, CO5</b>

**Text Books:**

1. Tamara Munzner, Visualization Analysis and Design, A K Peters Visualization Series, CRC Press, 2014.

**Reference Books:**

1. Scott Murray, Interactive Data Visualization for the Web, O'Reilly, 2013.
2. Nathan Yau, Visualize This: The FlowingData Guide to Design, Visualization and Statistics, John Wiley & Sons, 2011.

**CIE- Continuous Internal Evaluation (50 Marks)**

<b>Bloom's Category</b>	<b>Tests (25 marks)</b>	<b>Assignment 1 (7.5 Marks )</b>	<b>Assignment 2 (7.5Marks)</b>	<b>Quiz1 (05Marks)</b>	<b>Quiz2 (05 Marks )</b>
Remember	5	2.5	2.5	-	-
Understand	5	2.5	2.5	-	-
Apply	10	2.5	2.5	05	05
Analyze	2.5	-	-	-	-
Evaluate	2.5	-	-	-	-
Create	-	-	-	-	-

**SEE- Semester End Examination (50Marks)**

<b>Bloom's Category</b>	<b>Tests</b>
Remember	10
Understand	20
Apply	20
Analyze	-
Evaluate	-
Create	-

## ARTIFICIAL INTELLIGENCE

**Course Code** : 20AIM63A  
**L: T: P: S:** : 3: 0: 0: 0:  
**Exam Hours:** : 3

**Credits** : 3  
**CIE Marks:** 50  
**SEE Marks:** 50

<b>Course Outcomes:</b>		<b>At the end of the Course, the Student will be able to:</b>
<b>CO#</b>	<b>COURSE OUTCOME</b>	
20AIM63A.1	Apply the basic knowledge representation, problem solving, and learning methods of artificial intelligence.	
20AIM63A.2	Analyze various search techniques used to solve AI problems.	
20AIM63A.3	Design the machine learning, fuzzy logic, genetic algorithms to solve problems.	
20AIM63A.4	Evaluate the various statistical reasoning techniques to solve AI problems.	
20AIM63A.5	Use analytical concepts for solving logical problems using heuristics approaches.	

<b>Mapping of Course Outcomes to Program Outcomes</b>														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM63A.1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
20AIM63A.2	-	3	-	-	3	-	-	-	-	-	-	-	3	2
20AIM63A.3	-	-	3	-	-	-	-	-	-	-	-	-	3	3
20AIM63A.4	-	-	-	3	3	-	-	-	-	-	-	-	3	3
20AIM63A.5	-	-	-	-	3	-	-	-	-	-	-	-	3	3
Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)														

<b>Module No</b>	<b>Module Contents</b>	<b>Hours</b>	<b>COs</b>
1	Basics of AI, Artificial Intelligence Problems, Artificial Intelligence Techniques, applications of AI Problem Spaces and Search : Defining the problem as a state space search, Production systems, Production system characteristics, Problem characteristics	9	<b>CO1</b>
2	Informed Search Strategies : Heuristic functions, Generate and Test, Hill Climbing, Simulated Annealing, Best first search, A* algorithm, Constraint satisfaction	9	<b>CO2</b>
3	Knowledge Representation : Representations & mappings, Approaches in knowledge representation, Issues in knowledge representation, Propositional logic, Predicate logic, Procedural versus declarative knowledge	9	<b>CO3</b>
4	Statistical reasoning : Probability & Bayes' theorem, Bayesian networks, Certainty factors & rule-based systems Weak slot and filler structures : Semantic nets, Frames Strong slot and filler structures : Conceptual dependency	9	<b>CO4</b>
5	AI Programming language: Introduction to PROLOG and LISP, Programming techniques, Syntax and Numeric Functions; predicates and conditionals, List manipulation , redundancy and termination, Iteration and Recursion	9	<b>CO5, CO6</b>

**Text Books:**

1. Artificial Intelligence by Rich, Knight, McGraw Hill Education

**Reference Books:**

1. Artificial Intelligence By Kevin Knight, Elaine Rich, B. Shivashankar Nair, Tata Mcgraw Hill, India
2. Artificial Intelligence And Intelligent System BY N. P. Padhy, Oxford University Press

**CIE- Continuous Internal Evaluation (50 Marks)**

<b>Bloom's Category</b>	<b>Tests (25 marks)</b>	<b>Assignment 1 (7.5 Marks )</b>	<b>Assignment 2 (7.5Marks)</b>	<b>Quiz1 (05Marks)</b>	<b>Quiz2 (05 Marks )</b>
Remember	5	2.5	2.5	-	-
Understand	5	2.5	2.5	-	-
Apply	10	2.5	2.5	05	05
Analyze	2.5	-	-	-	-
Evaluate	2.5	-	-	-	-
Create	-	-	-	-	-

**SEE- Semester End Examination (50Marks)**

<b>Bloom's Category</b>	<b>Questions (50 marks)</b>
Remember	10
Understand	10
Apply	20
Analyze	5
Evaluate	5
Create	-

## DEEP LEARNING LABORATORY

**Course Code** : 20AIL66A  
**L: T: P: S:** : 0: 0: 2: 0:  
**Exam Hours:** : 3

**Credits** : 2  
**CIE Marks:** 25  
**SEE Marks:** 25

Course Outcomes:	At the end of the Course, the Student will be able to:
CO#	COURSE OUTCOME
20AIM66A.1	Apply the various deep learning algorithms in Python.
20AIM66A.2	Analyze and improve deep learning models
20AIM66A.3	Build deep learning models in TensorFlow and interpret the results
20AIM66A.4	Evaluate different deep learning frameworks like Keras, Tensor flow, PyTorch, Caffe etc.

Mapping of Course Outcomes to Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM66A.1	3	-	-	-	-	-	-	-	-	-	-	3	3	3
20AIM66A.2	-	3	-	-	3	-	-	-	-	-	-	3	3	2
20AIM66A.3	-	-	-	-	3	-	-	-	-	-	-	3	3	3
20AIM66A.4	-	-	-	3	3	-	-	-	-	-	-	3	3	3

Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)

Ex. No	Experiments	Hours	COs
1.	Basic image processing operations : Histogram equalization, thresholding, edge detection, data augmentation, morphological operations	4	CO1, CO2, CO3, CO4
2.	Implement SVM/Softmax classifier for CIFAR-10 dataset: (i) using KNN, (ii) using 3 layer neural network	4	CO1, CO2, CO3, CO4
3.	Study the effect of batch normalization and dropout in neural network classifier	4	CO1, CO2, CO3, CO4
4.	Familiarization of image labelling tools for object detection, segmentation	4	CO1,CO2, CO3, CO4
5.	Image segmentation using Mask RCNN, UNet, SegNet	4	CO1, CO2, CO3, CO4
6.	Object detection with single-stage and two-stage detectors (Yolo, SSD, FRCNN, etc.)	4	CO1, CO2, CO3, CO4
7.	Image Captioning with Vanilla RNNs	4	CO1, CO2, CO3, CO4
8.	Image Captioning with LSTMs	4	CO1, CO2, CO3, CO4

9.	Network Visualization: Saliency maps, Class Visualization	4	CO1 CO2 CO3 CO4
10.	Generative Adversarial Networks	4	CO1 CO2 CO3 CO4
11.	Chatbot using bi-directional LSTMs	4	CO1 CO2 CO3 CO4
12.	Familiarization of cloud based computing like Google colab	4	CO1 CO2 CO3 CO4

**Text Books:**

1. Goodfellow, I., Bengio, Y., and Courville, A., Deep Learning, MIT Press, 2016.
2. Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw-Hill Education, 2004.

**Reference Books:**

1. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009
2. Golub, G., H., and Van Loan, C., F., Matrix Computations, JHU Press, 2013.

**CIE- Continuous Internal Evaluation (25 Marks)**

Bloom's Category	Review (25marks)
Remember	-
Understand	-
Apply	10
Analyze	10
Evaluate	5
Create	-

**SEE- Semester End Examination (25Marks)**

Bloom's Category	Review (25marks)
Remember	-
Understand	-
Apply	10
Analyze	10
Evaluate	5
Create	-

## DATA VISUALIZATION LABORATORY

Course Code : 20AIL67A  
 L: T: P: S: : 0: 0: 2: 0:  
 Exam Hours: : 3

Credits : 2  
 CIE Marks: 25  
 SEE Marks: 25

Course Outcomes:	At the end of the Course, the Student will be able to:
CO#	COURSE OUTCOME
20AIM67A.1	Apply visualization on Trends and uncertainty
20AIM67A.2	Demonstrate basics of Data Visualization
20AIM67A.3	Implement visualization of distributions
20AIM67A.4	Design and develop visualization of time series, proportions & associations

Mapping of Course Outcomes to Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM67A.1	3	-	-	-	3	-	-	-	-	-	-	3	3	3
20AIM67A.2	3	-	-	-	-	-	-	-	-	-	-	3	3	3
20AIM67A.3	3	-	-	-	-	-	-	-	-	-	-	3	3	3
20AIM67A.4	-	-	3	-	-	-	-	-	-	-	-	3	3	3

Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)

Exp. No	Experiment	Hours	COs
1	Download the House Pricing dataset from Kaggle and map the values to Aesthetics	4	CO1
2	Use different Color scales on the Rainfall Prediction dataset	4	CO1
3	Create different Bar plots for variables in any dataset	4	CO2, CO3
4	Show an example of Skewed data and removal of skewedness	4	CO2, CO3
5	For a sales dataset do a Time Series visualization	4	CO2, CO3
6	Build a Scatterplot and suggest dimension reduction	4	CO2, CO3
7	Use Geospatial Data-Projections on datasets in <a href="http://www.gisinindia.com/directory/gis-data-for-india">http://www.gisinindia.com/directory/gis-data-for-india</a>	4	CO2, CO3
8	Create the a trend line with a confidence band in any suitable dataset	4	CO2, CO3
9	Illustrate Partial Transparency and Jittering	4	CO2, CO3
10	Illustrate usage of different color codes	4	CO2, CO3

**Text Books:**

1. Tamara Munzner, Visualization Analysis and Design, A K Peters Visualization Series, CRC Press, 2014.

**Reference Books:**

1. Scott Murray, Interactive Data Visualization for the Web, O'Reilly, 2013.
2. Nathan Yau, Visualize This: The Flowing Data Guide to Design, Visualization and Statistics, JohnWiley & Sons, 2011.

**CIE- Continuous Internal Evaluation (25 Marks)**

<b>Bloom's Category</b>	<b>Review (25marks)</b>
Remember	-
Understand	-
Apply	10
Analyze	10
Evaluate	5
Create	-

**SEE- Semester End Examination (25Marks)**

<b>Bloom's Category</b>	<b>Review (25marks)</b>
Remember	-
Understand	-
Apply	10
Analyze	10
Evaluate	5
Create	-

## MINI PROJECT - IV

**Course Code** : 20AIM68A  
**L: T: P: S:** : 0: 0: 2: 0:  
**Exam Hours:** : 3

**Credits** : 2  
**CIE Marks:** 25  
**SEE Marks:** 25

<b>Course Outcomes:</b>		<b>At the end of the Course, the Student will be able to</b>
CO#	COURSE OUTCOME	
20AIM39.1	Understand the technological needs and/ or societal needs and sustainability of the environment	
20AIM39.2	Analyze and evaluate the outcome of the project	
20AIM39.3	Design application using Deep learning techniques	
20AIM39.4	Evaluate, validate and communicate the identified solutions in a structured way.	

<b>Mapping of Course Outcomes to Program Outcomes</b>														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM39.1	3	-	-	-	-	3	2	3	-	-	-	3	3	2
20AIM39.2	-	3	-	-	-	-	-	-	-	-	-	3	3	2
20AIM39.3	-	-	3	-	3	-	-	-	-	-	-	3	3	2
20AIM39.4	-	-	-	3	-	-	-	-	3	3	3	3	3	2
Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)														

Each team capable of identifying a problem and carry out a mini project on the problem defined. A panel of experts will review the code developed towards the project during the course of the semester. Plagiarized projects will automatically get an **“F” GRADE** and the student will be liable for further disciplinary action. At the completion of a project, the team will submit a project report, which will be evaluated by duly appointed examiner(s).

### **CIE- Continuous Internal Evaluation (25 Marks)**

<b>Bloom’s Category</b>	<b>Review (25marks)</b>
Remember	-
Understand	-
Apply	10
Analyze	10
Evaluate	5
Create	-

### **SEE- Semester End Examination (25Marks)**

<b>Bloom’s Category</b>	<b>Review (25marks)</b>
Remember	-
Understand	-
Apply	10
Analyze	10
Evaluate	5
Create	-

## BIOMETRICS

**Course Code** : 20AIM641A  
**L: T: P: S:** : 3: 0: 0: 0:  
**Exam Hours:** : 3

**Credits** : 3  
**CIE Marks:** 50  
**SEE Marks:** 50

Course Outcomes:	At the end of the Course, the Student will be able to:
CO#	COURSE OUTCOME
20AIM641A.1	Be able to draw a system-level diagram for any biometric system and discuss its components
20AIM641A.2	Be able to solve verification, identification, and synthesis problems for a variety of biometrics such as fingerprint, face, iris, hand gestures and cryptography.
20AIM641A.3	Be able to use the biometrics ingredients of existing system to obtain a given security goal.
20AIM641A.4	Be able to design a biometric solution for a given application
20AIM641A.5	Apply security features in block chain technologies

Mapping of Course Outcomes to Program Outcomes															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
20AIM641A.1	3	-	-	-	-	-	-	-	-	-	-	3	3	3	
20AIM641A.2	-	3	-	-	-	-	-	-	-	-	-	3	3	3	
20AIM641A.3	-	-	3	-	-	-	-	-	-	-	-	3	3	3	
20AIM641A.4	-	-	-	3	-	-	-	-	-	-	-	3	3	3	
20AIM641A.5	-	-	-	3	3	-	-	-	-	-	-	3	3	3	
Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)															

Module No	Module Contents	Hours	COs
1	Biometrics: definition, history, basic working architecture, types; Performance measures of biometrics; applications and benefits of biometrics; design of biometrics; biometric identification versus verification	9	CO1
2	Background of face and iris recognition; Face recognition methods: Eigenface methods, contractive transformation method; Challenges of face biometrics; Design of iris biometrics: image segmentation, image preprocessing, determination of iris region; Advantages and disadvantages of face and iris biometrics.	9	CO2, CO3
3	Fingerprint matching: image acquisition, image enhancement and segmentation, image binarization, minutiae extraction and matching; Sign language biometrics: Indian sign language (ISL) biometrics, SIFT algorithm, advantages and disadvantages of ISL and fingerprint biometrics.	9	CO3
4	Introduction to biometric cryptography; general purpose cryptosystems; Cryptographic algorithms: DES and RSA; Privacy concerns and issues related to biometrics; biometrics with privacy enhancement; soft biometrics; comparison of various biometrics;	9	CO4 CO2 CO3
5	Identity and privacy Multimodal biometrics: basic architecture and fusion scheme, application, example of AADHAAR; scope and future market of biometrics; role of biometrics in enterprise and border security; DNA biometrics; biometric standards; biometric APIs.	9	CO5

**Text Books:**

1. Introduction to biometrics by Anil K Jain, Arun Ross and Karthik Nandakumar, Springer, 2011.
2. Biometrics Identity verification in a networked world by Samir Nanawati, Michael Thieme and Raj Nanawati, US edition of WileyIndia,2012.

**Reference Books:**

1. Privacy Enhancing Biometric, Chuck Wilson, Vein pattern recognition, CRC press 2010
2. Biometrics: Identity Verification in a Network, 1stEdition, Samir Nanavathi, Michel Thieme, andRaj Nanavathi, Wiley Eastern, 2002

**CIE- Continuous Internal Evaluation (50 Marks)**

<b>Bloom's Category</b>	<b>Tests (25 marks)</b>	<b>Assignment 1 (7.5 Marks )</b>	<b>Assignment 2 (7.5Marks)</b>	<b>Quiz1 (05Marks)</b>	<b>Quiz2 (05 Marks )</b>
Remember	5	2.5	2.5	-	-
Understand	5	2.5	2.5	-	-
Apply	10	2.5	2.5	05	05
Analyze	5	-	-	-	-
Evaluate	-	-	-	-	-
Create	-	-	-	-	-

**SEE- Semester End Examination (50Marks)**

<b>Bloom's Category</b>	<b>Questions(50 marks)</b>
Remember	10
Understand	10
Apply	20
Analyze	10
Evaluate	-
Create	-

## SOFT COMPUTING

Course Code : 20AIM642A  
 L: T: P: S : 3: 0: 0: 0  
 Exam Hours : 3

Credits : 3  
 CIE Marks : 50  
 SEE Marks : 50

Course Outcomes:	At the end of the course, students should be able to
CO#	Course Outcomes
20AIM642A.1	Recognize and apply soft computing theories in the creation of intelligent machines.
20AIM642A.2	Identify and determine the feasibility of applying neural networks to a particular problem.
20AIM642A.3	Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems.
20AIM642A.4	Apply genetic algorithms to optimization problems
20AIM642A.5	Design neural networks for pattern classification and regression problems

### Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM642A.1	3	3	3	-	-	-	-	-	-	-	-	-	3	2
20AIM642A.2	3	3	3	-	2	-	-	-	-	-	-	-	3	2
20AIM642A.3	3	3	-	-	-	-	-	-	-	-	-	-	3	3
20AIM642A.4	3	2	3	3	-	-	-	-	-	-	-	-	3	3
20AIM642A.5	3	3	3	2	-	-	-	-	-	-	-	-	3	3

Module No.	Module Contents	Hours	COs
1	<b>INTRODUCTION TO SOFT COMPUTING</b> Introduction-Artificial Intelligence-Artificial Neural Networks-Fuzzy Systems-Genetic Algorithm and Evolutionary of Neural Networks- Classification of ANNs-McCulloch and Pitts Neuron Model-Learning Rules: Hebbian and Delta-Perceptron Network-Adaline Network-Madaline Network.	9	CO1, CO2
2	<b>ARTIFICIAL NEURAL NETWORKS</b> Back propagation Neural Networks - Kohonen Neural Network -Learning Vector Quantization -Hamming Neural Network - Hopfield Neural Network- Bi-directional, Associative Memory -Adaptive Resonance Theory Neural Networks.	9	CO1, CO2
3	<b>FUZZY SYSTEMS</b> Introduction to Fuzzy Logic, Classical Sets and Fuzzy Sets - Classical Relations and Fuzzy Relations -Membership Functions -Defuzzification - Fuzzy Arithmetic and Fuzzy Measures - Fuzzy Rule Base and Approximate Reasoning - Introduction to Fuzzy Decision Making.	9	CO3
4	<b>GENETIC ALGORITHMS</b> Basic Concepts – Working Principle – Procedures of GA – Flow Chart of GA – Genetic Representation: (Encoding) Initialization and Selection – Genetic Operators: Mutation, Generational Cycle – Applications.	9	CO4
5	<b>Hybrid Soft Computing Techniques:</b> Neuro-Fuzzy Hybrid Systems-Adaptive Neuro-Fuzzy Inference System (ANFIS)-Genetic Neuro-Hybrid Systems-Genetic Fuzzy Hybrid and Fuzzy Genetic Hybrid Systems- Simplified Fuzzy ARTMAP- Applications.	9	CO5

**Text Books:**

1. S.N. Sivanandam, S.N. Deepa, “Principles of Soft Computing”, Third Edition, Wiley-India, 2008
2. S. Rajasekaran, G.A. Vijayalakshmi Pai, “Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications”, Prentice Hall of India, 2010.

**Reference Books :**

1. Siman Haykin, “Neural Networks”, Prentice Hall of India, 1999.
2. Timothy Ross, “Fuzzy Logic with Engineering Applications”, Wiley Publications, 2016.
3. David E. Goldberg, “Genetic Algorithms in Search, Optimization and Machine Learning”, Pearson Education, 2008.

**CIE- Continuous Internal Evaluation (50 Marks)**

<b>Bloom's Category</b>	<b>Tests (25 marks)</b>	<b>Assignment 1 (7.5 Marks )</b>	<b>Assignment 2 (7.5Marks)</b>	<b>Quiz1 (05Marks)</b>	<b>Quiz2 (05 Marks )</b>
Remember	5	2.5	2.5	2.5	2.5
Understand	5	2.5	2.5	2.5	2.5
Apply	10	2.5	2.5	-	-
Analyze	2.5	-	-	-	-
Evaluate	2.5	-	-	-	-
Create	-	-	-	-	-

**SEE- Semester End Examination (50Marks)**

<b>Bloom's Category</b>	<b>Questions (50 marks)</b>
Remember	10
Understand	10
Apply	20
Analyze	5
Evaluate	5
Create	-

## COMPILER DESIGN

Course Code : 20AIM643A  
 L: T: P: S: : 3: 0: 0: 0:  
 Exam Hours: : 3

Credits : 3  
 CIE Marks: 50  
 SEE Marks: 50

Course Outcomes:	At the end of the Course, the Student will be able to:
CO#	COURSE OUTCOME
20AIM643A.1	Apply the concepts of different Parsing techniques and implement the knowledge to Yacc tool.
20AIM643A.2	Analyse the concepts of Compilers and roles of the lexical analyzer.
20AIM643A.3	Implement the principles of scoping, parameter passing and runtime memory management.
20AIM643A.4	Develop syntax directed translation schemes.
20AIM643A.5	Use the new code optimization techniques to improve the performance of a program in terms of speed & space and develop algorithms to generate code for a target machine.

Mapping of Course Outcomes to Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM643.1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
20AIM643.2	-	3	-	-	3	-	-	-	-	-	-	-	3	2
20AIM643.3	-	3	-	-	3	-	-	-	-	-	-	-	3	3
20AIM643.4	3	-	-	-	-	-	-	-	-	-	-	-	3	3
20AIM643.5	-	-	-	3	3	-	-	-	-	-	-	-	3	3
Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)														

Module No	Module Contents	Hours	COs
1	Introduction : Introduction to Compiler, single and multi-pass compilers, Translators, Phases of Compilers, Compiler writing tools, Finite Automata and Lexical Analyzer: Role of Lexical Analyzer, Specification of tokens, Recognition of tokens, Regular expression, Finite automata, from regular expression to finite automata, transition diagrams, Implementation of lexical analyzer with LEX.	9	CO1, CO2
2	Syntax Analysis and Parsing Techniques : Context free grammars, Bottom-up parsing and top down parsing, Top down Parsing : elimination of left recursion, recursive descent parsing, Predicative Parsing, Bottom Up Parsing : Operator precedence parsing, LR parsers, Construction of SLR, Canonical LR and LALR parsing tables, Construction of SLR parse tables for Ambiguous grammar, parser generator- YACC, error recovery in top down and bottom up parsing	9	CO1, CO2
3	Syntax Directed Translation & Intermediate Code Generation : Synthesized and inherited attributes, Construction of syntax trees, bottom up and top down evaluation of attributes, S- attributed and Lattributed definitions ,Postfix notation; Three address codes, quadruples, triples and indirect triples, Translation of assignment statements, control flow, Boolean expression and Procedure Calls.	9	CO3, CO4
4	Run-time Environment: Storage organization, activation trees, activation records, allocation strategies, Parameter passing symbol table, dynamic storage allocation.	9	CO3, CO4
5	Code Optimization and Code Generation : Basic blocks and flow graphs, Optimization of basic blocks, Loop optimization, Global data flow analysis, Loop invariant computations. Issue in the design of Code generator, register allocation, the target machine, and simple Code generator.	9	CO3, CO5

**Text Books:**

1. Compilers Principles, Techniques and Tools, Alfred V. Aho, Ravi Sethi and Ullman J.D., 2nd edition, Addison Wesley.
2. Principle of Compiler Design, Alfred V. Aho and J.D. Ullman, Narosa Publication

**Reference Books:**

1. Compiler Design in C, A.C. Holub, PHI.
2. Compiler Design, O.G. Kakde, 4th edition, Laxmi Publication.
3. Compiler construction (Theory and Practice), A. Barret William and R.M., Bates, Galgotia Publication

**CIE- Continuous Internal Evaluation (50 Marks)**

<b>Bloom's Category</b>	<b>Tests (25 marks)</b>	<b>Assignment 1 (7.5 Marks )</b>	<b>Assignment 2 (7.5Marks)</b>	<b>Quiz1 (05Marks)</b>	<b>Quiz2 (05 Marks )</b>
Remember	5	2.5	2.5	-	-
Understand	5	2.5	2.5	-	-
Apply	10	2.5	2.5	05	05
Analyze	2.5	-	-	-	-
Evaluate	2.5	-	-	-	-
Create	-	-	-	-	-

**SEE- Semester End Examination (50Marks)**

<b>Bloom's Category</b>	<b>Questions (50 marks)</b>
Remember	10
Understand	10
Apply	20
Analyze	5
Evaluate	5
Create	-

## COMPUTER NETWORK

**Course Code** : 20AIM644A  
**L: T: P: S:** : 3: 0: 0: 0:  
**Exam Hours:** : 3

**Credits** : 3  
**CIE Marks:** 50  
**SEE Marks:** 50

Course Outcomes:	At the end of the Course, the Student will be able to:
CO#	COURSE OUTCOME
20AIM644A.1	Understand the basic structure of an abstract layered Network protocol model for any Networking environment
20AIM644A.2	Identify and apply basic theorems and formulae for the information-theoretic basis of communication and the performance of TCP/IP network protocols.
20AIM644A.3	Analyze necessary tools to support a career in Computer Networking at advanced professional level.
20AIM644A.4	Evaluate different protocols, software, and network architectures, their topologies, protocols in any networking application domains.
20AIM644A.5	Use security measures in real world scenario

### Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM644.1	3	-	-	-	-	-	-	-	-	-	-	3	3	3
20AIM644.2	3	3	-	-	-	-	-	-	-	-	-	3	3	3
20AIM644.3	-	3	-	-	-	-	-	-	-	-	-	3	3	2
20AIM644.4	-	-	-	3	3	-	-	-	-	-	-	3	3	3
20AIM644.5	-	-	-	3	3	-	-	-	-	-	-	3	3	3

Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)

Module No	Module Contents	Hours	COs
1	Introduction: OSI, TCP/IP and other networks models, Network Topologies WAN, LAN, MAN. Transmission media copper, twisted pair wireless, switching and Multiplexing and De- multiplexing, Networking Devices.	9	CO1, CO2
2	Data link layer: Framing, Error detection and correction, Flow Control. Multiple Access Protocols – Data Link Layer Addressing, ARP, RARP, DHCP, Ethernet standards. Media Access Control Protocols. MAC addresses. Wireless LANS. High Level Data Link Control, Asynchronous Transfer Mode.	9	CO1, CO2
3	Network Layer: Internet Protocol (IP), IPv4 and IPv6, Sub-netting and Super-netting, ICMP, Unicast Routing Protocols: Link State Routing, Distance Vector Routing, Hierarchical Routing, RIP, OSPF, BGP Multicast Routing, Multicast Routing Protocols: DVMRP, MOSPF, CBT, PIM, MBONE, Mobile IP, IPsec.	9	CO3
4	Transport Layer: Transport Layer Services Connectionless Protocols: UDP, UDP segment, Reliable Data Transfer. Connection-Oriented Protocols: TCP Segment Structure, RTT estimation, Flow Control, Connection Management, Congestion Control, Integrated and Differentiated Services: Intserv – Diffserv.	9	CO2, CO3, CO4
5	Application Layer: Principles of Network Applications, The Web and HTTP, FTP, Electronic Mail, SMTP, Mail Message Formats and MIME, DNS, Socket Programming with TCP and UDP. Multimedia Networking: Internet Telephony, RTP, RTCP, RTSP. Network Security: Principles of Cryptography, Firewalls, Attacks and Countermeasures.	9	CO2, CO3, CO5

**Text Books:**

1. Data Communications and Networking – Behrouz A. Forouzan. Third Edition TMH
2. Computer Networks — Andrew S Tanenbaum, 4th Edition. Pearson Education/PHI

**Reference Books:**

1. James F. Kurose and Keith W. Ross, “Computer Networking: A Top-Down Approach Featuring the Internet”, Pearson Education, Third edition, 2006
2. An Engineering Approach to Computer Networks-S.Keshav, 2nd Edition, Pearson Education

**CIE- Continuous Internal Evaluation (50 Marks)**

<b>Bloom's Category</b>	<b>Tests (25 marks)</b>	<b>Assignment 1 (7.5 Marks )</b>	<b>Assignment 2 (7.5Marks)</b>	<b>Quiz1 (05Marks)</b>	<b>Quiz2 (05 Marks )</b>
Remember	5	2.5	2.5	-	-
Understand	5	2.5	2.5	-	-
Apply	10	2.5	2.5	05	05
Analyze	2.5	-	-	-	-
Evaluate	2.5	-	-	-	-
Create	-	-	-	-	-

**SEE- Semester End Examination (50Marks)**

<b>Bloom's Category</b>	<b>Questions (50 marks)</b>
Remember	10
Understand	10
Apply	20
Analyze	5
Evaluate	5
Create	-

## AUGMENTED AND VIRTUAL REALITY

Course Code : 20AIM651A  
 L: T: P: S: : 3: 0: 0: 0:  
 Exam Hours: : 3

Credits: 3  
 CIE Marks: 50  
 SEE Marks: 50

Course Outcomes:	At the end of the Course, the Student will be able to:
CO#	COURSE OUTCOME
20AIM651.1	Understand the importance of Augmented reality
20AIM651.2	Apply the computer vision for Augmented reality and its applications
20AIM651.3	Implement the basic concepts of Virtual Reality
20AIM651.4	Analyze the importance of Tracking system.
20AIM651.5	Use the concepts of Computer Graphics and allied concepts for design of Virtual Reality

Mapping of Course Outcomes to Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM651.1	3	-	-	-	-	-	-	-	-	-	-	-	3	3
20AIM651.2	3	-	-	-	-	-	-	-	-	-	-	-	3	3
20AIM651.3	3	3	-	-	-	-	-	-	-	-	-	-	3	3
20AIM651.4	-	3	-	-	3	-	-	-	-	-	-	-	3	2
20AIM651.5	-	-	-	3	3	-	-	-	-	-	-	-	3	3

Module No	Module Contents	Hours	COs
1	Introduction to Augmented Reality: What Is Augmented Reality - Defining augmented reality, history of augmented reality, Examples, Displays-Multimodal Displays, Visual Perception, Requirements and Characteristics, Spatial Display Model	9	CO1
2	Tracking: Tracking, Calibration, and Registration, Characteristics of Tracking Technology, Stationary Tracking Systems, Mobile Sensors, Optical Tracking, Sensor Fusion	9	CO1, CO2, CO4
3	Computer Vision for Augmented Reality-Marker Tracking, Multiple- Camera Infrared Tracking, Natural Feature Tracking by Detection, Incremental Tracking, Simultaneous Localization and Mapping, Outdoor Tracking Calibration and Registration-Camera Calibration, Display Calibration, Registration	9	CO1, CO4
4	Introduction to Virtual Reality: Fundamental Concept and Components of Virtual Reality. Primary Features and Present Development on Virtual Reality. Multiple Models of Input and Output Interface in Virtual Reality: Input -Tracker, Sensor, Digital Glove, Movement Capture, Video-based Input, 3D Menus & 3DScanner etc. Output -- Visual /Auditory / Haptic Devices	9	CO3, CO4, CO5
5	Visual Computation in Virtual Reality: Fundamentals of Computer Graphics. Software and Hardware Technology on Stereoscopic Display. Advanced Techniques in CG: Management of Large Scale Environments & Real Time Rendering. Interactive Techniques in Virtual Reality: Body Track, Hand Gesture, 3D Manus, Object Grasp Development Tools and Frameworks in Virtual Reality: Frameworks of Software Development Tools in VR.X3D Standard; Vega, MultiGen, Virtools etc.	9	CO3, CO5

**Text Books:**

1. Augmented Reality: Principles and Practice by Dieter SCHMALSTIEG, Tobias HOLLERER
2. Virtual Reality Technology Burdea, G. C. P. Coffet Wiley-IEEE Press 2nd Edition 2003/2006

**Reference Books:**

1. Augmented Reality: Principles & Practice by Schmalstieg / Hollerer, Pearson Education India; First edition (12 October 2016), ISBN-10: 9332578494
2. Developing Virtual Reality Applications, Foundations of Effective Design Alan Craig William Sherman Jeffrey Will Morgan Kaufmann 2009

**CIE- Continuous Internal Evaluation (50 Marks)**

<b>Bloom's Category</b>	<b>Tests (25 marks)</b>	<b>Assignment 1 (7.5 Marks )</b>	<b>Assignment 2 (7.5Marks)</b>	<b>Quiz1 (05Marks)</b>	<b>Quiz2 (05 Marks )</b>
Remember	5	2.5	2.5	-	-
Understand	5	2.5	2.5	-	-
Apply	10	2.5	2.5	05	05
Analyze	2.5	-	-	-	-
Evaluate	2.5	-	-	-	-
Create	-	-	-	-	-

**SEE- Semester End Examination (50Marks)**

<b>Bloom's Category</b>	<b>Questions(50 marks)</b>
Remember	10
Understand	10
Apply	20
Analyze	5
Evaluate	5
Create	-

## PATTERN RECOGNITION AND IMAGE PROCESSING

Course Code : 20AIM652A  
 L: T: P: S: : 3: 0: 0: 0:  
 Exam Hours: : 3

Credits : 3  
 CIE Marks: 50  
 SEE Marks: 50

Course Outcomes:	At the end of the Course, the Student will be able to:
CO#	COURSE OUTCOME
20AIM625A.1	Understand the basics of Image formation and transformation using sampling and quantization
20AIM625A.2	Apply compression and coding techniques used for image data
20AIM625A.3	Analyze different types Segmentation Techniques.
20AIM625A.4	Evaluate the trade-offs, and appropriateness of the different feature types and classification techniques such as Bayesian, maximum-likelihood, etc
20AIM625A.5	Investigate the nature and inherent difficulties of the pattern recognition problems

### Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM625A.1	3	-	-	-	-	-	-	-	-	-	-	3	3	3
20AIM625A.2	3	-	-	-	-	-	-	-	-	-	-	3	3	3
20AIM625A.3	-	3	-	-	3	-	-	-	-	-	-	3	3	2
20AIM625A.4	3	-	-	3	3	-	-	-	-	-	-	3	3	3
20AIM625A.5	-	-	3	3	-	-	-	-	2	2	-	3	3	3

Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)

Module No	Module Contents	Hours	COs
1	<b>Introduction to Image Processing:</b> Image formation, image geometry perspective and other transformation, stereo imaging elements of visual perception. Digital Image-sampling and quantization serial & parallel Image processing.	9	CO1
2	<b>Image Restoration:</b> Image Restoration-Constrained and unconstrained restoration Wiener filter , motion blur remover, geometric and radiometric correction Image data compression-Huffman and other codes transform compression, predictive compression two tone Image compression, block coding, run length coding, and contour coding.	9	CO1, CO2
3	<b>Segmentation Techniques:</b> Segmentation Techniques-thresh holding approaches, region growing, relaxation, line and edge detection approaches, edge linking, supervised and unsupervised classification techniques, remotely sensed image analysis and applications, Shape Analysis – Gestalt principles, shape number, moment Fourier and other shape descriptors, Skelton detection, Hough transform, topological and texture analysis, shape matching.	9	CO3, CO4
4	<b>Pattern Recognition:</b> Basics of pattern recognition, Design principles of pattern recognition system, Learning and adaptation, Pattern recognition approaches, Mathematical foundations – Linear algebra, Probability Theory, Expectation, mean and covariance, Normal distribution, multivariate normal densities, Chi squared test.	9	CO4, CO5
5	<b>Statistical Patten Recognition:</b> Bayesian Decision Theory, Classifiers, Normal density and discriminant functions, Parameter estimation methods: Maximum-Likelihood estimation, Bayesian Parameter estimation, Dimension reduction methods – Principal Component Analysis (PCA), Fisher Linear discriminant analysis, Expectation- maximization (EM), Hidden Markov Models (HMM), Gaussian mixture models.	9	CO5

**Text Books:**

1. Digital Image Processing – Ganzalez and Wood, Addison Wesley, 1993.
2. Fundamental of Image Processing – Anil K.Jain, Prentice Hall of India.
3. Pattern Classification – R.O. Duda, P.E. Hart and D.G. Stork, Second Edition John Wiley, 2006

**Reference Books:**

1. Digital Picture Processing – Rosenfeld and Kak, vol.I & vol.II, Academic,1982
2. An Introduction to Digital Image Processing – Wayne Niblack, Prentice Hall, 1986
3. Pattern Recognition and Machine Learning – C. M. Bishop, Springer, 2009.
4. Pattern Recognition – S. Theodoridis and K. Koutroumbas, 4th Edition, Academic Press,2009

**CIE- Continuous Internal Evaluation (50 Marks)**

<b>Bloom's Category</b>	<b>Tests (25 marks)</b>	<b>Assignment 1 (7.5 Marks )</b>	<b>Assignment 2 (7.5 Marks)</b>	<b>Quiz1 (05 Marks)</b>	<b>Quiz2 (05 Marks )</b>
Remember	5	2.5	2.5	-	-
Understand	5	2.5	2.5	-	-
Apply	10	2.5	2.5	05	05
Analyze	5	-	-	-	-
Evaluate	-	-	-	-	-
Create	-	-	-	-	-

**SEE- Semester End Examination (50Marks)**

<b>Bloom's Category</b>	<b>Questions (50 marks)</b>
Remember	10
Understand	10
Apply	20
Analyze	10
Evaluate	-
Create	-

## ADVANCED JAVA

**Course Code** : 20AIM653A  
**L: T: P: S:** : 3: 0: 0: 0:  
**Exam Hours:** : 3

**Credits** : 3  
**CIE Marks:** 50  
**SEE Marks:** 50

Course Outcomes:		At the end of the Course, the Student will be able to:												
CO#	COURSE OUTCOME													
20AIM653A.1	Implement client-server applications and TCP/IP socket programs													
20AIM653A.2	Analyze the need for advanced Java concepts like enumerations and collections in developing modular and efficient programs													
20AIM653A.3	Design solutions using maps and comparators													
20AIM653A.4	Evaluate how servlets fit into Java-based web application architecture													
20AIM653A.5	Use JDBC API to demonstrate database access and details for managing information													
Mapping of Course Outcomes to Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM653A.1	-	-	-	-	3	-	-	-	-	-	-	3	3	3
20AIM653A.2	-	3	-	-	3	-	-	-	-	-	-	3	3	2
20AIM653A.3	-	-	3	-	-	-	-	-	-	-	-	3	3	3
20AIM653A.4	-	-	-	3	3	-	-	-	-	-	-	3	3	3
20AIM653A.5	-	-	-	3	3	-	-	-	-	-	-	3	3	3
Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)														
Module No	Module Contents												Hours	COs
1	<b>Java Networking:</b> Network Basics and Socket overview, TCP/IP client sockets, URL, TCP/IP server sockets, Datagrams, java.net package Socket, Server Socket, Inet Address, URL, URL Connection												9	CO1
2	<b>Enumerations, Autoboxing and Annotations:</b> Enumerations, Enumeration fundamentals, the values() and valueOf() Methods, java enumerations are class types, enumerations Inherits Enum, example, type wrappers, Autoboxing, Autoboxing and Methods, Autoboxing/Unboxing occurs in Expressions, Autoboxing/Unboxing, Boolean and character values, Autoboxing/Unboxing helps prevent errors, A word of Warning. Annotations, Annotation basics, specifying retention policy, Obtaining Annotations at run time by use of reflection, Annotated element Interface												9	CO2
3	<b>The collections and Framework :</b> The collections and Framework: Collections Overview, Recent Changes to Collections, The Collection Interfaces, The Collection Classes, Accessing a collection Via an Iterator, Storing User Defined Classes in Collections, The Random Access Interface, Working With Maps, Comparators, The Collection Algorithms, Why Generic Collections?, The legacy Classes and Interfaces, Parting Thoughts on Collections.												9	CO2, CO3
4	<b>Background:</b> Background; The Life Cycle of a Servlet; Using Tomcat for Servlet Development; A simple Servlet; The Servlet API; The Javax.servlet Package; Reading Servlet Parameter; The Javax .servlet.http package; Handling HTTP Requests and Responses; Using Cookies; Session Tracking. Java Server Pages (JSP): JSP, JSP Tags, Tomcat, Request String, User Sessions, Cookies, Session Objects												9	CO4
5	<b>The Concept of JDBC:</b> The Concept of JDBC; JDBC Driver Types; JDBC Packages; A Brief Overview of the JDBC process; Database Connection; Associating the JDBC/ODBC Bridge with the Database; Statement Objects; Result Set; Transaction Processing; Metadata, Data types; Exceptions.												9	CO4, CO5

**Text Books:**

1. Herbert Schildt: JAVA the Complete Reference, 7th/9th Edition, Tata McGraw Hill, 2007.
2. Jim Keogh: J2EE-TheCompleteReference, McGraw Hill, 2007.

**Reference Books:**

1. Y. Daniel Liang: Introduction to JAVA Programming, 7thEdition, Pearson Education, 2007.
2. Stephanie Bodoff et al: The J2EE Tutorial, 2nd Edition, Pearson Education,2004.

**CIE- Continuous Internal Evaluation (50 Marks)**

<b>Bloom's Category</b>	<b>Tests (25 marks)</b>	<b>Assignment 1 (7.5 Marks )</b>	<b>Assignment 2 (7.5Marks)</b>	<b>Quiz1 (05Marks)</b>	<b>Quiz2 (05 Marks )</b>
Remember	5	2.5	2.5	-	-
Understand	5	2.5	2.5	-	-
Apply	10	2.5	2.5	05	05
Analyze	5	-	-	-	-
Evaluate	-	-	-	-	-
Create	-	-	-	-	-

**SEE- Semester End Examination (50Marks)**

<b>Bloom's Category</b>	<b>Questions (50 marks)</b>
Remember	10
Understand	10
Apply	20
Analyze	10
Evaluate	-
Create	-

## BLOCK CHAIN TECHNOLOGY

Course Code : 20AIM654A  
 L: T: P: S: : 3: 0: 0: 0:  
 Exam Hours: : 3

Credits : 3  
 CIE Marks: 50  
 SEE Marks: 50

Course Outcomes:	At the end of the Course, the Student will be able to:
CO#	COURSE OUTCOME
20AIM654A.1	Understand the basic concepts and technology used for blockchain.
20AIM654A.2	Develop Ethereum block chain contract.
20AIM654A.3	Apply security features in blockchain technologies
20AIM654A.4	Analyze the primitives of the distributed computing and cryptography related to blockchain.
20AIM654A.5	Use Bitcoin Scripting language for secure transaction.

### Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM654A.1	3	-	-	-	-	-	-	-	-	-	-	3	3	3
20AIM654A.2	3	-	3	-	-	-	-	-	-	-	-	3	3	3
20AIM654A.3	3	-	-	-	-	-	-	-	-	-	-	3	3	3
20AIM654A.4	-	3	-	-	3	-	-	-	-	-	-	3	3	2
20AIM654A.5	-	-	-	3	3	-	-	-	-	-	-	3	3	3

Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)

Module No	Module Contents	Hours	COs
1	<b>Introduction:</b> Need for Distributed Record Keeping, Modeling faults and adversaries, Byzantine Generals problem, Consensus algorithms and their scalability problems, Nakamoto's concept with Blockchain based cryptocurrency, Technologies Borrowed in Blockchain – hash pointers, consensus, byzantine fault-tolerant distributed computing, digital cash etc.	9	CO1
2	<b>Basic Distributed Computing &amp; Crypto primitives:</b> Atomic Broadcast, Consensus, Byzantine Models of fault tolerance, Hash functions, Puzzle friendly Hash, Collision resistant hash, digital signatures, public key crypto, verifiable random functions, Zero- knowledge systems. .	9	CO2, CO3, CO4
3	<b>Bitcoin basics:</b> Bitcoin blockchain, Challenges and solutions, proof of work, Proof of stake, alternatives to Bitcoin consensus, Bitcoin scripting language and their use.	9	CO3, CO5
4	<b>Ethereum basics:</b> Ethereum and Smart Contracts, The Turing Completeness of Smart Contract Languages and verification challenges, Using smart contracts to enforce legal contracts, comparing Bitcoin scripting vs. Ethereum Smart Contracts, Writing smart contracts using Solidity & JavaScript.	9	CO2, CO4, CO5
5	<b>Privacy, Security issues in Blockchain:</b> Pseudo-anonymity vs. anonymity, Zcash and Zk-SNARKS for anonymity preservation, attacks on Blockchains: Sybil attacks, selfish mining, 51% attacks advent of algorand; Sharding based consensus algorithms to prevent these attacks.	9	CO3

**Text Books:**

1. Narayanan, Bonneau, Felten, Miller and Goldfeder, “Bitcoin and Cryptocurrency Technologies – A Comprehensive Introduction”, Princeton University Press.
2. Josh Thompson, ‘Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming’, Create Space Independent Publishing Platform, 2017.

**Reference Books:**

1. Imran Bashir, “Mastering Blockchain: Distributed ledger technology, decentralization, and smart contracts explained”, Packt Publishing.
2. Merunas Grincalaitis, “Mastering Ethereum: Implement Advanced Blockchain Applications Using Ethereum-supported Tools, Services, and Protocols”, Packt Publishing.

**CIE- Continuous Internal Evaluation (50 Marks)**

<b>Bloom’s Category</b>	<b>Tests (25 marks)</b>	<b>Assignment 1 (7.5 Marks )</b>	<b>Assignment 2 (7.5Marks)</b>	<b>Quiz1 (05 Marks)</b>	<b>Quiz2 (05 Marks )</b>
Remember	5	2.5	2.5	-	-
Understand	5	2.5	2.5	-	-
Apply	10	2.5	2.5	05	05
Analyze	5	-	-	-	-
Evaluate	-	-	-	-	-
Create	-	-	-	-	-

**SEE- Semester End Examination (50Marks)**

<b>Bloom’s Category</b>	<b>Questions (50 marks)</b>
Remember	10
Understand	10
Apply	20
Analyze	10
Evaluate	-
Create	-

## VII SEMESTER

S. No	Course Code	Course	BOS	Credit Distribution				Overall Credits	Contact Hours	Marks		
				L	T	P	S			CIE	SEE	Total
1	20AIM71A	Cloud Computing	AI&ML	3	0	0	0	3	4	50	50	100
2	20AIM72A	Web Technology	AI&ML	3	0	0	0	3	4	50	50	100
3	20AIM73A	Natural Language processing	AI&ML	3	0	0	0	3	4	50	50	100
4	20AIM74X	Professional Elective - V	AI&ML	3	0	0	0	3	4	50	50	100
5	20AIM75X	Professional Elective - VI	AI&ML	3	0	0	0	3	4	50	50	100
6	20AIM76A	Cloud Computing Laboratory	AI&ML	3	0	0	0	2	4	25	25	50
7	20AIL77A	Web Technology Lab	AI&ML	0	0	2	0	2	4	25	25	50
8	20AIL78A	Project Phase – I	AI&ML	0	0	2	0	2	0	25	25	50
9	20NHOPX X	Open Elective - II	AI&ML	3	0	0	0	3	4	50	50	100
<b>Total</b>								<b>24</b>	<b>32</b>	<b>375</b>	<b>375</b>	<b>750</b>

Professional Elective – V		Open Elective - II	
Course Code	Course	Course Code	Course
20AIM741A	Recommender System	20NHOP701	Big Data Analytics using HP Vertica-1
20AIM742A	Streaming Analytics	20NHOP702	VM Ware Virtualization Essentials-1
20AIM743A	Information Security	20NHOP704	Big Data Analytics using HP Vertica-2
20AIM744A	Human Computer Interaction	20NHOP707	SAP

Professional Elective – VI			
20AIM751A	Quantum Computing	20NHOP708	Schneider-Industrial Automation
20AIM752A	Software Testing	20NHOP709	CISCO-Routing and Switching-1
20AIM753A	Social Network Analysis	20NHOP712	CISCO-Routing and switching-2
20AIM754A	Cyber Security	20NHOP714	Block chain
		20NHOP715	Product Life Cycle Management
		20NHOP720A	Robotic Process Automation
		20NHOP721A	Industry 4.0
		20NHOP722A	Programming of Industrial Robot
		20NHOP723A	5G Communication
		20NHOP725A	VLSI Physical Design -1
		20NHOP726A	VLSI Physical Design -2
		20NHOP727A	Juniper Network Operating System
		20NHOP728A	Database Administration using DB2

## CLOUD COMPUTING

Course Code : 20AIM71A  
 L:T:P:S: : 3: 0: 0: 0:  
 Exam Hours: : 3

Credits: 3  
 CIE Marks: 50  
 SEE Marks: 50

Course Outcomes:	At the end of the Course the Student will be able to:
CO#	COURSE OUT COME (Student will be able to)
20AIM71A.1	<b>Understand</b> basic concepts, principles and paradigm of Cloud Computing.
20AIM71A.2	<b>Apply</b> the levels of virtualization and tools for resource provisioning.
20AIM71A.3	<b>Compare</b> the cloud platform architectures of virtualized data centers and Inter-cloud Resource Management.
20AIM71A.4	<b>Analyze</b> the principles of Security and Trust management to protect confidentiality of data in the Cloud.
20AIM71A.5	<b>Develop</b> a solution and explore Cloud Simulator to implement a scheduling algorithm for cloud resource sharing scenario.

Mapping of Course Outcomes to Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM71A.1	2	-	-	-	-	-	-	-	-	-	-	3	3	-
20AIM71A.2	3	-	-	-	-	-	-	-	-	-	-	3	3	-
20AIM71A.3	-	3	-	-	-	-	-	-	-	-	-	3	3	-
20AIM71A.4	-	3	-	-	-	-	-	-	-	-	-	3	3	-
20AIM71A.5	-	-	3	-	-	-	-	-	-	-	-	3	3	-
Correlation levels: 1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)														

Module No	Module Contents	Hours	COs
1	<b>Introduction</b> , Cloud Computing at a Glance, The Vision of Cloud Computing, Defining a Cloud, A Closer Look, Cloud Computing Reference Model, Characteristics and Benefits, Distributed Systems, Virtualization, Web 2.0, Service-Oriented Computing, Utility-Oriented Computing, Building Cloud Computing Environments, Application Development, Infrastructure and System Development, Computing Platforms and Technologies, Amazon Web Services (AWS), Google App Engine, Microsoft Azure, Hadoop, Force.com and Salesforce.com, Aneka.	9	CO1 CO2
2	<b>Cloud Computing Architecture</b> , Introduction, Cloud Reference Model, Architecture, Infrastructure / Hardware as a Service, Platform as a Service, Software as a Service, Types of Clouds, Public Clouds, Private Clouds, Hybrid Clouds, Community Clouds, Economics of the Cloud, Open Challenges, Cloud Definition, Cloud Interoperability and Standards Scalability and Fault Tolerance Security, Trust, and Privacy Organizational Aspects.	9	CO2 CO3

3	<b>Concurrent Computing:</b> Thread Programming, Introducing Parallelism for Single Machine Computation, Programming Applications with Threads, Thread APIs, Techniques for Parallel Computation with Threads, Multithreading with Aneka, Introducing the Thread Programming Model, Aneka Thread vs. Common Threads, Programming Applications with Aneka Threads, Aneka Threads Application Model, Domain Decomposition: Matrix Multiplication, Functional Decomposition: Sine, Cosine, and Tangent.	9	CO3 CO4
4	<b>Data Intensive Computing: Introduction-</b> Characterizing Data-Intensive Computations, Technologies for Data-Intensive Computing, Storage Systems, Programming Platforms, Aneka Map Reduce Programming, Introducing the Map Reduce Programming Model, Example Application.	9	CO4 CO5
5	<b>Cloud Platforms in Industry: Amazon Web Services:</b> Compute Services, Storage Services, Communication Services, And Additional Services. <b>Google App Engine:</b> Architecture and Core Concepts, Application Life-Cycle, Cost Model, Observations. <b>Microsoft Azure:</b> Azure Core Concepts, SQL Azure, Windows Azure Platform Appliance. Cloud Applications in Healthcare and Scientific.	9	CO3 CO4 CO5

**Text Book:**

1. Douglas Comer, “The Cloud Computing Book : The Future of Computing Explained”, 1<sup>st</sup> Edition, Chapman and Hall/CRC,2021.
2. Rajkumar Buyya, Christian Vecchiola, and ThamaraiSelvi Mastering Cloud. Computing McGraw Hill Education,2013

**Reference Book:**

1. Dan C. Marinescu, Cloud Computing Theory and Practice, Morgan Kaufmann, Elsevier 2013.

**Continuous Internal Evaluation (50Marks)**

Bloom’s Category	Tests (25marks)	Assessment(s) (25 Marks) *
Remember	5	
Understand	5	5
Apply	10	10
Analyze	5	10
Evaluate	-	
Create	-	

\* Assessments are to be selected from the assessment list attached to page 163.

**SEE-Semester End Examination (50Marks)**

Bloom’s Category	Questions (50marks)
Remember	10
Understand	20
Apply	10
Analyze	10
Evaluate	-
Create	-

## WEB TECHNOLOGY

Course Code : 20AIM72A  
 L:T:P:S : 3: 0: 0: 0:  
 Exam Hours : 3

Credits: 3  
 CIE Marks: 50  
 SEE Marks: 50

<b>Course Outcomes:</b>	<b>At the end of the Course, the Student will be able to:</b>
<b>CO#</b>	<b>COURSE OUT COME (Student will be able to)</b>
20AIM72A.1	<b>Understand</b> HTML, XHTML syntax, and semantics to build web pages.
20AIM72A.2	<b>Apply</b> the XML and CSS concepts to design web page.
20AIM72A.3	<b>Classify</b> the different Data Interchange formats in Web
20AIM72A.4	<b>Design</b> Client-Side Scripts using JavaScript and Server-Side Scripts using PHP to generate and display the contents dynamically.
20AIM72A.5	Examine PHP programs to demonstrate Error handling and Exceptions,

Mapping of Course Outcomes to Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM72A.1	2	-	-	-	-	-	-	-	-	-	-	2	3	-
20AIM72A.2	3	-	-	-	-	-	-	-	-	-	-	3	3	-
20AIM72A.3	-	3	-	-	-	-	-	-	-	-	-	3	3	-
20AIM72A.4	-	-	3	-	3	-	-	-	-	-	-	3	3	-
20AIM72A.5	-	3	-	-	-	-	-	-	-	-	-	3	3	-
Correlation levels: 1-Slight(Low)      2-Moderate(Medium) 3-Substantial(High)														

Module No	Module Contents	Hours	COs
1	<b>Introduction to HTML/XHTML:</b> Origins and Evolution of HTML and XHTML, Basic Syntax of HTML, Standard HTML Document Structure, Basic Text Markup, Images, Hypertext Links, Lists, Tables, Forms, HTML5, Syntactic Differences between HTML and XHTML.	9	CO1
2	<b>Introduction to Styles sheets and Frameworks Cascading Style Sheets:</b> Levels of Style Sheets - Style Specification Formats, Selector Forms, Property-Value Forms, Font Properties, List Properties, Alignment of Text, Color, The Box Model, Background Images, The span and div Tags. Frameworks: Overview and Basics of Responsive CSS Frameworks – Bootstrap	9	CO2
3	<b>Introduction to Data Interchange Formats XML:</b> The Syntax of XML, XML Document Structure, Namespaces, XML Schemas, Displaying Raw XML Documents, Displaying XML Documents with CSS, XSLT Style Sheets, XML Applications. <b>JSON(Basics Only):</b> Overview, Syntax, Datatypes, Objects, Schema, Comparison with XML.	9	CO2 CO3

4	<b>JavaScript:</b> Client-Side Scripting, JavaScript Design Principles, Syntax, JavaScript Objects, The Document Object Model (DOM), JavaScript Events, Forms, Introduction to Server-Side Development with PHP, what is Server-Side Development, A Web Server's Responsibilities, Quick Tour of PHP, Program Control, Functions	9	CO3 CO4
5	<b>PHP:</b> Arrays and Super global, Arrays, \$_GET and \$_POST, Super global Arrays, \$_SERVER Array, \$_FILES Array, Reading/Writing Files, PHP Classes and Objects, Object-Oriented Overview, Classes and Objects in PHP, Object Oriented Design, Error Handling and Validation, Errors and Exceptions.	9	CO4 CO5

**Text Books:**

1. P. J. Deitel, H.M. Deitel, Internet & World Wide Web How To Program, 5/e, Pearson International Edition 2010.
2. Robert W Sebesta, Programming the World Wide Web, 7/e, Pearson Education Inc., 2014

**Reference Books:**

1. Randy Connolly, Ricardo Hoar, "Fundamentals of Web Development", 1<sup>st</sup> Edition, Pearson Education India. (ISBN:978-9332575271)
2. Robin Nixon, "Learning PHP, MySQL & JavaScript with jQuery, CSS and HTML5", 4<sup>th</sup> Edition, O'Reilly Publications, 2015. (ISBN:978-9352130153)
3. Chris Bates, Web Programming Building Internet Applications, 3/e, Wiley India Edition 2009
4. Lindsay Bassett, Introduction to JavaScript Object Notation: A To-the-Point Guide to JSON 1<sup>st</sup> Edition, O'Reilly. [Chapter 1,2,3,4]
5. Luke Welling, Laura Thomson, "PHP and MySQL Web Development", 5<sup>th</sup> Edition, Pearson Education, 2016. (ISBN:978-9332582736)

**CIE-Continuous Internal Evaluation (50Marks)**

Bloom's Category	Tests (25marks)	Assessment(s) (25 Marks) *
Remember	-	5
Understand	5	10
Apply	10	10
Analyze	5	
Evaluate	5	
Create	-	

\* Assessments are to be selected from the assessment list attached to page 163.

**SEE-Semester End Examination (50Marks)**

Bloom's Category	Questions (50 marks)
Remember	-
Understand	10
Apply	20
Analyze	10
Evaluate	10
Create	-

## NATURAL LANGUAGE PROCESSING

Course Code : 20AIM73A  
 L:T:P:S : 3: 0: 0: 0:  
 Exam Hours : 3

Credits: 3  
 CIE Marks: 50  
 SEE Marks: 50

Course Outcomes :	At the end of the Course, the Student will be able to:
CO#	COURSE OUTCOME (Student will be able to)
20AIM73A.1	<b>Understand</b> basics of linguistics, probability and statistics associated with NLP.
20AIM73A.2	<b>Apply</b> the concepts of natural language processing, its applications and language modeling techniques.
20AIM73A.3	<b>Analyze</b> linguistic structure in text using parsing and CFG.
20AIM73A.4	<b>Design</b> a model to determine the sense of a word in NLP using different approaches.
20AIM73A.5	<b>Interpret</b> methods for recognising a sentence's structures.

Mapping of Course Outcomes to Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM73A.1	2	-	-	-	-	-	-	-	-	-	-	2	3	-
20AIM73A.2	3	-	-	-	-	-	-	-	-	-	-	2	3	-
20AIM73A.3	-	3	-	-	-	-	-	-	-	-	-	2	3	-
20AIM73A.4	-	-	3	-	-	-	-	-	-	-	-	2	3	-
20AIM73A.5	-	-	-	3	-	-	-	-	-	-	-	2	3	-

Correlation levels: 1-Slight (Low) 2- Moderate (Medium) 3-Substantial(High)

Module No	Module Contents	Hours	COs
1	<b>Natural Language Processing</b> – Components - Basics of Linguistics and Probability and Statistics – Words-Tokenization-Morphology-Finite State Automata.	9	CO1 CO2
2	<b>N-grams and Language models</b> –Smoothing- Evaluating Language Model -Text classification- Naïve Bayes classifier – Vector Semantics – TF-IDF - Word2Vec- Evaluating Vector Models –Sequence Labeling – Part of Speech – Part of Speech Tagging -Named Entities –Named Entity Tagging	9	CO2 CO3
3	<b>Constituency –Context Free Grammar</b> –Lexicalized Grammars- CKY Parsing – Earley's algorithm- Evaluating Parsers -Partial Parsing – Dependency Relations- Dependency Parsing -Transition Based - Graph Based	9	CO3 CO4
4	<b>Word Senses and WordNet</b> – Word Sense Disambiguation – Semantic Role Labeling – Proposition Bank- FrameNet- Selectional Restrictions - Information Extraction - Template Filling	9	CO4 CO5
5	<b>Discourse Coherence</b> – Discourse Structure Parsing –Question Answering – <b>Applications and Implementation of NLP:</b> Sentiment Analysis - Text Classification- Text Summarization- Named Entity Recognition code- Chatbots and Dialogue systems	9	CO3 CO4 CO5

**Text Books:**

1. Daniel Jurafsky and James H. Martin, "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition (Prentice Hall Series in Artificial Intelligence), 2020
2. Jacob Eisenstein. "Natural Language Processing ", MIT Press, 2019

**Reference Books:**

1. Samuel Burns "Natural Language Processing: A Quick Introduction to NLP with Python and NLTK, 2019
2. Christopher Manning, "Foundations of Statistical Natural Language Processing", MIT Press, 2009.

**CIE-Continuous Internal Evaluation (50Marks)**

<b>Bloom's Category</b>	<b>Tests (25marks)</b>	<b>Assessment(s) (25 Marks) *</b>
Remember	5	
Understand	5	5
Apply	10	10
Analyze	5	10
Evaluate	-	
Create	-	

\* Assessments are to be selected from the assessment list attached to page 163.

**SEE-Semester End Examination (50Marks)**

<b>Bloom's Category</b>	<b>Questions (50marks)</b>
Remember	10
Understand	10
Apply	20
Analyze	10
Evaluate	-
Create	-

## RECOMMENDER SYSTEM

Course Code : 20AIM741A  
 L:T:P:S : 3: 0: 0: 0:  
 Exam Hours : 3

Credits: 3  
 CIE Marks: 50  
 SEE Marks: 50

Course Outcomes:	At the end of the Course, the Student will be able to:
CO#	COURSE OUTCOME (Student will be able to)
20AIM741A.1	<b>Understand</b> the basic principles and concepts of recommender systems the field of science and technology.
20AIM741A.2	<b>Apply</b> the concept of content-based recommendation system and Classification algorithm in filtering
20AIM741A.3	<b>Analyze</b> the Collaborative Filtering in carrying out performance evaluation of recommender systems based on various metrics.
20AIM741A.4	<b>Design</b> a simple recommender system application with robust recommendation algorithm.
20AIM741A.5	<b>Evaluate</b> the limitations of recommender system using different accuracy metrics and user studies

Mapping of Course Outcomes to Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM741A.1	2	-	-	-	-	-	-	-	--	-	-	2	3	-
20AIM741A.2	3	-	-	-	-	-	-	-	-	-	-	2	3	-
20AIM741A.3	-	3	-	-	-	-	-	-	-	-	-	2	3	-
20AIM741A.4	-	-	3	-	-	-	-	-	-	-	-	2	3	-
20AIM741A.5	-	-	-	3	3	-	-	-	-	-	-	2	3	-
Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)														

Module No	Module Contents	Hours	COs
1	<b>INTRODUCTION:</b> Introduction and basic taxonomy of recommender systems - Traditional and non-personalized Recommender Systems - Overview of data mining methods for recommender systems- similarity measures- Dimensionality reduction – Singular Value Decomposition (SVD)	9	CO1 CO2
2	<b>CONTENT-BASED RECOMMENDATION SYSTEMS:</b> High-level architecture of content-based systems, Advantages and drawbacks of content-based filtering - Item profiles, Representing item profiles, Methods for learning user profiles, Similarity-based retrieval, and Classification algorithms.	9	CO2 CO3
3	<b>COLLABORATIVE FILTERING:</b> A systematic approach, Nearest-neighbor collaborative filtering (CF), user-based and item-based CF, components of neighborhood methods (rating normalization, similarity weight computation, and neighborhood selection).	9	CO3 CO4

4	<b>ATTACK-RESISTANT RECOMMENDER SYSTEMS:</b> Introduction – Types of Attacks – Detecting attacks on recommender systems – Individual attack – Group attack – Strategies for robust recommender design - Robust recommendation algorithms.	9	CO4 CO5
5	<b>EVALUATING RECOMMENDER SYSTEMS:</b> Evaluating Paradigms – User Studies – Online and Offline evaluation – Goals of evaluation design – Design Issues – Accuracy metrics – Limitations of Evaluation measures, Evaluation on historical datasets.	9	CO3 CO4 CO5

**Text Books:**

1. Charu C. Aggarwal, Recommender Systems: The Textbook, Springer, 2016.
2. Dietmar Jannach, Markus Zanker, Alexander Felfernig and Gerhard Friedrich, Recommender Systems: An Introduction, Cambridge University Press (2011), 1st Ed.

**Reference Book:**

1. Francesco Ricci, Lior Rokach, Bracha Shapira, Recommender Systems Handbook, 1st edition, Springer (2011).

**CIE-Continuous Internal Evaluation (50Marks)**

Bloom's Category	Tests (25marks)	Assessment(s) (25 Marks) *
Remember	5	
Understand	5	5
Apply	10	10
Analyze	5	10
Evaluate	-	
Create	-	

\* Assessments are to be selected from the assessment list attached to page 163.

**SEE-Semester End Examination (50Marks)**

Bloom's Category	Questions (50marks)
Remember	10
Understand	10
Apply	20
Analyze	10
Evaluate	
Create	-

## STREAMING ANALYTICS

Course Code : 20AIM742A  
 L:T:P:S : 3: 0: 0: 0:  
 Exam Hours : 3

Credits: 3  
 CIE Marks: 50  
 SEE Marks: 50

Course Outcomes:	At the end of the Course, the Student will be able to:
CO#	COURSE OUTCOME (Student will be able to)
20AIM742.1	<b>Understand</b> the characteristics of data streams that make it useful to solve real-world problems.
20AIM742.2	<b>Apply</b> appropriate algorithms for analyzing the data streams for variety of problems.
20AIM742.3	<b>Identify</b> the different algorithms for analyzing the data streams.
20AIM742.4	<b>Analyze</b> the working of Very Fast Decision Tree Algorithm in data streams and clustering.
20AIM742.5	<b>Design</b> the solution for data stream and pattern mining using different algorithms.

### Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM742.1	2	-	-	-	-	-	-	-	-	-	-	2	3	-
20AIM742.2	3	-	-	-	-	-	-	-	-	-	-	2	3	-
20AIM742.3	-	3	-	-	-	-	-	-	-	-	-	2	3	-
20AIM742.4	-	3	-	-	-	-	-	-	-	-	-	2	3	-
20AIM742.5	-	-	3	-	-	-	-	-	-	-	-	2	3	-
Correlation levels: 1-Slight(Low)      2-Moderate(Medium) 3-Substantial(High)														

Module No	Module Contents	Hours	COs
1	<b>INTRODUCTION</b> Characteristics of the data streams, Challenges in mining data streams Requirements and principles for real time processing, Concept drift Incremental learning	9	CO1 CO2
2	<b>DATA STREAMS</b> Basic Streaming Methods, Counting the Number of Occurrence of the Elements in a Stream, Counting the Number of Distinct Values in a Stream, Bounds of Random Variables, Poisson Processes, Maintaining Simple Statistics from Data Streams, Sliding Windows, Data Synopsis, Change Detection: Tracking Drifting Concepts, Monitoring the Learning Process	9	CO2 CO3
3	<b>DECISION TREE</b> Very Fast Decision Tree Algorithm (VFDT), The Base Algorithm, Analysis of the VFDT Algorithm, Extensions to the Basic Algorithm: Processing Continuous Attributes, Functional Tree Leaves, Concept Drift.	9	CO3 CO4

4	<b>CLUSTERING FROM DATA STREAMS</b> Clustering Examples: Basic Concepts, Partitioning Clustering- The Leader Algorithm, Single Passk-Means, Micro Clustering, Clustering Variables: A Hierarchical Approach	9	CO4 CO5
5	<b>FREQUENT PATTERN MINING</b> Mining Frequent Item sets from Data Streams- Landmark Windows, Mining Recent Frequent Item sets, Frequent Item sets at Multiple Time Granularities, SequencePatternMining- ReservoirSamplingforSequentialPatternMiningoverdata streams	9	CO3 CO4 CO5

**Text Books:**

1. Joao Gama, "Knowledge Discovery from Data Streams", CRC Press,2010.

**Reference Books:**

1. DavidLuckham, "ThePowerofEvents:AnIntroductiontoComplexEventProcessinginDis  
tributedEnterpriseSystems", AddisonWesley,2002.
2. CharuC.Aggarwal, "DataStreams:MoelsAndAlgorithms", KluwerAcademicPublishers,  
2007

**CIE-Continuous Internal Evaluation (50Marks)**

<b>Bloom's Category</b>	<b>Tests (25marks)</b>	<b>Assessment(s) (25 Marks) *</b>
Remember	5	
Understand	5	5
Apply	10	10
Analyze	5	10
Evaluate	-	
Create	-	

\* Assessments are to be selected from the assessment list attached to page 163.

**SEE-Semester End Examination (50Marks)**

<b>Bloom's Category</b>	<b>Questions (50marks)</b>
Remember	10
Understand	10
Apply	20
Analyze	10
Evaluate	-
Create	-

## INFORMATION SECURITY

**Course Code** : 20AIM743A  
**L:T:P:S:** : 3: 0: 0: 0:  
**Exam Hours:** : 3

**Credits:** 3  
**CIE Marks:** 50  
**SEE Marks:** 50

Course Outcomes:	At the end of the Course, the Student will be able to:
<b>CO#</b>	<b>COURS EOUTCOME (Student will be able to)</b>
20AIM743A.1	<b>Understand</b> the security parameters and access control methods in information security.
20AIM743A.2	<b>Apply</b> the legal, ethical and professional issues in information security.
20AIM743A.3	<b>Analyse</b> the fundamental policies and design principle of computing resources.
20AIM743A.4	<b>Classify</b> the different security policies in system design.
20AIM743A.5	<b>Design</b> the system with all Security measures.

Mapping of Course Outcomes to Program Outcomes														
CO#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM743A.1	2	-	-	-	-	-	-	-	-	-	-	3	3	-
20AIM743A.2	3	-	-	-	-	-	-	-	-	-	-	3	3	-
20AIM743A.3	-	3	-	-	-	-	-	-	-	-	-	3	3	-
20AIM743A.4	-	3	-	-	-	-	-	-	-	-	-	3	3	-
20AIM743A.5	-	-	3	-	-	-	-	-	-	-	-	3	3	-
Correlationlevels:1-Slight(Low)2-Moderate(Medium)3-Substantial(High)														

Module No	Module Contents	Hours	Cos
1	<b>Confidentiality, integrity and availability;</b> Security violation and threats; Security policy and procedure; Assumptions and Trust; Security Assurance, Implementation and Operational Issues; Security Life Cycle.	9	CO1 CO2
2	<b>Access Control Models:</b> Operating system access controls, Hardware protection, Distributed Systems: Concurrency, Fault tolerance and failure recovery, Naming.	9	CO2 CO3
3	<b>Security Policies:</b> Confidentiality policies, integrity policies, hybrid policies, non-interference and policy composition, international standards.	9	CO3 CO4
4	<b>Design principles,</b> representing identity, control of access and information flow, confinement problem. Assurance: Building systems with assurance, formal methods, evaluating systems	9	CO4 CO5
5	<b>Logic-based System:</b> Malicious logic, vulnerability analysis, auditing, intrusion detection. Applications: Network security, operating system security, user security, program security.	9	CO3 CO4 CO5

**Text Books:**

1. Computer Security Art and Science, 2nd Edition by Matt Bishop, 2018.
2. Security Engineering, A guide building dependable distribution systems, 3rd Edition by Ross Anderson, 2020.

**Reference Books:**

1. Micki Krause, Harold F. Tipton, — Handbook of Information Security Management, Vol 1-3 CRC Press LLC, 2004.
2. Stuart McClure, Joel Scrambray, George Kurtz, — Hacking Exposed, Tata McGraw- Hill, 2003

**CIE-Continuous Internal Evaluation (50Marks)**

<b>Bloom's Category</b>	<b>Tests (25marks)</b>	<b>Assessment(s) (25 Marks) *</b>
Remember	5	
Understand	5	5
Apply	10	10
Analyze	5	10
Evaluate	-	
Create	-	

\* Assessments are to be selected from the assessment list attached to page 163.

**SEE-Semester End Examination (50Marks)**

<b>Bloom's Category</b>	<b>Questions (50marks)</b>
Remember	10
Understand	10
Apply	20
Analyze	10
Evaluate	-
Create	-

## HUMAN COMPUTER INTERACTION

Course Code : 20AIM744A  
 L:T:P:S: : 3: 0: 0: 0:  
 Exam Hours: : 3

Credits: 3  
 CIE Marks: 50  
 SEE Marks: 50

Course Outcomes:	At the end of the Course, the Student will be able to:
CO#	COURSE OUTCOME (Student will be able to)
20AIM744A.1	Understand the principles of human computer interaction in effective dialog for HCI
20AIM744A.2	Apply the HCI implications for designing multimedia/ ecommerce/ e-learning Web sites.
20AIM744A.3	Analyze the importance of user feedback.
20AIM744A.4	Design effective HCI for individuals and persons with disabilities
20AIM744A.5	Compare Cognitive and Ubiquitous computing environment.

Mapping of Course Outcomes to Program Outcomes														
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM744A.1	2	-	-	-	-	-	-	-	-	-	-	2	3	-
20AIM744A.2	3	-	-	-	-	-	-	-	-	-	-	2	3	-
20AIM744A.3	-	3	-	-	-	-	-	-	-	-	-	2	3	-
20AIM744A.4	-	-	3	-	-	-	-	-	-	-	-	2	3	-
20AIM744A.5	-	-	-	3	-	-	-	-	-	-	-	2	3	-
Correlationlevels:1-Slight (Low) 2-Moderate (Medium)3-Substantial (High)														

Module No	Module Contents	Hours	Cos
1	<b>INTRODUCTION</b> The Human – Input-output channels – Human Memory – Thinking – emotions – Psychology & design of interactive systems; Computer – Text entry devices- Positioning, Pointing & drawing – Display devices for Virtual reality, 3D; Interaction – models – Frameworks & HCI, Ergonomics – Interaction styles – WIMP Interfaces – context; paradigms for Interaction	9	CO1 CO2
2	<b>SOFTWARE PROCESS &amp; DESIGN RULES</b> Interaction design basics – user focus – scenarios – navigation – screen design & layout; HCI in software process – life cycle – Usability engineering – Interactive design & prototyping; Design rules – Principles for usability – standards – guidelines – golden rules – HCI patterns.	9	CO2 CO4
3	<b>IMPLEMENTATION &amp; USER SUPPORT</b> Implementation support – Windowing system elements – using tool kits – user interface management; Evaluation techniques – goals – expert analysis – choosing a method; universal design principles – multimodal interaction; user support – requirements – Approaches – adaptive help systems – designing user support system	9	CO3 CO4

4	<b>COGNITIVE, COMMUNICATION &amp; COLLABORATIVE MODELS</b> Cognitive models – Goal & task hierarchies – Linguistic models – Physical & device models – architectures; communication & collaboration models – Face-to-face communication –conversation – text based – group working; Task analysis – difference between other techniques – task decomposition – Knowledge based analysis – ER based techniques –uses	9	CO4 CO5
5	<b>UBIQUITOUS COMPUTING, HYPERTEXT, WWW</b> Ubiquitous computing application research – virtual & augmented reality – information & data visualization; understanding hypertext – finding things – Web Technology & issues – Static Web content – Dynamic Web content; Groupware systems – Computer mediated communication – DSS – Frameworks for groupware.	9	CO3 CO5

**Text Books:**

1. Alan Dix, Janet Finlay, Gregory D.Abowd, Russell Beale, “Human Computer Interaction”, Third Edition, Pearson Education, 2004.
2. Brian Fling, —Mobile Design and Development, First Edition, O’Reilly Media Inc., 2009

**Reference Books:**

1. John M.Carrol, “Human Computer Interaction in the New Millenium”, Pearson Education, 2002

**CIE-Continuous Internal Evaluation (50Marks)**

Bloom’s Category	Tests (25marks)	Assessment(s) (25 Marks) *
Remember	5	
Understand	5	5
Apply	10	10
Analyze	5	10
Evaluate	-	
Create	-	

\* Assessments are to be selected from the assessment list attached to page 163.

**SEE-Semester End Examination (50Marks)**

Bloom’s Category	Questions(50marks))
Remember	10
Understand	10
Apply	20
Analyze	10
Evaluate	-
Create	-

## QUANTUM COMPUTING

Course Code : 20AIM751A  
 L:T:P:S : 3: 0: 0: 0:  
 Exam Hours : 3

Credits: 3  
 CIE Marks: 50  
 SEE Marks: 50

Course Outcomes:	At the end of the Course, the Student will be able to:
CO#	COURSEOUTCOME (Student will be able to)
20AIM751A.1	<b>Understand</b> the basics principles of quantum computing.
20AIM751A.2	<b>Apply</b> the different quantum algorithm to solve real world computing problems.
20AIM751A.3	<b>Analyze</b> the different computation models.
20AIM751A.4	<b>Design</b> the circuits using quantum computation environments and its frameworks.
20AIM751A.5	<b>Interpret</b> the performance of computing system with different operations and security measures.

Mapping of Course Outcomes to Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM751A.1	2	-	-	-	-	-	-	-	-	-	-	2	3	2
20AIM751A.2	3	-	-	-	-	-	-	-	-	-	-	2	3	2
20AIM751A.3	-	3	-	-	-	-	-	-	-	-	-	2	3	2
20AIM751A.4	-	-	3	-	-	-	-	-	-	-	-	2	3	2
20AIM751A.5	-	-	-	3	-	-	-	-	-	-	-	2	3	2
Correlationlevels:1-Slight(Low) 2-Moderate(Medium)3-Substantial(High)														

Module No	Module Contents	Hours	COs
1	<b>QUANTUM COMPUTING BASIC CONCEPTS:</b> Complex Numbers - Linear Algebra - Matrices and Operators - Global Perspectives Postulates of Quantum Mechanics – Quantum Bits - Representations of Qubits – Super positions.	9	CO1 CO2
2	<b>QUANTUM GATES AND CIRCUITS:</b> Universal logic gates - Basic single qubit gates - Multiple qubit gates - Circuit development-Solovay-Kitaev theorem, Deutsch-Jozsa algorithm, factoring, Quantum error correction.	9	CO1, CO2
3	<b>QUANTUM ALGORITHMS:</b> Quantum parallelism - Deutsch's algorithm - The Deutsch–Jozsa algorithm - Quantum Fourier transform and its applications - Quantum Search Algorithms: Grover's Algorithm	9	CO2 CO3
4	<b>QUANTUM INFORMATION THEORY:</b> Data compression - Shannon's noiseless channel coding theorem - Schumacher's quantum noiseless channel coding theorem - Classical information over noisy quantum channels	9	CO3 CO4
5	<b>QUANTUM CRYPTOGRAPHY:</b> Classical cryptography basic concepts - Private key cryptography - Shor's Factoring Algorithm - Quantum Key Distribution - BB84 - Ekart 91.	9	CO4 CO5

**Text Books:**

1. Parag K Lala, Mc Graw Hill Education, “Quantum Computing, A Beginners Introduction”, First edition (1 November 2020).
2. Michael A. Nielsen, Issac L. Chuang, “Quantum Computation and Quantum Information”, Tenth Edition, Cambridge University Press, 2010.
3. Chris Bernhardt, The MIT Press; Reprint edition (8 September 2020), “Quantum Computing for Everyone”.

**Reference Books:**

1. Scott Aaronson, “Quantum Computing Since Democritus”, Cambridge University Press, 2013.
2. N. David Mermin, “Quantum Computer Science: An Introduction”, Cambridge University Press, 2007.

**CIE-Continuous Internal Evaluation (50Marks)**

<b>Bloom’s Category</b>	<b>Tests (25marks)</b>	<b>Assessment(s) (25 Marks) *</b>
Remember	5	
Understand	5	5
Apply	10	10
Analyze	5	10
Evaluate	-	
Create	-	

\* Assessments are to be selected from the assessment list attached to page 163.

**SEE-Semester End Examination (50Marks)**

<b>Bloom’s Category</b>	<b>Questions (50marks)</b>
Remember	10
Understand	10
Apply	20
Analyze	10
Evaluate	-
Create	-

## SOFTWARE TESTING

Course Code : 20AIM752A  
 L:T:P:S : 3: 0: 0: 0  
 Exam Hours : 3

Credits: 3  
 CIE Marks: 50  
 SEE Marks: 50

Course Outcomes:	At the end of the Course, the Student will be able to:
CO#	COURSE OUTCOME (Student will be able to)
20AIM752A.1	<b>Understand</b> the fundamentals of software testing.
20AIM752A.2	<b>Apply</b> various testing activities in effective manner.
20AIM752A.3	<b>Analyze</b> the design of test cases for different testing techniques.
20AIM752A.4	<b>Design</b> test strategies and plans, design test case, prioritize and execute them.
20AIM752A.5	<b>Compute</b> test coverage and yield according to a variety of criteria using modern testing tool.

Mapping of Course Outcomes to Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM752A.1	2	-	-	-	-	-	-	-	-	-	-	3	3	-
20AIM752A.2	3	-	-	-	-	-	-	-	-	-	-	3	3	-
20AIM752A.3	-	3	-	-	-	-	-	-	-	-	-	3	3	-
20AIM752A.4	-	-	3	-	-	-	-	-	-	-	-	3	3	-
20AIM752A.5	-	-	-	3	3	-	-	-	-	-	-	3	3	-
Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)														

Module No	Module Contents	Hours	COs
1	<b>Testing as an Engineering Activity</b> – Testing as a Process – Testing Maturity Model- Testing axioms – Basic definitions – Software Testing Principles – The Tester’s Role in a Software Development Organization – Origins of Defects – Cost of defects – Defect Classes – The Defect Repository and Test Design – Defect Examples- Developer/Tester Support of Developing a Defect Repository.	9	CO1 CO2
2	<b>Test case Design Strategies</b> – Using Black Box Approach to Test Case Design – Boundary Value Analysis – Equivalence Class Partitioning – State based testing – Cause-effect graphing – Compatibility testing – user documentation testing – domain testing - Random Testing – Requirements based testing – Using White Box Approach to Test design.	9	CO2 CO3
3	<b>The need for Levels of Testing</b> – Unit Test – Unit Test Planning – Designing the Unit Tests – The Test Harness – Running the Unit tests and Recording results – Integration tests – Designing Integration Tests – Integration Test Planning – Scenario testing – Defect bash elimination System Testing – Acceptance testing – Performance testing – Regression Testing – Internationalization testing – Ad-hoc testing – Alpha, Beta Tests	9	CO3 CO4

4	<b>People and organizational issues in testing</b> – Organization structures for testing teams – testing services – Test Planning – Test Plan Components – Test Plan Attachments – Locating Test Items – test management – test process – Reporting Test Results – Introducing the test specialist – Skills needed by a test specialist – Building a Testing Group- The Structure of Testing Group- The Technical Training Program.	9	CO4 CO5
5	<b>Software test automation</b> – skills needed for automation – scope of automation – design and architecture for automation – requirements for a test tool – challenges in automation – Test metrics and measurements – project, progress and productivity metrics.	9	CO3 CO4 CO5

**Text Books:**

1. Srinivasan Desikan and Gopaldaswamy Ramesh, —Software Testing – Principles and Practices, Pearson Education, 2006.
2. Ron Patton, —Software Testing, Second Edition, Sams Publishing, Pearson Education, 2007. AU Library.com

**Reference Books:**

1. Ilene Burnstein, —Practical Software Testing, Springer International Edition, 200
2. Edward Kit, Software Testing in the Real World – Improving the Process, Pearson Education, 1995.

**CIE-Continuous Internal Evaluation (50Marks)**

Bloom's Category	Tests(25marks)	Assessment(s) (25 Marks) *
Remember	5	
Understand	5	5
Apply	10	10
Analyze	5	10
Evaluate	-	
Create	-	

\* Assessments are to be selected from the assessment list attached to page 163.

**SEE-Semester End Examination (50Marks)**

Bloom's Category	Questions(50marks)
Remember	10
Understand	10
Apply	20
Analyze	10
Evaluate	-
Create	-

## SOCIAL NETWORK ANALYSIS

Course Code : 20AIM753A  
 L:T:P:S: : 3: 0: 0: 0:  
 Exam Hours: : 3

Credits: 3  
 CIE Marks: 50  
 SEE Marks: 50

Course Outcomes:	At the end of the Course, the Student will be able to:
CO#	COURSE OUTCOME (Student will be able to)
20AIM753A.1	<b>Understand</b> the various concepts in social media and also learnt social media in an ethical manner.
20AIM753A.2	<b>Apply</b> graph theory concepts to social model networks.
20AIM753A.3	<b>Analyze</b> the social networks to draw insights on the interactions between/within social groups.
20AIM753A.4	<b>Design</b> the structure of a social network and identify the influential entities.
20AIM753A.5	<b>Interpret</b> the fundamental principles for analyzing social media marketing and its importance.

### Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM753A.1	2	-	-	-	-	-	-	-	-	-	-	2	3	-
20AIM753A.2	3	-	-	-	-	-	-	-	-	-	-	2	3	-
20AIM753A.3	-	3	-	-	-	-	-	-	-	-	-	2	3	-
20AIM753A.4	-	-	3	-	-	-	-	-	-	-	-	2	3	-
20AIM753A.5	-	-	-	3	-	-	-	-	-	-	-	2	3	-

Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)

Module No	Module Contents	Hours	COs
1	<b>INTRODUCTION:</b> Understand What Social Networking is, Social Media Characteristics, what is Social Media and Why It is Important, Types of Social Media, Core Values, Challenges, Advantages and Disadvantages, Future of Social Networking, Various social networking sites-FACEBOOK, INSTAGRAM, TWITTER, LINKEDIN - Why and how they matter, Key Features, Marketing - What You Need to Know.	9	CO1 CO2
2	<b>BUILDING A NETWORK:</b> Networks as Graphs – Actors, Ties, Networks, Multiplex Networks, Weighted Ties, Group, Geodesic Distance, Graph Connectivity, Degree of an Actor –Indegree and Outdegree, Types of nodes– Carrier, Transmitter, Receiver, Isolate, Representation of Social Network Data – Socio matrix and Edge List, Matrix Permutation and Blocks, Network Relationships Reciprocity, Transitivity, Popularity Structural Equivalence, Clique, Star.	9	CO2 CO3
3	<b>STRENGTH OF WEAK TIES &amp; HOMOPHILY:</b> Granovetter’s strength of weak ties, Triads, Clustering Coefficient and Neighborhood Overlap, Structure of Weak Ties, Bridges and Local Bridges, Embeddedness, Structural Holes, Social Capital, Tie Strength, Social Media and Passive Engagement, Strong And Weak Relationship, Introduction to Homophily, Selection and Social Influence, Foci Closure and Membership Closure	9	CO3 CO4

4	<b>NETWORK PROPERTIES:</b> Network Density, Properties of Nodes–Degree Centrality, Closeness Centrality, Betweenness Centrality, Centrality of a Network - Network Degree Centrality, Network Closeness Centrality, Network Betweenness Centrality, Pagerank centrality	9	CO4 CO5
5	<b>SOCIAL MEDIA ANALYSIS:</b> Four Dimension of Analysis, Criteria of Effectiveness, Metrics, Social Network Analysis, Semantic Analysis, Online Sentiment Analysis, Tools, Social Media Management, Centrality Measures, Opinion Mining, Feature Based Sentiment Analysis.	9	CO3 CO4 CO5

**Textbook:**

- 1) Robert A Hanneman, Department of Sociology, University of California, Riverside, “Introduction to Social Network methods”.
- 2) Christina Falci, Department of Sociology, University of Nebraska, Lincoln, “Social Network Analysis”
- 3) Matthew Ganis & Avinash Kohirkar, “Social Media Analytics”
- 4) BobbiJ Carothers, American Evaluation Association, Denver, Colorado, “NetworkAnalysisfromStarttofinish:Techniques,ToolsandTipsforEvaluatingyourNetwork”
- 5) Matthew Denny, Institute for Social Science Research, University of Massachusetts, AMHERST, “Social Network Analysis”
- 6) Timothy Baldwin, University of Melbourne, “Semantic Analysis of Social Media”.
- 7) The Social Media Analytics Compass: what and How to measure  
<http://www.razorsocial.com/social-media-analytics-tools/>
- 8) <https://www.youtube.com/watch?v=P33xa4l4GTM>
- 9) Overview of SNA[https://www.youtube.com/watch?v=fgr\\_g1q2ikA](https://www.youtube.com/watch?v=fgr_g1q2ikA)
- 10) <https://www.meaningcloud.com/solutions/media-analysis>
- 11) <https://www.enotes.com/homework-help/what-hypotheses-social-media-intimate-relationship-488912>

**CIE-Continuous Internal Evaluation (50Marks)**

Bloom’s Category	Tests (25marks)	Assessment(s) (25 Marks) *
Remember	5	
Understand	5	5
Apply	10	10
Analyze	5	10
Evaluate	-	
Create	-	

\* Assessments are to be selected from the assessment list attached to page 163.

**SEE-Semester End Examination (50Marks)**

Bloom’s Category	Questions (50marks)
Remember	10
Understand	10
Apply	20
Analyze	10
Evaluate	
Create	-

## CYBER SECURITY

Course Code : 20AIM754A  
 L:T:P:S : 3: 0: 0: 0:  
 Exam Hours : 3

Credits: 3  
 CIE Marks: 50  
 SEE Marks: 50

Course Outcomes:	At the end of the Course, the Student will be able to:
CO#	COURSE OUT COME (Student will be able to)
20AIM754A.1	Understand the basics of cyber security.
20AIM754A.2	Apply intrusion prevention techniques to prevent intrusion.
20AIM754A.3	Identify various types of attacks and learn the tools to launch the attacks
20AIM754A.4	Develop solution for cyber security attacks in various ways.
20AIM754A.5	Interpret an intrusion technique and evaluate its performance in order to detect intrusion.

Mapping of Course Outcomes to Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM754A.1	2	-	-	-	-	-	-	-	-	-	-	2	3	-
20AIM754A.2	3	-	-	-	-	-	-	-	-	-	-	2	3	-
20AIM754A.3	-	3	-	-	-	-	-	-	-	-	-	2	3	-
20AIM754A.4	-	-	3	-	-	-	-	-	-	-	-	2	3	-
20AIM754A.5	-	-	-	3	-	-	-	-	-	-	-	2	3	-
Correlation levels: 1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)														

Module No	Module Contents	Hours	COs
1	<b>INTRODUCTION:</b> Cyber Security – History of Internet – Impact of Internet – CIA Triad; Reason for Cyber Crime – Need for Cyber Security – History of Cyber Crime; Cybercriminals – Classification of Cybercrimes – A Global Perspective on Cyber Crimes; Cyber Laws – The Indian IT Act – Cybercrime and Punishment.	9	CO1 CO3
2	<b>ATTACKS AND COUNTER MEASURES: OSWAP;</b> Malicious Attack Threats and Vulnerabilities: Scope of Cyber-Attacks – Security Breach – Types of Malicious Attacks – Malicious Software – Common Attack Vectors – Social engineering Attack – Wireless Network Attack – Web Application Attack – Attack Tools – Counter measures.	9	CO1 CO2 CO3
3	<b>RECONNAISSANCE:</b> Harvester – Who is – Net craft – Host – Extracting Information from DNS – Extracting Information from E-mail Servers – Social Engineering Reconnaissance; Scanning – Port Scanning – Network Scanning and Vulnerability Scanning – Scanning Methodology – Ping Sweer Techniques – Nmap Command Switches – SYN – Stealth – XMAS – NULL – IDLE – FIN Scans – Banner Grabbing and OS Finger printing Techniques.	9	CO2, CO3

4	<b>INTRUSION DETECTION:</b> Host -Based Intrusion Detection – Network -Based Intrusion Detection – Distributed or Hybrid Intrusion Detection – Intrusion Detection Exchange Format – Honeypots – Example System Snort	9	CO3, CO4 CO5
5	<b>INTRUSION PREVENTION:</b> Firewalls and Intrusion Prevention Systems: Need for Firewalls – Firewall Characteristics and Access Policy – Types of Firewalls – Firewall Basing – Firewall Location and Configurations – Intrusion Prevention Systems – Example Unified Threat Management Products	9	CO4 CO5

**Text Books:**

1. Patrick Engebretson, “The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made easy”, Elsevier, 2011.
2. Kimberly Graves, “CEH Official Certified Ethical hacker Review Guide”, Wiley Publishers 2007
3. William Stallings, Lawrie Brown, “Computer Security Principles and Practice”, Third Edition, Pearson Education, 2015.

**Reference Books:**

- 1) Anand Shinde, “Introduction to Cyber Security Guide to the World of Cyber Security”, Notion Press, 2021.
- 2) Nina Godbole, Sunit Belapure, “Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives”, Wiley Publishers, 2011.
- 3) David Kim, Michael G. Solomon, “Fundamentals of Information Systems Security”, Jones & Bartlett Learning Publishers, 2013.

**CIE-Continuous Internal Evaluation (50Marks)**

Bloom’s Category	Tests(25marks)	Assessment(s) (25 Marks) *
Remember	5	
Understand	5	5
Apply	10	10
Analyze	5	10
Evaluate	-	
Create	-	

\* Assessments are to be selected from the assessment list attached to page 163

**SEE-Semester End Examination (50Marks)**

Bloom’s Category	Questions(50marks)
Remember	10
Understand	10
Apply	20
Analyze	10
Evaluate	-
Create	-

## CLOUD COMPUTING LABORATORY

**Course Code** : 20AIL76A  
**L:T:P:S:** : 0: 0: 2:0:  
**Exam Hours:** : 3

**Credits:** 2  
**CIE Marks:** 25  
**SEE Marks:** 25

Course Outcomes:	At the end of the Course, the Student will be able to:
CO#	COURSE OUT COME (Student will be able to)
20AIL76A.1	<b>Apply</b> the knowledge of cloud computing to Configure various virtualization tools such as Virtual Box, VMware workstation.
20AIL76A.2	<b>Analyze</b> how to simulate a cloud environment to implement new scheduler's using cloud simulation tool.
20AIL76A.3	<b>Develop</b> application with security mechanisms.
20AIL76A.4	<b>Design</b> and Implement applications on cloud.

### Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIL76A.1	3	-	-	-	-	2	2	-	-	2	-	2	3	-
20AIL76A.2	-	3	-	-	3	3	3	-	-	3	-	3	3	-
20AIL76A.3	-	-	3	-	3	3	3	3	-	3	-	3	3	-
20AIL76A.4	-	-	3	-	3	3	3	3	-	3	-	3	3	-

Correlation levels: 1-Slight(Low) 2-Moderate(Medium) 3-Substantial(High)

Exp.No	Experiment	Hours	CO
1	Install Virtual box/VMware Workstation with different flavors of Linux or windows OS on top of windows7 or 8.	3	CO1 CO2
2	Install a C compiler in the virtual machine created using virtual box and execute Simple Programs.	3	CO1 CO2
3	Create hello world app and other simple web applications using python/java.	3	CO1, CO2, CO3
4	Describe a procedure to transfer the files from one virtual machine to another virtual machine.	3	CO2, CO3
5	Use GAE launcher to launch the web applications.	3	CO2, CO3, CO4

<b>Part B</b>			
<b>6</b>	Create an AWS account and create EC2 instance for a simple application	<b>3</b>	<b>CO1,CO2,CO3,CO4</b>
<b>7</b>	Install Docker desktop and create a container then pull an image into container.	<b>3</b>	<b>CO1,CO2,CO3,CO4</b>
<b>8</b>	Write a HTML program in Visual Studio Code and execute in Docker.	<b>3</b>	<b>CO1,CO2,CO3,CO4</b>
<b>9</b>	Create an AWS S3 bucket and upload the content in the bucket.	<b>3</b>	<b>CO1,CO2,CO3,CO4</b>
<b>10</b>	Using Amazon DynamoDB, create a Dynamo table and enter the data into then query it.	<b>3</b>	<b>CO1,CO2,CO3,CO4</b>

#### **CIE-Continuous Internal Evaluation (25Marks)**

<b>Bloom's Category</b>	<b>Test (25marks)</b>
Remember	-
Understand	-
Apply	10
Analyze	10
Evaluate	5
Create	-

#### **SEE-Semester End Examination (25Marks)**

<b>Bloom's Category</b>	<b>Questions (25marks)</b>
Remember	-
Understand	-
Apply	10
Analyze	10
Evaluate	5
Create	-

## WEB TECHNOLOGY LABORATORY

Course Code : 20AIL77A  
 L: T: P:S: : 0: 0: 2: 0:  
 Exam Hours: : 3

Credits : 2  
 CIE Marks: 25  
 SEE Marks: 25

Course Outcomes:	At the end of the Course, the Student will be able to:
CO#	COURSEOUTCOME
20AIL77A.1	<b>Apply</b> the concepts of HTML5, CSS, JavaScript, XML, PHP and develop JavaScript programs.
20AIL77A.2	<b>Develop</b> XML program to display student information using CSS.
20AIL77A.3	<b>Analyze</b> PHP program to keep track of the number of visitors visiting the web page, Digital Clock, simple calculator, matrix addition, multiplication, transpose
20AIL77A.4	<b>Design</b> the PHP programs to sort the student records stored in database using selection sort, string manipulations

Mapping of Course Outcomes to Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIL77A.1	3	-	-	-	2	2	2	-	-	2	-	2	3	-
20AIL77A.2	-	-	3	-	3	2	2	-	-	2	-	2	3	-
20AIL77A.3	-	3	-	-	2	2	2	2	-	2	-	2	3	-
20AIL77A.4	-	-	3	-	3	2	2	2	-	2	-	2	3	-
Correlation levels: 1-Slight (Low)    2-Moderate (Medium)    3-Substantial(High)														

Exp. No	Experiment	Hours	COs
1	Design the following static web pages required for an online book store a) Home page: Must contain 3 frames b) Login page c) Catalogue page: Must contain all books details available in the store d) Registration page:	3	CO1 CO2 CO3 CO4
2	Develop and demonstrate the use of Inline, Internal, External style sheets using CSS.	3	CO1 CO2 CO3 CO4
3	Write a JavaScript to design a simple calculator to perform the following operations: sum, product, difference and quotient.	3	CO1 CO2 CO3 CO4
4	Write a JavaScript that calculates the squares and cubes of the numbers from 0 to 10 and outputs HTML text that displays the resulting values in an HTML table format.	3	CO1 CO2 CO3 CO4
5	Write a JavaScript code that displays text "TEXT-GROWING" with increasing font size in the interval of 100ms in RED COLOR, when the font size reaches 50pt it displays "TEXT-SHRINKING" in BLUE color. Then the font size decreases to 5pt.	3	CO1 CO2 CO3 CO4

6	Design an XML document to store information about a student in an engineering college affiliated to VTU. The information must include USN, Name, and Name of the College, Branch, Year of Joining, and email id. Make up sample data for 3 students. Create a CSS style sheet and use it to display the document.	3	CO1 CO2 CO3 CO4
7	Write a PHP program to keep track of the number of visitors visiting the web page and to display this count of visitors, with proper headings.	3	CO1 CO2 CO3 CO4
8	Write a PHP program to display a digital clock which displays the current time of the server	3	CO1 CO2 CO3 CO4
9	Write the PHP programs to do the following: a. Implement simple calculator operations. b. Find the transpose of a matrix. c. Multiplication of two matrices. d. Addition of two matrices.	3	CO1 CO2 CO3 CO4
10	Perform a case study for any one of the following using ReactJS a. Social media platform b. Teaching learning platform c. E-commerce platform d. Enterprise Resource Management Platform e. Mobile Application Platform	3	CO1 CO2 CO3 CO4

**CIE-Continuous Internal Evaluation (25Marks)**

Bloom's Category	Test (25marks)
Remember	-
Understand	-
Apply	10
Analyze	10
Evaluate	5
Create	-

**SEE-Semester End Examination (25Marks)**

Bloom's Category	Questions (25marks)
Remember	-
Understand	-
Apply	10
Analyze	10
Evaluate	5
Create	-

## PROJECT PHASE 1

**Course Code** : 20AIM78A  
**L:T:P:S:** : 0: 0: 2: 0:  
**Exam Hours:** : 3

**Credits:** 2  
**CIE Marks:** 25  
**SEE Marks:** 25

Course Outcomes:	At the end of the Course, the Student will be able to:
CO#	COURSE OUT COME (Student will be able to)
20AIM78A.1	Identify a real life/engineering problem, utilize prior knowledge and conduct extensive investigation, across diverse sources, in addressing the
20AIM78A.2	Competence in applying the software engineering principles in planning, formulating an innovative design/ approach and computing the requirements
20AIM78A.3	Perform professionally—as a team member, accepting responsibility, taking initiative, and providing leadership necessary to ensure project success.
20AIM78A.4	Use formal and informal communications with team members and guide, make presentations and prepare technical document.
20AIM78A.5	Provide solution within the context of legal framework addressing the societal and environmental concerns and upholding ethical issues.

Mapping of Course Outcomes to Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM78A.1	3	3										3	3	3
20AIM78A.2		3	3		3							3	3	3
20AIM78A.3						2	2	2	3	2		2	3	3
20AIM78A.4					3	2	2	2	3	3	3	2	3	3
20AIM78A.5						3	3	3	3	2	2	2	3	3
Correlation levels: 1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)														

**This course will be conducted largely as group of 2-4 student members under the direct supervision of a member of academic staff.**

**Students will be required to**

1. Students should form teams to carry out the project. The size of the teams can comprise of a minimum of two students and maximum of four students.
2. Each team are free to choose their Internal Guide or will be assigned an Internal Guide by the Department Coordinator.
3. Teams can carry out their project in-house or in a reputed organization (which has to be approved by the Internal Guide). Students taking up industry projects can do so with the condition that they are allowed to demonstrate their project work on the college campus.
4. Identification of a problem which is feasible and innovative based on the current state of art technology and having relevance and social impact, considering the boundaries of societal, environmental and ethical issues.

5. Survey of literature related to the identified problem to make a feasibility study and identify the project requirements. Prepare and submit a synopsis of your project to your respective Guides.
6. Based on the literature review, preparation of review paper and publishing it.
7. Evolve a high-level design/system level architecture and identify the various implementable modules with their input/output needs.
8. Preparation and submission of Project Phase I technical report.

**CIE-Continuous Internal Evaluation (25 Marks)**

<b>Bloom's Taxonomy</b>	<b>Project</b>
<b>Marks (Out of 25)</b>	
Remember	-
Understand	-
Apply	10
Analyze	10
Evaluate	5
Create	-

**SEE–Semester End Examination (25 marks)**

<b>Bloom's Taxonomy</b>	<b>Project</b>
<b>Marks (Out of 25 )</b>	
Remember	-
Understand	-
Apply	10
Analyze	10
Evaluate	5
Create	-

**VIII SEMESTER**

S.No	Course Code	Course	BOS	Credit Distribution				Overall Credits	Contact Hours	Marks		
				L	T	P	S			CIE	SEE	Total
1	20AIM81A	Reinforcement learning	AI&ML	3	0	0	0	3	4	50	50	100
2	20AIM82A	Internship Viva	AI&ML	0	0	4	0	4	0	50	50	100
3	20AIM83A	Project Phase - II	AI&ML	0	0	12	0	12	0	100	100	200
<b>Total</b>								<b>19</b>	<b>04</b>	<b>200</b>	<b>200</b>	<b>400</b>

## REINFORCEMENT LEARNING

Course Code : 20AIM81A  
 L:T:P:S : 3: 0: 0: 0:  
 Exam Hours : 3

Credits: 3  
 CIE Marks: 50  
 SEE Marks: 50

Course Outcomes:	At the end of the Course, the Student will be able to:
CO#	COURSE OUT COME (Student will be able to)
20AIM81A.1	<b>Understand</b> the basic concepts of Reinforcement Learning
20AIM81A.2	<b>Apply</b> multi-armed bandit algorithms to solve exploration-exploitation trade off and others.
20AIM81A.3	<b>Analyze</b> the Monte Carlo method's involvement in the learning process through experience as well as Temporal-Difference Learning.
20AIM81A.4	<b>Develop</b> reinforcement learning applications using Finite MDP
20AIM81A .5	<b>Evaluate</b> the performance of prediction problems through the principle of optimality.

### Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM81A.1	2	-	-	-	-	-	-	-	-	-	-	2	3	-
20AIM81A.2	3	-	-	-	-	-	-	-	-	-	-	2	3	-
20AIM81A.3	-	3	-	-	-	-	-	-	-	-	-	2	3	-
20AIM81A.4	-	-	3	-	-	-	-	-	-	-	-	2	3	-
20AIM81A .5	-	-	-	3	-	-	-	-	-	-	-	2	3	-

Correlation levels: 1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

Module No	Module Contents	Hours	COs
1	<b>Introduction:</b> Reinforcement Learning-Examples, Early History of Reinforcement Learning Elements of Reinforcement Learning. Limitations and Scope - An Extended Example: Tic-Tac-Toe.	9	CO1 CO2
2	<b>MULTI-ARMED BANDITS</b> - k-armed Bandit Problem- Action-value Methods -The 10-armed Testbed -Incremental Implementation - Tracking a Non stationary Problem- Optimistic Initial Values -Upper-Confidence-Bound Action Selection- Gradient Bandit Algorithms.	9	CO2 CO3
3	<b>FINITE MARKOV DECISION PEOCESSES:</b> The Agent-Environment Interface -Goals and Rewards -Returns and Episodes - Unified Notation for Episodic and Continuing Tasks -Policies and Value Functions -Optimal Policies and Optimal Value Functions-Optimality and Approximation. <b>DYNAMIC PROGRAMMING:</b> Policy Evaluation (Prediction) - Policy Improvement - Policy Iteration -Value Iteration -Asynchronous Dynamic Programming -Generalized Policy Iteration.	9	CO3 CO4

4	<b>MONTE CARLO METHODS:</b> Monte Carlo Prediction - Monte Carlo Estimation of Action Values -Monte Carlo Control - Monte Carlo Control without Exploring Starts -Off-policy Prediction via Importance Sampling -Incremental Implementation - Off-policy Monte Carlo Control. <b>TEMPORAL-DIFFERENCE LEARNING:</b> TD Prediction - Advantages of TD Prediction Methods - Optimality of TD (0)- Sarsa: On-policy TD Control -Q-learning: Off-policy TD Control	9	CO4 CO5
5	<b>APPROXIMATE SOLUTION METHODS:</b> Policy Gradient-Policy Approximation and its Advantages - The Policy Gradient Theorem - <b>REINFORCE:</b> Monte Carlo Policy Gradient -REINFORCE with Baseline -Actor-Critic Methods - Policy Gradient for Continuing Problems - Policy Parameterization for Continuous Actions.	9	CO3 CO4 CO5

**Text Books:**

1. Richard S. Sutton and Andrew G. Barto, Reinforcement Learning: An Introduction, second edition The MIT Press Cambridge, Massachusetts London, England.

**Reference Books:**

1. Dimitri Bertsekas and John Tsitsiklis, "Neuro-dynamic programming", Athena Scientific, 1997.
2. Csaba Szepesvari, "Algorithms for Reinforcement Learning", Morgan and Claypool, 2010.

**CIE-Continuous Internal Evaluation (50Marks)**

Bloom's Category	Tests (25marks)	Assessment(s) (25 Marks) *
Remember	5	
Understand	5	5
Apply	10	10
Analyze	5	10
Evaluate	-	
Create	-	

\* Assessments are to be selected from the assessment list attached to page 163.

**SEE-Semester End Examination (50Marks)**

Bloom's Category	Questions(50marks)
Remember	10
Understand	10
Apply	20
Analyze	10
Evaluate	-
Create	-

## INTERNSHIP

**Course Code** : 20AIM82A  
**L:T:P:S:** : 0: 0: 4: 0:  
**Exam Hours:** : 3

**Credits:** 4  
**CIE Marks:** 50  
**SEE Marks:** 50

### Objectives

- Students will be competent to connect with reputable industry, laboratory, or research institutes to gain Practical knowledge on software development and design, product design and development, analytics, Business processes and insights, industry practices, and other related aspects, as well as develop Problem- solving skills.
- Students acquire technical, interpersonal, and teamwork abilities to fulfil the demands of business, academia, and other organizations in the important areas of automation and digitalization.

Course Outcomes:	At the end of the Course, the Student will be able to:
<b>CO#</b>	<b>COURSE OUTCOME (Student will be able to)</b>
20AIM82A.1	<b>Apply</b> domain knowledge for problem solving.
20AIM82A.2	<b>Analyze</b> solutions to complex business problems
20AIM82A.3	<b>Design</b> solutions for the target platform.
20AIM82A.4	<b>Make</b> efficient use of time and accomplish the assigned work within the time frame.
20AIM82A.5	<b>Build</b> technical reports and presentations.

Mapping of Course Outcomes to Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM82A.1	3	-	-	-	-	3	3	-	3	-	-	3	3	2
20AIM82A.2	-	-	3	-	3	-	3	3	3	-	3	3	3	2
20AIM82A.3	-	3	-	-	-	-	-	-	-	-	3	3	3	2
20AIM82A.4	-	-	-	-	-	-	-	-	-	3	-	3	3	2
20AIM82A.5	-	3	-	-	-	-	-	-	-	3	-	3	3	2
Correlation levels: 1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)														

### Description:

The student shall identify a suitable industry or laboratory in the field of software development, artificial intelligence or any IT-related industry to carry out an internship. During the internship period, students' progress and work in industry will be reviewed by a panel of experts. At the completion of an internship, students will submit a report, which will be evaluated by duly appointed examiners. The report of the internship will undergo a plagiarism check to avoid repetition.

**Evaluation Stages:**

<b>Activity</b>	<b>Evaluation Attribute</b>
Review-I	1. A brief introduction about the company with an assigned domain, project or modules, and other necessary details. 2. Submit the offer letter received from the company.
Review-II	1. Show progress during the internship period using a PowerPoint presentation.
Review-III	1. Show a demo of the work carried out or completed with the necessary details. 2. Submit the final report in the prescribed format with an internship completion certificate.

**CIE-Continuous Internal Evaluation (50Marks)**

<b>Bloom's Taxonomy</b>	<b>Internship</b>
Remember	-
Understand	10
Apply	10
Analyze	10
Evaluate	10
Create	10

**SEE-Semester End Examination (50marks)**

<b>Bloom's Taxonomy</b>	<b>Internship</b>
Remember	-
Understand	10
Apply	10
Analyze	10
Evaluate	10
Create	10

## PROJRCT PHASE II

**Course Code** : 20AIM83A  
**L:T:P:S:** : 0: 0: 12: 0:  
**Exam Hours:** : 3

**Credits:** 12  
**CIE Marks:** 100  
**SEE Marks:** 100

### Objective

- Students to gain domain knowledge and technical skills to solve potential business problems, research problems, collect requirements, design suitable software solutions, and evaluate them.
- students work as a small team and understand the processes and practises in the industry.
- Implement, test, and deploy solutions for target platforms.
- Preparing project reports and presentations

Course Outcomes:	At the end of the Course, the Student will be able to:
CO#	COURSE OUTCOME (Student will be able to)
20AIM83A.1	Apply the Domain knowledge, technical skill set and software engineering principles for solving industry/research problems
20AIM83A.2	Analyze the required algorithms and design modules for solution
20AIM83A.3	Monitor, manage project schedules, resources and work assignments to ensure timely completion
20AIM83A.4	Evaluate the modules using testing methodologies and tools to prove the performance of the implemented project.
20AIM83A.5	Demonstrate and present the work with detailed project/technical report.

Mapping of Course Outcomes to Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20AIM83A.1	3	3	-	-	-	3	3	-	-	-	-	3	3	2
20AIM83A.2	3	3	3	-	3	-	-	3	-	-	-	-	3	2
20AIM83A.3	-	-	-	-	-	-	-	-	-	-	3	-	3	2
20AIM83A.4	-	-	-	3	3	-	-	-	-	-	-	-	3	2
20AIM83A.5	-	-	-	3	3	-	-	-	3	-	-	3	3	2
Correlationlevels:1-Slight (Low) 2-Moderate (Medium)3-Substantial (High)														

This course will be conducted largely as group of 2-4 student members under the direct supervision of a member of academic staff. The specific project topic undertaken will reflect the common interests and expertise of the student and supervisor.

### Students will be required to

1. Preparation of detailed design for the project (Continuation of Major Project Phase-1).
2. Implementation of the sub-modules and their integration.
3. Testing and validation.
4. Publish the work carried out on the project in the referred journal.
5. Prepare and submit the major project report

**Some of AIML application domains:**

- 1) Healthcare Applications
- 2) IoT/Surveillance and security
- 3) Games Application
- 4) Computer Vision
- 5) Inter disciplinary application, etc.,

**CIE-Continuous Internal Evaluation (100Marks)**

<b>Bloom's Taxonomy</b>	<b>Project</b>
Remember	-
Understand	20
Apply	20
Analyze	20
Evaluate	20
Create	20

**SEE–Semester End Examination (100marks)**

<b>Bloom's Taxonomy</b>	<b>Project</b>
Remember	-
Understand	20
Apply	20
Analyze	20
Evaluate	20
Create	20

## DATABASE ADMINISTRATION USING DB2

Course Code : 20NHOP728A

Credits: 3

L: T:P:S: : 3: 0: 0:0

CIE Marks: 50

Exam Hours: : 3

SEE Marks: 50

Course Outcomes:	At the end of the Course, the Student will be able to:
<b>CO#</b>	<b>COURSE OUTCOME (Student will be able to)</b>
20NHOP728A.1	<b>Apply</b> the knowledge of SQL and Locks in Data integrity and security in DB2.
20NHOP728A.2	<b>Analyze</b> the processing instructions given to DB2 via DB2 SQL statements.
20NHOP728A.3	<b>Design</b> a solution for data base operations and its security using DB2.
20NHOP728A.4	<b>Examine</b> the different functional operations and recovery concepts in DB2.

### Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20NHOP728A.1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
20NHOP728A.2		3	-	-	-	-	-	-	-	-	-	-	3	-
20NHOP728A.3	-		3	-	3	-	-	-	-	-	-	3	3	-
20NHOP728A.4	-	-	-	3	-	-	-	-	-	-	-	3	3	-

Correlation levels: 1-Slight (Low)    2-Moderate (Medium)    3-Substantial(High)

No	Module Contents	Hrs.	COs
1	<b>DB2-Introduction-</b> Database -Table Space- Simple table space-Segmented table space-Partitioned table space- Database Design-Logical Database-Physical Database Design-Implementing and Altering Database Design.	9	CO1 CO2
2	<b>DB2 SQL concepts and Linux Basics</b> – Introduction to SQL- characteristics of SQL in DB2-DB2 SQL: Create Storage- Alter Storage -Create View- Alias- DB2 catalog tables. Introduction to Linux- Basic commands- File Access and other Commands	9	CO2 CO3
3	<b>DB2 Locks:</b> Locks- Lock Size-Grant- Revoke-Isolation Level- Data Integrity- Interaction with DB2	9	CO1 CO2
4	<b>DESIGNING A DATABASE AND ITS SECURITY</b> Database objects and relationships – implementing and altering database design – DB2 security – managing access through authorization IDs or roles – managing access through trusted contexts and data definition control	9	CO3 CO4
5	<b>OPERATION AND RECOVERY</b> DB2 basic operational concepts – starting and stopping DB2 – scheduling administrative tasks – monitoring and controlling DB2 and its connection – managing the log and the bootstrap data set – recovering from different DB2 – reading log records.	9	CO3 CO4

**Text Books:**

1. “DB2 11 for z/OS Application Programming and SQL Guide”,2021, IBM Corp.
2. “DB2 11 for Z/OS Administration Guide”, 2021, IBM Corp.

**Online Resources/References:**

1. <https://www.db2tutorial.com/>

**CIE-Continuous Internal Evaluation (50 Marks)**

<b>Bloom’s Taxonomy</b>	<b>Test(50 Marks)</b>
Remember	-
Understand	10
Apply	10
Analyze	10
Evaluate	10
Create	10

**SEE–Semester End Examination (50marks)**

<b>Bloom’s Taxonomy</b>	<b>Questions (50 Marks)</b>
Remember	-
Understand	10
Apply	10
Analyze	10
Evaluate	10
Create	10

### LIST OF ASSESSMENT PATTERNS:

SNO	Tasks	Blooms category/Level	Remarks
1	Assignments	Understand-L2, Apply-L3, Analyse-L4	Individual / Group
2	Group Discussions	Apply-L3, Analyse-L4	Group
3	Case Studies/ Case Lets	Apply-L3, Analyse-L4, Evaluate-L5	Individual / Group
4	Practical Orientation on Design thinking	Analyse-L4, Create-L6	Creativity & Innovation
5	Participatory & Industry- Integrated Learning	Understand-L2, Apply-L3, Analyse-L4	Individual / Group
6	Practical activities / Problem solving exercises	Apply-L3, Analyse-L4, Evaluate-L5	Individual / Group
7	Class Presentations	Understand-L2, Apply-L3, Analyse-L4	Individual / Group
8	Analysis of Industry / Technical /Business Reports	Understand-L2, Apply-L3, Analyse-L4	Individual / Group
9	Reports on Industrial Visit	Understand-L2, Apply-L3, Analyse-L4	Individual / Group
10	Industrial / Social /Rural Projects	Analyse-L4, Create-L6	Individual / Group
11	Participation in external seminars/ workshops	Understand-L2, Apply-L3, Analyse-L4	Individual / Group
12	Any other academic activity	Understand-L2, Apply-L3, Analyse-L4	Individual / Group
13	Online / Offline Quizzes	Understand-L2, Apply-L3	Individual

**Note:**

1. The choice or selection of appropriate Tasks for each Assessment Type by the course coordinator
2. Assign / fix the marks for each Assessment Type by course co-ordinator.
3. Students either submit the report for Task or not, as determined by the course coordinator.
4. Need to get final approval from the HOD/BOS Chairman once finalising the mark allocations for Tasks and Assessment types.

## APPENDIX A

### Outcome Based Education

**Outcome-based education (OBE) is an educational theory that bases each part of an educational system around goals (outcomes). By the end of the educational experience, each student should have achieved the goal. There is no specified style of teaching or assessment in OBE; instead, classes, opportunities, and assessments should all help students achieve the specified outcomes.**

There are three educational Outcomes as defined by the National Board of Accreditation: Program Educational Objectives: The Educational objectives of an engineering degree program are the statements that describe the expected achievements of graduate in their career and in particular, what the graduates are expected to perform and achieve during the first few years after graduation. [nbaindia.org]

**Program Outcomes:** What the student would demonstrate upon graduation. Graduate attributes are separately listed in Appendix C

**Course Outcome:** The specific outcome/s of each course/subject that is a part of the program curriculum. Each subject/course is expected to have a set of Course Outcomes

**Mapping of Outcome:**



## APPENDIX B

### The Graduate Attributes of NBA

- PO1 Engineering knowledge:** Apply the knowledge of mathematics, science, Engineering fundamentals, and an Engineering specialization to the solution of complex Engineering problems in Computer Engineering.
- PO2 Problem analysis:** Identify, formulate, review research literature, and analyze complex Engineering problems in Computer Engineering reaching substantiated conclusions using first principles of mathematics, natural sciences, and Engineering sciences.
- PO3 Design / Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes of Computer Engineering that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations.
- PO4 Conduct Investigations of Complex Problems:** Use research based knowledge and research methods including design of experiments in Computer Engineering, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- PO5 Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modeling to complex Engineering activities in Computer Engineering with an understanding of the limitations.
- PO6 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 in Computer Engineering.
- PO7 Environment and Sustainability:** Understand the impact of the professional Engineering solutions of Computer Engineering in societal and Environmental contexts, demonstrate the knowledge of, and need for sustainable development.
- PO8 Ethics:** Apply ethical principles and commit to professional ethics, responsibilities, and norms of the Engineering practice.
- PO9 Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- PO10 Communication Skills:** Communicate effectively on complex Engineering activities with the Engineering community and with society, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

- PO11 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.
- PO12 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.

## APPENDIX C

### BLOOM’S TAXONOMY

Bloom’s taxonomy is a classification system used to define and distinguish different levels of human cognition—i.e., thinking, learning, and understanding. Educators have typically used Bloom’s taxonomy to inform or guide the development of assessments (tests and other evaluations of student learning), curriculum (units, lessons, projects, and other learning activities), and instructional methods such as questioning strategies.

