NEW HORIZON
COLLEGE OF ENGINEERING
Autonomous College Permanently Affiliated to VTU, Approved by AICTE & UGC
Accredited by NAAC with 'A' Grade, Accredited by NBA

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Academic Year 2021-22

Scheme and Syllabus

Seventh and Eighth Semesters

2018-2022 Batch (175 Credits)

SCHEME OF SEVENTH SEMESTER
Academic Batch: 2018-22
Academic Year: 2021-22

S. No	Course Code	Course	BOS	Credit Distribution				Overall Credits	Contact hours	Marks		
				L	T	P	S			CIE	SEE	Total
1	20CSE71A	Software Testing	CSE	3	0	0	0	3	3	50	50	100
2	20CSE72A	Mobile Application Development	CSE	3	0	0	0	3	3	50	50	100
3	20CSE73XA	Professional Elective-IV	CSE	3	0	0	0	3	3	50	50	100
4	20CSE74XA	Professional Elective-V	CSE	3	0	0	0	3	3	50	50	100
5	20NHOP7xx	Open Elective -II	-	3	0	0	0	3	3	50	50	100
6	20CSL75A	Software Testing Lab	CSE	0	0	2	0	2	4	25	25	50
7	20CSL76A	Mobile Application Development Lab	CSE	0	0	2	0	2	4	25	25	50
8	20CSE77A	Mini Project in Mobile Application Development	CSE	0	0	2	0	2	4	25	25	50
9	20CSE78A	Project Phase-I	CSE	0	0	2	0	2	-	25	25	50
TOTAL								23	27	350	350	700

S. No.	COURSE CODE	PROFESSIONAL ELECTIVE-IV
1	20CSE731A	Fundamentals of Data Science
2	20CSE732A	Artificial Intelligence
3	20CSE733A	Cyber Security, Forensics and Law
4	20CSE734A	Internet of Things
5	20CSE735A	Embedded Systems

S. No.	COURSE CODE	PROFESSIONAL ELECTIVE-V
1	20CSE741A	Natural Language Processing
2	20CSE742A	Deep Learning
3	20CSE743A	Robotics
4	20CSE744A	Computer Vision
5	20CSE745A	Service Oriented Architecture

Open Elective - II		
Course Code	**Course**	**BOS**
20NHOP701	Big Data Analytics using HP Vertica-I	CSE
20NHOP702	VM Ware Virtualization Essentials-I	ISE
20NHOP704	Big Data Analytics using HP Vertica-II	CSE
20NHOP705	VM Ware Virtualization Essentials-II	ISE
20NHOP707	SAP	MEE
20NHOP708	Schneider-Industrial Automation	EEE
20NHOP709	Cisco-Routing and Switching-I	ECE
20NHOP710	Data Analytics	CSE
20NHOP711	Machine learning	MEE
20NHOP712	CISCO-Routing and switching -II	ECE
20NHOP713	IIOT Embedded Systems	MEE
20NHOP714	Block chain	CSE
20NHOP715	Product Life Cycle Management	MEE
20NHOP717A	Network Security & Cryptography	ECE
20NHOP718A	Physical Design	ECE
20NHOP719A	AI Data Analysis with Python	AI & ML

SCHEME OF EIGHTH SEMESTER
Academic Batch: 2018-22
Academic Year: 2021-22

S. No	Course Code	Course	BOS	L	T	P	S	Overall Credits	Contact hours	CIE	SEE	Total
				Credit Distribution						Marks		
1	20CSE81xA	Professional Elective-VI	CSE	3	0	0	0	3	3	50	50	100
2	20CSE82xA	Professional Elective-VII	CSE	3	0	0	0	3	3	50	50	100
3	20CSE83A	Internship Viva	CSE	0	0	4	0	4	0	50	50	100
4	20CSE84A	Project Phase II	CSE	0	0	10	0	10	0	100	100	200
TOTAL								20	06	250	250	500

S. No.	COURSE CODE	PROFESSIONAL ELECTIVE-VI
1	20CSE811A	Pattern Recognition
2	20CSE812A	Advanced Databases
3	20CSE813A	Mobile Computing
4	20CSE814A	Multi-core Architecture

S. No.	COURSE CODE	PROFESSIONAL ELECTIVE-VII
1	20CSE821A	Ethical Hacking & Prevention
2	20CSE822A	Green Computing
3	20CSE823A	Data Compression
4	20CSE824A	Cognitive and Learning Science

SOFTWARE TESTING

Course Code	: 20CSE71A	**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

CO #	COURSE OUTCOME
20CSE71A.1	Understand the fundamental concepts in software testing
20CSE71A.2	Design and evaluate test cases for various black box and white box testing techniques
20CSE71A.3	Recognize the significance of integration testing
20CSE71A.4	Understand the importance of acceptance testing
20CSE71A.5	Analyze regression testing process and minimization
20CSE71A.6	Apply the software automation process using selenium tool.

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20CSE71A.1	3	-	-	-	-	-	-	-	-	-	-	1	-	1
20CSE71A.2	3	3	3	-	-	-	-	-	-	-	-	-	3	-
20CSE71A.3	3	3	3	-	-	-	-	-	-	-	-	-	3	-
20CSE71A.4	3	3	3	-	-	-	-	-	-	-	-	-	3	-
20CSE71A.5	3	3	3	-	-	-	-	-	-	-	-	-	3	-
20CSE71A.6	3	3	3	1	1	-	-	1	-	-	-	-	3	-

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

Module No	Module Contents	Hours	Cos
1	**Introduction** Faults, Errors, and Failures, Basics of software testing, Testing objectives, Principles of testing, Requirements, behavior and correctness, Testing and debugging, Test metrics and measurements, Verification, Validation and Testing, Types of testing, Software Quality and Reliability, Software defect tracking.	9	CO1

2	**White Box and Black Box Testing** White box testing, static testing, static analysis tools, Structural testing: Module/Code functional testing, Code coverage testing, Code complexity testing, Black Box testing, Requirements based testing, Boundary value analysis, Equivalence partitioning, state/ graph based testing, Model based testing and model checking, Differences between white box and Black box testing.	9	CO2
3	**Integration, System and Acceptance Testing** Top down and Bottom up integration, Bi-directional integration, System integration, Scenario Testing, Defect Bash, Functional versus Non-functional testing, Design/Architecture verification, Deployment testing, Beta testing, Scalability testing, Reliability testing, Stress testing, Acceptance testing: Acceptance criteria, test cases selection and execution	9	CO3 CO4
4	**Test Selection & Minimization for Regression Testing** Regression testing, Regression test process, Initial Smoke or Sanity test, Selection of regression tests, Execution Trace, Dynamic Slicing, Test Minimization, Tools for regression testing, Ad hoc Testing: Pair testing, Exploratory testing, Iterative testing, Defect seeding.	9	CO5
5	**Introduction to Selenium**: Selenium IDE installation – Recording and running test cases using Selenium IDE – Selenium Commands. **Software Test Automation**: Fundamentals of Test Automation – Design and Architecture for Automation – Challenges in Automation **Selenium Web Driver**: Introduction to Web Driver – Architecture – Installation of Selenium Web Driver	9	CO6

Text Books:

1. Desikan and G. Ramesh, "Software Testing: Principles and Practices", Pearson Education.

Reference Books:

1. Aditya P. Mathur, "Fundamentals of Software Testing", Pearson Education.
2. Naik and Tripathy, "Software Testing and Quality Assurance", Wiley
3. K. K. Aggarwal and Yogesh Singh, "Software Engineering", New Age International Publication.

Continuous Internal Evaluation: Theory (50 Marks)

Bloom's Taxonomy Marks (Out of 50)	Tests (25)	Assignments (15)	Quizzes (10)
	-	-	-
Remember	5	-	-
Understand	5	-	-
Apply	10		5
Analyze	5	7.5	5
Evaluate	-	7.5	
Create	-	-	-

SEE – Semester End Examination: Theory (50 Marks)

Bloom's Taxonomy Marks (Out of 50)	Tests
Remember	5
Understand	10
Apply	20
Analyze	15
Evaluate	-
Create	-

MOBILE APPLICATION DEVELOPMENT

Course Code	: 20CSE72A	**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

CO #	COURSE OUTCOME
20CSE72A.1	Comprehend the knowledge on essentials of android application development
20CSE72A.2	Analyze the application structure and the features of android technology
20CSE72A.3	Develop applications using Intents, service and Notification
20CSE72A.4	Create applications using files and data base
20CSE72A.5	Build mobile applications using Shared preferences and Preferences activity
20CSE72A.6	Develop mobile applications with location-based services and google maps

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20CSE72A.1	3	-	-	-	3	-	-	-	-	-	-	2	3	3
20CSE72A.2	3	3	-	-	3	-	-	-	-	-	-	2	3	3
20CSE72A.3	3	3	3	-	3	-	-	-	3	-	-	-	3	-
20CSE72A.4	3	3	3	-	3	-	-	-	3	-	-	-	3	-
20CSE72A.5	3	3	3	-	3	-	-	-	3	-	-	-	3	-
20CSE72A.6	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 ANDROID** Overview of Android, Types of Android Applications, Hardware imposed design considerations, Native Android Applications, Android Development Tools-Android SDK, Android SDK Features, Downloading and installing the Android SDK, Emulators, Android AVD, Creating AVDs, Android Debug Bridge, What comes in the box, Android API levels (version and version names), .apk file extension, Android architecture, The Dalvik Virtual Machine, What you need to begin, Android studio-Project Structure, Android Manifest File, Gradle build system, debug and profile tools-LogCat, The Android studio debugger, What makes an Android application, Creating your first Android Application	9	CO1

2	**APPLICATION STRUCTURE AND BASIC UI DESIGN** The activity lifecycle, Activity stacks, Activity states, Fundamental Android UI Design, Layouts-Linear, Relative, Constraint, frame, table, Absolute, Grid, Managing orientation, User Interface Components- Text view, Edit text box, Button, radio button, toggle button, checkboxes, spinners, Menu, Recycler view, Dialog and pickers -Alert dialog, Date picker, Time picker, Toast, Fragments – Creating fragments, The Fragment life cycle, creating and destroying fragments, Fragment states, Adding Fragments to activities, adding, removing and replacing fragments, Adapters- Array Adapter, Simple Cursor Adapter	10	CO2
3	**INTENTS, SERVICES AND NOTIFICATION** Intents-Explicit and Implicit intents, Native Android actions, Intent filters-Using Intent filters to service implicit intents, Broadcast Receiver-creating and registering, Services- Creating and controlling, Starting and stopping, Implementing a Service, Service lifecycle, Using background threads- Async Task, Notification, Designing for every screen size and density-Resolution independence, supporting and optimizing for different screen sizes	9	CO3
4	**DATA STORAGE AND PREFERENCES** Saving simple application data, Shared Preferences, Preferences activity, File access, SQLite database, content values and cursors, SQlite Open Helper, Querying a Database, Extracting values from a cursor, Adding, updating and removing rows, Content Providers-creating, registering, creating the Content Provider's database, Implementing Content Provider Queries, Introduction to Firebase	9	CO4, CO5
5	**ADVANCED ANDROID AND ANDROID APP DEPLOYMENT** Sending SMS using App, Building apps with Location Based Services and Google maps, Building app with Camera, Hardware sensors, Preparing for publishing – Signing & Versioning of apps, Using Google Play to distribute & Monetize, Best practices for security and privacy	8	CO6

Text Books:

1. Reto Meier; Professional Android 4 Application Development; Wiley India Pvt.ltd; 1st Edition; 2012; ISBN-13: 9788126525898.
2. Phillips, Stewart, Hardy and Marsicano; Android Programming, 2nd edition - Big Nerd Ranch Guide;2015; ISBN-13 978-0134171494.

Reference Books:

1. Mark Murphy; Beginning Android 3; Apress Springer India Pvt Ltd. ;1st Edition; 2011;ISBN-13: 978-1- 4302-3297-1
2. Eric Hellman; Android Programming – Pushing the limits by Hellman; Wiley; 2013; ISBN 13: 978-1118717370
3. www.developer.android.com

Continuous Internal Evaluation: Theory (50 Marks)

Bloom's Taxonomy	Tests	Assignments	Quizzes
Marks (Out of 50)	25	15	10
Remember	2	-	-
Understand	2	-	-
Apply	7	7.5	5
Analyze	5	7.5	5
Evaluate	5	-	-
Create	4	-	-

SEE – Semester End Examination: Theory (50 Marks)

Bloom's Taxonomy	Tests
Marks (Out of 50)	
Remember	10
Understand	10
Apply	10
Analyze	10
Evaluate	10
Create	-

FUNDAMENTALS OF DATA SCIENCE

Course Code	: 20CSE731A	**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

CO #	COURSE OUTCOMES
20CSE731A.1	Analyze fundamental concepts of data science.
20CSE731A.2	Analyze the mathematical foundations required for data science
20CSE731A.3	Apply basic probability theory and Bayesian model for predicting futuristic data.
20CSE731A.4	Analyze the data using inferential statistical models to draw insights for the society.
20CSE731A.5	Evaluate different mathematical models and identify the suitable model for a given application.
20CSE731A.6	Interpret data using visualization techniques.

Course Outcomes to Program Outcomes Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20CSE731A.1	3	-	-	-	-	-	-	-	-	3	-	-	-	3
20CSE731A.2	3	3	-	-	-	2	-	-	-	3	-	-	-	3
20CSE731A.3	3	3	-	-	-	-	-	-	-	3	-	–	–	3
20CSE731A.4	3	3	-	-	-	2	-	-	-	3	-	-	-	3
20CSE731A.5	3	3	-	1	-	-	-	–	–	3	-	–	–	3
20CSE731A.6	3	3	-	-	-	-	-	1	–	3	-	–	–	3

Module No	Module Contents	Hours	COs
1	**Introduction to Data Science**: What is Data Science? Basic Terminology, Why Data Science? The data science Venn diagram, Tools for data science, Data Science life cycle, machine learning algorithms for data science, Applications of data science. **Types of data:** Structured Vs unstructured data, Quantitative Vs Qualitative data, Four levels of data.	9	CO1
2	**Mathematical Foundation for Data Science:** Matrices, Vectors and their properties (determinants, traces, rank, nullity, etc.); Inner products; Distance measures; Projections; Notion of hyper planes; half-planes; Positive definite matrices; Eigenvalues and eigenvectors	9	CO2
3	**Advanced Probability**: Probability: Sample space, events and axioms; conditional probability; Bayes theorem; Random variables; Standard discrete and continuous probability distributions; Covariance and correlation; Central	9	CO3, CO4

	limit theorem .**Inferential Statistics:** Point estimates, sampling distributions, confidence interval, hypothesis tests, Analysis of variance, ANOVA, One way and two way classifications.		
4	**Algorithms for Data Science:** Basic algorithms under supervised and unsupervised learning methods, Ensemble Learning and Time Series Modeling.	9	CO5
5	**Data Visualization:** What is Data Visualization, Data Visualization Tools, History of Tableau, Tools of Tableau, Architecture of Tableau, Data Connection, Tableau Calculations, Tableau Filter Data, Charts & Graphs.	9	CO6

Text Book(s):
1. Doing Data Science : Straight Talk from the Front line" , " CathyO' Neil , Rachel Schutt , " O' Reilly Media, 2013
2. Matrix Computations by Gene H. Golub, C.F. Van Loan, The Johns Hopkins University Press.
3. G. Strang , Introduction to Linear Algebra, Wellesley-Cambridge Press, Fifth edition, USA,2016.

Reference Book(s):
1. " Data Science from Scratch First Principles with Python", " Joel Grus" O' Reilly Media, 2015
2. Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications", Wiley Publishers, 2015.

CIE – Continuous Internal Evaluation: Theory (50 Marks)

Bloom's Taxonomy	Tests	Assignments	Quizzes	Co curricular
Marks (Out of 50)	**25**	**10**	**5**	**10**
Remember	-	-	-	-
Understand	10	5	2.5	-
Apply	5	5	2.5	-
Analyze	5	-	-	5
Evaluate	5	-	-	5
Create	-	-	-	-

SEE – Semester End Examination: Theory (50 Marks)

Blooms Taxonomy	Marks(Out of 50)
L1: Remember	5
L2: Understand	5
L3: Apply	15
L4: Analyze	15
L5: Evaluate	10
L6: Create	-

ARTIFICIAL INTELLIGENCE

Course Code : 20CSE732A   **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

CO #	COURSE OUTCOME
20CSE732A.1	Apply the basic concepts of Artificial Intelligence and the searching techniques for searching and solving any AI problem.
20CSE732A.2	Analyze different logics to represent knowledge, reasoning patterns in propositional logic and derive the proof from the facts using inference.
20CSE732A.3	Analyze monotonic and non monotonic reasoning. Derive statistical reasoning for incomplete and uncertain Information using bayes theorem. Design a simple Bayesian network
20CSE732A.4	Analyze the concept of week and strong filler structures and different forms of learning and also demonstrate the fundamentals of conceptual dependency and design scripts.
20CSE732A.5	Analyze the fundamentals of different game playing techniques
20CSE732A.6	Analyze different AI techniques used in planning

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20CSE732A.1	3	3	-	-	-	-	-	-	-	2	-	2	-	-
20CSE732A.2	3	3	3	-	-	-	-	-	-	2	-	-	3	-
20CSE732A.3	3	3	3	-	-	-	-	-	-	2	-	2	3	-
20CSE732A.4	3	3	3	-	-	-	-	-	-	2	-	-	-	-
20CSE732A.5	3	3	3	2	-	-	-	-	-	2	-	-	3	-
20CSE732A.6	3	3	3	2	-	-	-	-	-	2	-	2	3	3

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

Module No	Module Contents	Hours	COs
1	**Introduction and Search techniques:** What is artificial intelligence? Foundations of AI, Problem solving, Problem Definition and characteristics, Spaces and search, Heuristic search technique –Generate and test, Hill climbing, Best first search, problem reduction.	9	CO1
2	**Knowledge Representation** Knowledge-based agents, the wumpus world as an example world, Logic, propositional logic, Reasoning patterns in propositional logic, Agents based on propositional logic Syntax and semantics of first-order logic, Using first-order logic, Knowledge engineering in first-order logic	9	CO2
3	**Reasoning with Uncertainty & Probabilistic Reasoning** Symbolic Reasoning under Uncertainty-Nonmonotonic reasoning implementation of BFS and DFS, Statistical reasoning-Bayes theorem and Bayesian networks	9	CO3
4	**Weak Slot and Filter Structures**-semantic nets and frames **Strong slot-and-filler structures**-conceptual dependency, scripts, CYC. **Learning**: Forms of learning, Inductive learning, Learning decision trees, Ensemble learning	9	CO4
5	**Game playing:** The minimax search procedure, adding alpha –beta cut-offs, additional refinements, iterative deepening, reference on specific games **planning**- An example domain: blocks world, Components of a planning system, goal stack planning, nonlinear planning using constraint posting, hierarchical planning, reactive systems.	9	CO5 CO6

Text Books:
1. E. Rich, K. Knight & S. B. Nair - Artificial Intelligence, 3/e, McGraw Hill
2. Artificial Intelligence: A Modern Approach, StuartRusell, Peter Norving, Pearson Education 2nd Edition.

Reference Books:
1. Dan W.Patterson, Introduction to Artificial Intelligence and Expert Systems –Prentice Hal of India.
2. G. Luger, "Artificial Intelligence: Structures and Strategies for complex problem Solving", Fourth Edition, Pearson Education, 2002.
3. Artificial Intelligence and Expert Systems Development by D W Rolston-McGraw hill

Continuous Internal Evaluation: Theory (50 Marks)

Bloom's Taxonomy	Tests	Assignments	Quizzes	Co curricular
Marks (Out of 50)	25	10	5	10
Remember	-	-	-	-
Understand	10	5	2.5	-
Apply	5	5	2.5	-
Analyze	5	-	-	5
Evaluate	5	-	-	5
Create		-	-	-

SEE – Semester End Examination: Theory (50 Marks)

Bloom's Taxonomy	Tests
Marks (Out of 50)	
Remember	5
Understand	5
Apply	15
Analyze	15
Evaluate	5
Create	5

CYBER SECURITY, FORENSICS AND LAW

Course Code: 20CSE733A   Credits   : 03
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

20CSE733A.1	Analyze the various types of cybercrimes and cybercriminals.
20CSE733A.2	Interpret the importance of tools and methods used in cybersecurity.
20CSE733A.3	Apply cyber laws to investigate cybercrimes.
20CSE733A.4	Develop solutions to societal problems using forensics techniques.
20CSE733A.5	Analyze various cyber forensic investigation tools and methods.
20CSE733A.6	Evaluate the methods for data recovery and evidence collection.

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
20CSE733A.1	3	3	-	-	-	-	-	-	-	-	-	2
20CSE733A.2	3	3	-	-	-	-	-	-	-	-	-	-
20CSE733A.3	3	3	-	-	-	-	-	-	-	-	-	2
20CSE733A.4	3	-	1	2	-	2	-	-	-	-	-	-
20CSE733A.5	3	3	-	-	-	-	-	-	-	-	-	-
20CSE733A.6	3	3	-	2	-	2	-	-	-	-	-	-

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

Module No	Module Contents	Hours	Cos
1	**Introduction to Cybercrime-** Cybercrime: Definition and origins of the word, Cybercrime and Information Security, Who are Cybercriminals ?, Classification of Cybercrimes, Categories of Cybercrime, How criminals plan the Attacks, Social engineering, Cyberstalking, Cybercafe and Cybercrimes	9	20CSE733A.1
2	**Tools and Methods used in Cybercrime-**Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDoS Attacks, SQL injection, Buffer Overflow, Attacks on wireless Networks, Methods of phishing, Phishing techniques, Spear Phishing, Types of Phishing Scams, Phishing Toolkits and Spy Phishing, Phishing countermeasures	9	20CSE733A.2

3	**Cybercrimes and Cybersecurity: The Legal Perspectives** – Cybercrime and the Legal Landscape around the world, Why do we need Cyber laws: The Indian Context, The Indain IT Act, Challenges to Indian Law and Cybercrime Scenario in India, Consequences of not addressing the weakness in Information Technology Act, Digital Signatures and the Indian IT Act, Amendments to the Indian IT Act, Cybercrime and punishment, Cyberlaw, technology and students: Indian Scenario	9	20CSE733A.3
4	**Understanding Computer Forensics**-Digital forensics science, The need for Computer Forensics, Cyber forensics and Digital Evidence, Forensics Analysis of E-mail, Digital Forensics Life cycle, Chain of custody concept, Network Forensics, Approaching a Computer Forensics Investigation, Computer Forensics and steganography, Relevance of the OSI 7 layer model to Computer Forensics, Forensics and social networking sites, Challenges in computer forensics, special tools and techniques, Antiforensics	9	20CSE733A.4
5	**Forensics of Hand-held devices**-Understanding Cell phone working characteristics, Hand-held devices and digital forensics, Toolkits for Hand-Held device forensics, forensics of iPods and Digital Music devices, An illustration on real life use of forensics, Techno-Legal Challenges with Evidence from Hand-held devices, Organizational Guidelines on Cell phone forensics	9	20CSE733A.5 20CSE733A.6

Text Book(s):
1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, by Nina Godbole and SunitBelapure, Wiley

Reference Book(s):
1. Guide to Computer Forensics and Investigations (4th edition). By B. Nelson, A. Phillips, F. Enfinger, C. Steuart. ISBN 0-619-20706-5,Thomson, 2009
2. Cyber Crime and Cyber Terrorism Investigator's Handbook ByBabakAkhgar, Andrew Staniforth, Francesca Bosco. ISBN: 978-0-12-800743-3, Elsevier, 2014
3. Websites and indiancyber law by Saisushanth, Kindle edition, 2015

CIE – Continuous Internal Evaluation: Theory (50 Marks)

Bloom's Taxonomy	Tests	Assignments	Quizzes	Co curricular
Marks (Out of 50)	25	10	5	10
Remember	-	-	-	-
Understand	10	5	2.5	-
Apply	5	5	2.5	-
Analyze	5	-	-	5
Evaluate	5	-	-	5
Create	-	-	-	-

SEE – Semester End Examination: Theory (50 Marks)

Blooms Taxonomy	Marks (Out of 50)
L1: Remember	-
L2: Understand	10
L3: Apply	15
L4: Analyze	15
L5: Evaluate	10
L6: Create	-

INTERNET OF THINGS

Course Code	: 20CSE734A	**Credits**	: 03
L: T: P:S	: 3:0:0:0	**CIE Marks**	: 50
Exam Hours	: 03 Hours	**SEE Marks**	: 50

Course Outcomes: At the end of the Course, the Student will be able to

20CSE734A.1	Interpret the impact and challenges posed by IoT networks leading to new architectural models.
20CSE734A.2	Compare and contrast the deployment of smart objects and the technologies to connect them to network.
20CSE734A.3	Appraise the role of IoT protocols for efficient network communication.
20CSE734A.4	Elaborate the need for Data Analytics in IoT.
20CSE734A.5	Analyse the importance of IOT Security
20CSE734A.6	Illustrate the different sensing technologies in real world environment and identify the applications of IoT using Arduino and Raspberry Pi

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20CSE734A.1	2	2	1	-	-	1	-	1	-	1	-	1	-	-
20CSE734A.2	1	1	1	-	-	1	-	1	-	-	-	1	-	-
20CSE734A.3	1	1	2	1		1	-	-	-	-	--	1	--	--
20CSE734A.4	2	1	2	2		1	-	-	-	--		1	-	-
20CSE734A.5	1	1	2	-	2	2	2	-	1	1	2	1	-	-
20CSE734A.6	1	1	2	-	2	2	2	-	1	1	2	1	-	-

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

Module No	Module Contents	Hours	COs
1	**Introduction:** What is IoT, Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges, IoT Network Architecture and Design, Drivers Behind New Network Architectures, Comparing IoT Architectures, A Simplified IoT Architecture, The Core IoT Functional Stack, IoT Data Management and Compute Stack	8	CO1
2	**Smart Objects:** The "Things" in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies. **IoT Platform**- Components of IoT Platform, AWS IoT Platform, ThinkSpeak	9	CO2
3	**IoT Protocol:** IP as the IoT Network Layer, The Business Case for IP, the need for Optimization, Optimizing IP for IoT, Profiles and Compliances, Application Protocols for IoT, The Transport Layer, IoT Application Transport Methods. MQTT, COAP	9	CO3

4	**Data and Analytics for IoT**, An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics, **IoT Security:** Securing IoT, A Brief History of OT Security, Common Challenges in OT Security, How IT and OT Security Practices and Systems Vary, Formal Risk Analysis Structures: OCTAVE and FAIR, The Phased Application of Security in an Operational Environment	10	CO4 CO5
5	**IoT Physical Devices and Endpoints** - **Arduino UNO**: Introduction to Arduino, Arduino UNO, Installing the Software, Fundamentals of Arduino Programming. **RaspberryPi:** Introduction to RaspberryPi, About the RaspberryPi Board: Hardware Layout, Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming RaspberryPi with Python, Wireless Temperature Monitoring System Using Pi, DS18B20 Temperature Sensor, Connecting Raspberry Pi via SSH, Accessing Temperature from DS18B20 sensors, Remote access to RaspberryPi, **Use cases:** Smart and Connected Cities, An IoT Strategy for Smarter Cities, Smart City IoT Architecture, Smart City Security Architecture	9	CO6

Text Book(s):
1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry,"IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", 1st Edition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978- 9386873743)
2. Srinivasa K G, "Internet of Things", CENGAGE Leaning India, 2017

Reference Book(s):
1. Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-on-Approach)", 1st Edition, VPT, 2014. (ISBN: 978-8173719547)
2. Raj Kamal, "Internet of Things: Architecture and Design Principles", 1st Edition, McGraw Hill Education, 2017. (ISBN: 978-9352605224)

CIE – Continuous Internal Evaluation: Theory (50 Marks)

Bloom's Taxonomy	Tests	Assignments	Quizzes	Co curricular
Marks (Out of 50)	**25**	**10**	**5**	**10**
Remember	-	-	-	-
Understand	10	5	2.5	-
Apply	5	5	2.5	-
Analyze	5	-	-	5
Evaluate	5	-	-	5
Create		-	-	-

SEE – Semester End Examination: Theory (50 Marks)

Blooms Taxonomy	Marks (Out of 50)
L1: Remember	5
L2: Understand	5
L3: Apply	15
L4: Analyze	15
L5: Evaluate	5
L6: Create	5

EMBEDDED SYSTEMS

Course Code	: 20CSE735A	**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

CO #	COURSE OUTCOME
20CSE735A.1	Apply the features of processors, Memory, I/O and communication interfaces in developing embedded system
20CSE735A.2	Analyzing the characters and applications of embedded systems
20CSE735A.3	Appraise the programmers model of 8051 micro controller to give frugal solutions for real world problems
20CSE735A.4	Design computational models for hardware and software design
20CSE735A.5	Apply the concept of RTOS in embedded system applications
20CSE735A.6	Engage in self learning in analyzing and carry out embedded projects

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20CSE735A.1	3	-	-	-	-	-	-	-	-	-	-	3	-	-
20CSE735A.2	3	3	3	-	3	-	-	-	-	-	-	-	-	-
20CSE735A.3	3	3	3	1	3	2	2	-	2	-	-	3	3	-
20CSE735A.4	3	3	3	-	3	-	-	-	-	-	-	3	-	-
20CSE735A.5	3	-	-	-	-	-	-	-	-	-	-	3	-	-
20CSE735A.6	-	-	-	-	3	2	2	-	2	1	-	3	-	-

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

Module No	Module Contents	Hours	COs
1	**Introduction to Embedded Systems**: What is an Embedded System, Embedded Systems Vs General Computing Systems, Classification of Embedded System, Major Application areas of Embedded System, Purpose of Embedded System, Th Innovative Bonding of lifestyle with Embedded Technologies **Typical Embedded System :** Core of the Embedded System, Sensors and Actuators, Memory, Communication Interface, Embedded Firmware	9	CO1
2	**Characteristic and application of Embedded system :** Characteristic and Quality Attributes of embedded system embedded system application and Domain specific	9	CO2
3	**Programming the 8051 micro controller :** instruction set of 8051 and Different Addressing mode supported by 8051 micro controller	9	CO3
4	**Hardware Software Co-Design and Program Modeling**: Fundamental Issues in	9	CO4

	Hardware Software Co-Design, Computational Models in Embedded Design, Introduction to Unified Modeling Language, Hardware Software Trade-offs		CO6
5	**Real Time Operating System(RTOS) based Embedded System Design** Operating system basics, Types of operating systems, Tasks, Process and threads, Multiprocessing and Multitasking, Task Scheduling The embedded product development lifecycle	**9**	**CO5** **CO6**

TEXT BOOKS:

1. Introduction to Embedded Systems, Shibu K V,2nd Edition 2017, McGRAW HILL

REFERENCE BOOKS:

1. Embedded Systems – A contemporary Design Tool, James K Peckol, 2014, John Wiley.
2. "Computers as Components- Principles of Embedded Computing System Design", by Marilyn Wolf , 4th edition, Morgan Kaufman Publications, ISBN: 978-0-12-805387-4,2017.

CIE – Continuous Internal Evaluation: Theory (50 Marks)

Bloom's Taxonomy	Tests	Assignments	Quizzes	Co curricular
Marks (Out of 50)	**25**	**10**	**5**	**10**
Remember	-	-	-	-
Understand	10	5	2.5	-
Apply	5	5	2.5	-
Analyze	5	-	-	5
Evaluate	5	-	-	5
Create	-	-	-	

SEE – Semester End Examination: Theory (50 Marks)

Blooms Taxonomy	Marks(Out of 50)
L1: Remember	5
L2: Understand	5
L3: Apply	15
L4: Analyze	15
L5: Evaluate	5
L6: Create	5

NATURAL LANGUAGE PROCESSING

Course Code : 20CSE741A   **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

CO #	COURSE OUTCOME
20CSE741A.1	Understand the basic concepts of NLP.
20CSE741A.2	Analyze Regular expression, word level and syntactic analysis
20CSE741A.3	Generate the natural language by extracting relations from text
20CSE741A.4	Evaluating word matching, latent semantic analysis, and topic models
20CSE741A.5	Examine Probabilistic Classification and Finite-State Sequence Modeling
20CSE741A.6	Apply information retrieval techniques for NLP

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20CSE741A.1	3	3	-	-	-	-	-	-	-	-	-	-	-	3
20CSE741A.2	3	3	3	3	-	-	-	-	-	-	-	3	3	3
20CSE741A.3	3	3	3	3	-	-	-	-	-	-	-	3	3	3
20CSE741A.4	3	3	3	3	-	-	-	-	-	-	-	3	3	3
20CSE741A.5	3	3	3	3	-	-	-	-	-	-	-	3	3	3
20CSE741A.6	3	3	3	3	-	-	-	-	-	-	-	3	3	3

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

Module No	Module Contents	Hours	COs
1	**OVERVIEW AND LANGUAGE MODELING**: Overview: Origins and challenges of NLP- Language and Grammar-Processing Indian Languages- NLP Applications-Information Retrieval. Language Modeling: Various Grammar-based Language Models-Statistical Language Model.	8	CO1
2	**WORD LEVEL AND SYNTACTIC ANALYSIS:** Word Level Analysis: Regular Expressions- Finite-State Automata-Morphological Parsing-Spelling Error Detection and correction-Words and Word classes-Part-of Speech Tagging. Syntactic Analysis: Context-free Grammar- Constituency- Parsing- Probabilistic Parsing	9	CO2

3	**EXTRACTING RELATIONS FROM TEXT:** From Word Sequences to Dependency Paths: Introduction, Subsequence Kernels for Relation Extraction, A Dependency-Path Kernel for Relation Extraction and Experimental Evaluation. Mining Diagnostic Text Reports by Learning to Annotate Knowledge Roles: Introduction, Domain Knowledge and Knowledge Roles, Frame Semantics and Semantic Role Labeling, Learning to Annotate Cases with Knowledge Roles and Evaluations. A Case Study in Natura lLanguage Based Web Search: In Fact System Overview, The GlobalSecurity.org Experience.	10	CO3
4	**EVALUATING SELF-EXPLANATIONS IN iSTART:** Word Matching, Latent Semantic Analysis, and Topic Models: Introduction, iSTART: Feedback Systems, iSTART: Evaluation of Feedback Systems, Textual Signatures: Identifying Text-Types Using Latent Semantic Analysis to Measure the Cohesion of Text Structures: Introduction, Cohesion, Coh-Metrix, Approaches to Analyzing Texts, Latent Semantic Analysis, Predictions, Results of Experiments. Automatic Document Separation: A Combination of Probabilistic Classification and Finite-State Sequence Modeling: Introduction, Related Work, Data Preparation, Document Separation as a Sequence Mapping Problem, Results. Evolving Explanatory Novel Patterns for Semantically-Based Text Mining: Related Work, A Semantically Guided Model for Effective Text Mining.	10	CO4, CO5
5	**INFORMATION RETRIEVAL AND LEXICAL RESOURCES:** Information Retrieval: Design features of Information Retrieval Systems-Classical, Non classical, and Alternative Modelsof Information Retrieval – valuation Lexical Resources: World Net-Frame Net- Stemmers-POS Tagger- Research Corpora.	8	CO6

Text Books:

1. Natural Language Processing and Information Retrieval, Tanveer Siddiqui, U.S. Tiwary, Oxford University Press, 2008
2. Natural Language Processing and Text Mining, Anne Kao and Stephen R. Potee, Springer- Verlag London Limited,2007

Reference Books:

1. Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition, Daniel Jurafsky and James H Martin, Prentice Hall, 2008 2nd Edition
2. Natural Language Understanding, D James Allen, Benjamin/Cummings publishing company, 2nd edition, 1995

Continuous Internal Evaluation: Theory (50 Marks)

Bloom's Taxonomy	Tests	NPTEL
Marks (Out of 50)	**25**	**25**
Remember	-	5
Understand	10	5
Apply	5	5
Analyze	5	5
Evaluate	5	5
Create	-	-

SEE – Semester End Examination: Theory (50 Marks)

Bloom's Taxonomy	Tests
Marks (Out of 50)	
Remember	-
Understand	20
Apply	10
Analyze	10
Evaluate	10
Create	-

DEEP LEARNING

Course Code : 20CSE742A		**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

CO #	COURSE OUTCOME
20CSE742A.1	Identify appropriate Activation functions and loss functions for training different neural networks
20CSE742A.2	Distinguish Neural Networks and Deep Neural Networks with respect to architectural principles
20CSE742A.3	Illustrate the architecture of different neural networks
20CSE742A.4	Select the appropriate Deep Neural Architecture based on application requirements
20CSE742A.5	Analyze the performance of Deep Neural Networks
20CSE742A.6	Apply Deep Learning for solving Real World Problems

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20CSE742A.1	3	3	-	-	-	-	-	-	-	-	-	-	-	-
20CSE742A.2	3	3	3	3	-	-	-	-	-	-	-	-	3	-
20CSE742A.3	3	3	3	3	-	-	-	-	-	-	-	3	3	-
20CSE742A.4	3	3	3	3	-	-	-	-	-	-	-	3	3	-
20CSE742A.5	3	3	3	3	-	-	-	-	-	-	3	-	3	-
20CSE742A.6	3	3	3	3	-	-	-	-	-	-	3	-	-	3

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

Module No	Module Contents	Hours	COs
1	Introduction of Neural Networks: Perceptron, Multilayer Feed forward Networks, Feed Forward Neural network Architecture Training Neural Networks, Activation Functions, Loss Functions, Loss Function classification, Hyper parameters	8	CO1
2	Fundamentals of Deep Networks: Defining Deep Learning, Common Architectural Principles of Deep Networks, Building Blocks of Deep Networks, Auto encoders: Types, Applications	9	CO2
3	Major Architectures of Deep Networks: Unsupervised Pretrained Networks, Convolution Neural Networks (CNNs), Recurrent Neural Networks, Stochastic Gradient descent NN, Recursive Neural Networks	10	CO3,CO4

4	Tuning Deep Networks: Basic Concepts in Tuning Deep Networks, Matching Input Data and Network Architectures, Relating Model Goal and Output Layers, Working with Layer Count, Parameter Count, and Memory, Weight Initialization Strategies, Using Activation Functions	10	CO5
5	Applications: Large Scale Deep Learning, Computer Vision, Speech Recognition, Natural Language Processing, Recommender Systems in social networks, case study-applications of deep learning in Health care for diagnosis of diseases	8	CO6

Text Books:

1. "Deep Learning a Practitioner's Approach" Adam Gibson, Josh Patterson ,O'Reilly Media, 2017
2. "Deep Learning", Ian Good fellow and Yoshua Bengio and Aaron Courville, MIT Press, 2016

Reference Books:
1. Deep Learning Neural Networks: Design And Case Studies, Daniel Graupe, world scientific publishing, 2016
2. Deep Learning: Methods and Applications, Li Deng , Dong Yu ,Now Publisher Inc, 2014
3. Introduction to Artificial Neural networks, Zurada J.M, Jaico Publishing house, 2012.

Continuous Internal Evaluation: Theory (50 Marks)

Bloom's Taxonomy	Tests	NPTEL
Marks (Out of 50)	25	25
Remember	-	5
Understand	10	5
Apply	5	5
Analyze	5	5
Evaluate	5	5
Create	-	-

SEE – Semester End Examination: Theory (50 Marks)

Bloom's Taxonomy	Tests
Marks (Out of 50)	
Remember	-
Understand	20
Apply	10
Analyze	10
Evaluate	10
Create	

ROBOTICS

Course Code	: 20CSE743A	**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

CO #	COURSE OUTCOME
20CSE743A.1	Summarize the concepts of industrial robots, classification, specifications and coordinate systems, the needs and application of robots in different sectors.
20CSE743A.2	Illustrate the different types of robot drive systems as well as robot end effectors.
20CSE743A.3	Apply the different sensors and image processing techniques in robotics to improve the ability of robots.
20CSE743A.4	Develop robotic programs for different tasks and familiarize with the kinematics motions of robot.
20CSE743A.5	Examine the implementation of robots in various industrial sectors and interpolate the economic analysis of robots.
20CSE743A.6	Illustrate the fundamental concept of various robot programming languages

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20CSE743A.1	3	3	3	-	-	-	-	-	-	-	-	3	-	-
20CSE743A.2	3	3	3	-	-	-	-	-	-	-	-	3	3	-
20CSE743A.3	3	3	3	-	-	-	-	-	-	-	-	3	3	-
20CSE743A.4	3	3	3	1	-	-	-	-	-	-	-	3	3	1
20CSE743A.5	3	3	3	-	-	-	-	-	-	-	-	3	-	-
20CSE743A.6	3	3	-	-	3	-	-	-	-	-	-	-	3	3

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

Module No	Module Contents	Hours	COs
1	**FUNDAMENTALS OF ROBOT** Robot - Definition - Robot Anatomy - Co ordinate Systems, Work Envelope Types and Classification- Specifications-Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load- Robot Parts and their Functions-Need for Robots-Different Applications	9	CO1
2	**ROBOT DRIVE SYSTEMS AND END EFFECTORS** Pneumatic Drives-Hydraulic Drives-Mechanical Drives-Electrical Drives-D.C. Servo Motors, Stepper Motors, A.C. Servo Motors-Salient Features, Applications and Comparison of all these Drives, End Effectors-Grippers-Mechanical Grippers, Pneumatic and Hydraulic- Grippers, Magnetic Grippers, Vacuum Grippers; Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers; Selection and Design Considerations.	9	CO2

3	**SENSORS AND MACHINE VISION** Requirements of a sensor, Principles and Applications of the following types of sensors- Position sensors - Piezo Electric Sensor, LVDT, Resolvers, Optical Encoders, pneumatic Position Sensors, Range Sensors Triangulations Principles, Structured, Lighting Approach, Time of Flight, Range Finders, Laser Range Meters, Touch Sensors ,binary Sensors., Analog Sensors, Wrist Sensors, Compliance Sensors, Slip Sensors, Camera, Frame Grabber, Sensing and Digitizing Image Data- Signal Conversion, Image Storage, Lighting Techniques, Image Processing and Analysis-Data Reduction, Segmentation, Feature Extraction, Object Recognition, Other Algorithms, Applications- Inspection, Identification, Visual Serving and Navigation.	9	CO3
4	**ROBOT KINEMATICS AND ROBOT PROGRAMMING** Forward Kinematics, Inverse Kinematics and Difference; Forward Kinematics and Reverse Kinematics of manipulators with Two, Three Degrees of Freedom (in 2 Dimension), Four Degrees of freedom (in 3 Dimension) Jacobians, Velocity and Forces-Manipulator Dynamics, Trajectory Generator, Manipulator Mechanism Design-Derivations and problems. Lead through Programming, Robot programming Languages-VAL Programming-Motion Commands, Sensor Commands, End Effector commands and simple Programs.	9	CO4 CO6
5	**IMPLEMENTATION AND ROBOT ECONOMICS** RGV, AGV; Implementation of Robots in Industries-Various Steps; Safety Considerations for Robot Operations - Economic Analysis of Robots.	9	CO5

Text Book(s):

1. Groover M.P., "Industrial Robotics -Technology Programming and Applications", McGraw Hill, 2012.
2. Klafter R.D., Chmielewski T.A and Negin M., "Robotic Engineering - An Integrated Approach",Prentice Hall, 2003.

Reference Book(s):

1. Craig J.J., "Introduction to Robotics Mechanics and Control", Pearson Education, 2008.
2. Deb S.R., "Robotics Technology and Flexible Automation" Tata McGraw Hill Book Co., 2013.
3. Fu.K.S.,Gonzalz R.C. and Lee C.S.G., "Robotics Control, Sensing, Vision and Intelligence", McGraw Hill Book Co., 1987.
4. Janakiraman P.A., "Robotics and Image Processing", Tata McGraw Hill, 1995.
5. Koren Y., "Robotics for Engineers", Mc Graw Hill Book Co., 1992.

Continuous Internal Evaluation: Theory (50 Marks)

Bloom's Taxonomy	Tests	NPTEL
Marks (Out of 50)	25	25
Remember	-	5
Understand	10	5
Apply	5	5
Analyze	5	5
Evaluate	5	5
Create	-	-

SEE – Semester End Examination: Theory (50 Marks)

Bloom's Taxonomy	Tests
Marks (Out of 50)	
Remember	-
Understand	20
Apply	10
Analyze	10
Evaluate	10
Create	-

COMPUTER VISION

Course Code: 20CSE744A   **Credits: 03**
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:

20CSE744A.1	Analyze fundamental image processing techniques required for computer vision.
20CSE744A.2	Apply boundary tracking techniques, chain codes and other region descriptors.
20CSE744A.3	Outline shape and region analysis methods.
20CSE744A.4	Apply Hough Transform for line, circle, and ellipse detections.
20CSE744A.5	Apply 3D vision and motion related techniques.
20CSE744A.6	Summarize the applications of computer vision.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20CSE744A.1	2	3	-	-	-	-	-	-	-	-	-	2	1	2
20CSE744A.2	2	3	1	-	-	-	-	-	-	-	-	2	1	2
20CSE744A.3	2	3	1	-	-	-	-	-	-	-	-	2	1	2
20CSE744A.4	2	3	1	-	-	-	-	-	-	-	-	2	1	2
20CSE744A.5	2	3	1	-	-	-	-	-	-	-	-	2	1	2
20CSE744A.6	2	3	1	-	-	-	-	-	-	-	-	-	1	2

Module No.	Module Contents	Hours	COs
1	**IMAGE PROCESSING FOUNDATIONS:** Review of image processing techniques – classical filtering operations – thresholding techniques – edge detection techniques – corner and interest point detection – mathematical morphology – texture.	9	CO1
2	**SHAPES AND REGIONS:** Binary shape analysis – connectedness – object labeling and counting – size filtering – distance functions – skeletons and thinning – deformable shape analysis – boundary tracking procedures – active contours – shape models and shape recognition – centroidal profiles – handling occlusion – boundary length measures – boundary descriptors – chain codes – Fourier descriptors – region descriptors – moments.	9	CO2, CO3
3	**HOUGH TRANSFORM:** Line detection – Hough Transform (HT) for line detection – foot-of-normal method – line localization – line fitting – RANSAC for straight line detection – HT based circular object detection – accurate center location – speed problem – ellipse detection – Case study: Human Iris location – hole detection – generalized Hough Transform (GHT) – spatial matched filtering – GHT for ellipse detection – object location – GHT for feature collation.	9	CO4

4	**3D VISION AND MOTION:** Methods for 3D vision – projection schemes – shape from shading – photometric stereo – shape from texture – shape from focus – active range finding – surface representations – point-based representation – volumetric representations – 3D object recognition – 3D reconstruction – introduction to motion – triangulation – bundle adjustment – translational alignment – parametric motion – spline-based motion – optical flow – layered motion.	9	CO5
5	**Applications:** Photo album – Face detection – Face recognition – Eigen faces – Active appearance and 3D shape models of faces Application: Surveillance – foreground-background separation – particle filters – Chamfer matching, tracking, and occlusion – combining views from multiple cameras – human gait analysis Application: In-vehicle vision system: locating roadway – road markings – identifying road signs – locating pedestrians.	9	CO6

TEXT BOOKS:

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

REFERENCE BOOKS:

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

CIE- Continuous Internal Evaluation: Theory (50 Marks)

Bloom's Taxonomy	Tests	NPTEL
Marks (Out of 50)	**25**	**25**
Remember	-	5
Understand	10	5
Apply	5	5
Analyze	5	5
Evaluate	5	5
Create	-	-

SEE- Semester End Examination: Theory (50 Marks)

Bloom's Category	Marks
Remember	05
Understand	10
Apply	15
Analyze	15
Evaluate	05
Create	-

SERVICE ORIENTED ARCHITECTURE

Course Code	: 20CSE745A	**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

CO #	COURSE OUTCOME
20CSE745A.1	Understand fundamentals of XML and understand the overview of Service Oriented Architecture and Web services
20CSE745A.2	Compare different IT architecture
20CSE745A.3	Analyze and design of SOA based applications
20CSE745A.4	Implement web service and realize SOA.
20CSE745A.5	Implement REST full services
20CSE745A.6	Design and implement of SOA based Application Integration using BPEL

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20CSE745A.1	3	3	-	-	-	-	-	-	-	-	-	3	-	3
20CSE745A.2	3	3	3	-	-	-	-	-	-	-	-	3	-	3
20CSE745A.3	3	3	3	3	-	-	-	-	-	-	-	3	3	3
20CSE745A.4	3	3	3	3	-	-	-	-	-	-	-	3	3	3
20CSE745A.5	3	3	3	3	-	-	-	-	-	-	-	3	3	3
20CSE745A.6	3	3	3	3	-	-	-	-	-	-	-	3	3	3

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

Module No	Module Contents	Hours	COs
1	**XML AND SOA BASICS** **XML document structure** – Well-formed and valid documents – DTD – XML Schema – Parsing XML using DOM, SAX – XPath – XML Transformation and XSL – Xquery **SOA BASICS:** Software Architecture; Need for Software Architecture, Objectives of Software Architecture, Characteristics of SOA, Benefits of SOA	9	CO1
2	**SERVICE ORIENTED ARCHITECTURE (SOA)** Types of IT Architecture, Comparing SOA with Client-Server and Distributed architectures, Architecture Patterns and Styles, Service oriented Architecture; Service Orientation in Daily Life, Drives for SOA, Dimension of SOA, Key components, perspective of SOA, Enterprise-wide SOA; Considerations for Enterprise-Wide SOA, Strawman Architecture For Enterprise-Wide-SOA-Enterprise, SOA-Layers, Application Development Process, SOA Methodology For Enterprise	9	CO2

3	**SOA GOVERNANCE:** SOA implementation and Governance – strategy – SOA development – SOA governance – trends in SOA – event-driven architecture – software a service – SOA technologies – proof-of-concept – process orchestration – SOA best practices.	9	CO3
4	**SOA IMPLEMENTATION:**SOA based integration – integrating existing application – development of web services – Integration - SOA using REST – RESTful services – RESTful services with and without JWS – Role of WSDL,SOAP and Java/XML mapping in SOA – JAXB Data binding.	9	CO4
5	**APPLICATION INTEGRATION:JAX –WS 2.0** client side/server side development – Packaging and Deployment of SOA component – SOA shopper case study –WSDL centric java WS with SOA-J – related software – integration through service composition (BPEL) – case study - current trends.	9	CO5

Text Books:

1. Service–Oriented Architecture for Enterprise Applications Shankar Kambhampaly Wiley Second Edition, 2014
2. XML and Web Services,RonSchmelzer et al.-Pearson Education, 2002.

Reference Books:

1. SOA using Java Web Services, Mark D. Hansen, Practice Hall, 2007.
2. SOA-Based Enterprise Integration, Waseem Roshen, Tata McGraw-HILL, 2009.

Continuous Internal Evaluation: Theory (50 Marks)

Bloom's Taxonomy	Tests	NPTEL
Marks (Out of 50)	**25**	**25**
Remember	-	5
Understand	10	5
Apply	5	5
Analyze	5	5
Evaluate	5	5
Create	-	-

SEE – Semester End Examination: Theory (50 Marks)

Bloom's Taxonomy	Tests
Marks (Out of 50)	
Remember	-
Understand	20
Apply	10
Analyze	10
Evaluate	10
Create	-

SOFTWARE TESTING LAB

Course Code	: 20CSL75A	**Credits**	: 2
L:T:P:S	: 0:0:2:0	**CIE Marks**	: 25
Exam Hours	: 3	**SEE Marks**	: 25

Course Outcomes: At the end of the Course, the Student will be able to

20CSL75A.1	Apply the fundamentals of testing in solving real world problems.
20CSL75A.2	Apply the concepts of test case and test suite based on unit testing and integration testing.
20CSL75A.3	Design and evaluate test cases for various black box testing techniques using open source tools.
20CSL75A.4	Design and evaluate test cases for various white box testing techniques using open source tools.
20CSL75A.5	Apply the concepts of the software automation testing process using Selenium IDE
20CSL75A.6	Understand the installation procedure ofSelenium web driver and create programs to assert various web elements.

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20CSL75A.1	3	3	3	-	3	-	-	-	-	-	-	2	-	2
20CSL75A.2	3	3	3	-	3	-	-	-	-	-	-	2	3	2
20CSL75A.3	3	3	3	-	3	-	-	-	-	-	-	-	3	-
20CSL75A.4	3	3	3	-	3	-	-	-	-	-	-	-	3	-
20CSL75A.5	3	3	3	-	3	-	-	2	-	-	-	-	3	-
20CSL75A.6	3	3	3	-	3	-	-	2	-	-	-	-	3	-

Exp. No	Experiment	Hours
1	Consider any ATM system, design and develop a program in a language of your choice for the same. Create the test cases for the following scenarios: Unsuccessful operation due to invalid account type. i) Successful selection of amount to be withdrawn. ii) Expected message due to amount to withdraw is greater than possible balance.. iii) Unsuccessful operation due to enter wrong PIN number 3 times Execute the test cases manually and discuss the result.	**4**

2	Design and develop a program in a language of your choice to solve the triangle problem defined as follows: Accept three integers which are supposed to be the three sides of triangle and determine if the three values represent an equilateral triangle, isosceles triangle, scalene triangle, or they do not form a triangle at all. Create the test cases for the following scenarios:
	     i) Represents not a triangle
	     ii) Represents a valid scalene triangle
	     iii) Represents a valid equilateral triangle
	     iv) Represents a valid isosceles triangle
	Execute the test cases manually and discuss the result.
		4

3	Design, develop, code and run the program in any suitable language to implement the NextDate function. Analyze it from the perspective boundary value testing. Create different test cases based on the following variants, execute the test cases by using Junit and discuss the test results.
	     i) Normal Boundary Value Testing
	     ii) Robust Boundary Value Testing
	     iii) Worst-Case Boundary Value Testing
	     iv) Robust Worst-Case Boundary Value Testing
		4

4	Design, develop, code and run the program in any suitable language to implement the NextDate function. Analyze it from the perspective boundary value testing. Create different test cases, execute these test cases by using JUnit and discuss the test results.
	     i) Weak Normal Equivalence Class Testing
	     ii) Strong Normal Equivalence Class Testing
	     iii) Weak Robust Equivalence Class Testing
	     iv) Strong Robust Equivalence Class Testing
		4

5	Demonstrate White box testing techniques using open source testing tool JUnit and ECLEMMA. Implement and execute test cases for achieving full statement coverage, decision/branch coverage and condition coverage for the triangle program.	4
6	Demonstrate White box testing techniques using open source testing tool JUnit and ECLEMMA. Implement and execute test cases for achieving full statement coverage, decision/branch coverage and condition coverage for Next Date function	4
7	Designing Test Cases using Selenium IDE	2
8	Write an automated selenium script to login into a web page	3
9	Write a test program to list the total number of objects present on a web page	4
10	Write a test program to demonstrate URL and title check point	4
11	Write a test program to demonstrate selecting and deselecting option from multi select dropdown	4
12	Write a test program to demonstrate Synchronization.	4

Reference Material(s):

1.Selenium Web Drive r Practical Guide-Satya Avasarala

CIE – Continuous Internal Evaluation: Theory (25 Marks)

Blooms Taxonomy	Tests
Marks (Out of 25)	**25**
L1: Remember	-
L2: Understand	5
L3: Apply	5
L4: Analyze	5
L5: Evaluate	10
L6: Create	-

SEE – Semester End Examination: Theory (25 Marks)

Blooms Taxonomy	Marks (Out of 25)
L1: Remember	-
L2: Understand	5
L3: Apply	5
L4: Analyze	5
L5: Evaluate	10
L6: Create	-

MOBILE APPLICATION DEVELOPMENT LAB

Course Code	: 20CSL76A	**Credits**	: 2
L: T: P:S	: 0:0:2:0	**CIE Marks**	: 25
Exam Hours	: 3	**SEE Marks**	: 25

Course Outcomes: At the end of the Course, the Student will be able to

20CSL76A.1	Develop single screen mobile applications by setting up Android development environment
20CSL76A.2	Develop mobile applications using Intents
20CSL76A.3	Develop mobile applications using Services
20CSL76A.4	Develop mobile applications using files
20CSL76A.5	Demonstrate methods of storing and retrieving data using Database
20CSL76A.6	Develop mobile applications using SMS and location based services

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20CSL76A.1	3	-	3	-	3	-	-	3	3	-	-	-	3	-
20CSL76A.2	3	3	3	-	3	-	-	3	3	-	-	-	3	-
20CSL76A.3	3	3	3	-	3	-	-	3	3	-	-	-	3	-
20CSL76A.4	3	3	3	-	3	3	-	3	3	-	-	-	3	-
20CSL76A.5	3	3	3	-	3	3	-	3	3	-	-	-	3	-
20CSL76A.6	3	3	3	-	3	-	-	3	3	-	-	-	3	-

Exp. No	Experiment	Hours
1	Develop an Android application using Button, TextView and EditText for designing a Calculator having basic functionality like Addition, Subtraction, Multiplication and Division.	3
2	Develop an Android application that displays information about a small business. Your design must include: • Business name • Photo of business • Contact information and • Description of Business	3
3	Develop an Android application to design a Visiting card. The visiting card should have a company logo at the top right corner. The company name should be displayed in capital letters, aligned to the center. Information like Name of the employee, Designation, Phone number, Address, Email, and the Website address is to be displayed.	3
4	Develop an Android application The Easy Unit Converter using Radio Buttons	3

5	Develop an Android application Currency Converter using Spinners	3
6	Develop an Android application using Explicit intent to display the login page. On giving the wrong credentials it should display the toast message and if credentials are correct it should display Welcome and the username	3
7	Develop an Android application using Implicit intent to display the Gallery and Call buttons. On clicking these buttons, it should goto the respective pages	3
8	Develop an Android application Tourist spot with three activities : Welcome page, Display attractions of tourist spot and Webpage of the tourist spot	3
9	Develop an Android application to play music in background	3
10	Develop an Android applicationHospital Database App using Android. The app should store Hospital ID, Hospital name and location of hospital in a file	3
11	Develop an Android application The Expense Manager using Android. The application should store all the expenses in a file	3
12	Develop an Android applicationStudent Database App using Android. The app should store USN, Student name and Semester of student in SQLite database	3
13	Develop an Android application Health Monitoring App using Android. The app should store Name, Age, blood pressure, blood group and glucose level of patient in SQLite database	3
14	Develop an Android application to display Map of your college locality	3
15	Develop an Android application to alert SMS to one given phone number	3

Reference Material(s):

1. Reto Meier; Professional Android 4 Application Development; Wiley India Pvt.ltd; 1st Edition; 2012; ISBN-13: 9788126525898.

2. www.developer.android.com

CIE – Continuous Internal Evaluation: Theory (25 Marks)

Blooms Taxonomy	Tests
Marks (Out of 25)	**25**
L1: Remember	-
L2: Understand	-
L3: Apply	15
L4: Analyze	5
L5: Evaluate	5
L6: Create	-

SEE – Semester End Examination: Theory (25 Marks)

Blooms Taxonomy	Marks (Out of 25)
L1: Remember	-
L2: Understand	-
L3: Apply	15
L4: Analyze	5
L5: Evaluate	5
L6: Create	-

MINI PROJECT IN MOBILE APPLICATION DEVELOPMENT

Course Code : 20CSE77A		**Credits:**	02
L: T: P:S : 0:0:2:0		**CIE Marks:**	25
Exam Hours : 03		**SEE Marks:**	25

Objectives

1. Student should be able to understand Mobile Application Development concepts
2. Student should be able to implement project based on Mobile Application

Description:

The student shall be capable of identifying a problem related to the field of Computer Science and Engineering and carry out a mini project on the problem defined. Each student to be expected to do the mini project individually. The code developed for the project will be reviewed by panel of experts 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 student will submit a project report, which will be evaluated by duly appointed examiner(s).

Evaluation Stages:

Activity	Evaluation Attribute
Synopsis Submission	Problem Statement
Review-I	Algorithm of the project and outline design of project
Review-II	Partial code development and or partial execution
Review-III	Final Implementation PPT (10-12 slides) + Results verification + Report Submission in defined format

Sample Mini Projects (Mobile based Applications):

1. Pizza Delivery
2. GPS based Search
3. Hospital Management
4. Billing Management system
5. Interdisciplinary application

CIE - Continuous Internal Evaluation (25 Marks)

Bloom's Taxonomy	Mini Project
Marks (Out of 25)	-
Remember	-
Understand	5
Apply	5
Analyze	5
Evaluate	5
Create	5

SEE – Semester End Examination (25 marks)

Bloom's Taxonomy	Mini Project
Remember	-
Understand	5
Apply	5
Analyze	5
Evaluate	5
Create	5

PROJECT PHASE- I

Course Code	: 20CSE78A	**Credits**	: 2
L: T: P:S	: 0:0:2:0	**CIE Marks**	: 25
Exam Hours	: 3	**SEE Marks**	: 25

Course Outcomes: At the end of the Course, the Student will be able to

CO #	COURSE OUTCOMES
20CSE78A.1	Identify societal problems and classify them under different domains of computer science and engineering.
20CSE78A.2	Demonstrate the ability to locate and use technical information from multiple sources.
20CSE78A.3	Analyze existing literature and formulate the problem statement.
20CSE78A.4	Formulate an algorithm to solve the problem.
20CSE78A.5	Design the models for the proposed system.
20CSE78A.6	Demonstrate their communication skill effectively with the technical presentation.

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20CSE78A.1	3	3	-	-	-	3	-	-	3	3	1	-	-	3
20CSE78A.2	3	3	3	-	-	3	-	-	3	3	-	-	-	3
20CSE78A.3	3	3	3	-	-	3	-	1	3	3	-	-	-	3
20CSE78A.4	3	3	3	2	2	-	-	-	3	3	-	1	2	3
20CSE78A.5	3	3	3	2	2	-	-	-	3	3	-	-	2	3
20CSE78A.6	3	-	-	-	-	-	-	-	3	3	-	-	-	3

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) Identify the Problem and choose the specific project topic which will reflect the common interests and expertise of the student and supervisor.
2) Perform a literature search to review current knowledge and developments in the chosen technical area.
3) Conduct a Feasibility study of the Project.
4) Submit the main Project Proposal.

CIE - Continuous Internal Evaluation (50 Marks)

Bloom's Taxonomy	Project
Marks (Out of 50)	
Remember	-
Understand	10
Apply	20
Analyze	20
Evaluate	-
Create	-

SEE – Semester End Examination (50 marks)

Bloom's Taxonomy	Project
Marks (Out of 50)	
Remember	-
Understand	10
Apply	20
Analyze	20
Evaluate	-
Create	-

PATTERN RECOGNITION

Course Code	: 20CSE811A	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

CO #	COURSE OUTCOME
20CSE811A.1	Describe areas where Pattern Recognition and Machine Learning can offer a solution.
20CSE811A.2	Describe strength and limitations of data transformation and dimensionality reduction
20CSE811A.3	Describe genetic algorithms, validation methods and sampling techniques.
20CSE811A.4	Apply model data to solve problems in regression and classification.
20CSE811A.5	Apply linear and non-linear classifier for supervised tasks.

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20CSE811A.1	3	3	3	3	-	-	-	-	-	-	-	-	3	-
20CSE811A.2	3	3	3	3	-	-	-	-	-	-	-		3	-
20CSE811A.3	3	3	3	3	3	-	-	-	-	-	-	3	3	-
20CSE811A.4	3	3	3	3	3	-	-	-	-	-	-	3	3	-
20CSE811A.5	3	3	3	3	3	-	-	-	-	-	-	3	3	-

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

Module No	Module Contents	Hours	COs
1	**Introduction:** Importance of pattern recognition, Features, Feature Vectors, and Classifiers, Supervised, Unsupervised, and Semi-supervised learning, Introduction to Bayes Decision Theory, Discriminant Functions and Decision Surfaces, Gaussian PDF and Bayesian Classification for Normal Distributions. L1, L2	7	CO1
2	**Data Transformation and Dimensionality Reduction:** Introduction, Basis Vectors, The KarhunenLoeve (KL) Transformation, Singular Value Decomposition, Independent Component Analysis (Introduction only). Nonlinear Dimensionality Reduction, Kernel PCA. L1, L2	8	CO2
3	**Estimation of Unknown Probability Density Functions:** Maximum Likelihood Parameter Estimation, Maximum a Posteriori Probability estimation, Bayesian Interference, Maximum Entropy Estimation, Mixture Models, Naive-Bayes Classifier, The Nearest Neighbor Rule. L1, L2, L3	9	CO3
4	**Linear Classifiers:** Introduction, Linear Discriminant Functions and Decision Hyperplanes, The Perceptron Algorithm, Mean Square Error Estimate, Stochastic Approximation of LMS Algorithm, Sum of Error Estimate. L1, L2, L3	8	CO4, CO5

5	**Nonlinear Classifiers:** The XOR Problem, The two Layer Perceptron, Three Layer Perceptron, Back propagation Algorithm, Basic Concepts of Clustering, Introduction to Clustering , Proximity Measures. L1, L2, L3.	8	CO4, CO5

Text Books:
1. Pattern Recognition: Sergios Theodoridis, Konstantinos Koutroumbas, Elsevier India Pvt. Ltd (Paper Back), 4th edition.
2. Pattern Recognition and Image Analysis Earl Gose: Richard Johnsonbaugh, Steve Jost, ePub eBook.

Reference Books:
1. The Elements of Statistical Learning: Trevor Hastie, Springer-Verlag New York, LLC (Paper Back), 2009.
2. Pattern Classification: Richard O. Duda, Peter E. Hart, David G. Stork. John Wiley & Sons, 2012.

Continuous Internal Evaluation: Theory (50 Marks)

Bloom's Taxonomy	Tests	Assignments	Quizzes	Co-curricular
Marks (Out of 50)	**25**	**10**	**5**	**10**
Remember	5	2.5	2.5	
Understand	5	2.5	2.5	5
Apply	15	5		5
Analyze	-	-	-	-
Evaluate	-	-		-
Create	-	-	-	-

SEE – Semester End Examination: Theory (50 Marks)

Bloom's Taxonomy	Tests
Marks (Out of 50)	
Remember	10
Understand	15
Apply	25
Analyze	-
Evaluate	-
Create	-

ADVANCED DATABASES

Course Code: 20CSE812A   **Credits   : 03**
L:T:P:S   : 3:0:0:0   **CIE Marks : 50**
Exam Hours: 03   **SEE Marks: 50**

Course Outcomes: At the end of the Course, the Student will be able to

CO#	COURSE OUTCOME
20CSE812A.1	Understand the Overview of Storage and Indexing, Disks and Files
20CSE812A.2	Apply Tree Structured indexing concepts to perform different operations.
20CSE812A.3	Analyze and Apply Hash Based Indexing concepts to different scenario.
20CSE812A.4	Evaluating queries using external sorting algorithms
20CSE812A.5	Evaluating queries based on relational operators.
20CSE812A.6	Inferring phases of physical database design and tuning.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20CSE812A.1	3	-	-	-	-	-	-	-	-	-	-	2	2	3
20CSE812A.2	3	3	-	-	-	-	-	-	-	-	-	-	-	3
20CSE812A.3	3	3	3	-	-	-	-	-	-	-	-	-	-	3
20CSE812A.4	3	3	3	2	-	-	-	-	-	-	-	-	-	3
20CSE812A.5	3	3	3	2	-	-	-	-	-	-	-	-	2	-
20CSE812A.6	3	3	3	2	-	-	-	-	-	-	-	2	-	-

Course contents:

Module	Contents of the Module	Hour	COs
1	**Overview of Storage and Indexing, Disks and Files**: Data on external storage; File organizations and indexing; Index data structures; Comparison of file organizations; Indexes and performance tuning Memory hierarchy; RAID; Disk space management; Buffer manager; Files of records; Page formats and record formats.	9	20CSE812A.1
2	**Tree Structured Indexing:** Intuition for tree indexes; Indexed sequential access method; B+ trees, Search, Insert, Delete, Duplicates, B+ trees in practice. **Hash-Based Indexing**: Static hashing; Extendible hashing, Linear hashing, comparisons.	9	20CSE812A.2 20CSE812A.3
3	**Overview of Query Evaluation, External Sorting**: The system catalo Introduction to operator evaluation; Algorithms for relational operation Introduction to query optimization; Alternative plans: A motivating exampl what a typical optimizer does. When does a DBMS sort data? A simple two-wa merge sort; External merge sort	9	20CSE812A.4
4	**Evaluating Relational Operators:** The Selection operation; General selection conditions; The Projection operation; The Join operation; The Set operations; Aggregate operations; The impact of buffering. **More Recent Applications**: Mobile databases; Multimedia databases, geographical Information Systems., Genome data management	9	20CSE812A.5

5	**Physical Database Design and Tuning**: Introduction; Guidelines for index selection, examples; Clustering and indexing; Indexes that enable index-only plans; Tools to assist in index selection; Overview of database tuning; Choices in tuning the conceptual schema; Choices in tuning queries and views; Impact of concurrency; DBMS benchmarking.	9	20CSE812A.6

Text Books:
1) Raghu Ramakrishnan and Johannes Gehrke: Database Management Systems, 3rd Edition, McGraw-Hill, 2003.
2) Elmasri and Navathe: Fundamentals of Database Systems, 5th Edition, Pearson Education, 2007.

Reference books:

1) Connolly and Begg: Database Systems, 4th Edition, Pearson Education, 2002.

CIE- Continuous Internal Evaluation (50Marks)

Bloom's Category	Tests	Assignments	Quizzes	Co Curricular
Marks (out of 50)	**25**	**10**	**5**	**10**
Remember		-	-	
Understand	5	-	-	
Apply	-	5	2.5	5
Analyze	5	5	2.5	5
Evaluate	5	-	-	
Create	10	-	-	

SEE- Semester End Examination: Theory (50 Marks)

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

MOBILE COMPUTING

Course Code	: 20CSE813A	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

CO #	COURSE OUTCOME
20CSE813A.1	Analyze the concepts of mobile computing and communication technologies
20CSE813A.2	Demonstrate the generations of telecommunication systems in wireless networks
20CSE813A.3	Identify the use of Mobile IP and its functionality
20CSE813A.4	Examine the working principles of adhoc routing
20CSE813A.5	Analyze the functionality of Transport and Application layers
20CSE813A.6	Differentiate available mobile platforms and its application

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20CSE813A.1	3	-	-	-	-	-	-	3	-	-	-	-		3
20CSE813A.2	3	3	-	-	-	-	-	-	-	-	-	-	3	-
20CSE813A.3	3	3	-	3	-		-	-	-	-	-	-	3	-
20CSE813A.4	3	3	-	2	-	3	-	-	-	-	-	-	3	-
20CSE813A.5	3	-	-	-	-	3	-	-	-	-	-	-	3	-
20CSE813A.6	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 Mobile Computing – Challenges in mobile computing, coping with uncertainties, resource poorness, bandwidth, etc. Applications of Mobile Computing- Generations of Mobile Communication Technologies- Multiplexing – Spread spectrum -MAC Protocols – SDMA- TDMA- FDMA- CDMA	9	CO1
2	**MOBILE TELECOMMUNICATION SYSTEM:** Introduction to Cellular Systems – GSM – Mobile Services & Architecture , Radio Interface – Protocols – Localization and calling, Connection Establishment – Frequency Allocation – Routing – Mobility Management – Security – GPRS- UMTS – Basic Architecture – Handover – Security	9	CO2

3	**MOBILE NETWORK LAYER:** **Mobile IP:** Goals, assumptions and requirements, Entities and Terminology, IP packet delivery, Agent advertisement and discovery, Registration, Tunneling and Encapsulation, Optimizations, Reverse tunneling, Ipv6; Dynamic host configuration protocol (DHCP), **Ad hoc networks: Routing.**– AdHoc– Proactive protocol-DSDV, Reactive Routing Protocols – DSR, AODV , Hybrid routing –ZRP, Multicast Routing- ODMRP, Vehicular Ad Hoc networks (VANET) –MANET Vs VANET	10	CO3 CO4
4	**MOBILE TRANSPORT AND APPLICATION LAYER:** Traditional TCP: Congestion control, Slow start, Fast retransmit/fast recovery, Implications on mobility; Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/fast recovery, Transmission/timeout freezing, Selective retransmission, Transaction oriented TCP. WAP – Architecture – WDP – WTLS – WTP – WSP – WAE – WTA Architecture – WML	9	C05
5	**MOBILE PLATFORMS AND APPLICATIONS:** Mobile Device Operating Systems – Special Constraints & Requirements – Commercial Mobile Operating Systems – **Software Development Kit**: iOS, Android, BlackBerry, Windows Phone – **Mobile Commerce** – Applications, Structure – Pros & Cons – Mobile Payment System – Security Issue	8	CO6

Text Books:

1. Jochen Schiller, ―Mobile Communications , PHI, Second Edition, 2003.
2. Prasant Kumar Pattnaik, Rajib Mall, ―Fundamentals of Mobile Computing , PHI Learning Pvt.Ltd, New Delhi – 2012
3. Frank Adelstein, S.K.S. Gupta, Golden G. Richard III and Loren Schwiebert, "Fundamentals of Mobile and Pervasive Computing", McGraw-Hill Professional.

Reference Books:

1. Charles Perkins, "Ad hoc Networks", Addison Wesley.
2. David Taniar, "Mobile Computing: Concepts, Methodologies, Tools, and Applications".
3. Asoke. K Talukder, Roopa R. Yavagal, Asoke K. Talukder, "Mobile Computing".
4. J. Schiller, "Mobile Communications", Addison Wesley.
5. Dharma Prakash Agarval, Qing and An Zeng, "Introduction to Wireless and Mobile systems",Thomson Asia Pvt Ltd, 2005.
6. Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, ―Principles of Mobile Computing , Springer, 2003.
7. William.C.Y.Lee,―Mobile Cellular Telecommunications-Analog and Digital Systems , Second Edition,TataMcGraw Hill Edition ,2006.
8. C.K.Toh, ―AdHoc Mobile Wireless Networks , First Edition, Pearson Education, 2002.

Continuous Internal Evaluation: Theory (50 Marks)

Bloom's Taxonomy	Tests	Assignments	Quizzes	Co Curricular
Marks (Out of 50)	25	10	5	10
Remember	-	-	-	-
Understand	-	-	2.5	-
Apply	10	-	2.5	5
Analyze	5	5	-	5
Evaluate	5	5	-	-
Create	5		-	

SEE – Semester End Examination: Theory (50 Marks)

Bloom's Taxonomy	Tests
Marks (Out of 50)	
Remember	5
Understand	5
Apply	15
Analyze	10
Evaluate	10
Create	5

MULTICORE ARCHITECTURE

Course Code: 20CSE814A
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
20CSE814A.1	Describe Multicore Architectures and identify their characteristics and challenges
20CSE814A.2	Program parallel Processors
20CSE814A.3	Develop Programs using OpenMP and MPI
20CSE814A.4	Design parallel Programming solutions to common Problems
20CSE814A.5	Performance Evolution of MPI
20CSE814A.6	Compare and Contrast programming for serial processors and programming for parallel processors

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20CSE814A.1	1	2	2	2	-	-	-	-	-	-	1	-	2	2
20CSE814A.2	2	2	2	1	-	-	-	-	-	-	-	-	3	-
20CSE814A.3	1	2	2	2	-	-	-	-	-	-	1	-	2	-
20CSE814A.4	2	3	3	2	-	-	-	-	-	-	1	2	2	-
20CSE814A.5	2	1	3	1	-	-	-	-	-	2	-	2	3	2
20CSE814A.6	3	3	3	3	-	-	-	-	-	-	-	2	3	1

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

Module No	Module Contents	Hours	COs
1	**MULTI-CORE PROCESSORS:** Single core to Multi-core architectures – SIMD and MIMD systems – Interconnection networks - Symmetric and Distributed Shared Memory Architectures – Cache coherence - Performance Issues – Parallel program design	8	CO1
2	**PARALLEL PROGRAM CHALLENGES:** Performance – Scalability – Synchronization and data sharing – Data races – Synchronization primitives (mutexes, locks, semaphores, barriers) – deadlocks and livelocks – communication between threads (condition variables, signals, message queues and pipes).	9	CO2
3	**SHARED MEMORY PROGRAMMING WITH OpenMP :** OpenMP Execution Model – Memory Model – OpenMP Directives – Work-sharing Constructs - Library functions – Handling Data and Functional Parallelism – Handling Loops - Performance Considerations.	9	CO3

4	**DISTRIBUTED MEMORY PROGRAMMING WITH MPI:** MPI program execution – MPI constructs – libraries – MPI send and receive – Point-to-point and Collective communication – MPI derived data types – Performance evaluation	**9**	**CO4,CO5**
5	**PARALLEL PROGRAM DEVELOPMENT:** Case studies - n-Body solvers – Tree Search – OpenMP and MPI implementations and comparison	**9**	**CO6**

Text Books:

1. Peter S. Pacheco, "An Introduction to Parallel Programming", Morgan-Kauffman/Elsevier, 2011.

2. Darryl Gove, "Multicore Application Programming for Windows, Linux, and Oracle Solaris", Pearson, 2011

3. Michael J Quinn, "Parallel programming in C with MPI and OpenMP", Tata McGraw Hill, 2003. 2. Shameem Akhter and Jason Roberts, "Multi-core Programming", Intel Press, 2006.

Reference Books:

1. Shameem Akhter and Jason Roberts, "Multi-core Programming", Intel Press, 2006.

2. John L. Hennessey and David A. Patterson, "Computer architecture – A quantitative approach", Morgan Kaufmann / Elsevier Publishers, 4th edition, 2007.

3. https://www.open-mpi.org/ and http://www.openmp.org/

Continuous Internal Evaluation: Theory (50 Marks)

Bloom's Taxonomy	Tests	Assignments	Quizzes	Co Curricular
Marks (Out of 50)	25	10	5	10
Remember	5	-	-	-
Understand	5	-	-	-
Apply	5	5	2.5	5
Analyze	-	-	2.5	5
Evaluate	-	-	-	-
Create	10	5	-	-

SEE – Semester End Examination: Theory (50 Marks)

Bloom's Taxonomy Marks (Out of 50)	Tests
Remember	10
Understand	10
Apply	20
Analyze	-
Evaluate	-
Create	10

ETHICAL HACKING AND PREVENTION

Course Code : 20CSE821A		**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

CO#	COURSE OUTCOME
20CSE821A.1	Understand and apply the fundamentals of hacking techniques.
20CSE821A.2	Apply different hacking strategies from business perspective.
20CSE821A.3	Analyze the different hacking techniques for real time scenarios.
20CSE821A.4	Gain the knowledge of the use and availability of tools to support an ethical hacking
20CSE821A.5	Interpret results of defense planning and mitigation.
20CSE821A.6	Analyze various dangers associated with ethical hacking.

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20CSE821A.1	3	-	-	-	-	-	-	2	-	2	-	3	3	-
20CSE821A.2	3	-	2	2	-	3	-	3	-	3	-	-	2	2
20CSE821A.3	3	3	3	-	-	3	-	3	-	-	-	-	2	3
20CSE821A.4	3	-	-	-	3	-	-	2	-	-	-	-	-	-
20CSE821A.5	3	2	-	-	-	-	-	2	-	3	-	-	-	2
20CSE821A.6	3	3	-	2	-	3	-	3	-	-	-	-	-	-

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

Module No	Module Contents	Hours	COs
1	**Introduction** :Hacking Impacts, The Hacker Framework: Planning the test, Sound Operations, Reconnaissance, Enumeration, Vulnerability Analysis, Exploitation, Final Analysis, Deliverable, Integration Information Security Models: Computer Security, Network Security, Service Security, Application Security, Security Architecture Information Security Program: The Process of Information Security, Component Parts of Information Security Program, Risk Analysis and Ethical Hacking	9	**20CSE821A.1**
2	**The Business Perspective**: Business Objectives, Security Policy, Previous Test Results, Business Challenges Planning for a Controlled Attack: Inherent Limitations, Imposed Limitations, Timing is Everything, Attack Type, Source Point, Required Knowledge, Multi-Phased Attacks, Teaming and Attack Structure, Engagement Planner, The Right Security Consultant, The Tester, Logistics, Intermediates, Law Enforcement	9	**20CSE821A.2**
3	**Preparing for a Hack**: Technical Preparation, Managing the Engagement Reconnaissance: Social Engineering, Physical Security, Internet Reconnaissance	9	**20CSE821A.3**

| 4 | **Enumeration**: Enumeration Techniques, Soft Objective, Looking Around or Attack, Elements of Enumeration, Preparing for the Next Phase Exploitation: Intutive Testing, Evasion, Threads and Groups, Operating Systems, Password Crackers, RootKits, applications, War dialing, Network, Services and Areas of Concern | 9 | **20CSE821A.4** |
| 5 | **Deliverable**: The Deliverable, The Document, Overall Structure, Aligning Findings, Presentation Integration: Integrating the Results, Integration Summary, Mitigation, Defense Planning, Incident Management, Security Policy, Conclusion | 9 | **20CSE821A.5**

20CSE821A.6 |

Text Books:

1. James S. Tiller, "The Ethical Hack: A Framework for Business Value Penetration Testing", Auerbach Publications, CRC Press

Reference Books:

1. EC-Council, "Ethical Hacking and Countermeasures Attack Phases", Cengage Learning

2. Michael Simpson, Kent Backman, James Corley, "Hands-On Ethical Hacking and Network Defense", Cengage Learning

Continuous Internal Evaluation: Theory (50 Marks)

Bloom's Taxonomy	**Tests**	**NPTEL**
Marks (Out of 50)	**25**	**25**
Remember	-	-
Understand	10	-
Apply	20	15
Analyze	10	10
Evaluate	10	--
Create	-	

SEE – Semester End Examination: Theory (50 Marks)

Bloom's Taxonomy	**Tests**
Marks (Out of 50)	
Remember	-
Understand	10
Apply	20
Analyze	10
Evaluate	10
Create	-

GREEN COMPUTING

Course Code: 20CSE822A   Credits   : 03
L:T:P:S   : 3:0:0:0   CIE Marks: 50
Exam Hours: 03   SEE Marks: 50

Course Outcomes: At the end of the course, student will be able to:

20CSE822A.1	Discuss Green IT with its different dimensions and Strategies
20CSE822A.2	Describe Green devices and hardware along with its green software methodologies
20CSE822A.3	Discuss the various green enterprise activities, functions and their role with IT.
20CSE822A.4	Describe the concepts of how to manage the green IT with necessary components.
20CSE822A.5	Discuss the various laws, standards and protocols for regulating green IT.
20CSE822A.6	Identify the various key sustainability and green IT trends.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20CSE822A.1	3	3	3	-	-	-	3	3	3	3	-	-	3	3
20CSE822A.2	3	3	3	-	-	-	3	3	3	3	-	-	3	3
20CSE822A.3	3	3	3	-	-	-	3	3	3	3	-	-	3	3
20CSE822A.4	3	3	3	-	-	-	3	3	3	3	-	-	3	3
20CSE822A.5	3	3	3	-	-	-	3	3	3	3	-	-	3	3
20CSE822A.6	3	3	3	-	-	-	3	3	3	3	-	-	3	3

Module No	Contents of Module	Hrs	COs
1	**Green IT: An Overview :**Introduction, Environmental Concerns and Sustainable Development, Environmental Impacts of IT, Green IT, Holistic Approach to Greening IT, Greening IT, Applying IT for enhancing Environmental sustainability, Green IT Standards and Eco-Labelling of IT, Enterprise Green IT strategy, Green IT: Burden or Opportunity?	8	CO1
2	**Green Devices and Hardware with Green Software :** Green Devices and Hardware: Introduction, Life Cycle of a device or hardware, Reuse, Recycle and Dispose. Green Software: Introduction, Energy-saving software techniques, Evaluating and Measuring software Impact to platform power.	12	CO2
3	**Green Enterprises and the Role of IT**: Introduction, Organization and Enterprise Greening, Information systems in Greening Enterprises, Greening Enterprise: IT Usage and Hardware, Inter-Organizational Enterprise activities and Green Issues, Enablers and making the case for IT and Green Enterprise.	8	CO3
4	**Managing Green IT :** Introduction, Strategizing Green Initiatives, Implementation of Green IT, Information Assurance, Communication and Social media. **Regulating the Green IT:** Laws, Standards and Protocols Introduction, The regulatory environment and IT manufacturers, Non regulatory	9	CO4, CO5

5	**Green IT: An Outlook:** Introduction, Awareness to implementations, Greening by IT, Green IT: A megatrend?, A seven-step approach to creating green IT strategy, Research and Development directions.	8	CO6

Continued from previous (top of table):

	government initiatives, Industry associations and standards bodies, Green building standards, Green data centres, Social movements and Greenpeace.		

TEXT BOOKS
1. San Murugesan, G.R. Gangadharan, "Harnessing Green IT Principles and Practices", Wiley Publication, 2012. ISBN:9788126539680
2. Woody Leonhard, Katherrine Murray, "Green Home computing for dummies", August2009, ISBN: 978-0-470-46745-9
3. Alvin Galea, Michael Schaefer, Mike Ebbers, "Green Data Center: steps for the Journey", Shoff/IBM rebook, 2011. ISBN: 10: 1-933742-05-4; 13: 978-1-933742-05-2
4. John Lamb, "The Greening of IT", Pearson Education, 2009, ISBN 10: 0137150830

REFERENCE BOOKS
1. Jason Harris, "Green Computing and Green IT- Best Practices on regulations & industry",Lulu.com, 2008, ISBN: 1558604898.
2. Bud E. Smith, "Green Computing Tools and Techniques for Saving Energy, Money and Resources", CRC Press, 2014, 9781466503403.

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Taxonomy	Tests	NPTEL
Marks (Out of 50)	**25**	**25**
Remember	-	-
Understand	10	-
Apply	20	15
Analyze	10	10
Evaluate	10	-
Create	-	-

SEE- Semester End Examination (50 Marks)

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

DATA COMPRESSION

Course Code : 20CSE823A		**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

CO #	COURSE OUTCOME
20CSE823A.1	Understand and apply the basic compression techniques
20CSE823A.2	Analyze the concepts of compressing text using dictionary based methods
20CSE823A.3	Compare and contrast various image compression techniques
20CSE823A.4	Analyze and apply various video compression techniques
20CSE823A.5	Evaluate the various techniques in audio compression
20CSE823A.6	Evaluate and recommend appropriate compression method

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20CSE823A.1	3	3	3	-	-	-	-	-	-	-	-	1	3	-
20CSE823A.2	3	3	3	-	-	-	-	-	-	-	-	-	3	-
20CSE823A.3	3	3	3	3	-	-	-	-	-	-	-	-	3	-
20CSE823A.4	3	3	3	3	-	-	-	-	-	-	-	-	3	-
20CSE823A.5	3	3	3	3	-	-	-	-	-	-	-	-	3	-
20CSE823A.6	3	3	3	3	-	-	-	-	-	-	-	-	3	-

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

Module No	Module Contents	Hours	COs
1	**Basic Techniques**: Intuitive Compression, Run-Length Encoding, RLE Text Compression, RLE Image Compression, Move-to-Front Coding, Scalar Quantization, Recursive Range Reduction. **Statistical Methods**: Information Theory Concepts, Variable-Size Codes, Prefix Codes, Tunstall Code, The Golomb Code, The Kraft-MacMillan Inequality, Shannon-Fano Coding, Huffman Coding, Adaptive Huffman Coding, MNP5, MNP7, Reliability, Facsimile Compression, Arithmetic Coding, Adaptive Arithmetic Coding, The QM Coder, Text Compression, PPM, Context-Tree Weighting	10	CO1

2	**Dictionary Methods**: String Compression, Simple Dictionary Compression, LZ77 (Sliding Window), LZSS, Repetition Times, LZX, GIF Images, RAR and WinRAR, The V.42bis Protocol, Various LZ Applications, Deflate: Zip and Gzip, LZMA and 7-Zip, PNG. **Image Compression**: Introduction, Approaches to Image Compression, Intuitive Methods, Image Transforms , Orthogonal Transforms, The Discrete Cosine Transform, Test Images, JPEG	9	CO2 CO3
3	**Video Compression:** Analog Video, Composite and Components Video, Digital Video, Video Compression, MPEG, MPEG-4, H.261, H.264	8	CO4
4	**Audio Compression:** Sound, Digital Audio, The Human Auditory System, WAVE Audio Format, µ-Law and A-Law Companding, ADPCM Audio Compression, MLP Audio, Speech Compression, MPEG-4 Audio Lossless Coding (ALS), MPEG-1/2 Audio Layers , Advanced Audio Coding (AAC), Dolby AC-3	9	CO5
5	**Other Methods:** The Burrows-Wheeler Method, Symbol Ranking, ACB, Sort-Based Context Similarity, Sparse Strings, Word-Based Text Compression, Textual Image Compression, Dynamic Markov Coding, FHM Curve Compression, Sequitur	9	CO6

Text Books:
1. Data Compression- The Complete Reference, David Salomon, Fourth Edition, Springer

Reference Books:
1. Introduction to Data Compression, Khalid Sayood, Third Edition, Elsevier.
2. Text Compression, Timothy C. Bell, First Edition, Prentice Hall

Continuous Internal Evaluation: Theory (50 Marks)

Bloom's Taxonomy	Tests	NPTEL
Marks (Out of 50)	25	25
Remember	-	-
Understand	5	-
Apply	10	15
Analyze	5	10
Evaluate	5	-
Create	-	-

SEE – Semester End Examination: Theory (50 Marks)

Bloom's Taxonomy	Tests
Marks (Out of 50)	
Remember	10
Understand	10
Apply	10
Analyze	10
Evaluate	10
Create	-

COGNITIVE AND LEARNING SCIENCE

Course Code	: 20CSE824A	**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

CO #	COURSE OUTCOME
20CSE824A.1	Know the subject and apply the main concepts of cognitive science, its fields, connections with other disciplines, and how it bridges knowledge from multiple perspectives.
20CSE824A.2	Analyze the theories of vision and pattern recognition in the field of cognitive science
20CSE824A.3	Analyze the advanced memory models in the field of cognitive science
20CSE824A.4	Analyze the advanced imagery and problem solving models in the field of cognitive science
20CSE824A.5	Apply artificial intelligence models in accordance with the research task.
20CSE824A.6	Apply and evaluate robots as ultimate intelligent agents.

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20CSE824A.1	3	-	-	-	-	-	-	-	-	3	-	-	-	-
20CSE824A.2	3	3	-	-	-	2	-	-	-	3	-	-	-	-
20CSE824A.3	3	3	-	-	-	-	-	-	-	3	–	–	-	-
20CSE824A.4	3	3	-	-	-	2	-	-	-	3	-	-	-	-
20CSE824A.5	3	3	-	1	-	-	-	–	–	3	-	–	–	-
20CSE824A.6	3	3	-	-	-	-	-	-	–	3	-	–	–	-

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

Module No	Module Contents	Hours	COs
1	**Introduction**: What Is Cognitive Science, Representation - Digital Representations, Analog Representations, The Dual-Coding Hypothesis, Propositional Representations, Computation - The Tri-Level Hypothesis, The Classical and Connectionist Views of Computation, The Interdisciplinary Perspective - The Philosophical Approach, The Psychological Approach, The Cognitive Approach, The Neuroscience Approach, The Network Approach, The Evolutionary Approach, The Linguistic Approach, The Artificial Intelligence Approach, The Robotics Approach	9	CO1
2	**The Cognitive Approach I**: History, Vision, and Attention - The Rise of Cognitive Psychology, The Cognitive Approach, Modularity of Mind, Theories of Vision and Pattern Recognition - Template Matching Theory, Feature Detection Theory, A Computational Theory of Vision, Feature Integration Theory, Theories of Attention - Broadbent's Filter Model, Treisman's Attenuation Model, The Deutsch-Norman Memory Selection Model, The Multimode Model of Attention, Kahneman's Capacity Model of Attention	9	CO2

3	**The Cognitive Approach** II: Memory, Imagery, and Problem Solving - Types of Memory - Sensory Memory, Working Memory, Long-Term Memory, Memory Models - The Modal Model, The ACT* Model, The Working Memory Model, Visual Imagery - The Kosslyn and Schwartz Theory of Visual Imagery, Image Structures, Image Processes, The Imagery Debate, Problem Solving - The General Problem Solver Model The SOAR Model, Overall Evaluation of the Cognitive Approach	9	CO3, CO4
4	**Artificial Intelligence** - Operational Perspective Introduction The Practical World of Artificial Intelligence, Approaches to the Design of Intelligent Agents, Machine Intelligence, Knowledge, and Machine Reasoning, Machine Representation of Knowledge, Machine Reasoning , Logical Reasoning (Deduction, Abduction, Induction) Inductive Reasoning, Expert Systems, Fuzzy Logic, Artificial Neural Nets (ANNs), Overall Evaluation of the Operational Perspective	9	CO5
5	**Robotics**: The Ultimate Intelligent Agents - Introduction, Some Robotic Achievements, Evaluating Robotic Potentials, Biological and Behavioral Foundations of Robotic Paradigms, Foundations of Robotic Paradigms, Robotic Paradigms - Hierarchical Paradigm, The Reactive Paradigm, The Hybrid Deliberative/Reactive Paradigm, Overall Evaluation of Robots as Ultimate Intelligent Agents	9	CO6

Text Books:
1. Cognitive Science – An Introduction to the study of mind, Jay Friedenberg, Gordon Silverman, SAGE Publications, 2006
2. Foundation of Cognitive Science-Mind, Body, World, Michael R W Dawson, AU Press, 2013

Reference Books:
1. Cognitive Science: An Introduction to the Science of the Mind, José Luis Bermúdez, Cambridge University Press, 2013

CIE – Continuous Internal Evaluation: Theory (50 Marks)

Blooms Taxonomy	Tests	NPTEL
Marks (Out of 50)	**25**	**25**
L1: Remember	5	-
L2: Understand	5	
L3: Apply	10	15
L4: Analyze	5	10
L5: Evaluate	-	-
L6: Create	-	-

SEE – Semester End Examination: Theory (50 Marks)

Blooms Taxonomy	Marks (Out of 50)
L1: Remember	10
L2: Understand	10
L3: Apply	20
L4: Analyze	10
L5: Evaluate	-
L6: Create	-

INTERNSHIP

Course Code	: 20CSE83A	**Credits:**	**04**
L: T: P:S	: 0:0:4:0	**CIE Marks:**	**50**
Exam Hours	: 03	**SEE Marks:**	**50**

Objectives
1. Students should be able to understand advanced application development concepts
2. Students should be able to implement technical module/unit as project as per industry requirements

Description:

The student shall be capable of identifying a problem related to the field of Computer Science and Engineering and carry out an internship on the problem defined. The code developed during the internship will be reviewed by a panel of experts. Plagiarized implementation will automatically get an **"F" GRADE** and the student will be liable for further disciplinary action. At the completion of an internship the student will submit a report, which will be evaluated by duly appointed examiner(s).

Evaluation Stages:

Activity	Evaluation Attribute
Abstract Submission	Problem Statement
Review-I	Algorithm and outline design
Review-II	Partial code development and or partial execution
Review-III	Final Implementation PPT(10-12 slides) + Results verification + Report Submission in defined format

Some of application domains:
1) Healthcare
2) Surveillance and security
3) Enterprises Resource Planning
4) Data Management & application
5) Interdisciplinary application, etc.,

CIE - Continuous Internal Evaluation (50 Marks)

Bloom's Taxonomy	Internship
Remember	-
Understand	10
Apply	10
Analyze	10
Evaluate	10
Create	10

SEE – Semester End Examination (50 marks)

Bloom's Taxonomy	Internship
Remember	-
Understand	10
Apply	10
Analyze	10
Evaluate	10
Create	10

PROJECT

Course Code	: 20CSE84A	**Credits**	: 10
L: T: P:S	:0:0:10:0	**CIE Marks**	: 100
Exam Hours	: 3	**SEE Marks**	: 100

Course Outcomes: At the end of the Course, the Student will be able to

20CSE84A.1	Prepare the students to solve/work on the real world/ Practical/Theoretical problems involving issues in computer science and Engineering
20CSE84A.2	Summarize their work by proper Software Engineering Documents after evaluating the testing plans
20CSE84A.3	Practice presentations, Communications and team work skills.
20CSE84A.4	Learn and develop new concepts in multidisciplinary area
20CSE84A.5	Use different Programming languages/software tools/ Hardware technologies
20CSE84A.6	Apply algorithmic strategies while solving problems

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
20CSE84A.1	3	3	3	3	3	2	3	3	3	3	3	2	3	3
20CSE84A.2	3	3	3	3	3	2	3	3	3	3	3	2	3	3
20CSE84A.3	3	3	3	3	3	-	-	3	3	3	3	2	3	3
20CSE84A.4	3	3	3	3	3	2	3	3	3	3	3	2	3	3
20CSE84A.5	3	3	3	3	3	2	-	3	3	3	3	2	3	3
20CSE84A.6	3	3	3	3	3	-	-	3	3	3	-	2	3	3

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) Undertake the detailed technical work in the chosen area.
2) Design the Architecture of the System
3) Produce progress reports or maintain a professional journal to establish work completed, and to schedule additional work within the time frame specified for the project.
4) Prepare an interim report describing the work undertaken and results obtained so far
5) Demonstrate the Complete working of the Project with results of all modules.
6) Present the work in a forum involving poster presentations and demonstrations of operational hardware and software.

CIE - Continuous Internal Evaluation (50 Marks)

Bloom's Taxonomy Marks (Out of 50)	Project
Remember	-
Understand	10
Apply	10
Analyze	10
Evaluate	10
Create	10

SEE – Semester End Examination (50 marks)

Bloom's Taxonomy Marks (Out of 50)	Project
Remember	-
Understand	10
Apply	10
Analyze	10
Evaluate	10
Create	10