Data Analytics using Python			
Course Code	**22MCA31**	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Learning objectives:
- Explain the basic of Python programming
- Design real time application using Python collection Objects and classes
- Familiarize the concept of Data Visualization with NumPy, Seaborn
- Define the Web Scraping and Numerical Analysis

Module-1

Python Basic Concepts and Programming

Interpreter, Parts of Python Programming Language, Identifiers, Keywords, Statements and Expressions, Variables, Operators, Precedence and Associativity, Data Types, Indentation, Comments, Program Execution, Reading Input, Print Output, Type Conversions, The type( ) Function and Is Operator, Control Flow Statements, The if Decision Control Flow Statement, The if…else Decision Control Flow Statement, The if…elif…else Decision Control Statement, Nested if Statement, The while Loop, The for Loop, The continue and break Statements, Sequences – Strings, Built-In Functions, Commonly Used Modules, Function Definition and Calling the Function, The return Statement and void Function, Scope and Lifetime of Variables, Default Parameters, Keyword Arguments, *args and **kwargs, Command Line Arguments.

Teaching-Learning Process	Chalk and Talk/PPT/Web Content

Module-2

Python Collection Objects, Classes

Strings- Creating and Storing Strings, Basic String Operations, Accessing Characters in String by Index Number, String Slicing and Joining, String Methods, Formatting Strings, Lists-Creating Lists, Basic List Operations, Indexing and Slicing in Lists, Built-In Functions Used on Lists, List Methods. Sets, Tuples and Dictionaries. Files: reading and writing files. Class Definition – Constructors – Inheritance – Overloading

Teaching-Learning Process	Chalk and Talk/PPT/Web Content

Module-3

Data Pre-processing and Data Wrangling

Acquiring Data with Python: Loading from CSV files, Accessing SQL databases. Cleansing Data with Python: Stripping out extraneous information, Normalizing data AND Formatting data. Combining and Merging Data Sets – Reshaping and Pivoting – Data Transformation – String Manipulation, Regular Expressions.

Teaching-Learning Process	Chalk and Talk/PPT/Web Content

Module-4

Web Scraping And Numerical Analysis

Data Acquisition by Scraping web applications –Submitting a form - Fetching web pages – Downloading web pages through form submission – CSS Selectors. NumPy Essentials: TheNumPy

Teaching-Learning Process	Chalk and Talk/PPT/Web Content

Module-5

Data Visualization with NumPy Arrays, Matplotlib, and Seaborn

Data Visualization: Matplotlib package – Plotting Graphs – Controlling Graph – Adding Text – More Graph Types – Getting and setting values – Patches. Advanced data visualization with Seaborn.- Time series analysis with Pandas.

| Learning | |
| Process | |

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- Three Unit Tests each of **20 Marks**
- Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks**
  to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
- Each full question will have a sub-question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:
Books

- Allen B. Downey, "Think Python: How to Think Like a Computer Scientist'', 2nd edition,Updated   for Python 3, Shroff/O'Reilly Publishers, 2016 (http://greenteapress.com/wp/thinkpython/)
- Guido van Rossum and Fred L. Drake Jr, ―An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.
- Jake Vander plas, "Python Data Science Handbook: Essential tools for working with data", O'Reilly Publishers, I Edition.

Reference Books

- Mark Lutz, "Programming Python", O'Reilly Media, 4th edition, 2010.
- Tim Hall and J-P Stacey, "Python 3 for Absolute Beginners", Apress, 1st edition, 2009.
- Magnus Lie Hetland, "Beginning Python: From Novice to Professional", Apress, Second Edition, 2005.
- 4. Shai Vaingast, "Beginning Python Visualization Crafting Visual Transformation Scripts", Apress, 2nd edition, 2014. 6. Wes Mc Kinney, "Python for Data Analysis", O'Reilly Media, 2012.

Web links and Video Lectures (e-Resources):

- https://youtu.be/4SJ7bEILPJk

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

Sl. No.	Description	Blooms Level
CO1	Understand and comprehend the basics of Python programming.	L2
CO2	Apply knowledge in real time applications	L3
CO3	Apply the Data Pre-processing & Data Wrapping	L3
CO4	Demonstrate the Web Scraping And Numerical Analysis	L3

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

Semester- III

Internet of Things			
Course Code	**22MCA32**	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Learning objectives:
- Define the IoT architecture and design along with functional/compute stack and data management.
- Explain IOT architecture for a given problem
- Analyse the application protocol, transport layer methods for the given business case.
- Analyse the application of data analytics for IOT for a given
- Analyse the architecture and develop programming using modern tools for the given use case

Module-1

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

Teaching-Learning Process	Chalk and Talk/PPT/Web Content

Module-2

Smart Objects: The "Things" in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies

Teaching-Learning Process	Chalk and Talk/PPT/Web Content

Module-3

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.

Teaching-Learning Process	Chalk and Talk/PPT/Web Content

Module-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, 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

Teaching-Learning Process	Chalk and Talk/PPT/Web Content

Module-5

IoT Physical Devices and Endpoints - Arduino UNO: Introduction to Arduino, Arduino UNO, Installing the Software, Fundamentals of Arduino Programming. IoT Physical Devices and Endpoints – 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, Smart and Connected Cities, An IoT Strategy for Smarter Cities, Smart City IoT Architecture, Smart City Security Architecture, Smart City Use-Case Examples.

Teaching-Learning Process	Chalk and Talk/PPT/Web Content

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- Three Unit Tests each of **20 Marks**
- Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks**
  to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
- Each full question will have a sub-question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Books

- David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the "Internet of Things", 1stEdition, Pearso Education (Cisco Press Indian Reprint). (ISBN: 9789386873743)
- Srinivasa K G, "Internet of Things", CENGAGE Leaning India, 2017

Reference Books

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

Web links and Video Lectures (e-Resources):

- https://youtu.be/WUYAjxnwjU4

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

Sl. No.	Description	Blooms Level
CO1	Analyse the IoT architecture and design along with functional/compute stack and data management.	L3
CO2	Apply IOT architecture for a given problem.	L3
CO3	Analyse the application protocol, transport layer methods for the given business case.	L3
CO4	Analyse the application of data analytics for IOT for a given.	L23
CO5	Analyse the architecture and develop programming using modern tools for the given use case	L2

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2	X									X		
CO3		X						X				
CO4												
CO5	X		X					X		X		

Semester- III

Block chain Technology				
Course Code		**22MCA331**	CIE Marks	50
Teaching Hours/Week (L:P:SDA)		2:0:0:2	SEE Marks	50
Total Hours of Pedagogy		40	Total Marks	100
Credits		03	Exam Hours	03

Course Learning objectives:
- Demonstrate the basics of Block chain concepts using modern tools/technologies.
- Illustrate the role of block chain applications in different domains including cyber security.
- Evaluate the usage of Block chain implementation/features for the given problem.
- Exemplify the usage of bitcoins and its impact on the economy.
- Analyze the application of specific block chain architecture for a given problem

Module-1

Introduction to Block chain, How Block chain works, Block chain vs Bitcoin, Practical applications, public and private key basics, pros and cons of Block chain, Myths about Bitcoin.

Teaching-Learning Process	Chalk and Talk/PPT/Web Content

Module-2

Block chain: Architecture, versions, variants, use cases, Life use cases of block chain, Block chain vs shared Database, Introduction to crypto currencies, Types, Applications.

Teaching-Learning Process	Chalk and Talk/PPT/Web Content

Module-3

Concept of Double Spending, Hashing, Mining, Proof of work. Introduction to Merkel tree, Privacy, payment verification, Resolving Conflicts, Creation of Blocks

Teaching-Learning Process	Chalk and Talk/PPT/Web Content

Module-4

Introduction to Bitcoin, key concepts of Bitcoin, Merits and De Merits Fork and Segwits, Sending and Receiving bitcoins, choosing bitcoin wallet, Converting Bitcoins to Fiat Currency.

Teaching-Learning Process	Chalk and Talk/PPT/Web Content

Module-5

Introduction to Ethereum, Advantages and Disadvantages, Ethereum vs Bitcoin, Introduction to Smart contracts, usage, application, working principle, Law and Regulations. Case Study.

Teaching-Learning Process	Chalk and Talk/PPT/Web Content

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- Three Unit Tests each of **20 Marks**
- Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks** to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
- Each full question will have a sub-question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module

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Suggested Learning Resources:

Books

- Beginning Block chain: A Beginner's Guide to Building Blockchain Solutions by ArshdeepBikramaditya Signal, Gautam Dhameja (Priyansu Sekhar Panda., A Press.) 2018
- Block chain Applications: A Hands-On Approach by Bahga, Vijay Madisetti ,2017
- Block chain by Melanie Swan, OReilly 2015

Reference Books

- Bitcoin and Cryptocurrency Technologies by Aravind Narayan. Joseph Bonneau, princton
- Bitcoin and Blockchain Basics: A non-technical introduction for beginners by Arthu.T Books.

Web links and Video Lectures (e-Resources):

- https://youtu.be/mzPoUjQC4WU

Skill Development Activity

The students with the help of the course teacher can take up relevant technical –activities which will enhance their skill. The prepared report shall be evaluated for CIE marks.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

Sl. No.	Description	Blooms Level
CO1	Demonstrate the basics of Block chain concepts using modern tools/technologies.	L2
CO2	Analyze the role of block chain applications in different domains including cyber security.	L3
CO3	Evaluate the usage of Block chain implementation/features for the given problem.	L2
CO4	Exemplify the usage of bitcoins and its impact on the economy	L2
CO5	Analyze the application of specific block chain architecture for a given problem	L2

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2	X									X		
CO3			X					X				
CO4	X								X			
CO5			X									

Cloud Computing			
Course Code	**22MCA332**	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	2:0:0:2	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Learning objectives:
- Explain the fundamentals of cloud computing
- Illustrate the cloud application programming and aneka platform
- Contrast different cloud platforms used in industry

Module-1	
Introduction to Cloud Computing: Eras of computing, The vision of Cloud Computing, Defining a cloud, A closer look, Cloud computing reference model, Historical developments: Distributed systems, Virtualization, Web 2.0; Service oriented computing; Utility oriented computing.	
Teaching-Learning Process	Chalk and Talk/PPT/Web Content

Module-2	
Architectures for parallel and distributed computing: Parallel Vs Distributed computing, Elements of parallel computing, Elements of distributed computing, Technologies for distributed computing.	
Teaching-Learning Process	Chalk and Talk/PPT/Web Content

Module-3	
Virtualization: Introduction, Characteristics of virtualized environments, Taxonomy of virtualization techniques, Virtualization and cloud computing, Pros and cons of virtualization, Technology examples: Xen: Para virtualization, VmWare: Full virtualization, Microsoft Hyper – V.	
Teaching-Learning Process	Chalk and Talk/PPT/Web Content

Module-4	
Cloud computing architecture: Introduction, Cloud reference model: Architecture, IaaS, PaaS, SaaS, Types of Clouds: Public, Private, Hybrid and Community clouds, Economics of the cloud, Open challenges.	
Teaching-Learning Process	Chalk and Talk/PPT/Web Content

Module-5	
Cloud Platforms in Industry : Amazon web services; Google AppEngine; Microsoft Azure; Cloud Applications. Scientific applications: Healthcare; Biology; Geo-Science, Business and Consumer applications: ARM & ERP; Productivity; Social networking	
Teaching-Learning Process	Chalk and Talk/PPT/Web Content

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- Three Unit Tests each of **20 Marks**
- Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks**
  to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
- Each full question will have a sub-question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Textbooks

1. RjkumarBuyya, Christian Vecchiola, and ThamaraiSelci, Mastering Cloud Computing, Tata McGraw Hill, New Delhi, India, 2013

   Reference Books

- Cloud Computing for Dummies by Judith Hurwitz, R.Bloor, M. Kanfman, F.Halper (Wiley India Edition)
- 2. Cloud Computing: A Practical Approach by J.Vette, Toby J. Vette, Robert Elsenpeter (Tata McGraw Hill).

Web links and Video Lectures (e-Resources):

Skill Development Activity
The students with the help of the course teacher can take up relevant technical –activities which will enhance their skill. The prepared report shall be evaluated for CIE marks.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

Sl. No.	Description	Blooms Level
CO1	Demonstrate the fundamental and core concepts of cloud computing	L2
CO2	Compare between parallel and distributed computing	L3
CO3	Investigate the system virtualization and outline its role in enabling the cloud computing system model	L2
CO4	Compare different deployment and service models of cloud to develop different variety of applications	L2

Mapping of COS and POs

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

Semester- III

Digital Marketing			
Course Code	**22MCA333**	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	2:0:0:2	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Learning objectives:

- Demonstrate the key concepts related to e-marketing for the given case.
- Demonstrate the use of different electronic media for designing marketing activities.
- Illustrate the role of search engine in improving digital marketing
- Analyze role of social media marketing for the given problem
- Analyze technical solutions to overcome social media threats

Module-1
Introduction to Digital Marketing Evolution of Digital Marketing from traditional to modern era, Role of Internet; Current trends, Info-graphics, implications for business & society; Emergence of digital marketing as a tool; Drivers of the new marketing environment; Digital marketing strategy; P.O.E.M. framework, Digital landscape, Digital marketing plan, Digital marketing models.

Teaching-Learning Process	Chalk and Talk/PPT/Web Content

Module-2
Internet Marketing and Digital Marketing Mix – Internet Marketing, opportunities and challenges; Digital marketing framework; Digital Marketing mix, Impact of digital channels on IMC; Search Engine Advertising: - Pay for Search Advertisements, Ad Placement, Ad Ranks, Creating Ad Campaigns, Campaign Report Generation Display marketing: - Types of Display Ads - Buying Models - Programmable Digital Marketing - Analytical Tools - YouTube marketing.

Teaching-Learning Process	Chalk and Talk/PPT/Web Content

Module-3
Social Media Marketing – Role of Influencer Marketing, Tools & Plan– Introduction to social media platforms, penetration & characteristics; Building a successful social media marketing strategy Facebook Marketing: - Business through Facebook Marketing, Creating Advertising Campaigns, Adverts, Facebook Marketing Tools Linkedin Marketing: - Introduction and Importance of Linkedin Marketing, Framing Linkedin Strategy, Lead Generation through Linkedin, Content Strategy, Analytics and Targeting Twitter Marketing: - Introduction to Twitter Marketing, how twitter Marketing is different than other forms of digital marketing, framing content strategy, Twitter Advertising Campaigns Instagram and Snapchat: - Digital Marketing Strategies through Instagram and Snapchat Mobile Marketing: - Mobile Advertising, Forms of Mobile Marketing, Features, Mobile Campaign Development, Mobile Advertising Analytics Introduction to social media metrics

Teaching-Learning Process	Chalk and Talk/PPT/Web Content

Module-4
Introduction to SEO, SEM, Web Analytics, Mobile Marketing, Trends in Digital Advertising– - Introduction and need for SEO, How to use internet & search engines; search engine and its working pattern, On-page and off-page optimization, SEO Tactics - Introduction to SEM Web Analytics: - Google Analytics & Google AdWords; data collection for web analytics, multichannel attribution, Universal analytics, Tracking code Trends in digital advertising

Teaching-Learning	Chalk and Talk/PPT/Web Content

Process	

Module-5
Social Media Channels: Introduction, Key terms and concepts, Traditional media vs Social media. Social media channels: Social networking. Content creation, Bookmarking & aggregating and Location & social media. Tracking social media campaigns. Social media marketing: Rules of engagement. Advantages and challenges. Social Media Strategy: Introduction, Key terms and concepts. Using social media to solve business challenges. Step-by-step guide to creating a social media strategy. Documents and processes. Dealing with opportunities and threats. Step-by-step guide for recovering from an online brand attack. Social media risks and challenges

Teaching-Learning Process	Chalk and Talk/PPT/Web Content

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- Three Unit Tests each of **20 Marks**
- Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks**
  to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
- Each full question will have a sub-question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:
Books
- Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi Mastering Cloud. Computing McGraw Hill Education
Reference Books

- Dan C. Marinescu, Cloud Computing Theory and Practice, Morgan Kaufmann, Elsevier 2013.
Web links and Video Lectures (e-Resources):

Skill Development Activity
The students with the help of the course teacher can take up relevant technical –activities which will enhance their skill. The prepared report shall be evaluated for CIE marks.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

Sl. No.	Description	Blooms Level
CO1	Analyze the use of different electronic media for designing marketing activities	L3
CO2	Analyze the role of search engine in improving digital marketing	L3
CO3	Analyze role of social media marketing for the given problem	L3
CO4	Overcome social media threats with the analysis of technical solutions	L2

Mapping of COS and POs

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

Object Oriented Modeling and Design			
Course Code	**22MCA334**	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	2:0:0:2	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Learning objectives:
- Describe the concepts involved in Object-Oriented modeling and their benefits.
- Demonstrate concept of use-case model, sequence model and state chart model for a given problem.
- Explain the facets of the unified process approach to design and build a Software system.
- Translate the requirements into implementation for Object Oriented design.
- Choose an appropriate design pattern to facilitate development procedure.

Module-1
Advanced object and class concepts; Association ends; N-ary associations; Aggregation; Abstract classes; Multiple inheritance; Metadata; Reification; Constraints; Derived Data; Packages. State Modeling: Events, States, Transitions and Conditions, State Diagrams, State diagram behaviour.

Teaching-Learning Process	Chalk and Talk/PPT/Web Content

Module-2
UseCase Modelling and Detailed Requirements: Overview; Detailed object-oriented Requirements definitions; System Processes-A use case/Scenario view; Identifying Input and outputs-The System sequence diagram; Identifying Object Behaviour-The state chart Diagram; Integrated Object-oriented Models.

Teaching-Learning Process	Chalk and Talk/PPT/Web Content

Module-3
Process Overview, System Conception and Domain Analysis: Process Overview: Development stages; Development life Cycle; System Conception: Devising a system concept; elaborating a concept; preparing a problem statement. Domain Analysis: Overview of analysis; Domain Class model: Domain state model; Domain interaction model; Iterating the analysis.

Teaching-Learning Process	Chalk and Talk/PPT/Web Content

Module-4
Use case Realization :The Design Discipline within up iterations: Object Oriented DesignThe Bridge between Requirements and Implementation; Design Classes and Design within Class Diagrams; Interaction Diagrams-Realizing Use Case and defining methods; Designing with Communication Diagrams; Updating the Design Class Diagram; Package Diagrams Structuring the Major Components; Implementation Issues for Three-Layer Design

Teaching-Learning Process	Chalk and Talk/PPT/Web Content

Module-5
Design Patterns: Introduction; what is a design pattern?, Describing design patterns, the catalogue of design patterns, Organizing the catalogue, How design patterns solve design problems, how to select a design patterns, how to use a design pattern; Creational patterns: prototype and singleton (only); structural patterns adaptor and proxy (only).

Teaching-Learning Process	Chalk and Talk/PPT/Web Content

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- Three Unit Tests each of **20 Marks**
- Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks**
  to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
- Each full question will have a sub-question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Books

- Michael Blaha, James Rumbaugh: Object Oriented Modelling and Design with UML,2nd Edition, Pearson Education,
- Satzinger, Jackson and Burd: Object-Oriented Analysis & Design with the Unified Process, Cengage Learning.
- Erich Gamma, Richard Helm, Ralph Johnson and john Vlissides: Design Patterns –Elements of Reusable Object-Oriented Software, Pearson Education.

Reference Books

- Grady Booch et. al.: Object-Oriented Analysis and Design with Applications,3rd Edition,Pearson Education,2007.
- Frank Buschmann, RegineMeunier, Hans Rohnert, Peter Sommerlad, Michel Stal: Pattern –Oriented Software Architecture. A system of patterns , Volume 1, John Wiley and Sons.2007.
- Booch, Jacobson, Rambaugh : Object-Oriented Analysis and Design with Applications, 3rdedition, pearson, Reprint 2013.

Web links and Video Lectures (e-Resources):

Skill Development Activity

The students with the help of the course teacher can take up relevant technical –activities which will enhance their skill. The prepared report shall be evaluated for CIE marks.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

Sl. No.	Description	Blooms Level
CO1	Explain the concepts of object-oriented and basic class modelling.	L2
CO2	Create class diagrams, sequence diagrams and interaction diagrams to solve problems.	L3
CO3	Choose and apply a befitting design pattern for the given problem.	L2

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1										X		
CO2	X		X									
CO3												X

Semester- III

NOSQL				
Course Code	**22MCA335**	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	2:0:0:2	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Learning objectives:
- Demonstrate the concepts of unstructured data
- Analyse and Manage the Data using CRUD operations
- Develop the applications using NoSQL
- Realize the concept of Map Reduce its applicability in the real world application development
- Analyze the framework of NOSQL

Module-1
Introduction to NoSQL ,Definition of NoSQL, History of NoSQL and Different NoSQL products. Exploring NoSQL Exploring Mongo DB Java/Ruby/Python, Interfacing and Interacting with NoSQL.

Teaching-Learning Process	Chalk and Talk/PPT/Web Content

Module-2
NoSQL Basics: NoSQL Storage Architecture, CRUD operations with Mongo DB, Querying, Modifying and Managing. Data Storage in NoSQL: NoSQL Data Stores, Indexing and ordering datasets (Mongo DB/Couch DB/Cassandra)

Teaching-Learning Process	Chalk and Talk/PPT/Web Content

Module-3
Advanced NoSQL, NoSQL in Cloud, Parallel Processing with Map Reduce, Big Data with Hive.

Teaching-Learning Process	Chalk and Talk/PPT/Web Content

Module-4
Working with NoSQL, Surveying Database Internals, Migrating from RDBMS to NoSQL, Web Frameworks and NoSQL, using MySQL as a NoSQL.

Teaching-Learning Process	Chalk and Talk/PPT/Web Content

Module-5
Developing Web Application with NOSQL and NOSQL Administration Php and MongoDB, Python and MongoDB, Creating Blog Application with PHP.

Teaching-Learning Process	Chalk and Talk/PPT/Web Content

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- Three Unit Tests each of **20 Marks**
- Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks** to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
- Each full question will have a sub-question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Books

- Professional NOSQL Shashank Tiwari WROX Press

Reference Books

- The Definitive Guide to Mongo DB, The NOSQL Database for cloud and Desktop Computing Eelco Plugge, Peter Membrey and Tim Hawkins A Press

Web links and Video Lectures (e-Resources):

Skill Development Activity

The students with the help of the course teacher can take up relevant technical –activities which will enhance their skill. The prepared report shall be evaluated for CIE marks.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

Sl. No.	Description	Blooms Level
CO1	Analyse and Manage the Data using CRUD operations	L2
CO2	Apply and Develop the applications using NoSQL	L3
CO3	Realize the concept of Map Reduce its applicability in the real world application development	L2
CO4	Apply the framework of NOSQL to find the solutions	L2

Mapping of COS and POs

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

Advanced Java and J2EE			
Course Code	22MCA341	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	2:0:2	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Learning objectives:
- Explain the need for advanced Java concepts like Enumerations and Collections
- Define the working of Strings in Java
- Demonstrate the use of JDBC to access database through Java Programs
- Adapt servlets to build server side programs

Module-1
Enumerations, Autoboxing and Annotations(metadata): Enumerations, Enumeration fundamentals, the values() and valueOf() Methods, java enumerations are class types,enumerations Inherits Enum, example, type wrappers, Autoboxing, Autoboxing and Methods, Autoboxing/Unboxing occurs in Expressions, Autoboxing/Unboxing, Boolean and character values, Autoboxing/Unboxing helps prevent errors, A word of Warning. Annotations, Annotation basics, specifying retention policy, Obtaining Annotations at run time by use of reflection, Annotated element Interface, Using Default values, Marker Annotations, Single Member annotations, Built-In annotations.

Teaching-Learning Process	Chalk and Talk/ PPT / Web resources

Module-2
The collections and Framework: Collections Overview, Recent Changes to Collections, The Collection Interfaces, The Collection Classes, Accessing a collection Via an Iterator, Storing User Defined Classes in Collections, The Random Access Interface, Working With Maps, Comparators, The Collection Algorithms, Why Generic Collections?, The legacy Classes and Interfaces, Parting Thoughts on Collections.

Teaching-Learning Process	Chalk and Talk/ PPT / Web resources

Module-3
String Handling :The String Constructors, String Length, Special String Operations, String Literals, String Concatenation, String Concatenation with Other Data Types, String Conversion and toString( ) Character Extraction, charAt( ), getChars( ), getBytes( ) toCharArray(), String Comparison, equals( ) and equalsIgnoreCase( ), regionMatches( ) startsWith( ) and endsWith( ), equals( ) Versus == , compareTo( ) Searching Strings, Modifying a String, substring( ), concat( ), replace( ), trim( ), Data Conversion Using valueOf( ), Changing the Case of Characters Within a String, Additional String Methods, StringBuffer , StringBuffer Constructors, length( ) and capacity( ), ensureCapacity( ), setLength( ), charAt( ) and setCharAt( ), getChars( ),append( ), insert( ), reverse( ), delete( ) and deleteCharAt( ), replace( ), substring( ), Additional StringBuffer Methods, StringBuilder .

Teaching-Learning Process	Chalk and Talk/ PPT / Web resources

Module-4
Background; The Life Cycle of a Servlet; Using Tomcat for Servlet Development; A simple Servlet; The Servlet API; The Javax.servlet Package; Reading Servlet Parameter; The Javax.servlet.http package; Handling HTTP Requests and Responses; Using Cookies; Session Tracking. Java Server Pages (JSP): JSP, JSP Tags, Tomcat, Request String, User Sessions, Cookies, Session Objects

Teaching-Learning Process	Chalk and Talk/ PPT / Web resources

Module-5

The Concept of JDBC; JDBC Driver Types; JDBC Packages; A Brief Overview of the JDBC process; Database Connection; Associating the JDBC/ODBC Bridge with the Database; Statement Objects; ResultSet; Transaction Processing; Metadata, Data types; Exceptions

Teaching-Learning Process	Chalk and Talk/ PPT / Case Study

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:
- Three Unit Tests each of 20 Marks
- Two assignments each of 20 Marks or one Skill Development Activity of 40 marks to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be scaled down to 50 marks

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:
- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
- Each full question will have a sub-question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

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

  Reference book:
  - Y. Daniel Liang: Introduction to JAVA Programming, 7thEdition, Pearson Education, 2007.
  - Stephanie Bodoff et al: The J2EE Tutorial, 2nd Edition, Pearson Education,2004.
  - Uttam K Roy, Advanced JAVA programming, Oxford University press, 2015.

Web links and Video Lectures (e-Resources):
   https://youtu.be/pobgvYXsBIo
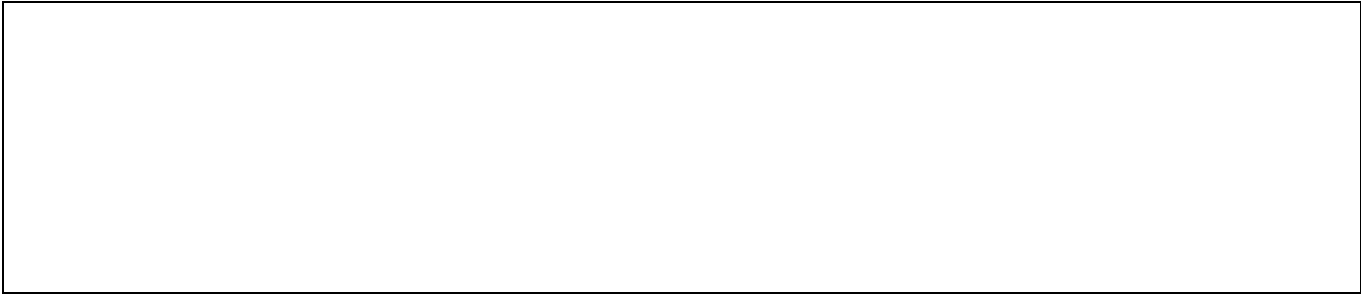   https://youtu.be/J_d1fJy90GY

Skill Development Activities Suggested

The students with the help of the course teacher can take up relevant technical activities which will enhance their skill. The prepared report shall be evaluated for CIE marks.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

Sl. No.	Description	Blooms Level
CO1	Interpret the need for advanced Java concepts like enumerations and collections in developing modular and efficient programs	L2
CO2	Develop Solutions to problems using Arrays, Structures, Stack, Queues	L3
CO3	Illustrate database access and details for managing information using the JDBC API	L4

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	X											X
CO2					X			X				X
CO3		X				X						X

Introduction to Dot Net Framework for Application Development			
Course Code	22MCA342	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	2:0:2	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Learning objectives:
- Inspect Visual Studio programming environment and toolset designed to build applications for Microsoft Windows
- Explain Object Oriented Programming concepts in C# programming language.
- Interpret Interfaces and define custom interfaces for application.
- Build custom collections and generics in C#
- Explore events and query data using query expressions

Module-1
Introducing Microsoft Visual C# and Microsoft Visual Studio 2015: Welcome to C#, Working with variables, operators and expressions, Writing methods and applying scope, Using decision statements, Using compound assignment and iteration statements, Managing errors and exceptions

Teaching-Learning Process	Chalk and Talk/ PPT / Web resources

Module-2
Understanding the C# object model: Creating and Managing classes and objects, Understanding values and references, Creating value types with enumerations and structures, Using arrays

Teaching-Learning Process	Chalk and Talk/ PPT / Web resources

Module-3
Understanding parameter arrays, Working with inheritance, Creating interfaces and defining abstract classes, Using garbage collection and resource management.

Teaching-Learning Process	Chalk and Talk/ PPT / Web resources

Module-4
Defining Extensible Types with C#: Implementing properties to access fields, Using indexers, Introducing generics, Using collections

Teaching-Learning Process	Chalk and Talk/ PPT / Web resources

Module-5
Enumerating Collections, Decoupling application logic and handling events, Querying inmemory data by using query expressions, Operator overloading

Teaching-Learning Process	Chalk and Talk/ PPT / Case Study

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:
- Three Unit Tests each of 20 Marks
- Two assignments each of 20 Marks or one Skill Development Activity of 40 marks
  to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be scaled down to 50 marks

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:
- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
- Each full question will have a sub-question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Books
- John Sharp, Microsoft Visual C# Step by Step, 8th Edition, PHI Learning Pvt. Ltd. 2016

  Reference Books:
- Christian Nagel, "C# 6 and .NET Core 1.0", 1st Edition, Wiley India Pvt Ltd, 2016. Andrew Stellman and Jennifer Greene, "Head First C#", 3rd Edition, O"Reilly Publications, 2013.
- Mark Michaelis, "Essential C# 6.0", 5th Edition, Pearson Education India, 2016.
- Andrew Troelsen, "Prof C# 5.0 and the .NET 4.5 Framework", 6th Edition, Apress and Dreamtech Press, 2012.

Web links and Video Lectures (e-Resources):
1. https://youtu.be/SXmVym6L8dw
2. https://youtu.be/M5ugY7fWydE

Skill Development Activities Suggested

The students with the help of the course teacher can take up relevant technical activities which will enhance their skill. The prepared report shall be evaluated for CIE marks.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

Sl. No.	Description	Blooms Level
CO1	Build applications on Visual Studio .NET platform by understanding the syntax and semantics of C#.	
CO2	Demonstrate Object Oriented Programming concepts in C# programming language	L3
CO3	Design custom interfaces for applications and leverage the available built-in interfaces in building complex applications.	
CO 4	Illustrate the use of generics and collections in C#	

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	X									
CO2		X				X			X	X
CO3	X							X		
CO 4			X				X		X	

Knowledge Engineering			
Course Code	22MCA343	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	2:0:2	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Learning objectives:
- Illustrate the basic knowledge representation, problem solving, and learning methods of Artificial Intelligence.
- Solve problems in Artificial Intelligence using Python.
- Compare the Fuzzy Logic and knowledge processing in expert systems.

Module-1	
Problems and Search: What is Artificial Intelligence, The AI Problems, Defining the Problem as a State Space Search, Problem Characteristics Searching strategies – Generate and Test, Heuristic Search Techniques- Hill climbing– issues in hill climbing. Python-Introduction to Python- Lists Dictionaries & Tuples in Python- Python implementation of Hill Climbing	
Teaching-Learning Process	Chalk and Talk/ PPT / Web resources

Module-2	
Search Methods - Best First Search - Implementation in Python - OR Graphs, The A * Algorithm, Problem Reduction AND-OR Graphs, The AO* algorithm, Constraint Satisfaction. MINIMAX search procedure, Alpha–Beta pruning	
Teaching-Learning Process	Chalk and Talk/ PPT / Web resources

Module-3	
Knowledge representation - Using Predicate logic - representing facts in logic, functions and predicates, Conversion to clause form, Resolution in propositional logic, Resolution in predicate logic, Unification. Representing Knowledge Using Rules: Procedural Versus Declarative knowledge, Logic Programming, Forward versus Backward Reasoning.	
Teaching-Learning Process	Chalk and Talk/ PPT / Web resources

Module-4	
Learning: What is learning, Rote learning, Learning by Taking Advice, Learning in Problem-solving, Learning from example: induction, Explanation-based learning.	
Teaching-Learning Process	Chalk and Talk/ PPT / Web resources

Module-5	
Connectionist Models: Hopfield Networks, Learning in Neural Networks, Applications of Neural Networks, Recurrent Networks. Connectionist AI and Symbolic AI. Expert System –Representing and using Domain Knowledge – Reasoning with knowledge– Expert System Shells –Support for explanation- examples –Knowledge acquisition-examples.	

Teaching-Learning Process	Chalk and Talk/ PPT / Case Study

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:
- Three Unit Tests each of 20 Marks
- Two assignments each of 20 Marks or one Skill Development Activity of 40 marks
  to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be scaled down to 50 marks

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:
- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
- Each full question will have a sub-question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:
Books

    TEXT BOOKS:
- Elaine Rich and Kevin Knight, "Artificial Intelligence", Tata McGraw-Hill Publishing Company Ltd., New Delhi, Third Edition, ISBN: 13:978-0-07-008770-5.
- Stuart Russell, Peter Norvig, "Artificial Intelligence- A modern approach", Pearson Education Asia, Second Edition, ISBN:81-297-0041-7.

    REFERENCE BOOKS:
- Akshar Bharati, Vineet Chaitanya, Rajeev Sangal, "Natural Language Processing: A Paninian Perspective", Prentice Hall India Ltd., New Delhi, 1996, ISBN 10: 8120309219.
- Amit Konar, Artificial Intelligence and Soft Computing, CRC Press.
- Dan W.Patterson, "Introduction to Artificial Intelligence and Expert Systems", Prentice Hall India Ltd., New Delhi, 2009, ISBN: 81-203-0777-1.
- Rajendra Akerkar, Introduction to Artificial Intelligence, PHI Learning Pvt. Ltd., 2005, ISBN: 81-203- 2864-7.

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/106106140
- https://www.youtube.com/watch?v=z2y1sMrHKDw
- https://www.youtube.com/watch?v=u_TE42-uWD0
- https://www.youtube.com/watch?v=SWddnSmtbLE

Skill Development Activities Suggested

The students with the help of the course teacher can take up relevant technical activities which will enhance their skill. The prepared report shall be evaluated for CIE marks.

	Course outcome (Course Skill Set)	

At the end of the course the student will be able to :

Sl. No.	Description	Blooms Level
CO1	Recognize the fundamental conceptsof Artificial Intelligence such as knowledge representation, problem solving, fuzzy set and expert systems	
CO2	Implement the search methods using Python	
CO3	Use the Connectionist Models for solving problems.	

Mapping of COS and Pos

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	X	X										
CO2										X	X	
CO3						X	X					

Software Testing			
Course Code	22MCA344	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	2:0:2	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Learning objectives:

- Explain the essence of Software testing and Debugging
- Illustrate the various types of testing
- Explore how to generate new test cases

Module-1

Basics of Software Testing, Basic Principles, Test case selection and Adequacy

Humans, Errors and Testing, Software Quality; Requirements, Behavior and Correctness, Correctness Vs Reliability; Testing and Debugging; Test Metrics; Software and Hardware Testing; Testing and Verification; Defect Management; Execution History; Test Generation Strategies; Static Testing; Test Generation from Predicates. Sensitivity, Redundancy, Restriction, Partition, Visibility and Feedback, Test Specification and cases, Adequacy Criteria, Comparing Criteria

Teaching-Learning Process	Chalk and Talk/ PPT / Web resources

Module-2

A perspective on Testing

Basic definitions, Test cases, Insights from a Venn diagram, Identifying test cases, Error and fault taxonomies, Level of testing, Examples: Generalized pseudo code, The triangle problem, the Next Date function, The commission problem, The SATM (Simple Automation Teller Machine) problem, The currency converter, Saturn windshield wiper

Teaching-Learning Process	Chalk and Talk/ PPT / Web resources

Module-3

Boundary value testing, Equivalence class testing, Decision table based testing

Boundary value analysis, Robustness testing, Worst-case testing, special value testing, Examples, Random testing, Equivalence classes, Equivalence test cases for triangle problem, Next Date function and commission problem, Guidelines and observations, Decision tables, Test cases for triangle problem

Teaching-Learning Process	Chalk and Talk/ PPT / Web resources

Module-4

Path Testing, Data flow testing, Levels of Testing, Integration Testing

DD Paths, Test coverage metrics, Basis path testing, guidelines and observations, Definition Use testing, Slice based testing, Guidelines and observations. Traditional view of testing levels, Alternative life cycle models, the SATM systems, separating integration and system testing, Guidelines and observations.

Teaching-Learning Process	Chalk and Talk/ PPT / Web resources

Module-5

Fault Based Testing, Planning and Monitoring the Process, Documenting Analysis and Test

Assumptions in fault-based testing, Mutation Analysis, Fault-based Adequacy Criteria; Variations on mutation Analysis; From Test case specification to Test Cases, Scaffolding, Generic vs. specific Scaffolding, Test Oracles, Self checks as oracles, Capture and Replay. Quality and Process, Test and Analysis strategies and plans, Risk Planning, Monitoring the Process, Improving the process, The quality team, Organizing documents, Test strategy document, Analysis and test plan, Test design specifications documents, Test and analysis reports.

Teaching-Learning Process	Chalk and Talk/ PPT / Case Study

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:
- Three Unit Tests each of 20 Marks
- Two assignments each of 20 Marks or one Skill Development Activity of 40 marks
  to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be scaled down to 50 marks

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:
- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
- Each full question will have a sub-question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Text Books:

- Adithya P.Mathur " Foundations of Software Testing – Fundamental Algorithms and Techniques", Pearson Education India, 2011

- Mauro Pezze, Michael Young, Software testing and Analysis- Process, Principles and Techniques, Wiley India, 2012 Paul C Jorgensen, "Software Testing A Craftsman's Approach", Auerbach publications, 3rd edition, 2011.

Reference Books:

- KshirasagaraNaik, PriyadarshiTripathy: Software Testing and Quality Assurance, Wiley India 2012
- M.G. Limaye: Software Testing-Principles, Techniques and Tools – McGraw Hill, 2009

Web links and Video Lectures (e-Resources):

- https://youtu.be/OGImfxO2TEU
- https://youtu.be/T3q6QcCQZQg

Skill Development Activities Suggested

The students with the help of the course teacher can take up relevant technical activities which will enhance their skill. The prepared report shall be evaluated for CIE marks.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

Sl. No.	Description	Blooms Level
CO1	Acquire knowledge of basic principles and knowledge of software testing and Debugging and test cases. L2	
CO2	Understand the perceptions on testing like levels of testing, generalized pseudo code and with related examples	L3
CO3	Analyze the difference between functional testing and structural testing.	L4

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	X	X										
CO2		X	X									
CO3			X	X								

Virtual Reality			
Course Code	**22MCA345**	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	2:0:2	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Learning objectives:
- Explain the design of VR technology relates to human perception and cognition.
- Discuss about applications of VR and conduct of scientific research, training and industrial design.
- Describe the fundamental aspects of designing and implementing rigorous empirical experiments using VR.
- Evaluating good and bad virtual interfaces.

Module-1

Introduction to Virtual Reality :
Defining Virtual Reality, History of VR, Human Physiology and Perception, Key Elements of Virtual Reality Experience, Virtual Reality System, Interface to the Virtual World-Input & output- Visual, Aural & Haptic Displays, Applications of Virtual Reality.

Teaching-Learning Process	Chalk and Talk/ PPT

Module-2

Representing the Virtual World :
Representation of the Virtual World, Visual Representation in VR, Aural Representation in VR and Haptic Representation in VR

Teaching-Learning Process	Chalk and Talk/ PPT

Module-3

The Geometry of Virtual Worlds & The Physiology of Human Vision:
Geometric Models, Changing Position and Orientation, Axis-Angle Representations of Rotation, Viewing Transformations, Chaining the Transformations, Human Eye, eye movements & implications for VR.

Teaching-Learning Process	Chalk and Talk/ PPT / Web Resources: https://www.youtube.com/watch?v=7HbBknJcHUM

Module-4

Visual Perception & Rendering :
Visual Perception - Perception of Depth, Perception of Motion, Perception of Color, Combining Sources of Information Visual Rendering -Ray Tracing and Shading Models, Rasterization, Correcting Optical Distortions, Improving Latency and Frame Rates

Teaching-Learning Process	Chalk and Talk/ PPT

Module-5

Motion & Tracking :
Motion in Real and Virtual Worlds- Velocities and Accelerations, The Vestibular System, Physics in the Virtual World, Mismatched Motion and Vection Tracking- Tracking 2D & 3D Orientation, Tracking Position and Orientation, Tracking Attached Bodies

Teaching-Learning Process	Chalk and Talk/ PPT

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:
- Three Unit Tests each of 20 Marks
- Two assignments each of 20 Marks or one Skill Development Activity of 40 marks
  to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be scaled down to 50 marks

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:
- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
- Each full question will have a sub-question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:
Books
1. Virtual Reality, Steven M. LaValle, Cambridge University Press, 2016.
2. Understanding Virtual Reality: Interface, Application and Design, William R Sherman and Alan B Craig, (The Morgan Kaufmann Series in Computer Graphics)". Morgan Kaufmann Publishers, San Francisco, CA, 2002.
3. Developing Virtual Reality Applications: Foundations of Effective Design, Alan B Craig, William R Sherman and Jeffrey D Will, Morgan Kaufmann, 2009

REFERENCE BOOKS:
1. Gerard Jounghyun Kim, "Designing Virtual Systems: The Structured Approach", 2005.
2. Doug A Bowman, Ernest Kuijff, Joseph J LaViola, Jr and Ivan Poupyrev, "3D User Interfaces, Theory and Practice", Addison Wesley, USA, 2005.
3. Oliver Bimber and Ramesh Raskar, "Spatial Augmented Reality: Meging Real and Virtual Worlds", 2005.
4. Burdea, Grigore C and Philippe Coiffet, "Virtual Reality Technology", Wiley Interscience, India, 2003

Web links and Video Lectures (e-Resources):
- https://nptel.ac.in/courses/106106138
- https://www.youtube.com/watch?v=XLP4YTpUpBI
- https://www.youtube.com/watch?v=w6badCKzmXU
- https://www.youtube.com/watch?v=DU3IiqUWGcU

Skill Development Activities Suggested

The students with the help of the course teacher can take up relevant technical activities which will enhance their skill. The prepared report shall be evaluated for CIE marks.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

Sl. No.	Description	Blooms Level
CO1	Build application on how VR systems work and list the applications of VR	L3

CO2	Design and implement the hardware that enables VR systems to be built	L4
CO3	Explain the concepts of motion and tracking in VR systems.	L4
CO 4	Explore the importance of interaction and audio in VR systems.	L3

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	X	X										
CO2			X	X								
CO3					X					X		

PROJECT WORK PHASE – 1				
Course Code	**22MCAL35**	CIE Marks	100	
Number of contact Hours/Week	2	SEE Marks	--	
Credits	02	Exam Hours	--	

Course objectives:
- Support independent learning.
- Guide to select and utilize adequate information from varied resources maintaining ethics.
- Guide to organize the work in the appropriate manner and present information (acknowledging the sources) clearly.
- Develop interactive, communication, organisation, time management, and presentation skills.
- Impart flexibility and adaptability.
- Inspire independent and team working.
- Expand intellectual capacity, credibility, judgement, intuition.
- Adhere to punctuality, setting and meeting deadlines.
- Instil responsibilities to oneself and others.
- Train students to present the topic of project work in a seminar without any fear, face audience confidently, enhance communication skill, involve in group discussion to present and exchange ideas.

Project Phase-1 Students in consultation with the guide/s shall carry out literature survey/ visit industries to finalize the topic of the Project. Subsequently, the students shall collect the material required for the selected project, prepare synopsis and narrate the methodology to carry out the project work.

Seminar: Each student, under the guidance of a Faculty, is required to
- Present the seminar on the selected project orally and/or through power point slides.
- Answer the queries and involve in debate/discussion.
- Submit two copies of the typed report with a list of references.

The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident.

Course outcomes:
At the end of the course the student will be able to:
- Demonstrate a sound technical knowledge of their selected project topic.
- Undertake problem identification, formulation, and solution.
- Design engineering solutions to complex problems utilising a systems approach.
- Communicate with engineers and the community at large in written an oral forms.
- Demonstrate the knowledge, skills and attitudes of a professional engineer.

Continuous Internal Evaluation
CIE marks for the project report (50 marks), seminar (30 marks) and question and answer (20 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session by the student) by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three faculty from the department with the senior most acting as the Chairperson.

Data Analytics Lab with Mini-Project			
Course Code	**22MCAL36**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:4:0	SEE Marks	50
Credits	02	Exam Hours	03

Course objectives:

- Develop python program to perform search/sort on a given data set
- Demonstrate object oriented principles
- Demonstrate data visualization using Numpy for a given problem
- Demonstrate regression model for a given problem
- Design and develop an application for the given problem

Sl.NO	Experiments
1	Write a Python program to perform linear search
2	Write a Python program to insert an element into a sorted list
3	Write a python program using object oriented programming to demonstrate encapsulation, overloading and inheritance
4	Implement a python program to demonstrate 1) Importing Datasets 2) Cleaning the Data 3) Data frame manipulation using Numpy
5	Implement a python program to demonstrate the following using NumPy a) Array manipulation, Searching, Sorting and splitting. b) broadcasting and Plotting NumPy arrays
6	Implement a python program to demonstrate Data visualization with various Types of Graphs using Numpy
7	Write a Python program that creates a mxn integer array and Prints its attributes using matplotlib
8	Write a Python program to demonstrate the generation of linear regression models.
9	Write a Python program to demonstrate the generation of logistic regression models using
10	Write a Python program to demonstrate Time series analysis with Pandas.
11	Write a Python program to demonstrate Data Visualization using Seaborn
	Part B
1	Students shall carry out a mini project using python/pandas to demonstrate the data analysis
2	A team of two students must develop the mini project. However during the examination, each student must demonstrate the project individually.
3	The team must submit a brief project report (20-25 pages) that must include the following a. Introduction b. Requirement Analysis c. Software Requirement Specification d. Analysis and Design, e. Implementation f. Testing
4	Brief synopsis not more than two pages to be submitted by the team as per the format given. It is recommended that students to do prior art search as part of literature survey before submitting the synopsis for the Mini/Major projects.
5	Rubrics may be used to evaluate the Mini-Project

Course outcomes (Course Skill Set):
At the end of the course the student will be able to:
CO1:Apply object-oriented programming concepts to develop dynamic interactive Python Applications.

CO2: Use the procedural statements: assignments, conditional statements, loops, method calls and arrays

CO3: Design, code, and test small Python programs with a basic understanding of top-down Design.

CO4: Learn how to create GUI and solve real-world problem using language idioms, data structures and standard library

Assessment Details (both CIE and SEE)

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Continuous Internal Evaluation (CIE):

CIE marks for the practical course is **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment to be evaluated for conduction with observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments designed by the faculty who is handling the laboratory session and is made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled downed to 30 marks (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct 02 tests for 100 marks, the first test shall be conducted after the 8th week of the semester and the second test shall be conducted after the 14th week of the semester.
- In each test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability.
- The average of 02 tests is scaled down to **20 marks** (40% of the maximum marks).

The Sum of **scaled-down** marks scored in the report write-up/journal and average marks of two tests is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

SEE marks for the practical course is 50 Marks.

SEE shall be conducted jointly by the two examiners of the same institute, examiners are

appointed by the University.

All laboratory experiments are to be included for practical examination.

(Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.

Students can pick one question (experiment) from the questions lot prepared by the internal /external examiners jointly.

Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

Change of experiment is allowed only once and 10% Marks allotted to the procedure part to be made zero.

The duration of SEE is 03 hours

Suggested Learning Resources:

-

IoT Laboratory with Mini Project			
Course Code	**22MCAL37**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:0:2:0	SEE Marks	50
Credits	2	Exam Hours	03

Course objectives:

- Demonstrate theIoT architecture design for a given problem
- Apply IOT techniques for a given problem
- Analyse the application protocol, transport layer methods for the given business case.

Sl.NO	Experiments
1	Run some python programs on Pi like: Read your name and print Hello message with name Read two numbers and print their sum, difference, product and division. Word and character count of a given string Area of a given shape (rectangle, triangle and circle) reading shape and appropriate values from standard input Print a name 'n' times, where name and n are read from standard input, using for and while loops. Handle Divided by Zero Exception. Print current time for 10 times with an interval of 10 seconds. Read a file line by line and print the word count of each line
2	Get input from two switches and switch on corresponding LEDs
3	Flash an LED at a given on time and off time cycle, where the two times are taken from a file
4	Switch on a relay at a given time using cron, where the relay's contact terminals are connected to a load.
5	Access an image through a Pi web cam
6	Control a light source using web page.
7	Implement an intruder system that sends an alert to the given email
8	Get the status of a bulb at a remote place (on the LAN) through web.
	Demonstration Experiments (For CIE) if any
9	Get an alarm from a remote area (through LAN) if smoke is detected
10	A team of two students must develop the mini project. However during the examination, each student must demonstrate the project individually
11	The team must submit a brief project report (20-25 pages) that must include the following a. Introduction b. Requirement Analysis c Software Requirement Specification d. Analysis and Design, e. Implementation f. Testing
12	.Brief synopsis not more than two pages to be submitted by the team as per the format given. It is recommended that students to do prior art search as part of literature survey before submitting the synopsis for the Mini/Major projects

Course outcomes (Course Skill Set):

At the end of the course the student will be able to:

- Design and develop an application for the given problem for the societal/industrial problems
- Develop python program by applying suitable feature for the given problem and verify the output
- Build intruder system that sends an alert to the given email

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. The student has to secure not less than 40% of maximum marks in the semester-end examination(SEE). In total of CIE and SEE student has to secure 50% maximum marks of the course.

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CIE marks for the practical course is **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment to be evaluated for conduction with observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments designed by the faculty who is handling the laboratory session and is made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled downed to 30 marks (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct 02 tests for 100 marks, the first test shall be conducted after the 8th week of the semester and the second test shall be conducted after the 14th week of the semester.
- In each test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability.
- The average of 02 tests is scaled down to **20 marks** (40% of the maximum marks).

The Sum of **scaled-down** marks scored in the report write-up/journal and average marks of two tests is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

SEE marks for the practical course is 50 Marks.

SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the University.

All laboratory experiments are to be included for practical examination.

(Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.

Students can pick one question (experiment) from the questions lot prepared by the internal /external examiners jointly.

Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

Change of experiment is allowed only once and 10% Marks allotted to the procedure part to be made zero.

The duration of SEE is 03 hours

NOTE:

Part A:The student should have hands on experience in using various sensors like temperature, humidity, smoke, light, etc. and should be able to use control web camera, network, and relays connected to the Pi.

Part B:Each students has to execute one program picked from Part-A during the semester end examination. In SEE Part-A and Part-B shall be given 50% weightage each.

Societal Project				
Course Code		**22MCAL38**	CIE Marks	100
Number of contact Hours/Week		2	SEE Marks	__
Credits		2	Exam Hours	03

Course objectives:
- Build creative solutions for development problems of current scenario in the Society.
- Utilize the skills developed in the curriculum to solve real life problems.
- Improve understanding and develop methodology for solving complex issues.

Some of the domains to choose for societal projects:
- Infrastructure
- Health Care
- Social security
- Security for women
- Transportation
- Business Continuity
- Remote working and Education
- Digital Finance
- Food Security
- Rural employment
- Water and land management
- Pollution
- Financial Independence
- Agricultural Finance
- Primary Health care
- Nutrition
- Child Care
- E-learning
- Distance parenting
- Mentorship Etc

Course outcomes:
At the end of the course the student will be able to:
- Building solution for real life societal problems.
- Improvement of their technical/curriculum skills

Continuous Internal Evaluation:
Identifying the real life problems and producing literature report : 20 marks
Data sampling and Cleaning :10 Marks
Establishing the right Objective: 10 Marks
Developing the solution : 20 Marks
Propagating the solution to the stake holders 1)Lectures 2)Social Meetings 3)Social media 4)Street plays 5)Advertisement Either of the 3(evidence of the work through Jio tag photo)
Project Report: 20 marks. The basis for awarding the marks shall be the involvement of the student in the project and in the preparation of project report. To be awarded by the internal guide in consultation with external guide if any. Certified by stake holders and authorized by concerned government authorities.
Project Presentation: 10 marks.
The Project Presentation marks of the Project Work Phase -II shall be awarded by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three faculty from the department with the senior most acting as the Chairperson.
Evalution: 10 marks.
The student shall be evaluated based on the ability in the Question and Answer session for 10 marks.

INTERNSHIP			
Course Code	**22MCA39**	CIE Marks	50
Number of contact Hours/Week	3	SEE Marks	50
Credits	06	Exam Hours	03

Course objectives:

Internship/Professional practice provide students the opportunity of hands-on experience that include personal training, time and stress management, interactive skills, presentations, budgeting, marketing, liability and risk management, paperwork, equipment ordering, maintenance, responding to emergencies etc. The objective are further,

To put theory into practice.

To expand thinking and broaden the knowledge and skills acquired through course work in the field.

To relate to, interact with, and learn from current professionals in the field.

To gain a greater understanding of the duties and responsibilities of a professional.

To understand and adhere to professional standards in the field.

To gain insight to professional communication including meetings, memos, reading, writing, public speaking, research, client interaction, input of ideas, and confidentiality.

To identify personal strengths and weaknesses.

To develop the initiative and motivation to be a self-starter and work independently.

Internship/Professional practice: Students under the guidance of internal guide/s and external guide shall take part in all the activities regularly to acquire as much knowledge as possible without causing any inconvenience at the place of internship.

Seminar: Each student, is required to

- Present the seminar on the internship orally and/or through power point slides.
- Answer the queries and involve in debate/discussion.
- Submit the report duly certified by the external guide.
- The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident.

Course outcomes:

At the end of the course the student will be able to:

- Gain practical experience within industry in which the internship is done.
- Acquire knowledge of the industry in which the internship is done.
- Apply knowledge and skills learned to classroom work.
- Develop a greater understanding about career options while more clearly defining personal career goals.
- Experience the activities and functions of professionals.
- Develop and refine oral and written communication skills.
- Identify areas for future knowledge and skill development.
- Expand intellectual capacity, credibility, judgment, intuition.
- Acquire the knowledge of administration, marketing, finance and economics.

Continuous Internal Evaluation

CIE marks for the Internship/Professional practice report (20 marks), seminar (20 marks) and question and answer session (10 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session by the student) by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three faculty from the department with the senior most acting as the Chairperson.

Semester End Examination

SEE marks for the internship report (20 marks), seminar (20 marks) and question and answer session (10 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session) by the examiners appointed by the University.

Semester- IV

Deep Learning			
Course Code	**22MCA411**	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	2:0:0:2	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Learning objectives:
- Demonstrate the basics of deep learning for a given context.
- Implement various deep learning models for the given problem
- Realign high dimensional data using reduction techniques for the given problem
- Analyze optimization and generalization techniques of deep learning for the given problem.
- 5.   Evaluate the given deep learning application and enhance by applying latest techniques

Module-1
Introduction to machine learning- Linear models (SVMs and Perceptron's, logistic regression)- Intro to Neural Nets: What a shallow network computes- Training a network: loss functions, back propagation and stochastic gradient descent- Neural networks as universal function approximates

Teaching-Learning Process	Chalk and Talk/PPT/Web Content

Module-2
DEEP NETWORKS : History of Deep Learning- A Probabilistic Theory of Deep Learning- Back propagation and regularization, batch normalization- VC Dimension and Neural Nets-Deep Vs Shallow Networks Convolutional Networks- Generative Adversarial Networks (GAN), Semi- supervised Learning

Teaching-Learning Process	Chalk and Talk/PPT/Web Content

Module-3
DIMENTIONALITY REDUCTION : Linear (PCA, LDA) and manifolds, metric learning - Auto encoders and dimensionality reduction in networks - Introduction to Convnet - Architectures – AlexNet, VGG, Inception, ResNet - Training a Convnet: weights initialization, batch normalization, hyper parameter optimization

Teaching-Learning Process	Chalk and Talk/PPT/Web Content

Module-4
OPTIMIZATION AND GENERALIZATION Optimization in deep learning– Non-convex optimization for deep networks- Stochastic Optimization Generalization in neural networks- Spatial Transformer Networks- Recurrent networks, LSTM - Recurrent Neural Network Language Models- Word-Level RNNs & Deep Reinforcement Learning - Computational & Artificial Neuroscience

Teaching-Learning Process	Chalk and Talk/PPT/Web Content

Module-5
CASE STUDY AND APPLICATIONS Imagenet- Detection-Audio Wave Net-Natural Language Processing Word2Vec - Joint Detection Bio Informatics- Face Recognition- Scene Understanding- Gathering Image Captions

Teaching-Learning Process	Chalk and Talk/PPT/Web Content

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Continuous Internal Evaluation:

- Three Unit Tests each of **20 Marks**
- Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks**
  to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
- Each full question will have a sub-question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Books

1. Cosma Rohilla Shalizi, Advanced Data Analysis from an Elementary Point of View,2015.

   Reference Books

   - Deng & Yu, Deep Learning: Methods and Applications, Now Publishers, 2013.
   - Ian Good fellow, Yoshua Bengio, Aaron Courville, Deep Learning, MIT Press, 2016.
   - 3. Michael Nielsen, Neural Networks and Deep Learning, Determination Press, 2015.

Web links and Video Lectures (e-Resources):

Skill Development Activity
The students with the help of the course teacher can take up relevant technical –activities which will enhance their skill. The prepared report shall be evaluated for CIE marks.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

Sl. No.	Description	Blooms Level
CO1	Illustrate the basics of deep learning for a given context	L2
CO2	Apply various deep learning models for the given problem	L3
CO3	Realign high dimensional data using reduction techniques for the given problem	L2
CO4	Apply and Analyze optimization and generalization techniques for the given problem	L2
CO5	Application of latest deep learning techniques and to enhance the results..	L3

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3		X	X						X		X	
CO4												
CO5		X		X						X		

Semester- IV

<table>
<tr><td colspan="5" align="center">**Big Data Analytics**</td></tr>
<tr><td>Course Code</td><td>**22MCA412**</td><td>CIE Marks</td><td>50</td></tr>
<tr><td>Teaching Hours/Week (L:P:SDA)</td><td>2:0:0:2</td><td>SEE Marks</td><td>50</td></tr>
<tr><td>Total Hours of Pedagogy</td><td>40</td><td>Total Marks</td><td>100</td></tr>
<tr><td>Credits</td><td>03</td><td>Exam Hours</td><td>03</td></tr>
</table>

Course Learning objectives:
- Identify the business problem for a given context and frame the objectives to solve it through data analytics tools.
- Apply various algorithms for handling large volumes of data.
- Illustrate the architecture of HDFS and explain functioning of HDFS clusters.
- Analyze the usage of Map-Reduce techniques for solving big data problems.
- Conduct experiment with various datasets for analysis / visualization and arrive at valid conclusions.

Module-1

Big Data and Analytics
Example Applications, Basic Nomenclature, Analysis Process Model, Analytical Model Requirements , Types of Data Sources, Sampling, Types of Data Elements, Data Exploration, Exploratory Statistical Analysis, Missing Values, Outlier Detection and Treatment, Standardizing Data Labels, Categorization

Teaching-Learning Process	Chalk and Talk/PPT/Web Content

Module-2

Big Data Technology
Hadoop's Parallel World, Data discovery, Open source technology for Big Data Analytics, Cloud and Big Data, Predictive Analytics, Mobile Business Intelligence and Big Data, Crowd Sourcing Analytics, Inter- and Trans-Firewall Analytics.

Teaching-Learning Process	Chalk and Talk/PPT/Web Content

Module-3

Meet Hadoop
Data, Data Storage and Analysis, Comparison with Other Systems, RDBMS, Grid Computing, Volunteer Computing, A Brief History of Hadoop, Apache Hadoop and the Hadoop Ecosystem Hadoop Releases Response.

Teaching-Learning Process	Chalk and Talk/PPT/Web Content

Module-4

The Hadoop Distributed File system
The Design of HDFS, HDFS Concepts, Blocks, Namenodes and Datanodes, HDFS Federation, HDFS High-Availability, The Command-Line Interface, Basic Filesystem Operations, Hadoop Filesystems Interfaces, The Java Interface, Reading Data from a Hadoop URL, Reading Data Using the FileSystem API, Writing Data, Directories, Querying the Filesystem, Deleting Data, Data Flow Anatomy of a File Read, Anatomy of a File Write, Coherency Model, Parallel Copying with distcp Keeping an HDFS Cluster Balanced, Hadoop Archives.

Teaching-Learning Process	Chalk and Talk/PPT/Web Content

Module-5

A Weather Dataset ,Data Format, Analysing the Data with Unix Tools, Analyzing the Data with Hadoop, Map and Reduce, Java MapReduce, Scaling Out, Data Flow, Combiner functions, Running a Distributed MapReduce Job, Hadoop Streaming, Hadoop Pipes, Compiling and Running, Developing a MapReduce Application, The Configuration API, Combining Resources, Variable Expansion, Configuring the Development Environment, Managing Configuration.

	Generic Options Parser, Tool and Tool Runner, Writing a Unit Test, Mapper, Reducer, Running Locally on Test Data, Running a Job in a Local Job Runner, Testing the Driver, Running on a Cluster, Packaging, Launching a Job, The MapReduce Web UI, Retrieving the Results, Debugging a Job, Hadoop Logs, Remote Debugging.
Teaching-Learning Process	Chalk and Talk/PPT/Web Content

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- Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
- Each full question will have a sub-question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Books

1. Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications" Wiley.

2. Michael Minelli, Michehe Chambers, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", 1st Edition, Michael Minelli, Michele Chambers, AmbigaDhiraj, Wiley CIO Series, 2013.

3. Tom White, "Hadoop: The Definitive Guide", 3rd Edition, O'reilly, 2012.

   Reference Books

- Boris Lublinsky, Kevin T. Smith, Alexey Yakubovich, "Professional Hadoop Solutions", Wiley, ISBN: 9788126551071, 2015.
- Chris Eaton, Dirk deroos et al., "Understanding Big data", McGraw Hill, 2012.
- Vignesh Prajapati, "Big Data Analytics with R and Haoop", Packet Publishing 2013.
- Tom Plunkett, Brian Macdonald et al, "Oracle Big Data Handbook", Oracle Press, 2014.

Web links and Video Lectures (e-Resources):

Skill Development Activity
The students with the help of the course teacher can take up relevant technical –activities which will enhance their skill. The prepared report shall be evaluated for CIE marks.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

Sl. No.	Description	Blooms Level
CO1	Apply analytical tools to identify and solve the business problem for a given context.	L2
CO2	Analyse various algorithms for handling large volumes of data.	L3
CO3	Apply the architecture of HDFS and explain functioning of HDFS clusters.	L2
CO4	Analyse the usage of Map-Reduce techniques for solving big data problems.	L2
CO5	Carryout experiments on various datasets for analysis / visualization.	L3

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3		X	X						X		X	
CO4												
CO5		X		X						X		

Semester- IV

	Wireless Ad Hoc Networks		
Course Code	**22MCA413**	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	2:0:0:2	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Learning objectives:
- Illustrate the issues of ad-hoc wireless network
- Demonstrate the existing network and improve its quality of service
- Demonstrate to choose appropriate protocol for various applications and design the architecture
- Analyze the security measures present at different levels
- Analyze energy consumption and management in ad-hoc wireless networks

Module-1	
Ad-hoc Wireless Networks Introduction, Issues in Ad-hoc Wireless Networks, Ad-hoc Wireless Internet; MAC Protocols for Ad-hoc Wireless Networks: Introduction, Issues in Designing a MAC Protocol, Design Goals of MAC Protocols, Classification of MAC protocols, Contention- Based Protocols, Contention-Based Protocols with Reservation Mechanisms, Contention-Based Protocols with Scheduling Mechanisms, MAC Protocols that Use Directional Antennas	
Teaching-Learning Process	Chalk and Talk/PPT/Web Content

Module-2	
Routing Protocols for Ad-hoc Wireless Networks Introduction, Issues in Designing a Routing Protocol for Ad-hoc Wireless Networks; Classification of Routing Protocols; Table Driven Routing Protocols; On-Demand Routing Protocols, Hybrid Routing Protocols, Hierarchical Routing Protocols and Power-Aware Routing Protocols.	
Teaching-Learning Process	Chalk and Talk/PPT/Web Content

Module-3	
Multicast Routing in Ad-hoc Wireless Networks Introduction, Issues in Designing a Multicast Routing Protocol, Operation of Multicast Routing Protocols, An Architecture Reference Model for Multicast Routing Protocols, Classifications of Multicast Routing Protocols, Tree-Based Multicast Routing Protocols and Mesh-Based Multicast Routing Protocols.	
Teaching-Learning Process	Chalk and Talk/PPT/Web Content

Module-4	
Transport Layer and Security Protocols for Ad-hoc Networks: Introduction, Issues in Designing a Transport Layer Protocol; Design Goals of a Transport Layer Protocol; Classification of Transport Layer Solutions; TCP over Transport Layer Solutions; Other Transport Layer Protocols for Ad-hoc Networks; Security in Ad-hoc Wireless Networks, Issues and Challenges in Security Provisioning, Network Security Attacks, Key Management and Secure Touting Ad-hoc Wireless Networks.	
Teaching-Learning Process	Chalk and Talk/PPT/Web Content

Module-5	
Quality of Service and Energy Management in Ad-hoc Wireless Networks: Introduction, Issues and Challenges in Providing QoS in Ad-hoc Wireless Networks, Classification of QoS Solutions, MAC Layer Solutions, Network Layer Solutions; Energy Management in Ad-hoc Wireless Networks: Introduction, Need for Energy Management in Ad-hoc Wireless Networks, Classification of Energy Management Schemes, Battery Management Schemes, Transmission Management Schemes, System Power Management Schemes.	

Teaching-Learning Process	Chalk and Talk/PPT/Web Content

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- Three Unit Tests each of **20 Marks**
- Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks**
  to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
- Each full question will have a sub-question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Books

1. Ad-hoc Wireless Networks, C. Siva Ram Murthy& B. S. Manoj, Pearson Education, 2nd Edition, 2011
   Reference Books

- Ad-hoc Wireless Networks, Ozan K. Tonguz and John Wiley, 2007 ,Gianguigi Ferrari
- Ad-hoc ireless Networking. Xiuzhen Cheng, Xiao Hung, Ding-Zhu Du, Kluwer Academic Publishers, 2004
- Ad-hoc Mobile Wireless Networks- Protocols and Systems, C.K. Toh, Pearson Education, 2002

Web links and Video Lectures (e-Resources):

Skill Development Activity
The students with the help of the course teacher can take up relevant technical –activities which will enhance their skill. The prepared report shall be evaluated for CIE marks.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

Sl. No.	Description	Blooms Level
CO1	Analyze the issues of ad-hoc wireless network	L2
CO2	Evaluate the existing network and improve its quality of service	L3
CO3	Choose appropriate protocol for various applications and design the architecture	L2
CO4	Examine security measures present at different levels and identify the possible improvements for the latest version of the ad hoc network IEEE standard	L2
CO5	Analyze energy consumption and management in ad-hoc wireless networks	L3

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3	X		X	X							X	
CO4												
CO5		X										X

Semester- IV

Software Project Management			
Course Code	**22MCA414**	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	2:0:0:2	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Learning objectives:
- Apply the practices and methods for successful software project management
- Identifytechniquesforrequirements,policiesanddecisionmakingforeffectiveresource management
- Illustratetheevaluationtechniquesforestimatingcost,benefits,scheduleandrisk
- Devise a framework for software project management plan for a ctivities, risk, monitoring and control
- 5. Design a framework to manage people

Module-1	
INTRODUCTION TO SOFTWARE PROJECT MANAGEMENT	
Introduction, Why is Software Project Management important? What is a Project?, Contract Management, Activities Covered by Software Project Management, Plans, Methods and Methodologies, Some ways of categorizing software projects, Stakeholders, Setting Objectives, Business Case, Project Success and Failure, What is Management? Management Control, Traditional versus Modern Project Management Practices	
Teaching-Learning Process	Chalk and Talk/PPT/Web Content

Module-2	
PROJECT EVALUATION & FINANCE	
Evaluation of Individual Projects, Cost Benefit Evaluation Techniques, Risk Evaluation, Programme Management, Managing allocation of Resources within Programmes, Financial Accounting–An overview– Accounting concepts, Principles & Standards, Ledger posting, Trial balance, Profit and Loss account Balance sheet	
Teaching-Learning Process	Chalk and Talk/PPT/Web Content

Module-3	
ACTIVITY PLANNING	
Objectives of Activity Planning, When to Plan, Project Schedules, Sequencing and Scheduling Activities, Network Planning Models, Forward Pass– Backward Pass, Identifying critical path, Activity Float, Shortening Project Duration, Activity on Arrow Networks Risk Management, Nature of Risk, Categories of Risk, A framework for dealing with Risk, Risk Identification, Risk analysis and prioritization, risk planning and risk monitoring.	
Teaching-Learning Process	Chalk and Talk/PPT/Web Content

Module-4	
MONITORING AND CONTROL	
Creating the Framework, Collecting the Data, Review, Project Termination Review, Visualizing Progress, Cost Monitoring, Earned Value Analysis, Prioritizing Monitoring, Getting Project Back To Target, Change Control, Software Configuration Management	
Teaching-Learning Process	Chalk and Talk/PPT/Web Content

Module-5	
MANAGING PEOPLE AND WORKING IN TEAMS	
Introduction, Understanding Behavior, Organizational Behavior:A Background, Selecting the Right Person for the Job, Instruction in the Best Methods, Motivation, The Oldham–Hackman Job Characteristics Model, Stress–Health and Safety Working In Teams, Becoming a Team, Decision Making,	

Leadership.	
Teaching-Learning Process	Chalk and Talk/PPT/Web Content

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- Three Unit Tests each of **20 Marks**
- Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks**
  to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
- Each full question will have a sub-question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:
Books

- Bob Hughes, Mike Cotterell, Rajib Mall, "Software Project Management", Fifth Edition,Tata McGraw Hill, 2011.

- "Accounting for Management" Jawahar Lal, 5th Edition, Wheeler Publications, Delhi.

  Reference Books

  - Jack Marchewka," Information Technology-Project Management", Wiley Student Version, 4th Edition, 2013.
  - James P Lewis, "Project Planning, Scheduling & Control", McGraw Hill, 5th Edition, 2011.
  - 3. Pankaj Jalote, "Software Project Management in Practise", Pearson Education, 2002.

Web links and Video Lectures (e-Resources):

Skill Development Activity
The students with the help of the course teacher can take up relevant technical –activities which will enhance their skill. The prepared report shall be evaluated for CIE marks.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

Sl. No.	Description	Blooms Level
CO1	Apply theoretical concepts for projects management	L2
CO2	Planning for resources allocation with case studies.	L3
CO3	Solving problems related to risk identification, cost based analysis, etc.	L2
CO4	Managing and working in team	L2

Mapping of COS and POs

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

Software Defined Networks			
Course Code	**22MCA415**	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	2:0:0:2	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Learning objectives:
- Demonstrate the fundamentals of Software Defined Networks for the given problem
- Illustrate the basics of Software Defined Networks Operations and Data flow
- Demonstrate different Software Defined Network Operations and Data Flow
- Analyse alternative definitions of Software Defined Networks
- Apply different Software Defined Network Operations in real world problem

Module-1

Introduction to SDN
Understanding the SDN, Understanding the SDN technology, Control Plane, Data Plane, Moving information between planes, separation of the control and data planes, Distributed control planes, Load Balancing, Creating the MPLS Overlay, Centralized control planes.

Teaching-Learning Process	Chalk and Talk/PPT/Web Content

Module-2

Working of SDN
Evaluation of Switches and Control planes, SDN Implications, Data centre Needs, Forerunner of SDN, Software Defines Networks is Born, Sustain SDN interoperability, Open source contribution, Fundamental Characteristics of SDN, SDN Operations, SDN Devices, SDN Controllers, SDN Applications, Alternate SDN methods.

Teaching-Learning Process	Chalk and Talk/PPT/Web Content

Module-3

The Open Flow Specifications

Open Flow Overview, Open Flow Basics, Open Flow 1.0 additions, Open Flow 1.1 additions, Open Flow 1.2 additions, Open Flow 1.3 additions, Open Flow limitations.

Teaching-Learning Process	Chalk and Talk/PPT/Web Content

Module-4

SDN via APIS, SDN via Hypervisor-Based Overlays, SDN via Opening up the device, Network function virtualization, Alternative Overlap and Ranking.

Teaching-Learning Process	Chalk and Talk/PPT/Web Content

Module-5

Data centres definition, Data centres demand, tunnelling technologies for Data centres Path technologies in data centres, Ethernet fabrics in Data centres, SDN use case in Data centres.

Teaching-Learning Process	Chalk and Talk/PPT/Web Content

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- Three Unit Tests each of **20 Marks**
- Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks**
  to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
- Each full question will have a sub-question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Books

- Software Defined Networking by Thomas D Nadeau and Ken Gray.
- Software Define Networks, A Comprehensive Approach, Paul Goransson, Chuck Black. MK Publications.

Reference Books

- Software Defined Networking for Dummies brought you by cisco, Brian Underdahl and Gary Kinghorn.

Web links and Video Lectures (e-Resources):

Skill Development Activity

The students with the help of the course teacher can take up relevant technical –activities which will enhance their skill. The prepared report shall be evaluated for CIE marks.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

Sl. No.	Description	Blooms Level
CO1	Apply the fundamentals of Software Defined Networks for the given problem	L3
CO2	Illustrate the basics of Software Defined Networks Operations and Data flow.	L2
CO3	Apply different Software Defined Network Operations and Data Flow	L3
CO4	Analyse alternative definitions of Software Defined Networks	L3
CO5	Apply different Software Defined Network Operations in real world problem	L3

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		X										
CO2										X		X
CO3			X									
CO4		X			X							X
CO5	X								X		X	

IT Project management			
Course Code	**22MCA421**	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	3:0:2	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Learning objectives:
- Discuss about the Software Project Planning and Evaluation techniques.
- Explain about manage projects at each stage of the software development life cycle (SDLC).
- Analyze the activity of planning and risk management principles.
- Apply agile technique to manage software projects and control software deliverables.
- To develop skills to manage the various phases involved in project management and people management.

Module-1

PROJECT EVALUATION AND PROJECT PLANNING
Importance of Software Project Management – Activities - Methodologies – Categorization of Software Projects – Setting objectives – Management Principles – Management Control – Project portfolio Management – Cost-benefit evaluation technology – Risk evaluation – Strategic program
Management – Stepwise Project Planning.

Teaching-Learning Process	Chalk and Talk/PPT/Web Content

Module-2

PROJECT LIFE CYCLE AND EFFORT ESTIMATION
Software process and Process Models – Choice of Process models - Rapid Application development – Agile methods – Dynamic System Development Method – Extreme Programming– Managing interactive processes – Basics of Software estimation – Effort and Cost estimation techniques –
COSMIC Full function points - COCOMO II - a Parametric Productivity Model.

Teaching-Learning Process	Chalk and Talk/PPT/Web Content

Module-3

PROJECT MANAGEMENT AND CONTROL
Framework for Management and control – Collection of data – Visualizing progress – Cost monitoring – Earned Value Analysis – Prioritizing Monitoring – Project tracking – Change control – Software Configuration Management – Managing contracts – Contract Management.

Teaching-Learning Process	Chalk and Talk/PPT/Web Content

Module-4

ACTIVITY PLANNING AND RISK MANAGEMENT
Objectives of Activity planning – Project schedules – Activities – Sequencing and scheduling – Network Planning models – Formulating Network Model – Forward Pass & Backward Pass techniques – Critical path (CRM) method – Risk identification – Assessment – Risk Planning –Risk Management – – PERT technique – Monte Carlo simulation – Resource Allocation – Creation of
critical paths – Cost schedules.

Teaching-Learning Process	Chalk and Talk/PPT/Web Content

Module-5

STAFFING IN SOFTWARE PROJECTS
Managing people – Organizational behavior – Best methods of staff selection – Motivation – The Oldham – Hackman job characteristic model – Stress – Health and Safety – Ethical and Professional concerns – Working in teams – Decision making – Organizational structures – Dispersed and Virtual teams – Communications genres – Communication plans – Leadership.

Teaching-Learning Process	Chalk and Talk/PPT/Web Content

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

* Three Unit Tests each of **20 Marks**
* Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks**
  to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

* The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
* The question paper will have ten full questions carrying equal marks.
* Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
* Each full question will have a sub-question covering all the topics under a module.
* The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Books

Bob Hughes, Mike Cotterell and Rajib Mall: Software Project Management – Fifth Edition, Tata McGraw Hill, New Delhi, 2012.

Reference Books

* Robert K. Wysocki ―Effective Software Project Management‖ – Wiley Publication, 2011.

* Walker Royce: ―Software Project Management‖- Addison-Wesley, 1998.Cyber Law simplified- VivekSood, Mc-GrawHill, 11th reprint , 2013

* Gopalaswamy Ramesh, ―Managing Global Software Projects‖ – McGraw Hill Education (India), Fourteenth Reprint 2013.

Web links and Video Lectures (e-Resources):

Skill Development Activity

The students with the help of the course teacher can take up relevant technical –activities which will enhance their skill. The prepared report shall be evaluated for CIE marks.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

Sl. No.	Description	Blooms Level
CO1	Recognize knowledge about the basic project management concepts, framework and the process models.	L2
CO2	Identify knowledge about software process models and software effort estimation techniques.	L2
CO3	Define the checkpoints, project reporting structure, project progress and tracking mechanisms using project management principles.	L2

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1				x				x			x	
CO2	x	x										
CO3								x			x	

Semantic Web & Social Networks			
Course Code	**22MCA422**	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	3:0:2	SEE Marks	50
Total Hours of Pedagogy	50	Total Marks	100
Credits	04	Exam Hours	03

Course Learning objectives:
- Learn Web Intelligence
- Describe how the Semantic Web provides the key in aggregating information across heterogeneous sources
- Learn Knowledge Representation for the Semantic Web
- Explain the analysis of the social Web and the design of a new class of applications

Module-1
Web Intelligence Thinking and Intelligent Web Applications, The Information Age ,The World Wide Web, Limitations of Today's Web, The Next Generation Web, Machine Intelligence, Artificial Intelligence, Ontology, Inference engines, Software Agents, Berners-Lee www, Semantic Road Map, Logic on the semantic Web.

Teaching-Learning Process	Chalk and talk/PPT/case study/web content: https://www.youtube.com/watch?v=Uiql42PGW6Y

Module-2
Knowledge Representation for the Semantic Web Ontology's and their role in the semantic web, Ontologies Languages for the Semantic Web – Resource Description Framework(RDF) / RDF Schema, Ontology Web Language(OWL), UML, XML/XML Schema.

Teaching-Learning Process	Chalk and talk/PPT/case study/web content: https://www.youtube.com/watch?v=rAkSY5Ha9vk

Module-3
Ontology Engineering, Constructing Ontology, Ontology Development Tools, Ontology Methods, Ontology Sharing and Merging, Ontology Libraries and Ontology Mapping, Logic, Rule and Inference Engines.

Teaching-Learning Process	Chalk and talk/PPT/case study/web content: https://youtu.be/rhgUDGtT2EM?list=PLvgeTuKrhSLPbYlF0gW3V2ivGqevTQlCf

Module-4
Semantic Web Applications, Services and Technology Semantic Web applications and services, Semantic Search, e-learning, Semantic Bioinformatics, Knowledge Base ,XML Based Web Services, Creating an OWL-S Ontology for Web Services, Semantic Search Technology, Web Search Agents and Semantic Methods

Teaching-Learning Process	Chalk and talk/PPT/case study/web content: https://www.youtube.com/watch?v=aPlyXvEtUHM

Module-5
Social Network Analysis and semantic web What is social Networks analysis, Development of the social networks analysis, Electronic Sources for Network Analysis – Electronic Discussion networks, Blogs and Online Communities, Web Based Networks. Building Semantic Web Applications with social network features.

Teaching-Learning Process	Chalk and talk/PPT/case study/web content: https://www.youtube.com/watch?v=yCXu10eDtcA

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- Three Unit Tests each of **20 Marks**
- Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks**
  to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
- Each full question will have a sub-question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

TEXT BOOKS:

1. Thinking on the Web - Berners Lee, Godel and Turing, Wiley inter science, 2008.
2. Social Networks and the Semantic Web, Peter Mika, Springer, 2007.

REFERENCE BOOKS:

1. Semantic Web Technologies, Trends and Research in Ontology Based Systems, J.Davies, R.Studer, P.Warren, John Wiley & Sons.
2. Semantic Web and Semantic Web Services -Liyang Lu Chapman and Hall/CRC Publishers,(Taylor & Francis Group).

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=yCXu10eDtcA
- https://www.youtube.com/watch?v=Q7tyi1kp33w
- https://www.youtube.com/watch?v=QQCWHgclGB8
- https://www.youtube.com/watch?v=QQCWHgclGB8&t=1474s
- https://www.youtube.com/playlist?list=PL3JRjVnXiTBYHhu15olX6ugN5B4oizwAb

Skill Development Activities Suggested

- The students with the help of the course teacher can take up relevant technical –activities which will enhance their skill.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

Sl. No.	Description	Blooms Level
CO1	Summarize to create ontology and knowledge representation for the semantic web	L2
CO2	Solve to build a blogs and social networks	L3
CO3	Describe the Modeling and aggregating social network data.	L2
CO4	Illustrate the Web- based social network and Ontology	L3

Mapping of COS and POs

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

Fundamentals of Game Design			
Course Code	**22MCA423**	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Learning objectives:
- Explore basics of game design
- Identify major genres and its categories
- Build visual appearances for games

Module-1	
Games and Video Games. Conventional Games Versus Video Games. Games for Entertainment.Serious Games. Designing and Developing Games: An Approach to the Task. Key Components of Video Games. The Structure of a Video Game. Stages of the Design Process. Game Design Team Roles. Game Design Documents, The Anatomy of a Game Designer	
Teaching-Learning Process	Chalk and talk/PPT/case study/web content: https://youtu.be/9z7AEAyhAG8?list=PLyKrcyFLz9-dSNJma6yq5sExoR73fFLSU

Module-2	
The Major Genres, What Is a Genre?. ,The Classic Game Genres. Understanding Your Player. Vanden Berghe's Five Domains of Play,D emographic Categories. . Gamer Dedication. The Dangers of Binary Thinking.	
Teaching-Learning Process	Chalk and talk/PPT/case study/web content: https://youtu.be/fis26HvvDII

Module-3	
Understanding Your Machine. Home Game Consoles. Personal Computers. Portable Devices. Other Devices. Making Money from Your Game. . Direct Payment Models. . Indirect Payment Models. World Market. Game Concepts Getting an IdeaFrom Idea to Game Concept	
Teaching-Learning Process	Chalk and talk/PPT/case study/web content: https://youtu.be/MJ9ddtyP4_Y?list=PLdRfLcb1DviyM-TUDiITQwnqJsGTGZRbH

Module-4	
Game Worlds,What Is a Game World?. ,The Purposes of a Game World. The Dimensions of a Game World. Realism. Creative and Expressive Play,Self-Defining Play. Creative Play. Other Forms of Expression Game Modifications. Character Development. . The Goals of Character Design. The Relationship Between Player and Avatar	
Teaching-Learning Process	Chalk and talk/PPT/case study/web content

Module-5	
Visual Appearances. Character Depth,Audio Design. Storytelling. . Why Put Stories in Games?. The Storytelling Engine. Linear Stories. Nonlinear Stories. Granularity Mechanisms for Advancing the Plot. Emotional Limits of Interactive Stories	
Teaching-Learning Process	Chalk and talk/PPT/case study/web content

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- Three Unit Tests each of **20 Marks**
- Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks**
  to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
- Each full question will have a sub-question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

TEXT BOOKS

1 Fundamentals of Game Design Ernest Adams, Third Edition

REFERENCE BOOKS

Web links and Video Lectures (e-Resources):

https://youtu.be/iIOIT3dCy5w

Skill Development Activities Suggested

- The students with the help of the course teacher can take up relevant technical –activities which will enhance their skill.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

Sl. No.	Description	Blooms Level
CO1	Understand basics of game design	L1
CO2	Build approaches and key components of video games	L2
CO3	Apply Game concept in designing the games	L2
CO4	Build visual appearances for games	L1

Mapping of COS and POs

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

Agile Technologies			
Course Code	**22MCA424**	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Learning objectives:
- Explain the Agile technologies, methods ,XP lifecycle and concepts
- Illustrate the Informative workspace, RootCause analysis
- Categorize the collaborating and Releasing in Agile
- Explain Planning and Developing in Agile

Module-1
Why Agile?: Understanding Success, Beyond Deadlines, The Importance of Organizational Success, Enter Agility, How to Be Agile?: Agile Methods, Don't Make Your Own Method, The Road to Mastery, Find a Mentor. Understanding XP: The XP Lifecycle, The XP Team, XP Concepts

Teaching-Learning Process	Chalk and talk/PPT/case study/web content: https://youtu.be/9z7AEAyhAG8?list=PLyKrcyFLz9-dSNJma6yq5sExoR73fFLSU

Module-2
Adopting XP: Is XP Right for Us?, Go!, Assess Your Agility, Thinking: Pair Programming, Energized Work, Informative Workspace, RootCause Analysis, Retrospectives

Teaching-Learning Process	Chalk and talk/PPT/case study/web content: https://youtu.be/fis26HvvDII

Module-3
Collaborating: Trust, Sit Together, Real Customer Involvement, Ubiquitous Language, Stand-Up Meetings, Coding Standards, Iteration Demo, Reporting, **Releasing**:"Done Done", No Bugs, Version Control, Ten-Minute Build, Continuous Integration, Collective Code Ownership, Documentation. .

Teaching-Learning Process	Chalk and talk/PPT/case study/web content: https://youtu.be/MJ9ddtyP4_Y?list=PLdRfLcb1DviyM-TUDiITQwnqJsGTGZRbH

Module-4
Planning: Vision, Release Planning, The Planning Game, Risk Management, Iteration Planning, Slack, Stories, Estimating. Developing: Incremental requirements, Customer Tests, Test-Driven Development, Refactoring, Simple Design ,Incremental Design and Architecture, Spike Solutions, Performance Optimization, Exploratory Testing

Teaching-Learning Process	Chalk and talk/PPT/case study/web content

Module-5

	Mastering Agility: Values and Principles: Commonalities, About Values, Principles, and Practices, Further Reading, **Improve the Process:** Understand Your Project, Tune and Adapt, Break the Rules, **Rely on People :** Build Effective Relationships, Let the Right People Do the Right Things, Build the Process for the People **Eliminate Waste :** Work in Small, Reversible Steps, Fail Fast, Maximize Work Not Done, Pursue Throughput, **Deliver Value:** Exploit Your Agility, Only Releasable Code Has Value, Deliver Business Results, Deliver Frequently, **Seek Technical Excellence** :Software Doesn't Exist, Design Is for Understanding, Design Trade-offs, Quality with a Name, Great Design, Universal Design Principles, Principles in Practice, Pursue Mastery	
Teaching-Learning Process	Chalk and talk/PPT/case study/web content	

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  to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
- Each full question will have a sub-question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:
TEXT BOOKS

- "The Art of Agile Development" James shore,Chromatic, O'Reilly, 2007
- Agile Software Development,Principles, Patterns, and Practices , Robert C. Martin, Prentice Hall, 1st edition, 2002
- Agile and Iterative Development A Manger's Guide, Craig Larman, Pearson Education, First Edition, India, 2004

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=J326LIUrZM8
- https://onlinecourses.nptel.ac.in/noc20_cs12/preview
- https://www.geeksforgeeks.org/what-is-data-mining-trends-and-research-frontiers/

Skill Development Activities Suggested

● The students with the help of the course teacher can take up relevant technical –activities which will enhance their skill.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

Sl. No.	Description	Blooms Level
CO1	Illustrate the working of Agile Methods, XP	L2
CO2	Explain the concept of Coding Standards, Iteration Demo, Reporting	L2
CO3	Demonstrate Incremental requirements, Customer Tests, Test-Driven Development, Refactoring (can be attained through assignment or CIE)	L3
CO4	Evaluate how to Build Effective Relationships (can be attained through assignment or CIE)	L3

Mapping of COS and POs

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

SOFTWARE METRICS & QUALITY ASSURANCE				
Course Code	**22MCA425**	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	3:0:2	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Learning objectives:
- Learn about Software quality assurance and benchmarking measurements
- Describe software development best practices for minimizing vulnerabilities in programming code
- Conduct a security verification and assessment (static and dynamic) of a software application..
- To discover an availability of metrics and measures.

Module-1
What Is Software Quality: Quality: Popular Views, Quality Professional Views, Software Quality, Total Quality Management and Summary. Fundamentals Of Measurement Theory: Definition, Operational Definition, And Measurement, Level Of Measurement, Some Basic Measures, Reliability And Validity, Measurement Errors, Be Careful With Correlation, Criteria For Causality, Summary. Software Quality Metrics Overview: Product Quality Metrics, In Process Quality Metrics, Metrics for Software Maintenance, Examples For Metrics Programs, Collecting Software Engineering Data.

Teaching-Learning Process	Chalk and Talk method /PPT/ Case study/Web contents

Module-2
Applying The Seven Basic Quality Tools In Software Development: Ishikawa's Seven Basic Tools, Checklist, Pareo Diagram, Histogram, Run Charts, Scatter Diagram, Control Chart, Cause And Effect Diagram. The Rayleigh Model: Reliability Models, The Rayleigh Model Basic Assumptions, Implementation, Reliability And Predictive Validity.

Teaching-Learning Process	Chalk and Talk method /PPT/ Case study/Web contents

Module-3
Complexity Metrics And Models: Lines Of Code, Halstead's Software Science , Cyclomatic Complexity Syntactic Metrics, An Example Of Module Design Metrics In Practice .Metric And Lessons Learned For Object Oriented Projects: Object Oriented Concepts And Constructs, Design And Complexity Metrics, Productivity Metrics, Quality And Quality Management Metrics, Lessons Learned For object oriented Projects.

Teaching-Learning Process	Chalk and Talk method /PPT/ Case study/Web contents

Module-4

	Availability Metrics: Definition And Measurement Of System Availability, Reliability Availability And Defect Rate, Collecting Customer Outage Data For Quality Improvement, In Process Metrics For Outage And Availability .Conducting Software Project Assessment :Audit Ad Assessment , Software Process Maturity Assessment And Software Project Assessment , Software Process Assessment A Proponed Software Project Assessment Method.
Teaching-Learning Process	Chalk and Talk method /PPT/ Case study/Web contents

Module-5	
	Dos And Don'ts Of Software Process Improvement :Measuring Process Maturity, Measuring Process Capability, Staged Versus Continuous Debating Religion, Measuring Levels Is Not Enough, Establishing The Alignment Principle , Take Time Getting Faster, Keep it Simple Or Face Decomplexification, Measuring The Value Of Process Improvement , Measuring Process Compliance , Celebrate The Journey Not Just The Destination. Using Function Point Metrics to Measure Software Process Improvement: Software Process Improvement Sequences, Process Improvement Economies, Measuring Process Improvement at Activity Levels.
Teaching-Learning Process	Chalk and Talk method /PPT/ Case study/Web contents

Assessment Details (both CIE and SEE)

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Semester End Examination:

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
- Each full question will have a sub-question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:
TEXT BOOKS

1. Metrics and Models in Software Quality Engineering, Stephen H Khan Pearson 2nd edition 2013

REFERENCE BOOKS

1. Software quality and Testing Market,. S.A.Kelkar PHI Learing, Pvt, Ltd 2012
2. Managing the Software Inc,. Watts S Humphrey Process Pearson Education 2008

Web links and Video Lectures (e-Resources):

- https://www.bmc.com/blogs/software-quality-metrics/
- https://www.youtube.com/watch?v=KqDlDubS-OU
- https://www.youtube.com/watch?v=Jj7dLM8cLuE

Skill Development Activities Suggested
- The students with the help of the course teacher can take up relevant technical –activities which will enhance their skill. The prepared report shall be evaluated for CIE marks.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

Sl. No.	Description	Blooms Level
CO1	Identify and apply various software metrics, which determines the quality level of software	L1
CO2	Compare and Pick out the right reliability model for evaluating the software	L2
CO3	Discover new metrics and reliability models for evaluating the quality level of the software based on the requirement	L3
CO4	Identify and evaluate the quality level of internal and external attributes of the software product	L1

Mapping of COS and POs

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

TECHNICAL SEMINAR			
Course Code	22MCA43	CIE Marks	50
Number of contact Hours/week (L:P:SDA)	0:2:0	SEE Marks	50
Credits	02	Exam Hours	03

Course objectives:

The objective of the seminar is to inculcate self-learning, face audience confidently, enhance communication skill, involve in group discussion and present and exchange ideas.

Each student, under the guidance of a Faculty, is required to

- Choose, preferably through peer reviewed journals, a recent topic of his/her interest relevant to the Course of Specialization.
- Carryout literature survey, organize the Course topics in a systematic order.
- Prepare the report with own sentences.
- Type the matter to acquaint with the use of Micro-soft equation and drawing tools or any such facilities.
- Present the seminar topic orally and/or through power point slides.
- Answer the queries and involve in debate/discussion.
- Submit two copies of the typed report with a list of references.

The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident.

The CIE marks for the seminar shall be awarded (based on the relevance of the topic, presentation skill, participation in the question and answer session and quality of report) by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three faculties from the department with the senior most acting as the Chairperson.

Continuous Internal Evaluation

CIE marks for the Technical seminar report (20 marks), seminar (20 marks) and question and answer session (10 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session by the student) by the committee constituted for the purposeby the Head of the Department. The committee shall consist of three faculty from the department with the senior most acting as the Chairperson.

Semester End Examination

SEE marks for the Seminar report (20 marks), seminar (20 marks) and question and answer session (10 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session) by the examiners appointed by the University.

PROJECT WORK PHASE -2			
Course Code	22MCA44	CIE Marks	100
Practical /Field work/Week	5	SEE Marks	100
Credits	16	Exam Hours	03

Course objectives:

- To support independent learning.
- To guide to select and utilize adequate information from varied resources maintaining ethics.
- To guide to organize the work in the appropriate manner and present information (acknowledging the sources) clearly.
- To develop interactive, communication, organization, time management, and presentation skills.
- To impart flexibility and adaptability.
- To inspire independent and team working.
- To expand intellectual capacity, credibility, judgement, intuition.
- To adhere to punctuality, setting and meeting deadlines.
- To instill responsibilities to oneself and others.
- To train students to present the topic of project work in a seminar without any fear, face audience confidently, enhance communication skill, involve in group discussion to present and exchange ideas.

Project Work Phase - II: Each student of the project batch shall involve in carrying out the project work jointly in constant consultation with internal guide, co-guide, and external guide and prepare the project report as per the norms avoiding plagiarism.

- Follow the Software Development life cycle
- Data Collection ,Planning
- Design the Test cases
- Validation and verification of attained results
- Significance of parameters w.r.t scientific quantified data.
- Publish the project work in reputed Journal.

Course outcomes:

At the end of the course the student will be able to:

- Present the project and be able to defend it.
- Make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to the project task.
- Habituated to critical thinking and use problem solving skills
- Communicate effectively and to present ideas clearly and coherently in both the written and oral forms.
- Work in a team to achieve common goal.
- Learn on their own, reflect on their learning and take appropriate actions to improve it.

Continuous Internal Evaluation:
Project Report: 20 marks. The basis for awarding the marks shall be the involvement of the student in the project and in the preparation of project report. To be awarded by the internal guide in consultation with external guide if any.
Project Presentation: 20 marks.
The Project Presentation marks of the Project Work Phase -II shall be awarded by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three faculty from the department with the senior most acting as the Chairperson.
Project Execution: 50 Marks
The Project Execution marks of the Project Work Phase -II shall be awarded by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three faculty from the department with the senior most acting as the Chairperson.
Question and Answer: 10 marks.
The student shall be evaluated based on the ability in the Question and Answer session for 10 marks.
Semester End Examination
SEE marks for the project report (60 marks), seminar (30 marks) and question and answer session (10 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session) by the examiners appointed by the University.

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