PG DEPARTMENT OF INFORMATION TECHNOLOGY AND BCA

OUTCOME BASED EDUCATION SYLLABUS

CHOICE BASED CREDIT SYSTEM (CBCS)

M.Sc. INFORMATION TECHNOLOGY

Effective for the students admitted from the academic year

2023-2024 and onwards

DWARAKA DOSS GOVERDHAN DOSS VAISHNAV COLLEGE

(AUTONOMOUS)

Reaccredited with A++ Grade by NAAC

College with Potential for Excellence

Linguistic Minority Institution, Affiliated To University Of Madras,

E.V.R. PERIYAR HIGH ROAD,

ARUMBAKKAM, CHENNAI – 600106, TAMILNADU

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M.Sc. INFORMATION TECHNOLOGY

VISION

To impart technical knowledge and skills to work on real challenges of the industries and societal needs in the field of Information Technology. To expose Students to the current trends in computing which will enable them to become leaders in the IT field.

MISSION

M1	Encourage them to independently design and develop computer software systems and products based on the theoretical principles and software development skills acquired throughout the program.
M2	To make them aware of and adapt to technological advances through active participation in life-long learning.
M3	To inculcate the foundation of research insights among students and make them employable.

PROGRAMME EDUCATION OBJECTIVES (PEOs)

PEO 1	To motivate the progression of the post graduates into a professional by inculcating knowledge relating to the field of Information Technology.
PEO 2	Develop strong skills in systematic planning, developing algorithms and providing solutions for Information Technology based systems which helps in employability.
PEO3	To continue lifelong professional development in computing that benefit personality and societal growth.
PEO4	Able to draw upon foundational knowledge, learn, adapt and successfully bring to bear analytical and computational approaches on changing societal and technological Challenges.
PEO5	To keep abreast with latest area & research in Computer Science and Engineering and its applications in all allied areas.

PROGRAM OUTCOMES (PO) IN RELATION TO GRADUATE ATTRIBUTES

PROGRAMME OUTCOMES

At the completion of the M.Sc. Information Technology program, the students of our Department will be able to:

PO1	Apply the knowledge of technological fundamentals and compute specialized solutions for complex problems.
PO2	An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use scientific judgment to draw accurate inferences.
PO3	Develop strong reasoning skills to enable them to take successful decisions in problem solving areas.
PO4	Create, select, and apply appropriate techniques, resources, and IT tools to model complex computing activities.
PO5	Communicate effectively in order to design, implement and evaluate a computational system to meet desired needs within realistic constraints.
PO6	Ensure professional development growth through contextual, reflective and lifelong learning.

PROGRAMME SPECIFIC OUTCOMES

PSO 1	Understanding the theoretical foundations in technological and computing systems.
PSO 2	Ability to apply the theoretical concepts and practical knowledge of information technology in analysis, design, development and management of information processing systems and applications in the Inter disciplinary domain.
PSO 3	An ability to use appropriate techniques, skills, and tools necessary for Computing practice.
PSO 4	To motivate students to accept new challenges for multi-disciplinary projects.
PSO 5	Develop workable solutions for problems drawn either from social context or from technological areas.

ELIGIBILITY FOR ADMISSION

The candidate shall be admitted to the course provided he/she has passed the bachelor's degree in B.C.A/B.E.S/B.Sc. in Computer Science/Mathematics/Physics/ Statistics / Applied Sciences OR (b) B.Com / Bachelor of Bank Management/B.B.A/B.L.M/B.A Corporate Secretary-ship / B.A. Economics/ any other Bachelor's Degree in any discipline with Business Mathematics and Statistics or Mathematics/Statistics in Main/Allied level OR (c) B.Sc. Chemistry with Mathematics and Physics as allied subjects OR (d) B.E/B.Tech./M.B.A OR (e) A Bachelor's Degree in any discipline with Mathematics as one of the subjects at the Higher Secondary level (i.e. in +2 level of the 10+2pattern)

Candidate shall be admitted to the examination only if he/she has taken the qualified degree in science/any subjects as mentioned after having completed the prescribed courses consisting of 12 years of study and has passed the qualifying examination

DURATION OF THE COURSE

The duration of the course for two academic years consisting of four semesters and each semester comprises of 90 days. In order to be eligible for the award of the degree the candidate shall successfully complete the course in a maximum period of five years reckoned from the date of enrolment for the first semester of the course.

ASSESSMENT PATTERN

BLOOM'S TAXONOMY BASED ASSESSMENT PATTERN

K1-Remember; **K2**- Understand; **K3**- Apply; **K4**-Analyze; **K5**-Evaluate; **K6**-Create;

1. THEORY EXAMINATION

CIA- Continuous Internal Assessment (50 Marks)Test – I & II: 25 Marks (Theory)

Bloom's Category	Section	Description	Marks	Total
K1, K2	Part A-10 x 1 Mark [MCQ/Short answers]	Choose/Fill ups/One word	10	**50**
K3, K4, K5	Part B-4 (Either or Pattern) x 5 Marks	200 Words	20	
K4,K5,K6	Part C-1 (Compulsory Question) x10 Marks and 1 (Either or Pattern) x 10 Marks	500 Words	20	

Components of Continuous Internal Assessment (CIA)

Components			Calculation	CIA Total
Test	I	50	(Test1 + Test2) *0.3 = 30	**50**
	II	50		
Test III-Generic Skills (Group discussion/Real time Project work/Seminar/ Poster Presentation)			15	
Attendance			05	

ESE- Semester End Examination (100 Marks; Weightage is 50%)

Bloom's Category	Section	Description	Marks	ESE Total
K1, K2	Part A – 10 x 2 Marks	50 Words	20	**100**
K3, K4,K5	Part B– 5 (Either or pattern) x 7 Marks	300 Words	35	
K3,K4,K5,K6	Part C- One Compulsory question x 15marks 2 (either or pattern) x 15 marks	500 words	45	

1. **PRACTICAL EXAMINATION**

Bloom's Category	(Performance and Attendance)	ESE (Record Work and Performance)	Total
K3, K4, K5, K6	50	50	100

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Scheme of Examination

(For the students admitted during the academic year 2023-2024 and onwards)

Under Choice Based Credit System (CBCS)

POSTGRADUATE PROGRAMMES

Programme:M.Sc **Branch: Information Technology**

Part	Course Code	Study Components and Course Title	Instruction Hours/Week	Total Contact Hours	Continuous Internal Assessment (CIA)	End-Semester Examination (ESE)	Total Marks	Credits
Semester-I								
I	2328101	Core -Operating System	4	60	50	50	100	4
I	2328102	Core -Computer Organization and Architecture	4	60	50	50	100	4
I	2328103	Core -Data Base Management Systems	4	60	50	50	100	4
I	2328104	Core -Java Programming	4	60	50	50	100	4
I	2328105	Elective I	4	60	50	50	100	4
I	2328106	Core Practical - I DBMS Lab	5	75	50	50	100	3
I	2328107	Core Practical - II Java Programming lab	5	75	50	50	100	3
II		Soft Skill - Effective Communication in English I	-	-	50	50	100	2
II	2328108	Spoken Tutorial -Introduction to Computers						1
Semester-II								
I	2328209	Core– Data Structures and Algorithms	4	60	50	50	100	4
I	2328210	Core– Introduction to Artificial Intelligence	4	60	50	50	100	4
I	2328211	Core– Enterprise Computing Techniques	4	60	50	50	100	4
I	2328212	Core – Python Programming	4	60	50	50	100	4
I	2328213	Elective II	4	60	50	50	100	4

I	2328214	Core Practical - III : Enterprise Computing Techniques Lab	5	75	50	50	100	3
I	2328215	Core Practical - IV: Python Programming Lab	5	75	50	50	100	3
II		Soft Skill -English for Competitive Exams	-	-	50	50	100	2
II	2328116	Spoken Tutorial – Python 3.4.3						1
Semester-III								
I	2328317	Core – Fundamentals of Digital Image Processing	4	60	50	50	100	4
I	2328318	Core – Concepts of Data Mining	4	60	50	50	100	4
I	2328319	Core - C# and .NET Programming	4	60	50	50	100	4
I	2328320	Core– Software Testing	4	60	50	50	100	4
I	2328321	Elective III	4	60	50	50	100	4
I	2328322	Core Practical - V : C# and .NET Programming Lab	5	75	50	50	100	3
I	2328323	Core Practical - VI :Data Mining Lab	5	75	50	50	100	3
II		Soft Skill - Personality Development	-	-	50	50	100	2
II	2328324	Internship						2
II	2328325	Spoken Tutorial – JAVA						1
Semester-IV								
I	2328426	Core- Project & Viva Voce					100	15
II		Soft Skill - Presentation	2	30	50	50	100	2
II	2328427	Spoken Tutorial - LATEX						1

- **Part-II courses** are **not** included in Total Marks and CGPA Calculation.

- **Summer Internship** will be carried out by the students during the summer vacation of the first year with a minimum of 3 weeks or 21 days (as per UGC guidelines) and the internship certificate should be sent to the COE office and the same will be included in the Third Semester Marks Statement to earn 2 credit.

- **Project & Viva-Voce** will be conducted in fourth semester, Soft Skill and Spoken Tutorial Certificate course will be conducted. Summer Internship and one MOOC certificate course will be conducted for the entire course.

- **Spoken Tutorial Courses (SP**)**Offered by IIT Mumbai through Spoken Tutorial Projects MHRD, Government of India, Online Examination will be conducted and qualified students (Minimum passing 40%) will be issued certificate by IIT, Mumbai. Students will submit a copy of the certificate as a proof of qualifying the online test to the COE office.

- **Soft Skill** Syllabus framed and approved by English Department.

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Programme: M.Sc **Branch:Information Technology**

Abstract of
Scheme of Examination

(For the students admitted during the academic year 2023-2024 and onwards)

Part	Course	Papers	Credit	Total Credits	Marks	Total Marks
Part I	Core Theory	12	4	48	100	1200
	Core Practical	6	3	18	100	600
	Core Project	1	15	15	100	100
	Electives	3	4	12	100	300
PART I				93		2200
PART II	Soft Skill	4	2	8	100	400
	Spoken Tutorial	4	1	4	-	-
	Internship	1	2	2	-	-
	TOTAL			107		2600

List of Elective Papers (Can choose any one of the paper as electives)		
Component	**Course Code**	**Course Name**
Elective-I	2328105(A)	Object Oriented Software Engineering
	2328 105(B)	Case Tools Using UML
	2328 105(C)	Object Oriented Analysis and Design
Elective-II	2328 213(A)	Fundamentals of IoT
	2328 213(B)	Introduction to Cloud Computing
	2328 213(C)	Introduction to Grid Computing
Elective-III	2328 321(A)	Mobile Communication
	2328 321(B)	Cryptography
	2328 321(C)	Block Chain

Syllabus Co-Ordinator **BOS-Chairman**

Academic Council-Member Secretary

DEPARTMENT OF M.Sc IT

FIRST SEMESTER (SYLLABUS)

Course Title: CORE PAPER I - OPERATING SYSTEM

(For Students admitted from 2023 onwards)

Course Code: 2328101	**Credits 04**
L:T:P:S : 4:0:0:0	**CIA Marks :50**
Exam Hours : 03	**ESE Marks :50**

LEARNING OBJECTIVES:

On taking this course the student will be able to gain the knowledge about main components of an Operating system and Process Management and Scheduling, to analyses the mechanisms of OS to handle Processes and Threads and their Communication, to gain knowledge on Distributed Operating System concepts that includes Architecture, Mutual Exclusion Algorithms, Deadlock Detection Algorithms, to discuss the mechanisms involved in Memory Management Policies and Virtual Memory, to gain the knowledge about Paging and various Page Replacement Algorithms, to compile the working of an Files and Directory Structure in OS.

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

CO1	Basic concepts of operating system, process management, Threads - Interprocess Communication. CPU Scheduling
CO2	Discuss various Process Synchronization problems, critical region and monitors
CO3	Discuss about Deadlock Characterization, Methods for handling Deadlocks, Prevention, Avoidance, and Detection of Deadlock and Recovery from deadlock. Analyse the Memory Management and its allocation policies.
CO4	Evaluate the various Page Replacement Algorithms handled by Operating System. Analyse the Virtual memory and Thrashing concepts.
CO5	Interpret the mechanisms adopted for File Sharing in Distributed Applications.

Mapping of Course Outcomes to Program Outcomes:

CO/PSO	**PSO**				
	1	**2**	**3**	**4**	**5**
CO1	**3**	**3**	**3**	**3**	**2**
CO2	**3**	**2**	**3**	**3**	**3**
CO3	**3**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**2**	**3**	**3**
CO5	**3**	**3**	**3**	**3**	**3**

3-Strong 2-Medium 1-Low

S. No	CONTENT OF MODULE	Hrs	COs
1	**UNIT I:** Introduction: Views –Goals –Types of system – OS Structure –Components – Services – System Calls. Process Management: Process - Process Scheduling – Cooperating Process –Threads - Interposes Communication. CPU Scheduling: CPU Schedulers – Scheduling criteria – Scheduling Algorithms.	12	CO1
2	**UNIT II:** Process Synchronization: Critical-Section problem - Synchronization Hardware – Semaphores – Classic Problems of Synchronization – Critical Region – Monitors.	**12**	CO2
3	**UNIT III:** Deadlock: Characterization – Methods for handling Deadlocks – Prevention, Avoidance, and Detection of Deadlock - Recovery from deadlock. Memory Management: Address Binding – Dynamic Loading and Linking – Overlays – Logical and Physical Address Space - Contiguous Allocation – Internal& External Fragmentation. Non Contiguous Allocation:	**12**	CO3
4	**UNIT IV:** Paging and Segmentation schemes –Implementation – Hardware Protection – Sharing - Fragmentation. Virtual Memory**:** Demand Paging – Page Replacement - Page Replacement Algorithms – Thrashing.	**12**	CO4
5	**UNIT V**: File System: Concepts – Access methods – Directory Structure - Allocation methods. Secondary Storage Structures: Protection – Goals- Domain Access matrix.	**12**	CO5,

TEXT BOOKS

1. Silberschatz A., Galvin P.B., Gange, (2003). *Operating System Principles*, (6th Edition), John Wiley &Sons.
2. AshfaqA.Khan, *(*2001). *Practical Linux Programming*, (Revised Edition), Firewall Media.

REFERENCE BOOKS

1. Richard Petersen (2001). *The Complete Reference – Linux*, (6thEdition), TMH.

E- REFERENCES

1. http://www.freetechbooks.com/introduction-to-operating-systems-t340.html
2. http://www.tutorialspoint.com/operating_system/index.htm
3. http://www.spoken_tutorial.org

Course Title: CORE PAPER II – COMPUTER ORGANIZATION AND ARCHITECTURE

Course Code: 2328102	**Credits 04**
L:T:P:S : 4:0:0:0	**CIA Marks :50**
Exam Hours : 03	**ESE Marks :50**

LEARNING OBJECTIVES

Conceptualize the basics of Organizational and Architectural issues of a digital Computer. Understanding the concepts of Boolean algebra, Logical Operations and various Adders. Learn various types of Flip-Flops and Data Transfer Techniques in Digital Computer and Articulate design issues in the development of Processor or other components that satisfy design requirements and objectives to explain different types of Addressing Modes and Memory Organization.

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

COS	Content of module
CO1	Detailed representation about number systems and boolean algebra.
CO2	Describe the various types of flip flops, registers and circuit system.
CO3	Analyze the stack organization and identify the addressing modes.
CO4	Interpret peripheral devices with memory access.
CO5	Acquire a good knowledge about memory hierarchies and mapping.

Mapping of Course Outcomes to Program Outcomes:

CO/PSO	PSO				
	1	**2**	**3**	**4**	**5**
CO 1	3	3	2	2	3
CO 2	3	2	2	2	1
CO 3	3	2	2	3	2
CO 4	3	2	2	3	3
CO 5	3	3	3	3	2

3-Strong 2-Medium 1-Low

S.No	CONTENTS OF MODULE	HRS	COS
1	**UNIT I:** Number System – Converting numbers from one base to– Complements – Binary Codes– Boolean algebra – Properties of Boolean algebra – Boolean functions. – Logical Operations – Logic gates - Adder – Subtractor.	12	CO1
2	**UNIT II:**Decoders – Multiplexers- Flip Flops – Triggering of flip-flops – Analyzing a sequential circuit – State reduction – excitation tables – Design of sequential circuits – Counters. –shift registers.	**12**	CO2
3	**UNIT III:** Central processing unit: General register and stack organizations, instruction formats - Addressing modes, Data transfer and manipulation - program control,RISC.	**12**	CO3
4	**UNIT IV:** Input-output organization - peripheral devices, I/O interface, modes of transfer- Interrupt, Direct memory access, I/O processor.	**12**	CO4
5	**UNIT V:** Memory Organization - Memory Hierarchy- Main memory-Auxiliary memory-Associative memory and its mapping techniques - Cache memory-cache memory mapping techniques- Virtual Memory.	**12**	CO5,

TEXT BOOKS

1. M.MorrisMano (2007). *Computer System Architecture(*3rdEdition), PHI,ISBN: 9789332585607.
2. D. P. Leach and A. P. Malvino(2002). *Digital Principles and Applications* (5th Edition), TMH, ISBN:9780070141704.

REFERENCE BOOKS

1. William Stallings(2015).*Computer Organization and Architecture* (10thEdition),Pearson Education, ISBN:9780134101613.
2. M.Morris Mano(2007). *Digital Logic and Computer Design*(3rdEdition),Pearson Education,ISBN:817758409X
3. V.C. Hamacher, G. Vranesic, S. G. Zaky (2000). *Computer Organization* (Revised Edition), TMH, ISBN:0471467405.

E-REFERENCES

1. http://www.freetechbooks.com/computer-organization-and-design-fundamentals-t347.html
2. http://www.nptel.iitm.ac.in/video.php?subjectId=106102062
3. https://freevideolectures.com/course/2277/computer-organization
4. http://www.infocobuild.com/education/audio-video-courses/computer-science/ComputerOrganizationArchitecture-IIT-Madras

Course Title: CORE PAPER III - DATABASE MANAGEMENT SYSTEMS

Course Code: 2328103	**Credits 04**
L:T:P:S : 4:0:0:0	**CIA Marks 50**
Exam Hours : 03	**ESE Marks 50**

LEARNING OBJECTIVES

On taking this course the student will be able to assess the applications of DBMS, difference between File Systems vs. DBMS, identify the data models and understand the DBMS structure and identifies the Entity, Attribute and Entity Relationship Diagrams. Understand the Relational Algebra concepts, selection, projection, relational calculus which helps in understanding queries. Study the concepts of functional dependencies and the need of normalization and Normal forms I, II, III, IV BCNF and know the properties of transaction management and the recovery management. Compile various file organization methods and access methods to store the data.

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

CO1	Describe a database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS. Design ER-models to represent simple database application scenarios.
CO2	Convert the ER-model to relational tables, populate relational database and formulate SQL queries on data for current needs. Develop applications using DDL, DML queries.
CO3	Identifies the Functional dependencies, decompositions, lossless join, and dependency preserving decomposition. Classify the various normalization techniques and improve the database design by applying it.
CO4	Use the concept of a transaction and design the database using some tools which satisfies the ACID properties when concurrent transaction occurs in a database. Evaluate the sophisticated access protocols to control access to the database.
CO5	Identifies the suitable File organization methods and access methods and design the database for storing the data.

Mapping of Course Outcomes to Program Outcomes:

CO/PSO	**PSO**				
	1	**2**	**3**	**4**	**5**
CO 1	3	3	3	2	3
CO 2	3	3	3	2	3
CO 3	3	3	3	3	3
CO 4	3	3	3	3	3
CO 5	3	3	3	3	3

3-Strong 2-Medium 1-Low

S. No	CONTENTS OF MODULE	Hrs	COs
1	**UNIT- I** Introduction to DBMS and ER Model-Advantage of DBMS approach, various view of data, data independence, schema and sub-schema, primary concepts of data models, Database languages, Database administrator and users, data dictionary, overall system Architecture. Basic concepts of ER, mapping constraint, keys, ER diagram, weak and strong entity sets, specialization and generalization, aggregation.	12	**CO1**
2	**UNIT- I** Domains, Relations and Keys, Relational Algebra & SQL-Domains, Relations, kind of relations, relational database, various types of keys-candidate, primary, alternate and foreign key. Relationalalgebra, SQL- set operations, aggregate functions, null values, nested sub queries, views, join relations, DDL in SQL.	**12**	**CO2**
3	**UNIT- III** Functional Dependencies and Normalization-Basic definitions, trivial and non-trivial dependencies, introduction to normalization, non-loss decomposition, FD diagram, first, second, third Normal forms, dependency preservation, BCNF, multivalued dependencies and fourth normal form, Join dependency and fifth normal form.	**12**	**CO3**
4	**UNIT- IV** Transaction, concurrency and Recovery-Basic concepts of Transaction, ACID properties, Transaction states, implementation of atomicity and durability, concurrent executions, basic idea of serializability, concurrency control-two phase locking and deadlock handling, Recovery system-Failure Classification, Storage Structure ,Recovery and Atomicity , Log-Based Recovery, Shadow Paging.	**12**	**CO4**
5	**UNIT- V** Storage structure and file organizations-Overview of physical storage media, magnetic disks-performance and optimizations, basic idea of RAID, file organizations, organization of records in files, basic concepts of indexing, ordered indices, basic idea of B-tree andB+-tree organization.	**12**	**CO5,**

TEXT BOOK

1. Henry Forth, Abraham Silberschatz, S. Sudharshan (2006).*Database SystemConcepts* (5thEdition), McGraw Hill Publications.
2. R. Elmasri, S.B. Navathe (2007)**.** *Fundamentals of Database Systems (*5th Edition), Pearson Education.

REFERENCE BOOKS

1. Raghu Ramakrishnan,Johannes Gehrke(2014) ,*Database Management Systems*(3rd Edition), McGraw HillPublictions.
2. J. Date, A. Kannan and S. Swamynathan, (2009). *An Introduction to DatabaseSystems* (8thEdition), Pearson Education.

E- REFERENCES

1. https://www.coursera.org/course/datasci
2. http://www.nptel.iitm.ac.in/video.php?subjectId=106106093
3. https://gateoverflow.in/47124/which-video-lecture-will-be-the-best-for-dbms

Course Title: CORE PAPER IV – JAVA PROGRAMMING

CourseCode: 2328104		**Credits**	**04**
L:T:P:S	**: 4:0:0:0**	**CIA Marks**	**50**
Exam Hours	**: 03**	**ESE Marks**	**50**

LEARNING OBJECTIVES

On taking this course the student will be able to enable the students to learn the basic concepts of Java programming. For increasing learning ability to use class and objects to create applications, students can have an overview of interfaces, packages, multithreading and exceptions and familiarize students with basic data structures and their use in AWT, I/O and network interfaces

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

CO S	Content of module
CO1	Develop the knowledge of Hardware and Software requirements, Object Oriented Concepts , data types, different types of operators and Control Structures in JAVA
CO2	Implementation of arrays, Looping Structures, Functions in JAVA
CO3	Analyze the concepts of Package, interfaces, Creating a Thread ,File System.
CO4	Gain the Knowledge for Managing Errors and Exceptions
CO5	Implementation of Streams , and Learn the concepts of Network ,TCP/IP

Mapping of Course outcomes to program outcomes:

CO/ PSO	PSO				
	1	**2**	**3**	**4**	**5**
CO1	3	3	3	3	2
CO2	3	3	3	3	2
CO3	2	3	3	3	2
CO4	2	3	3	3	3
CO5	2	3	3	3	2

3-Strong 2- Medium 1- Low

S N O	CONTENT OF MODULE	Hrs	COS
1	**UNIT I:** Introduction to Java-Features of Java-Basic Concepts of Object Oriented Programming-Java Tokens-Java Statements-Constants-Variables-Data Types- Type Casting-Operators-Expressions-Control Statements: Branching and Looping Statements.	12	**CO1**
2	**UNIT II**: Classes, Objects and Methods - Constructors - Methods Overloading-Inheritance-Overriding Methods- Finalizer and Abstract Methods-Visibility Control –Arrays, Strings and Vectors-String Buffer Class-Wrapper Classes	**12**	**CO2**
3	**UNIT III:** Interfaces-Packages-Creating Packages-Accessing a Package-Multithreaded Programming-Creating Threads-Stopping and Blocking a Thread-Life Cycle of a Thread-Using Thread Methods-Thread Priority-Synchronization-Implementing the Runnable Interface	**12**	**CO3**
4	**UNIT IV:** Managing Errors and Exceptions-Syntax of Exception Handling Code-Using Finally Statement-Throwing Our Own Exceptions-Managing Input/Output Files: Concept of Streams-Stream Classes-Byte Stream Classes-Character Stream Classes – Using Streams-Using the File Class-Creation of Files-Random Access Files-Other Stream Classes.	**12**	**CO4**
5	**UNIT V:** Applet Programming-Applet Life Cycle-Graphics Programming Introducing the AWT: Working with Windows, Graphics and Text- AWT Classes- Working with Frames-Working with Graphics-Working with Color-Working with Fonts-Using AWT Controls, Layout Managers and Menus.	**12**	**CO5,**

TEXT BOOKS

1. Herbert Schildt,(2005),"*The Complete Reference Java"* , 5thEdition,TMH
2. Cay S. Horstmann and Gary Cornell,(2005) "*Core Java Volume I-Fundamentals"*, (7th Edition)- Pearson Education. ISBN no -10: 0-13-148202-5
3. K. Arnold and J. Gosling (2000) "*The JAVA programming language*", (4rd edition), Pearson Education, ISBN: 0-321-34980-6.

REFERENCE BOOKS

1. Timothy Budd, (2000) "*Understanding Object-oriented programming with Java*", Pearson Education,.
2. Y. Daniel Liang (2003), "*An Introduction to JAVA Programming*," Prentice-Hall of India Pvt. Ltd.

E-REFERENCES

1. https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs08/
2. https://www.w3schools.com/java/
3. https://www.programiz.com/java-programming
4. https://www.coursera.org/learn/object-oriented-java
5. http://www.spoken_tutorial.org

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Course Title: ELECTIVE I - OBJECT ORIENTED SOFTWARE ENGINEERING

Course Code: 2328105(A)	**Credits 04**
L:T:P:S : 4:0:0:0	**CIA Marks :50**
Exam Hours : 03	**ESE Marks :50**

LEARNING OBJECTIVES

On taking the course, the students will be able to Develop the knowledge and practical skills needed to successfully participate in the analysis, design and development of large software systems, using object-oriented approaches, they can Apply team dynamics by working in teams, focus on object-oriented approaches and project management techniques Communicate the science and Development of graphical user interfaces, and quality assurance.

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

CO1	Knows the reason about the basic Software life cycle models Importance of various kinds of Project Management methods, Tracking Software Quality, Quality Standards and Metrics.
CO2	Develop System Concepts for Object Modeling Design and implement a software design concept to meet desired needs and Requirements. Design the UML concepts like sequential, Use cases and Activity diagram
CO3	Concepts of Use cases, actors, and common modeling techniques. Implementing the concept use cases, business actors, Significance of identifying the subsystems and business requirements
CO4	Explain Design Workflow and System Design Concept Create Mapping Object Model to Database Schema Testing and verification process Creation.
CO5	Usage of Software Configuration Management Definition and Types of maintenance Life Build Reverse and re-engineering process.

Mapping of Course Outcomes to Program Outcomes:

C0/PSO	**PSO**				
	1	**2**	**3**	**4**	**5**
CO1	2	2	2	3	2
CO2	2	3	3	3	3
CO3	2	3	3	3	3
CO4	2	3	3	3	3
CO5	2	3	2	3	2

3-Strong 2- Medium 1- Low

S. No	CONTENTS OF MODULE	Hrs	Cos
1	Software life cycle models:Waterfall,RAD,and Spiral model Processmetric – Product metrics – Estimation – LOC, FP, COCOMO models – ProjectManagement – Planning, Scheduling and Tracking Software Quality – Quality Standards, Quality Metrics.	12	CO1
2	System Concepts for Object Modeling – Abstraction, Inheritance, Polymorphism, Encapsulation, Message Sending, Association, Aggregation – Requirement Workflow Functional, Non-functional – CharacteristicsofRequirements – Requirement Elicitation Techniques – Requirement Documentation – Use case specification, Activity Diagram.	**12**	CO2
3	Use-Case Modeling – Actors, Use Cases, Use Case Relationships. The Process of Requirements Use-Case – Identify Business Actors, Identify Business Requirements, Use Cases, Construct, Use Case Model Diagram – Class Diagrams and Object Diagrams – Package Diagrams – Sequence and Collaboration diagrams, State chart diagram.	**12**	CO3
4	Design Workflow: System Design Concept – Coupling and Cohesion – Architectural Styles – Identifying Subsystems and Interfaces – Design Patterns Implementation Workflow – Mapping models to Code – Mapping Object Model to Database Schema Testing – Formal Technical Reviews – Walkthrough and Inspection.	**12**	CO4
5	Software Configuration Management – Managing and controlling Changes – Managing and controlling versions Maintenance- Types of maintenance – Maintenance Log and defect reports – Reverse and re-engineering.	**12**	CO5,

TEXT BOOKS

1. Roger Pressman, (2005). *Software Engineering*, (Sixth Edition), TMH. ISBN no: 13:978- 007-126782-3.
2. Bahrami, (2008). *Object Oriented Systems Development*, (Second edition), TMH, ISBN no: 13978-0070265127.
3. Bernd Bruegge, (2004). *Object oriented software engineering*, (Second Edition), Pearson Education. ISBN no: 13978-93332518681

REFERENCE BOOKS

1. Stephan R Schach, (2007). *Object oriented software engineering*, (Second edition), TMH. ISBN no:9780071259415
2. Timothy C Lethbridge, Robert Laganiere (2004). *Object-Oriented Software Engineering Practical software development using UML and Java*, (Second edition),TMH.

E- REFERENCES

1. https://nptel.ac.in/courses/106/105/106105224/
2. https://nptel.ac.in/courses/106/101/106101061/
3. https://www.edutechlearners.com/oose-notes/
4. https://www.youtube.com/watch?v=BqVqjJq7_vI&list=PLrjkTql3jnm_kpRxNK6la_gHuKQ3WI_dL

Course Title: ELECTIVE I - CASE TOOLS USING UML

Course Code: 2328105(B)	**Credits 04**
L:T:P:S : 4:0:0:0	**CIA Marks :50**
Exam Hours : 03	**ESE Marks :50**

LEARNING OBJECTIVES

On taking the course, the students will be able to understand the importance of various basic concepts of object modeling Gain the knowledge about various basic structural modeling along with their applicability contexts. The students can Analyze various basic Behavioral modeling of object-oriented software design (UML) and Review the concepts of Advance Behavioral modeling.

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

CO1	Analyze the basic concepts of object modeling.
CO2	Demonstrate various Basic Structural Modeling using the appropriate notation
CO3	Demonstrate various Basic Behavioral Modeling using the appropriate notation
CO4	Analyze various Advanced Behavioral Modeling using the appropriate notation
CO5	Analyze Architectural Modeling using the appropriate notation

Mapping of Course Outcomes to Program Outcomes:

CO/PSO	**PSO**				
	1	**2**	**3**	**4**	**5**
CO1	3	2	2	2	2
CO2	1	3	3	3	2
CO3	2	3	2	3	2
CO4	2	2	2	2	3
CO5	2	3	3	3	3

3-Strong 2- Medium 1- Low

S.No	CONTENTS OF MODULE	Hrs	Cos
1	Introduction to UML: Importance of modeling, principles of modeling, object oriented modeling, conceptual model of the UML Architecture,Basic building models of UML.	12	CO1
2	Basic Structural Modeling: Classes, Relationships, common Mechanisms, and diagrams. Interfaces, Types and Roles, Packages. Class & Object Diagrams: Terms, Concepts, modeling techniques for Class & Object Diagrams.	**12**	CO2
3	Basic Behavioral Modeling: Interactions, Interaction diagrams. Use cases, Use case Diagrams, Identifying actors- Activity Diagrams.	**12**	CO3
4	Advanced Behavioral Modeling: Events and signals, state Machines, processes and Threads, time and space, state chart diagrams.	**12**	CO4
5	Architectural Modeling: Component, Deployment, Component diagrams and Deployment diagrams.	**12**	CO5,

TEXT BOOKS

1. Grady Booch, James Rumbaugh, Ivar Jacobson (2005). *The Unified Modeling Language User Guide,* (Second Edition), Pearson Education, ISBN no:0-201-57168-4
2. Hans-Erik Eriksson, Magnus Penker, Brian Lyons, David Fado (2003).*UML Toolkit,* (Second Edition), WILEY-Dreamtech India Pvt. Ltd, ISBN no: 13:978-81-265-0466-4
3. Grady Booch (2007). *Object Oriented Analysis and Design*, (Third Edition), Addison Wesley, ISBN no:0-8053-5340-2

REFERENCE BOOKS

1. Pascal Roques, Modeling (2007). *Software Systems Using UML2*, (Fourth Edition), WILEY-Dreamtech India Pvt. Ltd. ISBN no:13-978-81-265-0505-0
2. AtulKahate, (2000). *Object Oriented Analysis &Design*, Tata McGraw-Hill. ISBN no: 0-07-058376-5
3. Ali Bahrami, (1999). *Object Oriented Systems Development,* McGraw Hill. ISBN no:13-978-0-07-026512-7

E-REFERENCES

1. www.uml-tutorials.trireme.com
2. www.smartdraw.com/resources/tutorials/uml-diagrams

Course Title: ELECTIVE I - OBJECT ORIENTED ANALYSIS AND DESIGN

Course Code: 2328105(C)	**Credits 04**
L:T:P:S :4:0:0:0	**CIA Marks :50**
Exam Hours :03	**ESE Marks :50**

LEARNING OBJECTIVES

On taking the course, the students will be able to understand the concept of object-oriented development, and create a static object model and a dynamic behavioral model and a functional model of the system. They can easily understand the approaches to system design and object design, and the techniques of translating design to implementation.

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

CO1	Analyze object basics and UML
CO2	Gain knowledge about attributes and relationship.
CO3	Interpret axioms and do a case study
CO4	Detailed study about Micro level process
CO5	Digital signatures

Mapping of Course Outcomes to Program Outcomes:

CO/PSO	**PSO**				
	1	**2**	**3**	**4**	**5**
CO1	3	2	2	2	2
CO2	1	3	3	3	2
CO3	2	3	2	3	2
CO4	2	2	2	2	3
CO5	2	3	3	3	3

3-Strong 2- Medium 1- Low

S.No	CONTENTS OF MODULE	Hrs	COs
1	System development - object basics - development life cycle - methodologies - patterns - frameworks - unified approach - UML.	12	CO1
2	Use Case models - object analysis - object relations - attributes - methods, class and object responsibilities - case Studies	**12**	CO2
3	Design processes - design axioms - class design – object storage - object interoperability - case studies.	**12**	CO3
4	User interface design - view layer classes - micro - level processes - view layer interface - case studies.	**12**	CO4
5	Quality assurance tests - testing strategies - object orientation on testing - test cases - test plans - continuous testing - debugging principles - system usability- measuring user satisfaction - case studies	**12**	CO5,

TEXT BOOKS

1. Ali Bahrami, (1999). *Object Oriented Systems Development*, McGraw Hill. ISBN no:13-978-0-07-026512-7
2. Grady Booch (2007). *Object Oriented Analysis and Design*, (Third Edition), Addison Wesley, ISBN no:0-8053-5340-2
3. Bernd Bruegge, (2004). *Object oriented software engineering*, (Second Edition), Pearson Education. ISBN no: 13978-93332518681.

REFERENCE BOOKS

1. James Rumbaugh, Michael R. Blaha, (2004). *Object-Oriented Modeling and Design with UML* , (Second Edition),Prentice Hall ISBN no:978-81-317-1106-4
2. AtulKahate, (2000). *Object Oriented Analysis &Design*, Tata McGraw-Hill. ISBN no: 0-07-058376-5
3. Roger Pressman, (2005). *Software Engineering*, (Sixth Edition), TMH. ISBN no: 13:978- 007-126782-3

E-REFERENCES

1. http://www.exforsys.com/tutorials/ooad/ooad-introduction.html
2. http://www.devshed.com/c/a/Practices/Introducing-UMLObjectOriented-Analysis-and-Design

Course Title: Core Paper VI PRACTICAL I – DBMS LAB

Course Code: 2328106	**Credits 03**
L:T:P:S :0:0:5:0	**CIA Marks :50**
Exam Hours :03	**ESE Marks :50**

LEARNING OBJECTIVES

Design and implementation of relational databases. Describe basic concepts of how a database stores information via tables and Explore Updating and inserting data into existing tables. Explaining SQL syntax used with MySQL. Describe how to retrieve and manipulate data from one or more tables using joins. Describe how to filter data based upon multiple conditions. Explaining various functions such as string, date and time, aggregate functions. Describe the complex and various types of sub queries in SQL.

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

CO1	Design and implement a Database Systems by creating tables, views for an Applications.
CO2	Populate and query a database by performing basic operations like CREATE, DELETE, UPDATE, SELECT, ALTER using SQL DDL and DML commands.
CO3	Develop queries using SQL Operators and Functions.
CO4	Declare and enforce Integrity Constraints on a database using SQL commands.
CO5	Formulate queries by using set operations, join operations, functions, operators and sub queries. Show execution of SQL queries using MySQL for database tables using DCL and TCL commands

Mapping of Course Outcomes to Program Outcomes:

CO/PSO	**PSO**				
	1	**2**	**3**	**4**	**5**
CO 1	3	3	3	3	2
CO 2	3	3	3	3	3
CO 3	3	3	3	3	3
CO 4	3	3	3	3	3
CO 5	3	3	3	3	3

3-Strong 2- Medium 1- Low

S. No	CONTENTS OF MODULE	Hrs	COs
1	DDL–DataTypes, Create, Alter, Drop,Truncate, Views.	**15**	CO1
2	DML–Insert,Deleteand UpdateCommands. Integrity Constraints.	**15**	CO2
3	SelectCommandwithOperatorslikeArithmetic,Comparison, Logical,Order By,GroupBy, Having Clauseetc. SetOperations–Union,IntersectandMinus.	**15**	CO3
4	SQLFunctions –Date,Numeric,Character Conversion,Avg, Max,Min, Sum,Count.	**15**	CO4
5	DCL&TCL–Grant,Revoke, Commit , Rollback and Savepoint. Join Query concept – Inner, Left, Right, Outer Joins.Complexand Sub Queries.	**15**	CO5,

Course Title: CORE PAPER VII PRACTICAL II - JAVA PROGRAMMING LAB

CourseCode: 2328107		**Credits**	**03**
L:T:P:S	**:0:0:5:0**	**CIA Marks**	**50**
Exam Hours	**:03**	**ESE Marks**	**50**

LEARNING OBJECTIVES

On taking the course, the students will be able to demonstrate the insight of an exciting growing field Java Programming. Learn the OOPS concepts to develop the knowledge of Java programs .Analyze real time programs to acquire the knowledge of Applets and AWT concepts. Derive the coding of Java techniques focusing on industry applications. Exhibit the fundamental techniques and principles in achieving Java Projects

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

CO1	Create Java programs using class , object using Object oriented concepts
CO2	Apply knowledge and demonstrate programming proficiency using the various error-handling techniques using exception handling and multithreading.
CO3	Analyze programs and various projects using inheritance and polymorphism
CO4	Implement files concepts and establish database connection.
CO5	Develop GUI using Applets and AWT components.

Mapping of Course Outcomes to Program Outcomes:

CO/PSO	**PSO**				
	1	**2**	**3**	**4**	**5**
CO 1	3	3	3	3	2
CO 2	3	3	3	3	3
CO 3	3	3	3	3	3
CO 4	3	3	3	3	3
CO 5	3	3	3	3	3

3-Strong 2- Medium 1- Low

SNO	CONTENT OF MODULE	HRS	COS
1	**APPLICATIONS:** a. Substring Removal from a String. Use String Buffer Class. b. Determining the Perimeter and Area of a Triangle. Use Stream Class. c. Determining the Order of Numbers Generated randomly using Random Class. d. Usage of Calendar Class and Manipulation	**15**	**CO1**
2	a. Implementation of Point Class for Image Manipulation. b. String Manipulation Using Char Array. c. Usage of Vector Classes.	**15**	**CO2**
3	a. Interfaces and Packages b. Implementing Thread based Applications and Exception Handling. c. Application using Synchronization such as Thread based, Class based and Synchronized Statements.	**15**	**CO3**
4	a. Textfiles (copy, display, counting characters, words and lines) b. Data file creating and processing for electricity billing. c. Data file creating and processing for telephone billing	**15**	**CO4**
5	**APPLETS** a. Working with Frames and Various Controls. b. Working with Dialog Box and Menus. c. Working with Colors and Fonts. d. Drawing various shapes using Graphical statements. e. Design a simple calculator with minimal of 10 operations f. Usage of buttons, labels, text components in suitable application	**15**	**CO5,**

SPOKEN TUTORIAL

CODE -2328108

SP01 - INTRODUCTION TO COMPUTERS

S.NO	CONTENTS
1	Getting to know computers
2	Printer Connection
3	Introduction to Gmail
4	Compose Options for Email
5	Google Drive Options

Note:
Courses Offered by IIT Mumbai through Spoken Tutorial Projects MHRD, Government of India. At the end of the course Online Examination will be conducted for 45 minutes and qualified students (Minimum passing 40%) will be issued certificate by IIT, Mumbai.

********End of First Semester********

SECOND SEMESTER SYLLABUS

Course Title: CORE PAPER IX DATA STRUCTURES AND ALGORITHMS

Course Code: 2328209		**Credits**	**04**
L:T:P:S	**: 4:0:0:0**	**CIA Marks**	**50**
Exam Hours	**: 03**	**ESE Marks**	**50**

LEARNING OBJECTIVES

Develops skills in implementations and applications of data structures. Implements basic algorithms for sorting and searching. Implements basic data structures such as stacks, queues and trees. Applies algorithms and data structures in various real-life software problems.

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

CO1	Define data structures like array, stack, queues and linked list.
CO2	Explain insertion, deletion and traversing operations on data structures.
CO3	Identify the asymptotic notations to find the complexity of an algorithm.
CO4	Compare various searching and sorting techniques.
CO5	Choose appropriate data structure while designing the algorithms.

Mapping of Course Outcomes to Program Outcomes

CO/PSO	PSO				
	1	2	3	4	5
CO 1	3	3	2	2	3
CO 2	3	2	2	2	1
CO 3	3	2	2	3	2
CO 4	3	2	2	3	3
CO 5	3	3	3	3	2

3-Strong 2- Medium 1- Low

S.No	CONTENTS OF MODULE	HRS	COS
1	UNIT I: Abstract data types asymptotic notations – complexity analysis – Arrays- representation of arrays – Linked lists: Singly linked list - Circular linked lists – Doubly linked lists – stacks –queues - circular queues – Postfix Notation.	12	CO1, CO2
2	UNIT II: Trees – Binary Trees – Binary Tree Traversals – Binary Tree Representations – Binary Search Trees – Threaded Binary Trees -Introduction to AVL Trees-Red-Black Trees, Splay Trees, B-Trees.	**12**	CO3,
3	UNIT III: – Representation of Graphs – Graph Implementation – Graph Traversals- Minimum Cost Spanning Trees – Shortest Path Problem	**12**	CO5
4	UNIT IV: Divide and conquer – Quick sort, Merge sort – Greedy Method: General Method –knapsack problem.	**12**	CO4
5	UNITV: Back Tracking: General Method – 8-queens - Branch and Bound: General Method - Traveling Salesperson problem.	**12**	CO2

TEXT BOOKS

1. E. Horowitz, S. Sahni and S. Rajasekaran (2001). Computer Algorithms, Galgotia publishers,ISBN:9788173716126
2. E.Horowitz, S. Sahni and Mehta(2000).Fundamentals of Data Structures in C++, Galgotiapublishers,ISBN:0929306376

REFERENCE BOOKS

1. G. L. Heileman(1999). Data Structures, Algorithms and Object Oriented Programming, Revised Edition, TMH, ISBN:0070278938.
2. A.V.Aho, J.D. Ullman, J.E. Hopcraft (1983). Data Structures and Algorithms, Revised Edition, Addison Wesley publishers, ISBN:0201000237.
3. A.V. Aho, J.E. Hopcroft, J.D. Ullmann (1974).The design and analysis of Computer Algorithms, Revised Edition, Addison Wesleypublishers,ISBN:0201000237.

E-REFERENCES

1. www.freetechbooks.com/a-practical-introduction-to-data-structures-and-algorithm-analysis-third-edition-c-version-t804.html
2. www.nptel.iitm.ac.in/courses/106101060
3. http://www.nptel.iitm.ac.in/courses/106104019/
4. https://www.techiedelight.com/best-online-courses-data-structures-algorithms/
5. https://freevideolectures.com/course/2279/data-structures-and-algorithms/

COURSE TITLE: CORE PAPER X – INTRODUCTION TO ARTIFICIAL INTELLIGENCE

CourseCode: 2328210		**Credits**	**04**
L:T:P:S	**: 4:0:0:0**	**CIA Marks**	**50**
Exam Hours	**: 03**	**ESE Marks**	**50**

LEARNING OBJECTIVES

On taking this course the student will be able to gain the knowledge about main components of an Artificial intelligence and level to model, to analyses the Characteristics of Problem to handle Production and Hill Climbing, Best first search to gain knowledge on Knowledge representation issues concepts that includes Predicate logic, Symbolic Reasoning, Logic Programming, to discuss the mechanisms involved in Statistical Reasoning. Natural Language Processing, Parallel and Distributed AI to gain the knowledge about Syntactic Processing, Psychological modeling to acquire the knowledge on Artificial Intelligence.

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

CO1	Design user interfaces to improve human–AI interaction and real-time decision-making. Evaluate the advantages, disadvantages, challenges, and ramifications of human–AI augmentation.
CO2	Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning
CO3	Demonstrate awareness and a fundamental understanding of various applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.
CO4	Extract information from text automatically using concepts and methods from natural language processing (NLP), including stemming, n-grams, POS tagging, andparsing
CO5	Develop robotic process automation to manage business processes and to increase and monitor their efficiency and effectiveness. Determine the framework in which artificial intelligence and the Internet of things may function, including interactions with people, enterprise functions, and environments.

Mapping of Course Outcomes to Program Specific Outcomes:

CO/PSO	**PSO**				
	3	**3**	**3**	**2**	**3**
CO1	**3**	**2**	**3**	**3**	**3**
CO2	**3**	**3**	**3**	**3**	**3**
CO3	**3**	**3**	**2**	**3**	**3**
CO4	**3**	**3**	**3**	**2**	**3**
CO5	**2**	**3**	**3**	**3**	**3**

3-Strong 2- Medium 1- Low

SNO	CONTENT OF MODULE	Hrs	COS
1	**UNIT I: Introduction to Artificial Intelligence** What is Artificial Intelligence? AI Technique, Representation of a problem as State space search, production systems, Problem characteristics, Production System characteristics – Issues in the design of search programs, Heuristic Search Techniques - Generate & Test Hill Climbing, Best First search, Problem reduction, Constraint satisfaction, Means-End Analysis	12	CO1
2	**UNIT II: Knowledge Representation** Approaches and issues in knowledge representation – The Frame Problem -Using Predicate Logic – Representing simple facts in logic – Representing Instance and ISA relationship – Computable functions and predicates – resolution – Natural deduction	**12**	CO2
3	**UNIT III: Representing Knowledge Using Rules**Procedural versus declarative knowledge – Logic programming - Forward versus backward reasoning – Matching – Control Knowledge - Symbolic reasoning under uncertainty - Logics for Nonmonotonic reasoning – Implementation Issues – Augmenting a problem solver – Implementation: Depth first search, Breadth first search -Statistical Reasoning Probability and Bayes‟ Theorem - Certainty factors and rule-based systems- Bayesian networks – Dempster - Shafer Theory	**12**	CO3
4	**UNIT IV: Weak Slot-Filler Structure** Semantic nets – frames. Strong slot-filler structure- Conceptual dependency – Scripts – CYC – Knowledge Representation - Syntactic – Semantic spectrum of Representation – Logic and slot-and-filler structure – Other representational Techniques	**12**	CO4,
5	**UNIT V**: **Natural Language Processing**Syntactic Analysis, Semantic Analysis, Discourse and Pragmatic Processing – Statistical Natural Language processing- Parallel and Distributed AI – Psychological Modeling – Parallelism in Reasoning System– Distributed Reasoning Systems	**12**	CO5,

TEXT BOOKS

1. Elaine Rich, Kevin Knight (2008), Shivsankar B Nair, Artificial Intelligence, Third Edition, Tata McGraw Hill Publication

REFERENCE BOOKS

1. Russel S, Norvig P (2010), Artificial Intelligence : A Modern approach,Third Edition, Pearson Education
2. Dan W Patterson (2007), Introduction to Artificial Intelligence and Expert System, Second Edition, Pearson Education Inc.
3. Jones M(2006), Artificial Intelligence application Programming, Second Edition, Dreamtech Press
4. Nilsson (2000), Artificial Intelligence : A new synthesis, Nils J Harcourt Asia PTE Ltd.

E-REFERENCES

1. https://builtin.com/artificial-intelligence
2. https://www.geeksforgeeks.org/artificial-intelligence-an-introduction/
3. https://www.javatpoint.com/artificial-intelligence-ai

Course Title:CORE PAPER XI - ENTERPRISE COMPUTING TECHNIQUES

CourseCode	**: 2328211**	**Credits**	**04**
L:T:P:S	**: 4:0:0:0**	**CIA Marks**	**50**
Exam Hours	**: 03**	**ESE Marks**	**50**

LEARNING OBJECTIVES:

On taking this course, student will be able to understand the various concepts of Enterprise programming, developing RMI Application, Servlet and session management and learn data manipulation using JDBC, develop web applications using JSP and implement the concepts in web applications.

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

CO1	Develop the knowledge JavaScript Structure, Variables, data types, different types of operators and Control Structures in JavaScript.
CO2	Implementation of arrays, Looping Structures, Functions in JavaScript.
CO3	Analyse the life cycle of servlet and implement Session management using Servlet.
CO4	Implementation of JDBC Concepts and applications
CO5	Develop Web applications using JSP and JSP error pages. Study and use modern tools for rapidly building enterprise applications.

Mapping of Course Outcomes to Program Outcomes:

CO/PSO	**PSO**				
	1	**2**	**3**	**4**	**5**
CO 1	1	1	1	2	3
CO 2	2	1	1	3	3
CO 3	2	3	3	2	3
CO 4	2	3	2	3	2
CO 5	2	3	2	3	3

3-Strong 2- Medium 1- Low

Unit	CONTENTS OF MODULE	Hrs	COS
1	**UNIT-I: I**ntroduction to Scripting: Introduction - Java Script Structure - Java Script Variables – Global variable - Data types - Java Script Operators – Java Script Control Statements – Java Script Looping statements - Java script Arrays - array literal – creating instance of Array directly- using an array constructor- JavaScript Array methods.	12	CO 1
2	**UNIT-II:** JavaScript Functions- JavaScript Function Arguments – Function with Return Value – JavaScript Function Object – JavaScript Function methods – Passing arrays to functions – java script global functions - JavaScript String methods – JavaScript Number methods- JavaScript Exception Handling-JavaScript Validation	**12**	CO 2
3	**UNIT-III:** Introduction to Servlets – Servlet Life Cycle – Servlet API Basics – HTTP Redirects –Cookies –State and Session Management –Hidden Fields – URL rewriting –Session Management with the Servlet API –Inter Servlet Communication – Server Side Includes and Request Forwarding.	**12**	CO 3
4	**UNIT-IV:** JDBC : Introduction to JDBC – Applications Of JDBC – Components of JDBC – Architecture of JDBC – JDBC Architecture Types – JDBC Driver Types-JDBC Connections-statements-result sets-prepared statements. JDBC Example : Insert, select, Delete and Update Records.	**12**	C O 4,
5	**UNIT-V:** JSP: Introduction JSP –Advantage of JSP over Servlet-Life Cycle of JSP-Examining MVC and JSP –JSP scripting elements &directives –Working with variables scopes –JSP Implicit Objects-Error Pages.	**12**	C O 5,

TEXT BOOKS

1. Mark Myers,(2014). A Smater Way to learn JavaScript (1st edition), Lightning Source Inc Publishers,ISBN-10:1497408180
2. Jason hunter, William Crawford (2001). *Java Server Programming* (2nd Edition), O'Reilly Media, Inc., ISBN:9780596000400.
3. J McGovern,RAdatia,Y Fain (2003). *J2EE 14 Bible*, Wiley-dreamtech India PvtLtd.
4. James Holmes, HerbertSchildt (2000). *Struts: The complete Reference*(2nd Edition), TMH.

REFERENCE BOOKS

1. K Moss (1999). *Java Servlets* (Second Edition), TMH.
2. Cay S Horstmann&Gary Cornell (2002). *Core Java Vol II Advanced Features*(8th Edition), Addison Wesley.
3. Ivelin Demirov,(2014).Learn JavaScript with Interactive Exercises Visually, (3rd Edition), Sams publishers.

E-REFERENCES

1. https://www.tutorialspoint.com/javascript/index.htm
2. https://www.javatpoint.com/javascript-tutorial
3. https://www.tutorialspoint.com/servlets/servlets-first-example.htm
4. http://www.servlets.com/jservlet2/examples/
5. http://www.j2eetutorials.50webs.com/JSP_example1html

Course Title: **CORE PAPER XII – PYTHON PROGRAMMING**

Course Code : 2328212	**Credits 04**
L:T:P:S : 4:0:0:0	**CIA Marks :50**
Exam Hours : 03	**ESE Marks :50**

LEARNING OBJECTIVES

On taking this course the student will be able to develop a basic understanding of programming and the Python programming language and understand the basics of Strings, Lists and Tuples, learn how to design object-oriented programs with Python classes, learn how to use class inheritance in Python for reusability and how to use exception handling in Python applications for error handling, to provide knowledge on how to develop the ability to write database applications in Python, to develop the skills of designing Graphical user interface in Python and to acquire knowledge about Data science in Python using numpy.

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

CO1	To acquire basic programming skills of Python programming language.
CO2	To develop applications using python sequence.
CO3	Implement basic object oriented concepts like inheritance and polymorphism.
CO4	Develop GUI applications using PyGTK. and GUI applications.
CO5	To have basic knowledge of implementing data science in python.

Mapping of Course Outcomes to Program Outcomes:

CO/PO/PSO	**PSO**				
	1	**2**	**3**	**4**	**5**
CO 1	3	3	3	3	3
CO 2	3	3	3	3	3
CO 3	3	3	3	3	3
CO 4	3	3	3	3	3
CO 5	3	3	3	3	3

3-Strong 2- Medium 1- Low

S No	CONTENTS OF MODULE	Hrs	COs
1	**UNIT-I :** Introduction to Python - Installing in various Operating Systems - Variables and Data Types – Operators – Conditional Statements- if-if-else-nested if – Looping – for-while-nested loops– Control Statements- break- continue-pass- Input/output Statements	12	CO1
2	**UNIT-II:** Sequences -String Manipulations - Lists –Tuples – Mapping and Set types - Dictionaries –Set- Functions- Defining a function–calling a function–types of function – function arguments-lamda function- Exception Handling- Modules	**12**	CO2
3	**UNIT-III :** File handling - Object Oriented Programming - Classes - Objects –Attributes - Inheritance - Overloading - Polymorphism - Interacting with Databases - Introduction to MySQL - interacting with MySQL –Database connection- creating database table, insert operation, read operation-update operation-delete operation - Regular Expressions - Text handling	**12**	CO3
4	**UNIT-IV:** Introduction to Graphics programming–Building GUI using python : Tkinter programming, Tkinter widgets like button, canvas, entry, frame, label, list box, menu, message, scale, text, spinbox, labelframe, TkMessagebox.- Network Programming- socket module - server socket methods - client socket methods - general socket methods- Web services using SOAP	**12**	CO4, CO6
5	**UNIT-V:** Data Science in Python –Numpy – Numpy introduction, Data types Object – dtype-Numerical operations on Numpy arrays– Changing the dimensions of arrays -matrix arithmetic Scipy–introduction – basic functions – special function – optimization – linear algebra–Pandas- Introduction to Series and Data Frames –reading and writing data – Data Exploration – Data Munging- Introduction to version control system – subversion/Git	**12**	CO5,

TEXT BOOKS

1. Allen B Downey(2012), *Think Python: How to Think Like a ComputerScientist*(1st Edition), O'Reilly Publications.
2. Jeff McNeil(2010), *Python 26 Text Processing: Beginners Guide*, PacketPublications.
3. Mark Pilgrim(2009), *Dive into Python(*2nd edition), Apresspublications.

REFERENCE BOOKS

1. Kent D Lee(2010), *Python Programming Fundamentals(*2nd Edition),Springer,.
2. John V Guttag ,*Introduction to Computation and Programming Using Python*,Prentice Hall ofIndia.

E- REFERENCES

1. http://wwwswaroopchcom/notes/python
2. http://enwikibooksorg/wiki/Python_Programming
3. http://docspythonorg/release/301/tutorial/
4. http://learnpythonthehardwayorg/
5. https://wwwcourseraorg/course/interactivepython
6. http://wwwpython-courseeu/pandasphp
7. http://wwwspoken_tutorialorg
8. https://www.coursera.org/learn/python-data?specialization=python

Course title: **ELECTIVE II - INTRODUCTION TO CLOUD COMPUTING**

Course Code : 2328213(A)	**Credits 04**
L:T:P:S : 4:0:0:0	**CIA Marks :50**
Exam Hours : 03	**ESE Marks :50**

LEARNING OBJECTIVES

On taking this course the student will be able to give an insight into the basics of cloud computing along with virtualization, cloud computing is one of the fastest growing domain from a while now. It will provide the students basic understanding about cloud and virtualization along with it how one can migrate over it

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

CO1	Knows the reason about the basic Cloud models and Importance of various kinds of cloud platforms
CO2	Develop Cloud Concepts and how to implement a software virtualization concept to meet desired needs and Requirements.
CO3	Analyze the Concepts of cloud Utility and Enterprise grid computing, Implementing security level of third party in cloud computing, cloud security benefits and Government policies.
CO4	Design the Cloud Architecture- Layers and Models
CO5	Usage of cloud Configuration using Cloud Simulators

Mapping of Course outcomes to program outcomes:

C0/PSO	**PSO**				
	1	**2**	**3**	**4**	**5**
CO1	2	2	2	3	2
CO2	2	3	3	3	3
CO3	2	3	3	3	3
CO4	2	3	3	3	3
CO5	2	3	2	3	2

3-Strong 2- Medium 1- Low

SNO	Content of module	Hrs	COS
1	**UNIT-I** Cloud Computing Overview Origins of Cloud computing – Cloud components - Essential characteristics – On-demand selfservice, Broad network access, Location independent resource pooling ,Rapid elasticity , Measured service, Comparing cloud providers with traditional IT service providers, Roots of cloud computing.	12	**CO1**
2	**UNIT-II** Cloud Insights Architectural influences – High-performance computing, Utility and Enterprise grid computing, Cloud scenarios – Benefits: scalability ,simplicity ,vendors ,security, Limitations – Sensitive information - Application development- security level of third party - security benefits, Regularity issues: Government policies.	**12**	**CO2**
3	**UNIT-III** Cloud Architecture- Layers and Models Layers in cloud architecture, Software as a Service (SaaS), features of SaaS and benefits, Platform as a Service (PaaS), features of PaaS and benefits, Infrastructure as a Service (IaaS), features of IaaS and benefits, Service providers, challenges and risks in cloud adoption.	**12**	**CO3**
4	**UNIT-IV** Cloud deployment model: Public clouds – Private clouds – Community clouds - Hybrid clouds - Advantages of Cloud computing. Cloud Simulators- CloudSim and GreenCloud Introduction to Simulator, understanding CloudSim simulator, CloudSim Architecture(User code, CloudSim, GridSim, SimJava)	**12**	**CO4**
5	**UNIT-V** Introduction to VMWare Simulator Basics of VMWare, advantages of VMware virtualization, using Vmware workstation, creating virtual machines-understanding virtual machines,	**12**	**CO5,**

TEXT BOOKS

1. Anthony T.Velte , Toby J. Velte Robert (2010) "*Cloud computing a practical approach*" - TATA McGraw- Hill , New Delhi ISBN no:978-0-07-162695
2. Michael Miller (2008) "*Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online* "Que Print Publishers ,ISBN no: 9780768686227

REFERENCE BOOKS

1. Judith Hurwitz , Robin Bloor , Marcia Kaufman ,Fern Halper, (2010) "*Cloud computing for dummies*"- Wiley Publishing, ISBN no:978-0-470-48470-8
2. Rajkumar Buyya, James Broberg, Andrzej Goscinski. (2011) *"Cloud Computing Principles and Paradigms",* Wiley & Sons, Inc publications. ISBN no: 978-0-470-88799-8

E-REFERENCES

1. https://www.ibm.com/in-en/cloud/learn/cloud-computing
2. http://dhoto.lecturer.pens.ac.id/lecture_notes/internet_of_things/cloud%20computing
3. https://ptgmedia.pearsoncmg.com/images/9780133387520/samplepages/0133387526.pdf
4. https://searchaws.techtarget.com/definition/Amazon-Web-Services
5. https://www.simplilearn.com/tutorials/aws-tutorial/what-is-aws

Course Title**: ELECTIVE II - FUNDAMENTALS OF IoT**

CourseCode : 2328213(B)	**Credits 04**
L:T:P:S : 4:0:0:0	**CIA Marks :50**
Exam Hours : 03	**ESE Marks :50**

LEARNING OBJECTIVES

On taking this course, student will be able to understand the fundamentals of Internet of Things and its architecture, to learn about the basics of IOT protocol, to gain understanding and build a small low cost embedded system using RaspberryPi, to apply the concept of Internet of Things in the real world scenario.

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

CO1	Interpret the vision of IoT from a global context
CO2	Describe the fundamentals of IoT and M2M
CO3	Analyze applications of IoT in Raspberry PI
CO4	Appreciate the role of cloud computing and services in IoT.
CO5	Appreciate the role of Big data analytics in a typical IoT system and determine its industrial perspective.

Mapping of Course Outcomes to Program Specific Outcomes:

C0/PSO	**PSO**				
	1	**2**	**3**	**4**	**5**
CO1	2	2	2	3	2
CO2	2	3	3	3	3
CO3	2	3	3	3	3
CO4	2	3	3	3	3
CO5	2	3	2	3	2

3-Strong 2- Medium 1- Low

SNO	CONTENT OF MODULE	Hrs	COS
1	**UNIT I:** Introduction - Physical Design of IoT- Logical Design of IoT IoT Enabling Technologies - IoT Levels & Deployment Templates.	12	**CO1**
2	**UNIT II:** Iot and M2M : M2M – Difference between IoT and M2M-SDN and NFV for IoT. IoT system management: Need for SNMP-Network operator requirements- NETCONF - YANG - IoT System Management with NETCONF-YANG.	**12**	**CO2**
3	**UNIT III:** IoT Platforms Design Methodology: Ten steps in IoT design methodology- IoT Physical Devices & Endpoints: Basic building blocks of IoT devices – Exemplary device: Raspberry Pi – Linux on Raspberry Pi – Raspberry Pi Interfaces.	**12**	**CO3**
4	**UNIT IV:** IoT Physical Servers and Cloud Offerings : Introduction to Cloud storage models and Communication APIs – WAMPAutoBahn for IoT – Xively Cloud for IoT – Python Web Application Framework for DJANGO – DJANGO Architecture.	**12**	**CO4**
5	**UNIT V:** Amazon Web Services for IoT – Amazon EC2 – Amazon AutoScaling – Amazon S3 – AmazonRDS – Amazon DynamoDB – Data Analytics for IoT: Apache Hadoop – MapReduce Programming Model – Hadoop YARN	**12**	**CO5**

TEXT BOOKS

1. Arshdeep Bahga, Vijay Madisetti (2015), *Internet of Things: A Hands-on Approach* , (Ist Edition), Universities Press, ISBN: 978-8173719547
2. Dimitrios Serpanos, Marilyn Wolf (2018), *Internet-of-Things (IoT) Systems: Architectures, Algorithms, Methodologies* (Ist Edition), Springer, ISBN : 978-3319697147

REFERENCE BOOKS

1. Honbo Zhou (2011), *The Internet of Things in the Cloud: A Middleware Perspective*,(Ist Edition), CRC Press, 2012. ISBN: 978-1439892992
2. Olivier Hersent, David Boswarthick, Omar Elloumi (2012),*The Internet of Things – Key applications and Protocols*, Wiley, ISBN: 978-8126557653
3. Raj Kamal (2017), *Internet of Things Architecture and Design Principles* (First Edition), Mc-Graw Hill Education. ISBN: 978-9352605224
4. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stamatis, Karnouskos, Stefan Avesand. David Boyle (2014). *From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence* (Ist Edition), Academic Press, ISBN : 012407684X

E- REFERENCES

1. https://nptel.ac.in/courses/106/105/106105166/
2. https://www.edureka.co/blog/iot-tutorial/
3. https://www.javatpoint.com/iot-internet-of-things

Course title: **ELECTIVE II - INTRODUCTION TO GRID COMPUTING**

Course Code : 2328213(C)	**Credits 04**
L:T:P:S : 4:0:0:0	**CIA Marks :50**
Exam Hours : 03	**ESE Marks :50**

LEARNING OBJECTIVES

On taking this course, student will be able to understand the fundamentals of grid and cluster computing, to learn Grid and cluster computing technologies and its architecture, to learn about the basics of web services and OGSA in Grid computing, to gain understanding of cluster middle ware, to build and administer a cluster for load balancing and sharing.

Course Outcome: At the end students will be able to

CO1	To define the fundamentals and requirements of Grid.
CO2	Illustrate the Grid web services and OGSA Architecture.
CO3	Gain the insights of cluster computing and cluster middleware.
CO4	Describe the cluster architecture and its networking design.
CO5	Organize and administer setting up of cluster. Illustrate load balancing and load sharing in clusters

Mapping of Course Outcomes to Program Specific Outcomes:

CO/PSO	**PSO**				
	1	**2**	**3**	**4**	**5**
CO1	3	1	2	2	3
CO2	2	3	2	3	2
CO3	1	2	2	2	3
CO4	3	3	2	3	2
CO5	1	1	2	2	2

3-Strong 2- Medium 1- Low

SNo	CONTENT OF MODULE	Hrs	COS
1	**UNIT I:**Introduction –The data centre, the Grid/High-Performance Distributed Computing – Cluster computing and Grid Computing – Meta computing - web services and Grid computing. Technologies and Architecture for Grid Computing:Issues in Data Grids - Key Functional Requirements in Grid Computing– standards	12	**CO1**
2	**UNIT II:**Web Services and the Service Oriented Architecture (SOA): History and Background - Service Oriented Architecture-Working principle of Web Service - SOAP and WSDLDescription - Creating Web Services - Server Side.OGSA and WSRF:OGSA for Resource Distribution - Stateful Web Services in OGSA, WSRF (Web Services Resource Framework)	**12**	**CO2**
3	**UNIT III:** Cluster Computing: Approaches to Parallel Computing - Low-Cost Parallel Computing through Clusters - Definition and Architecture of a Cluster - Functionality a Cluster- Categories of Clusters. Cluster Middleware: An Introduction Levels and Layers of Single System Image (SSI) - Cluster Middleware Design Objectives - Resource Management and Scheduling	**12**	**CO3**
4	**UNIT IV**:Early Cluster Architectures and High Throughput Computing Clusters: Early Cluster Architectures - High Throughput Computing Clusters, Condor.Networking, Protocols & I/O for Clusters: Networks and Inter-connection/Switching Devices - Design Issues in Interconnection Networking/Switching, Design Architecture.	**12**	**CO4**
5	**UNIT V:**Setting Up and Administering a Cluster: Setting up a Simple Cluster - Design Considerations for the Front End of a Cluster - Setting Up Node -Meta-clusters - Administering Heterogeneous Clusters. Load Sharing and Load Balancing: Introduction- Strategies for Load Balancing - Modelling Parameters	**12**	**CO5**

TEXT BOOKS

1. C.S.R Prabhu (2008), *Grid and Cluster Computing* (Ist Edition), PHI, ISBN: 9788120334281
2. Jinjun Chen, Lizhe Wang, Wei Jie (2009), *Grid Computing : Infrastructure, Service and Applications* (Ist Edition), CRC Press, ISBN : 978-1420067668

REFERENCE BOOKS

1. Frederic Magoules (2009), *Fundamentals of Grid Computing: Theory, Algorithms and Technologies* (IstEdition), CRC Press, ISBN: 978-1439803677
2. Barry Wilkinson (2017), *Grid Computing Techniques and Applications* (Ist Edition), Chapman and Hall/CRC, ISBN: 9781138116061
3. RakjumarBuyya , Clemens Szyperski (2002), *Cluster Computing* (Ist Edition), Nova Biomedical, ISBN:978-1590331132

E- REFERENCES

1. https://www.mooc-list.com/course/introduction-grid-computing-uva
2. https://www.mooc-list.com/course/high-performance-scientific-computing-coursera
3. http://bedford-computing.co.uk/learning/wp-content/uploads/2016/03/sg246778.pdf
4. http://www.buyya.com/papers/GridIntro-CSI2005.pdf
5. http://www.cs.kent.edu/~farrell/grid04/reference

Course Title: CORE PAPER XIVPRACTICAL III - ENTERPRISE COMPUTING TECHNIQUES LAB

CourseCode: 2328214		**Credits**	**03**
L:T:P:S	**:0:0:5:0**	**CIA Marks**	**50**
Exam Hours	**:03**	**ESE Marks**	**50**

LEARNING OBJECTIVES

On taking this course, student will be able to equip the students with the advanced feature of contemporary java, to enable them in handling complex programs relating to managing data and processes over the network, to provide a sound foundation on the concepts, precepts and practices, in a field that is of immense concern to the industry and business

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

CO1	Develop application using Control structures and Looping statements.
CO2	Develop application using array functions, string functions, date functions
CO3	Manage sessions within an application and communication between sessions.
CO4	Access database through Java programs, using Java Data Base Connectivity.
CO5	Implement and manage web sessions using Servlet and JSP. Handling Errors and Exceptions in any web application ,Develop a complete web application using JSP/Servlets and JDBC

Mapping of Course Outcomes to Program Outcomes:

CO/PSO	**PSO**				
	1	**2**	**3**	**4**	**5**
CO1	3	2	3	3	3
CO2	2	3	2	2	2
CO3	3	3	2	3	2
CO4	3	2	2	3	3
CO5	3	2	3	3	3

3-Strong 2- Medium 1- Low

SNO	CONTENT OF MODULE	HRS	COS
1	Create application using Control Structures such as IF-Statement – IF-Else, IF-Else IF – Nested IF, Switch Statement ,Built in application using Looping Statements such as For ,While, Do-While Statement	15	CO1
2	Create Application using array, Develop programs using String and Date Functions	**15**	CO2
3	Create a Simple HTML to Servlet Application Design Web application using HTML and java servlet for session tracking and management using Cookies Hidden form field, URL rewriting HTTPsession. Display the session details of the webapplication.	15	CO3
4	Design Java Web Application using Java Database connectivity with MYSQL for Select Insert Delete Update Operations	**15**	CO4
5	Implementation of JSP: student scoring system Implement exception handling using Error pages in JSP. Design web page using HTML and java servlet pages for the implementation of inter servlet communication using Request Dispatcher.	15	CO5

Course Title: CORE PAPER XV

PRACTICAL IV - PYTHON PROGRAMMING LAB

Course Code	**: 2328215**	**Credits**	**03**
L:T:P:S	**: 0:0:5:0**	**CIA Marks**	**50**
Exam Hours	**: 03**	**ESE Marks**	**50**

LEARNING OBJECTIVES

On taking this course the student will be able to develop simple applications using control flow and loops, to create files and perform file access operations, develop applications using object oriented concepts, to create a database and connect to the database from python, to develop GUI programs using PYGTK, to acquire knowledge about Data science in Python using numpy

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

CO1	To do programs using conditional statements and control statements
CO2	To do programs in List, Tuples, Function and handle exceptions
CO3	To do File handling, programs using classes, inheritance and regular expression
CO4	To connect to MYSQL database from python
CO5	To develop GUI applications using PyGTK

Mapping of Course Outcomes to Program Outcomes:

CO/PSO	**PSO**				
	1	**2**	**3**	**4**	**5**
CO 1	3	3	3	3	3
CO 2	3	3	3	3	3
CO 3	3	3	3	3	3
CO 4	3	3	3	3	3
CO 5	3	3	3	3	3

3-Strong 2- Medium 1- Low

S. No	CONTENTS OF MODULE	Hrs	COs
1	Simple calculator to do all the arithmetic operations, Programs to use control flow tools like if, Programs to use for loop, New module for mathematical operations and use in your program	**15**	CO1
2	Programs to read and write files, create and delete directories, Programs for String handling and regular expressions	**15**	CO2
3	Programs to read and write files, create and delete directories, Programs with exception handling, Programs using classes and objects	**15**	CO3
4	Connect with MYSQL and create an address book and do the operations, Insert, read, update and delete and GUI program using PYGTK	**15**	CO4
5	Programs Using Numpy, Programs Using scipy, Programs using series and data frames and Programs using charts/graphs	**15**	CO5,

SPOKEN TUTORIAL

Course Code : 2328216

SP02 - PYTHON 3.4.3.

S.NO	CONTENTS
1	Getting started with python – Using the plot command interactively– Embellishing a plot– Saving plots– Multiple plots– Additional features ofPython– loading data from files– Plotting the data– Other types of plots– Getting started with sage notebook – Getting started with symbolic – Using Sage-Using sage to teach– Getting started with lists– Getting started with for – Getting started with strings – Getting started with files – Parsing data – Statistics-Getting started with arrays– Accessing parts of arrays– Matrices– Least square fit – Basic data types and operators – I/O – conditionals – Loops – Manipulating lists– Manipulating strings– Getting started with tuples– Dictionaries– Sets– Getting started with functions– Advanced features offunctions– Using python modules– Writing python scripts– Testing anddebugging.

Note:

Courses Offered by IIT Mumbai through Spoken Tutorial Projects MHRD, Government of India. At the end of the course Online Examination will be conducted for 45 minutes and qualified students (Minimum passing 40%) will be issued certificate by IIT, Mumbai.

********End of Second Semester********

THIRD SEMESTER SYLLABUS

Course Title: CORE PAPER XVII - FUNDAMENTALS OF DIGITAL IMAGE PROCESSING

Course Code: 2328317	**Credits : 04**
L:T:P:S :4:0:0:0	**CIA Marks : 50**
Exam Hours :03	**ESE Marks : 50**

LEARNING OBJECTIVES

On taking this course, student will be able to understand digital image processing fundamentals, to compare and contrast the classification of image Enhancement techniques in detail, to identify and analyze the concepts of image restoration and degradation, to get good understanding of image segmentation and image compression techniques, to apply the knowledge in research.

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

CO1	Describe the fundamentals of image processing and its applications.
CO2	Gain adequate knowledge of Image enhancement techniques in spatial domain
CO3	Detailed classification of Image enhancement techniques in frequency domain and compare with spatial domain techniques
CO4	Analyze the Image restoration and degradation concepts Identify the fundamentals techniques in image segmentation
CO5	Acquire a good knowledge of Image compression techniques

Mapping of Course Outcomes to Program Outcomes:

CO/PSO	**PSO**				
	1	**2**	**3**	**4**	**5**
CO 1	3	2	2	2	3
CO 2	2	3	2	3	3
CO 3	3	3	2	3	3
CO 4	3	3	2	3	2
CO 5	3	3	2	2	2

3-Strong 2- Medium 1- Low

S.No	CONTENTS OF MODULE	Hrs	COs
1	**UNIT I:** Introduction–Origin of Digital Image Processing- Fundamental steps in image processing – Components of Image Processing System - Image acquisition- Acquisition using single sensor, sensor strips and sensor arrays. Sampling and quantization, Representation of Image - relationship between pixels.	12	CO1
2	**UNIT II:** Image enhancement in spatial domain – Basic gray level transformations – Image Negatives, Log Transformations, Power-Law Transformation, Piecewise-Linear transformation - Basics of Histogram processing – Enhancement using arithmetic, logic operations – basics of spatial filtering.	12	CO2
3	**UNIT III:** Image enhancement in Frequency domain – Introduction to Fourier transform: 1-D, 2-D DFT and its inverse transform.Smoothing frequency domain filters – Ideal low-pass filters, Butterworth Low-pass filter, Gaussian Low-pass filters. Sharpening frequency domain filters – Ideal High pass filter, Butterworth high pass filter, Gaussian High Pass filter	12	CO3
4	**UNIT IV:** Image restoration: Model of degradation and restoration process – noise models – Gaussian Noise, Exponential Noise, uniform noise, Salt and pepper noise. Restoration in the presence of noise – Arithmetic mean Filter, Median filter, max and min filter, Midpoint filter. Image segmentation: Detection of Discontinuities -Point Detection - Line Detection – Edge Detection	12	CO4
5	**UNIT V:** Image compression: Fundamentals – coding redundancy, psychovisual redundancy. Image compression models – error free compression – Variable coding, Huffman coding, Arithmetic coding, Bit Plane Coding- Basics of lossy compression.	12	CO5,

TEXT BOOKS

1. RC Gonzalez, RE Woods (2018). *Digital Image processing* (4th Edition), Pearson Education, ISBN 0201180758
2. RC Gonzalez (2020). Digital Image Processing using MATLAB (3rd edition), GP Publishers, ISBN 978-0070702622
3. Maria Petrou, Costas Petrou (2010). *Image Processing: The Fundamentals (*2nd edition*),* Wiley, ISBN 978-0470745861

REFERENCE BOOKS

1. Chris Solomon.*Fundamentals of Digital Image Processing* (1st edition), Wiley, ISBN 978-0470844731.
2. Anil. K. Jain (1988). *Fundamentals of Digital Image Processing* (1st edition), Pearson ISBN 978-0133361650.
3. P. K. Sinha (2012). *Image Acquisition and preprocessing for machine vision systems* (1st edition), SPIE Press, ISBN 978-0819482020.

E- REFERENCES

1. www.nptel.iitm.ac.in/video.php?subjectId=117105079
2. http://www.library.cornell.edu/preservation/tutorial/contents.html
3. https://freevideolectures.com/course/2316/digital-image-processing-iit-kharagpur

Course Title: **CORE PAPER XVIII- CONCEPTS OF DATA MINING**

Course Code	**: 2328318**	**Credits**	**04**
L:T:P:S	**:4:0:0:0**	**CIA Marks**	**50**
Exam Hours	**:03**	**ESE Marks**	**50**

LEARNING OBJECTIVES

On taking this course the student will be able to understand and implement classical models and algorithms in data warehousing and data mining, analyze the data, identify the problems, and choose the relevant algorithms for the chosen dataset, compare and contrast different conceptions of data mining, to characterize the kinds of patterns that can be discovered by association rule mining, classification and clustering.

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

CO1	Appreciate the basic principles, concepts and applications of data warehousing and data mining
CO2	Have a good knowledge of the preprocessing techniques
CO3	Perform Data Mining using association rules
CO4	Get insights from data using classification and prediction techniques. Acquire knowledge of clustering techniques and outliers
CO5	Apply data mining techniques to real world data by cleaning the data, integrating the data from different sources, predicting a model to group the data tuples into classes, discovering patterns using association rule mining and grouping the data set into clusters.

Mapping of Course Outcomes to Program Outcomes:

CO/PSO	**PSO**				
	1	**2**	**3**	**4**	**5**
CO 1	3	3	3	3	3
CO 2	3	3	3	3	3
CO 3	3	3	3	3	3
CO 4	3	3	3	3	3
CO 5	3	3	3	3	3

3-Strong 2- Medium 1- Low

S.No	CONTENTS OF MODULE	Hrs	COs
1	**UNIT I:** What is Data Mining – What Kinds of Data can be mined- Kinds of Patterns that can be mined - Technologies used - Issues in Data Mining – Data Objects and Attribute Types- Basic Statistical Description of Data- Data Visualization.	12	CO1
2	**UNIT II:** Data Preprocessing: Why preprocess the data – Data cleaning – Data Integration – Data Transformation – Data Reduction – Data Discretization. Data Warehouse: Basic concepts- Data Warehouse Modeling:Data Cube and OLAP	12	CO2
3	**UNIT III:** Data Mining Techniques: Association Rule Mining – Types of Association Rule Mining - Basic Terminologies- Naïve algorithm- Limitations of Naïve Algorithm - Improved Naïve Algorithm-Apriori Algorithm-How to improve the efficiency of the Apriori Algorithm.	12	CO3
4	**UNIT IV:** Classification and Prediction: Issues regarding Classification and Prediction – Decision Tree induction – Naïve Bayes Classification– Back Propagation – Classification Methods – Prediction – Classifiers accuracy using Confusion Matrix	12	CO4, CO6
5	**UNIT V:** Clustering Techniques: cluster Analysis – Clustering Methods – Similarity and Distance Measures – Hierarchical Methods – Partitional Methods Methods – Outlier Analysis-Types of Outliers-Finding Outliers using Inter Quartile Range	12	CO5,

TEXT BOOKS

1. Jiawei Han, Micheline Kamber, Jian Pei (2008). *Data Mining: Concepts and Techniques* (2nd edition), Morgan Kaufmann, ISBN- 9780123814791

REFERENCE BOOKS

1. Dunham MH, (2003). *Data Mining: Introductory and Advanced Topics*, Pearson Education.
2. Paulraj Ponnaiah, (2001). *Data Warehousing Fundamentals*, Wiley Publishers.
3. SN Sivananda and S Sumathi, (2006). *Data Mining*, Thomsan Learning, Chennai

E- REFERENCES

1. https://onlinecourses.nptel.ac.in/noc21_cs06/preview/
2. https://www.udemy.com/fundamentals-of-data-mining/
3. https://www.coursera.org/specializations/data-mining/
4. https://www.classcentral.com/subject/data-mining/

Course Title: **CORE PAPER XIX- C# AND .NET PROGRAMMING**

Course Code	**: 2328319**	**Credits**	**04**
L:T:P:S	**:4:0:0:0**	**CIA Marks**	**50**
Exam Hours	**:03**	**ESE Marks**	**50**

LEARNING OBJECTIVES:

On taking this course, student will be able to gain knowledge on concepts of .NET environment and C# basics, to create console application in C# using object-oriented concepts, to integrate C# and ASP.NET in developing web application, to build a web application using database connectivity, to construct a web application with enhanced Add-on services which includes web services, cookies and session

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

CO1	Acquire the knowledge of .NET environment. Expertise the fundamental concepts in developing the basics of C# programming
CO2	Develop, compile and execute console application in C# using object-oriented concepts.
CO3	Build a web application in ASP.NET using webserver controls
CO4	Demonstrate web application with database connectivity
CO5	Integrate web application using cookies, sessions

Mapping of Course Outcomes to Program Outcomes:

CO/PSO	**PSO**				
	1	**2**	**3**	**4**	**5**
CO 1	3	2	3	2	2
CO 2	2	3	2	3	2
CO 3	3	3	2	3	2
CO 4	3	3	2	3	2
CO 5	3	3	2	2	2

3-Strong 2- Medium 1- Low

S.No	CONTENTS OF MODULE	Hrs	COs
1	**UNIT I:** Introduction to .NET Framework, CLR – Overview of C#, Literals, Variables, Data Types, Operators and Expressions, Branching, Looping, Methods, Arrays.	12	CO1
2	**UNIT II:** Classes, Objects, Inheritance, Interfaces, Structures, Enumerations, Errors and Exceptions.	12	CO2
3	**UNIT III:** Programming Web Applications with Web Forms – Standard Web server Controls – Label, Textbox, Button, Link Button, Image, CheckBox and Radio button. Rich controls – Calendar, Ad Rotator. List Controls – Check box list, Radio button list, Drop down list, List Box.	12	CO3
4	**UNIT IV**: Data controls – Data grid, Repeater. Validation Controls- Compare Validator, Range Validator, Regular Expression, Required Field, Validation summary. Working with Data – OLEDB connection class, command class, data adaptor class, data reader – data set class.	12	CO4
5	**UNIT V:** Session & Application Object: global.asa file, Webconfig files, Application Object – creating & reading application variables. Session object – Introduction, storing session-information, contents and identifying session, controlling when session ends. Cookies- Creating &reading cookies.	12	CO5,

TEXT BOOKS:

1. E Balagurusamy (2004). *Programming in C#* (3rd edition), Tata McGraw-Hill India. ISBN 9780070702073
2. Stephen Walter (2006). *Asp.net 2.0 Unleashed*, (1st edition), Pearson Education, ISBN 978-8131703236
3. Greg Buczek (2010). *ASP.NET Developer's guide* (1st edition), Tata McGraw-Hill India, ISBN 978-0070499171

REFERENCE BOOKS:

1. Herbert Schildt (2010). *TheComplete Reference: C#4.0*, Tata McGraw-Hill Education India ISBN: 9780070703681.
2. Mathew Macdonald (2017). *ASP.NET: The Complete Reference*, McGraw Hill Education, ISBN 978-0070495364
3. Bill Evjen, Scott Hanselman, Devin Rader (2008). *Professional ASP.NET 3.5 In C# and VB* (Pap/Psc edition), Wrox publishers, ISBN 978-0470187579
4. Dino Sposito (2019). *Programming ASP.NET Core*, PHI learning | Microsoft Press, ISBN 978-9388028431

E- REFERENCES:

1. http://www.csharp-station.com/tutorial.aspx
2. http://www.tutorialspoint.com/csharp
3. http://asp.net-tutorials.com
4. http://www.aspnetbook.com

Course Title: CORE PAPER XX - SOFTWARE TESTING

Course Code : 2328320	**Credits 04**
L:T:P:S : 4:0:0:0	**CIA Marks 50**
Exam Hours : 03	**ESE Marks 50**

LEARNING OBJECTIVES

On taking this course the student will be able to study fundamental concepts in software testing, including software testing objectives, process, criteria, strategies, and methods, to discuss various software testing issues and solutions in software unit test; integration, regression, and system testing, to learn how to planning a test project, design test cases and data, conduct testing operations, manage software problems and defects, generate a testing report, to learn various software testing process like verification and validation, to gain the techniques and skills on how to use modern software testing tools to support software testing projects.

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

CO1	Discuss about the concept of bugs and analyses the principles in software testing to prevent and remove bugs.
CO2	Discuss about domains and path Analyze Linguistic and Structural Metric
CO3	Discuss about Verification and Validation. Analyse various levels of Testing, Testing Approaches, and Types of Testing & Test Plan.
CO4	Analyze Defect Management Discuss about Acceptance testing and special test.
CO5	Analyze various automation testing tools.

Mapping of Course Outcomes to Program Outcomes:

CO/PSO	**PSO**				
	1	**2**	**3**	**4**	**5**
CO1	**3**	**3**	**3**	**2**	**3**
CO2	**3**	**2**	**3**	**3**	**3**
CO3	**3**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**2**	**3**	**3**
CO5	**3**	**3**	**3**	**3**	**3**

3-Strong 2- Medium 1- Low

S.No.	CONTENT OF MODULE	Hrs	COs
1	**UNIT I:** Introduction: Purpose – Productivity and Quality in Software – Testing Vs Debugging Model for Testing – Bugs – Types of Bugs – Software Testing Development Life- cycle. Requirement Traceability matrix-Work Bench. Principles of software testing, Salient features of Good Testing-Challenges in Testing-Software Testing Methodologies.	12	CO1
2	**UNIT II:** Domain Testing:Domain Knowledge – Skills Required for Domain Testing – Domain Errors – Domain Testing Strategy – Domain Testing Example	12	CO2
3	**UNIT III:** Software Testing Process-Verification and Validation-Levels of Testing-Testing Approaches-Types of Testing-Test Plan.	12	CO3
4	**UNIT IV:** Test Model- Defect Management-Levels of Testing-Acceptance Testing-Special Tests-Test Planning.	12	CO4
5	**UNIT V:** Software Testing Tools Overview- Selenium-test engine-Selenium reports- Selenium scripts-Performance Testing Tools-Load Runner Tool. Testing Management Tools-Test Director-GUI Testing-Silk Test-Open Source Testing Tool-JMeter.	12	CO5,

TEXT BOOKS

1. B. Beizer (2003). *Software Testing Techniques*, Second Edition), DreamTechIndia, New Delhi. (UNIT I and II).
2. K.V.KK. Prasad (2005). *Software Testing Tools*, DreamTech. , India, NewDelhi.
3. (UNIT III, IV and V).
4. M.G.Limaye (2009). *Software Testing Principles, Techniques and Tools*, TataMc.Graw Hill Education Private Limited, New Delhi.(UNIT III and IV)

REFERENCE BOOKS

1. I.Burnstein (2003). *Practical Software Testing*, Springer InternationalEdition.
2. M G Limaye (2009). *Software Testing*, TMH, NewDelhi.

E-REFERENCES

1. http://awards.istqb.org/award-winner/boris-beizer.html
2. http://www.testingreferences.com/testinghistory.php
3. http://www.swquality.com/users/pustaver/Books/books.htm
4. http://www.bullseye.com/coverage.html
5. https://www.tutorialspoint.com/software_testing/
6. https://lecturenotes.in/subject/129/software-testing-st
7. www.ecs.csun.edu/~rlingard/COMP595VAV/SoftwareTesting.ppt

Course Title: ELECTIVE III - MOBILE COMMUNICATION

CourseCode: 2328210		**Credits**	**04**
L:T:P:S	**: 4:0:0:0**	**CIA Marks**	**50**
Exam Hours	**: 03**	**ESE Marks**	**50**

LEARNING OBJECTIVES

On taking this course the student will be able to explain the basics of Mobile communication systems, multiplexing and compare the various cellular systems and its components, Describe the concepts of Telecommunication systems and Satellite systems, Discuss about Wireless LAN and Bluetooth technology, Gain core knowledge of mobile network layer such as Packet delivery, tunneling and routing Strategies and Discuss the transport layer congestion control, snooping and TCP protocols.

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

CO1	Understand the basic concepts of mobile computing Understand Wireless LAN, Bluetooth and WiFi TechnologiesBe familiar with the network protocol stack
CO2	Learn the basics of mobile telecommunication systemBe exposed to Ad-Hoc networks
CO3	Understand the basic concepts of mobile computing Understand Wireless LAN, Bluetooth and WiFi TechnologiesBe familiar with the network protocol stack
CO4	Learn the basics of mobile telecommunication systemBe exposed to Ad-Hoc networks
CO5	Understand the basic concepts of mobile computing Understand Wireless LAN, Bluetooth and WiFi TechnologiesBe familiar with the network protocol stack

Mapping of Course Outcomes to Program Specific Outcomes:

CO/PSO	**PSO**				
	3	3	3	2	2
CO1	3	3	3	2	2
CO2	3	3	3	2	2
CO3	3	3	3	2	2
CO4	3	3	3	3	2
CO5	3	3	3	3	2

3-Strong 2- Medium 1- Low

SNO	CONTENT OF MODULE	Hrs	COS
1	**UNIT- I : Introduction** Introduction to Mobile Computing – Applications of Mobile Computing- Generations of Mobile Communication Technologies- MAC Protocols – SDMA- TDMA- FDMA- CDMA	12	CO1
2	**UNIT -II: Mobile Telecommunication System** GSM – Architecture – Protocols – Connection Establishment – Frequency Allocation – Routing –Mobility Management – Security – GPRS- UMTS- Architecture	12	CO2
3	**UNIT- III: Wireless Networks** Wireless LANs and PANs – IEEE 802.11 Standard – Architecture – Services – Blue Tooth- Wi-Fi –WiMAX	12	CO3
4	**UNIT- IV: Mobile IP** – DHCP – AdHoc– Proactive and Reactive Routing Protocols – Multicast Routing- Vehicular Ad Hoc networks (VANET) –MANET Vs VANET – Security	12	CO4
5	**UNIT-V: Mobile Transport And Application Layer** Mobile TCP– WAP – Architecture – WDP – WTLS – WTP –WSP – WAE – WTA Architecture – WML	12	

TEXT BOOK

1. Jochen Schiller, ―Mobile Communications‖, PHI, Second Edition, 2003.
2. Prasant Kumar Pattnaik, Rajib Mall, ―Fundamentals of Mobile Computing‖, PHI LearningPvt.Ltd, New Delhi – 2012

REFERENCE BOOKS

1. Dharma Prakash Agarval, Qing and An Zeng, "Introduction to Wireless and Mobile systems",Thomson Asia Pvt Ltd, 2005.
2. Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, ―Principles of Mobile Computing‖, Springer, 2003.
3. William.C.Y.Lee,―Mobile Cellular Telecommunications-Analog and Digital Systems‖, SecondEdition,Tata Mc Graw Hill Edition ,2006.

E-REFERENCES

1. Android Developers : http://developer.android.com/index.html
2. Apple Developer : https://developer.apple.com/
3. Windows Phone Dev Center :http://developer.windowsphone.com
4. .BlackBerry Developer : http://developer.blackberry.com

Course Title: ELECTIVE III - CRYPTOGRAPHY

Course Code : 2328321(B)	**Credits 04**
L:T:P:S : 4:0:0:0	**CIA Marks 50**
Exam Hours : 03	**ESE Marks 50**

LEARNING OBJECTIVES

To understand the mathematics behind cryptography, security concepts, vulnerabilities, different types of cryptosystems and attacks on various cryptosystems.

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

COS	Content of module
CO1	Gain knowledge about Conventional encryption model
CO2	Analyze Euclidean Algorithm and Number theory
CO3	Understanding Key exchanges.
CO4	Detailed representation of Hashing functions.
CO5	Describe the various Digital signatures logic.

Mapping of Course Outcomes to Program Outcomes:

CO/PSO	PSO				
	1	**2**	**3**	**4**	**5**
CO 1	3	3	2	2	3
CO 2	3	2	2	2	1
CO 3	3	2	2	3	2
CO 4	3	2	2	3	3
CO 5	3	3	3	3	2

3-Strong 2- Medium 1- Low

S. No	CONTENTS OF MODULE	HRS	COS
1	**UNIT I:** Conventional encryption model –Security Concepts- Substitution and Transposition Ciphers- DES algorithm –AES algorithm - Random number generation.	12	CO1
2	**UNIT II:** Number Theory: Modular arithmetic – Euler's theorem – Euclid's algorithm – Extended Euclidean Algorithm and its applications.–Prime numbers and factorization–Discrete Logarithms.	12	CO2
3	**UNIT III:** Principles of Public key Cryptography– RSA algorithm – Key Management- Diffie – Hellman key exchange	12	CO3
4	**UNIT IV:** Message Authentication and Hash functions: Authentication requirements –Authentication function- Message Authentication codes-Hash functions-Secure Hash Algorithm.	12	CO4
5	**UNIT V:** Digital Signature and Authentication Protocols: Digital Signature Authentication Protocols –Digital Signature Standard.	12	CO5

TEXT BOOK

1. Stallings. W (2013). Cryptography and Network Security Principles and Practice, Pearson Education, Delhi, ISBN:9788131761663.

REFERENCE BOOKS

1. Charlie Kaufman, Radia Perlman, Mike specimen (2016). Network Security Private Communication in a public world, Prentice Hall PTR, ISBN: 9789332586000
2. Michael Welsehenbach (2013). Cryptography in C & C++, Apress, ISBN: 9781430250999.

E-REFERENCES

1. http://www.webopedia.com/TERM/C/cryptography.html
2. http://www.sagemath.org/pdf/en/reference/cryptography/cryptography.pdf
3. http://www.freetechbooks.com/lecture-notes-on-cryptography-t565.html
4. https://nptel.ac.in/courses/10610503/https://nptel.ac.in/courses/106105162/

Course Title: ELECTIVE III - BLOCK CHAIN

Course Code : 2328321(C)	**Credits 04**
L:T:P:S : 4:0:0:0	**CIA Marks :50**
Exam Hours : 03	**ESE Marks :50**

LEARNING OBJECTIVES:

- *To understand the history, types and applications of Blockchain*
- *To acquire knowledge about cryptography and consensus algorithms.*
- *Deploy projects using Web3j and design blockchain based applications*

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

CO1	Contentedly discuss and describe the history, types and applications of Blockchain
CO2	Gains familiarity with cryptography and Consensus algorithms.
CO3	Create and deploy projects using Web3j
CO4	Implement an ICO on Ethereum
CO5	Design blockchain based application with Swarm and IPFS

Mapping of Course Outcomes to Program Outcomes:

CO/PSO	**PSO**				
	1	**2**	**3**	**4**	**5**
CO 1	3	3	2	2	3
CO 2	3	2	2	2	1
CO 3	3	2	2	3	2
CO 4	3	2	2	3	3
CO 5	3	3	3	3	2

3-Strong 2- Medium 1- Low

S.No	CONTENTS OF MODULE	HRS	COS
1	**UNIT I** DISTRIBUTED DBMS – Limitations of Distributed DBMS, Introduction to Block chain – History, Definition, Distributed Ledger, Blockchain Categories – Public, Private, Consortium, Blockchain Network and Nodes, Peer-to-Peer Network, Mining Mechanism, Generic elements of Blockchain,	12	CO1
2	**UNIT II** BLOCKCHAIN ARCHITECTURE Operation of Bitcoin Blockchain, Blockchain Architecture – Block, Hash, Distributer P2P, Structure of Blockchain- Consensus mechanism: Proof of Work (PoW), Proof of Stake (PoS), Byzantine Fault Tolerance (BFT), Proof of Authority (PoA) and Proof of Elapsed Time (PoET)	12	CO2
3	**UNIT III** BLOCKCHAIN-BASED FUTURES SYSTEM Project presentation- Futures smart contract: Blockchain oracles- Web3j: Setting up the Web3J- Installing web3j- Wallet creation, Java client: The wrapper generator- Initializing web3j- Setting up Ethereum accounts- Deploying the contract	12	CO3
4	**UNIT IV** - BLOCKCHAINS IN BUSINESS AND CREATING ICO Public versus private and permissioned versus permission less blockchains- Privacy and anonymity in Ethereum- Why are privacy and anonymity important? - The Ethereum Enterprise Alliance- Blockchainas-a-Service- Initial Coin Offering (ICO): Project setup for ICO implementation	12	CO4
5	**UNIT V** - DISTRIBUTED STORAGE IPFS AND SWARM Ethereum Virtual Machine- Swarm and IPFS: Installing IPFS, Hosting our frontend: Serving your frontend using IFPS, Serving your frontend using Swarm,	12	CO5

TEXT BOOK

1. Imran Bashir, “Mastering Blockchain: Distributed Ledger Technology, decentralization, and smart contracts explained”, 2nd Edition, Packt Publishing Ltd, March 2018.

2. Bellaj Badr, Richard Horrocks, Xun (Brian) Wu, “Blockchain By Example: A developer's guide to creating decentralized applications using Bitcoin, Ethereum, and Hyperledger”, Packt Publishing Limited, 2018..

REFERENCE BOOKS

1. Andreas M. Antonopoulos , “Mastering Bitcoin: Unlocking Digital Cryptocurrencies”, O’Reilly Media Inc, 2015
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, “Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction”, Princeton University Press, 2016.

E-REFERENCES

1. https://www.velmie.com/practical-blockchain-study
2. https://www.udemy.com/course/build-your-blockchain-az/

Course Title: CORE PAPER XXII
PRACTICAL V - C# AND .NET PROGRAMMING LAB

Course Code	**: 2328322**	**Credits**	**03**
L:T:P:S	**: 0:0:5:0**	**CIA Marks**	**50**
Exam Hours	**: 03**	**ESE Marks**	**50**

LEARNING OBJECTIVES

On taking this course, student will be able to develop simple console applications using control flow, loops, arrays, to create console application using strings, delegates and events, to design and develop console applications using object-oriented concepts, to create simple web page using ASP.NET, to design a website utilizing database and connect to the database from ASP.NET, to develop web application using cookies, sessions and Web services.

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

CO1	Develop console application using C#
CO2	Develop C# console applications using object oriented concepts
CO3	Build and develop web-application using ASP.NET controls and validations
CO4	Develop web application using ASP.NET incorporating database connection
CO5	Develop web application using ASP.NET using cookies and session

Mapping of Course Outcomes to Program Outcomes:

CO/PSO	**PSO**				
	1	**2**	**3**	**4**	**5**
CO 1	2	2	3	3	3
CO 2	3	3	3	3	2
CO 3	3	3	2	3	2
CO 4	3	3	2	3	2
CO 5	3	3	2	2	2

3-Strong2- Medium 1- Low

S.No	CONTENTS OF MODULE	Hrs	Cos
1	**C#** a. Creating a simple Console application b. Programs using Array and Array List c. Create a console application containing classes and Inheritance d. Programs using Interface e. Programs using Structures and Enumerations	33	CO1, CO2
2	**ASP.NET** a. Create a Website containing various standard controls b. Create a Webform that demonstrate using Validator controls c. Create a Website that contains AdRotator and Calendar controls. d. Create a Web application using Data Base Connections e. Create a Web application using sessions and cookies	42	CO3, CO4, CO5,

Course Title: CORE PAPER XXIII

PRACTICAL VI - DATA MINING LAB

Course Code	**: 2328323**	**Credits**	**03**
L:T:P:S	**:0:0:5:0**	**CIA Marks**	**50**
Exam Hours	**:03**	**ESE Marks**	**50**

LEARNING OBJECTIVES:

On taking this course the student will be able to create a DataFrame, load a dataset and perform data cleaning operations, to integrate data from different sources, to select the relevant data and remove the irrelevant data, to perform classification using classification algorithms and apply clustering algorithms to cluster the data.

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

CO1	Perform Data Cleaning, Data Integration
CO2	Perform Data Transformation
CO3	Remove Outliers
CO4	Perform Association Mining
CO5	Do Classification using Classification algorithms, Reading, writing, Sharpening, smoothening and segmenting the image.

Mapping of Course Outcomes to Program Outcomes:

CO/PSO	**PSO**				
	1	**2**	**3**	**4**	**5**
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Strong 2- Medium 1- Low

S. No	CONTENTS OF MODULE	Hrs	COs
1	Data Preprocessing and Data Integration	12	CO1
2	Programs using Min max Normalization, Zscore Normalization	12	CO2
3	Programs to remove Outliers	12	CO3
4	Programs using Association Mining	12	CO4,
5	Programs using Naïve Bayes Classification, Decision Tree Classification, Clustering using Kmeans and Agglomerative.	12	CO5
6	Reading ,Writing, sharpening,smoothing and segmenting the image	15	CO5

SPOKEN TUTORIAL

SP03 - JAVA

Course code: 2328325

S.NO	CONTENTS
1	Getting started java Installation – First Java Program – Installing Eclipse – Getting started Eclipse-Hello World Program in Eclipse – Errors and Debugging in Eclipse – Programming features Eclipse – Numerical Datatypes – Arithmetic Operations – Strings – Primitive type conversions – Relational Operations – Logical Operations – if else – Nested if – switch case – while loop – For loop – do while – introduction to Array – Array operations – creating class – creating object – instance fields – Methods – Default constructor – Parameterized constructors – using this keyword – Non static block – Constructor overloading – Method overloading – userinput – subclassing and method overriding – Calling methods of the superclass – Using final keyword – Polymorphism – Abstract Classes – Java Interfaces – Static Variables – Static Methods – Static Blocks.

Note:

Courses Offered by IIT Mumbai through Spoken Tutorial Projects MHRD, Government of India. At the end of the course Online Examination will be conducted for 45 minutes and qualified students (Minimum passing 40%) will be issued certificate by IIT, Mumbai.

********End of Third Semester********

FOURTH SEMESTER

Course Title: PROJECT & VIVA-VOCE

Course Code	**: 2328326**	**Credits**	**15**
L:T:P:S	**: 0:0:0:0**	**CIA Marks**	**50**
Exam Hours	**:03**	**ESE Marks**	**50**

LEARNING OBJECTIVES

On taking the course, the students will be able to Implement the solution for the chosen problem using the concepts and the techniques learnt in the curriculum, Identify, formulate and implement computing solutions, Design and conduct experiments, analyze and interpret data, Record the result, demonstrate skills to use modern tools, software and equipment's to analyze the chosen problem.

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

CO1	Demonstrate a depth of knowledge of modern technology.
CO2	Complete an independent research project, resulting in dissertation.
CO3	Communicate effectively and to present ideas clearly and coherently to specific audience in both the written and oral forms.
CO4	Self-study, reflect on their learning and take appropriate actions to improve it.

Mapping of Course Outcomes to Program Outcomes:

CO/PSO	**PSO**				
	1	**2**	**3**	**4**	**5**
CO 1	3	3	3	3	3
CO 2	3	3	3	3	3
CO 3	3	3	3	3	3
CO 4	3	3	3	3	3

3-Strong 2- Medium 1- Low

PROCEDURE

- The final semester will be entirely assigned for the student to carry out their project work.
- The Head of the Department will assign an Internal Guide for each student.
- The students should submit the contact details of the organization to their guide.
- During regular intervals, student should report his/her progress of the project work.
- After the submission of the final report, an external examiner will evaluate the project document and conduct the viva-voce examination.

SPOKEN TUTORIAL

SP04 – LaTeX
Course code : 2328326

S.NO	CONTENTS
1	Beamer- Bibliography- Equations- Inside Story of Bibliography- Latex on Windows using Texworks - Letter-Writing - Mathematical Typesetting – Report Writing - Tables and Figures.

Note:
Courses Offered by IIT Mumbai through Spoken Tutorial Projects MHRD, Government of India. At the end of the course Online Examination will be conducted for 45 minutes and qualified students (Minimum passing 40%) will be issued certificate by IIT, Mumbai.

********End of Fourth Semester********