DEPARTMENT OF M.C.A

OUTCOME BASED EDUCATION SYLLABUS

TWO YEARS MCA PROGRAMME

2020 - 2021 BATCH ONWARDS

DWARAKA DOSS GOVERDHAN DOSS VAISHNAV COLLEGE

(AUTONOMOUS)

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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VISION

Empower every student to be innovative, creative and productive in the domain of Computer Science by importing quality education, developing skills and inculcating human values.

MISSION

M1	To organize workshops at regular intervals to bridge the gap between the academia and industry.
M2	To enable the students to be industry ready by developing state-of-the-art curriculum in tune with industry requirements.
M3	By providing the necessary skills and to make students to excel in challenging scenario.
M4	To make students to understand the concepts using innovative teaching materials.

PROGRAMME EDUCATIONAL OUTCOMES (PEOs)

PEO1	To progress their career productively in software industry, academia, research, entrepreneurial pursuit, government, consulting firms and other Information Technology enabled services.
PEO2	To achieve peer-recognition; as an individual or in a team; by adopting ethics and professionalism and communicate effectively to excel well in cross culture and inter-disciplinary teams.
PEO3	To continue a lifelong professional development in computing that contributes in self and societal growth.

PEO TO MISSION STATEMENT MAPPING

MISSION STATEMENTS	PEO1	PEO2	PEO3
M1	3	2	2
M2	3	3	2
M3	3	3	3
M4	3	2	3

CORRELATION: 3- STRONG 2- MEDIUM 1- LOW

PROGRAMME OUTCOMES [Pos] FOR POST GRADUATE

At the end of the PG programme, the student will be able:

PO1	To attain suitable scientific knowledge and technical skills to realize, calibrate and develop innovative processes / skills for creation of inventive products which are beneficial to society.
PO2	To implement discipline, professionalism, team spirit, communication skills, social and ethical commitment in the post graduates in order to embellish leadership roles expediting perfection in different sector with a categorical professional distinctiveness, business savvy, international recognition and imperishable expansion.
PO3	To be habituated with the emerging expanses of erudition and their applications in several domains of biological sciences and to enlighten the students of its relevance in forthcoming studies.
PO4	To enhance the insight of research-oriented knowledge in conjunction with literature survey, design of experimental methodology, analysis and interpretation of results and draw valid conclusions.
PO5	To provoke entrepreneurship among the students along with strong ethics and communication skills.
PO6	To engage in Lifelong learning and enduring proficient progress.

MAPPING OF POs TO PEOS

PEO/PO	PO1	PO2	PO3	PO4	PO5	PO6
PEO 1	3	3	2	3	3	3
PEO 2	2	3	2	3	3	3
PEO 3	3	3	3	3	2	3

CORRELATION: 3- STRONG 2- MEDIUM 1- LOW

PROGRAMME SPECIFIC OUTCOMES [PSOs] FOR MCA

PSO1	Understand, analyze and develop Computer Programs in the areas related to algorithms, process and solutions for specific application development using appropriate data modeling concepts.
PSO2	Design, develop, test and maintain desktop, web, mobile and cross-platform software applications using latest tools, technologies and skills and computing models and thereby enhance the ability to carry out research, experiment, contemporary issues to solve industrial problems.
PSO3	Develop skill set to communicate one's ideas effectively and to demonstrate team, work as a member/leader to solve complex computing problems and design appropriate techniques to enhance ability for life-long learning.
PSO4	Make graduates to understand cross-cultural, societal, profession, legal and ethical issues prevailing in industry.

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 (40 Marks)

Test – I & II: 25 Marks (Theory)

Bloom's Category	Section	Description	Marks	Total
K1, K2	A-10 x 1 Mark [MCQ/Short answers]	Choose/Fill ups/One word	10	**50**
K3, K4,K5,K6	B-4 out of 6 x 10 Marks	250 Words	40	

Components of Continuous Internal Assessment (CIA)

Components			Calculation	CIA Total
Test	I	50	(Test1 + Test2) / 4 = 25	**40**
	II	50		
Generic Skills (Group discussion/Real time Project work/Seminar/ Poster Presentation)			10	
Attendance			05	

ESE- Semester End Examination (100 Marks; Weightage is 60%)

Bloom's Category	Section	Description	Marks	Total
K1, K2,K3,K4	A – 5 out of 8 x 5 Marks	250 Words	25	**100**
K3, K4,K5,K6	B– 5 (Either or pattern) x 15 Marks	500 Words	75	

2. **PRACTICAL EXAMINATION (100 Marks)**

Bloom's Category	CIA	ESE		Total
	Lab Performance	Lab Performance	Record Work	
K3, K4, K5,K6	40	50	10	**100**

DEPARTMENT OF M.C.A

SCHEME OF I SEMESTER M.C.A PROGRAMME

Sl. No.	Course Category	Course Code	Course	Credit Distribution				Over all Credits	Total Contact Hours/ Week	Marks		
				L	T	P	S			CIA	ESE	Total
1	Core Theory T1	XX29101	Principles of Database Management Systems	3	1	0	0	4	4	40	60	100
2	Core Theory T2	XX29101	Advanced Java Programming	3	1	0	0	4	4	40	60	100
3	Core Theory T3	XX29101	Advanced Data Structures and algorithms	4	0	0	0	4	4	40	60	100
4	Core Theory T4	XX29101	Operating System Concepts	4	0	0	0	4	4	40	60	100
5	Non-Major Elective 1	XX29101	Basics of Statistics	4	0	0	0	4	4	40	60	100
6	Core Practical P1	XX29106	Database Programming Lab	0	0	5	0	2	5	40	60	100
7	Core Practical P2	XX29107	Advanced Java Programming Lab	0	0	5	0	2	5	40	60	100
8	Soft Skills*		Soft Skills-1	0	0	0	0	2	0	50	50	100
9	ST**	------	Spoken Tutorial 1-LINUX	0	0	0	0	1	0	-	-	-
			Total	-	-	-	-	**27**	**30**	**330**	**470**	**800**

CIA-Continuous Internal Assessment

ESE-End Semester Examination

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

ST-** Courses offered by IIT Mumbai through Spoken Tutorial Project MHRD Govt. of India. Online Examination will be conducted and qualified students (minimum passing percentage of 40%) will be issued certificate by IIT Mumbai. Students will submit a copy of the certificate after qualifying the online test as a proof to the COE's office to earn 1 credit for the same.

XX -Year of Admission

DEPARTMENT OF M.C.A

SCHEME OF II SEMESTER M.C.A PROGRAMME

Sl. No.	Course Category	Course Code	Course	Credit Distribution				Over all Credits	Total Contact Hours/ Week	Marks		
				L	T	P	S			CIA	ESE	Total
1	Core Theory T5	XX29201	Python for Data Science	3	1	0	0	4	4	40	60	100
2	Core Theory T6	XX29202	Mobile Application Development	3	1	0	0	4	4	40	60	100
3	Core Theory T7	XX29203	Fundamentals of Machine Learning	4	0	0	0	4	4	40	60	100
4	Core Theory T8	XX29204	Mobile Communications	4	0	0	0	4	4	40	60	100
5	Core Theory Elective 1	XX29205	a. Principles of Digital Image Processing b. Introduction to Multimedia c. Computer Animation	4	0	0	0	4	4	40	60	100
6	Core Practical P3	XX29206	Python for Data Science Lab	0	0	5	0	2	5	40	60	100
7	Core Practical P4	XX29207	Mobile Application Development Lab	0	0	5	0	2	5	40	60	100
8	Intern#		Summer Internship	0	0	0	0	1	0	-	-	-
9	Soft Skills*		Soft Skills-2	0	0	0	0	2	0	50	50	100
10	ST**	------	Spoken Tutorial 2-PYTHON	0	0	0	0	1	0	-	-	-
			Total	-	-	-	-	**28**	**30**	**330**	**470**	**800**

CIA-Continuous Internal Assessment

ESE-End Semester Examination

Intern# -Internship will be carried out by the students during their second semester/ summer vacation of the first year with a minimum of 3 weeks/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 Second Semester Marks Statement to earn 1 credit.

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XX -Year of Admission

DEPARTMENT OF M.C.A

SCHEME OF III SEMESTER M.C.A PROGRAMME

Sl. No.	Course Category	Course Code	Course	Credit Distribution				Over all Credits	Total Contact Hours/ Week	Marks		
				L	T	P	S			CIA	ESE	Total
1	Core Theory T9	XX29301	Introduction to Big Data Analytics	3	1	0	0	4	4	40	60	100
2	Core Theory T10	XX29302	Dot Net Programming	3	1	0	0	4	4	40	60	100
3	Core Theory T11	XX29303	Principles of Cloud Computing	4	0	0	0	4	4	40	60	100
4	Core Theory Elective 2	XX29304	a. Computer Forensics and Bioinformatics b. Network Security c. Information Security	4	0	0	0	4	4	40	60	100
5	Core Theory Elective 3	XX29305	a. Introduction to Internet of Things b. Block Chain Technology c. Green Computing	4	0	0	0	4	4	40	60	100
6	Core Practical P5	XX29306	Big Data Analytics Lab	0	0	5	0	2	5	40	60	100
7	Core Practical P6	XX29307	Dot Net Programming Lab	0	0	5	0	2	5	40	60	100
8	Soft Skills*		Soft Skills-3	0	0	0	0	2	0	50	50	100
9	ST**	-----	Spoken Tutorial 3-GIT	0	0	0	0	1	0	-	-	-
			Total	-	-	-	-	**27**	**30**	**330**	**470**	**800**

CIA-Continuous Internal Assessment

ESE-End Semester Examination

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

ST-** Courses offered by IIT Mumbai through Spoken Tutorial Project MHRD Govt. of India. Online Examination will be conducted and qualified students (minimum passing percentage of 40%) will be issued certificate by IIT Mumbai. Students will submit a copy of the certificate after qualifying the online test as a proof to the COE's office to earn 1 credit for the same.

XX -Year of Admission

DEPARTMENT OF M.C.A

SCHEME OF IV SEMESTER M.C.A PROGRAMME

Sl. No.	Course Category	Course Code	Course	Credit Distribution				Over all Credits	Total Contact Hours/ Week	Marks		
				L	T	P	S			CIA	ESE	Total
1	Core Project T13	XX29401	Project Work	0	0	0	0	12	-	40	60	100
2	Certificate Course ##	XX29402	Certificate Course-NPTEL	0	0	0	0	2	-	-	-	-
3	Soft Skills*		Soft Skills-4	0	0	0	0	2	-	50	50	100
4	ST**	-----	Spoken Tutorial 4-LATEX	0	0	0	0	1	-	-	-	-
Total								**17**	**-**	**90**	**110**	**200**

CIA-Continuous Internal Assessment

ESE-End Semester Examination

Certificate Course ## -Certificate Courses offered by NPTEL. Students should complete any one Certificate Course (Not Less Than 8 Weeks) within the duration of the course (on or before the completion of the final semester). Students will submit a copy of the certificate issued by NPTEL after qualifying as a proof to the COE's office to earn 2 credits for the same.

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

ST-** Courses offered by IIT Mumbai through Spoken Tutorial Project MHRD Govt. of India. Online Examination will be conducted and qualified students (minimum passing percentage of 40%) will be issued certificate by IIT Mumbai. Students will submit a copy of the certificate after qualifying the online test as a proof to the COE's office to earn 1 credit for the same.

XX -Year of Admission

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FIRST SEMESTER

Course Title: CORE THEORY T1-PRINCIPLES OF DATABASE MANAGEMENT SYSTEMS
(For Students admitted from 2020 onwards)

Course Code	**: XX29101**	**Credits**	**: 04**
L:T:P:S	**: 3:1:0:0**	**CIA Marks**	**: 40**
Exam Hours	**: 03**	**ESE Marks**	**: 60**

Course Objectives:

- *To understand the fundamentals of data models and conceptualize and depict a database system using ER diagram*
- *To make a study of SQL and relational database design.*
- *To know about data storage techniques and query processing.*
- *To impart introductory knowledge on NoSQL.*

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

CO1	Explain difference between file system and database system, the basic concepts of data models and its classification like ER model, relational model, network model, object oriented model and case study as ER model.
CO2	Discuss the relational database terminologies; analyze types of keys in relational database system. Understand the Relational algebra and improve the performance of database by normalization and hence the types of normal forms.
CO3	Implementation of Relational Database in Oracle SQL, analyzing of DDL, DML and DRL statements, Joins, Group functions and Integrity Constraints with syntax and examples.
CO4	Demonstrate the types of PL/SQL statements with examples and hence discuss the purpose of Cursors, Triggers, Procedures and Functions in PL/SQL with its implementation.
CO5	Apply the database tuning methodologies on Indexes, Database Design, and Queries. Explain the Transaction States and properties of Transactions and acquire the basic knowledge about concurrency techniques over databases.

Mapping of Course Outcomes to Program Specific Outcomes:

	PSO1	**PSO2**	**PSO3**	**PSO4**
CO1	3	2	3	3
CO2	3	3	3	3
CO3	3	3	2	2
CO4	3	2	2	2
CO5	3	2	2	2

3-Strong 2-Medium 1-Low

Sl No.	**Contents of Module**	**Hrs**	**COs**
1	Introduction to Databases- Characteristics of the Database -Advantages of using DBMS - Categories of Data Models-Schemas and Instances -Three-Schema Architecture-Data Independence– **Conceptual Modeling using ER Model:** Entities and Attributes, Entity types and Entity sets, Relationship types, Degree of a Relationship Type, Weak Entity types, Notations for ER diagrams, Naming Conventions, An Example ER diagram.	**12**	**CO1**
2	**Relational Model Concepts**: Domains, Attributes, Tuples, Relations, Types of Keys- **Relational Algebra**: Unary Operations, Operations from Set Theory, Cartesian product, Division and Rename. **Normalization**: Purpose of Normalization – Functional Dependencies –First Normal Form, Second	**12**	**CO2**

	Normal Form, Third Normal Form-Boyce-Codd Normal Form (BCNF).		
3	**Basic SQL:** Attribute Data types and Domains in SQL -DDL Commands- DML Commands-Select statement using where, in, between, order by, like, distinct, relational operators and logical operators- Numeric functions-Character functions -Date functions- - SQL Group functions - SQL Set Operators – Commit-Rollback-Integrity Constraints in SQL.	**12**	**CO3**
4	Nested Query-Inner Joins-Outer Joins-Format of PL/SQL Block-Decision making statements in PL/SQL-Looping Statements in PL/SQL-Implicit Cursor- Explicit Cursor- Built-in Exceptions -User-Defined Exceptions.	**12**	**CO4**
5	**Indexing:** Types of Indexing - **Transaction and System Concepts:** Transaction States, The System Log, Commit point of a Transaction, Desirable properties of Transactions- **Concurrency Control:** Two-phase locking technique.	**12**	**CO5**

Text Books:

1. Ramez Elmasri and Shamkant B. Navathe**, "Fundamentals of Database Systems"**, 7th Edition, Pearson Education, 2017. (Units I,II,V)
2. Sharad Maheswari and Ruchin Jain, "**Introduction to SQL and PL/SQL**", Firewall Media, 2016. (Units III,IV)

Reference Books:

1. Avi Silberschatz, Henry F. Korth and S. Sudarshan**. "Database System Concepts"**, 6th Edition, McGraw Hill.
2. Raghurama Krishnan and Johannes Gehrke, "Data Base Management Systems", TMH 3rd Edition,2003
3. Majumdr, Bhattacharyya," Data Base Management Systems", TMH ,96.

E-References:

1. https://nptel.ac.in/courses/106/105/106105175/
2. https://www.db-book.com/db6/slide-dir/index.html
3. https://beginnersbook.com/2015/04/dbms-tutorial/
4. https://www.technolamp.co.in/2011/09/database-management-systems-dbms-imp.html

FIRST SEMESTER

Course Title: CORE THEORY T2-ADVANCED JAVA PROGRAMMING
(For Students admitted from 2020 onwards)

Course Code	**: XX29102**	**Credits**	**: 04**
L:T:P:S	**: 3:1:0:0**	**CIA Marks**	**: 40**
Exam Hours	**: 03**	**ESE Marks**	**: 60**

Course Objectives:

- *To provide the ability to design a console based, GUI based and web based advanced applications.*
- *Students will also be able to understand integrated development environment to create, debug and run multi-tier and enterprise-level applications*
- *To develop distributed applications*
- *Analyzing different problems in Web Applications and providing solutions*
- *Applying the knowledge to develop Web Applications for industries and individuals.*

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

CO1	Describe how servlets fit into Java-based web application architecture
CO2	Explain the concepts and terminologies of JSP
CO3	Build client-server web applications
CO4	Apply the concepts of RMI in an application
CO5	Design and implement dynamic web page with validation using JavaScript objects
CO6	Develop proficiency in creating solutions for web applications

Mapping of Course Outcomes to Program Specific Outcomes:

	PSO1	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	2	1
CO2	3	3	3	2
CO3	3	3	3	3
CO4	3	3	3	2
CO5	3	3	3	2
CO6	3	3	3	3

3-Strong 2-Medium 1-Low

Sl No.	**Contents of Module**	**Hrs**	**COs**
1	**Introduction to Javascript:** Data types and literals –Type Casting - Variables - Java Script Array – Operators and Expressions - Java Script Programming Constructs- JavaScript Functions- Dialog boxes.	**12**	**CO1,CO5**
2	**Forms used by a Website:** Form object-Form object's Methods - Different elements - Other built-in Object-User defined objects – Regular expression – Form validation.	**12**	**CO6**
3	**Java Servlets:** Servlet life-Cycle -Types of Servlet – Servlet Chaining -Forward Model - Include Model - Session Tracking Mechanisms -URl-Rewriting - Hidden Form Fields – Cookies-HttpSession - using JDBC in Servlets.	**12**	**CO3**
4	**RMI :** RMI Overview – Developing applications with RMI: Declaring & Implementing remote interfaces - stubs & skeletons - Registering remote objects - writing RMI clients – Pushing data from RMI Servlet – RMI over Inter- ORB Protocol.	**12**	**CO4**
5	**JSP:** JSP Overview – Advantages of JSP over Servlet - life Cycle of JSP Page - Examining MVC and JSP - JSP Scripting Elements- JSP Directives - JSP implicit objects – JSP exception – JSP	**12**	**CO2**

	action tags.		

Text Books:

1. Ivan Bayross, “Web Enabled Commercial Application Development Using HTMl, DHTMl, JavaScript, Perl CGI “, BPB publication”, 2l1l.
2. J. McGovern,R. Adatia,Y. Fain, “J2EE 1.4 Bible”, Wiley-dreamtech India Pvt. ltd, 2ll3.

Reference Books:

1. Thomas Powell and Fritz Schneider, "JavaScript 2.l The Complete Reference", Second Edition, McGraw-Hill,20l4.
2. Thomas A.Powell and Fritz Schneider, *JavaScript: The Complete Reference,* TataMcGraw Hill, 20l2.
3. Patrick Naughton and Herbert Schildt, Java 2: The complete Reference, Tata-
4. McGraw Hill Publishing, 2nd Reprint, 20l1.
5. Kogent Solution Inc, “Java 6 Programming Black Book”, Dreamtech Press, 20l7.
6. J2EE the Complete Reference, First Edition by Jim Keogh, Tata McGraw Hill, 20l2.
7. Java Servlet Programming, Second Edition by Jason Hunter, William Crawford, O'Reilly, 20l1.

E-References:

1. https://www.edureka.co/blog/advanced-java-tutorial
2. https://www.javatpoint.com/jsp-tutorial
3. https://www.javatpoint.com/servlet-tutorial
4. https://www.javatpoint.com/RMI
5. https://www.javascripttutorial.net/
6. https://www.javatpoint.com/javascript-tutorial

FIRST SEMESTER

Course Title: CORE THEORY T3-ADVANCED DATA STRUCTURES AND ALGORITHMS
(For Students admitted from 2020 onwards)

Course Code	**: XX29103**	**Credits**	**: 04**
L:T:P:S	**: 4:0:0:0**	**CIA Marks**	**: 40**
Exam Hours	**: 03**	**ESE Marks**	**: 60**

Course Objectives:

- *To impart the knowledge about the concepts of data structures and algorithms.*
- *To enable the students to analyze the efficiency of algorithms.*
- *Train the students to design and analyze linear and non-linear data structures.*
- *Enable the students to implement suitable data structures and algorithms in real time applications*

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

CO1	Analyze the performance of algorithms using asymptotic notations.
CO2	Evaluate and provide suitable techniques for solving a problem using basic properties of Data Structures.
CO3	Illustrate different types of algorithmic approaches to problem solving.
CO4	Understand the nature of problems and to develop prototypes or applications of varying complexities.
CO5	Determine the drawbacks of data structures and algorithms and assess the tradeoffs involved.

Mapping of Course Outcomes to Program Specific Outcomes:

	PSO1	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	3	2
CO2	3	3	3	2
CO3	3	3	3	3
CO4	3	3	3	3
CO5	3	3	3	3

3-Strong 2-Medium 0-Low

Sl No.	**Contents of Module**	**Hrs**	**COs**
1	**Introduction:** Abstract data types - asymptotic notations – complexity analysis – Arrays-representation of arrays. **Linked lists:** Singly linked list- Circular linked lists – Doubly linked lists. **Stacks**: Operation, array representation of a stack, Application – expression evaluation, Recursion – Towers of Hanoi. **Queues**: operations - circular queues.	**12**	**CO1**
2	**Trees** – Basic terminologies, Binary Trees – Binary Tree Traversals – Binary Tree Representations – Binary Search Trees – Threaded Binary Trees- AVL Trees-Red- Black Trees.	**12**	**CO2**
3	**Graphs:** Representation of Graphs – Graph Implementation – Graph Traversals – BFS, DFS, Single-Source Shortest Path Problem- Dijkstra's algorithm, Bellman-Ford algorithm. Minimum Cost Spanning Trees by Prim's and Kruskal's algorithm– All Pair Shortest Path Problem- Floyd Warshall algorithm.	**12**	**CO3**
4	**Divide and Conquer** – Quick sort, Merge sort, Binary Search. **Greedy Method:** General Method – knapsack problem.	**12**	**CO4**
5	**Back Tracking**: General Method – 8-queens, Sum of Subsets. **Branch and Bound:** General Method – Travelling Salesperson problem.	**12**	**CO5**

Text Books:

1. E. Horowitz, S. Sahni and S. Rajasekaran, “Computer Algorithms”, Galgotia Publishers, 2001.
2. E.Horowitz, S. Sahni and Mehta, “Fundamentals of Data Structures in C++”, Galgotia Publishers, 2000.

Reference Books:

1. G. L. Heileman, “Data Structures, Algorithms and Object Oriented Programming”, Revised Edition, TMH, 1999.
2. A.V. Aho, J.E. Hopcroft, J.D. Ullmann, “The Design and Analysis of Computer Algorithms”, Pearson Education Asia, Addison Wesley Publishers, 2006.
3. S.K. Basu ,”Design Methods and Analysis of Algorithms”, Fourth Edition ,2013.
4. Kruse R.L, Leung B.P, Tondo C.L,” Data structures and Program design in C”, Pearson, Second Edition, 2007

E-References:

1. https://nptel.ac.in/courses/106/102/106102064/
2. https://www.programiz.com/dsa
3. https://www.tutorialspoint.com/data_structures_algorithms/index.htm
4. https://www.javatpoint.com/daa-tutorial

FIRST SEMESTER

Course Title: CORE THEORY T4-OPERATING SYSTEM CONCEPTS
(For Students admitted from 2020 onwards)

Course Code	**: XX29104**	**Credits**	**: 04**
L:T:P:S	**: 4:0:0:0**	**CIA Marks**	**: 40**
Exam Hours	**: 03**	**ESE Marks**	**: 60**

Course Objectives:

- *To be aware of the evolution and fundamental principles of operating system, processes and their communication*
- *To understand the various operating system components like process management, memory management*
- *To know about file management and the distributed file system concepts in operating systems*
- *To be aware of components of operating system with relevant case study.*

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

CO1	Defining the need of operating system components and evolution, its architecture and different types of system calls
CO2	Introduce the concept of process, operations and scheduling and thereby explain the concept of process scheduling, CPU scheduling criteria and algorithms. .
CO3	Acquire the knowledge of process synchronization and illustrate the critical section problems and ways to handle the dead lock problems with the help of algorithms.
CO4	Explain and discuss the background of memory with segmentation and paging techniques and the virtual memory management with various page replacement algorithms
CO5	Describe file management with file organization, file access methods, B-trees, and File System security.
CO6	Sketch out the various storage structures with different disk scheduling algorithms. Explain how a Linux server can be integrated within a multi-platform environment.

Mapping of Course Outcomes to Program Specific Outcomes:

	PSO1	**PSO2**	**PSO3**	**PSO4**
CO1	2	1	1	2
CO2	3	2	1	2
CO3	3	2	2	2
CO4	3	2	3	2
CO5	2	1	3	2
CO6	3	1	2	2

3-Strong 2-Medium 1-Low

Sl No.	**Contents of Module**	**Hrs**	**COs**
1	Introduction: Types of operating systems-operating systems services-System calls-Systems programs-Process Management: Process concept- Process Scheduling-Operation on Processes-Co-Operating Processes- Interprocess Communications-CPU Scheduling: Scheduling Criteria-Scheduling algorithms.	**12**	**CO1**
2	Process Synchronization –Critical Section Problem – Semaphores-Classical problems of synchronization-Deadlock Characterization-Deadlock Prevention-Deadlock avoidance-Deadlock Detection-Deadlock Recovery.	**12**	**CO2, CO3**
3	Memory Management-Swapping-Contiguous Memory Allocation-Paging-Segmentation-Virtual Memory-Demand paging-Page Replacement-Thrashing.	**12**	**CO4**

4	Disk Structures-Disk Scheduling algorithms-File Systems Organization-File concepts-File Operations-Access methods-Directory Structures-File System Implementation-Directory Implementation-Allocation Methods-Free Space management.	**12**	**CO5, CO6**
5	History of Linux- Properties of Linux-Linux Commands-Overview of the Linux file system-Manipulation of files –File Security.	**12**	**CO6**

Text Book:

1. Abraham Silberschalz Peter B Galvin, G.Gagne, "Operating Systems Concepts", 9th Edition, John Wiley & Sons, 2013.

Reference Books:

1. Andrew S.Tanenbaum, "Modern operating Systems", Third Edition, PHI Learning Pvt. Ltd., 2008.
2. D M Dhamdhere, " Operating Systems: A Concept-based Approach", Second Edition, Tata McGraw-Hill Education, 2007.
3. H M Deital, P J Deital and D R Choffnes, "Operating Systems", 3rd edition, Pearson Education, 2011.
4. William Stallings, "Operating Systems: Internals and Design Principles", Seventh Edition, Prentice Hall, 2011.

E-References:

1. https://www.tutorialspoint.com/operating_system/index.htm
2. https://www.javatpoint.com/os-tutorial
3. https://nptel.ac.in/courses/106/105/106105214/

FIRST SEMESTER

Course Title: NON MAJOR ELECTIVE 1-BASICS OF STATISTICS
(For Students admitted from 2020 onwards)

Course Code	**: XX29105**	**Credits**	**: 04**
L:T:P:S	**: 4:0:0:0**	**CIA Marks**	**: 40**
Exam Hours	**: 03**	**ESE Marks**	**: 60**

Course Objectives:

- *To provide an understanding of the statistical methods and probabilistic concepts by which real- life problems are analyzed (Focus on problems- No derivations)*
- *To develop the students ability to deal with numerical and quantitative issues*
- *To enable the use of statistical, graphical and algebraic techniques wherever relevant.*

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

CO1	Recall the concepts of sample spaces, events, axiomatic approach, conditional probability, Baye's theorem. Summarize the random variables, expectation and variance. Demonstrate the chebyshev's inequality.
CO2	Distinguish Discrete and continuous distributions. Solve the real time problems involving various distributions like Binomial, Poisson and normal distributions.
CO3	Explain the concept of Bivariate analysis and point out the importance of correlation analysis, Regression analysis and various curves using method of least squares.
CO4	Summarize the concept of sampling and various methods of sampling. Point out the various errors such as standard error, type I error, type II error. Explain the Null Hypothesis and alternative hypothesis. Point the importance of estimation.
CO5	Differentiate large and small samples. Compare the various parametric tests like Z-test, t-test, F test by giving practical examples. Explain the non parametric chi square test with illustrated examples
CO6	Restate the analysis of variance and classify the one way and two classifications. Categorize the computing randomized design and randomized block design. Define time series and list the components of time series. Illustrate the measurement of trend and seasonal variations.

Mapping of Course Outcomes to Program Specific Outcomes:

	PSO1	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	2	3
CO2	3	3	1	2
CO3	3	3	1	2
CO4	3	2	1	3
CO5	3	2	2	2
CO6	3	3	3	3

3-Strong 2-Medium 1-Low

Sl No.	**Contents of Module**	**Hrs**	**COs**
1	Sample spaces - Events - Axiomatic approach to Probability - Conditional Probability - Independent Events -Baye's Formula - Random Variables - Continuous and Discrete Random Variables - Distribution Function of a Random Variables - Expectation, Variance - Coefficient of Variation -Chebyshev's Inequality.	**12**	**CO1,CO2**
	Bivariate Distribution – Conditional and Marginal Distributions – **Discrete Distributions:**	**12**	**CO3**

2	Discrete, Uniform, Binomial, Poisson and Geometric Distributions – **Continuous Distributions**: Uniform, Normal, Exponential and Gamma Distributions (only simple problems).		
3	Correlation: Bivariate Data - Correlation between Two Variables - Covariance between Two Variables - Karl Pearson's Coefficient of Correlation - Rank Correlation. **Regression Analysis**: Simple Linear Regression - Regression Equations.	**12**	**CO3,CO4**
4	Concepts of Sampling Distributions and Standard Error -Point Estimation (Concepts Only) - Interval Estimation of Mean and Proportion. Tests of Hypotheses - Critical Region - Two Types of Errors - Level of Significance - Power of the Test - Large Sample Tests for Mean and Proportion - Exact Tests Based on Normal, t, f and Chi-Square Distributions.	**12**	**CO5**
5	Basic Principles of Experimentation – Analysis of Variance – One Way and Two Way Classifications – Computing Randomized Design – Randomized Block Design.	**12**	**CO6**

Text Book:

1. Gupta S.C and Kapoor V.K, "Fundamentals of Mathematical Statistics", 11th Edition, Sultan Chand & Sons, India, 2007.

Reference Books:

1. P.R.Vital, —Mathematical Statistics‖, Marghan Publication, 2004.
2. T.K.V. Iyengar "Probability & Statistics for MCA". S. Chand & company, New Delhi, 2009 edition.
3. Trivedi, K.S, "Probability and Statistics with Reliability, Queuing and Computer Science Applications", Prentice Hall India,1994.
4. James T. McClave and Terry Sincich, "Statistics", 12th Edition, Pearson Education, India, 2013.
5. Erwin Miller and John E.Freund, "Probability and Statistics for Engineers", 7th Edition, Pearson Education, India, 2017.

E-References:

1. https://nptel.ac.in/courses/111/105/111105041/
2. https://nptel.ac.in/courses/111/105/111105043/
3. https://nptel.ac.in/courses/110/106/110106064/

FIRST SEMESTER

Course Title: CORE PRACTICAL P1-DATABASE PROGRAMMING LAB
(For Students admitted from 2020 onwards)

Course Code	**: XX29106**	**Credits**	**: 02**
L:T:P:S	**: 0:0:5:0**	**CIA Marks**	**: 40**
Exam Hours	**: 03**	**ESE Marks**	**: 60**

Course Objectives:

- *To explain basic database concepts, applications, data models, schemas and instances.*
- *To demonstrate the use of constraints and relational algebra operations.*
- *Describe the basics of SQL and construct queries using SQL.*
- *To emphasize the importance of normalization in databases.*
- *To facilitate students in Database design*

Lab Exercises:

1. DDL Statements
2. DML Statements
3. SELECT statement
4. Numeric functions
5. Character functions
6. Date functions
7. Group Functions
8. Set Operations
9. Nested query
10. Joins
11. Commit and Rollback
12. PL/SQL-Decision Making statements
13. PL/SQL-Looping statements
14. PL/SQL-Cursors
15. PL/SQL-Exception Handling

FIRST SEMESTER

Course Title: CORE PRACTICAL P2- ADVANCED JAVA PROGRAMMING LAB
(For Students admitted from 2020 onwards)

Course Code	**: XX29107**	**Credits**	**: 02**
L:T:P:S	**: 0:0:5:0**	**CIA Marks**	**: 40**
Exam Hours	**: 03**	**ESE Marks**	**: 60**

Course Objectives:

- *The course covers Graphical User Interface (GUI) networking, JavaScript and database*
- *Student will be able to use advanced technology in Java such as Remote method Invocation , JSP.*
- *Student will be able to develop web application using Java Servlet.*

Lab Exercises:

1. Design a form and implement java script showing all the major form validations.
2. JavaScript program illustrating the Date and Math Objects
3. JavaScript program to handle different events.
4. Basic Servlet Programming
5. Servlet Collaboration-Request Dispatcher
6. Session Management and Implementation of Cookies using Servlet
7. Developing a web application with MySQl Database using Servlet
8. Designing online applications with JSP
9. Creating Web services with RMI.

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

SECOND SEMESTER

Course Title: CORE THEORY T5- PYTHON FOR DATA SCIENCE
(For Students admitted from 2020 onwards)

Course Code	**: 20XXXX**	**Credits**	**: 04**
L:T:P:S	**: 3:1:0:0**	**CIA Marks**	**: 40**
Exam Hours	**: 03**	**ESE Marks**	**: 60**

Course Objectives:

- *To introduce Python programming language through its core language basics and program design techniques suitable for modern applications.*
- *To understand the wide range of programming facilities available in Python covering graphics, GUI, data visualization and Databases.*
- *To utilize high-performance programming constructs available in Python to develop solutions in real life scenarios.*

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

CO1	Examine Python syntax and semantics and be fluent in the use of Python input output functions.
CO2	Create, run and manipulate Python Programs using core data structures like Lists, Dictionaries and use Regular Expressions.
CO3	Interpret/Evaluate the concepts of Object-Oriented Programming using Python.
CO4	Demonstrate proficiency in handling Strings and File Systems.
CO5	Discover the capabilities of numpy ,scipy and matplotlib for scientific programming.
CO6	Implement exemplary applications related to Pandas andDataFrames in Python.

Mapping of Course Outcomes to Program Specific Outcomes:

	PSO1	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	2	1
CO2	3	3	2	2
CO3	3	3	3	3
CO4	3	3	3	2
CO5	3	3	3	3
CO6	3	3	3	3

3-Strong 2-Medium 1-Low

Sl No.	**Contents of Module**	**Hrs**	**COs**
1	Introduction to Python - Installing in various Operating Systems - Executing Python Programs - Basic Programming concepts - Variables, expressions and statements - Input/Output –Operators.	**12**	**CO1**
2	Conditional Statements - Functions - Arguments - Return values - Iteration - Loops - Strings -**Data Structures**: Lists - Dictionaries - Tuples – Sequences- Modules.	**12**	**CO2**
3	File Handling - Regular Expressions - Text handling - **O**bject Oriented Programming- Classes - Objects - Inheritance - Overloading - Polymorphism Interacting with Databases - Exception Handling -Introduction to MySQL -Interacting with MySQL - Building a address book with add/edit/delete/search features.	**12**	**CO3,CO4**

4	Scientific Programming using NumPy/SciPy and Matplotlib – Array operations, 2D numpy arrays, Numpy basic Statistics ,ScipyLinalg, scipy Optimize. Matplotlib – Introduction, Simple plots, Figures and Subplots.	**12**	**CO5**
5	Introduction to Pandas-Creation of Series- Operations-Creation of Dataframes-Operations-Import/Export of different types of Files-Slicing - Filtering- groupby-Aggregation-Simple plot using pandas-Real time Case Study.	**12**	**CO6**

Text Books:

1. Allen B. Downey O'Reilly —Think Python: How to Think Lik ea Computer Scientist.
2. Python Programming: A Modern Approach, Vamsi Kurama, Pearson Education
3. Core Python Programming, R. Nageswara Rao, 2nd Edition, Dreamtech.

Reference Books:

1. Learning Python, Mark Lutz, Orielly
2. Core Python Programming, W.Chun, Pearson.
3. Introduction to Python, Kenneth A. Lambert, Cengage
4. Programming in Python, Pooja Sharma, BPB Publications, 2017.
5. Python in a Nutshell, A. Martelli, A. Ravenscroft, S. Holden, OREILLY.

E-References:

1. https://nptel.ac.in/courses/106/106/106106182/
2. https://nptel.ac.in/courses/106/106/106106145/
3. https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs36/
4. https://www.tutorialspoint.com/python/
5. https://www.udacity.com/course/introduction-to-python

SECOND SEMESTER

Course Title: CORE THEORY T6-MOBILE APPLICATION DEVELOPMENT
(For Students admitted from 2020 onwards)

Course Code	**: 20XXXX**	**Credits**	**: 04**
L:T:P:S	**: 3:1:0:0**	**CIA Marks**	**: 40**
Exam Hours	**: 03**	**ESE Marks**	**: 60**

Course Objectives:

- *To introduce Android platform and its architecture.*
- *To learn activity creation and Android UI designing.*
- *To be familiarized with Intent, Broadcast receivers and Internet services.*
- *To work with SQLite Database and content providers.*

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

CO1	Define Android applications, download and install Android Studio, work in development environment and to execute the First Android Application.
CO2	Illustrate the use of activities, fragments and intents in Android to invoke Built-in Applications and use of notification in Android.
CO3	Design and implement the user interfaces using basic widgets, views, view groups and layouts of Android.
CO4	Work with user interface to handle pictures and menus and explain data storage options using the internal and external storage using Shared Preferences, files, SQLite database and Content Providers.
CO5	Illustrate the formation of SMS and E-mail in the mobile phones and demonstrate the Location Based Services (LBS) and consumption of Web Services in Android using JSON and Sockets.
CO6	Developing Android Services by establishing communication between a service and an activity and illustrating the steps for publishing Android applications.

Mapping of Course Outcomes to Program Specific Outcomes:

	PSO1	**PSO2**	**PSO3**	**PSO4**
CO1	2	3	3	2
CO2	3	2	2	3
CO3	3	3	2	2
CO4	3	3	2	3
CO5	3	3	3	2
CO6	3	3	2	2

3-Strong 2-Medium 1-Low

Sl No.	**Contents of Module**	**Hrs**	**COs**
1	Introduction to Android – Features of Android-Architecture of Android-Obtaining the Required Tools- Creating First Android Application - Anatomy of Android Application-Components of Android Application-Lifecycle of Activity. **Intents**: Creating Intents, Types of Intents, Intents returning result, Intent Filters, Calling Built–In Application Using Intents and Displaying Notifications using PendingIntent. **Fragments**: Lifecycle of Fragment, Types of Fragments and how to create and use fragments.	**12**	**CO1,CO2**
2	**Screen Layouts:** Linear, Table, Relative, Absolute and Grid. **Basic Views:** Toast**,** TextView**,** EditText, Button, AutoCompleteTextView, CheckBox, ToggleButton,	**12**	**CO3**

	ImageButton, RadioButton, SeekBar, ListView, ImageView, DatePicker and TimePicker- Adapting to Display Orientation - Creating the views programmatically.		
3	**Menus**: OptionsMenu, ContextMenu and PopupMenu. **Data Persistence:** Saving and Loading using Shared Preferences - Persisting Data to Files - **SQLite Database**: Create, Insert, Delete, Update and Select queries. **Content Provider:** Creating and using Content Provider.	**12**	**CO4**
4	Sending SMS - Sending E-Mail- **Location – Based Services:** Displaying Maps - Getting Location Data**. Networking:** Consuming Web Services Using HTTP - Consuming JSON Services - Sockets Programming.	**12**	**CO5**
5	**Developing Android Services:** Lifecycle of Service, Types of service and Creating own services. **Threading**: Worker thread and Async thread. **Publishing Android Applications:** Preparing for Publishing - Deploying APK Files.	**12**	**CO6**

Text Book:

1. J.F. DiMarzio, "**Beginning Android Programming with Android Studio**", 4th Edition, Wiley Publications, 2017.

Reference Books:

1. Wei Meng Lee, **"Beginning Android 4 Application Development"**, Wiley Publications, 2013.
2. Anubhav Pradhan, Anil V Deshpande, 'Mobile Applications Development', First Edition.
3. Barry Burd 'Android Applications Development all in one for Dummies",First Edition.
4. "Teach Your self Android Application Development in 24 hours" First Edition, SAMS.
5. Rick Boyer, **"Android 9 Development Cookbook"**, 3rd Edition, Packt Publishing, 2018.
6. Reto Meier and Ian Lake, **"Professional Android",** 4th Edition, Wiley Publishers.

E-References:

1. http://developer.android.com/
2. https://www.tutorialspoint.com/android/index.htm
3. https://abhiandroid.com/

SECOND SEMESTER

Course Title: CORE THEOERY T7-FUNDAMENTALS OF MACHINE LEARNING
(For Students admitted from 2020 onwards)

Course Code	**: 20XXXX**	**Credits**	**: 04**
L:T:P:S	**: 4:0:0:0**	**CIA Marks**	**: 40**
Exam Hours	**: 03**	**ESE Marks**	**: 60**

Course Objectives:

- *To introduce students to the basic concepts and techniques of Machine Learning.*
- *To have a thorough understanding of the Supervised and Unsupervised learning techniques*
- *To study the various probability based learning techniques*
- *To understand graphical models of machine learning algorithms*

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

CO1	The learners shall understand the machine learning techniques like Clustering, Induction. Bayesian, Decision Tree, Analytical and Instance based learning and to apply the techniques in computing.
CO2	The learners shall be able to compare the various machine learning techniques and design issues in machine learning.
CO3	Introduce students to state-of-the-art methods and modern programming tools for data analysis.

Mapping of Course Outcomes to Program Specific Outcomes:

	PSO1	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	2	2
CO2	3	3	3	3
CO3	2	3	3	3

3-Strong 2-Medium 1-Low

Sl No.	**Contents of Module**	**Hrs**	**COs**
1	**INTRODUCTION:** Designing a learning system - Perspectives and Issues in machine learning - Concept learning task - Concept learning as search - Version spaces - Candidate Elimination learning algorithm - Inductive Bias.	**12**	**CO1**
2	**DECISION TREE LEARNING:** Decision Tree representation - Appropriate Problems for Decision Tree Learning - Basic Decision tree learning algorithm - Hypothesis space search and Inductive Bias in Decision tree learning - Issues in Decision Tree Learning. **ANN**: Perceptrons - Back propagation Algorithms.	**12**	**CO1**
3	**BAYESIAN LEARNING:** Bayes Theorem and Concept learning - Maximum Likelihood and Least Squared error hypothesis - Maximum Likelihood hypotheses for predicting probabilities - Minimum description Length principle - Bayes optimal classifier - Gibbs algorithm - Naïve Bayes classifier - Bayesian Belief networks -EM algorithm.	**12**	**CO1,CO2**
4	**ANALYTICAL AND COMBINING ANALYTICAL AND INDUCTIVE LEARNING:** Analytical learning - Explanation based learning - Inductive Analytical approaches to learning - Using prior knowledge to initialize the hypothesis, to alter the search objective and to augment search operators.	**12**	**CO3**
5	**INSTANCE-BASED LEARNING AND REINFORCEMENT LEARNING:** K - nearest neighbor learning -Locally weighted regression - Radial Basis functions - Case based reasoning - Reinforcement learning: Learning task-Q Learning:Q function - Algorithm for learning Q-convergence - Updating sequence - Temporal difference learning.	**12**	**CO3**

Text Book:

1. Tom M Mitchell, "Machine Learning", McGraw Hill, 1st Edition, 2003.

Reference Books:

1. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, 2nd Edition, 2010.
2. Stephan Marsland, "Machine Learning - An Algorithmic Perspective", Chapman and Hall, 1st Edition, 2009.
3. Nils Nilsson, "Introduction to Machine Learning", MIT Press, 1997.
4. Jude Shavil, Thomas G Dietterich, "Readings in Machine Learning", Morgan Kaufmann Publishers, 1990.8. Peter Harrington, “Machine Learning in Action”, DreamTech

E-References:

1. https://nptel.ac.in/courses/106/105/106105152/
2. http://www.cs.cmu.edu/~tom/mlbook.html

SECOND SEMESTER

Course Title: CORE THEORY T8-MOBILE COMMUNICATIONS
(For Students admitted from 2020 onwards)

Course Code	**: 20XXXX**	**Credits**	**: 04**
L:T:P:S	**: 4:0:0:0**	**CIA Marks**	**: 40**
Exam Hours	**: 03**	**ESE Marks**	**: 60**

Course Objectives:

- *Understand the basic concepts of mobile computing*
- *Understand Wireless LAN, Bluetooth and WiFi Technologies*
- *Be familiar with the network protocol stack*
- *Learn the basics of mobile telecommunication system*
- *Be exposed to Ad-Hoc networks*

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

CO1	Explain the basics of mobile telecommunication system
CO2	Illustrate the generations of telecommunication systems in wireless network
CO3	Understand the architecture of Wireless LAN technologies
CO4	Determine the functionality of network layer and Identify a routing protocol for a given Ad hoc networks
CO5	Explain the functionality of Transport and Application layer

Mapping of Course Outcomes to Program Specific Outcomes:

	PSO1	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	3	3
CO2	2	3	3	2
CO3	2	2	2	3
CO4	3	2	2	3
CO5	2	3	2	2

3-Strong 2-Medium 1-Low

Sl No.	**Contents of Module**	**Hrs**	**COs**
1	**Introduction:** Introduction to Mobile Computing – Applications of Mobile Computing- Generations of Mobile Communication Technologies-MAC Protocols – SDMA-TDMA-FDMA-CDMA.	**12**	**CO1**
2	**Mobile Telecommunication System:** GSM – Architecture – Protocols – Connection Establishment – Frequency Allocation – Routing – Mobility Management – Security – GPRS- UMTS- Architecture.	**12**	**CO2**
3	**Wireless Networks:** Wireless LANs and PANs – IEEE 802.11 Standard – Architecture – Services – Blue Tooth- Wi-Fi – WiMAX.	**12**	**CO3**
4	**Mobile Network Layer:** Mobile IP – DHCP – AdHoc– Proactive and Reactive Routing Protocols – Multicast Routing- Vehicular Ad Hoc networks (VANET) –MANET Vs VANET – Security.	**12**	**CO4**
5	**Mobile Transport and Application Layer:** Mobile TCP– WAP – Architecture – WDP – WTLS – WTP –WSP – WAE – WTA Architecture – WML.	**12**	**CO5**

Text Books:

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

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‖, Second Edition,Tata Mc Graw Hill Edition ,2006.
4. C.K.Toh, —AdHoc Mobile Wireless Networks‖, First Edition, Pearson Education, 2002.

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

SECOND SEMESTER

Course Title: CORE THEORY ELECTIVE 1-PRINCIPLES OF DIGITAL IMAGE PROCESSING
(For Students admitted from 2020 onwards)

Course Code	**: 20XXXX**	**Credits**	**: 04**
L:T:P:S	**: 4:0:0:0**	**CIA Marks**	**: 40**
Exam Hours	**: 03**	**ESE Marks**	**: 60**

Course Objectives:

- *To provide the basic knowledge on image processing techniques like image acquisition, enhancement, transform, segmentation, object recognition in images and their applications.*
- *To impart the mathematical logic behind the various image processing algorithms*
- *To facilitate the students apprehend and implement various image processing algorithms.*
- *To impart the performance of the algorithms with real time applications*.

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

CO1	Understand and analyse the problems in the formation of various types of images
CO2	Analyze the need for image transforms, different types of image transforms and their properties
CO3	Analyze different techniques employed for the enhancement of images using filters
CO4	Implement different segmentation technique.
CO5	Analyzing and extracting suitable features for classification of objects.
CO6	Familiar with the use of Python and OpenCV for Image Analysis

Mapping of Course Outcomes to Program Specific Outcomes:

	PSO1	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	2	1
CO2	3	3	3	2
CO3	3	3	3	2
CO4	3	3	3	3
CO5	3	3	3	3
CO6	3	3	3	3

3-Strong 2-Medium 1-Low

Sl No.	**Contents of Module**	**Hrs**	**COs**
1	**Introduction** – Steps in Digital Image Processing, Components of an Image Processing System – Image sensing and acquisition, Image Sampling and Quantization: Basic Concepts, Representing Digital Images, Basic Relationships between pixels. – color models – basics of color image processing	**12**	**CO1**
2	**Intensity Transformations and Spatial Filtering:** Some basic gray level transformation functions – Histogram Processing – Fundamentals of Spatial Filtering – Smoothing Spatial Filters.	**12**	**CO2**
3	**Filtering in the Frequency Domain** – The Discrete Fourier Transform of One Variable, Extensions to Functions of Two Variables, The Basics of Filtering in the Frequency Domain, Image Smoothing Using Low-pass Frequency Domain, Image Sharpening Using High-pass Filters.	**12**	**CO3**
4	**Image Segmentation**: Fundamentals – Point, Line and Edge Detection- Thresholding , Segmentation by Region Growing and by Region Splitting and Merging. **Feature Extraction**: Boundary Pre-processing – Boundary Features Descriptors – Region Features Descriptors – Principal Components as Feature Descriptors.	**12**	**CO4**

5	**Image Pattern Classification:** Patterns and Pattern Classes, Pattern Classification by Prototype Matching: Minimum Distance Classifier, Correlation For 2-D Prototype Matching. **Case Study**: Performing image pre-processing using enhancement methods, Implementing Segmentation techniques and Classifying objects using Python, ML libraries and predefined models.	**12**	**CO5,CO6**

Text Book:

1. Rafael.C. Gonzalez, Richard.E.Woods, "**Digital Image processing**", Fourth Edition, Pearson Education Limited, 2018.

Reference Books:

1. A.K. Jain, "Fundamentals of Digital Image Processing", PHI, 2011
2. Mark Nixon, Alberto Aguado, "Feature Extraction and Image Processing", Second Edition, Elsevier, 2008.
3. S. Jayaraman, S. Esakkirajan, T. Veerakumar, "Digital Image Processing", Mc-Graw Hill, 2012 .
4. Himanshu Singh, "Practical Machine Learning and Image Processing: For Facial Recognition, Object Detection, and Pattern Recognition Using Python", Apress, 2019

E-References:

1. http://www.nptel.iitm.ac.in/video.php?subjectId=117105079
2. https://docs.opencv.org/
3. https://opencv-python-tutroals.readthedocs.io/en/latest/py_tutorials/py_tutorials.html
4. https://scikit-image.org/
5. https://github.com/Gogul09/image-classification-python

SECOND SEMESTER

Course Title: CORE THEORY ELECTIVE 1-INTRODUCTION TO MULTIMEDIA
(For Students admitted from 2020 onwards)

Course Code	**: 20XXXX**	**Credits**	**: 04**
L:T:P:S	**: 4:0:0:0**	**CIA Marks**	**: 40**
Exam Hours	**: 03**	**ESE Marks**	**: 60**

Course Objectives:

- *This course aims to introduce the fundamental elements of multimedia.*
- *It will provide an understanding of the fundamental elements in multimedia.*
- *The emphasis will be on learning the representations, perceptions and applications of multimedia.*
- *Software skills and hands on work on digital media will also be emphasized.*
- *On completion of the subject, the students will understand the technologies behind multimedia applications and master the skills for developing multimedia projects.*

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

CO1	Describe the types of media and define multimedia system.
CO2	Describe the process of digitizing (quantization) of different analog signals (text, graphics, sound and video).
CO3	Use and apply tools for image processing, video, sound and animation.
CO4	Apply methodology to develop a multimedia system.
CO5	Apply acquired knowledge in the field of multimedia in practice and independently continue to expand knowledge

Mapping of Course Outcomes to Program Specific Outcomes:

	PSO1	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	3	3
CO2	2	3	3	2
CO3	3	2	3	3
CO4	2	2	2	2
CO5	2	2	2	3

3-Strong 2-Medium 1-Low

Sl No.	**Contents of Module**	**Hrs**	**COs**
1	**Introduction to Multimedia:** What is multimedia, Components of multimedia, Web and Internet multimedia applications, Transition from conventional media to digital media. Computer Fonts and Hypertext. Usage of text in Multimedia, Families and faces of fonts, outline fonts, bitmap fonts International character sets and hypertext, Digital fonts techniques.	**12**	**CO1**
2	**Audio Fundamentals and Representations :**Digitization of sound, frequency and bandwidth, decibel system, data rate, audio file format, Sound synthesis, MIDI, wavetable, Compression and transmission of audio on Internet, Adding sound to your multimedia project, Audio software and hardware.	**12**	**CO2**
3	**Image Fundamentals and Representations:** Colour Science , Colour, Colour Models, Colour palettes, Dithering, 2D Graphics, Image Compression and File Formats :GIF, JPEG, JPEG 2000, PNG, TIFF, EXIF, PS, PDF, Basic Image Processing [Can Use Photoshop], Use of image editing software, White balance correction, Dynamic range correction, Gamma correction, Photo Retouching.	**12**	**CO3**

4	**Video and Animation:** Video Basics , How Video Works, Broadcast Video Standards, Analog video, Digital video, Video Recording and Tape formats, Shooting and Editing Video (Use Adobe Premier for editing), Video Compression and File Formats. Video compression based on motion compensation, MPEG-1, MPEG-2, MPEG-4, MPEG-7, MPEG-21, Animation: Cell Animation, Computer Animation, Morphing**.**	**12**	**CO4**
5	**Multimedia Authoring:** Multimedia Authoring Basics, Some Authoring Tools, Macromedia Director & Flash.	**12**	**CO5**

Text Books:

1. Tay Vaughan, "Multimedia making it work", Tata McGraw-Hill, 2008.
2. Rajneesh Aggarwal & B. B Tiwari, " Multimedia Systems", Excel Publication, New Delhi, 2007.

Reference Books:

1. Li & Drew, " Fundamentals of Multimedia" , Pearson Education, 2009.
2. Fred Halsall ,"Multimedia Communications: Applications, Networks, Protocols and Standards", Addison Wesley, 2000
3. Parekh Ranjan, "Principles of Multimedia", Tata McGraw-Hill, 2007
4. Anirban Mukhopadhyay and Arup Chattopadhyay, "Introduction to Computer Graphics and Multimedia", Second Edition, Vikas Publishing House.

E-References:

1. Anatomy of a Sound Board. PC Magazine Online Located at: http://www.zdnet.com/cshopper/features/9510/feature2/sub3.html
2. Berinato, S. (1997). Streaming video enters spotlight. PC Week Online. [On-line]. Available: http://www8.zdnet.com/pcweek/news/0728/28video.html
3. CyberTech Information Group. (1997). Streaming video. [On-line]. Available: http://www.web-ads.com/cbertech/vivofree.html

SECOND SEMESTER

Course Title: CORE THEORY ELECTIVE 1-COMPUTER ANIMATION
(For Students admitted from 2020 onwards)

Course Code : 20XXXX		**Credits**	**: 04**
L:T:P:S	**: 4:0:0:0**	**CIA Marks**	**: 40**
Exam Hours	**: 03**	**ESE Marks**	**: 60**

Course Objectives:

- -*Recognize, locate, and navigate through all aspects of the new user interface.*
- *Create, manipulate, and edit text and graphics to obtain desired graphical outcomes.*
- *Understand, create, and edit symbols, filters and instances in 3Dspaces.*
- *Design, create, edit, and manipulate animation using several animation tools and techniques.*
- *Utilize tweens and articulated motions with inverse kinematics to morph shapes.*
- *Design, create, and edit a flash-based navigation menus and interactive movies.*
- *Utilize and understand sound and sound formats in flash movies and components to create interactivity.*

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

CO1	**P**rovides an overview of the evolution of animation, and how animation came into existence.
CO2	The process of animation techniques developed with various equipments and how the process was performed**.**
CO3	The animation techniques such as cell animation, classic characters, cut out animation, stop motion effects, puppet stop motion, pixilation, optical printing, vector / key framed animation, sand animation, silhouette animation, pin-screen animation, Chinese shadow puppetry and rot scope techniques are illustrated which would be helpful for creating clear and good animation.
CO4	The information about how animation was developed in India, It also deals with the growth of Indian animation companies and studios, it discusses the emerging trends in Indian animation industry and outsourcing demands. It helps them to understand how great animators helped to improvise animation to Indian directors.
CO5	Develop proficiency in creating solutions for web applications

Mapping of Course Outcomes to Program Specific Outcomes:

	PSO1	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	3	2
CO2	3	3	3	2
CO3	3	3	3	3
CO4	3	3	3	3
CO5	3	3	3	3

3-Strong 2-Medium 1-Low

Sl No.	**Contents of Module**	**Hrs**	**COs**
1	Creating Your First Flash Animation – how to create a new blank movie file in Flash MX – and the tools and steps involved in making your first simple animation using motion twining – basic shapes – Flash Animation 2 - Shape Twining – pick up at the end of where we left off – Shape twining in Flash MX.	**12**	**CO1**
2	Flash Lesson 8 -Adding Simple Audio – add a looping audio background to our Flash character animation to complete it – Lip-Synching For Animation: Basic Phonemes – add actual expression and realistic mouth-movements to your animation – it helps	**12**	**CO2**

	to study how the shape of the mouth changes with each sound – these ten basic phonemes shapes can match almost any sound of speech – in varying degrees of expression.		
3	Flash Animation – Fireworks E-card – using Flash's drawing tools to set a scene for an animation – creating the scene for a Fourth of July exploding fireworks E-card – a future lesson will demonstrate how to animate it – Flash Animation - Animating E-card – set the stage for our E-card – use a new kind of symbol called a MovieClip.	**12**	**CO3**
4	Flash Tip – Tools of the Trade – Drawing in Flash With a Graphics Tablet – frame-by-frame vector animation with this high-tech – but inexpensive – plug and play tool – Animation Tip – Tools of the Trade – Light Tables – 2D animation for cell painting – computer animation – a light table.	**12**	**CO4**
5	Animating the limbs – add speech bubbles – about adding actual audio tracks later – to learn about working with text in Flash – and to give our characters a ‑voice‖ to communicate with the viewer – so to animate our facial features and give them expression and lip movements.	**12**	**CO5**

Text Books:

1. Adam Watkins, "Maya A Professional Guide", Dreamtech,First edition– 2003.
2. Joey Lott and Robert Reinhardt, "Flash 8 Action Script Bible",Wiley India (P)Ltd.2006.

Reference Books:

1. Tom Meade and Shinsaka Anima,"The Complete Reference Maya6", TataMC.Graw–Hill Publishing Company Limited edition2004.
2. Robert Rein hardt and SnowDowd,"Macromedia Flash 8 Bible", Wiley India Pvt Ltd.2006.

E-References:

1. https://www.tutorialspoint.com/computer_graphics/computer_animation.htm
2. https://www.geeksforgeeks.org/computer-animation

SECOND SEMESTER

Course Title: CORE PRACTICAL P3-PYTHON FOR DATA SCIENCE LAB
(For Students admitted from 2020 onwards)

Course Code	**: 20XXXX**	**Credits**	**: 02**
L:T:P:S	**: 0:0:5:0**	**CIA Marks**	**: 40**
Exam Hours	**: 03**	**ESE Marks**	**: 60**

Course Objectives:

- *Master the fundamentals of writing Python scripts*
- *Learn core Python scripting elements such as variables and flow control structures*
- *Discover how to work with lists and sequence data*
- *Write Python functions to facilitate code reuse*
- *Use Python to read and write files*
- *Make their code robust by handling errors and exceptions properly*
- *Work with the Python standard library*
- *Explore Python's object-oriented features*

Lab Exercises:

1. Multilevel Inheritance
2. Exception Handling
3. File Operations
4. List Operations
5. String Operations
6. Python with SQLiteDB
7. Module in Python
8. Plotting two graphs using matplotlib and subplot
9. Plotting bar chart graph using matplotlib
10. Plotting pie chart graph using matplotlib

SECOND SEMESTER

Course Title: CORE PRACTICAL P4-MOBILE APPLICATION DEVELOPMENT LAB
(For Students admitted from 2020 onwards)

Course Code	**: 20XXXX**	**Credits**	**: 02**
L:T:P:S	**: 0:0:5:0**	**CIA Marks**	**: 40**
Exam Hours	**: 03**	**ESE Marks**	**: 60**

Course Objectives:

- *Describe the platforms upon which the Android OS will run.*
- *Create simple applications that runs under Android OS*
- *Access and work with the Android file system*
- *Define and access with databases under Android OS*

Lab Exercises:

1. Activity Lifecycle
2. Fragments
3. Notifications
4. Screen Orientation
5. Implicit and Explicit Intents
6. Intents returning results
7. Working with Basic Widgets-Button, Textview, Edittext, Togglebutton, Radiobutton, Radiogroup, Autocompletetextview, Checkbox, Seekbar, Listview, Pickerviews.
8. Storing data permanently using Shared preferences, Files and SQLite
9. Sending SMS
10. Location Based Services
11. JSON Services
12. Socket Programming
13. Illustration of menus-Option menu, Context menu, Popup menu
14. Android Services
15. Android Threading

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

THIRD SEMESTER

Course Title: CORE THEORY T9-INTRODUCTION TO BIG DATA ANALYTICS
(For Students admitted from 2020 onwards)

Course Code	**: 20XXXX**	**Credits**	**: 04**
L:T:P:S	**: 3:1:0:0**	**CIA Marks**	**: 40**
Exam Hours	**: 03**	**ESE Marks**	**: 60**

Course Objectives:

- *To explore the fundamental concepts of big data analytics*
- *To learn to analyze the big data using intelligent techniques.*
- *To understand the various search methods and visualization techniques.*
- *To learn to use various techniques for mining data stream.*
- *To understand the applications using MapReduce Concepts*

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

CO1	Knows the reason about the evolution of data science and its development. Study the basic of big data analytics and to develop the code. Importance of various kinds of data comparing the other language.
CO2	Develop HDFS environment using NOSQL implementing the queries. Aggregate the data using NOSQL.
CO3	Concept of basic Hadoop, data format and analyzing the data in the HDFS environment. Implementing the concept Hadoop pipes and implementations and java interfaces. Significance of various methods of compression, serialization.
CO4	Apply Mapreduce applications, unit test , MRUnit, Create file using MapReduce sorting and shuffling process. Creating input and output format of Mapreduce.
CO5	Usage of Hadoop related tools. Definition of hbase, Hbase clients, Cassandra, Pig, HiveQL. Life Build data manipulation byHiveQL queries.
CO6	Analyze Life Build data manipulation by HiveQL queries.

Mapping of Course Outcomes to Program Specific Outcomes:

	PSO1	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	3	3
CO2	3	3	3	2
CO3	3	3	3	3
CO4	3	3	3	2
CO5	3	3	3	3
CO6	3	3	3	3

3-Strong 2-Medium 1-Low

Sl No.	**Contents of Module**	**Hrs**	**COs**
1	Understanding big data: What is Big Data – Why Big Data – Convergence of key trends – unstructured data – industry examples of Big Data – Web analytics – Big Data and marketing – Fraud and Big Data – Risk and Big Data – Credit Risk Management – Big Data and algorithmic trading – Big Data and healthcare – Big Data in Medicine.	**12**	**CO1**
2	NoSQL data management: Introduction to NoSQL – Aggregate Data Models – Aggregates – Key- Value And Document Data Models – Relationships – Graph Databases – Schemaless Databases – Materialized Views – Distribution Models –	**12**	**CO2**

	Sharding – Master-Slave Replication – Peer-Peer Replication - Sharding And Replication – Consistency – Relaxing Consistency – Version Stamps – MapReduce – Partitioning and Combining – Composing MapReduce Calculations.		
3	Basics of Hadoop Data format – Analyzing data with Hadoop – Scaling out – Hadoop streaming- Hadoop pipes – Design of Hadoop distributed file system (HDFS) – HDFS concepts – Java interface - data flow – Hadoop I/O – Data Integrity – Compression – Serialization – Avro – File-Based Data Structures.	**12**	**CO3**
4	MapReduce applications MapReduce workflows – Unit tests with MRUnit – test data and local tests – anatomy of MapReduce job run – classic Map-reduce – YARN – failures in classic Map- reduce and YARN – job scheduling – shuffle and sort – task execution – MapReduce types – Input Formats – Output Formats.	**12**	**CO4**
5	Hadoop related tools Hbase – Data model and implementations – Hbase clients – Hbase examples – praxis. Cassandra – cassandra data model – cassandra examples – cassandra clients – Hadoop integration. Pig – Grunt – Pig data model – Pig Latin – developing and testing Pig Latin scripts. Hive – Data types and file formats – HiveQL data definition – HiveQL data manipulation –HiveQL queries.	**12**	**CO5,CO6**

Text Books:

1. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
2. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging Worl dof Polyglot Persistence", Addison-Wesley Professional,2012.
3. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley,2012.
4. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.
5. AlanGates,"ProgrammigPig",O'Reilley,2011. Hadoop in Practice by Alex Holmes, MANNING Publ
6. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley,2012.

Reference Books:

1. Lars George, "HBase: The Definitive Guide", O'Reilley,2011.
2. Eben Hewitt, "Cassandra: The Definitive Guide", O'Reilley,2010.
3. HadoopMapReduceCookbook‖,SrinathPerera,Thilina Gunarathne Software

E-References:

1. Hadoop:http://hadoop.apache.org/
2. Hive: https://cwiki.apache.org/confluence/display/Hive/Home Piglatin:
3. http://pig.apache.org/docs/r0.7.0/tutorial.html

THIRD SEMESTER

Course Title: CORE THEORY T10-DOT NET PROGRAMMING
(For Students admitted from 2020 onwards)

Course Code	**: 20XXXX**	**Credits**	**: 04**
L:T:P:S	**: 3:1:0:0**	**CIA Marks**	**: 40**
Exam Hours	**: 03**	**ESE Marks**	**: 60**

Course Objectives:

- *To understand .NET Platform and its core functionalities.*
- *To develop windows and web applications with Microsoft SQL and Visual Studio.*
- *To understand and develop user defined Applications using MVC framework.*
- *To strengthen Object Oriented Programming using advance VB.NET concepts*

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

CO1	Explore Microsoft .NET Integrated Development Environment (IDE)
CO2	Understand the basic concepts of VB.NET framework.
CO3	Developing programs using VB .NET.
CO4	Illustrate and implement the concepts of Class and objects, Inheritance, Overloading, Exceptions and File Handling in VB.NET
CO5	Building ASP.NET Programming through Web Server Controls, Validation Controls and DataList Web Server Controls.
CO6	Apply ADO.NET and OLEDB concepts for establishing connectivity among applications with reduced code complexity and develop network applications

Mapping of Course Outcomes to Program Specific Outcomes:

	PSO1	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	2	3
CO2	3	3	1	2
CO3	3	3	1	2
CO4	3	2	1	3
CO5	3	2	2	2
CO6	3	3	3	2

3-Strong 2-Medium 1-Low

Sl No.	**Contents of Module**	**Hrs**	**COs**
1	**Introducing Microsoft .NET**:- Microsoft .NET platform: .NET Enterprise Servers, .NET framework and .NET Building block Services - .NET Namespaces. Common Type System(CTS), Common Language Specification(CLS) and CLR Execution (Class loader, verifier, JIT compilers).	**12**	**CO1**
2	**VB.Net Basics**: VB Dot Net Framework Basics - Visual Studio Environment – Data Types , Variables, constants ,Operators and Expressions – Decisions and Conditions - Loops - Sub Procedures and Functions – Built-in functions - Arrays - Structures- Enumerators – Delegates and Events.	**12**	**CO2,CO3**
3	**VB.Net Advanced**: Windows Forms and Basic Controls - Timer control - Graphics and Animation: The Graphics Environment – Simple Animation – Scroll Bar Controls - Menus and Status Bars- Multi Form applications - Class and Objects - Inheritance - Exception Handling.	**12**	**CO3,CO4**

4	**ASP.NET Basics**: ASP.NET Language Structure - Page Structure - Page event, Properties & Compiler Directives. **Basic Web Server Controls**: TextBox, Label, Button, CheckBox, RadioButton and LinkButton. **Validation Controls**: RequiredValidator, CompareValidator and RegularExpressionValidator. **DataListWebserver Controls**: ListBox, CheckboxList, RadioButtonList, DropDownList and Data Grid control.	**12**	**CO5**
5	**Working with Data**: Benefits of ADO.NET, ADO.NET Architecture, Main classes in ADO.NET, Developing a Windows/Web application using database. OLEDB Connection class, Command class, Transaction class, DataAdaptor class, DataSet class. **ASP.NET Advanced:** MVC Pattern, Life Cycle, Controllers, Actions, Views, Data Model. Model Binding, using Databases. Request and Response Objects, Cookies.	**12**	**CO6**

Text Books:

1. Jeff Prosise, Programming Microsoft .NET - Microsoft Press, 1st Edition, 2009.
2. Visual Basic.Net Black Book by Steven HolznerDreamtech Press
3. The Complete Reference Visual Basic .NET Jeffery R. Shapiro Tata McGraw Hills
4. Thuan Thai, .NET Framework, O'Reily publications, 3rd edition, 2009

Reference Books:

1. David S Platt, Introducing Microsoft .NET ,Microsoft press, 3rd Edition, 2003
2. Murach's Beginning Visual basic .Net By Anne Bohem
3. Freeman, Adam, Pro ASP.NET MVC, aprèss, 2013
4. Paul Yao, David Durant, Programming .NET Compact Framework 3.5, PearsonEducation, 2nd Edition, 2010.

E-References:

1. http://www.nptelvideos.com/visualbasic_net/visualbasicnet_video_tutorials.php
2. http://www.nptelvideos.com/video.php?id=1775&c=21
3. https://freevideolectures.com/course/3002/dot-net-tutorial/1
4. http://www.philadelphia.edu.jo/academics/qhamarsheh/uploads/Lecture_14_Introduction_to_ASP.pdf
5. http://sigc.edu/department/computerscience/studymet/AdvancedASP.NET.pdf

THIRD SEMESTER

Course Title: CORE THEORY T11-PRINCIPLES OF CLOUD COMPUTING
(For Students admitted from 2020 onwards)

Course Code	**: 20XXXX**	**Credits**	**: 04**
L:T:P:S	**: 4:0:0:0**	**CIA Marks**	**: 40**
Exam Hours	**: 03**	**ESE Marks**	**: 60**

Course Objectives:

- *To introduce the broad perceptive of cloud architecture and model*
- *To understand the concept of virtualization and design of cloud Services*
- *To be familiar with the lead players in cloud.*
- *To study the various security issues in cloud computing.*

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

CO1	Analyze the core concepts of the cloud computing paradigm: Evolution, characteristics, advantages and challenges brought about by the various models and services in cloud computing.
CO2	Develop the ability to understand and use the architecture of compute and storage cloud, service and delivery models.
CO3	Apply fundamental concepts in cloud infrastructures to understand the tradeoffs in power, efficiency and cost.
CO4	Analyse and develop multimedia cloud application.
CO5	Implementation of cloud platform using python

Mapping of Course Outcomes to Program Specific Outcomes:

	PSO1	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	2	2
CO2	3	3	3	2
CO3	3	3	3	2
CO4	3	3	3	3
CO5	3	3	3	3

3-Strong 2-Medium 1-Low

Sl No.	**Contents of Module**	**Hrs**	**COs**
1	Introduction to Cloud Computing – Definition of Cloud – Characteristics of Cloud Computing – Cloud Models – Cloud Service Examples – Cloud Based Services and applications- Cloud Concepts and Technologies.	**12**	CO1
2	**Cloud Services and Platforms**: Compute Services – Storage Services – Database Services – Application Services – Content Delivery Services – Analytic Services – Deployment and Management Services – Identity and Access Management Services – Open Source Private Cloud Software. **Developing for Cloud**: Cloud Application Design – Reference Architectures for Cloud Applications – Cloud Application Design Methodologies – Data Storage Approaches.	**12**	CO2
3	**Python for Cloud**: Python for Amazon Web Services – Python for Google Cloud Platform – Python for Windows Azure – Python for MapReduce – Python Packages of Interest – Python Web Application Framework Django.	**12**	CO3

4	**Cloud Application Benchmarking and Tuning**: Introduction – Workload Characteristics – Application Performance Metrics – Design Consideration for Benchmarking Methodology – Benchmarking tools – Deployment Prototyping – Cloud Security.	**12**	CO4
5	**Case Studies**: Cloud for Manufacturing Industry – Cloud for Healthcare – Cloud for Education – Load Testing and Bottleneck Detection – Hadoop Benchmarking – Live Video Streaming App – Video Transcoding App.	**12**	CO5

Text Book:

1. Arshdeep Bahga and Vijay Madisetti," **Cloud Computing: A Hands on Approach**", University Press, Hyderabad, 2014.

Reference Books:

1. Barrie Sosinsky," **Cloud Computing Bible**", Wiley Publishing Inc, 2013.
2. John W.Rittinghouse and James F.Ransome, "**Cloud Computing: Implementation, Management, and Security**", CRC Press, 2010.
3. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "**Distributed and Cloud Computing, From Parallel Processing to the Internet of Things**", Morgan Kaufmann Publishers, 2012

E-References:

1. https://nptel.ac.in/courses/106/105/106105167/
2. https://www.tutorialspoint.com/cloud_computing/index.html
3. https://www.guru99.com/cloud-computing-for-beginners.html
4. https://www.youtube.com/watch?v=LICA-ILkO4w

THIRD SEMESTER

Course Title: CORE THEORY ELECTIVE 2-COMPUTER FORENSICS AND BIOINFORMATICS
(For Students admitted from 2020 onwards)

Course Code	**: 20XXXX**	**Credits**	**: 04**
L:T:P:S	**: 4:0:0:0**	**CIA Marks**	**: 40**
Exam Hours	**: 03**	**ESE Marks**	**: 60**

Course Objectives:

- *To provide an understanding Computer forensics fundamentals*
- *To analyze various computer forensics technologies*
- *To provide computer forensics systems*
- *To identify methods for data recovery.*
- *To understand Genomic data acquisition and analysis, comparative and predictive analysis in Bioinformatics field.*

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

CO1	Demonstrate competency in the collection, processing, analyses, and evaluation of evidence.
CO2	Demonstrate competency in the principles of crime scene investigation, including the recognition, collection, identification, preservation, and documentation of physical evidence. Classify and apply the acquisition tools
CO3	Identify the role of the forensic scientist and physical evidence within the criminal justice system. Identify and examine current and emerging concepts and practices within the forensic science field.
CO4	To get introduced to the basic concepts of Bioinformatics and its significance in Biological data analysis.
CO5	Describe the history, scope and importance of Bioinformatics and role of internet in Bioinformatics
CO6	Classify different types of Biological Databases. Introduction to the basics of sequence alignment and analysis

Mapping of Course Outcomes to Program Specific Outcomes:

	PSO1	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	2	3
CO2	3	3	3	3
CO3	3	3	1	3
CO4	3	2	3	3
CO5	3	2	2	3
CO6	2	1	3	3

3-Strong 2-Medium 1-Low

Sl No.	**Contents of Module**	**Hrs**	**COs**
1	Understanding of Computer Forensics: Computer Forensics vs other related disciplines – A brief history of Computer Forensics – Understanding Case law – Developing Computer Forensics resources-Preparing for Computer Investigation.	**12**	**CO1**
2	Data Acquisition: Understanding Storage Formats for Digital Evidence – Determining the Best Acquisition Model – Contigency Planning for Image Acquisitions – Using Acquisition Tools – Validating Data Acquisition.	**12**	**CO2**
3	Processing Crime and Incident Scenes: Identifying Digital Evidence – Collecting Evidence in Private Sector Incident Scenes – Seizing Digital Evidence at the Scene – Storing Digital Evidence.	**12**	**CO3**

4	Introduction to Bioinformatics – Databases and Matrices – Biological Database – Database Searching –Scoring Matrices.	**12**	**CO4,CO5**
5	Sequence Alignment – Pair wise sequence alignment – Multiple sequence alignment. Probabilistic Modes - Markov chain - Hidden Markov Models.	**12**	**CO6**

Text Books:

1. Bill Nelson,Amelia Philips and Christoper Stewart,"Guide to Computer Forensics and Investigations",Censage learning,2010.
2. Ruchi Singh and Richa Sharma,BioInformatics, University Press, Hyderabad, 2010.
3. Richard Durbin, Sean Eddy, Anders Krogh, and Graeme Mitchison, "Biological Sequence Analysis: Probabilistic Models of Proteins and Nucleic Acids", Cambridge UniversityPress,2008.

Reference Books:

1. Jay G Heiser and Warren G Kruse, "Computer Forensics: Incident Response Essentials", Addison Wesley, NewDelhi,2010.
2. RobertMSlade,"SoftwareForensics:Collecting Evidence from the scene of a DigitalCrime", Tata Mc GrawHill,NewDelhi,2011.
3. Arthur M Lesk,‖Introduction to BioInformatics‖ Oxford Universitypress,2014.
4. Bishop M.J., Rawlings C.J. (Eds.), "DNA and protein sequence analysis: A Practical Approach", IRL Press,Oxford,2010

E-References:

1. https://www.bioinformatics.org/
2. https://resources.infosecinstitute.com/category/computerforensics/introduction/

THIRD SEMESTER

Course Title: CORE THEORY ELECTIVE 2-NETWORK SECURITY
(For Students admitted from 2020 onwards)

Course Code	**: 20XXXX**	**Credits**	**: 04**
L:T:P:S	**: 4:0:0:0**	**CIA Marks**	**: 40**
Exam Hours	**: 03**	**ESE Marks**	**: 60**

Course Objectives:

- *To know about various encryption techniques.*
- *To understand the concept of Public key cryptography.*
- *To study about message authentication and hash functions*
- *To impart knowledge on Network security*

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

CO1	Classify the symmetric encryption techniques
CO2	Illustrate various Public key cryptographic techniques
CO3	Evaluate the authentication and hash algorithms.
CO4	Discuss authentication applications
CO5	Summarize the intrusion detection and its solutions to overcome the attacks.
CO6	Basic concepts of system level security

Mapping of Course Outcomes to Program Specific Outcomes:

	PSO1	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	2	1
CO2	3	3	3	2
CO3	3	2	2	1
CO4	3	3	3	3
CO5	3	3	2	3
CO6	3	3	3	3

3-Strong 2-Medium 1-Low

Sl No.	**Contents of Module**	**Hrs**	**COs**
1	Introduction: Security trends – Legal, Ethical and Professional Aspects of Security, Need for Security at Multiple levels, Security Policies – Model of network security – Security attacks, services and mechanisms – OSI security architecture – Classical encryption techniques: substitution techniques, transposition techniques, steganography- Foundations of modern cryptography: perfect security – information theory – product cryptosystem – cryptanalysis.	**12**	**CO1**
2	Symmetric key cryptography: Mathematics of symmetric key Cryptography: Algebraic structures – Modular arithmetic-Euclid‟s algorithm- Congruence and matrices – Groups, Rings, Fields- Finite fields- SYMMETRIC KEY CIPHERS: SDES – Block cipher Principles of DES – Strength of DES – Differential and linear cryptanalysis – Block cipher design principles – Block cipher mode of operation – Evaluation criteria for AES – Advanced Encryption Standard – RC4 – Key distribution.	**12**	**CO2**
3	Public key cryptography: Mathematics of asymmetric key Cryptography: Primes – Primality Testing – Factorization – Euler„s totient function, Fermat„s and Euler„s Theorem – Chinese Remainder Theorem – Exponentiation and logarithm –	**12**	**CO3**

	ASYMMETRIC KEY CIPHERS: RSA cryptosystem – Key distribution – Key management – Diffie Hellman key exchange – ElGamal cryptosystem – Elliptic curve arithmetic-Elliptic curve cryptography.		
4	Message authentication and integrity: Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC – SHA – Digital signature and authentication protocols – DSS- Entity Authentication: Biometrics, Passwords, Challenge Response protocols- Authentication applications – Kerberos, X.509.	**12**	**CO4**
5	Security practice and system security: Electronic Mail security – PGP, S/MIME – IP security – Web Security – SYSTEM SECURITY: Intruders – Malicious software – viruses – Firewalls.	**12**	**CO5,CO6**

Text Book:

1. William Stallings, -Cryptography and Network Security: Principles and Practice ", PHI 3rd Edition, 2006.

Reference Books:

1. C K Shyamala, N Harini and Dr. T R Padmanabhan " Cryptography and Network Security", Wiley IndiaPvt.Ltd
2. Behrouz A.Foruzan, "Cryptography and Network Security", Tata McGraw Hill2007.
3. Charlie Kaufman, Radia Perlman, and Mike Speciner, "Network Security: PRIVATE Communication in a PUBLIC World, Prentice Hall", ISBN0-13-046019-2

E-References:

1. https://www.tutorialspoint.com/information_security_cyber_law/network_security.htm
2. https://www.pdfdrive.com/network-security-books.html

THIRD SEMESTER

Course Title: CORE THEORY ELECTIVE 2-INFORMATION SECURITY
(For Students admitted from 2020 onwards)

Course Code	**: 20XXXX**	**Credits**	**: 04**
L:T:P:S	**: 4:0:0:0**	**CIA Marks**	**: 40**
Exam Hours	**: 03**	**ESE Marks**	**: 60**

Course Objectives:

- *To understand and apply the models of information security*
- *To study and analyze cryptographic and forensic methods*
- *Analyze and simulate the network and application security*
- *Explore the nature and logic behind security threats on the web as an ethical hacker*

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

CO1	Analyze the broad perceptive and need of information security.
CO2	Explain the various encryption techniques and illustrate the master fundamentals of secret and public cryptography.
CO3	Compute the Risk control strategies and Risk Management and compare with Hash Algorithms, Signature and network security designs.
CO4	Describe the policies of Information Security and hence identify network security designs using available secure solutions.
CO5	Illustrate the Intrusion Detection and Prevention Systems and discover the layers of application security
CO6	Identify different threats and suggest fixes in data and cyber security.

Mapping of Course Outcomes to Program Specific Outcomes:

	PSO1	**PSO2**	**PSO3**	**PSO4**
CO1	2	3	2	2
CO2	3	2	3	2
CO3	3	2	2	2
CO4	3	2	2	2
CO5	2	2	2	1
CO6	2	2	3	3

3-Strong 2-Medium 1-Low

Sl No.	**Contents of Module**	**Hrs**	**COs**
1	Information Security - Critical Characteristics of Information, NSTISSC Security Model, Components of an Information System, , Balancing Security and Access, Security SDLC.	**12**	**CO1**
2	Cryptography- Classical Cryptography, Symmetric Cryptography, Public Key (Asymmetric cryptography), Modern Cryptography. Forensics: DRM technology (including watermarking and fingerprinting), Steganography, Biometrics.	**12**	**CO2,CO3**
3	Network Security- Network Protocols, Wireless Security (WiFi, WiMAX, Bluetooth, cell phone), IDS and IPS, Network Intrusion Management.	**12**	**CO4**
4	Application Security- Software Security, Mobile Security, and Database Security.	**12**	**CO5**
5	Information Security Threats- Viruses, Worms and other malware, Email Threats,	**12**	**CO6**

	Web Threats, Identity Theft, Data Security Breaches, Ethical Hacking -Hacking Tools and Techniques.		

Text Books:

1. W. Stallings, “Cryptography and Network Security: Principles and Practice”, 6th Edition, Prentice Hall,2013.
2. Michael E Whitman and Herbert J Mattord, “Principles of Information Security”, Vikas Publishing House, New Delhi, 2003

Reference Books:

1. NeilDaswani,ChristophKern,AnitaKesavan,“Foundations of Security:What Every Programme”, APRESS,2007.
2. Michael E Whitman and Herbert J Mattord, "Principles of Information Security", Vikas Publishing House, 2003.

E-References:

1. http://williamstallings.com/Cybersecurity/
2. freecomputerbooks.com › compscspecialSecurityBooks

THIRD SEMESTER

Course Title: CORE THEORY ELECTIVE 3-INTRODUCTION TO INTERNET OF THINGS
(For Students admitted from 2020 onwards)

Course Code	**: 20XXXX**	**Credits**	**: 04**
L:T:P:S	**: 4:0:0:0**	**CIA Marks**	**: 40**
Exam Hours	**: 03**	**ESE Marks**	**: 60**

Course Objectives:

- *To understand the fundamentals of Internet of Things*
- *To learn about the basics of IOT protocols*
- *To 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 the 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 big data, cloud computing and data analytics in a typical IoT system
CO5	Determine the market perspective of IoT
CO6	Illustrate the application of IoT in Industrial Automation and identify Real World Design Constraints.

Mapping of Course Outcomes to Program Specific Outcomes:

	PSO1	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	2	2
CO2	3	3	2	2
CO3	3	3	3	3
CO4	3	3	3	3
CO5	3	2	3	3
CO6	2	1	3	3

3-Strong 2-Medium 1-Low

Sl No.	**Contents of Module**	**Hrs**	**COs**
1	Introduction - Physical Design of IoT- Logical Design of IoT- IoT Enabling Technologies - IoT Levels & Deployment Templates.	**12**	**CO1**
2	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	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 – Programming Raspberry Pi with Python.	**12**	**CO3**
4	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 -DJANGO –– Amazon Web Services for IoT – Amazon EC2 – Amazon AutoScaling – Amazon S3 – AmazonRDS – Amazon DynamoDB – Data Analytics for IoT: Apache Hadoop –MapReduce Programming Model – Hadoop	**12**	**CO4**

	MapReduce job Execution – MapReduce job for Execution Workflow.		
5	Case Studies and Real-World Applications: Realworld design constraints– Applications:Asset Management - Smart Grid - Commercial Building Automation - Smart Cities - Participatory Sensing.	**12**	**CO5,CO6**

Text Books:

1. ArshdeepBahga, Vijay Madisetti, “Internet of Things: A Hands-on Approach” , First Edition, Universities Press, 2015.
2. Jan Holler, VlasiosTsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2014.

Reference Books:

1. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), “Architecting the Internet of Things”, Springer, 2011.
2. Honbo Zhou, “The Internet of Things in the Cloud: A Middleware Perspective‖”, CRC Press, 2012.
3. Olivier Hersent, David Boswarthick, Omar Elloumi ,”The Internet of Things – Key applications and Protocols”, Wiley, 2012
4. AmmarRayes, SamereSalam,“Internet of Things – From Hype to Reality”, First Edition, Springer Publishers, 2017.
5. Raj Kamal, “Internet of Things Architecture and Design Principles”, First Edition, Mc-Graw Hill Education, 2017.
6. AgusKurniawan, “Smart Internet of Things Projects”, First Edition, Packt Publishing Ltd., 2016.

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

THIRD SEMESTER

Course Title: CORE THEORY ELECTIVE 3-BLOCK CHAIN TECHNOLOGY
(For Students admitted from 2020 onwards)

Course Code	**:20XXXX**	**Credits**	**: 04**
L:T:P:S	**: 4:0:0:0**	**CIA Marks**	**: 40**
Exam Hours	**: 03**	**ESE Marks**	**: 60**

Course Objectives:

- *Understand how blockchain systems (mainly Bitcoin and Ethereum) work.*
- *To securely interact with them.*
- *Design, build, and deploy smart contracts and distributed applications.*
- *Integrate ideas from blockchain technology into their own projects.*

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

CO1	Understand emerging abstract models for Blockchain Technology.
CO2	Identify major research challenges and technical gaps existing between theory and practice in crypto currency domain.
CO3	It provides conceptual understanding of the function of Blockchain as a method of securing distributed ledgers, how consensus on their contents is achieved, and the new applications that they enable.
CO4	Apply hyperledger Fabric and Etherum platform to implement the Block chain Application.

Mapping of Course Outcomes to Program Specific Outcomes:

	PSO1	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	3	3
CO2	3	3	3	2
CO3	3	3	3	3
CO4	3	3	3	2

3-Strong 2-Medium 1-Low

Sl No.	**Contents of Module**	**Hrs**	**COs**
1	**Introduction to Blockchain:** Blockchain-Centralized vs Decentralized systems-Layers of blockchain- Limitations of Centralized Systems - Blockchain adoption so far-Blockchain uses and Use cases-Byzantine Generals' Problem-The blockchain and Merkle Trees-Properties of Blockchain Solutions-Blockchain Transactions-Distributed Consensus Mechanisms-Blockchain applications.	**12**	**CO1**
2	**Working of BitCoin:** Bitcoin -Working with bitcoins-**The Bitcoin Blockchain**: Block Strucure, The Genesis Block-**The Bitcoin Network**: Bitcoin Transactions, Consensus and Block Mining, Block Propagation-Full Nodes vs SPVs.	**12**	**CO2**
3	**Working of Ethereum:** Design Philosophy of Ehtereum-Etherreum Blockchain-Ethereum accounts-Trie Usage-Merkle Patricia Tree -Ethereum Transaction and Message Structure-Ethereum State Transaction Function-Gas and Transaction Cost-Ethereum smart contracts-Ethereum virtual machine and code execution- **Ethereum Ecosystem:**Swarm, Whisper, DApp, Development Components.	**12**	**CO3**
4	**Hyperledger:** Introduction to Hyperledger-Blockchain for business-Advantages of Hyperledger fabric-Problems with existing blockchain technology-Hyperledger fabric architecture-Consensus in Hyperledger-Hyperledger tools-Hyperledger components.	**12**	**CO4**
5	**Blockchain-Outside of Currencies: Internet of Things**: Physical Object Layer, Device Layer, Network Layer, Management Layer and Application Layer-**Government**: Border	**12**	**CO4**

	control, Voting, ID cards-Health-**Finance**: Insurance, Post trade settlement and Financial Crime Prevention, Media.		

Text Books:

1. B. Singhal & G. Dhameja,"Beginning Blockchain: A Beginner's Guide to Building Blockchain Solutions", First Edition, Apress 2018. (Units:I,II,III)
2. Nakul Shah , "Blockchain for Business with Hyperledger Fabric: A complete guide to enterprise blockchain implementation using Hyperledger Fabric", BPB Publications, 2019 (Unit IV)
3. Bashir, Imran, "Mastering Blockchain: Deeper Insights Into Decentralization, Cryptography, Bitcoin, and Popular Blockchain Frameworks",2017. (Unit V)

Reference Books:

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction", Princeton University Press, 2016.
2. D. Mohanty, Blockchain - From Concept to Execution, (2e) BPB Publications, 2018.
3. Antonopoulos, "Mastering Bitcoin: Unlocking Digital Cryptocurrencies".
4. Satoshi Nakamoto, "Bitcoin: A Peer-to-Peer Electronic Cash System".
5. Joseph Bonneau et al, SoK: Research perspectives and challenges for Bitcoin and cryptocurrency, IEEE Symposium on security and Privacy, 2015.

E-References:

1. https://www.tutorialspoint.com/blockchain/index.htm
2. https://www.javatpoint.com/blockchain-tutorial
3. https://nptel.ac.in/courses/106/105/106105184/
4. https://onlinecourses.nptel.ac.in/noc20_cs01/preview

THIRD SEMESTER

Course Title: CORE THEORY ELECTIVE 3-GREEN COMPUTING
(For Students admitted from 2020 onwards)

Course Code	**: 20XXXX**	**Credits**	**: 04**
L:T:P:S	**: 4:0:0:0**	**CIA Marks**	**: 40**
Exam Hours	**: 03**	**ESE Marks**	**: 60**

Course Objectives:

- *To learn the fundamentals of Green Computing.*
- *To analyze the Green computing Grid Framework.*
- *To understand the issues related with Green compliance.*
- *To study and develop various case studies.*

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

CO1	Discuss Green IT with its different dimensions and Strategies
CO2	Describe Green devices and hardware along with its green software methodologies.
CO3	Analyze the various green enterprise activities, functions and their role with IT.
CO4	Describe the concepts of how to manage the green IT with necessary components.
CO5	Discuss the various laws, standards and protocols, key sustainability for regulating green IT.

Mapping of Course Outcomes to Program Specific Outcomes:

	PSO1	**PSO2**	**PSO3**	**PSO4**
CO1	2	3	2	3
CO2	3	3	3	2
CO3	3	3	3	2
CO4	2	3	3	3
CO5	2	3	3	3

3-Strong 2-Medium 1-Low

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

	government initiatives, Industry associations and standards bodies, Green building standards, Green data centers, Social movements and Greenpeace. **Green IT: An Outlook:** Introduction, Awareness to implementations, Greening by IT, Green IT: A megatrend?, A seven-step approach to creating green IT strategy, Research and Development directions.		

Text Book:

1. Harnessing Green IT Principles and Practices , San Murugesan, G.R. Gangadharan Wiley Publication, ISBN:9788126539680

Reference Books:

1. Bhuvan Unhelkar, "Green IT Strategies and Applications-Using Environmental Intelligence", CRC Press, June 2014.
2. Woody Leonhard, Katherine Murray, "Green Home computing for dummies", August 2012.
3. Alin Gales, Michael Schaefer, Mike Ebbers, "Green Data Center: steps for the Journey", Shroff/IBM rebook, 2011.
4. John Lamb, "The Greening of IT", Pearson Education, 2009..
5. Jason Harris, "Green Computing and Green IT- Best Practices on regulations and industry", Lulu.com, 2008
6. Carl Speshocky, "Empowering Green Initiatives with IT", John Wiley and Sons, 2010.
7. Wu Chun Feng, "Green computing: Large Scale energy efficiency", CRC Press

E-References:

1. http://digitalthinkerhelp.com/what-is-green-computing-advantages-disadvantages-examples/
2. https://www.tutorialspoint.com/environmental_studies/environmental_studies_towards_sustainable_future.htm

THIRD SEMESTER

Course Title: CORE PRACTICAL P5- BIG DATA ANALYTICS LAB
(For Students admitted from 2020 onwards)

Course Code	**: 20XXXX**	**Credits**	**: 02**
L:T:P:S	**: 0:0:5:0**	**CIA Marks**	**: 40**
Exam Hours	**: 03**	**ESE Marks**	**: 60**

Course Objectives:

- *Demonstrate the insight of an exciting growing field of Big Data analytics.*
- *Derive the scripts of Hadoop, NoSql, MapReduce to develop the knowledge of data science*
- *Derive the coding to manage and analyze big data like Hadoop, NoSql, MapReduce.*
- *Practice big data analytics and machine learning approaches, which include the study of modern computing big data technologies.*
- *Scaling up machine learning techniques focusing on industry applications.*
- *Exhibit the fundamental techniques and principles in achieving big data analytics with scalability and streaming capability.*
- *Validate the students to have skills that will help them to solve complex real-world problems in for decision support.*

Lab Exercises:

1. Perform setting up and Installing Hadoop in its three operating modes:

i. Standalone, Pseudo distributed, fully distributed

ii. Use web based tools to monitor your Hadoop setup.

2. Implement the following file management tasks in Hadoop:

a. Adding files and directories

b. Retrieving files

c. Deleting files Hint: A typical Hadoop workflow creates data files (such as log files) elsewhere and copies them into HDFS using one of the above command line utilities.

3. Run a basic Word Count Map Reduce program to understand Map ReduceParadigm.
4. Write a Map Reduce program that mines weather data. Weather sensors collecting data every hour at many locations across the globe gather a large volume of log data, which is a good candidate for analysis with MapReduce, since it is semi structured and record- oriented.
5. Implement Matrix Multiplication with Hadoop MapReduce
6. Install and Run Pig then write Pig Latin scripts to sort, group, join, project, and filter your data.
7. Install and Run Hive then use Hive to create, alter, and drop databases,tables, views, functions, and indexes.

THIRD SEMESTER

Course Title: CORE PRACTICAL P6- DOT NET PROGRAMMING LAB
(For Students admitted from 2020 onwards)

Course Code	**: 20XXXX**	**Credits**	**: 02**
L:T:P:S	**: 0:0:5:0**	**CIA Marks**	**: 40**
Exam Hours	**: 03**	**ESE Marks**	**: 60**

Course Objectives:

- *To develop windows and web applications in MVC .Net platform.*
- *To strengthen Object Oriented Programming using advanced concepts in VB.NET.*

Lab Exercies-VB.NET:

1. Simple Computations
2. Classes and methods
2. Constructors with parameters
3. Pass by values and pass by reference
4. Arrays
5. Structures
6. Enumerator
7. Method Overloading
8. Inheritance
9. Delegates and Events
10. Exception Handling

Lab Exercises-ASP.NET:

1. Create a windows form with the following controls Textbox, Radio button, Check box, Command Button
2. Write a program for Menu option.
3. Create a program to perform validation using validation controls.
4. Windows Application with Database Connectivity using VB.NET and ADO.NET
5. Windows Application with Database Connectivity using VB.NET and OLEDB.
6. Web Application with Database Connectivity using ASP.NET and ADO.NET
7. Developing an application to implement request, response objects and cookies

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

FOURTH SEMESTER

Course Title: CORE PROJECT T13-PROJECT WORK
(For Students admitted from 2020 onwards)

Course Code	**: 20XXXX**	**Credits**	**: 12**
L:T:P:S	**: 0:0:0:0**	**CIA Marks**	**: 40**
Exam Hours	**: 03**	**ESE Marks**	**: 60**

Course Objectives:
Students will be able to:

- *Implement the solution for the chosen problem using the concepts and the techniques learnt in the curriculum.*
- *Develop software applications*
- *Record the research results for a given problem*
- *Identify, formulate and implement computing solutions.*
- *Design and conduct experiments, analyze and interpret data.*
- *Analyze a system, component or process as per needs and specification.*
- *Work on multidisciplinary tasks and will be aware of the new and emerging disciplines.*
- *Demonstrate skills to use modern tools, software and equipments to analyze problems.*

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

CO1	Demonstrate a sound technical knowledge, skills and attitude of their selected project topic.
CO2	Understand problem identification, formulation and solution.
CO3	Design solutions to complex problems utilizing a systems approach.
CO4	Communicate with engineers and the community at large in written and oral forms.

Mapping of Course Outcomes to Program Specific Outcomes:

	PSO1	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	2	3
CO2	3	3	3	2
CO3	3	3	3	2
CO4	2	3	3	3

3-Strong 2-Medium 1-Low

Procedure:

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

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