SHIVAJI UNIVERSITY, KOLHAPUR
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शिवाजी विद्यापीठ, कोल्हापूर ४१६ ००४, महाराष्ट्र
दूरध्वनी - इपीबीएक्स - २०६०९०००, अभ्यासमंडळे विभाग : ०२३१- २६०९०९४, २६०९४८७
वेबसाईट : www.unishivaji.ac.in ईमेल : bos@unishivaji.ac.in

Estd. 1962
"A++" Accredited by NAAC (2021)
With CGPA 3.52

SU/BOS/Sci & Tech/ 316 **Date: 23/05/2025**

To,

The Director,
School of Engineering and Technology,
Shivaji University, Kolhapur.

Subject: Regarding revised syllabus of **B. Tech.** Part - III (Sem - V & VI) degree **Programme (Deparment of Technolgy)** under the Faculty of Science and Technology as per NEP 2020.

Sir/Madam,

With reference to the subject mentioned above, I am directed to inform you that the university authorities have accepted and granted approval to the revised syllabi, Nature of Question paper and equivalence of B. Tech. Part - III (Sem - V & VI) under the Faculty of Science & Technology as per NEP 2020.

No.	Course Syllabus
1	Civil Engineering
2	Mechanical Engineering
3	Computer Science and Technology
4	Chemical Engineering
5	Electronics and Telecommunication Engineering
6	Food Technology

This Syllabus, shall be implemented from the academic year **2025-26** onwards. A soft copy containing the syllabus is attached herewith and it is available on university website **www.unishivaji.ac.in NEP-2020@suk (Online Syllabus).**

The question papers on the pre-revised syllabi of above-mentioned course will be set for the examinations to be held in October/ November 2025 & March / April 2026. These chances are available for repeater students, if any

You are, therefore, requested to bring this to the notice of all students and teachers concerned.

Thanking you,

Yours faithfully,

Dr. S. M. Kubal
Dy. Registrar

Copy to: for Information and necessary action

1	The I/c Dean, Faculty of Science & Technology	6	Appointment Section A & B
2	Director, Board of Examinations & Evaluation	7	Affiliation Section (T.1) (T.2)
3	The Chairpersan, Respective Board of Studies	8	P.G.Admission Section, /P.G Seminar Section
4	OE 4 Exam Section,	9	Computer Centrev/ IT Cell
5	Eligibility Section,	10	Internal Quality Assorance Cell (IQAC)

Shivaji University

Vidya Nagar, Kolhapur, Maharashtra 416004

Department of Technology

As per NEP2020 guidelines

Third Year B.Tech (Computer Science and Technology) Detailed Curriculum 2025-26 onwards

Shivaji University, Kolhapur
Department of Technology

Third Year B. Tech (Computer Science and Technology), Semester- V

Teaching & Evaluation Scheme

S.N.	Category	Code	Course Title	Hours per week			Contact Hours	Credits	Evaluation scheme	
									Theory	Practical
				L	T	P			ISE:ESE	IE:EE
1.	Professional Core Courses	PCC311	System Programming	03	-	-	03	03	30:70	00:00
2.	Professional Core Courses	PCC312	Design and Analysis of Algorithm	03	-	-	03	03	30:70	00:00
3.	Professional Core Courses	PCC313	Operating System	03	-	-	03	03	30:70	00:00
4.	Professional Core Courses	PCC314	Database Engineering	03	-	02	05	04	30:70	50:50
5.	Professional Core Course	PCC315	Machine Learning	03	-	-	03	03	30:70	00:00
6.	Professional Core Course	PCC316	Java Programming Lab	-	-	04	04	02	00:00	50:50
7.	Professional Core Course	PCC317	Free Open Source Software Lab	-	-	02	02	01	00:00	50:00
8.	Ability Enhancement Courses	AEC311	Introduction to Foreign Language	01	-	-	01	01	-	50:00
9.	MDM Course	MDM 311	Multidisciplinary Minor Course II*	03	-	-	03	03	30:70	00:00
				-	-	-	-	**23**	**600**	**300**
10.	Project Based Learning	PBL311	Seminar	-	01	-	01	IE at Course in charge end		
11.	Mandatory Audit Course	MAC311	Aptitude Enhancement Course II		01	-	01			
			Total Hours	**19**	**02**	**08**	**29**	-	-	-

Shivaji University, Kolhapur
Department of Technology

Third Year B. Tech (Computer Science and Technology), Semester- VI

Teaching & Evaluation Scheme

S.N.	Category	Code	Course Title	Hours per week			Contact Hours	Credits	Evaluation scheme	
				L	T	P			ISE:ESE	IE:EE
1.	Professional Core Courses	PCC 321	Compiler Construction	03	-	-	03	03	30:70	00:00
2.	Professional Core Course	PCC322	Computer Graphics and Multimedia Techniques	03	-	02	05	04	30:70	50:50
3.	Professional Core Course	PCC323	Distributed and Cloud Computing	03	-	-	03	03	30:70	50:00
4.	Professional Elective Course	PEC321	Elective- I	03	-	-	03	03	30:70	00:00
5.	Open Elective Course	OEC 321	Open Elective –I	03	-	-	03	03	30:70	00:00
6.	MDM Course	MDM 321	Multidisciplinary Minor Course III*	03	-	-	03	03	30:70	00:00
7.	Professional Core Course	PCC324	Advanced Programming Lab	02	-	02	04	03	00:00	50:50
8.	Ability Enhancement Course	AEC321	Mini Project –III	-	-	02	02	01	00:00	50:00
				-	**-**	**-**	**-**	**23**	**600**	**300**
9.	Vocational and Skill Enhancement Course	VSEC321	Design Thinking & Innovation – III	01	-	-	01	IE at Course in charge end		
10.	Mandatory Audit Course	MAC 321	Aptitude Enhancement Course III	-	01	-	01			
			Total Hours	**21**	**01**	**06**	**28**	-	-	-

Year, Program, Semester	T.Y. B.Tech (Computer Science and Technology) , Part III, Semester V					
Course Code	PCC311					
Course Category	Professional Core Courses					
Course title	**System Programming**					
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**		**Total Credits**
	03	**-**	**-**	**03**		**03**
Evaluation Scheme	**ISE**	**ESE**	**IE**	**EE**	**Total**	
	30	**70**	**00**	**00**	**100**	
Pre-requisites(if any)	The knowledge of Computer Organization and Programming					
Course Objectives	The Course is aimed at- 1. Conceptualize the fundamentals of language specifications and system software's 2. Provide the knowledge of different passes of assemblers 3. Provide the concept and functionality of macros in system programming 4. Provide the knowledge of working of compiler and interpreter 5 Provide the fundamental concepts and functionality of linkers and loaders 6. Familiarize with various software development tools.					
Course Outcomes	Upon completion of this course, student should be able to – 1. Identify different types of system software and language specifications. 2. Design one pass and two pass assembler 3. Describe the working of macro processors, including macro definition, expansion, and substitution. 4. Describe working, advantages and disadvantages of compiler and interpreter 5. Analyze various types of linkers and loaders such as static linking, dynamic Linking, and their respective loaders. 6. Differentiate between various types of editors, such as text editors, source code editors, and their features.					

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	1		-		-	-	-	-	-	-	-	-	-	-
CO 2	-	2	3	-	2	-	-	-	-	-	-	-	-	-	-
CO 3	2		-	-	3	-	-	-	-	-	-	-	-	-	-
CO 4	3	2	-	1		-	-	-	-	-	-	-	-	-	-
CO 5	3	2	-	-	2	-	-	-	-	-	-	-	-	-	-
CO6	3	2	-	-		-	-	-	-	-	-	-	-	-	-

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**Language Processors** : Introduction, Language processing activities, Fundamentals of language processing, Fundamentals of language specification, Language processor development tools.	05
II	**Assemblers:** Elements of assembly language programming, a simple assembly scheme, pass structure of assemblers, design of a two pass assembler, a single pass assembler for IBM PC.	08
III	**Macro Processors:** Macros facility, Macro definition and call, Macro Expansion, Nested macro calls, Advanced macro facilities, Design of macro preprocessor.	06
IV	**Compilers and Interpreters :** Aspects of compilation**,** memory allocation, compilation of expressions, compilation of control structures, code optimization, Interpreters.	07
V	**Linkers & Loaders :** Relocation and linking concepts, design of a linker, Self-relocating programs, a linker for MS DOS, Linking for overlays, Loaders**.**	07
VI	**Software Tools** Software tools for program development, Editors, Debug monitors, Programming Environments, User interfaces	04
Text Books		
i)	System Programming and Operating Systems", D. M. Dhamdhere, TMGH, 2nd Edition.	
Reference Books		
i)	"System Programming", J. J. Donovan, Mc-Graw Hill.	
ii)	"Systems Programming" by A A Puntambekar and I A Dhotre	
iii)	"System Programming and Compiler Construction (Includes Labs)" by R K Maurya and Anand A Godbole	

Year, Program, Semester	T.Y. B. Tech (Computer Science and Technology) , Part III, Semester V					
Course Code	PCC312					
Course Category	Professional Core Courses					
Course title	**Design and Analysis of Algorithm**					
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**		**Total Credits**
	03	**-**	**-**	**03**		**03**
Evaluation Scheme	**ISE**		**ESE**	**IE**	**EE**	**Total**
	30		**70**	**--**	**--**	**100**
Pre-requisites(if any)	Data Structures					
Course Objectives	The Course is aimed at- 1. Expose students to fundamentals of algorithms. 2. Provide knowledge about different algorithm design paradigms. 3. Provide details of different asymptotic Analysis 4. Provide knowledge about various non- linear data structure and different operations on them. 5. Provide detail knowledge concept of backtracking and P, NP and NP Complete Problems 6. Provide knowledge about selected Algorithms from various application areas like number theory					
Course Outcomes	Upon completion of this course, student should be able to – 1. Describe fundamentals of algorithms. Determine time complexity and space complexity of a given algorithm. 2. Discover solution to problems using algorithm design technique like Divide and conquer 3. Analyze performance of algorithms using asymptotic analysis. 4. Discover solution to problems using algorithm design paradigms like Greedy Approach, Dynamic Approach 5. Apply algorithms for performing operations on graphs and trees. Apply concept of backtracking algorithm. 6. Understand basic concepts Complexity theory and understand selected Algorithms from various application areas like number theory					

(DAA) Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	**3**	--	**1**	--	--	--	--	--	--	--	--	--	--	--	--
CO 2	**2**	--	**3**	**2**	--	--	--	--	--	--	--	--	--	--	--
CO 3	**2**	**3**	--	**2**	--	--	--	--	--	--	--	--	--	--	--
CO 4	**3**	**3**	**1**	**1**	--	--	--	--	--	--	--	--	**2**	--	--
CO 5	**2**	**3**	**2**	**3**	--	--	--	--	--	--	--	--	**2**	--	--
CO6	**2**	**3**	**2**	**3**	**2**	--	--	--	--	--	--	--	**2**	--	--
Avg	**2.33**	**2**	**1.5**	**1.83**	**0.33**								**1**		

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**Introduction**: Introduction, Characteristics of algorithms, Pseudo code Conventions, Recursive Algorithms, Performance analysis, Asymptotic notations (O, Ω, Θ), Performance measurement, Recurrence relations.	06
II	**Divide and Conquer**– General method, Binary search, finding the maximum and minimum, Merge sort, Quick sort, Selection sort	07
III	**The Greedy method** General method, , Knapsack problem, Job sequencing with deadlines, minimum-cost spanning trees – Prim's and Kruskal's Algorithms, Optimal storage on tapes , Optimal merge patterns, Huffman codes Single source shortest paths.	07
IV	**Dynamic Programming** General method, Multistage graphs, All pair shortest paths, Optimal binary search trees, Reliability design, Traveling Sales person problem	07
V	**Basic Traversal and Search Techniques and Backtracking** Techniques for Binary Trees, Techniques for Graphs – Breadth First Search & Traversal, Depth First Search & Traversal, Connected components and Bi-connected components **Unit** **Backtracking –** General method, n-queen problem, Permutation tree, Sum of subsets, Hamiltonian Cycle, and Graph Coloring	06
VI	**basic of Complexity problems and Selected Algorithms** **NP Hard and NP Complete Problems –** Basic Concepts of P, NP, NP Complete, NP Hard Number -Theoretic algorithms: GCD algorithm, Chinese remainder theorem, Primality testing	06
	Text Books	
i)	Fundamentals of Computer Algorithms-Ellis Horowitz, SartajSahni, SanguthevarRajasekaran, 2ndEdition, Universities Press.	
ii)	"Introduction to Algorithms", Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, 3rd Edition, The MIT Press.	
	Reference Books	
i)	The Design and Analysis of Computer Algorithms-A. Aho, J. Hopcroft and J. Ullman, 1st Edition, Addison-Wesley.	
ii)	Gilles Brassard and Paul Bratley, "Fundamentals of Algorithmics", PHI, ISBN-13: 978-8120311312	

<table>
<tr><td>Year, Program, Semester</td><td colspan="6">T.Y. B.Tech (Computer Science and Technology) , Part III, Semester V</td></tr>
<tr><td>Course Code</td><td colspan="6">PCC313</td></tr>
<tr><td>Course Category</td><td colspan="6">Professional Core Courses</td></tr>
<tr><td>Course title</td><td colspan="6">Operating System</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td colspan="2">Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>03</td><td>-</td><td>-</td><td colspan="2">03</td><td>03</td></tr>
<tr><td rowspan="2">Evaluation Scheme</td><td colspan="2">ISE</td><td>ESE</td><td>IE</td><td>EE</td><td>Total</td></tr>
<tr><td colspan="2">30</td><td>70</td><td>00</td><td>00</td><td>100</td></tr>
<tr><td>Pre-requisites(if any)</td><td colspan="6">An operating system is an interface between user and hardware and manages the allocation of computer hardware. The purpose of an operating system is to provide a platform on which a user can execute programs in a convenient and efficient manner. This course provides the fundamental concepts of operating system and it covers the internal process scheduling algorithms, including CPU scheduling, inter process synchronization and communication, memory management and I/O management.</td></tr>
<tr><td>Course Objectives</td><td colspan="6">The Course is aimed at -
1. Providing a fundamental understanding of operating system concepts, including types of operating systems, system calls, and various system architectures.
2. Introduction of process management concepts such as process scheduling, interposes communication, and threads, along with scheduling algorithms for efficient CPU utilization.
3. Studying interprocess synchronization mechanisms, classical synchronization problems, and solutions like semaphores and monitors.
4. Explaining deadlocks, their characteristics, and various deadlock handling techniques such as prevention, avoidance, detection, and recovery.
5. Analysing memory management techniques, including paging, segmentation, and virtual memory concepts like page replacement algorithms and thrashing.
6. Understanding the working of the I/O system, including hardware components, application interfaces, and kernel-level I/O operations.</td></tr>
<tr><td>Course Outcomes</td><td colspan="6">Upon completion of this course, student should be able to –
1. Describe the role and functionalities of an operating system and differentiate between various types of operating systems.
2. Implement process scheduling techniques and evaluate scheduling algorithms for effective CPU utilization.
3. Analyse synchronization issues in concurrent processing and apply synchronization mechanisms to solve critical section problems.
4. Identify and evaluate deadlock situations, and implement appropriate strategies to prevent or resolve deadlocks.
5. Compare and apply different memory management techniques, including virtual memory and page replacement strategies, for efficient memory utilization.</td></tr>
</table>

	6. Explain and design components of the I/O system, including device management and kernel-level operations for optimized system performance.

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1		1		2			2								
CO 2	2			3	1										
CO 3		2		2							2				
CO 4	1	2		2											
CO 5			2			2	2								
CO6	1			2				2							

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**Unit: I Introduction** What is an operating system?, Simple Batch System, Multi programmed Batch System, Time Sharing System, Personal Computer System, Parallel System, Real Time System, System Calls.	5
II	**Unit: II Process** Process Concept, Process Scheduling, Operation on process, Cooperating process, Threads, Inter process communication (Algorithm evaluation). Process Scheduling: Basic concept, Scheduling Criteria, Scheduling Algorithms, Multiple processor scheduling, real time scheduling	8
III	**Unit: III Interprocess Synchronization** Background, Classical problems of synchronization, Critical Region, The critical section problem, Synchronization Hardware Monitors, Semaphores.	5
IV	**Unit: IV Deadlocks** System modes, Deadlock characterization, Methods for handling, deadlocks Deadlock prevention,	7
V	**Unit: V Memory Management** Background, Logical Versus Physical Address space, Swapping Contiguous Allocation, Paging, Segmentation, Segmentation with paging. Virtual Memory: Background, Demand paging, Page replacement, Page replacement algorithms, Allocation of frames, Thrashing, Demand segmentation.	9
VI	**Unit: VI I/O System** Overview, I/O hardware, Application I/O interface, Kernel I/O subsystem, Transforming I/O request to hardware operation	5
	Text Books	
i)	"Operating System Concepts", Silberschatz Galvin, John Wiley, 5th Edition.	
ii)	Operating System A Design Oriented Approach", Charles Crowley, TMGH.	
	Reference Books	
i)	"Operating System Concepts and Design ", Milan Milenkovic TMGH Second Edition	
ii)	Operating System A Design Oriented Approach", Charles Crowley, TMGH.	
iii)	"Operating System with Case Studies in Unix, Netware and Windows NT", Achyut S. Godbole, TMGH.	
	Assessment	
	a) ISE has a total weightage of 30 marks which is a (20+10) marks pattern. Theory paper examination will be conducted at central level for 20 marks. 10 marks will be given based on the assignments on each unit. It consists of assignments, quiz, seminars, presentations, research papers and research articles, developing working models, surveys and activities related to course as designed by the course coordinator to suit the needs of the course and to complement program outcomes. The practical work and its journal is not part of course work. b) ESE will be conducted at central level at the end of the semester. It will be theory paper for 100 Marks and then it will be scaled down for 70 marks.	

<table>
<tr><td>Year, Program, Semester</td><td colspan="6">T.Y. B. Tech (Computer Science and Technology) , Part III, Semester V</td></tr>
<tr><td>Course Code</td><td colspan="6">PCC314</td></tr>
<tr><td>Course Category</td><td colspan="6">Professional Core Courses</td></tr>
<tr><td>Course title</td><td colspan="6">Database Engineering</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td colspan="2">Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>03</td><td>-</td><td>02</td><td colspan="2">05</td><td>04</td></tr>
<tr><td rowspan="2">Evaluation Scheme</td><td colspan="2">ISE</td><td>ESE</td><td>IE</td><td>EE</td><td>Total</td></tr>
<tr><td colspan="2">30</td><td>70</td><td>50</td><td>50</td><td>200</td></tr>
<tr><td>Pre-requisites (if any)</td><td colspan="6">Basic knowledge of Programming.</td></tr>
<tr><td>Course Objectives</td><td colspan="6">The Course is aimed at-
1. Help student to understand the role of a database management system in an organization.
2. Demonstrate logical database design Principles including E-R diagrams.
3. Explain procedures connectivity, design and implement a small database project.
4. Give overview of physical design of a database system.
5. Describe the concept of a database transaction, related facilities, concurrency control, Backup and recovery.
6. Introduce the recent trends in database technology.</td></tr>
<tr><td>Course Outcomes</td><td colspan="6">Upon completion of this course, student should be able to –
1. Explain the features of database management systems and Relational database with applications.
2. Design conceptual models of a database using ER model for real life applications.
3. Create and Design SQL for a real-life application, with constraints and keys.
4. Formulate complex queries with data manipulation language to Database.
5. Apply database normalization principals to analyze the existing design of a database schema and to design an optimal database.
6. Create and construct indexing mechanisms for efficient retrieval of information.</td></tr>
</table>

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2	3	2	-	3	-	-	-	-	-	-	2	3	-	2
CO 2	3	3	3		2	-	-	-	2	2	-	-	3	-	2
CO 3	3	3	3	2	3	-	-	-	2	2	1	-	3	-	3
CO 4	3	2	3	2	3	-	-	-	2	2	-	2	3	-	3
CO 5	3	3	3	2	3	-	-	-	2	2	-	2	3	-	3
CO6	3	3	3	3	3	-	2	-	2	2	-	3	3	-	3

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**Unit I Introduction and Database Modeling using ER Model** General introduction to database systems and its advantages & applications, Database System Architecture, Database users and Administrator, Data models, Database management system, Database languages, View of Database, Data Models. ER Model, Entity set, Entity types, attributes, Notations, Relationship sets, Relationship types, Keys- super key, candidate key, primary key, Extended Features of ER Model-Generalization, Specialization and aggregation	06
II	**Unit II Data Modelling and SQL** Concept of relations, Schema-instance distinction, Referential integrity and foreign keys, Relational algebra, Various types of joins, Tuple relation calculus, Domain relational calculus, Example queries, Introduction to SQL, Data definition statements with constraints, Update behaviors, Nested Queries, Aggregate functions group by and having clauses.	07
III	**Unit III Database Design** Importance of a good schema design, Motivation for normal forms, dependency theory - functional dependencies, Closure of a set of FDs, Definitions of 1NF, 2NF, 3NF and BCNF, Decompositions and desirable properties of them, multi-valued dependencies and 4NF, Join dependencies and definition of 5NF.	06
IV	**Unit IV Data Storage and Indexes** File organizations, Primary, Secondary index structures, Various index structures - hash-based, Dynamic hashing techniques, multi-level indexes, B+ tree indices, Multiple key access.	05
V	**Unit V Transaction Processing and Concurrency Control** Concepts of transaction processing, ACID properties, Transaction states, Implementation of atomicity, isolation and durability, Serializability, Testing for serializability. Concurrency Control: Lock-based protocols, Timestamp - based Protocols, Validation - based Protocols, Multiple Granularities, Deadlock handling	10
VI	**Unit VI Recovery System** Failure classification, Storage structure, Implementation of stable storage, Recovery and Atomicity, Log based recovery, Checkpoints, Shadow Paging, Buffer management in crash recovery.	05

Suggested list of Assignments:

1. Draw ER diagrams for different schemas & convert them into tables (Assume any suitable schema). Apply normalization. Display constraints.
2. Study of SQL.
3. Design the relational database for any of the ER Model from assignment No.1 using SQL.
4. Insert and Modify Database: Implement queries to insert, update data in tables created in assignment 3 and store data in separate File / Table.
5. View Data: Design queries to view and retrieve table data.
6. Canonical cover & Closure: For given set of functional dependencies to find canonical cover & closure.
7. B+ Tree Indexing Technique: Write program to implement B+ Tree Index.
8. Dynamic Hashing Technique: Write program to implement Dynamic Hashing on the created data.
9. Concurrency Control: Write program to simulate any one concurrency control Protocol.
10. Database Logs: Write program to create logs of the activities of assignment 3 & 4. Choose

either Immediate Log or Deferred Log.

11. Database Connectivity: Write a program to implement MySQL/Oracle database connectivity with any front-end language to implement Database navigation operations (add, delete, edit etc.)
12. Cursors (All types: Implicit, Explicit, Cursor FOR Loop, Parameterized Cursor) Write a PL/SQL block of code using parameterized Cursor that will merge the data available in the newly created table N-Aadhar _Number with the data available in the table O_ Aadhar Number. If the data in the first table already exist in the second table, then that data should be skipped.
13. Database Trigger (All Types: Row level and Statement level triggers, Before and After Triggers). Write a database trigger on Grocery Shop table. The System should keep track of the records that are being updated or deleted. The old value of updated or deleted records should be added in Grocery Audit table.
14. Unnamed PL/SQL code block: Use of Control structure and Exception handling is mandatory.
15. Named PL/SQL Stored Procedure and Stored Function.

General Instructions: Any 12-14 experiments to be performed from the list, any 2 experiments to be studied as demonstration

Text Books	
i)	Silberschatz A., Korth H., Sudarshan S. “Database System Concepts”, 6th edition, Tata McGraw Hill Publishers
ii)	G. K. Gupta “Database Management Systems”, Tata McGraw Hill
Reference Books	
i)	Rab P., Coronel C. “Database Systems Design, Implementation and Management”, 5th edition, Thomson Course Technology, 2002
ii)	Elmasri R., Navathe S. “Fundamentals of Database Systems”, 4th edition, Pearson Education, 2003
iii)	Date C. “An Introduction to Database Systems”, 7th edition, Pearson Education, 2002
iv)	Ramkrishna R., Gehrke J. “Database Management Systems”, 3rd edition, McGraw Hill

Year, Program, Semester	T.Y. B.Tech (Computer Science and Technology) , Part III, Semester V				
Course Code	PCC315				
Course Category	**Professional Core Courses**				
Course title	**Machine Learning**				
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**Total Credits**
	03	**-**	**-**	**03**	**03**
Evaluation Scheme	**ISE**	**ESE**	**IE**	**EE**	**Total**
	30	**70**	**00**	**00**	**100**
Pre-requisites(if any)	Discrete Mathematics, Mathematics for Computer Science				
Course Objectives	Course Objectives: The Course Teacher will 1. Explain Human learning aspects. 2 .Explain primitives in learning process by computer. 3. Demonstrate nature of problems solved with Machine Learning 4. Introduce students to the basic concepts and techniques of Machine Learning. 5. Explain strengths and challenges of machine learning				
Course Outcomes	Course Outcomes: Students will be able to 1. Explain machine learning concepts 2. Analyze the Machine learning model. 3. Design solution using machine learning techniques. 4. Characterize machine learning algorithms as supervised and unsupervised 5. Apply machine learning techniques like classification, decision tress, naive Bayesian model and clustering 6. Demonstrate concepts related to Recommendation System and Time series analysis				

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	3	-		3	-	-	-	-	-	-	2	3	-	1
CO 2	3	3	-	3	3	-	-	-	-	-	-	2	3	-	3
CO 3	3	3	3	2	3	-	-	-	-	-	3	3	3	-	3
CO 4	3	3	-	3	3	-	-	-	-	-	-	2	3	-	
CO 5	3	3	3	2	3	-	-	-	-	-	3	3	3	-	3
CO6	3	3	3	3	3	-	-	-	-	-	3	3	3	-	3

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	Unit I **Introduction to Machine Learning:** Definition, Terminology, Types of learning, Machine Learning Problem categories, Machine learning architecture, process, Lifecycle, Performance measures, tools and framework, data visualization.	6
II	Unit II **Regression:** Simple regression – hypothesis, cost function, parameter learning with gradient descent, learning rate, Gradient Descent for linear regression, examples, simple regression in matrix form. Multivariate Linear Regression – multiple features, hypothesis functions, Gradient Descent for multiple variables, Feature scaling, polynomial regression	8
III	Unit III **Classification- logistic regression & Neural Network:** Definition, logistic regression – hypothesis representation, decision boundary, cost function, gradient descent for logistic regression. multiclass classification, Regularization - Overfitting & Underfitting, cost function, Regularized Linear Regression, Regularized Logistic Regression Neural Networks- Neuron representation and model, Hypothesis for neuron, cost function, solution of a problem using single neuron. Gradient descent for a neuron. Neural network, Multiclass classification with neural network. Learning in neural network-backpropagation algorithm	8
IV	Unit IV **Classification- Decision trees and Naïve Bayes** Decision trees: definition, terminology, the need, advantages, and limitations. constructing and understanding Decision trees, common problems with Decision trees, Decision tree algorithms, random forest, examples. Conditional probability and Naïve Bayes Classifier Instance-based classifier – K- Nearest Neighbour Classifier	6
V	Unit V **Unsupervised learning:** Clustering, K Means clustering, Hierarchical clustering, Association Rule mining	4
VI	Unit VI **Recommendation System and Time series analysis** Basic Text Processing with Python, regular expression, Natural Language Processing, Text Classification, Topic modelling Popularity based recommender engines, Content based recommendation engines, Classification based recommendation engine, collaborative filtering Date and Time Handling, Window functions, Correlation, Time Series Forecasting	6
Text Books		
i)	1. Machine Learning with Python- an approach to applied ML, by Abhishek Vijayvargia, BPB publications	
ii)	2. Practical Machine Learning by Sunila Gollapudi Packt Publishing Ltd.	
iii)	3. Machine Learning by Tom M. Mitchell, McGraw Hill Education; First edition	
Reference Books		
i)	Machine Learning for dummies John Paul Muller, Willey Publication	
ii)	EthemAlpaydin : Introduction to Machine Learning, PHI 2nd Edition-2013	

Year, Program, Semester	T.Y. B.Tech (Computer Science and Technology) , Part III, Semester V					
Course Code	PCC316					
Course Category	Professional Core Courses					
Course title	**Java Programming Lab**					
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**		**Total Credits**
	-	**-**	**04**	**04**		**04**
Evaluation Scheme	**ISE**		**ESE**	**IE**	**EE**	**Total**
	-		**-**	**50**	**50**	**100**
Pre-requisites (if any)	Knowledge of Programming Methodology, C, C++ or Object-Oriented language.					
Course Objectives	The Course is aimed at- 1. Introduce fundamentals of programming, Execution, methods, etc. 2. Introduce fundamentals of object-oriented programming in Java. 3. Demonstrate principles of software development. 4. Explain how to write a computer program to solve specified problems. 5. Demonstrate use of java environment to run simple Java programs.					
Course Outcomes	Upon completion of this course, student should be able to – 1. Generate an application based upon the concepts of core java & advanced java. 2. Understand the structure and model of the Java programming language. 3. Develop Java programs to implement error handling techniques using exception handling and develop programs using class and inputs from keyboard. 4. Develop graphical User Interface using AWT. 5. Create and communicate between client and server using Java and create a good, effective and dynamic website. 6. Develop Java program using packages, inheritance and interface.					

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	2	3	-	2	-	-	-	2	2	-	3	2	1	3
CO 2	3	3	3	-	3	-	-	-	2	2	-	3	2	1	3
CO 3	3	3	3	-	3	2	-	-	3	2	-	3	3	2	3
CO 4	3	3	3	-	3	2	-	-	3	2	-	3	3	2	3
CO 5	3	-	-	-	3	-	-	-	-	2	-	3	3	-	3

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**Unit I INTRODUCTION JAVA BASICS** Review of Object-oriented concepts, History of Java, Java buzzwords, JVM architecture, Data types, Variables, Scope and life time of variables, arrays, operators, control statements, type conversion and casting, simple java program, constructors, methods, Static block, Static Data, Static Method String and String Buffer Classes, Using Java API Document. Generalization, Specialization and aggregation.	03
II	**Unit II ARRAY & STRING** Defining an Array, Initializing & Accessing Array, Multi –Dimensional Array, Operation on String, Mutable & Immutable String, Using Collection Bases Loop for String, tokenizing a String, Creating Strings using String Buffer.	04
III	**Unit III INHERITANCE AND POLYMORPHISM INHERITANCE** Basic concepts, Types of inheritance, Member access rules, Usage of this and Super key word, Method Overloading, Method overriding, Abstract classes, Dynamic method dispatch, Usage of final keyword. PACKAGES AND INTERFACES: Defining package, Access protection, importing packages, Defining and Implementing interfaces, and Extending interfaces. I / O STREAMS: Concepts of streams, Stream classes- Byte and Character stream, reading console Input and Writing Console output, File Handling.	06
IV	**Unit IV EXCEPTION HANDLING** Exception types, Usage of Try, Catch, Throw, Throws and Finally keywords, Built-in Exceptions, Creating own Exception classes. MULTI THREADING: Concepts of Thread, Thread life cycle, creating threads using Thread class and Runnable interface, Synchronization, Thread priorities, Inter Thread communication.	05
V	**Unit V AWT CONTROLS** The AWT class hierarchy, user interface components- Labels, Button, Text Components, Check Box, Check Box Group, Choice, List Box, Panels – Scroll Pane, Menu, Scroll Bar. Working with Frame class, Color, Fonts and layout managers. EVENT HANDLING: Events, Event sources, Event Listeners, Event Delegation Model (EDM), Handling Mouse and Keyboard Events, Adapter classes, Inner classes.	04
VI	**Unit VI SWINGS** Introduction to Swings, Hierarchy of swing components. Containers, Top level containers – J-Frame, J-Window, J-Dialog, J-Panel, J-Button, J-Toggle Button, J-Checkbox, J-Radio Button, J-Label-Text Field, J-Text Area, J-List, J-Combo Box, J-Scroll Pane.	04

General Instructions: Any 15 experiments to be performed from the list, any 2 experiments to be studied as demonstration.

	Text Books
i)	"Core Java Fundamentals Vol –I", Cay S. Horstmann, Gary Cornell, The Sun Microsystems Press Java Series
ii)	"Core Java Vol – II", Cay S. Horstmann, Gary Cornell, The Sun Microsystems Press Java Series.
iii)	"Database Programming with JDBC and JAVA", Grorge Reese, O'REILLY
	Reference Books
i)	"Java 2 Complete Reference", Herbert Schildt, TMGH, 5th Edition.
ii)	"How to Java", Dietel & Dietel.

Experiment No.	Experiment Title/Objective	Hours
1.	Implement java program to: a. To perform arithmetic operations on two numbers using switch statements. b. To find number is prime or not using for statement.	02
2.	Write a program to find out day of the given date using command line argument.	02
3.	Implement java program using Scanner class.	02
4.	Implement java program for one dimensional and two-dimensional arrays.	02
5.	Implement java program for Jagged array.	02
6.	Implement java program to study concept of class.	02
7.	Implement java program for method overloading & Constructor overloading.	02
8.	Implement java program to perform string operations using string class.	02
9.	Implement java program to perform string operations using string buffer class.	02
10.	Write a Java program to demonstrate inheritance by creating suitable classes.	02
11.	Write a Java program to demonstrate use of a. super keyword b. static keyword c. final keyword.	02
12.	Implement java program using abstract classes.	02
13.	Implement java program for method overriding.	02
14.	Implement java program for implementing interface.	02
15.	Write a program to implement mathematical package for arithmetic, statistical and trigonometric operations.	02
16.	Write a program to develop java package for the stack class.	02
17.	Implement java program for exception handling.	02
18.	Implement concept of multithreading using java programming.	02
19.	Implement java program for database connectivity with JDBC.	02
20.	Implement java program for AWT.	02
21.	Implement java program for swing.	02
General Instructions: Practical Journal Assessment, Internal practical Examination and External Practical Examination		

<table>
<tr><td>Year, Program, Semester</td><td colspan="5">T.Y. B.Tech (Computer Science and Technology) , Part III, Semester V</td></tr>
<tr><td>Course Code</td><td colspan="5">PCC317</td></tr>
<tr><td>Course Category</td><td colspan="5">Professional Core Course</td></tr>
<tr><td>Course title</td><td colspan="5">FREE OPEN SOURCES SOFTWARE LAB</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>-</td><td>-</td><td>02</td><td>02</td><td>01</td></tr>
<tr><td rowspan="2">Evaluation Scheme</td><td colspan="2">ISE</td><td>ESE</td><td>IE</td><td>EE</td><td>Total</td></tr>
<tr><td colspan="2">00</td><td>00</td><td>50</td><td>00</td><td>50</td></tr>
<tr><td>Pre-requisites(if any)</td><td colspan="5">Fundamental concepts and techniques for analysis, design and implementation of computer programming</td></tr>
<tr><td>Course Objectives</td><td colspan="5">1. To study free and open source software.
2. To develop applications using FOSS.
3. Apply FOSS strategy in SDLC.
4. Describe linear and Logistic regression models.
5. Introduce various type of classification methods including SVM, Naive bayes, decision tree, and random forest
6. Describe unsupervised learning and learn to use clustering algorithms</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">Students will be able to
1. Elaborate use of FOSS.
2. Build applications using FOSS.
3. Inculcate FOSS strategy in SDLC to design and develop applications.
4. Apply linear and Logistic regression models
5. Analyze supervised methods.
6. Implement unsupervised learning</td></tr>
</table>

FOSS Lab Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	2	1	1	3	1	1	1	1	2	1	2	3	2	2
CO 2	3	3	3	2	3	-	-	-	2	2	3	3	3	-	3
CO 3	3	3	3	3	3	-	-	-	2	2	3	3	3	-	3
CO 4	3	3	2	3	3	-	-	-	-	-	2	3	3	-	2
CO 5	3	3	2	3	3	-	-	-	-	-	2	3	3	-	2
CO6	3	3	2	3	3	-	-	-	-	-	2	3	3	-	2

Level of Mapping as: Low 1, Moderate 2, High 3

	Course Content	
	In Open Source Lab – I, the student has to study 3-4 open source software tools. It should consist of combination of applications and system software which are free and open source. The student has to perform 4 experiments based on basic python programming and 6 experiments separately on Machine learning using python or any suitable open source technology.	

Suggested list of Assignments:

1. Demonstration of various open source tools and technologies used for Machine learning.
2. Implementation of operations on tuples, lists and dictionaries using python.
3. Demonstration of built -in packages using python.
4. Implementation of data visualization using matplotlib.
5. Write a python program to implement simple Linear Regression.
6. Write a program to implement Multivariate linear regression.
7. Implementation of Decision tree using sklearn and its parameter tuning.
8. Implementation of KNN using sklearn.
9. Implementation of K-means Clustering.
10. Implement Random Forest Algorithm using Python.
11. Write a program to calculate the accuracy, precision, and recall for your data set. Assume a set of documents that need to be classified, use the naïve Bayesian Classifier model to performthis task.as a .CSV file.
12. Performance analysis of classification Algorithms on a specific dataset (Mini Project).

General Instructions:

1. Students must be encouraged to solve engineering mathematics problems using different software's
2. Each Student has to write at least 10 assignments on entire syllabus.

	Text Books
i)	Machine Learning with Python- an approach to applied ML, by Abhishek Vijayvargia, BPB publications
ii)	Practical Machine Learning by Sunila Gollapudi Packt Publishing Ltd.
iii)	Machine Learning by Tom M. Mitchell, McGraw Hill Education; First edition
	Reference Books
i)	Machine Learning for dummies John Paul Muller, Willey Publication
ii)	EthemAlpaydin : Introduction to Machine Learning, PHI 2nd Edition-2013

Year, Program, Semester	T.Y. B.Tech (Computer Science and Technology) , Part III, Semester V					
Course Code	AEC311					
Course Category	Ability Enhancement Course					
Course title	**Introduction to Foreign Language**					
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**		**Total Credits**
	01	**-**	**-**	**01**		**01**
Evaluation Scheme	**ISE**	**ESE**	**IE**	**EE**	**Total**	
	00	**00**	**50**	**00**	**50**	
Pre-requisites(if any)	Fundamental concepts and techniques for analysis, design and implementation of computer programming					
Course Objectives	1. To make the students able to communicate and translate in foreign languages for the technical and scientific documentation, beneficial to Defense and other Government sector services. 2. To make them globally competent in the era of industrial liberalization. 3. To complement their core studies in international business. 4. To make them confident while opting for better career prospects in Multinational Companies (MNCs) for technical and scientific translation/ interpretation tasks while working for joint ventures or collaborative partnership.					
Course Outcomes	Students will be able to 1. The students will be able to acquire a good knowledge the basic grammar of foreign language and learn Alphabet, Common Words and Phrases in foreign language. 2. The students will also be able to learn to read the simple texts in foreign language. 3. The students would be able to speak a little using the greetings, well wishes etc. in Foreign Language. 4. The students will learn to count numbers, answer to the questions like, what is your name, surname, tell age, and can initiate little communication in Foreign Language. 5. The students can also translate simple sentences in foreign language.					

IFL Lab Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1										2				3	
CO 2										2				3	
CO 3										2				3	
CO 4										2				3	
CO 5										2				3	

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I.	**Unit I:** General Information on Basic Grammar of the foreign language, Introduction to Alphabet.	**07**
II.	**Unit II:** Gender of Noun, Number of Noun, Pronouns, Adjectives, Verbs and their usage in simple sentences, Numbers (up to 10), Simple Greetings in foreign language.	**07**
III.	**Unit III** General Questions in foreign language, like What is your name/surname? Who/What is this? Etc.	**07**
IV.	**Unit IV:** Simple narration about self/family/friend/University in foreign language chosen for studies. Practicing the learnt topics in the class itself.	**05**
V.	**Unit V:** Formation of simple sentences using Parts of Speech, Information on Cases, One or Two simple lessons from any book.	**07**
VI.	**Unit VI**: Basic information on Country & Culture of language under study.	**06**
Reference Books		
i.	V.N.Wagner and V. G.Ovsienko, Russian, People's Publishing House, New Delhi.	
ii.	S. Khavronina and A. Shirochenskaya, Russian in Exercises.	
iii.	Genki – Japan Times	
iv.	Aural Comprehension in Japanese – Osamu & Nobuko Mizutani.	
v.	An Introduction to Modern Japanese - Osamu & Nobuko Mizutani.	
vi.	Japanese for Today – Y. Yoshida.	
vii.	Lagune 1(Full set), Published by Langers, (An imprint of Saraswati House Pvt.Ltd), New Delhi 1 10002 (India).	

<table>
<tr><td>Year, Program, Semester</td><td colspan="6">T.Y. B.Tech (Computer Science and Technology) , Part III, Semester V</td></tr>
<tr><td>Course Code</td><td colspan="6">MDM 311</td></tr>
<tr><td>Course Category</td><td colspan="6">Multidisciplinary Minor Course II</td></tr>
<tr><td>Course title</td><td colspan="6">Embedded Systems for IoT</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td colspan="2">Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>03</td><td>-</td><td>-</td><td colspan="2">03</td><td>03</td></tr>
<tr><td rowspan="2">Evaluation Scheme</td><td colspan="2">ISE</td><td>ESE</td><td>IE</td><td>EE</td><td>Total</td></tr>
<tr><td colspan="2">30</td><td>70</td><td>00</td><td>00</td><td>100</td></tr>
<tr><td>Pre-requisites(if any)</td><td colspan="6">Basic electronic components and circuits, digital electronics and C programming.</td></tr>
<tr><td>Course Objectives</td><td colspan="6">The Course is aimed to-
1. Provide the knowledge of the basic concept and architecture of embedded systems.
2. Describe different design platforms used for an embedded system for IoT applications.
3. Introduce the principles and functionalities of analog and digital inputs and outputs devices.
4. Introduce the various Internet of Things (IoT) ecosystem components.</td></tr>
<tr><td>Course Outcomes</td><td colspan="6">Upon completion of this course, student should be able to –
1. Explain the embedded system concepts and architecture of embedded systems.
2. Explain the different hardware/software co-design techniques for microcontroller-based embedded systems,
3. Demonstrate proficiency in utilizing analog or digital inputs to receive signals and analog or digital outputs to control external devices.
4. Design, develop and deploying effective web / cloud based IoT applications.</td></tr>
</table>

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3					2									
CO 2	2			2						2					
CO 3	1					3				1					
CO 4	3					3									

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	Purpose and requirement specification, IoT level specification, Functional view specification, Operational view specification, Device and component integration, Pillars of Embedded IoT and Physical Devices: The internet of devices.	7
II	Design of Embedded Systems: Common Sensors, Actuators, Embedded Processors, Memory Architectures, Software architecture.	8
III	Inputs and Outputs: Digital Inputs and Outputs, Digital Inputs, Digital Outputs, BusIn, BusOut, and BusInOut, Analog Inputs and Outputs, Analog Inputs, Analog Outputs, Pulse Width Modulation (PWM), Accelerometer and Magnetometer, SD Card, Local File System (LPC1768).	7
IV	IoT Enabling Technologies: Communications, RFID and NFC (Near-Field Communication), Bluetooth Low Energy (BLE), LiFi, 6LowPAN, ZigBee, Z-Wave, LoRa, Protocols, HTTP, WebSocket, MQTT, CoAP, XMPP, Node-RED, Platforms, IBM Watson IoT—Bluemix, Eclipse IoT, AWS IoT, Microsoft Azure IoT Suite, Google Cloud IoT, ThingWorx, GE Predix, Xively, macchina.io, Carriots.	8
V	Web of Things and Cloud of Things: Web of Things versus Internet of Things, Two Pillars of the Web, Architecture Standardization for WoT, Platform Middleware for WoT, Cloud of Things. IoT Physical Servers, Cloud Offerings and IoT Case Studies: Introduction to Cloud Storage Models,Communication API.	9
Text Books		
i	RMD Sundaram Shriram K Vasudevan, Abhishek S Nagarajan, Internet of Things, John Wiley and Sons.	
ii	"Klaus Elk, "Embedded Software for the IoT".	
Reference Books		
i	Perry Xiao, "Designing Embedded Systems and the Internet of Things (IoT) with the ARM Mbed".	
ii	Elizabeth Gootman et. al, "Designing Connected Products", Shroff Publisher/O'Reilly Publisher.	
Assessment		
	a) ISE has a total weightage of 30 marks which is a (20+10) marks pattern. Theory paper examination will be conducted at central level for 20 marks. 10 marks will be given based on the assignments on each unit. It consists of assignments, quiz, seminars, presentations, research papers and research articles, developing working models, surveys and activities related to course as designed by the course coordinator to suit the needs of the course and to complement program outcomes. The practical work and its journal is not part of course work. b) ESE will be conducted at central level at the end of the semester. It will be theory paper for 100 Marks and then it will be scaled down for 70 marks.	

Year, Program, Semester	T.Y. B.Tech (Computer Science and Technology) , Part III, Semester V				
Course Code	PBL311				
Course Category-	Project Based Learning				
Course title	**Seminar**				
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**Total Credits**
	-	**01**	**-**	**01**	**-**
Evaluation Scheme	IE at Course in charge end				
Pre-requisites(if any)	**Soft Skills**				
Course Objectives	The Course is aimed to- 1. Help to develop effective communication skills 2. Help to develop effective presentation skills. 3. Introduce how to compete successfully in the business environment 4. Create ability to perform close and critical readings. 5. Identify, understand and discuss current, real-world issues				
Course Outcomes	After completion of course, students would be able to: 1. Develop learning tools that will help to be life-long learners. 2. Investigate current scientific issues facing society. 3. Acquire practice skills those are necessary for any academic learner 4. Get acquainted with the organization structure, business operations and administrative functions. 5. Create and convey verbal and non-verbal method of communication that demonstrates respect and understanding in a complex society.				

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	3								1		2			
CO 2	1	2								1					
CO 3	1	3		1	2										
CO 4	1									2		2			
CO 5	1									2		2			
CO6	1									2		2			

Level of Mapping as: Low 1, Moderate 2, High 3

Practical Covered
Every individual student has to select a technical and field relevant topic for seminar and he or she has to deliver the same in the class. Seminar should consist of a presentation of about 30-40 minutes by every individual student. The main objectives of seminar are to provide exposure to latest developments and trends in Computer Science and Technology and to prepare a detailed seminar report for submission and evaluation. A report on the seminar should be submitted to the department. Assessment should be jointly done by panel of teachers consisting of respective guide and other teachers from the department.
Assessment
a) ISE has a total weightage of 30 marks which is a (20+10) marks pattern. Theory paper examination will be conducted at central level for 20 marks. 10 marks will be given based on the assignments on

	each unit. It consists of assignments, quiz, seminars, presentations, research papers and research articles, developing working models, surveys and activities related to course as designed by the course coordinator to suit the needs of the course and to complement program outcomes. The practical work and its journal is not part of course work. b) ESE will be conducted at central level at the end of the semester. It will be theory paper for 100 Marks and then it will be scaled down for 70 marks.

<table>
<tr><td>Year, Program, Semester</td><td colspan="4">T.Y. B.Tech (Computer Science and Technology) , Part III, Semester V</td></tr>
<tr><td>Course Code</td><td colspan="4">MAC311</td></tr>
<tr><td>Course Category</td><td colspan="4">Mandatory Audit Course</td></tr>
<tr><td>Course title</td><td colspan="4">Aptitude Enhancement Course II</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td></tr>
<tr><td>-</td><td>01</td><td>-</td><td>01</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="4">IE at Course in charge end</td></tr>
<tr><td>Pre-requisites(if any)</td><td colspan="4">Basic Mathematical Concepts</td></tr>
<tr><td>Course Objectives</td><td colspan="4">The Course is aimed to-
1. Understand key concepts such as HCF, LCM, decimal fractions, square roots, and cube roots, to build a strong base for problem-solving.
2. Enhance skills in simplifying complex mathematical expressions and perform efficient computations using the principles of simplification, surds, and logarithms.
3. Learn to solve practical problems involving percentages, profit-loss scenarios, and partnership calculations.
4. Grasp the principles and formulas used in solving problems related to time and work, pipes and cisterns, and time and distance.
5. Sharpen the ability to analyze and solve problems involving analogies, classifications, series, and coding-decoding sequences.
6. Develop problem-solving skills related to blood relations, direction sense tests, puzzles, and logical Venn diagrams.</td></tr>
<tr><td>Course Outcomes</td><td colspan="4">Upon completion of this course, student should be able to –
1. Demonstrate an ability to solve problems related to number systems, including HCF, LCM, decimal fractions, square roots, and cube roots, accurately.
2. Solve complex problems involving simplification, surds, and logarithms more efficiently, and improve calculation speed and accuracy.
3. Apply knowledge of percentages, profit and loss, ratio and proportion, and partnership to real-life scenarios and mathematical problems.
4. Solve time, work, and distance-related problems, including pipes and cisterns, with a clear understanding of concepts and application of formulas.
5. Solve questions involving analogies, classifications, series completions, and coding-decoding with greater confidence.
6. Demonstrate enhanced ability to solve puzzles, directional sense, blood relation, and logical Venn diagram problems with precision and logical deduction.</td></tr>
</table>

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	1	2	-	-	-	-	-	-	-	-	1	-	-	-
CO 2	3	1	2	-	-	-	-	-	-	-	-	1	-	-	-
CO 3	3	1	2	-	-	-	-	-	-	-	-	1	-	-	-
CO 4	3	1	2	-	-	-	-	-	-	-	-	1	-	-	-
CO5	1	-	1	-	-	-	-	-	-	-	-	1	-	-	-
CO6	1	-	1	-	-	-	-	-	-	-	-	1	-	-	-

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**Quantitative Aptitude 1** Number System, H.C.F. and L.C.M. of Numbers, Decimal Fractions, Simplification, square Roots and Cube Roots.	2
II	**Quantitative Aptitude 2** Average, Problems on Numbers, Problems on Ages, Surds and Indices, Logarithms.	2
III	**Quantitative Aptitude 3** Percentage, Profit and Loss, Ratio and Proportion, Partnership.	2
IV	**Quantitative Aptitude 4** Chain Rule, Pipes and Cisterns, Time and Work, Time and Distance.	2
V	**Logical Reasoning 1** Analogy, classification, series completion, coding and decoding.	2
VI	**Logical Reasoning 2** Blood relation, Puzzle test, direction sense test, logical Venn diagram.	2

General Instructions:
Each Student has to write at least 6 assignments on entire syllabus.

Reference Books	
i)	Dr. R S Aggarwal — Quantitative aptitude, S. Chand Publication.
ii)	R V Praveen — Quantitative aptitude and logical reasoning, 2nd Edition, PHI Publication.

Assessment	
	Assessment will be done by Course Teacher. MCQ Test can be conducted based on the syllabus.

T.Y. B. Tech (Computer Science and Technology) , Part III, Semester VI

<table>
<tr><td>Year, Program, Semester</td><td colspan="6">T.Y. B.Tech (Computer Science and Technology) , Part III, Semester VI</td></tr>
<tr><td>Course Code</td><td colspan="6">PCC 321</td></tr>
<tr><td>Course Category</td><td colspan="6">Professional Core Courses</td></tr>
<tr><td>Course title</td><td colspan="6">Compiler Construction</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td colspan="2">Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>03</td><td>-</td><td>-</td><td colspan="2">03</td><td>03</td></tr>
<tr><td rowspan="2">Evaluation Scheme</td><td colspan="2">ISE</td><td>ESE</td><td>IE</td><td>EE</td><td>Total</td></tr>
<tr><td colspan="2">30</td><td>70</td><td>-</td><td>-</td><td>100</td></tr>
<tr><td>Pre-requisites (if any)</td><td colspan="6">The knowledge of System Programming</td></tr>
<tr><td>Course Objectives</td><td colspan="6">The Course is aimed at-
1. Initiate an understanding of compilers in general and brief about phases of compiler.
2. Conceptualize how compiler makes tokens in Lexical analysis.
3. Explore how grammar will be used in finding syntax error.
4. Describe how compiler builds syntax tree and allocates the memory.
5. Explain Optimization of the machine code generated by the compiler to make it faster and more efficient.
6. Help to understand how machine language code will be generated from intermediate code.</td></tr>
<tr><td>Course Outcomes</td><td colspan="6">Upon completion of this course, student should be able to –
1. Describe different phases of compiler.
2. Implement generation of token in Lexical analysis.
3. Identify checking of code for syntax errors using grammar.
4. Understand steps for generating syntax tree and memory allocation.
5. Implement generation of intermediate code and applying optimization principles on for code optimization.
6. Apply optimization principles on given code which is generated by the compiler to make it faster and more efficient.</td></tr>
</table>

CC Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	3	3	-	2	-	-	-	-	-	-	2	3	-	3
CO 2	3	2	3	-	2	-	-	-	-	2	-	-	3	-	3
CO 3	3	3	3	-	2	-	-	-	-	2	-	-	3	-	3
CO 4	3	3	3	-	2	-	-	-	2	-	-	-	3	-	3
CO 5	3	-	3	3	3	-	-	-	2	-	-	-	3	-	3
CO6	3	-	3	-	3	2	-	-	-	2	-	-	3	-	3

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**Unit I: Introduction** Compilers, Phases of a compiler, Compiler construction tools, A simple one pass compiler.	04
II	**Unit II: Lexical Analysis** Role of a Lexical analyzer, input buffering, specification and recognition of tokens, finite automata implications, designing a lexical analyzer generator.	07
III	**Unit III: Syntax Analysis** Role of Parser, Writing grammars for context free environments, Top-down parsing, Recursive descent and predictive parsers (LL), Bottom-Up parsing, Operator precedence parsing, LR, SLR and LALR parsers.	09
IV	**Unit IV: Syntax Directed Translation and Run Time Environments** Syntax directed definitions, construction of syntax tree, Source language issues, storage organization and allocation strategies, parameter passing, symbol table organizations and generations, dynamic storage allocations.	07
V	**Unit V: Intermediate Code Generation** Intermediate languages, declarations, assignment statements and Boolean expressions, case statements, back patching, procedure calls.	05
VI	**Unit VI: Code Generation** Issues in design of a code generator and target machine, Run time storage management, Basic blocks and flow graphs, Next use information and simple code generator, Issues of register allocation, assignment and basic blocks, code generation from Dags and the dynamic code generation algorithm.	07
	Text Books	
i)	"Compilers - Principles, Techniques and Tools", A.V. Aho, R. Shethi and J.D.Ullman, Pearson Education.	
	Reference Books	
i)	"Compiler Construction", Dhamdere, Mc-Millan	
ii)	"Compilers - Principles, Techniques and Tools", A.V. Aho, R. Shethi and J.D.Ullman, Addison Wesley Publishing Company.	
iii)	"Compiler Construction", Barret, Bates, Couch, Galgotia.	
iv)	"Unix Programming", Pepkin Pike.	

<table>
<tr><td>Year, Program, Semester</td><td colspan="6">T.Y. B.Tech (Computer Science and Technology) , Part III, Semester VI</td></tr>
<tr><td>Course Code</td><td colspan="6">PCC 322</td></tr>
<tr><td>Course Category</td><td colspan="6">Professional Core Courses</td></tr>
<tr><td>Course title</td><td colspan="6">Computer Graphics and Multimedia Techniques</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td colspan="2">Total Credits</td></tr>
<tr><td>03</td><td>-</td><td>02</td><td>05</td><td colspan="2">04</td></tr>
<tr><td rowspan="2">Evaluation Scheme</td><td colspan="2">ISE</td><td>ESE</td><td>IE</td><td>EE</td><td>Total</td></tr>
<tr><td colspan="2">30</td><td>70</td><td>50</td><td>50</td><td>200</td></tr>
<tr><td>Pre-requisites (if any)</td><td colspan="6">Basic knowledge of Computer Systems, Matrix Algebra, Calculus in Three Dimensions, or equivalents</td></tr>
<tr><td>Course Objectives</td><td colspan="6">The Course is aimed at-
1. Introduce the use of the components of a graphics system.
2. Describe the basic principles of three-dimensional computer graphics.
3. Provide an understanding of how to scan convert the basic geometrical primitives.
4. Provide an understanding of mapping from a world coordinate to device coordinates.
5. Enable to discuss the application of computer graphics concepts in games.
6. Analyze the fundamentals of animation, underlying technologies, principles, and applications.</td></tr>
<tr><td>Course Outcomes</td><td colspan="6">Upon completion of this course, student should be able to –
1. List the basic concepts used in computer graphics.
2. Implement various algorithms to scan, convert the basic geometrical primitives, transformations, Area filling, clipping.
3. Describe the importance of viewing and projections.
4. Define the fundamentals of animation, virtual reality and its related technologies.
5. Understand a typical graphics pipeline.
6. Understand the principles of multimedia techniques.</td></tr>
</table>

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2	1	2	-	3	-	-	-	2	2	-	-	3	1	2
CO 2	2	2	3	-	3	-	-	-	2	2	-	-	2	-	3
CO 3	2	2	3	-	2	1	-	-	2	2	-	-	2	-	3
CO 4	3	2	3	-	2	-	-	-	-	2	-	-	2	-	3
CO 5	3	2	3	-	2	-	-	-	-	2	-	2	2	-	3
CO 6	3	3	3	-	3	2	1	2	2	3	1	2	2	1	3

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**Unit I Introduction to Graphics Devices** Display Devices and Adapters, Working of Printers, LCD Display.	03
II	**Unit II Transformations** Basic 2D & 3D transformations - Translation, Scaling, Rotation, Reflection, Shearing, Multiple Transformations, Rotation about an axis parallel to a coordinate axis, Rotation about an arbitrary axis in space, Affine and Perspective Geometry, Orthographic projections and Axonometric projections.	08
III	**Unit III Raster Scan Graphics** Bresenham's line and circle drawing algorithms, Scan Conversion techniques: RLE, Frame Buffer, Scan converting polygons: Edge fill and Seed fill algorithms, Antialiasing and Halftoning.	07
IV	**Unit IV Viewing and Clipping** Introduction, Windowing and View-porting, Introduction to clipping, Point clipping, Line clipping: Sutherland - Cohen line clipping algorithm.	06
V	**Unit V Curves and Surfaces** Curve Representation, Non-parametric and parametric curves, representation of space curves, Cubic Spline, Parabolic Blended curves, Bezier curves and B-spline curves, Z- buffer, Warnock algorithm.	08
VI	**Unit VI Multimedia Applications** Media preparation, composition, integration, communication, entertainment using commercial tools	07

Suggested list of Assignments:

1. Study of Computer graphics devices adapters and multimedia storage devices.
2. Two Dimensional transformations.
3. Three Dimensional transformations and animations.
4. Generalized Bresenham’s line drawing algorithm.
5. Bresenham’s circle drawing algorithm.
6. Polygon filling algorithm.
7. Clipping algorithms like two-dimensional clipping, Sutherland Cohen Clipping.
8. Windowing, Hidden line and surfaces
9. Compression technique algorithms for text, image and video.
10. Bezier curve.
11. Study of mm file formats and conversions (BMP-JPG, WAV-MP3, DAT-MPEG).
12. GIF animator / Flash /3D Max/Maya etc.
13. Application software/animation using multimedia concepts.

General Instructions: Any 8 experiments to be performed from the list, any 2 experiments to be studied as demonstration

Text Books	
i)	Multimedia Communication”, Fred Halsall, Pearson Education

ii)	"Mathematical elements for Computer Graphics" - David F. Rogers, J. Alan Adams (MGH Int.) (For chapters 1, 2, 6.
ii)	"Procedural elements for Computer Graphics" - David F. Rogers, (MGH Int.) (For chapters 3, 4)
iv)	"Multimedia Making it Work", Tay Vaughan, TMGH, 5th Edition.
Reference Books	
i)	Newman Sproul, "Principles of Interactive Computer Graphics" - (MGH) (chapters 1,4)
ii)	Prof. Rajesh Maurya, "Computer Graphics" (Wiley India Pvt. Ltd.) (Chapter 4)
iii)	"Hearn & Baker, "Computer Graphics".
iv)	Ranjan Parekh, "Principles of Multimedia", TMGH Maurya

<table>
<tr><td>Year, Program, Semester</td><td colspan="6">T.Y. B.Tech (Computer Science and Technology) , Part III, Semester VI</td></tr>
<tr><td>Course Code</td><td colspan="6">PCC323</td></tr>
<tr><td>Course Category</td><td colspan="6">Professional Core Course</td></tr>
<tr><td>Course title</td><td colspan="6">Distributed and Cloud Computing</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td colspan="2">Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>03</td><td>-</td><td>-</td><td colspan="2">03</td><td>03</td></tr>
<tr><td rowspan="2">Evaluation Scheme</td><td>ISE</td><td colspan="2">ESE</td><td>IE</td><td>EE</td><td>Total</td></tr>
<tr><td>30</td><td colspan="2">70</td><td>50</td><td>--</td><td>150</td></tr>
<tr><td>Pre-requisites(if any)</td><td colspan="6">Operating system (PCC313)</td></tr>
<tr><td>Course Objectives</td><td colspan="6">The Course is aimed to-
1. Introduce the fundamentals of distributed operating systems
2. Describing the principles, architectures, and algorithms used in distributed systems.
3. Introduce the concepts of naming, synchronization, consistency and replication, and distributed file systems.
4. Provide students a basic grounding in designing and implementing distributed and cloud systems.
5. Explain the fundamental ideas behind Cloud Computing, the evolution of the paradigm, its applicability; benefits, as well as current and future challenges.
6. Help students identify the technical foundations of cloud systems architectures.</td></tr>
<tr><td>Course Outcomes</td><td colspan="6">Upon completion of this course, student should be able to –
1. Demonstrate knowledge of the core architectural aspects of distributed Systems.
2. Demonstrate distributed systems using various interpose communication techniques, such as remote procedure call, and remote method invocation.
3. Summarize key mechanisms and models for distributed systems including logical clocks, election algorithms, distributed mutual exclusion, consistency, and replication.
4. Describe the various design issues in distributed systems e.g. system performance and reliability, distributed file system, etc.
5. Understand the fundamental principles of cloud computing and cloud architectural model
6. Demonstrate public cloud platforms.</td></tr>
</table>

DCC Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	-	1	2	-	-	-	-	-	-	-	-	-	-	-	-
CO 2	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-
CO 4	-	-	3		-	-	-	-	-	-	-	-	-	-	-
CO 5	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-		-	-	-	-	-	-	-	-	-	-	-

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**Unit I Introduction** Definition, Goals, Types of distributed systems: Distributed Computing System, Distributed Information System, Architecture: Architectural, Styles, System Architecture	6
II	**Unit II Processes and Communication** Virtualization, Servers, Code Migration, Software Agents, Remote Procedure Call, Message Oriented Transient Communication	6
III	**Unit III Synchronization** Distributed Shared Memory: General architecture, Design and Implementation Issues, Consistency Models, Implementing Sequential Consistency Model, Replacement Strategy, Thrashing, Heterogeneous DSM, Physical Clock Synchronization, Logical Clock, Mutual exclusion, Election Algorithms	8
IV	**Unit IV** Distributed File Systems Architecture, Processes, Communication, Naming, Synchronization, Consistency Replication	5
V	**Unit V Cloud Computing and Service Models** Public, Private, and Hybrid Clouds, Cloud Ecosystem and Enabling Technologies, Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS) and Software-as-aService (SaaS) **Architectural Design of Compute and Storage Clouds** A Generic Cloud Architecture Design, Layered Cloud Architectural Development, Virtualization Support and Disaster Recovery, Architectural Design Challenges	8
VI	**Unit VI** Public Cloud Platforms: GAE, AWS, and Azure Public Clouds and Service Offerings, Google App Engine (GAE), Amazon Web Services 6 (AWS), Microsoft Windows Azure, Cloud Security Defense Strategies	6

General Instructions:
Each Student has to write at least 6 assignments on entire syllabus.

	Text Books
i)	A. S. Tanenbaum (2nd Edition) Distributed Systems Principles and Paradigms-, Pearson Education
ii)	P. K. Sinha (PHI) Distributed Operating Systems (For Distributed Shared Memory and Distributed Operating Systems)
iii)	Kai Hwang, Geoffrey C. Fox, Jack J. Dongarra, Distributed and Cloud Computing, © 2012 Elsevier
	Reference Books
i)	George Coulouris, Jean Dollimore, Tim Kindberg (Pearson Education) Distributed Systems Concepts & Design

Year, Program, Semester	**T.Y. B.Tech (Computer Science and Technology) , Part III, Semester VI**					
Course Code	PEC321					
Course Category	**Elective-I**					
Course title	**Mobile Computing**					
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**		**Total Credits**
	03	**-**	**-**	**03**		**03**
Evaluation Scheme	**ISE**		**ESE**	**IE**	**EE**	**Total**
	30		**70**	**00**	**00**	**100**
Pre-requisites(if any)	Knowledge of Data Communication and Computer Network					
Course Objectives	The Course is aimed at- 1. Provide the fundamental aspects of wireless transmissions. 2 Introduce medium access technology 3. Explain GSM and DECT system. 4. Teach wireless local area network technologies. 5. Provide the knowledge of Wireless ATM 6. Provide the knowledge of mobile network layer and transport layer.					
Course Outcomes	Upon completion of this course, student should be able to – 1.Learn basics facts about signal, antenna and signal propagation, and different Data transmission techniques 2. Learn medium access control algorithms and compare SDMA, FDMA, CDMA mechanisms. 3. Identify the architecture, services and protocol of GSM and DECT system. 4. Identify architectures and data transmission technologies used in IEEE 802.11, HIPERLAN, Bluetooth, and WATM. 5. Explain Wireless ATM. 6. Identify the design issues of network layer and transport layer with its approaches for wireless communication.					

Mobile Computing Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	2	-	-		-	-	-	-	-	-	-	-	-	-
CO 2	2	2	-	-	2	-	-	-	-	-	-	-	-	-	-
CO 3	3	2	-	-	1	-	-	-	-	-	-	-	-	-	-
CO 4	3	-	-	2	2	-	-	-	-	-	-	-	-	-	-
CO 5	2	2	-	-	2	-	-	-	-	-	-	-	-	-	-
CO6	3	2	-	-	2	-	-	-	-	-	-	-	-	-	-

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**Introduction to wireless communication:** Need and Applications of wireless communication, Wireless Data Technologies, Market for mobile communication, Mobile and wireless devices	04
II	**Wireless transmission:** Frequencies for radio transmission, signals, antennas, signal propagation, Multiplexing, Modulation, Spread spectrum and Cellular systems.	07
III	**Medium Access Control:** Specialized MAC, SDMA, FDMA, TDMA and CDMA.	06
IV	**Telecommunication Systems :** GSM, DECT systems – Architecture and protocols, Tetra frame structure, UMTS basic architecture and UTRA modes. **Wireless LAN :** Introduction, Infrared v/s Radio transmission, Infrastructure and ad-hoc networks, IEEE 802.11, HIPERLAN, Blue To	08
V	**Wireless ATM :** WATM services, Reference model, functions, radio access layer, handover, Location management, Addressing, Mobile QoS, Access point control protocol.	04
VI	**Mobile Network Layer :** Mobile IP, DHCP. Transport Layer: Traditional TCP, Indirect TCP, Snooping TCP, Mobile TCP, Fast and selective retransmission & recovery. control, and system run levels, performance Analysis tools,	08
Text Books		
i)	1. Jachen Schiller Mobile Communications – (Addison-Wesley).	
Reference Books		
i)	1. Peter T. Davis, Craig R. McGuffin Wireless LAN – (MGH International Edn).	
ii)	2 – SandeepSinghal, JariAlvinen and group The Wireless Application Protocol. (Addison-Wesley).	
iii)	3. Charles Arehart and group Professional WAP – (SPD).	

Year, Program, Semester	T.Y. B.Tech (Computer Science and Technology) , Part III, Semester VI				
Course Code	PEC 321				
Course Category	**Elective-I**				
Course title	**Object Oriented Modeling and Design**				
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**Total Credits**
	03	**-**	**-**	**03**	**03**
Evaluation Scheme	**ISE**	**ESE**	**IE**	**EE**	**Total**
	30	**70**	**00**	**00**	**100**
Pre-requisites(if any)	Basic knowledge of software engineering is required.				
Course Objectives	The Course is aimed at- 1. To Create, Critique and Refine customer Use Cases. 2. Transform Use Cases into Object Oriented software Realizations through OO Analysis and OO Design. 3. To Document your requirements, analysis, and design models in the Unified Modelling Language (UML) notation. 4. To Document your requirements, analysis, and design models in the Unified Modelling Language (UML) notation. 5. To prepare Interaction of the real world system. 6. To develop Component and deployment view of the problem statement.				
Course Outcomes	Upon completion of this course, student should be able to – 1. Know the concept of object-oriented development, and create a static object model and a dynamic behavioural model and a functional model of the system. 2. Use the approaches to system design and object design, and the techniques of translating design to implementation. 3. Implement the object-oriented modelling and design patterns to provide solutions to the real-world software design problems. 4. Describe how design patterns facilitate development and list several of the most popular patterns. 5. To Measure the Level of User satisfaction and software quality assurance. 6. Design all structural and behavioural views of the software system.				

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	3	2	2	3	-	-	-	-		2	3	3		2
CO 2	3	3	3	2	3	-	-	-	-	2	3	3	3		3
CO 3	3	3	3	3	3	-	-	-	2	2	3	3	3	-	3
CO 4	3	2	2	2	3	-	-	-	-	2	2	3	3	-	2
CO 5	2	3	3	2	3	2	2	2	2	3	3	3	3	-	3
CO6	3	3	3	3	3	-	-	-	-	-	3	3	3	-	3

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**Unit: I Introduction:** Object Oriented development and themes, evidence for usefulness, modeling as a Design Technique. Objects, classes, links and associations, generalization and inheritance, grouping constructs, aggregation, abstract classes, generalization as extension and restriction, multiple inheritance, metadata, candidate keys and inheritance.	7
II	**Unit: II Dynamic and Functional Modeling** Events, states, operations, concurrency, nested state diagrams, advanced dynamic modeling concepts, relation of object and dynamic models, DFD, relation of functional to object and dynamic models.	7
III	**Unit: III Design Methodology** Impact of an object oriented approach, Analysis, System design with examples, combining models, Designing models, designing Algorithms, Optimization of design, control. Associations, Physical packaging, Comparing methodologies using structure analysis and design, Jackson's structured Development Information modeling notation and object oriented works.	6
IV	**Unit: IV Structural Modeling using UML** Classes, Relationships, Common mechanisms. Diagrams, Class Diagrams, Interfaces, Types and Roles, Packages, Instances and Object Diagram.	7
V	**Unit: V Behavioral Modeling using UML** Interactions, Use cases, Use case diagram, Interaction Diagrams and Activity diagrams, Events and signals, State Machines, Processes and Threads, Time and space, State chart diagrams.	6
VI	**Unit: VI Architectural Modeling using UML** Components, Deployment, Collaboration, Patterns and Frame works, Component Diagrams and Deployment Diagrams.	6
Text Books		
i)	"Object Oriented Modeling and Design", Rambaugh, Premerlani, Eddy, Lorenson, PHI.	
ii)	The Unified Modeling Language User Guide", Grady Booch, Jeams Rambaugh, Ivar Jacotson, Addison Wesley.	
Reference Books		
i)	"Object Oriented Analysis and Design", Andrew High, TMG.	
ii)	Practical Object Oriented Design with UML", Mark Priestley.	
iii)	"Object Oriented Analysis and Design", Kahate, TMH.	

<table>
<tr><td>Year, Program, Semester</td><td colspan="6">T.Y. B. Tech (Computer Science and Technology) , Part III, Semester VI</td></tr>
<tr><td>Course Code</td><td colspan="6">PEC321</td></tr>
<tr><td>Course Category-</td><td colspan="6">Elective I</td></tr>
<tr><td>Course title</td><td colspan="6">Advanced Operating System</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td colspan="2">Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>03</td><td>-</td><td>03</td><td colspan="2">03</td><td>03</td></tr>
<tr><td rowspan="2">Evaluation Scheme</td><td colspan="2">ISE</td><td>ESE</td><td>IE</td><td>EE</td><td>Total</td></tr>
<tr><td colspan="2">30</td><td>70</td><td>00</td><td>00</td><td>100</td></tr>
<tr><td>Pre-requisites(if any)</td><td colspan="6">Basic concepts of Operating System and programming concepts</td></tr>
<tr><td>Course Objectives</td><td colspan="6">The Course is aimed at-
1. Describe the concepts, design, and structure of the UNIX operating system.
2. Describe the concept of working of buffer cache and internal representation of files
3. Describe system calls process for communication and internal representation of file system in UNIX OS.
4. Explain the concepts of structure of processes and process control in UNIX OS.
5. Describe the knowledge of process control
6. Explain the concept of memory management policies.</td></tr>
<tr><td>Course Outcomes</td><td colspan="6">Upon completion of this course, student should be able to –
1. Analyze architecture of UNIX and windows operating system.
2. Conceptualize the knowledge of basic issues with fundamental of buffer cache and internal representation of files.
3. Study process and Structure of Process this covers a broad range of engineering aspects.
4. Understand various concepts of Process and Process Control.
5. Understand concepts of process control
6. Analyze basic issues in representation, scheduling, allocation and management in operating system.</td></tr>
</table>

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	-	1	-	2	-	-	2		-	-	-	-	-	-	-
CO 2	1		-	3	1	-	-	-	-	-	-	-	-	-	-
CO 3	-	2	-	2		-	-	-	-	-	2	-	-	-	-
CO 4	1	2	-	2	-	-	-	-	-	-	-	-	-	-	-
CO 5	-	-	2	-	-	2	2		-	-	-	-	-	-	-
CO6	1	-	-	-	2	2	-	-	-	-	2	-	-	-	-

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**Unit: I Introduction** General Overview of the UNIX System - History, System Structure, User Perspective, Operating System Services, Assumption about Hardware, Introduction to system concepts, Kernel Data Structure, System Administration.	**5**
II	**Unit: II The Buffer Cache** Buffer headers, structure of the buffer pool, scenarios for retrieval of a buffer, reading and writing disk blocks, advantages and disadvantages of cache.	**5**
III	**Unit: III Internal Representation of Files** Inodes, structure of the regular file, directories, conversion of a pathname to inode, super block, inode assignment to a new file, allocation of disk blocks, other file types. System calls for the file System **:** Open, Read, write, File and Record Locking, Adjusting the position of FILE I/O-LSEEK, Close, File Creation, Creation of Special File, Change Directory and Change Root, Change Owner and Change Mode, Stat and Fstat, Pipes, Dup, Mounting and Unmounting file systems, Link, Unlink, File System Abstractions, File System maintenance.	**10**
IV	**Unit: IV The Structure of Process** Process stages and transitions, layout of system memory, the context of a process, Saving context of a process, manipulation of the process address space.	**5**
V	**Unit: V Process Control** Process creation, signals, process termination, awaiting process termination, invoking other programs, the user id of a process, the shell, System Boot and the Init process, Process Scheduling and Time : Process Scheduling, system call for time, clock.	**9**
VI	**Unit: VI Memory Management Policies** Swapping, Demand passing, hybrid system with demand paging and swapping.	**5**
Text Books		
i)	"The Design of Unix Operating System", Maurice J. Bach, PHI.	
Reference Books		
i)	"Unix Concepts and Administration", Sumitabha Das, TMGH, 3rd Edition.	
ii)	"Unix Shell Programming", Yeshvant Kanetkar, BPB Publications.	
iii)	"Unix Utilities", Tare, MGM.	
iv)	"Advanced Programming in the UNIX Environment", Stevens and Rego, Pearson Education, 2nd Edition..	
Assessment		
	a) ISE has a total weightage of 30 marks which is a (20+10) marks pattern. Theory paper examination will be conducted at central level for 20 marks. 10 marks will be given based on the assignments on each unit. It consists of assignments, quiz, seminars, presentations, research papers and research articles, developing working models, surveys and activities related to course as designed by the course coordinator to suit the needs of the course and to complement program outcomes. The practical work and its journal is not part of course work. b) ESE will be conducted at central level at the end of the semester. It will be theory paper for 100 Marks and then it will be scaled down for 70 marks.	

Year, Program, Semester	**T.Y. B. Tech (Computer Science and Technology) , Part III, Semester VI**					
Course Code	PEC321					
Course Category	**Elective-I**					
Course title	**Image Processing**					
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**		**Total Credits**
	03	**-**	**-**	**03**		**03**
Evaluation Scheme	**ISE**		**ESE**	**IE**	**EE**	**Total**
	30		**70**	**-**	**-**	**100**
Pre-requisites (if any)	PCC 315,PCC 322					
Course Objectives	The Course is aimed at- 1. Introduce the students to the fundamental techniques. 2. Study algorithms used for acquiring, processing and extracting useful information from digital images 3. Emphasizes on covering basic image processing operations. 4. cover the basic analytical methods which are widely used in image processing 5. Study mathematical principles of digital image enhancement 6. Give the students some advanced topics in digital image processing					
Course Outcomes	Upon completion of this course, student should be able to – 1. Introduce basic display devices. 2. Describe the roles and the scope of image processing systems in a variety of applications 3. Learn how to explore on color image features and transformation techniques. 4. Develop the insight of how digital images are represented. 5. Evaluate the mathematical principles of digital image enhancement 6. Explore and apply the concepts of Edge detection, segmentation and object recognition					

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2	2	-	-	-	-	-	-	-	-	-	-	2	-	-
CO 2	1	1	2	2	1	-	-	-	-	-	-	-	2	-	-
CO 3	2	2	2	2	2	-	-	-	-	-	-	-	2	-	-
CO 4	2	2	-	2	1	-	-	-	-	-	-	-	2	-	-
CO 5	2	2	2	2	2	-	-	-	-	-	-	-	2	-	-
CO 6	2	2	2	2	2	-	-	-	-	-	-	-	2	-	-

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	*Curriculum Content*	Hours
I	**Unit I** **Introduction** Concept of digital image processing, steps in image processing, components of image processing system, Applications areas.	6
II	**Unit II** **Digital Image Fundamentals** Image sensing and acquisition, Basic concept of sampling and quantization, representations of digital image, spatial and grey level resolution, zooming and shrinking of image, Basic relationship between pixels.	6
III	**Unit III** **Colour Image Processing** Colour fundamentals, colour models, RGB colour model, CMY colour model, HSI colour model, pseudo-colour image processing: intensity slicing, grey level to colour transformation	7
IV	**Unit IV** **Edge Detection And Segmentation** Detection of discontinuities: point, line and edge detection, Thresholding, Region based segmentation	6
V	**Unit V** **Image Enhancement In Spatial Domain** Basic grey level transformations, image negation, log transformations, power law transformations, piece wise linear transformations, histogram processing, histogram equalization, histogram matching, Image enhancement using arithmetic and logical operations	7
VI	**Unit VI** **Object Recognition** Patterns and Pattern Classes, Recognition Based on Decision-Theoretic Methods, Matching, Optimum Statistical Classifiers, Structural Methods, Matching Shape Numbers, String Matching.	7
	Suggested Text Books:	
	1. R.C.Gonzalez and R.E.Woods, “Digital Image Processing”, Addison-Wesley Longman, Inc, 1999	
	Suggested Reference Books:	
	1. A.K.Jain, “Digital Image Processing”, PHL	
	2. M.Sonka, V.Hlavac, and R.Boyle – Image processing, Analysis and Machine vision, Thomson Asia pvt. Ltd, 1999.	

<table>
<tr><td>Year, Program, Semester</td><td colspan="7">T.Y. B. Tech (Computer Science and Technology) , Part III, Semester VI</td></tr>
<tr><td>Course Code</td><td colspan="7">OEC 321</td></tr>
<tr><td>Course Category</td><td colspan="7">Open Elective -I</td></tr>
<tr><td>Course title</td><td colspan="7">Industrial Economics and Management</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td colspan="2">Total Contact Hours</td><td colspan="2">Total Credits</td></tr>
<tr><td>03</td><td>-</td><td>-</td><td colspan="2">03</td><td colspan="2">03</td></tr>
<tr><td>Evaluation Scheme</td><td>ISE</td><td>ESE</td><td>IOE</td><td>IPE</td><td>EOE</td><td>EPE</td><td>Total</td></tr>
<tr><td></td><td>30</td><td>70</td><td>-</td><td>-</td><td>-</td><td>-</td><td>100</td></tr>
<tr><td>Pre-requisites(if any)</td><td colspan="7">BSC211, BSC 221,HSMEC 211,PCC 223</td></tr>
<tr><td>Course Rationale</td><td colspan="7">This course provides basic knowledge about the concepts of economics and management. The emphasis is deal with various concepts related to economic problems, national income, inflation, food processing industries, principles of management, production, finance, and marketing management and its relevance.</td></tr>
<tr><td>Course Objectives</td><td colspan="7">The course aims to provide students with:
1. Fundamentals of Economics – Understanding the basic concepts of micro and macroeconomics relevant to industries.
2. Industrial Structure & Growth – Analyzing different industrial structures, market conditions, and factors influencing industrial growth.
3. Cost & Production Analysis – Understanding cost concepts, production functions, and pricing strategies for business decision- making.
4. Market Structures & Competition – Examining different types of market structures such as monopoly, oligopoly, and perfect competition.
5. Economic Policies & Industrial Development – Evaluating government policies, trade regulations, and their impact on industries.
6. Financial & Business Management – Gaining knowledge of financial statements, investment decisions, and capital management.</td></tr>
<tr><td>Course Outcomes</td><td colspan="7">After completing the course, students will be able to:
1. Explain fundamental economic concepts and their application in industrial decision-making.
2. Analyze industrial structures, growth factors, and government policies affecting industries.
3. Apply cost and production theories to optimize business operations and pricing strategies.
4. Differentiate various market structures and assess competition levels in industrial sectors.
5. Evaluate financial statements and investment decisions to enhance Business profitability.
6. Develop strategic business plans and apply management principles in Industrial operations.</td></tr>
</table>

Course Outcome and Program Outcome Mapping

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	2	1	-	1	-	-	-	1	2	1
CO2	3	3	2	2	-	1	1	-	-	1	3	2
CO3	3	3	3	3	2	1	1	-	-	1	3	2
CO4	2	3	3	2	2	2	1	-	1	2	2	2
CO5	3	2	2	3	2	1	2	1	1	2	3	2
CO6	3	2	3	2	1	2	2	2	2	3	3	3

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I.	**Demand Analysis and Forecasting** Economic problem, law of diminishing utility, consumer surplus. Demand: concepts, types of demand, demand function, law of demand and determinant of demand, Forecasting concept, types, steps and techniques of demand forecasting.	**06**
II.	**Market and Inflation** Concepts of costs, cost curves and revenue curves of a firm Market, break-even point Market: Meaning, types of market – Perfect Competition, Monopoly, Oligopoly, Monopolistic Competition. Inflation: Causes, measurement, effects, controlling of inflation. Index Numbers.	**08**
III.	**Industrialization** Industrialization: Need, Importance and Problems, Classification of Industries: role, problems and remedies, Industrial Productivity: norms, measurement, importance and Factors affecting productivity. New Economic Reforms: Liberalization, Privatization and Globalization GATT, WTO agreement, Foreign exchange.	**08**
IV.	**Principles of Management** Definition, nature, levels of management, functions of management. Planning Nature, importance, types of plans, planning process, decision making. Organization: Principles of organization, organizational structure. Directing, Theories of Motivation, Communication: process and barriers, Leadership styles, Controlling: Control techniques.	**07**

V.	**Production Management** Production Management: Definition, Objectives, Functions and Scope, Production Planning and Control; its significance, stages in production planning and control. Concepts of material management and inventory control: importance and various Methods.	**05**
VI.	**Financial and Marketing Management** Financial Management: Scope and importance, capital structure planning, working capital management, sources of funds. Marketing Management: Definition of marketing, marketing concept, objectives and functions of marketing. Marketing Research – Meaning; Definition; objectives; Importance; Limitations. Advertising – meaning, objectives, functions.	**06**
Text Books		
1.	Divedi, D.N, "Managerial Economics". Vikas, New Delhi,2003	
2.	Ahuja, H.L, "Advanced Economic Theory". S. Chand Publication, New Delhi,2017	
3.	Gupta, R.S., Sharma, B.D., Bhalla, N.S, "Principles and Practice of Management". Kalyani Publishers,2018	
4.	Pugel. T.A, "International Economics". McGraw-Hill Education, 16th edition,2016	
Reference Books		
1.	Koutsoyiannis, "Modern Microeconomics". Macmillan Press Ltd.,2008	
2.	Jhingan, M.L,"Principles of Economics" (Hindi and English), Vikas, New Delhi,2019	
3.	Seth, M.L., "Principles of Economics" (Hindi and English), Laxmi Narayan, Agra, 2020	
4.	Ahuja, H.L., "Economic Environment of Business - Macroeconomic Analysis" S. Chand Publication, New Delhi, 2019.	
5.	Ahuja, H.L., "Macro Economics Theory and Policy" S. Chand Publication, New Delhi,2019.	

Year, Program, Semester	**T.Y. B. Tech (Computer Science and Technology) , Part III, Semester VI**					
Course Code	MDM 321					
Course Category	Multidisciplinary Minor Course III					
Course title	**IoT with Arduino, ESP, and Raspberry Pi**					
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**		**Total Credits**
	03	-	-	03		03
Evaluation Scheme	**ISE**		**ESE**	**IE**	EE	**Total**
	30		70	00	00	100
Pre-requisites(if any)	Basic knowledge of Computer Systems.					
Course Objectives	The Course is aimed to- 1. Give students hands-on experience using different IoT architectures. 2. Provide skills for interfacing sensors and actuators with different IoTarchitectures. 3. Develop skills on data collection and logging in the cloud.					
Course Outcomes	After completion of course, students would be able: 1. To understand Arduino Uno, NODE MCU 8266 and Raspberry PI along with critical protocols and its communication to cloud. 2. To apply commonly used IOT protocols such as REST API, MQTT through IOT based demonstration. 3. To solve analog sensor and digital sensor interfacing with IOT devices.					

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2						3								
CO 2	1					3	2								
CO 3	2					3					2				

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	IoT- introduction and its components, IoT building blocks, Sensors and Actuators, IoT Devices, IoT boards (Arduino Uno, ESP 8266-12E Node MCU, and Raspberry Pi 3).	5
II	Arduino Uno – getting started with the Uno boards, blink program, connection of sensors to the Uno board, reading values of sensors from the Uno board, interrupts. Case study: Temperature/Humidity Control; Case Study: Sending values Temperature/Humidity values to the Internet via GSM module.	9
III	ESP 8266-12E Node MCU – getting started with the ESP board, Micropython and Esplorer IDE, Flushing the ESP8266 board with micropython, connecting sensors to the ESP board, Connecting ESP board to WiFi, Interfacing ESP with the Cloud (REST API- GET, POST, MQTT), interrupts, comparison of ESP 32 board with the ESP 8266 board. Case Study: Switching light on /off remotely. Case Study: Voice-based Home Automation for switching lights on/off (Android phone – Google Assistant (Assistant <-> IFTTT), MQTT (ESP <-> IFTTT), ESP 8266 <-> Lights).	8
IV	Raspberry Pi 3 - Rpi3 introduction and installing the Raspbian Stretch OS, Headless - Computer and Rpi3 configuration to connect through SSH via Ethernet, Headless - connecting Rpi3 remotely without Ethernet cable via SSH, IP address, Rpi 3 - Testing the GPIO pins through Scripts.	8
V	Raspberry pi3 interfacing with Sensor DHT11, Raspberry pi3 python library install and reading sensor feed, 'Plug and play ' type cloud platform overview for integration to IOT devices, 'Plug and play' cloud platform for integration to IOT device - actuator (LED), Plug and play platform - Custom widget (DHT11-Sensor) integration through Python. New - Raspeberry Pi 4 Vs Raspberry Pi3 Mobel B Comparison, LoRawan /LPWAN – Overview.	9
Text Books		
i	Rao, M. (2018). Internet of Things with Raspberry Pi 3: Leverage the power of Raspberry Pi 3 and JavaScript to build exciting IoT projects. Packt Publishing Ltd	
ii	Baichtal, J. (2013). *Arduino for beginners: essential skills every maker needs*. Pearson Education.	
Reference Books		
i	Schwartz, M. (2016). *Internet of Things with ESP8266*. Packt Publishing Ltd.	
ii	Richardson, M., & Wallace, S. (2012). *Getting started with raspberry PI*. " O'Reilly Publisher Media, Inc."	
Lab Work		
1	Study on Understanding Arduino UNO Board, Installation and work with Arduino IDE	
2	Rpi3 introduction and installing the Raspbian Stretch OS	

3	Study on the graphic user interface for Raspian Linux distribution and operate the Raspberry Pi in "headless mode".
4	Hands on basic Linux Commands
5	Testing the GPIO pins of Rpiby python programs and scripts.
6	Raspberry pi3 python library installation and reading sensor feed.
7	'Plug and play ' type cloud platform overview for integration to IoT devices
8	Establishing a standalone web server on a Raspberry Pi to display temperature and humidity data gathered from a DHT11 sensor linked through an 8266 module
9	Control two outputs of an ESP8266 using MQTT protocol.
10	Study on ESP 8266-12E Node MCU
11	Design and Development of project for Switching light on /off remotely using Node MCU
12	Environment setup for Android Things with Raspberry pi.
Assessment	
	a. ISE has a total weightage of 30 marks which is a (20+10) marks pattern. Theory paper examination will be conducted at central level for 20 marks. **10 marks will be given based on the assignments of lab work.** It consists of assignments, quiz, seminars, presentations, research papers and research articles, developing working models, surveys and activities related to course as designed by the course coordinator to suit the needs of the course and to complement program outcomes. The practical work and its journal is not part of course work. b. ESE will be conducted at central level at the end of the semester. It will be theory paper for 100 Marks and then it will be scaled down for 70 marks.

Year, Program, Semester	T.Y. B.Tech (Computer Science and Technology) , Part III, Semester VI				
Course Code	PCC324				
Course Category	Professional Core Course				
Course title	**Advanced Programming Lab**				
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**Total Credits**
	02	-	02	04	03
Evaluation Scheme	**IE:50**			**EE: 50**	**Total=100**
Pre-requisites (if any)	Programming knowledge				
Course Objectives	The Course is aimed at- 1. Understand .net Architecture 2. Implement OOPS Concepts with C# 3. Implementing Inheritance, Exception Handling in C# 4. Use windows controls and to program them. 5. To develop user friendly application 6. Handle database in C#				
Course Outcomes	Upon completion of this course, student should be able to – 1. Describe .net Architecture. 2. Write program using OOPS concepts in C# 3. Describe exception handling in C# 4. Implement inheritance in C# 5. Develop windows applications. 6. Handle data using ADO.net in C#.				

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2	-	-	-	1	-	-	-	-	-	-	-	-	-	-
CO 2	2	-	2	-	2	-	-	-	-	-	-	-	-	-	-
CO 3	2	-	2	-	3	-	-	-	-	-	-	-	-	-	-
CO 4	2	-	2	-	3	-	-	-	-	-	-	-	-	-	-
CO 5	2	1	2	-	3	-	-	-	-	-	-	-	-	-	-
CO 6	2	1	2	-	3	-	-	-	-	-	-	-	-	-	-

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**Unit I: .NET Architecture** The Relationship of C# to .NET, The Common Language Runtime, A Closer Look at Intermediate Language, Assemblies, .NET Framework Classes, Namespaces	2
II	**Unit II: C# Basics** Variables, Predefined Data Types, Flow Control, Enumerations, Arrays, Namespaces, The Main () Method, More on Compiling C# Files, Console I/O, Using Comments, The C# Preprocessor Directives, C# Programming Guidelines Classes and Structs, Class Members, Constructors, Constructor Overloading, Destructors .	3
III	**Unit III: Inheritance, Exception Handling** Types of Inheritance, Implementation Inheritance, Modifiers, Method Overloading, Method Overriding, Interfaces Exception classes , Introduction to Exceptions Exception handling, The Exception Class, C# Exception Handling Keywords, The Exception Chain, Nested Exception Handling, User-Defined Exception Classes	4
IV	**Unit IV : Using Controls for Application Development** Control like : Textbox, Button, Radiobutton, Checkbox, Listbox, Combobox etc Different Properties like: Name, Text, TabStop, TabIndex, Enabled, Selction Mode etc Events like: Keypress, Validating, Validated, Click, Checked Changed, Selection Index Changed etc	7
V	**Unit V: Other Controls like Menu and Containers** Menu Strip, Status Strip, Tool Strip, Context Menu Strip, Group Box, Tab Control, Panel, Tab Control.	3
VI	**Unit VI: Using ADO.net** ADO.NET object model ,Connected and disconnected environment, Data sets and data adaptors, Command object and data readers, Data tables, rows and columns, data grid view control, Data View, Constraints and relations.	7

Suggested list of Assignments:

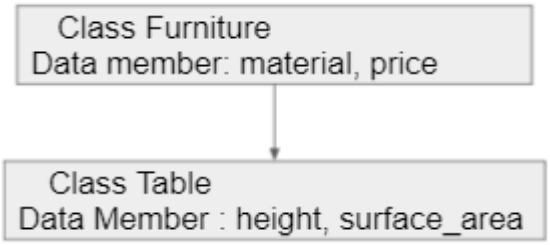
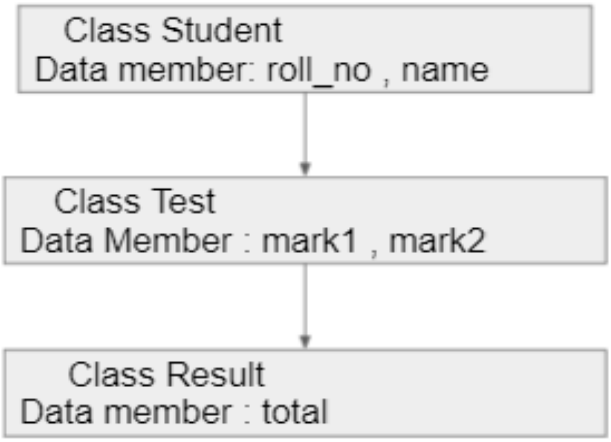
1. Explain Architecture of NET framework and explain CLR execution model.
2. Write a console Application for conditional statement and loops.
3. Explain the array the and information of class and structure.
4. Parameterized constructor and its types.

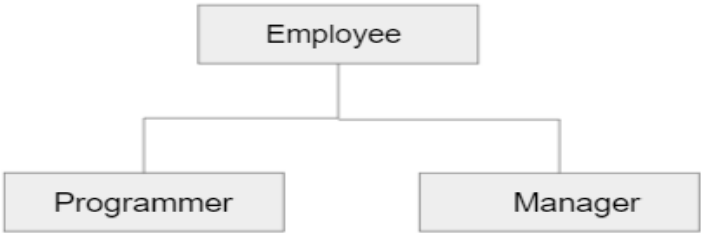
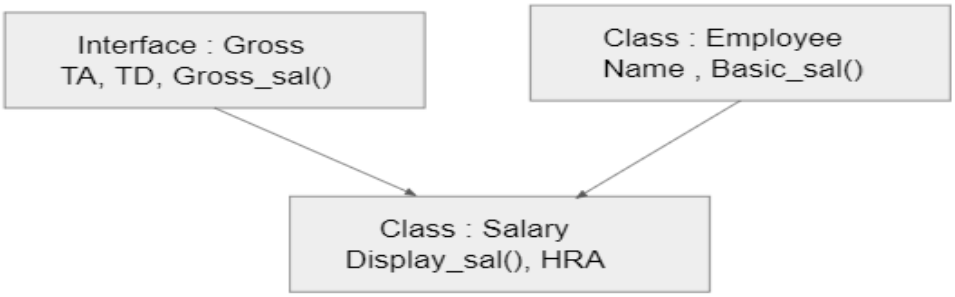
5. Write a program on single inheritance, multilevel inheritance and hierarchy.
6. Write a program on Method overloading ,method overriding, and method hiding
7. Write a program on Interface and Abstract class.
8. Write a program on Enumeration.
9. Exception handling implementation using.
10. Study of Boxing and Unboxing and study of Boolean case.
11. Design and develop window application for simple calculator.
12. Develop window application for student information.
13. Develop sample window application form.

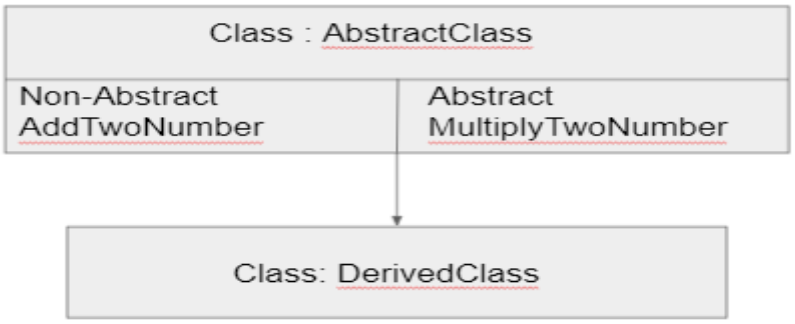
General Instructions:
1. Students must implement 12-14 assignments from above list of assignment

Details for Experiment Implementation

Sr. No.	List of Experiments
1.	• Explain Architecture of .NET Framework • Explain CLR Execution model.
2.	Write a console Application for conditional statements and loops: 1. Write a console Application that places double quotation marks around each word in a string. 2. Generate prime numbers. 3. Reverse a number and find the sum of digits of a number. 4. Test for vowels. 5. Generate Fibonacci series. 6. Generate diamante pattern with number.
3.	Note: Explain the array and information of class and structure. Q1. Write a program in C# to find the second largest element in a single dimensional array Q2. Write a program to declare a class “staff” having data members as name and post.accept this data 5 for 5 staffs and display names of staff who are HOD. Q3. Write an application that receives the following information from a set of students: Student Id: Student Name: Course Name: Date of Birth: The application should also display the information of all the students once the data is Entered. Implement this using an Array of Structures.

	Q4 .Write a program in C# to multiply two matrices using multidimensional arrays. Q5. Find the sum of all the elements present in a jagged array of 3 inner arrays. Q6. Write a program for finding the reverse of the string array by using array function argument.
4.	**Assignment No 4** Q1. Write a Program to Declare class 'Distance' have data members dist1, dist2, dist3. Initialization two data members using constructor and store their addition in the third data member using function and display addition.(parameterized Constructor) Q2. Define a class 'Salary' which will contain member variables Basic, TA, DA, HRA. Write a program using Constructor with default values for DA and HRA and calculate the salary of the employee.(parameter less Constructor). Q3. Write a program using Copy Constructor to initialize a new instance to the values of an existing instance.(Define class 'Student' have data members Name , roll number, address, genter) Q4.Write a program Constructor overloading.(add the numbers)
5.	Q 1. Write a program to implement single inheritance from the following figure. accept and display data for one table.  Q2.Write a program to implement multilevel inheritance from the following figure. accept and display data for one student.  Q 3. Write a program for the above hierarchy for the Employee where the base class is

	Employee and derived class are Programmer and Manager. Here makes the display function visual common for all and which will display information of Programmer and Manager interactively. 
6.	(Method Overloading, Method Overriding, Method hiding) Q.1. Write a program using method overloading to swap two integer numbers and swap two float numbers. Q.2. Write a program using method overloading to add the numbers by changing the number of parameters. Q.3. Write a program using method overloading to display the name and id of a student by changing the order of the parameters. Q.4. Method overriding Q.5. Method hiding
7.	Interface And Abstract Class Q 1. Program to implement the following multiple inheritance using interface.  Q.2. Program to implement default implementation and Explicit Implementation using interface. Q.3. Program to calculate the area of square using abstract class and abstract method. Q.4. Program to implement the following non-abstract and abstract method using abstract class.

	
8.	Enumeration Q.1. Write a program to create an enum. Here an enum with name **month** is created and its data members are the name of months like jan, feb, mar, apr, may. Now let's try to print the default integer values of these enums. Q.2 . Write a program to create an enum. Here an enum with name **gender** is created and its data members are the name of Male, Female, Unknown. Now let's try to print the Name and Gender.(using switch case
9.	Exception Handling Q.1 .Write a program to show how exceptions occurred in a program. Q.2. Write a program to accept a number form the user and throw an exception if the number is not an even number. Q.3.Write a program to accept a two number form the user and divide the number and multiple try catch block exceptions .(Format Exception, Overflow Exception, DivideByZero Exception,Exception) Q.4. Write a program to user-defined Exception
10.	**Note: Information about type casting** Q.1. Study of boxing and Unboxing (also Write a code). Q.2.If you have two integers stored in variable var1 and var2, what boolean test can you perform to see if not both numbers are greater than 10?
11.	Q.1. Design & Develop windows application for simple Calculator
12.	Q.1. Develop sample windows application for Student Information.(label, textbox, button,radioButton,checkBox,comboBox,groupBox). (using Page navigation displays information on another page).
13.	Q.1. develop Windows application for registration page using validation (name email id, contact no, password, confirm password).(after login button click message box display yes no cancel)

	Q. 2 Develop Sample window application for read and write the file .(menustrip use) open an exit button use menu strip, read write and search button in form
14.	Q1 Develop sample Windows application Form. (Collection information and display that information in gridview with table) name, mobile number ,courses, year
15.	ADO.NET Using generate windows form and web applications. Q.1 . Develop sample Windows application form. use database connectivity table include ID, name, email, contact number . buttons insert update delete. Q.2. Develop sample ASP.Net Web application. use database connectivity table include ID, name, email, contact number . Display information in GridView.

Text Books	
i)	Christian Nagel, Bill Evjen, Jay Glynn, Morgan Skinner, Karli Watson, "Beginning C# 2008" – Wrox Publication
ii)	Christian Nagel, Bill Evjen, Jay Glynn, Morgan Skinner, Karli Watson, "Professional C# 2008" – Wrox Publication
Reference Books	
i)	Chapman "Teach yourself Visual C++ in 21days" Techmedia publications
ii)	Jon Bates & Tim Tompkins "Practical Visual C++" (PHI)

Year, Program, Semester	T.Y. B. Tech (Computer Science and Technology) , Part III, Semester VI					
Course Code	AEC321					
Course Category	Ability Enhancement Course					
Course title	**Mini Project –III**					
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**Total Credits**	
	-	**-**	**02**	**01**	**01**	
Evaluation Scheme	**ISE**	**ESE**	**IE**	**EE**	**Total**	
	-	**-**	**50**	**-**	**50**	
Pre-requisites(if any)	Basics of Programming Language and Computers					
Course Objectives	The Course is aimed to- 1. Create awareness among the students to express technical ideas, strategies and methodologies in written form. 2. Enable students to work as a responsible member and possibly a leader of a team in developing software solutions. 3. Motivate students to self-learn new tools, algorithms, and/or techniques that contribute to the software solution of the project 4. Create awareness among the students of the characteristics of several domain areas where IT can be effectively used. 5. Improve the team building, communication and management skills of the students 6. Enable students to develop a design solution for a set of requirements					
Course Outcomes	Upon completion of this course, student should be able to – 1. Acquire practical knowledge within the chosen area of technology for project development 2. Identify, analyze and handle programming projects with a comprehensive and systematic approach 3. Contribute as an individual or in a team in development of technical projects 4. Develop effective communication skills for presentation of project related activities 5. Formulate and propose a plan for creating a solution for the problem identified 6. Report and present the findings of the study conducted in the preferred domain					

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	-	-	2		-	-	-	-	-	-	-	-	-	-	-
CO 2	-	-	2	2	-	-	-	-	-	-	-	-	-	-	-
CO 3	-	-	-	-	-	-	-	-	2	2	-	-	-	-	-
CO 4	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	2	2	-	-	-

Level of Mapping as: Low 1, Moderate 2, High 3

Course Content

Mini Project III is a continuation of the experiential learning journey initiated in Semester IV. Building upon the foundations laid in Mini Project II, students will delve deeper into project activities related to their chosen area of interest within Computer Science and Technology. The course encompasses following component:

Mini Project III: Students will continue their project activities from the preceding semester, further refining their research objectives, conducting experiments, analyzing data, and presenting findings. Emphasis will be placed on applying advanced concepts and techniques to address specific challenges or opportunities identified in the chosen project area.

The course will be conducted over the duration of two hour practical per week, with additional time allocated for project work as necessary. Assessment will be based on project presentations, reports, evaluating students' understanding, application, and integration of theoretical and practical knowledge.

The mini-project should be undertaken preferably by a group of 3 students who will jointly work and implement the mini-project. The group will select a project with the approval of the guide. A batch of practical / Tutorial will be divided into mini project groups. Mini project topics and the work for these groups in the batch will be guided by a teacher for the batch, preferably on one of the topics like Compiler Construction, Database Engineering, Operating System, Computer Graphics and Multimedia, Advanced Programming and latest developments and trends in Computer Science and Technology. The teacher will periodically assess the performance of individual student in the mini project, jointly with a teacher of another batch. Project group will submit hardcopy project report along with project demonstration software in CD and/or project hardware gadget at the term end. The IOE of mini project will be jointly conducted by appointed examiners. Note: Use of Open source tools should be preferred.

Course Assessment Process

The appointed examiners will follow the instructions as below:

Evaluation Format: The evaluation may be conducted using a combination of assessment methods, including:

- Rubric-based assessment for mini project.
- Peer evaluation for team-based projects.
- Written exams or quizzes to assess theoretical knowledge.
- Instructor-led discussions or presentations to evaluate communication skills and critical thinking.
- Overall course grading based on a weighted average of individual assessments and participation.

Year, Program, Semester	T.Y. B.Tech (Computer Science and Technology) , Part III, Semester VI			
Course Code	VSEC321			
Course Category	Vocational and Skill Enhancement Course			
Course title	**Design Thinking and Innovation-III**			
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**
	01	**-**	**-**	**01**
Evaluation Scheme	IE at Course in charge end			
Pre-requisites(if any)	The Design Thinking & Innovation III course aims to bridge the gap between conceptual design and real-world application. By integrating advanced design thinking methodologies with industry-relevant challenges, the course prepares students to develop, validate, and execute innovative solutions. This progression ensures that students transition from ideation to actionable strategies that are market-ready and impactful.			
Course Objectives	The Course is aimed to- 1. To advance students' capabilities in synthesizing complex design challenges into feasible solutions. 2. To refine iterative problem-solving skills through industry-focused projects and case studies. 3. To cultivate a proactive, entrepreneurial mindset that addresses sustainability and societal needs.			
Course Outcomes	Upon completion of this course, student should be able to – 1. Analyze complex problems to develop innovative, user-centric design solutions. 2. Apply advanced prototyping techniques to validate and optimize product concepts. 3. Collaborate effectively across disciplines to deliver actionable and sustainable innovations. 4. Evaluate and align solutions with market trends, user feedback, and ethical considerations.			

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2	3	3	-		2	-	-	-	-	-	-	-	-	-
CO 2	2	-	2	2	3	-	-	-	-	-	-	-	-	-	-
CO 3	-	-	-	-	-	-	-	-	3	3	-	-	-	-	-
CO 4	2	-	-	-	-	-	3	-	-	-	-	2	-	-	-

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**Design Thinking Framework Revisited** • Advanced principles of empathy, ideation, and prototyping. • Reflection on learning from Design Thinking & Innovation I and II. • Introduction to systems thinking in the design context.	2
II	**Problem Scoping and Opportunity Identification** • Techniques for problem discovery and framing. • Identifying gaps and opportunities in existing systems. • Leveraging tools like Journey Mapping and SWOT Analysis.	2
III	**: Ideation Techniques and Advanced Prototyping** • Brainstorming 2.0: Mind Mapping and SCAMPER techniques. • Prototyping with a focus on technology integration. • Real-world prototyping examples from diverse industries.	3
IV	**: Validation and Iterative Development** • Usability testing methods and feedback incorporation. • Iterative design models: Agile and Lean principles. • Creating Minimum Viable Products (MVPs).	2
V	**: Innovation Strategy and Entrepreneurship** • Bridging design with business models (Canvas Model). • Strategies for market positioning and scaling innovations. • Ethical considerations and sustainable innovation practices.	3
VI	**: Case Studies and Capstone Projects** • Real-world applications of design thinking in Computer Science and Technology. • Group projects focusing on an innovative solution for an industry-related problem. • Presentation and feedback.	2

General Instructions:

Pedagogical Strategies

- **Interactive Sessions:** Facilitators to encourage collaborative discussions and problem-solving activities.
- **Hands-On Assignments:** Individual and group-based projects for practical application.
- **Case Studies:** Industry-specific scenarios for analysis and solution generation.
- **Technology Integration:** Use of tools like Miro, Figma, or Scilab for design processes.

Assessment Methods

1. **Formative Assessments:**
   - Assignments: Application of unit-specific tools (20%).
   - Group Activities: Problem framing and solution ideation tasks (30%).
2. **Summative Assessments:**
   - Final Presentation of Capstone Project (50%).

Reference Books	
1.	Brown, T. (2009). *Change by Design*. HarperBusiness.
2.	Lewrick, M., Link, P., & Leifer, L. (2018). *The Design Thinking Playbook*. Wiley.
3.	Plattner, H., Meinel, C., & Leifer, L. (2020). *Design Thinking Research*. Springer.
4.	Christensen, C. M. (2013). *The Innovator's Dilemma*. Harvard Business Review Press.

Year, Program, Semester	T.Y. B.Tech (Computer Science and Technology) , Part III, Semester VI			
Course Code	MAC321			
Course Category	Mandatory Audit Course			
Course title	**Aptitude Enhancement Course III**			
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**
	-	**01**	**-**	**01**
Evaluation Scheme	IE at Course in charge end			
Pre-requisites(if any)	Basic Mathematical Concepts			
Course Objectives	The Course is aimed to- 1. Equip students with techniques for solving quantitative aptitude problems like interest and mixture. 2. Enhance logical reasoning abilities, including decision-making and assertion-reason analysis. 3. Develop skills to calculate and apply geometric areas, volumes, and surface areas in problem-solving. 4. Introduce fundamental concepts of probability and statistics for solving quantitative problems. 5. Strengthen abilities to solve time-based problems, improving speed and accuracy. 6. Train students to recognize and solve logical sequences and patterns in reasoning and mathematics.			
Course Outcomes	Upon completion of this course, student should be able to – 1. Solve quantitative aptitude problems related to Boats and Streams, Trains, Mixtures, and Interest calculations effectively. 2. Develop logical reasoning skills for problems like decision-making, number ranking, and time sequence tests. 3. Calculate areas, volumes, and surface areas of geometric shapes and apply them to practical problems. 4. Apply probability and statistical analysis in solving real-world problems like stocks, shares, and series. 5. Solve time-based problems involving calendars, clocks, and distances, enhancing time management skills. 6. Master advanced techniques in Permutations, Combinations, and other mathematical concepts for higher-level exams.			

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	1	2	-	-	-	-	-	-	-	-	1	-	-	-
CO 2	3	1	2	-	-	-	-	-	-	-	-	1	-	-	-
CO 3	3	1	2	-	-	-	-	-	-	-	-	1	-	-	-
CO 4	3	1	2	-	-	-	-	-	-	-	-	1	-	-	-
CO5	1	-	1	-	-	-	-	-	-	-	-	1	-	-	-
CO6	1	-	1	-	-	-	-	-	-	-	-	1	-	-	-

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**Quantitative Aptitude 1** Boats and Streams, Problems on Trains, Alligation or Mixture, Simple Interest.	2
II	**Quantitative Aptitude 2** Compound Interest, Area, Volume and Surface Area, Races and Games of Skill.	2
III	**Quantitative Aptitude 3** Calendar, Clocks, Stocks and Shares, Permutations and Combinations.	2
IV	**Quantitative Aptitude 4** Probability, True Discount, Banker's Discount, Heights and Distances, Odd Man Out and Series.	2
V	**Logical Reasoning 1** Number ranking and time sequence test, Decision making, Assertion and reason, Situation reaction Test.	2
VI	**Logical Reasoning 2** Mathematical Operations, Inserting the missing one, logical sequence of words.	2

General Instructions:
Each Student has to write at least 6 assignments on entire syllabus.

Reference Books	
i)	Dr. R S Aggarwal — Quantitative aptitude, S. Chand Publication.
ii)	R V Praveen — Quantitative aptitude and logical reasoning, 2nd Edition, PHI Publication.

Assessment	
	Assessment will be done by Course Teacher. MCQ Test can be conducted based on the syllabus.

Third Year B. Tech (CST) SEM – V Equivalence with Old Syllabus

Sr. No.	Third Year B. Tech Semester V Pre-revised syllabus	Third Year B. TechSemester V Revised syllabus	Remark
1	System Programming	System Programming	No change in the subject content
2	Design and Analysis of Algorithm	Design and Analysis of Algorithm	No change in the subject content
3	Operating System	Operating System	No change in the subject content
4	Machine Learning	Machine Learning	No change in the subject content
5	Database Engineering	Database Engineering	No change in the subject content
6	Free Open Source Software Lab	Free Open Source Software Lab	No change in the subject content
7	Database Engineering Lab	Database Engineering Lab	No change in the subject content
8	Java Programming Lab	Java Programming Lab	No change in the subject content
9	Seminar	Seminar	No change in the subject content
10	Internship- I	------	Shifted to Sem VIII
11	Research Methodology	------	Course Removed
12	------	Aptitude Enhancement Course II	Newly introduced.
13	------	Introduction to Foreign Language	Made it as a Credit course.

Third Year B. Tech (CST) SEM – VI Equivalence with Old Syllabus

Sr. No.	Third Year B. Tech Semester VI Pre-revised syllabus	Third Year B. Tech Semester VI Revised syllabus	Remark
1	Compiler Construction	Compiler Construction	No change in the subject content
2	Advanced Operating System	Elective I (Advanced Operating System)	Shifted to Elective I Sem VI
3	Object Oriented Modeling and Design	Elective I (Object Oriented Modeling and Design)	Shifted to Elective I Sem VI
4	Computer Graphics and Multimedia Techniques	Computer Graphics and Multimedia Techniques	No change in the subject content
5	------	Distributed and Cloud Computing	Taken from Sem VII
6	Engineering Economics	------	Subject Removed
7	------	Open Elective I (Industrial Economics and Management)	Newly introduced
8	Object Oriented Modeling and Design Lab	------	Lab removed
9	Computer Graphics and Multimedia Techniques Lab	Computer Graphics and Multimedia Techniques Lab	No change in the subject content
10	Advanced Programming Lab	Advanced Programming Lab	No change in the subject content
11	Mini Project	Mini Project – III	No change in the subject content. Made it as a Credit course.
12	Introduction to Foreign Language	------	Shifted to Sem V Made it as a Credit course
13	------	Design Thinking & Innovation – III	Newly introduced.
14	------	Aptitude Enhancement Course III	Newly introduced.