



**WALCHAND INSTITUTE OF TECHNOLOGY  
(AUTONOMOUS INSTITUTE)**

**Name of the Faculty: Science and Technology**

**CHOICE BASED CREDIT SYSTEM**

**Structure and Syllabus : Computer Science & Engineering**

**Name of the Course: T.Y. B. Tech. Sem V and Sem VI**

**(Syllabus to be implemented from July 2023)**

**WALCHAND INSTITUTE OF TECHNOLOGY, SOLAPUR**  
**FACULTY OF SCIENCE & TECHNOLOGY**  
**Computer Science & Engineering**

**Programme Educational Objectives and Outcomes**

***A. Program Educational Objectives***

1. Graduate will exhibit strong fundamental knowledge and technical skills in the field of Computer Science & Engineering to pursue successful professional career, higher studies and research.
2. Graduate will exhibit capabilities to understand and resolve various societal issues through their problem solving skills.
3. Graduate will be sensitive to ethical, societal and environmental issues as a software engineering professional and be committed to life-long learning.

***B. Program Outcomes***

Engineering Graduate will be able to –

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

***C. Program Specific Outcomes (PSOs)***

1. Apply the principles of computational mathematics, computer systems and programming paradigms to solve computational problems.
2. Design and develop application software with functionalities applicable for desktop, web and mobile applications with due consideration of system software constraints.
3. Apply software engineering methods, cutting edge technologies and ICT, using appropriate tools and FOSS alternatives for designing, developing & testing application software

**WALCHAND INSTITUTE OF TECHNOLOGY, SOLAPUR**  
**FACULTY OF SCIENCE & TECHNOLOGY**  
**Credit System Structure of Third Year B.Tech. (CSE) wef. 2023-2024**

**SEMESTER – V**

Course Code	Theory Course Name	Hrs./Week			Credits	Examination Scheme			
		L	T	P		ESE	ISE	ICA	Total
21CSU5CC1T	System Programming	3	--	--	3	60	40		100
21CSU5CC2T	Operating Systems	3	--	--	3	60	40		100
21CSU5CC3T	Database Engineering	3	--	--	3	60	40		100
21CSU5CC4T	Design and Analysis of Algorithm	3	--	--	3	60	40		100
21CSU5CC5T	Advanced Java Programming	2	--	--	2	--	25		25
21CSU5SL6T	Self Learning (HSS)	--	--	--	2	50	--		50
	<b>Sub Total</b>	<b>14</b>	<b>--</b>	<b>--</b>	<b>16</b>	<b>290</b>	<b>185</b>		<b>475</b>
	<b>Laboratory / Workshop</b>					<b>ESE</b>		<b>ICA</b>	
						<b>POE</b>			
21CSU5CC1L	System Programming	--	--	2	1	--		25	25
21CSU5CC2L	Operating Systems			2	1			25	25
21CSU5CC3L	Database Engineering	--	--	2	1	50		25	75
21CSU5CC4L	Design and Analysis of Algorithm	--	--	2	1	50		25	75
21CSU5CC5L	Advanced Java Programming	--	--	2	1	50		25	75
21CSU5CC7L	Mobile Application Development	--	--	2	1	--		25	25
	<b>Sub Total</b>	<b>--</b>	<b>--</b>	<b>12</b>	<b>6</b>	<b>150</b>		<b>150</b>	<b>300</b>
	<b>Grand Total</b>	<b>14</b>		<b>12</b>	<b>22</b>	<b>440</b>	<b>185</b>	<b>150</b>	<b>775</b>

- *Abbreviations: L - Lectures, P –Practical, T - Tutorial, ISE - In Semester Exam., ESE- End Semester Exam, ICA - Internal Continuous Assessment, ISE - Internal Tests, ESE University Examination (Theory &/ POE &/Oral examination)*

**Note :**

1. Batch size for the practical/tutorial shall be of 15 students. On forming the batches, if the strength of remaining student exceeds 7, then a new batch shall be formed.
2. ICA assessment shall be a continuous process based on student's performance in – class tests, assignments, homework, subject seminars, quizzes, laboratory books and their interaction and attendance for theory and lab sessions as applicable.

### 3. Self-Learning (HSS) at T.Y. B.Tech. – I

Curriculum for Humanities and Social Sciences, Self Learning (HSS) is common for all under graduate engineering programs.

A. Student can select & enroll a Self Learning (HSS) Course from

#### 21CSU5SL6T -A: HSS Course List

Sr. No.	Course Name
1	Economics
2	Intellectual Property Rights for Technology Development and Management
3	Introduction to Sociology
4	Stress and Coping
5	Professional Ethics & Human Value

OR

B. Student can select and enroll for minimum eight weeks NPTEL HSS course (UHS56SL-B), complete its assignments and appear for certificate examination conducted by NPTEL. The list of courses as shown in Table UHS56SL-B will be updated from time to time. Latest updated list will be valid for selection of self learning (HSS) courses.

More details about NPTEL are available at <http://npTEL.ac.in>.

#### 21CSU5SL6T -B : NPTEL- HSS course List

1. Soft skills	15. Management of Inventory Systems
2. Introduction to Modern India Political Thought	16. Economic Growth and Development
3. Intellectual Property	17. Ethic in Engineering Practice
4. Technical English for Engineers	18. Corporate Social Responsibility
5. Developing Soft Skills and Personality	19. Marketing Management –I
6. Educational Leadership	20. Marketing Research and Analysis
7. Microeconomics: Theory & Applications	21. Selected Topics in Decision Modeling
8. Engineering Economics	22. Innovation, Business Models and Entrepreneurship
9. Human Resource Development	23. Simulation of Business Systems: An Applied Approach
10. Project Management for managers	24. Sustainability through Green Manufacturing Systems: An Applied Approach
11. Data Analysis and Decision Making - I	25. Total Quality Management - I
12. E-Business	26. Introduction to Operations Research
13. Working Capital Management	27. Knowledge Management
14. Industrial Safety Engineering	

**WALCHAND INSTITUTE OF TECHNOLOGY, SOLAPUR**  
**FACULTY OF SCIENCE & TECHNOLOGY**

**Credit System Structure of Third Year B.Tech. (CSE) wef. 2023-2024**

**SEMESTER – VI**

<b>Course Code</b>	<b>Theory Course Name</b>	<b>Hrs./Week</b>			<b>Credits</b>	<b>Examination Scheme</b>			
		<b>L</b>	<b>T</b>	<b>P</b>		<b>ESE</b>	<b>ISE</b>	<b>ICA</b>	<b>Total</b>
21CSU6CC1T	Artificial Intelligence	3	--	--	3	60	40	--	100
21CSU6CC2T	Compiler Construction	3	--	--	3	60	40	--	100
21CSU6CC3T	Software Engineering	3	--	--	3	60	40	--	100
21CSU6CC4T	Cloud Computing	3	--	--	3	60	40	--	100
21CSU6EN5T	Professional Elective-I	3	--	--	3	60	40	--	100
21CSU6CC6T	Full Stack Development	2	--	--	2		25	--	25
	<b>Sub Total</b>	<b>17</b>	<b>--</b>	<b>--</b>	<b>17</b>	<b>300</b>	<b>225</b>	<b>--</b>	<b>525</b>
<b>Course Code</b>	<b>Laboratory Course Name</b>					<b>ESE</b>	<b>ISE</b>	<b>ICA</b>	
						<b>POE</b>			
21CSU6CC1L	Artificial Intelligence	--	--	2	1			25	25
21CSU6CC2L	Compiler Construction	--	--	2	1			25	25
21CSU6CC4L	Cloud Computing	--	--	2	1			25	25
21CSU6EN5L	Professional Elective-I	--	--	2	1			25	25
21CSU6CC6L	Full Stack Development	--	--	2	1	50		25	75
21CSU6MPL	Mini Project	--	--	2	1	50		25	75
	<b>Sub Total</b>	<b>17</b>	<b>--</b>	<b>12</b>	<b>6</b>	<b>100</b>		<b>150</b>	<b>250</b>
	<b>Grand Total</b>	<b>17</b>	<b>--</b>	<b>12</b>	<b>23</b>	<b>400</b>	<b>225</b>	<b>150</b>	<b>775</b>

- *Abbreviations: L - Lectures, P –Practical, T - Tutorial, ISE - In Semester Exam., ESE-End Semester Exam, ICA - Internal Continuous Assessment, ISE - Internal Tests, ESE University Examination (Theory &/ POE &/Oral examination)*

**Professional Elective I**

<b>Course Code</b>	<b>Course Name</b>
21CSU6E15T	Internet of Things
21CSU6E25T	Information and Cyber Security

**Note :**

1. Batch size for the practical /tutorial shall be of 15 students. On forming the batches, if the strength of remaining student exceeds 7, then a new batch shall be formed.
2. Vocational Training (evaluated at Final Year B.Tech. Part-I) of minimum 15 days shall be completed in vacation/s after S.Y. B.Tech. Part-II but before Final Year B.Tech. Part-I & the report shall be submitted and evaluated in Final Year B. Tech Part-I.

3. ICA assessment shall be a continuous process based on student's performance in – class tests, assignments, homework, subject seminars, quizzes, laboratory books and their interaction and attendance for theory and lab sessions as applicable.
4. Mini Project shall consist of developing software, based on various tools & technologies.
5. Project groups shall not be of more than **five** students.

**WALCHAND INSTITUTE OF TECHNOLOGY, SOLAPUR**

**Faculty of Science and Technology**

**Third Year B.Tech. (Computer Science & Engineering)**

**SEMESTER – V**

**21CSU5CC1T : SYSTEM PROGRAMMING**

**Teaching Scheme**

Lectures – 3 Hrs./week, 3 Credits

Practical – 2 Hrs./week, 1 Credit

**Examination Scheme**

ESE – 60 Marks

ISE – 40 Marks

ICA - 25 Marks

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**Introduction:** This course introduces Language Processing activities, which helps to understand the basics of design and development of various professional languages, along with understanding of all the system software involved in executing a particular code written in a particular language.

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**Course Prerequisite:** Students should have knowledge of Data Structures, Computer Organization, Microprocessors, Advanced C Concepts.

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**Course Outcomes:**

Student will be able to

1. Describe the basic principles of system software and tools.
2. Implement Assembler and Macros to provide program generation facilities.
3. Use LPDT tools for a relevant problem to generate a scanner and parser.
4. Apply linkers and loaders for execution of a program.

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**SECTION - I**

**Unit 1 - Language Processors**

**(08)**

Introduction, language processing activities, Fundamentals of language processing, Fundamentals of language, Specification, language Processor development tools, UNIX programming Tools-lex & yacc, Recognizing words with Lex, Parser lexer communication, the parts of Speech lexer, A Yacc parser, The rules section of yacc, running lex and yacc on Unix.

**Unit 2 - Assemblers**

**(07)**

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.

**Unit 3 - Macros and Macro Processors**

**(06)**

Macro definition and call, Macro Expansion, Nested macro calls, Design of Macro preprocessor- Design overview.

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**SECTION – II**

**Unit 4 - Compilers and Interpreters**

**(07)**

Aspects of compilation, compilation of expressions, code optimization, Static and dynamic memory allocation, Memory allocation in block structured languages (Scope Rules, Memory allocation and access, Dynamic pointer), Interpreters



**Unit 5 - Linkers****(06)**

Relocation and linking concepts, design of a linker, Self-relocating programs, linking for overlays.

**Unit 6 - Loaders****(07)**

Function of loader, General loader scheme, Absolute loader, Relocating loader, Direct linking loader, Dynamic loading, Design of direct linking loader.

**Internal Continuous Assessment (ICA) :**

ICA consists of minimum 8 to 10 experiments based on the following guidelines.

1. Design Lex specifications for the tokens – keywords, identifiers, numbers, operators, whitespaces.
  2. Implementation of simple Lexical Analyzer in C which will generate the different tokens.
  3. Implementation of syntax recognizer using grammar rules.
  4. Simulation of text editor.
  5. Introduction of TASM.
  6. Symbol Table generation for \*.c or \*.asm file.
  7. Design and Implementation of two pass assembler.
  8. Design and Implementation of Single pass assembler.
  9. Implementation of Macros.
  10. Implementation of Nested macros.
  11. Implementation of Toy-code generator.
  12. Simulation of linkers.
  13. Simulation of loaders.
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**Text Books:**

1. System Programming and operating systems, D.M. Dhamdhare, 2<sup>nd</sup> Edition (TMGH)(Unit-1,2,3,4,5)
  2. System Programming, J. J. Donovan, Mc-Graw Hill, (Unit 6)
  3. Unix Programming Tools – lex & yacc , John R. Levine, Tony Mason & Doug Brown,(O'REILLY) (Unit 1)
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**Reference Books:**

1. System Software - An Introduction to Systems Programming, Leland L. Beck, 3<sup>rd</sup> Edition(Pearson Education)
2. System Programming with C and Unix, Adam Hoover, Pearson,2010
3. Language Implementation Patterns, Terence Parr, SPD,2009

**Faculty of Science and Technology**  
**Third Year B. Tech. (Computer Science & Engineering)**  
**SEMESTER – V**  
**21CSU5CC2T : OPERATING SYSTEMS**

**Teaching Scheme**

Lectures– 3 Hrs./week, 3 Credits  
Practical-2 Hrs./week, 1 Credit

**Examination Scheme**

ESE – 60 Marks  
ISE – 40 Marks  
ICA – 25 Marks

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**Introduction:**

This course introduces Fundamentals and basic knowledge of an operating system. It also covers the details Process Management, deadlock, Memory Management, Unix System commands, and Introduction to Shell programming and awk programming

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**Course Prerequisite:**

Students should have knowledge of Computer Systems and basics of C programming language.

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**Course Outcome**

1. Comprehend the features of operating system to formulate its role and responsibilities.
2. Use different process scheduling algorithm and synchronization techniques to avoid deadlock.
3. Apply memory management techniques for CPU performance.
4. Execute various Unix commands and write shell and awk script

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**SECTION-I**

**Unit 1 – Introduction**

**(05)**

Operating system definition, Simple Batch System, Multiprogrammed Batch System, Time Sharing System, Personal Computer System, Parallel System, Real Time System, and System Calls.

**Unit 2 - Process**

**(06)**

Process Concept, Process Scheduling, Operations on processes, Cooperating Processes, Threads, Inter-Process communication

**Unit 3 - Process Scheduling**

**(06)**

Basic concept, Scheduling Criteria, Scheduling Algorithms, Multiple processor scheduling

**Unit 4 - Inter-process synchronization**

**(05)**

Background, The critical section problem, Peterson's algorithm, Synchronization Hardware, Semaphores, Classical problems of synchronization, Monitors.

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**SECTION –II**

**Unit 5 - Deadlocks**

**(07)**

System model, Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock, combined approach to deadlock.

**Unit 6 - Memory Management**

**(06)**

Background, Logical Versus Physical Address space, Swapping, Contiguous Allocation, Paging, Segmentation, Segmentation with paging.

**Unit 7 - Virtual Memory**

**(05)**

Background, Demand paging, Page replacement, Page replacement algorithms, Allocation of frames, thrashing (Only concept).

**Internal Continuous Assessment :**

1. Study of Unix commands
  2. Program using system calls: fork (), exec(), suspend() , resume()
  3. Implementation of FCFS scheduling algorithm
  4. Implementation of SJF ( non preemptive)
  5. Implementation of round robin (RR).
  6. Implementation of priority scheduling algorithm (nonpreemptive)
  7. Implementation of Mutual Exclusion using semaphore (wait & signal)
  8. Implement Bankers Algorithm for Deadlock Avoidance
  9. Implementation of RAG or WFG method for deadlock detection for single instance of resources.
  10. Simulation of page replacement strategies (FIFO, LRU , Optimal)
  11. Simulation of Memory Allocation Strategies (First Fit, Best Fit, Worst Fit)
  12. Study of shell programming
    - To find whether entered number is even or odd
    - To find factorial of number
    - To find whether entered number is prime or not
    - To generate fibonnaci series
    - To find sum of series of entered number
    - To find power of number.
  13. Study of Awk Programming
    - Scans a file line by lines
    - Splits each input line into fields
    - Compares input line/fields to pattern
    - Performs action(s) on matched lines
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**Text Books:**

1. Operating System concepts, Silberschatz, Galvin, 7 th or 8th Edition (John Wiley).
2. Introduction to Unix Shell Programming , M.G. Venkateshmurthy

**WALCHAND INSTITUTE OF TECHNOLOGY, SOLAPUR**  
**Third Year B.Tech (Computer Science & Engineering)**  
**SEMESTER - V**  
**21CSU5CC3T : DATABASE ENGINEERING**

**Teaching Scheme**

Lectures: 3 Hrs/week, 3 Credits  
Practical: 2 Hrs/week, 1 Credit

**Examination Scheme**

ESE: 60 Marks  
ISE: 40 Marks  
ICA: 25 Marks  
POE: 50 Marks

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**Introduction:**

In today's data-driven economy, no computer science or business curriculum would be complete without a course in databases and data management system. This course emphasizes the understanding of the fundamentals of relational database system including data models, database architectures, normalization, data integrity, security and data manipulation. It also provides students with theoretical knowledge and practical skills in the use of databases and database management systems with the help of Structured Query language (SQL). It ends with covering database transaction and recovery concepts. Upon completion, students should be able to design and implement normalized database structures by creating simple database.

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**Course Prerequisite:**

No prerequisite knowledge of databases is required but basic understanding of data-structures and algorithms is assumed. Any general purpose programming language knowledge is needed.

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**Course Objectives:**

1. To understand the basics of database design, structure, implementation and applications.
2. To develop the logical design of the database using data modeling concepts such as entity relationship diagrams.
3. To study and use Structured Query Language to query, update, and manage a database.
4. To apply normalization techniques to normalize the database.
5. To familiarize the students with the fundamentals of database transaction processing and learn techniques for concurrency control and recovery methods along with different indexing techniques.

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**Course Outcomes:**

At the end of this course, the student will be able to -

1. Apply the principles of database system and relational query language.
2. Design database using E-R modelling and apply normalization techniques on a given scenario.
3. Formulate SQL queries to perform CRUD operations.
4. Apply appropriate indexing technique to optimize the performance of the database.
5. Demonstrate transaction processing techniques.

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**SECTION – I**

**Unit 1: Introduction**

**(04)**

Database System Applications, Purpose of Database Systems, View of data, Database Languages, Data Storage and Querying, Database Architectures, Database users and administrators, history of databases system.

**Unit 2: Database Design and E-R Model**

**(10)**

Overview of design process, E-R Model, Constraints, Removing redundant attributes in entity sets,

E-R diagrams, Reduction to relational schema, E-R design issues, and Extended E-R features. Relational Model: Structure of relational databases, Database schema, keys, Schema diagrams, Relational Query languages, Relational algebra, Tuple Relational Calculus, Domain Relational Calculus.

**Unit 3: SQL and Advanced SQL (10)**

SQL : Overview, SQL data definition, Basic structure of SQL Queries, Additional basic operations, Set operations, NULL values, Aggregate functions, Nested sub queries, Modification of the databases , Join operations, Views, Transactions, Integrity constraints, SQL data types and schemas, Authorization, Advanced SQL : Embedded SQL, Functions and Procedures, Triggers.

**Unit 4: Relational Database Design (10)**

Features of good Relational Designs, Atomic Domains, First Normal Form, Decomposition using Functional dependencies, Second Normal Form, BCNF, Third Normal Form, Functional-dependency theory, Fourth Normal Form.

**SECTION – II**

**Unit 5: Indexing and Hashing (08)**

Basic Concepts, Ordered Indices, B+ Tree Index Files, B Tree Index Files, Multiple Key Access, Static Hashing, Dynamic Hashing, Comparison of Indexing and Hashing, Bitmap indices, Index definition in SQL

**Unit 6: Transactions (06)**

Transaction concepts, A simple transaction Model, Storage structure, Transaction Atomicity and Durability, Transaction Isolation, Serializability, Transaction Isolation and Atomicity.

**Unit 7: Concurrency Control (06)**

Lock based protocol, Deadlock handling, Multiple granularity, Time Stamp-based protocols, Validation based protocols.

**Unit 8: Recovery System (06)**

Failure Classification, Storage, Recovery and Atomicity, Recovery algorithms, Buffer management.

**Course Instructions:**

Assignments 2 to 4 should be implemented in MySQL/Oracle/ PostGreSQL.

Assignments 6 to 11 should be implemented in C++/Java.

**Internal Continuous Assessment (ICA):**

It should consist of 8-10 laboratory assignments as follows:

1. E-R Diagrams: Draw E-R diagram for any specific database application and create a data dictionary for the same.
2. a) Basic SQL DDL commands: write simple queries in SQL on above database application for schema creation and updation.  
b) SQL DML commands: insert, update, select command with different clauses, queries using aggregates, grouping and ordering.
3. a) Nested sub queries, Joins and Set operations: write queries in SQL using concept of nested sub queries, join and different set operations.
4. a) Views, Integrity constraints and Authorization: queries for creating views, different integrity constraints and authorization commands.  
b) Advanced SQL: queries on embedded SQL, functions and procedures, triggers

5. Convert the created database into 1NF, 2NF, 3NF and BCNF.
  6. Given a set of functional dependencies, find canonical cover and closure of functional dependency.
  7. Write a Java program for database (created in expt-2) connectivity using JDBC.
  8. Write a program to implement B+ tree index (n=3 or n=5) on the database previously created.
  9. Write a program to implement dynamic hashing on the database previously created.
  10. Write a program to simulate log based protocol using immediate or deferred database modification.
  11. Write a program to simulate any one concurrency control protocol.
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**Text Book:**

1. Database system concepts by Abraham Silberschatz, Henry F. Korth, S. Sudarshan (McGraw Hill International Edition) sixth edition.
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**Reference books:**

1. Fundamentals of Database systems by Ramez ElMasri, S. B. Navathe (Pearson Education) Fifth edition.
2. Database Management Systems by Ramkrishnan Gehreke (Tata McGraw Hill) third edition.
3. Principles of Database Systems by J. D. Ullman (Galgotia Publications)
4. SQL The Complete Reference, 3rd Edition by James R Groff, Paul N. Weinberg and Andy Opperl
5. Database system concepts by Peter Rob, Carlos Coronel (Cengage Learning) ninth edition.

**WALCHAND INSTITUTE OF TECHNOLOGY, SOLAPUR**  
**Faculty of Science and Technology**  
**Third Year B.Tech. (Computer Science and Engineering)**  
**Semester – I**

**21CSU5CC4T : DESIGN AND ANALYSIS OF ALGORITHM**

**Teaching Scheme**

Lectures– 3 Hrs./week, 3 Credits

Practical– 2 Hrs./week, 1 Credit

**Examination Scheme**

ESE - 60 Marks

ISE - 40 Marks

ICA - 25 Marks

POE - 50 Marks

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**Introduction :**

This course introduces the algorithms, strategies of algorithm and analysis of algorithm which will help to compare and determine good algorithm.

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**Course Prerequisite:**

Student should have knowledge of basic programming. They should also have basic knowledge of data structure and graph theory.

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**Course Outcomes:**

At the end of the course, students will be able to -

1. Derive time and space complexity of a given algorithm
2. Select appropriate algorithm design paradigm for a problem.
3. Apply algorithm design paradigm for a problem.
4. Describe and distinguish complexity classes of problems

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**SECTION-I**

**Unit 1 – Introduction**

**(08)**

Algorithm Specification: Pseudo code Conventions, Recursive Algorithm, Performance Analysis: Space Complexity, Time Complexity, Calculating worst case, best case and average case complexities, complexities Asymptotic Notations, Performance Measurement

**Unit 2 - Divide and Conquer**

**(07)**

The general method, Binary search, Finding the maximum and Minimum, Quicksort, Selection Sort, Merge Sort.

**Unit 3 - The Greedy method**

**(08)**

The 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, Single source shortest paths

**SECTION-II**

**Unit 4 - Dynamic Programming**

**(08)**

The general method, Multistage graphs, All pair shortest paths, Optimal binary search trees, 0/1 Knapsack, Reliability design, The Traveling Sales person problem. Flow shop scheduling

**Unit 5 – Backtracking**

**(07)**

The general method, 8-queen problem, sum of subsets, Knapsack Problem, Hamilton Cycle, and

Graph Coloring.

**Unit 6 - NP-Hard and NP-Complete problems**

**(07)**

Tractable and Intractable Problems: Computability. The Halting problem, Computability classes –P, Np- class, NP-complete and NP-hard, Standard NP-complete problems, NP-Hard Problem (Only Basics problems)

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**Internal Continuous Assessment (ICA) :**

ICA shall consist of minimum ten practical assignment problems.

- 1) The nature of the problems shall be with objectives to assess student's ability to
    - a. Compare and choose an appropriate algorithm design paradigm on time and space complexity
    - b. Apply algorithm design paradigm to provide a solution to the problem using either C,C++, Python, Java or any other programming language the student is proficient in.
    - c. Effectively assess performance of provided solutions w.r.t programming language's runtime implementation.
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**Text Book:**

1. Fundamentals of Computer Algorithms, Horowitz, Sahni & Rajasekaran (Galgotia Publications)
  2. Fundamental of Algorithm, Gilles Brassard, Paul Bratley (Pearson Publication)
  3. Introduction to Algorithms, Thomas Cormen (Pearson Publication)
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**Reference books :**

1. Introduction to Design and Analysis of Algorithm, Goodman (McGrawhill)
2. Design and analysis of algorithms, Aho, Hopcraft and Ullman (Addison wesley)
3. Design & Analysis of Algorithms, Sharma, Khanna Publishing House, N.Delhi
4. Design& Analysis of Algorithms, S. Sridhar, Oxford



**WALCHAND INSTITUTE OF TECHNOLOGY, SOLAPUR**

**Faculty of Science and Technology**

**Third Year B.Tech. (Computer Science & Engineering)**

**SEMESTER – V**

**21CSU5CC5T : ADVANCED JAVA PROGRAMMING**

**Teaching Scheme**

Lectures – 2 Hrs./week, 2 Credits

Practical – 2 Hrs./week, 1 Credit

**Examination Scheme**

ICA – 25 Marks

ISE – 25 Marks

POE – 50 Marks

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**Introduction:**

It is an advanced technology or advance version of Java specially designed to develop web-based applications. It includes the concepts like Servlet, JSP etc.

For developing web applications in Java , advanced Java fundamentals, like JSP, Servlets, JDBC etc. can add on to the capabilities and features of the application and thus are essential for developers.

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**Course Prerequisite:** Students should have knowledge of Core Java with Swing.

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**Course Outcomes:**

Student will be able to:

1. Implement the web based applications using effective database access
2. Apply the concepts of server side technologies for creating dynamic web applications
3. Design web application using Hibernate and Spring framework.

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**Unit 1 – Introduction to JDBC**

**(6)**

JDBC Introduction, JDBC features, JDBC Drivers, Setting up a database and creating a schema, Writing JDBC code to connect to DB, CRUD Operations with JDBC, Statement types in JDBC, Types of Rowset, ResultSet in JDBC.

**Unit 2 - Servlets and Session Management**

**(6)**

Servlets Introduction, Need and Working, HTTP Methods; GET, POST, PUT, DELETE, TRACE, OPTIONS. GET/POST request; differences between the two, Servlet Lifecycle, ServletContext and ServletConfig, Forwarding and Redirection of requests.

**Unit 3: Java Server Pages**

**(6)**

Introduction, Difference between JSP and servlet, Life cycle of JSP, JSP elements- Scriptlets, Expressions, Declarations, JSP Directives, Working with JSP basic tags and Implicit objects, Exception Handling in JSP

**Unit 4 - Spring Framework**

**(6)**

Introduction to Spring, Spring Architecture explanation and all its components, Spring MVC, Spring DAO, setting up of Spring framework Download JARs, Configure XML files.

**Unit 5 - Hibernate Framework**

**(6)**

ORM, ORM principle, ORM Implementation, Introduction to Hibernate, Hibernate Architecture, Persistent classes, Hibernate CRUD, setting up connection to DB using Hibernate

**Internal Continuous Assessment (ICA):**

ICA consists of minimum 8 to 10 assignments based on the above given topics.

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**Text Books:**

1. Java The Complete Reference, Ninth Edition, by Herbert Schildt, McGraw Hill Education
  2. Head First Servlets and JSP, Kathy Sierra, Bryan Basham, Bert Bates, O'Reilly Media, Inc.
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**Reference Books:**

1. Spring Microservices in Action, Second Edition, John Carnell, Manning Publications.
  2. Core and Advanced Java, Black Book, Dreamtech Press.
  3. Java Programming for Core and advanced learners, Sagayaraj, Denis, Karthik and Gajalakshmi, Universities Press
  4. Java Web Services: Up and Running, 2nd Edition, by Martin Kalin, O'Reilly Media, Inc.
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**Web reference:**

1. <https://hibernate.org/orm/documentation/6.0/>
2. <https://docs.spring.io/spring-framework/docs/current/reference/html/>

**WALCHAND INSTITUTE OF TECHNOLOGY, SOLAPUR**  
**Faculty of Science and Technology**  
**Third Year B. Tech. (Computer Science & Engineering)**  
**SEMESTER – V**

**21CSU5CC7T : MOBILE APPLICATION DEVELOPMENT**

**Teaching Scheme**

Lectures– 2 Hrs./week, 2 Credits

Practical – 2 Hrs./week, 1 Credit

**Examination Scheme**

ISE – 25 Marks

ICA - 25 Marks

POE – 50 Marks

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**Introduction:** Mobile application development course will build your skills in creating mobile apps for Android platform as well as for Cross platform. This course includes Android application development and Xamarin Application development with basic User Interface design, basic building blocks, data handling, Testing mobile apps and how to take app to the market.

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**Course Prerequisite:** Knowledge of programming paradigms and object-oriented programming principles.

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**Course Outcomes:**

At the end of this course students will be able to

1. Select suitable development practices for a mobile application
  2. Build cross platform mobile application for a given problem scenario.
  3. Choose suitable method of testing, signing, packaging and distribution for a mobile application.
- 

**SECTION I**

**Unit 1 –Introduction**

**(05)**

Introduction to Kotlin, building first android application, build basic layout, Dice roller app, get user inputs, Display a scrollable list

**Unit 2 – Navigation and Connect to the internet**

**(05)**

Navigation between screens, Introduction to the navigation component, Architecture components, Advanced Navigation App example, Adaptive layouts, Coroutines, Get and display data from the internet

**Unit 3 –Data Persistence and Work Manager**

**(05)**

Introduction to SQL, Rooms, and Flow, Room for data persistence, schedule tasks with work manager

**SECTION II**

**Unit 4 – Introduction to Dart**

**(04)**

Introduction, Syntax basics, Types, Patterns, Functions, Control Flow, Error Handling, Classes & Objects, Concurrency, Null Safety

**Unit 5 – Building application with Flutter and Introduction to Firebase**

**(04)**

Introduction to widgets, Building Layouts, Navigation and Routing, Animations, Introduction to firebase

**Unit 6 –Platform Integration and Testing & Debugging**

**(07)**

Supported Platforms, Building Desktop apps with flutter, writing platform specific code, Debugging tools, Testing plugins, Debugging Flutter apps programmatically, Flutter's build modes, Common Flutter errors, Handling errors, Testing, Integration testing

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**In Semester Evaluation (ISE) :** ISE Evaluation for the course will consists of three hands on tests based for 30 marks on the topics mentioned in the syllabus and a capstone project submitted in group of 4 students that will be evaluated for 10 marks.

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**Internal Continuous Assessment (ICA):** Minimum 10 assignments requiring students to design, develop and test cross platform mobile applications for real world problem/use-case/scenario.

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**Text Books :**

Android Application Development - All in one for Dummies, Barry Burd

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**Reference books :**

Android Developer Tools Essentials by Mike Wolfson (O'Reilly Media)

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**e-Resources**

- Android Developer Resources: <https://developer.android.com/courses/android-basics-kotlin/course>
  - Dart Resources: <https://dart.dev/guides>
  - Flutter Resources: <https://docs.flutter.dev/>
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**WALCHAND INSTITUTE OF TECHNOLOGY, SOLAPUR**  
**Faculty of Science and Technology**  
**Third Year B.Tech. (Computer Science & Engineering) Semester-I**  
**SELF LEARNING MODULE – I (H.S.S.)**  
**21CSU5SL61T : ECONOMICS**

**Teaching Scheme**  
**Credits :- 2 Credits**

**Examination Scheme**  
**ESE: 50 Marks**

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**Course Outcomes:**

Upon completion of this course, students will be able to

1. Identify the Basic Economic problems, Resource Constraints.
2. Apply various theories of economics for economic growth.
3. Identify causes of Inflation consequence and remedies.
4. To assess the impact of International Trade, foreign exchange on Indian economy.

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**Unit 1: Introduction**

History of Economic thought, Basic Economic problems, Resource Constraints and Welfare maximization

Nature of Economics: Positive and Normative Economics, Micro and Macro Economics, Basic concepts in Economics, The role of State in economic activity, Market and Government failures, New economic Policy in India.

**Unit 2: Theories of Economics**

Theory of utility and consumer's choice, Theories of Demand, supply and market equilibrium, Theories of firm, production and costs, Market structures, Perfect and imperfect competitions, oligopoly, monopoly.

**Unit 3: Macroeconomics**

An overview of Macroeconomics, measurement and determination of national income, Consumption, saving and investment.

**Unit 4: Banking & Inflation.**

Commercial and Central Banking, Relationship between money, output and prices. Inflation causes, consequences and remedies.

**Unit 5: International Influences on Economics**

International Trade, foreign exchange and balance payments, stabilization policies, Monetary, Fiscal and exchange rate policies.

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**ASSIGNMENTS**

Students shall complete five assignments, based on syllabus. (One assignment for every unit of the syllabus)

In addition to the above, the institute may prescribe additional modes of assessment such as Unit test, Quiz, Presentation, Course seminar etc. for ensuring continuous assessment of the students.

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**TEXT BOOKS**

1. Economics: P.A. Samuelson & W.D Nordhaus (McGraw Hill, New York, 1995.)
2. Modern Microeconomics : A. Koutsoyiannis (Macmillan,1975)

**REFERENCE BOOKS**

1. Microeconomics: R. Pindyck and D.L. Rubinfeld. (Macmillan New York, 1989
2. Microeconomics: Gordon, 4<sup>th</sup> edition, Little Brown & Co., Boston,1987.
3. The Organization of Industry: William F. Shughart II, Richard D. Irwin, Illinois, 1990.

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**Faculty of Science and Technology**  
**Third Year B.Tech. (Computer Science & Engineering)**  
**SEMESTER – V**

**Self Learning Module – I (H.S.S.)**  
**21CSU5SL62T : INTELLECTUAL PROPERTY RIGHTS FOR TECHNOLOGY**  
**DEVELOPMENT AND MANAGEMENT**

**Teaching Scheme**  
**Credits :- 2 Credits**

**Examination Scheme**  
**ESE: 50 Marks**

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**Course Outcomes:**

Upon completion of this course, students will be able to,

1. Appreciate the intellectual property rights coming out of research and intellectual works
2. Demonstrate their knowledge about the process of acquiring the patents and copyrights for the innovative works.
3. Elaborate the role of Indian IPR system and role of WTO in protecting IntellectualProperty Rights
4. Avoid the plagiarism in their thesis, research papers etc. which can be questioned legally.

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**Unit 1:**

Dynamics of Knowledge evolution, creation of ownership domains in the knowledge space using various instruments of IPR

**Unit 2:**

Outlines concepts of confidentiality and information security, explores their role in technology development and transfer integrating Intellectual Property in project planning, execution & commercialization,

**Unit 3:**

Discussion on the shifting paradigms of R&D and their linkage to IPR, Introduction to concepts of Valuation of IP & Value Realization,

**Unit 4:**

Comparison the Indian IPR system with international IPR frameworks especially in the context of WTO, followed by a few sessions on IPR litigations both for the enforcement of rights and business strategy.

**Unit 5:**

Discussion on contentious issues of current interest such as Biotechnology and Intellectual Property, Protection of Traditional Knowledge, IPR and Electronic Commerce, TRIPS and Access to Medicines, Copyright issues in creative works, etc.

**ASSIGNMENTS**

Students shall complete five assignments, based on syllabus. (One assignment for every unit of the syllabus)

In addition to the above, the institute may prescribe additional modes of assessment such as Unit test, Quiz, Presentation, Course seminar etc. for ensuring continuous assessment of the students.

**TEXT BOOKS**

1. Prabuddha Ganguli: Intellectual Property Rights Unleashing the Knowledge Economy. Tata McGraw Hill, New Delhi, 2001.
2. Prabuddha Ganguli: Gearing Up for Patents The Indian Scenario. Universities Press India Ltd., Hyderabad, 1998.

3. P. Narayan: Patent Law. Eastern Law Co., Calcutta.

**REFERENCE BOOKS**

1. Global Dimensions of Intellectual Property Rights in Science and Technology, Author: National Research Council , National Academies Press, 1993.
2. Technology Transfer: Intellectual Property Rights, C Sri Krishna, ICFAI University press (2008)



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**Faculty of Science and Technology**  
**Third Year B.Tech. (Computer Science & Engineering)**  
**SEMESTER-V**  
**Self Learning Module – H.S.S.**  
**21CSU5SL63T : INTRODUCTION TO SOCIOLOGY**

**Teaching Scheme**  
**Credits :- 2 Credits**

**Examination Scheme**  
**ESE: 50 Marks**

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**Course Outcomes:**

Upon completion of this course, students will be able to,

1. Interpret the effect of various social phenomena on sociology
2. Elaborate the role of urbanization on the society
3. Appreciate the need of social institutions for better society.
4. Assess the role of modernization, industrialization, environmental/ecological changes in the development of society.

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**Unit 1:**

What is sociology, some sociological concepts: social structure, status, role, norms, values etc., Socialization, and culture and change.

Social stratification - various approaches and concept of social mobility.

**Unit 2:**

Population and society - Trends of demographic change in India and the world, Human Ecology, Trends of Urbanization in the developing countries and the world.

**Unit 3:**

Major social institutions - Family and marriage, caste and tribe and organizations:

- i. Formal organization (bureaucracy)
- ii. Informal Organization

**Unit 4:**

Processes of social change- Modernization (including Sanskritization), industrialization, environmental/ecological changes and development.

**Unit 5:**

Social movements - protest movements, reformist movement and radical movements in India.

**ASSIGNMENTS**

Students shall complete five assignments, based on syllabus. (One assignment for every unit of the syllabus)

In addition to the above, the institute may prescribe additional modes of assessment such as Unit test, Quiz, Presentation, Course seminar etc. for ensuring continuous assessment of the students.

**TEXT BOOKS**

1. Sociology, L. Broom, P. Selznick and D. Dorrock, 11th Edn. 1990 (Harper International).
2. Sociology: Themes and Perspectives, M. Haralambos, Oxford University Press, 1980.
3. General Introduction to Sociology, Guy Rocher, A. , MacMillan, 1982.

## **REFERENCE BOOKS**

1. Social movements in India, vols. 1-2, 1984, M.S.A. Rao, Manohar Publications.
2. Society in India, David Mandelbaum, 1990, Popular Publications.
3. Social change in modern India, M.N. Srinivas, 1991, Orient Longman Publications.

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**Third Year B.Tech. (Computer Science & Engineering)**  
**SEMESTER -V**  
**Self Learning Module – I (H.S.S.)**  
**21CSU5SL64T :STRESS AND COPING**

**Teaching Scheme**  
**Credits :- 1 Credit**

**Examination Scheme**  
**ESE: 50 Marks**

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**Course Outcomes:**

Upon completion of this course, students will be able to,

1. Identify various sources and nature of a stress.
2. Elaborate the effects of medical, psychological and behavioral stress.
3. Appreciate the social support to mitigate the stress.
4. Adopt various stress management techniques.

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**Unit 1:**

Concept of stress-current and historical status. The nature of the stress response.

**Unit 2:**

Common sources of stress biological, personality and environmental.

**Unit 3:**

Coping styles defensive behaviors and problem-solving. Consequences of stress - medical, psychological and behavioral.

**Unit 4:**

The role of social support in mitigating stress.

**Unit 5:**

Stress management techniques-relaxation, meditation, cognitive restructuring, self-control, bio-feedback and time management, Preparing stress profile of a student.

**ASSIGNMENTS**

Students shall complete five assignments, based on syllabus. (One assignment for every unit of the syllabus)

In addition to the above, the institute may prescribe additional modes of assessment such as Unit test, Quiz, Presentation, Course seminar etc. for ensuring continuous assessment of the students.

**TEXT BOOKS**

1. Walt, S. "Stress Management for Wellness". Harcourt Brace & Jovanovich, N.York, 1994.
2. D. Girdano and G. Everly., "Controlling Stress and Tension", Prentice-Hall, 1986.
3. Monat and R. Lazarus, "Stress and Coping: An Anthology", Columbia Univ. Press, 1985.

**REFERENCE BOOKS**

1. Weisman, "The Coping Capacity", Human Services Press, 1984.
2. Stress and Coping: The Indian Experience, D.M. Pestonjee, SAGE India; Second edition (1998)

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**Third Year B.Tech. (Computer Science & Engineering)**  
**SEMESTER-V**

**Self Learning Module – I (H.S.S.)**

**21CSU5SL65T :PROFESSIONAL ETHICS & HUMAN VALUES**

**Teaching Scheme**

**Credits :- 2 Credits**

**Examination Scheme**

**ESE: 50 Marks**

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**Course Outcomes:**

Upon completion of this course, students will be able to,

1. Inculcate the human values in their behavior.
  2. Demonstrate the Engineering ethics in their professional practice.
  3. Practice the safety and responsibility and professional rights in their professional practice.
  4. Incorporate the code of ethics of Global organizations such as ASME, ASCE, and IEEE
- 

**Unit 1: Human Values**

Morals, Values and Ethics, Integrity, Work Ethics, Service Learning, Civic Virtue, Respect for others, Living Peacefully, Caring, sharing, Honesty, Courage, Valuing Time, Cooperation, Commitment, Empathy, Self-Confidence, Character, spirituality

**Unit 2: Engineering Ethics**

Senses of engineering ethics, Variety of Moral Issues, Types of inquiry, Moral Dilemmas Moral Autonomy, Kohlberg's Theory, Gilligan's Theory, Consensus and Controversy, Models of Professional Roles, Theories about Right Action, Self Interest , Customs and Religion.

**Unit 3: Safety, Responsibilities and Rights**

Safety and Risk, Assessment of safety and Risk, Risk Benefit Analysis and Reducing Risk, The Three Mile Island and Chernobyl Case Studies.

Collegiality and Loyalty, Respect for Authority, Collective Bargaining, Confidentiality, Conflicts of Interest, Occupational Crime, Whistle Blowing, Professional Rights – Employee Rights, Intellectual Property Rights (IPR) – Discrimination

**Unit 4: Global Issues**

Multinational Corporations, Environmental Ethics, Computer Ethics, Weapons Development, Engineers as Managers, Consulting Engineers, Engineers as Expert Witnesses and Advisors, Sample Code of Ethics of ASME, ASCE, IEEE, Institution of Engineers (India), etc.

**ASSIGNMENTS**

Students shall complete five assignments, based on syllabus. (One assignment for every unit of the syllabus)

In addition to the above, the institute may prescribe additional modes of assessment such as Unit test, Quiz, Presentation, Course seminar etc. for ensuring continuous assessment of the students.

**TEXT BOOKS**

1. Bayles, M.D.: Professional Ethics, California: Wadsworth Publishing Company, 1981.
2. Koehn, D.: The Ground of Professional Ethics, Routledge, 1995.
3. R.S. Naagarazan, A Text Book of Professional Ethics & Human Values, New Age International,2006

**REFERENCE BOOKS**

1. Camenisch, P.F.: Grounding Professional Ethics in a Pluralistic Society, N.Y.: Haven Publications, 1983.
2. Wuest, D.E.: Professional Ethics and Social Responsibility, Rowman & Littlefield, 1994.

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**Faculty of Science and Technology**  
**Third Year B. Tech. (Computer Science & Engineering)**  
**SEMESTER – VI**  
**21CSU6CC1T : ARTIFICIAL INTELLIGENCE**

**Teaching Scheme**

Lectures– 3 Hrs/week, 3 Credits  
Practical – 2 Hrs/week, 1 Credit

**Examination Scheme**

ESE – 60 Marks  
ISE – 40 Marks  
ICA - 25 Marks

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**Introduction:**

This course presents a basic introduction to the techniques used in developing Artificial Intelligent systems. It is a walkthrough to problem spaces and search algorithms, Knowledge representation, reasoning, logic programming and applications of Artificial Intelligence.

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**Course Prerequisite :**

Student shall have some exposure to algorithms and programming.

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**Course Outcomes:** At the end of the course students will be able to

1. Formulate and solve sequence of actions for an agent as a search problem.
  2. Infer from represented knowledge using logical and probabilistic reasoning methods
  3. Solve agent decision problems using probability theory
  4. Comprehend forms of learning and demonstrate their working.
- 

**SECTION - I**

**Unit 1 – Overview** (06)  
Foundations, scope, problems, and approaches of AI. **Intelligent agents:** reactive, deliberative, goal-driven, utility-driven, and learning agents

**Unit 2 - Problem-solving through Search** (07)  
Forward and backward, state-space, blind, heuristic, problem-reduction, A, A\*, AO\*, minimax, constraint propagation, neural, stochastic, and evolutionary search algorithms, sample applications.

**Unit 3 - Knowledge Representation and Reasoning** (07)  
Ontologies, foundations of knowledge representation and reasoning, representing and reasoning about objects, relations, events, actions, time, and space; first order logic, situation calculus, description logics, reasoning with defaults, reasoning about knowledge, sample applications.

**SECTION - II**

**Unit 4 - Representing and Reasoning with Uncertain Knowledge** (07)  
Probability, connection to logic, independence, Bayes rule, Bayesian networks, probabilistic inference, and sample applications.

**Unit 5 - Decision-Making** (06)  
Basics of utility theory, decision theory, sequential decision problems, elementary game theory, sample applications.

**Unit 6 - Learning and Knowledge Acquisition (07)**

Forms of Learning: Supervised, Unsupervised, Semi-supervised. Statistical learning, Reinforcement Learning: Q-learning, sample applications.

**Unit 7 - Conclusions (05)**

Philosophical Foundations, AI: The Present and Future.

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**Internal Continuous Assessment (ICA):**

ICA should consist minimum 10 assignments using any programming language with openly available tools, frameworks and resources based on the following topics.

- Intelligent agents
- Problem solving through search
- First order logic
- Bayesian Networks
- Decision and Game theory
- Statistical Learning
- Q-learning.

In addition to above students shall undertake a case study on “**Applications of AI: The Present and Future**”

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**Text Book:**

1. Artificial Intelligence: A Modern Approach, Stuart Russell and Peter Norvig, 3<sup>rd</sup> Edition, Prentice Hall
  2. A First Course in Artificial Intelligence, Deepak Khemani, McGraw Hill Education (India)
  3. Introduction to Artificial Intelligence & Expert Systems, Dan W Patterson, PHI.
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**Reference Book:**

Artificial Intelligence, Elaine Rich and Kevin Knight, Tata McGraw Hill

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**Third Year B.Tech. (Computer Science and Engineering)**  
**SEMESTER – VI**  
**21CSU6CC2T : COMPILER CONSTRUCTION**

**Teaching Scheme**

Lecture: 3 Hrs/week, 3 Credits  
Practical : 2 Hrs/week,

**Examination Scheme**

ESE: 60 Marks  
ISE: 40 Marks  
ICA : 25 Marks

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**INTRODUCTION:**

A compiler translates a program written in a high-level programming language that is suitable for human programmers into the low-level machine language that is required by computers.

Since writing a compiler is a nontrivial task, it is a good idea to split the compilation into several phases with well-defined interfaces. Conceptually, these phases operate in sequence, each phase except first phase taking the output from the previous phase as its input. Each phase is handled by a separate module.

This course provides an in-depth view of translation and optimization process. All phases required for translating a high-level language to machine language is covered in this course including scanning, parsing, intermediate-code generation, machine-code generation, register allocation and code optimization.

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**COURSE PREREQUISITE:**

1. Theory of Computation
2. System Programming
3. Programming Language knowledge

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**COURSE OUTCOMES:**

At the end of the course, students will be able to

1. Describe language translation and compiler design constructs.
2. Design and develop lexical analyzer and parser.
3. Apply optimization principles for generating code
4. Describe storage allocation strategies for memory allocation

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**SECTION-I**

**Unit 1 - Introduction to Compiling**

**(03)**

Introduction, Compilers, Phases of a compiler, Compiler construction tools

**Unit 2 - Lexical Analysis**

**(07)**

Role of a Lexical analyzer, Input buffering, Specification and recognition of tokens, Finite automata implications, Designing a lexical analyzer generator

**Unit 3 - Syntax Analysis**

**(10)**

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 parsers, SLR parsers, LALR parsers.

**Unit 4 - Syntax Directed Translation**

**(08)**

Syntax directed definitions, construction of syntax tree, Bottom-up evaluation of S-attributed definitions, L-attributed definitions, Top-down translation of inherited attributes, Bottom-up evaluation of inherited attributes, Analysis of syntax directed definitions.

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**SECTION-II**

**Unit 5 - Run Time Environments**

**(05)**

Source language issues, storage organization and allocation strategies, Parameter passing, Symbol table



organizations and generations, Dynamic storage allocations

**Unit 6 - Intermediate Code Generation**

(07)

Intermediate languages, declarations, Assignment statements, Boolean expressions, case statements Back patching, procedure calls, Back patching, procedure calls

**Unit 7 - Code Generation**

(08)

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 DAG and the dynamic code generation algorithm

**Unit 8 - Code Optimization**

(08)

Sources of optimization, Peephole optimization and basic blocks, loops in flow graphs, Data flow analysis and equations, code improving transformation and aliases, Data flow analysis and algorithms, symbolic debugging of optimized code

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**Internal Continuous Assessment (ICA) :**

ICA shall consist of minimum 10 practical assignment problems.

1. Generate the grammar for 'C' language.
2. Implement the lexical analyzer for simple 'C' language.
3. Implement the recognizer for given transition diagram.
4. Implement the top-down parsing using recursive decent parsing technique.
5. Implement the shift- reduce parser.
6. Implement the operator precedence parser.
7. Implement the LL(1) parser for the language.
8. Generate the symbol table for language.
9. Generation of 3- address code for language.
10. Implement the code optimization technique on the code produced in 10.
11. Generation of target code for given 3-address code.
12. Use of free open source software to practice the parsing example.

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**Text Books:**

1. Compilers - Principles, Techniques and Tools, A.V. Aho, R. Shethi and J.D. Ullman (Pearson Education.)
2. Compiler Construction, Dhamdhare (Mc-Millan)
3. Principles of Compiler Design- V.Raghavan (Mc Grawhill Education) (2nd edition)

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**Reference books:**

1. Compiler Construction, Principles & Practice – Ken Loudon ( Cengage Learning)
2. Compiler Design in C,– Allen I. Holub (PHI / Pearson Education)
3. Compiler Construction: An advance course- Manish Kumar Jha (Dhanpat Rai) (3rd Edition)

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**Third Year B.Tech. (Computer Science and Engineering)**  
**SEMESTER – VI**  
**21CSU6CC3T : SOFTWARE ENGINEERING**

**Teaching Scheme**

Lecture: 3 Hrs/week, 3 Credits

**Examination Scheme**

ESE: 60 Marks

ISE: 40 Marks

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**COURSE OBJECTIVES:**

1. To illustrate and compare the use of life cycle models for software development.
2. To identify different methods for analyzing and designing software requirements.
3. To apply different testing methods to the software system.
4. To describe various quality standards used in the software system.

---

**COURSE OUTCOMES:** The Student will be able to

1. Select and apply the appropriate lifecycle model for software development.
2. Prepare SRS and SDS accordingly for a given problem.
3. Select and apply appropriate software testing method.
4. Ensure the quality of a product by applying the quality management process.

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**SECTION-I**

**Unit 1 - Introduction to Software Engineering (11)**

Introduction, The Problem Domain, Software Engineering Challenges and Approach, Software Process, Characteristics of Software Process, Software Development Process Models: Waterfall model, Prototype model, Iterative development model: Incremental Model, Spiral model, Rational unified Process model, Time Boxing model, Agile process model.

**Unit 2 - Software Requirement Analysis & Specification (06)**

Need of SRS, Characteristics of Good SRS, Requirement Process, Requirements specification, Functional Specification with Use Cases, Other Approaches for Analysis: Data Flow Diagram, Entity Relationship Diagram,

**Unit 3 - Software Architecture and Design (08)**

Introduction to Software Design, Software Architecture: Role of Software Architecture, Architecture Views, Component & Connector View, Architecture Style for Component & Connector view, Documenting Architecture Design, Design Concepts: Design Principles, Conceptual Design and Technical Design, Coupling, Cohesion, Open Closed Principle, Function-Oriented Design, Object Oriented Design, High Level Design, Detailed Design, Verification, Metrics.

**SECTION-II**

**Unit 4 - Testing (04)**

Testing Fundamentals, Testing Process, Black-Box Testing, White-Box Testing, Object-Oriented Software testing methods, Functional testing, Unit testing, System testing, User satisfaction testing.

**Unit 5 - Project Planning and Management (08)**

Project management process, The Inspection and Audit Process, Software Configuration Management process, Effort estimation, Project Schedule and Staffing, Quality planning: Quality Concepts, Qualitative quality management planning. CMM project management process, Risk Management Planning, Project Monitoring Plan, Detailed Scheduling.

## **Unit 6 - Agile Project Management**

**(08)**

Introduction to APM, Implementation, Iterative Project Management Life Cycle, Adaptive Project Management Life Cycle, Adaptive & Integrating the APM toolkit, The Science of Scrum, New Management Responsibilities.

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### **Text Books:**

1. An Integrated Approach to Software Engineering- 3rd edition: Pankaj Jalote (Narosa Publishers)
2. Effective Project Management Traditional, Agile, Extreme, Robert K. Wysocki WILEY INDIA, 6<sup>th</sup> edition.

### **Reference Books :**

1. Ian Sommerville, software engineering, Pearson education Asia, 6th edition
2. Software Engineering Fundamentals –Ali Behforooz and Frederick j. Hudson (Oxford University Press).
3. Project Management with Scrum By Ken Schwaber.

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**Faculty of Science and Technology**  
**Third Year B.Tech. (Computer Science and Engineering)**  
**SEMESTER – VI**  
**21CSU6CC4T :CLOUD COMPUTING**

**Teaching Scheme**

Lectures: 3 Hours /Week, 3 credits

Practical: 2 Hour/Week, 1 credit

**Examination Scheme**

ESE - 60 Marks

ISE - 40 marks

ICA - 25 marks

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**COURSE OUTCOME:**

At the end of this course, students will be able to

1. Analyze various hardware & software to choose appropriate one for implementation of cloud environment.
2. Identify different cloud based solutions to meet a set of given requirements.
3. Identify Security and Privacy concerns in cloud computing for data management.

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**SECTION-I**

**Unit1: Introduction to Cloud Computing (7)**

History of Cloud Computing, Evolution of Cloud Computing, Traditional vs. Cloud Computing. Why Cloud Computing, Cloud service models (IaaS, PaaS & SaaS), Cloud deployment models (Public, Private, Hybrid and Community Cloud), Benefits and Challenges of Cloud Computing, Role of virtualization in Cloud Computing.

**Unit 2: Virtual Machines Provisioning and Migration Services (7)**

Virtual Machines Provisioning and Manageability, Virtual Machine Migration Services, VM Provisioning and Migration in Action, Provisioning in the Cloud Context.

**Unit 3: Understanding Services and Applications by Type (9)**

Defining Infrastructure as a Service (IaaS), IaaS workloads, Pods, aggregation, and silos, Defining Platform as a Service(PaaS), Defining Software as a Service (SaaS), SaaS characteristics, Open SaaS and SOA, Salesforce. Command CRM SaaS, Defining Identity as a Service, What is an identity? Networked identity service classes, Identity system codes of conduct, IDaaS interoperability, User authentication Authorization markup languages, Defining Compliance as a Service(CaaS)

**SECTION II**

**Unit 4: Integration of Private and Public Clouds (8)**

Aneka: Introduction, Technologies and Tools for Cloud Computing, Aneka Cloud Platform, Aneka Resource Provisioning Service, Hybrid Cloud Implementation, Comet: Comet Cloud Architecture, Autonomic Behavior of Comet Cloud, Overview of Comet Cloud-based Applications.

**Unit 5: Understanding of Cloud Security (8)**

Securing the Cloud, The security boundary, Security service boundary, Security mapping, Securing Data, Brokered cloud storage access, Storage location and tenancy, Encryption Auditing and compliance, Establishing Identity and Presence, Identity protocol standards, Windows Azure identity standards

## **Unit 6: Migration to Cloud**

(6)

When and not to migrate to Cloud, Migration paths for cloud, Selection criteria for cloud deployment, Issues/risks in migrating to cloud computing.

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### **Internal Continuous Assessment (ICA):**

Minimum 10 assignments must be of nature, which require students to identify and implement the use case scenarios for Cloud and Cloud enabled technologies mentioned above.

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### **Text Books:**

1. Cloud Computing : Principles and paradigms By Raj Kumar Buyya, Ames Broberg, Andrezei M.Goscinski, 2011 Cloud Computing, By Michael Miller, 2008.
  2. Cloud Computing Bible by Barrie Sosinsky by Wiley Publications.
  3. <https://arpitapatel.files.wordpress.com/2014/10/cloud-computing-bible1.pdf>
  4. Cloud Computing for dummies, By Judith Hurwitz, Robin Bllor, Marcia Kaufman, Fern Halper, 2009. Download E-book
  5. Cloud Computing: Black Book, by Kalish Jayaswal, J. Kallakurchi, Donald J. Houde, Dr. Deven Shah Kogent learning Solutions Inc. Dream techpress
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### **Reference Books:**

1. Cloud Security, A comprehensive Guide to Secure Cloud Computing by Krutz, Ronald L.; Vines, Russell Dean
2. Cloud Computing : Implementation, management and security By Ritting house, John, W.
3. Mastering Cloud Computing, Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, McGraw Hill, 2013
4. Cloud Computing for dummies, By Judith Hurwitz, Robin Bllor, Marcia Kaufman, Fern Halper, 2009.
5. Cloud Computing: A Practical Approach, By Anthony T. Velte, Toby J. Velte, and Robert Elsenpeter, McGraw Hill, 2010.



**WALCHAND INSTITUTE OF TECHNOLOGY, SOLAPUR**  
**Faculty of Science and Technology**  
**Third Year B.Tech. (Computer Science and Engineering)**  
**SEMESTER – VI**  
**Professional Elective-I**  
**21CSU6E15T : INTERNET OF THINGS**

**Teaching Scheme**

Lectures: 3 Hrs/week, 3 Credits  
Practical : 2 Hrs/week, 1 Credit

**Examination Scheme**

ESE: 60 Marks  
ISE: 40 Marks  
ICA : 25 Marks

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**Introduction:**

This course introduces Internet of Things (IoT) Architecture, layers, design standards, Communication Technologies. Actuators, Sensors, IoT standard protocols and security models. Course includes case studies of various IoT applications.

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**PREREQUISITES:**

1. Fundamentals of Communication and computer network
2. Micro controller, Network Security and Web programming.

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**COURSE OUTCOMES:**

At the end of the course students will be able to

1. Interpret the characteristics and applications of IoT for deployment of the architectural model.
2. Compare smart objects and associated technologies for deployment in the network.
3. Analyze and choose the IoT protocol for efficient network communication.
4. Apply security concerns and challenges while implementing IoT solutions.
5. Provide the appropriate IoT solutions to the given problem

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**SECTION – I**

**Unit 1: Introduction to IoT**

**(07)**

Definition, Applications and characteristics of IoT, Physical Design of IoT, Logical Design of IoT, IoT Enabling Technologies, IoT Levels.

**Unit 2: IoT Architecture and Communication Technologies**

**(08)**

IoT Architecture by Oracle, Sources of IoT, M2M Communication, IoT/M2M systems, layers and design standards, Communication Technologies.

**Unit 3: Elements of IoT**

**(08)**

Sensor Technology, Participatory Sensing – Industrial IoT and Automotive IoT, Actuator, Sensor Data Communication Protocols, RFID, WSN Technology.

**SECTION – II**

**Unit 4: IoT Standards and Connectivity**

**(08)**

Constrained Application Protocols (CoAP), Representational State Transfer (REST), Zigbee / IEEE 802.15.4, Bluetooth and its low energy profile, IEEE 802.15 WPAN, 6LoWPAN.

**Unit 5: IoT Security and Business model**

**(08)**

Introduction to IoT Privacy, Security and Vulnerabilities, Use case and Misuse cases, IoT Security Tomography and Layered attacker model, Business model and business model innovation for IoT,

Value Creation in the IoT, Business model scenarios for IoT.

**Unit 6: Case Studies**

**(06)**

Domain Specific IoTs: Home Automation, Smart Cities, Environments, Energy, Agriculture, Industry, Health and Lifestyle.

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**Internal Continuous Assessment (ICA):**

The ICA shall consist of design and implementing a mini project based on the techniques and tools covered in above chapters.

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**Text Book :**

1. Internet of Things: A Hands-on approach, Arshdeep Bahga, Vijay Madisetti, Universities Press (Unit 1 and 6).
  2. IoT Architecture and Design Principles, Raj Kamal, McGraw Hill Education (Unit 2, 3 & 5).
  3. Building the IoT with IPv6 and MIPv6, Daniel Minoli, Wiley Publication ( Unit 4).
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**Reference Books:**

1. The Internet of Things: Applications and Protocols, Wiley publications. Author(s): Oliver Hersent, David Boswarthick, Omar Elloumi.



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**Faculty of Science and Technology**  
**Third Year B.Tech. (Computer Science and Engineering)**  
**SEMESTER – VI**  
**Professional Elective-I**  
**21CSU6E25T :: INFORMATION & CYBER SECURITY**

**Teaching Scheme**

Lectures: 3 Hrs/week, 3 Credits  
Practical : 2 Hrs/week, 1 Credit

**Examination Scheme**

ESE: 60 Marks  
ISE: 40 Marks  
ICA : 25 Marks

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**Course Outcomes**

At the end of course the student will be able to

1. Describe the issues addressed by Network Security and understand the concepts of cryptography and Network security.
2. Apply cryptographic techniques and algorithms to provide security to the transmitted information.
3. Analyze the concepts of Authentication and Hash functions.
4. Analyze System level security issues.

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**SECTION - I**

**Unit – 1**

**(10)**

Introduction: OSI Security Architecture, Classical Encryption techniques: Symmetric Cipher Model, Substitution Techniques, Transportation Techniques. Block Ciphers and Data Encryption Standards: Traditional Block Cipher Structure, The Data Encryption Standard, A DES Example, The Strength of DES. Advanced Encryption Standard: AES Transformation Functions, AES Key Expansion, An AES Example, AES Implementation.

**Unit – 2**

**(10)**

Public Key Cryptography and RSA: Principles of Public-Key Cryptosystems, The RSA Algorithm. Other Public-Key Cryptosystems: Diffie-Hellman Key Exchange, Elgamal Cryptographic System, Elliptic Curve Arithmetic, Elliptic Curve Cryptography, Pseudorandom Number Generation Based on an Asymmetric Cipher.

**Unit – 3**

**(04)**

Cryptographic Hash Functions: Applications of Cryptographic Hash Functions, Two Simple Hash Functions, Hash Functions Based on Cipher Block Chaining, Secure Hash Algorithm (SHA), SHA-3.

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**SECTION - II**

**Unit – 4**

**(06)**

Message Authentication Codes: Message Authentication Requirements, Message Authentication Functions, Requirements for Message Authentication Codes, Security of MACs, MACs Based on Hash Functions: HMAC, MACs Based on Block Ciphers: DAA and CMAC, Authenticated Encryption: CCM and GCM, Pseudorandom Number Generation Using Hash Functions and MACs. Digital Signatures: Digital Signatures, Elgamal Digital Signature Scheme, Schnorr Digital Signature Scheme, NIST Digital Signature Algorithm, Elliptic Curve Digital Signature Algorithm, RSA-PSS Digital Signature Algorithm.

**Unit – 5**

**(12)**

Network Access Control and Cloud Security: Network Access Control, Extensible Authentication

Protocol, IEEE 802.1X Port-Based Network Access Control. Wireless Network Security: Wireless Security, Mobile Device Security, IEEE 802.11 Wireless LAN Overview, IEEE 802.11i Wireless LAN Security.

## **Unit – 6**

**(10)**

Electronic Mail Security: Internet Mail Architecture, Email Formats, Email Threats and Comprehensive Email Security, S/MIME, Pretty Good Privacy, DNSSEC, DNS-Based Authentication of Named Entities, Sender Policy Framework, Domain Keys Identified Mail. IP Security: Overview, IP Security Policy, Encapsulating Security Payload, Combining Security Associations, Internet Key Exchange.

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### **Internal Continuous Assessment (ICA):**

1. Write a program that can encrypt and decrypt using the Caesar cipher (Additive Cipher)
  2. Write a program to encrypt and decrypt given text using the Affine Cipher
  3. Write a program to encrypt and decrypt a message using Mono-alphabetic Cipher.
  4. Write a program to encrypt and decrypt a message using Play fair Cipher.
  5. Write a program to encrypt the message using the Hill cipher
  6. Write a program to encrypt and decrypt a message using Poly alphabetic Cipher (Vigenere Cipher )
  7. Write a program to encrypt and decrypt a message using One Time Pad (OTP)/Vernam Cipher
  8. Implement Transposition Techniques Rail Fence Cipher
  9. Write a program to simulate RSA algorithm
  10. Write a program to demonstrate Diffie Hellman Key Exchange algorithm
  11. Study Block chain network using Ethereum and smart contract
  12. Study and analyze different Cyber Crime for different societal problem
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### **Text Books :**

1. Cryptography And Network Security - Principles and Practices, William Stallings Pearson Education Limited, 7th Edition, 2017. ISBN-13: 978-0134444284 ISBN-10: 0134444280.
2. Cryptography and Network Security, Behrouz A. Forouzan, Tata McGraw-Hill, 2008, ISBN-13: 978-0-13-187319-3. RV College of Engineering® Digital Communication Engineering 10
3. Computer Security: Principles and Practice, William Stallings, Lawrie Brown, Pearson Education Limited, 4th Edition. ISBN-10: 9780134794105.
4. Cryptography and Network Security, Atul Kahate, Tata McGraw-Hill, 2003, ISBN-81:203-2186-3.

**WALCHAND INSTITUTE OF TECHNOLOGY, SOLAPUR**  
**Faculty of Science and Technology**  
**Third Year B.Tech. (Computer Science and Engineering)**  
**SEMESTER – VI**  
**21CSU6CC6T :FULL STACK DEVELOPMENT**

**Teaching Scheme**

Lectures: 2Hrs/Week, 2 Credits  
Practical: 2 Hrs/ Week, 1 Credit

**Examination Scheme**

ISE: 25 Marks  
ICA: 25 Marks  
POE: 50 Marks

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**Introduction:**

Web Technology alludes to the different tools and techniques that are used during the process of communication between various sorts of gadgets over the web or internet. An internet browser is utilized to get to pages. Internet browsers can be characterized as projects that show text, information, pictures, liveliness, and video on the Internet. Hyperlinked assets on the World Wide Web can be gotten to utilizing programming interfaces given by Web programs.

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**Course Objectives**

1. Inculcate skills necessary to design, develop and style a web-based user interface.
2. Develop ability to identify appropriate client/server-side scripting web technologies suitable for a given use case.
3. Develop skills required to create light weight, efficient and scalable browser-based APIs web applications

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**Course Outcomes:**

At the end of this course students will be able to

1. Structure and implement web pages using HTML, CSS and JavaScript
2. Analyse client/server-side scripting technologies to meet requirements of web application
3. Develop a fully functioning website with full stack development

**SECTION 1**

**Unit 1 – Basics of HTML, CSS, and JavaScript** (05)

**HTML5:** Features of HTML5, designing frontend using HTML5

**CSS3:** Features of CSS3, Styling frontend using CSS3

**JavaScript:** Syntax and Semantics of JavaScript, Document Object Model, Event Handling, Form handling and validations.

**JSON:** Introduction to AJAX.

**Unit 2: REACT JS** (05)

Introduction, Fundamentals of React JS, working with Lists and Conditionals, Styling React Components and Elements, Adding Bootstrap in React, Debugging React apps, Understanding Http Requests in React in context of AJAX

**Unit 3: Express JS** (05)

Introduction to Express JS, Views and Layouts, Middleware, Routing, Form Handling with Express, Request and Response Objects.

**SECTION II**

**Unit 4: Introduction to Server-side JS Framework – Node.js** (05)

Introduction - What is Node JS, Architecture, Feature of Node JS, Installation and setup, creating web servers with HTTP (Request & Response), Event Handling, GET & POST implementation

**Unit 5: Introduction to Mongo DB****(05)**

Getting Started with MongoDB Atlas, Overview of MongoDB and the Document Model, connecting to a MongoDB Database, MongoDB CRUD Operations: Insert, Find Documents, Replace, Delete, Modifying Query Results.

**Unit 6: PHP and MySQL****(05)**

Introduction to PHP 5 and PHP 6, variables and constants, program flow, functions, arrays and files and directories, Forms and Databases, integration with MySQL applications on PHP

**In Semester Evaluation:** ISE Evaluation for the course will consists of three hands on tests based for 25 marks on the topics mentioned in the syllabus and a capstone project submitted in group of 4 students per group that will be evaluated for 10 marks.

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**Internal Continuous Assessment (ICA):**

1. Minimum 12 assignments based on above topics.
  2. Objective of assignments should be to test students' understanding and assess their ability to put into practice the concepts and terminologies learned.
  3. Assignments must be of nature, which require students to identify the use case scenarios for using technologies mentioned in the syllabus.
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**Text Books /Reference Books:**

1. Ben Frain, "Responsive Web Design with HTML5 and CSS3", Packt Publication
2. Jon Duckett, "JavaScript and jQuery: Interactive Front-End Web Development"
3. Official documentation of OpenAPI standard <http://spec.openapis.org/oas/v3.0.3>
4. Official documentation of Node.js: <https://nodejs.org/en/>
5. Official documentation of React JS <https://reactjs.org/docs/getting-started.html>
6. Official documentation of PHP <https://www.php.net/docs.php>
7. Web link for MongoDB: <https://www.mongodb.com/>
8. Official documentation of Express JS: <https://devdocs.io/express-getting-started/>

**Walchand Institute of Technology, Solapur**  
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**Third Year B. Tech. (Computer Science and Engineering)**  
**Semester – VI**  
**21CSU6MPL : Mini Project**

**Teaching Scheme**

Practical: 2 practical / week, 1 credits

**Examination Scheme**

ICA: 25 marks

POE:50 marks

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**Course Outcomes :**

At the end of this course, student will be able to

1. Select mini project problem of societal relevance in selected domain
2. Design system architecture with due consideration of environment, sustainability and ethics.
3. Develop the solution to the problem using tools, resources and frameworks.
4. Engage in teamwork and communicate effectively, while observing professional ethics.
5. Inculcate habit of self study and lifelong learning.

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**Note :**

1. There should be a group of preferably 4/5 students.
2. Students should be given projects in Hardware, Software, Embedded or any contemporary topic.
3. One guide should be allocated per group.