JSPM's
RAJARSHI SHAHU COLLEGE OF ENGINEERING
TATHAWADE, PUNE-33
(An Autonomous Institute Affiliated to SavitribaiPhule Pune University, Pune)

Department of Computer Engineering

Structure & Syllabi

S. Y. B. Tech (2019 Pattern)

w.e.f. Academic Year 2021-2022

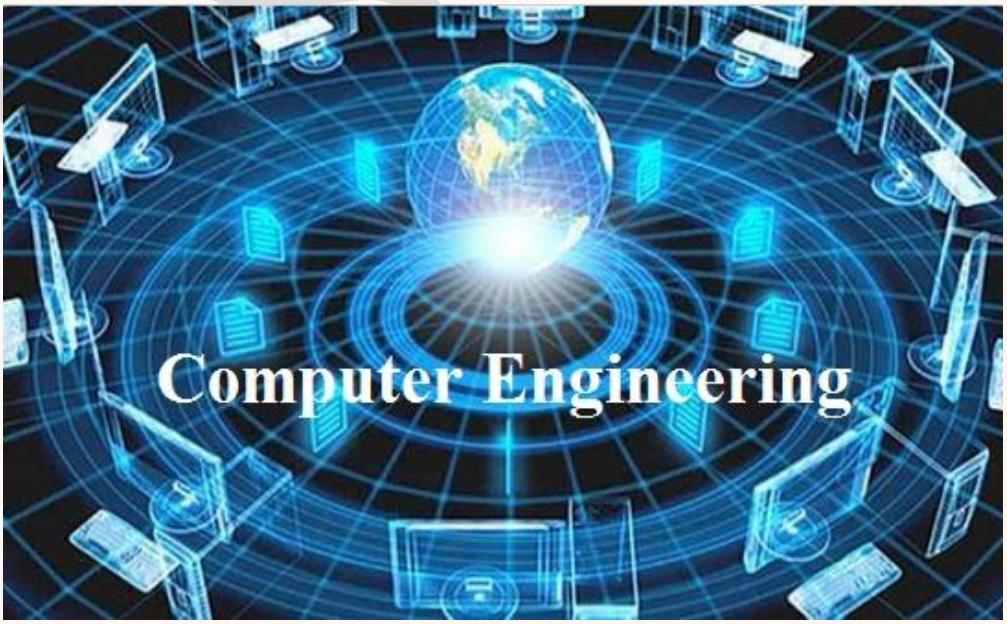
Department of Computer Engineering

Vision

To create quality computer professionals through an excellent academic environment.

Mission of Department

1. To empower students with the fundamentals of Computer Engineering for being successful professionals.
2. To motivate the students for higher studies, research, and entrepreneurship by imparting quality education.
3. To create social awareness among the students.



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Department of Computer Engineering

Program Outcomes (POs)

Engineering Graduates 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 modelling 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.

Department of Computer Engineering

Program Specific Outcomes (PSOs)

Upon successful completion of UG course in Computer Engineering Technology, the students will attain following Program Specific Outcomes:

PSO1: Domain Specialization - The ability to understand, analyze and develop computer programs related to algorithms, system software, multimedia, web design, data science, and networking for efficient design of computer-based systems.

PSO2: Problem-Solving Skills - Applying standard practices and strategies in software project development using open-ended programming environments to deliver advanced computing systems.

PSO3: Professional Career and Entrepreneurship -The ability to employ modern computer languages, operating environments, and platforms in creating innovative career paths to be an entrepreneur.

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Highlights of the Syllabus

Curriculum of UG program for Computer Engineering is designed in association with


Academic Experts


Industry/Corporate Experts


Distinguished Alumni

Features of **Computer Engineering** curriculum are designed in association with the **Tata Consultancy Services.**

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Unique features of the curriculum

1. **Curriculum centered at Outcome Based Education:**
   The new Curriculum is based on student-centered instruction models that focus on measuring student performance through outcomes. The outcomes include subject knowledge, industry required skills and attitudes.

2. **Emphasize on Fundamentals:**
   The nature of the new curriculum is rigorous and well prescribed so that the students can spend more time on preparation and self-study. The students have to learn core subjects, solve practical based assignments and must attempt periodical quizzes. This will benefit them to grasp and keep a strong hold on fundamentals of Engineering in the most effective way.

3. **Experiential Learning:**
   The curriculum emphasizes on hands-on sessions along with theoretical information. The new curriculum considers Problem Based Learning (PBL) as a teaching pedagogy and includes different subjects that encourage the students for hands on learning through virtual labs, mini-projects, etc. Accordingly, the curriculum maintains good balance between theory and laboratory credits.

4. **Promote Creativity and Innovation:**
   Along with experiential learning, the curriculum also motivates the students to inculcate creativity and innovation. Apart from conventional lab, the curriculum provides a freedom for students to perform industry assignments, pilot projects, innovative development, etc.

5. **Inculcating Ethics and Values:**
   To improvise student's behaviour, the curriculum has included systematic courses on ethics and values. The moral principles can help students to make right decisions, lead their professional lives and become ethical citizen.

6. **Blend of Curricular and Noncurricular Activities**

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The curriculum also gives importance of different activities like co-curricular, extra-curricular, sports, culture, etc. This will help to do all round development of students in all possible ways.

7. Four Tracks in B-Tech:

By offering various courses flexibility in choosing mentoring at work in specified field as:

I. Industry Internship
II. Higher Studies and Research
III. Entrepreneur
IV. In house Project

8. Global Competence:

The curriculum provides a unique opportunity for students to learn and engage in open and effective interaction with people from diverse and interconnected world. The combination of foreign languages (German, Japanese, English) and international internships in the curriculum help the students to build a capacity to examine global and intercultural issues and to propose perspectives and views.

9. Industry Induced Internship Program

To support ever demanding industry requirements, the curriculum has included an industry internship with an objective to learn technologies pertaining to their discipline and enhance their technical knowledge with a support of the live platform of Industry.

10. Motivation for Self-Learning:

The curriculum also offers a freedom to students to take the initiatives in their learning needs and set the goals with the help of online learning platforms like MOOCs, NPTEL, Swayam, etc.

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S. Y. B. Tech (Computer Engineering)
Academic Year – 2021-2022 Semester -III Structure

Course Code	Course	Teaching Scheme			Examination Schemes						Credits
		TH	Tut	Lab	Theory			Practical		Total	Total
					ISE (15)	MSE (25)	ESE (60)	TW	Lab		
CS2101	Formal Language & Automata Theory	3	1	0	15	25	60	25	-	125	4
CS2102	Object Oriented Programming	3	0	2	15	25	60	-	25	125	4
CS2103	Computer Organization & Architecture	3	0	0	15	25	60	-	-	100	3
CS2104	Computational Statistics	3	0	2	15	25	60		25	125	4
CS2113	Software Engineering and Modelling	3	0	2	15	25	60	-	25	125	4
CS2106	Engineering Design & Innovation-I	0	1	2	-	-	-	25	25	50	2
CS2114	Programming Lab-I	-	-	2	-	-	-	-	25	25	1
HS2101/ HS2102/ HS2103/ HS2109	Language Proficiency –II English/ German/ Japanese/ French	0	0	2	-	-	-		25	25	1
	Audit Course-I	Non-Credit									
	Total	**15**	**02**	**12**	**75**	**125**	**300**	**50**	**150**	**700**	**23**

Audit Course Code	Audit Course Title
HS2106	Indian Constitution
CE2113B	Environmental Awareness
CE2106B	Road Safety Management
CS2116	Online Certification Course

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S. Y. B. Tech (Computer Engineering)

Academic Year – 2021-2022 Semester -IV Structure

Course Code	Course	Teaching Scheme			Examination Schemes						Credits
		TH	Tut	Lab	Theory			Practical		Total	Total
					ISE (15)	MSE (25)	ESE (60)	TW	Lab		
CS2108	Operating Systems	3	0	2	15	25	60	-	25	125	4
CS2109	Database Management Systems	3	0	2	15	25	60	-	25	125	4
ES2103	Calculus and Transforms	3	0	0	15	25	60	-	-	100	3
CS2110	Computer Graphics and Animation	3	0	2	15	25	60	-	25	125	4
CS2111 / CS2115	Operations Research / Software Testing & Quality Assurance	3	0	0	15	25	60	-	-	100	3
HS2105	Business Communication & Value Science III	-	-	2	-	-	-	25	-	25	1
CS2112	Engineering Design & Innovation - II	-	2	4	-	-	-	50	50	100	4
	Audit Course-II	Non-Credit									
	Total	**15**	**02**	**12**	**75**	**125**	**300**	**75**	**125**	**700**	**23**

Audit Course Code	Audit Course Title
HS2108	Indian Traditional Knowledge
ME2111C	Innovations in Agriculture Engineering
CS2117	Critical Thinking
CS2116	Online Certification Course

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SEMESTER III Syllabus

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S. Y. B. Tech (Computer Engineering)
Academic Year – 2021-2022 Semester -III
[CS2101]: Formal Language & Automata Theory

Teaching Scheme:	Credit	Examination Scheme:
TH: 3 Hours/Week	TH: 03	In Sem. Evaluation : 15 Marks
TU: 1 Hours/Week	TU: 01	Mid Sem. Exam : 25 Marks
		End Sem. Exam : 60 Marks
		Term Work : 25 Marks

Course Prerequisites : Discrete mathematics [ES1108]

Course Objective:

- To study abstract computing models.
- To learn Grammar and Turing Machine.
- To learn about the theory of computability and complexity.
- To study different complexity classes.

Course Outcome:

After successful completion of the course, students will able to:

CO1: To design finite state machines to solve problems in computing.
CO2: To apply mathematical knowledge for syntax verification using grammar.
CO3: To design and analyze Push Down automata and Post Machine for formal languages.
CO4: To design and analyze Turing machine.
CO5: To explain undecidability, apply reduction techniques, prove NP completeness of a problem.

Course Contents

UNIT-I	Regular languages and finite automata	07 Hours

Introduction to Formal language, introduction to language translation logic, Essentials of translation, Alphabets and languages, Finite representation of language, Finite Automata (FA): An Informal Picture of FA, Finite State Machine (FSM), Language accepted by FA, Definition of Regular Language, Deterministic and Nondeterministic FA(DFA and NFA), epsilon- NFA, FA with output: Moore and Mealy machines -Definition, models, inter-conversion.
Self-Study: Є-NFA and its conversion to NFA.
Case Study: Construct a Finite Automata using Jflap tool for a given string.

UNIT-II	Regular Expressions (RE)	06 Hours

Introduction, Operators of RE, Building RE, Precedence of operators, Algebraic laws for RE, Regular expressions and languages, Conversions: NFA to DFA, RE to DFA Conversions: RE to DFA, DFA to RE Conversions, Pumping Lemma for Regular languages, Kleene's theorem, Myhill-Nerode theorem and its uses, minimization of finite automata.
Self-Study: Design an Application for regular expression matching using C++/Java/Python.

UNIT-III	Context-free Languages	06 Hours

Languages and grammars, productions and derivation, parse trees, ambiguity in CFG, Chomsky hierarchy of languages. Context-free grammars (CFG) and languages (CFL), Chomsky and Greibach

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normal forms, pumping lemma for context-free languages, closure properties of CFLs.
regular grammars and equivalence with finite automata, Context-sensitive languages: Context-sensitive grammars (CSG) and languages, linear bounded automata and equivalence with CSG.
Self-Study: Chomsky Hierarchy.

UNIT-IV	Pushdown Automata	05 Hours

Introduction to PDA, formal definition of PDA, deterministic pushdown automata, nondeterministic pushdown automata (NPDA) and equivalence with CFG, introduction to post machine.
Self-Study: Design of Post Machine

UNIT-V	Turing Machines	07 Hours

The basic model for Turing machines (TM), Turing recognizable(recursively enumerable) and Turing-decidable (recursive) languages and their closure properties, variants of Turing machines, nondeterministic TMs and equivalence with deterministic TMs, unrestricted grammars and equivalence with Turing machines, TMs as enumerators.
Self-Study: Halting Problem of Turing Machine
Case Study: Build a Turing Machine using Jflap tool.

UNIT-VI	Undecidability and Introduction to Complexity	07 Hours

Church-Turing thesis, universal Turing machine, the universal and diagonalization languages, reduction between languages and Rice s theorem, undecidable problems about languages.
Introductory ideas on Time complexity of deterministic and nondeterministic Turing machines, P and NP, NP- completeness, Cook's Theorem, other NP -Complete problems.
Self-Study: Post Correspondence Problem, Vertex Cover Problem.

Guidelines for Tutorial and Term Work

i) Tutorial shall be engaged in batches for each division.
ii) Term work shall be based on continuous assessment of six assignments (one per each unit).

Text Books:

T1. Vivek Kulkarni "Theory of Computation", Oxford University Press, ISBN 0-19-808458.
T2. John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman "Introduction to Automata Theory, Languages, and Computation" , Pearson Addison Wesley, Third Edition.

Reference Books:

R1. Harry R. Lewis and Christos H. Papadimitriou, "Elements of the Theory of Computation", Prentice-Hall, Second Edition, ISBN 0-13-262478-8.
R2. Dexter C. Kozen, "Automata and Computability", Springer Science+Business Media, LLC, ISBN 978-3-642-85708-9.
R3. Michael Sipser, "Introduction to the Theory of Computation", Thomson, Second Edition, ISBN 0–534–95097–3.
R4. John Martin, "Introduction to Languages and the Theory of Computation", McGraw Hill, Fourth Edition, ISBN 978–0–07–319146–1.
R5. M. R. Garey and D. S. Johnson, "Computers and Intractability: A Guide to the Theory of NP Completeness", W. H. Freeman and Company, ISBN 0–7167–1045–5.

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S. Y. B. Tech (Computer Engineering)
Academic Year – 2021-2022 Semester -III
[CS2102]: Object Oriented Programming

Teaching Scheme:	Credit	Examination Scheme:
TH: - 3 Hours/Week	TH:03	In Sem. Evaluation:15 Marks
PR: -2 Hours/Week	PR: 01	Mid Sem. Exam : 25 Marks
		End Sem. Exam : 60 Marks
		Lab Evaluation : 25 Marks

Course Prerequisites : Fundamentals of Computer Programming [CS1103]

Course Objective:

- To explore the principles of Object-Oriented Programming (OOP).
- To understand object-oriented concepts such as data abstraction, encapsulation, inheritance, dynamic binding, and polymorphism.
- To use the object-oriented paradigm in program design.
- To lay a foundation for advanced programming.
- Provide programming insight using OOP constructs

Course Outcome:

After successful completion of the course, students will able to:

CO1: Explain the basic concepts of object-oriented programming.
CO2: Describe programming insights in OOP.
CO3: Describe Files and Streams handling with their solutions
CO4: Demonstrate the use of advance features like templates and exception for reusability and sophistication
CO5: Apply standard template library for faster development
CO6: Develop the applications using object-oriented programming with C++.

Course Contents

UNIT-I	Fundamentals of Object-Oriented Programming	06 Hours

Programming Paradigms, An Overview of C, Necessity for OOP, difference between C and C++, Data Hiding, Data Abstraction, Encapsulation, Procedural Abstraction, Class and Object. Single line comments, Local variable declaration within function scope, function declaration, function overloading, stronger type checking, Reference variable, parameter passing – value Vs reference, passing pointer by value or reference, Operator new and delete, the typecasting operator.

UNIT-II	OOP Facilities	06 Hours

Scope of Class and Scope Resolution Operator, Member Function of a Class, private, protected and public Access Specifier, this Keyword, Inline Functions in contrast to macro, default arguments, Constructors and Destructors, friend function and friend class.

UNIT-III	Polymorphism	06 Hours

Introduction to Polymorphism, Operator Overloading - Concept of overloading, operator overloading, Overloading Unary Operators, Overloading Binary Operators, Data Conversion, Type casting (implicit and

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explicit), Pitfalls of Operator Overloading and Conversion, Mutable keyword, function overloading, **Self-Study: Explicit keyword**		
UNIT-IV	**Inheritance**	**06 Hours**
Introduction to Inheritance, Types of inheritance: Single inheritance, Multiple inheritance, Multilevel inheritance, Hierarchy inheritance, Hybrid Inheritance, Virtual Class, Abstract Class, Constructor in Derived Classes, Pointers to Objects, Pointer To Derived Classes, Virtual Functions, Pure Virtual Functions, Assignment of an Object to another Object, Polymorphism through dynamic binding, Overriding and hiding.		
UNIT-V	**Templates and Exception Handling**	**06 Hours**
Template: Concept, Class Template, Function Template, Member Function Template, template specialization. **Exception Handling**: Basics of Exception Handling, Exception Handling Mechanism, Throwing Mechanism, Caching Mechanism, Re-Throwing Mechanism, Standard Template Library (STL). **Self-Study: System exceptions**		
UNIT-VI	**File Handling**	**06 Hours**
Data hierarchy, Stream and files, Stream Classes, Stream Errors, Disk File I/O with Streams, File Pointers, and Error Handling in File I/O, Library functions and formatted output, File I/O with Member Functions, Overloading the Extraction and Insertion Operators, memory as a Stream Object, Command-Line Arguments **Self-Study: seekg ( )**		

Lab Contents

Guidelines for Assessment

1) Continuous assessment shall be based on experiments performed, submission of results of program in the form of report/journal, timely completion, attendance ,understanding, efficient codes, punctuality and neatness.
2) Practical/Oral examination shall be based on the practical's performed in the lab.
3) Lab assessment of 25 marks shall be based on continuous assessment and performance in Practical/Oral examination

List of Laboratory Assignments

1	Write a C++ program to create a calculator for an arithmetic operator.
2	Develop an object-oriented program in C++ to create a database of student information system using constructor, default constructor, copy constructor, destructor, static member functions, friend class, this pointer, inline code and dynamic memory allocation operators-new and delete.
3	Write a C++ program to perform different arithmetic operations on complex number using operator overloading.
4	Write a C++ program to create employee biodata using multiple inheritance.
5	Crete User defined exception to check the following conditions and throw the exception if the criterion does not meet. a. User has age between 18 and 55 b. User stays has income between Rs. 50,000 – Rs. 1,00,000 per month c. User stays in Pune/ Mumbai/ Bangalore / Chennai d. User has 4-wheeler

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	Accept age, Income, City, Vehicle from the user and check for the conditions mentioned above. If any of the condition not met then throw the exception.
6	Write a C++ menu driven program that will create a data file and implement the following operations on data: a. Search the specific item b. Display the item Update the item
7	Write a C++ program using template that inputs, sorts and outputs an integer array and a float array for selection sort.
8	Perform Function Overloading C++ Concept using VLAB.
9	Design and Develop a mini project using C++ concepts.

Text Books:

T1. Bjarne Stroustrup, "The C++ Programming language", Pearson Education, Third edition, ISBN 9780201889543.

T2. Deitel, "C++ How to Program", Pearson Education, Fourth edition ISBN:81-297-0276-2.

Reference Books:

R1. Robert Lafore, "Object-Oriented Programming in C++", Sams Publishing, Fourth Edition, ISBN:0672323087 (ISBN 13: 9780672323089).

R2. Herbert Schildt, "C++ The complete reference", McGraw Hill Professional, Eighth Edition, 2011, ISBN:978-00-72226805.

R3. Matt Weisfeld, "The Object-Oriented Thought Process", Pearson, Third Edition, ISBN-13:075-2063330166.

R4. Cox Brad and Andrew J. Novobilski, "Object Oriented Programming: An Evolutionary Approach", Addison–Wesley, Second Edition, ISBN:13:978-020-1548341.

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S. Y. B. Tech (Computer Engineering)
Academic Year – 2021-2022 Semester -III
[CS2103]: Computer Organization and Architecture

Teaching Scheme:	Credit	Examination Scheme:
TH: - 3 Hours/Week	TH: 03	In Sem. Evaluation :15 Marks Mid Sem. Exam : 25 Marks End Sem. Exam : 60 Marks

Course Prerequisites: Fundamentals of Computer Programming [CS1103] and Principles of Electronic Engineering [EC1102].

Course Objective:

- Explanation of various functional units and components of digital computers.
- Description of modern instructions set and their impact on processor design.
- Explanation of element of a memory hierarchy, identify and compare different methods for computer I/O.
- Comparison of simple computer architectures and organizations based on performance metrics.

Course Outcome:

After successful completion of the course, students will able to:

CO1: Illustrate architecture of computer
CO2: Perform arithmetic operation
CO3: Illustrate basics of memory
CO4: Describe instruction sets and pipeline strategy
CO5: Describe role of I/O systems and its techniques
CO6: Describe role of I/O systems and its techniques

Course Contents

UNIT-I	Functional Blocks of a Computer & Data Representation	6 Hours

Computer Architecture and Organization, Computer Components, CPU, Memory, Input-Output Subsystems, Control Unit, Interconnection Structures & Bus Interconnection, Signed Number Representation, Fixed and Floating-Point Representations, IEEE 754 Format, Character Representation, Number Conversion. Self-Study: Top level view of computer system.

UNIT-II	Computer Arithmetic	6 Hours

Integer Addition and Subtraction, Ripple Carry Adder, Carry Look-Ahead Adder, Multiplication – Shift-and-Add, Booth Multiplier, Carry Save Multiplier, Hardware Implementation of Integer Multiplication, Division Restoring and Non-Restoring Techniques, Floating Point Arithmetic, Self-Study: Hardware Implementation of Integer Division.

UNIT-III	Memory System Design	6 Hours

Memory Interleaving, Concept of Hierarchical Memory Organization, Cache Memory, Cache Size Vs. Block Size, Mapping Functions, Replacement Algorithms, Write Policies, Semiconductor Memory Technologies, Memory Organization, Self-Study: RAID.

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UNIT-IV	**Instruction Set Architecture & Pipelining**	**6 Hours**
Registers, Case Study: Register Organization of 8086, Instruction Execution Cycle, RTL interpretation of instructions, Addressing Modes, Case Study: Addressing Modes of 8086, Instruction set, Outlining Instruction Sets of Some Common CPUs, Basic Concepts of Pipelining, Throughput and Speedup, Pipeline Hazards. Self-Study: Types of Data Hazards.		
UNIT-V	**Peripheral Devices and Their Characteristic**	**6 Hours**
Input-Output Subsystems, I/O Device Interface, I/O Transfers – Program Controlled, Interrupt Driven and DMA, Data Transfer Modes of DMA, Privileged and Non-Privileged Instructions, Software Interrupts and Exceptions, Programs and Processes – Role of Interrupts In Process State Transitions, I/O Device Interfaces – SCSI, USB. Self-Study: 82C59A DMA Controller.		
UNIT-VI	**Control Unit Design**	**6 Hours**
Hardwired and Micro-programmed Design Approaches, Microinstructions, Microinstruction Representation, Micro-program Sequencing, Design of a Simple Hypothetical CPU. Self-Study: Single CPU Bus interconnection.		

Text Books:

T1. W. Stallings, "Computer Organization and Architecture: Designing for performance", Pearson Education/ Prentice Hall of India, 2003, ISBN 978-93-325-1870-4, 8th Edition.

T2. Computer System Architecture M. M. Mano, 3rd ed., Prentice Hall of India, New Delhi, 1993.

T3. Zaky S, Hamacher, "Computer Organization‖", 5th Edition, McGraw-Hill Publications, 2001, ISBN- 978-1-25-900537-5.

Reference Books:

R1. John P Hays, "Computer Architecture and Organization", McGraw-Hill Publication, 1998, ISBN: 978-1-25-902856-4, 3rd Edition.

R2. A. Tanenbaum, "Structured Computer Organization", Prentice Hall of India, 1991 ISBN: 81 – 203 – 1553 – 7, 4th Edition.

R3. Computer System Design and Architecture, Vincent P. Heuring and Harry F. Jordan.

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Academic Year – 2021-2022 Semester -III
[CS2104]: Computational Statistics

Teaching Scheme:	Credit	Examination Scheme:
TH: 3 Hours/Week	TH:03	In Sem. Evaluation :15 Marks
PR: 2 Hours/Week	PR:01	Mid Sem. Exam : 25 Marks
		End Sem. Exam : 60 Marks
		Lab Evaluation : 25 Marks

Course Prerequisites : Introductory topics in Statistics, Probability and Calculus [ES1106], Linear Algebra, [ES1109] Statistical Modeling [ES1110]

Course Objective:

- To learn multivariate statistical analysis
- To develop different regression models for real life problems.
- To understand and apply Discriminant Analysis
- To understand the concept of dimensionality reduction and use PCA and factor analysis
- Understand clustering and its application.

Course Outcome:
After successful completion of the course, students will able to:

CO 1: Analyze the properties of Multivariate Data.
CO 2: Apply regression models to solve real life problems.
CO 3: Apply Discriminant Analysis to solve real life problems.
CO 4: Identify key features using PCA and factor analysis methods.
CO 5: Identify clusters using k-means and hierarchical clustering methods.

Course Contents

UNIT-I	Multivariate Normal Distribution	6 Hours

Data Types, Multivariate data analysis, Benefits and Drawbacks, Bivariate and Multivariate Normal Distribution, Properties of multivariate normal distribution function, Conditional Distribution and its relation to regression model, Estimation of parameters. Multivariate Data Visualization, Case Study: Iris dataset

UNIT-II	Regression Model	6 Hours

Classical Linear Regression and its assumptions, Multiple Linear Regression: Standard multiple regression models with emphasis on detection of collinearity, outliers, non-normality and autocorrelation, Validation of model assumptions. Multivariate Regression: Assumptions of Multivariate Regression Models, Parameter estimation, Multivariate Analysis of variance and covariance, Logistic Regression, Case Study: Boston Housing Dataset

UNIT-III	Discriminant Analysis	6 Hours

Statistical background, Bayes Rule and Classification Problem, Linear discriminant analysis, Estimating linear discriminant functions and their properties, Fisher's LDA Method Case Study: Insect Data

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UNIT-IV	Principal Component Analysis	6 Hours
Principal components, Algorithm for conducting principal component analysis, deciding on how many principal compnents to retain, interpretation of principal components, H-plot. Case Study: Places Rated Data		
UNIT-V	**Factor Analysis**	**6 Hours**
Factor analysis model, extracting common factors, determining number of factors, Transformation of factor analysis solutions, Communalities, Maximum like hood estimation model, Goodness of fit, Factor scores. Case Study: Places Rated Data		
UNIT-VI	**Cluster Analysis**	**6 Hours**
Introduction, Types of clustering, Correlations and distances, clustering by partitioning methods, hierarchical clustering: Single Linkage, Complete Linkage and Average linkage, overlapping clustering, K-Means Clustering-Profiling and Interpreting Clusters Case Study: Telecom Case Study		

Lab Contents

Guidelines for Assessment

1) Continuous assessment shall be based on experiments performed, submission of results of program in the form of report/journal, timely completion, attendance ,understanding, efficient codes, punctuality and neatness.
2) Practical/Oral examination shall be based on the practical's performed in the lab.
3) Lab assessment of 50 marks shall be based on continuous assessment and performance in Practical/Oral examination

List of Laboratory Assignments

1	Using python, calculate mean, standard deviation, and variance, correlation, Pearson correlation coefficients and covariance matrix of two given arrays without using library functions. Visualize the data using suitable plots.
2	Statistical Data Analysis and Data Visualization: Download a standard dataset and perform do statistical analysis of data and plot data Visualization I. Use python to perform following: a. Identify number of features and their types (nominal or numeric). b. Compute and display summary statistics for multivariate data c. Multivariate Data visualization II. Using any tool, perform statistical analysis of data and plot data Visualization
3	Using standard dataset, apply Multiple linear regression technique and make prediction.
4	Consider a standard dataset to perform Discriminant Analysis.
5	Consider a standard dataset to perform Principal Components Analysis (PCA).
6	Consider a standard dataset and use statistical tool to perform Factor Analysis
7	Consider a standard dataset and write a program in python to apply K means clustering technique.
8	Consider a standard dataset and write a program to apply single linkage hierarchical clustering technique.
9	Considering any standard dataset, implement a mini project using concepts of computation statistics.

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Text Books:

T1. Alvin C. Rencher, "Methods of Multivariate Analysis", Second Edition, Wiley Publication

T2. Richard Johnson and Dean Wichern, "Applied multivariate Statistical Methods", Sixth Edition, Person

T3. Magnus Lie Hetland "Beginning Python: From Novice to Professional" Edition, 2005.

T4. T.W. Anderson "An Introduction to Multivariate Statistical Analysis", Wiley Publication, Third edition.

Reference Books:

R1: Han, Jiawei Kamber, Micheline Pei and Jian, "Data Mining: Concepts and Techniques", Elsevier Publishers Second Edition

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T. Y. B. Tech (Computer Engineering)
Academic Year – 2021-2022 Semester -III
[CS2114]: Programming Lab

Teaching Scheme:	Credit	Examination Scheme:
PR : - 2 Hours/Week	PR: 1	Lab Evaluation : 25 Marks

Course Prerequisites: Fundamentals of Programming Language, Data Structure and Algorithms

Course Objective:

- To adapt the usage of modern tools and recent software.
- To evaluate problems and analyze data using current technologies
- To learn the process of creation of data-driven web applications using current technologies
- To understand how to incorporate best practices for building enterprise applications
- To learn how to employ Integrated Development Environment(IDE) for implementing and testing of software solution

  To construct software solutions by evaluating alternate architectural patterns.

Course Outcome:

After successful completion of the course, students will able to:

CO 1: Use an integrated development environment to write, compile, run, and test simple object-oriented Java programs.

CO 2: Read and make elementary modifications to Java programs that solve real-world problems.

CO 3: Identify classes, objects, members of a class and relationships among them needed for a specific problem

CO 4: Write Java application programs using OOP principles and proper program structuring

UNIT-I	Java Basics	2 Hours

Overview of Java, Features of Java, Setting Java Environment, Introduction to JVM, My First Java Program, Lexical Tokens, Identifiers, Keywords, Literals, Comments , Variables in Java ,Primitive Datatypes, Operators Assignments.

UNIT-II	Control Structures in Java	2 Hours

Working with Control Structures ,Types of Control Structures ,Decision Control Structure (if, if-else, if else if, switch –case) ,Repetition Control Structure (do –while, while, for) ,Problem Solving.
Lexical Tokens, Identifiers, Keywords, Literals, Comments ,Primitive Datatypes, Operators Assignments.

UNIT-III	Array & String	2 Hours

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

UNIT-IV	Introduction to Java – Objects & Classes	2 Hours

Class and Object Declaration Methods, Types of Methods, Passing Object as Method Argument, What is Constructor, Type of Constructor, Constructor Overloading, Static Keyword, This keyword

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UNIT-V	Thread	2 Hours
Understanding Threads , Needs of Multi-Threaded Programming ,Thread Life-Cycle, Thread Priorities ,Synchronizing Threads, Inter Communication of Threads ,Critical Factor in Thread –DeadLock,		
UNIT-VI	**Package**	**2 Hours**
Organizing Classes and Interfaces in Packages , Package as Access Protection , Defining Package ,CLASSPATH Setting for Packages , Making JAR Files for Library Packages Import and Static Import Naming Convention For Packages		

Lab Contents

Guidelines for Assessment

1) Continuous assessment shall be based on experiments performed, submission of results of program in the form of report/journal, timely completion, attendance ,understanding, efficient codes, punctuality and neatness.
2) Practical/Oral examination shall be based on the practical's performed in the lab.
3) Lab assessment shall be based on continuous assessment and performance in Practical/Oral examination

List of Laboratory Assignments/Experiments

1	Write program to check prime numbers
2	Write a Java Program to print Fibonacci series
3	Java Program to Check Whether a Number is Palindrome or Not
4	Write a java program to make animated board using multi-threading
5	Program for producer consumer problem
6	Program to implement thread using runnable interface
7	Write a program to implement Applet life cycle.
8	Write a java program to demonstrate packages

Text Books:

T1: Herbert Schildt "Java The Complete Reference", Mc Graw Hill Education,11th Edition, ISBN: 978-1260440232
T2: Dr. R. Nageswara Rao, "Core Java: An Integrated Approach", Dreamtech Press, ISBN:978-9351199250

Reference Books:

R1: Java 2 programming black books, Steven Horlzner
R2: Programming with Java , A primer ,Forth edition , By E. Balagurusamy
R3. Core Java Volume-I-Fundamentals, Eighth Edition, Cay S. Horstmann, Gary Cornell, Prentice Hall, Sun Microsystems Press

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S. Y. B. Tech (Computer Engineering)
Academic Year – 2021-2022 Semester -III
[CS2113]: Software Engineering and Modelling

Teaching Scheme:	Credit	Examination Scheme:
TH: - 03 Hours/Week	TH: 03	In Sem. Evaluation: 15 Marks
PR: - 02 Hours/Week	PR: 01	Mid Sem. Exam : 25 Marks
		End Sem. Exam : 60 Marks
		Lab Evaluation : 25 Marks

Course Prerequisites: Fundamentals of Computer Programming[CS1103], Object Oriented Programming[CS2102]

Course Objective:

- To learn and understand the principles of Software Engineering.
- To transform requirement document to appropriate design.
- To choose and use modern design tools for project development and implementation.
- To understand different architectural designs and to transform them into proper model.

Course Outcome:

After successful completion of the course, students will able to:

CO 1: Choose appropriate process model depending on the user requirement.
CO 2: Apply design engineering principles and techniques to develop a software system.
CO 3: Analyze and design software model using UML.
CO 4: Apply design patterns to understand reusability in OO design.

Course Contents

UNIT-I	Introduction to Software Engineering	06 Hours

Software Engineering Fundamentals: Nature of Software, Software Engineering Principles, The Software Process, Software Myths. **Process Models:** Generic Process Model, Prescriptive **Process Models-** The Waterfall, Incremental Process (RAD), Evolutionary Process, Unified Process, Concurrent. **Advanced Process Models:** Agile Process Model Methods, Plan driven and agile development, Extreme Programming (XP) Practices.
Self-Study: Agile open source tool.

UNIT-II	Software Requirements Analysis, Design and Construction	06 Hours

Requirements Engineering: User and system requirements, Functional and non-functional requirements. **Software Requirements Specification (SRS):** The software requirements Specification document, The structure of SRS, Ways of writing an SRS. **Requirement Elicitation:** Process, Requirement validation, Elicitation techniques. **Requirement Modeling:** Decision Tables, Event Tables, State Transition Tables, Petri Nets, Class Responsibility Collaborator (CRC) model.
Self-Study: SRS for any system.

UNIT-III	Design Engineering	06 Hours

Design Concepts, The design Model, Pattern-based Software Design. **Architectural Design:** Design Decisions, Views, Patterns, Application Architectures. **Modeling Component level Design:**

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Component, Designing class-based components, Conducting Component-Level Design. **User Interface Design:** The Golden Rules, Interface Design Steps and Analysis. **Introduction to the UML Language:** Standards, Elements of the language, General description of various models. **Use Case Diagram:** Actor definitions, Writing a case goal, Use Case Relationships.
Self-Study: Use case diagram for any system.

UNIT-IV	Static Structure Diagrams	06 Hours

Class Diagram Model: Attributes, Operations, Connections descriptions in the Static Model, Association, Generalization, Aggregation, Dependency and Interfacing. **Package Diagram Model:** Description of the model, White box, Black box, Connections between packagers, Interfaces, Create Package Diagram, Drill Down. **Component Diagram:** Physical Aspect, Logical Aspect, Connections and Dependencies. **Deployment Diagram:** Processors, Connections, Components, Tasks, Threads, Signals and Events. **Self-study:** Multiplicity.

UNIT-V	Dynamic Modeling	06 Hours

Description of goal, Defining UML Method, Operation, Object Interface, Class, Sequence Diagram, Finding objects from Flow of Events, Describing the process of finding objects using a Sequence Diagram. Describing the process of finding objects using a Collaboration Diagram. Description of the State Diagram, Events Handling, Description of the Activity Diagram, Exercise in State Machines.
Self-Study: Logical difference between in activity and sequence diagram.

UNIT-VI	Architectural Design and Design Patterns	06 Hours

Architectural design: Introduction, overview of software architecture, Object oriented software architecture, Client server Architecture, Service oriented Architecture, Component based Architecture, Real time software Architecture.
Design Patterns: Introduction to Creational design patterns - Singleton, Factory, Structural design patterns - Proxy design pattern, Adapter design pattern, Behavioral - Iterator design pattern, Observer design pattern.
Self-Study: Comparative study between architectural designs and design patterns.

Lab Contents

Guidelines for Assessment

1) Continuous assessment shall be based on experiments performed, submission of results of program in the form of report/journal, timely completion, attendance ,understanding, efficient codes, punctuality and neatness.
2) Practical/Oral examination shall be based on the practical's performed in the lab.
3) Lab assessment of 25 marks shall be based on continuous assessment and performance in Practical/Oral examination

List of Laboratory Assignments

1	Construct Software Requirement Specification (SRS) document for any system.
2	Construct Data Flow diagram for any system
3	Design Use cases and implement Use case diagram for any System.
4	Design basic class diagrams to identify and describe key concepts like classes, types in your system and their relationships.
5	Design Activity Diagram for any system.
6	Design sequence diagrams OR communication diagrams with advanced notation for your system to show objects and their message exchanges.

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7	Design component & Deployment diagrams assuming that you will build your system reusing existing components along with a few new ones.
8	Write Test cases for any system.
9	Simulate modeling dataflow diagram on virtual lab(http://vlabs.iitkgp.ernet.in/se/)

Text Books:

T1. Roger Pressman, Software Engineering: A Practitioner's Approach, McGraw Hill, ISBN 0–07–337597–7.

T2. Ian Sommerville, Software Engineering, Addison and Wesley, ISBN 0-13-703515-2.

T3. Bernd Bruegge and Allen H. Dutoit "Object-Oriented Software Engineering: using UML, Patterns, and Java".

T4. Hassan Gomaa, "Software Modeling and Design- UML, Use cases, Patterns and Software Architectures" Cambridge University Press, 2011, ISBN 978-0-521-76414-8.

Reference Books:

R1. Carlo Ghezzi, Fundamentals of Software Engineering", Prentice Hall India, ISBN-10: 0133056996.

R2. Rajib Mall, Fundamentals of Software Engineering, Prentice Hall India, ISBN-13: 978-8120348981.

R3. Pankaj Jalote, An Integrated Approach to Software Engineering, Springer, ISBN 13: 9788173192715.

R4.S K Chang, Handbook of Software Engineering and Knowledge Engineering, World Scientific, Vol I, II, ISBN: 978-981-02-4973-1.

R5. Erich Gamma, Richard Helm, Ralph Johnson, and John M. Vlissides "Design Patterns: Elements of Reusable Object-Oriented Software".

R6. Gardy Booch, James Rambaugh, Ivar Jacobson," The unified modeling language user guide", Pearson Education, Second edition, 2008, ISBN 0-321-24562-8.

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S. Y. B. Tech (Computer Engineering)
Academic Year – 2021-2022 Semester -III
[CS2106]: Engineering Design &Innovation I

Teaching Scheme:	Credit	Examination Scheme:
Tut: 01 Hour/Week	TH:1	Term Work : 25 Marks
PR: 02 Hours/Week	PR: 1	Lab Evaluation : 25Marks

Course Prerequisites: Any Programming Language

Course Objective:
The primary objective of this project-based learning course is to develop critical thinking and problem-solving skills by exploring and proposing solutions to current computer engineering problems in the real world. This course will help students begin to identify themselves as computer engineers and prepare them for opportunities for their undergraduate studies.

Course Outcome:
After successful completion of the course, students will able to:
CO1: Identify real world problem.
CO2: Analyze the problem, propose different solutions and select best solution.
CO3: Prepare software requirement specification.
CO4: Design the system using UML diagrams**.**

Tutors Role in Project Based Learning

1. The fundamentals of problem-based learning, lies with the Tutors role.
2. Tutors are not the source of solutions rather they act as the facilitator and mentor.
3. The facilitator skills of the Tutors / Teacher are central to the success of PBL.
4. Students are not used to the constructivist approach to learning, it is important that they are
5. carefully told what to expect in PBL.
6. Tutors need to explain the differences between PBL and traditional learning.
7. Tutors need to explain the principals involved and role of the students in PBL learning.

Students Role in Project Based Learning

1. Prepare students for PBL before starting the sessions.
2. Students must have ability to initiate the task/idea. they should not be mere imitators.
3. They must learn to think.
4. Students working in PBL must be responsible for their own learning.
5. Throughout the PBL process, students have to define and analyze the problem, generate learning issues and apply what they have learned to solve the problem and act for them-selves and be free.
6. Students must quickly learn how to manage their own learning, Instead of passively receiving instruction.
7. Students in PBL are actively constructing their knowledge and understanding of the situation in

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groups.

8. Students in PBL are expected to work in groups.
9. They have to develop interpersonal and group process skills, such as effective listening or coping creatively with conflicts.

Guidelines for Assessment

PBL requires regular mentoring by faculty throughout the semester for successful completion of the idea/project tasks selected by the students per batch. PBL is monitored and continuous assessment is done by supervisor /mentor and authorities. It is recommended that all activities should to be recorded regularly, regular assessment of work need to be done and proper documents need to be maintained at college end by both students as well as mentor (PBL work book). PBL- I is an integral part of the PBL-II. In this, the student shall complete the partial work of the Project which will consist of problem statement, literature review, SRS, Model and Design. The student is expected to complete the project at least up to the design phase. As a part of the progress report of PBl-I, the candidate shall deliver a presentation on the advancement in Technology pertaining to the selected project topic. The student shall submit the duly certified progress report of project in standard format for satisfactory completion of the work by the concerned guide and head of the Department/Institute. Project Exam will be conducted at end of semester.

PBL Project Assignments

1	Identify domain of interest and form a team of 3 to 4 members
2	Identify and present any two problem statements addressing real life problems/innovative idea.
3	Identify different alternative solutions, select best solution and perform feasibility study for the problem.
4	Prepare synopsis for proposed system.
5	Design different UML diagrams for proposed system.

Text Books:

T1. A new model of problem-based learning. By Terry Barrett. All Ireland Society for higher education (AISHE). ISBN:978-0-9935254-6-9; 2017

T3. Problem Based Learning. By Mahnazmoallem, Woei Hung and Nada Dabbagh, Wiley Publishers. 2019.

T4. Stem Project based learning and integrated science, Technology, Engineering and mathematics approach. By Robert Capraro, Mary Margaret Capraro

T5. Hassan Gomaa, "Software Modeling and Design- UML, Use cases, Patterns and Software Architectures" Cambridge University Press, 2011, ISBN 978-0-521-76414-8.

Reference Books:

R1. De Graaff E, Kolmos A., red.: Management of change: Implementation of problem-based and project-based learning in engineering. Rotterdam: Sense Publishers. 2007.

R2. Gopalan," Project management core text book", 2 Indian Edition

R3. James Shore and Shane Warden, "The Art of Agile Development"

R4. Gardy Booch, James Rambaugh, Ivar Jacobson, "The unified modeling language user guide" , Pearson Education, Second edition, 2008, ISBN 0-321-24562-8.

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S. Y. B. Tech (Computer Engineering)
Academic Year – 2021-2022 Semester -III
[HS2101]: Language Proficiency-II [English]

Teaching Scheme: PR: 2 Hours/Week	Credit PR:1	Examination Scheme: Term Work : 25 Marks

Course Prerequisites: Language Proficiency (English) [107012A]

Course Objective:

- Inculcate the importance of Technical English Communication Skills
- Enhance their communicative competence
- Enable the students to communicate with clarity and precision
- Prepare the students to acquire structure and written expression required for their profession

Course Outcome:
After successful completion of the course, students will able to:
CO 1: Employ the understanding of Sentence Correction in day to day life.
CO 2: Understand the importance of grooming properly and imitate it for presentation.
CO 3: Express about himself /herself effectively in front of others.
CO 4: Explain their ideas, present PPTs in group meetings/ seminars and take stand for his/her beliefs.
CO 5: Communicate and speak effectively in vocal competitions

Course Contents

UNIT-I	Application of Grammar to solve questions and to form sentences correctly	4 Hours
Sentence Correction- Subject -Verb agreement, Modifiers, Parallelism, Pronoun-antecedent agreement, Verb time sequence, Prepositions		
UNIT-II	**Soft Skills**	**4 Hours**
Corporate Etiquettes, Body Language, Communication (Importance/Skills/Behaviors), Grooming (Dressing/Styling), Proxemics: Space Distance		
UNIT-III	**Oral Communication**	**4 Hours**
Speeches for different Occasions, Self-Introduction, Welcome Speech, Introductory Speech, Vote of Thanks Speech		
UNIT-IV	**Presentation**	**4 Hours**
Power point Presentation (Individual/ Group), On current trends/Travel Destinations/ Upcoming Opportunities etc..), Extempore- Orientation & Mock, (Individual Extempore on current affairs/Abstract Topics/ Controversial topics/ Political Views)		
UNIT-V	**Placement Essentials**	**4 Hours**
Orientation of Group Discussion, Mock Group Discussion, Interview, Mock Interview, Debate, Mock Debate		

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Text Books:

T1. K. R. Laxminarayan an, English for Technical Communication, SciTech, Sixth Edition, 2008

T2. William Sanborn Pfeiffer, T.V.S. Padmaja, Technical Communication: A Practical Approach, Pearson, Sixth Edition 2012

T3. A. K. Jain, Praveen Bhatia, A. M. Shaikh, Professional Communication Skills, S. Chand and Co: Fifth edition ,2009

T4. Ashraf Rizvi, Effective Technical Communication, Tata McGraw Hills publishing Company 2006

Reference Books:

R1. F. T. Wood, Remedial English Grammar, Macmillan, 2007

R2. Andrea J. Rutherford, PhD. Basic Communication Skills for Technology, Pearson Education Asia,2001

R3. Exercises in Spoken English, Parts 1 and II CIEFL, Hyderabad, Oxford University Press

R4. Sanjay Kumar, Pushplata, Communication Skills, Oxford University Press, First edition, 2012

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S. Y. B. Tech (Computer Engineering)
Academic Year – 2021-2022 Semester -III
[HS2102]: Language Proficiency-II [German]

Teaching Scheme: PR: 2 Hours/Week	Credit PR:1	Examination Scheme: Term Work : 25 Marks

Course Prerequisites: Language Proficiency-I (German)

Course Objective: To build the students' proficiency in German language in reading, speaking, writing and listening as a step towards the A1 Level Goethe Institute Certification.

Course Outcome:

After successful completion of the course, students will able to:

CO 1. Develop the skill to introduce themselves and schedule an appointment.
CO 2. Understand the Modal verb, vocabulary and rent agreement.
CO 3. Understand Dativ cases in grammar, set daily time table and activities.
CO 4. Summarize past tense and Dativ case pronouns.
CO 5. Explain everyday expressions and very simple sentences, which relate to the satisfying of concrete needs.
CO 6. Build basic sentence and build a good foundational vocabulary

Course Contents

UNIT-I	Time, Preposition and Articles	4 Hours
Grammar Revision; Akkusativ Case– Artikel, Verbs, Prepositions, Learn to read and tell time, schedule and reschedule an appointment		
UNIT-II	**Modal Verb, Vocabulary House, rooms Furniture**	**4 Hours**
Modal Verben – when and how to use them and practice, Vocabulary – Houses, Rooms, Furniture, Rent and Agreement		
UNIT-III	**Past tense, dative cases Vocabulary Time Table and daily Activities**	**4 Hours**
Past tense – Praeteritum of haben and sein ; understand the dativ case, Speak about the past,Vocabulary,time table and daily activities		
UNIT-IV	**Past tense –PII,Dative case Verbs Article and praposition**	**4 Hours**
Vocabulary – Clothes and Fashion ,Past tense – Partizip 2, Dativ Case – Pronouns ,Verbs, Artikel and Prepositions		
UNIT-V	**Personal pronouns of all cases of Vocabulary of Body parts and Vacation**	**4 Hours**
Vocabulary – Health and Body Parts, Illnesses and Healthcare system, Vocabulary - Vacation and Holidays; Personal Pronouns – all cases		
UNIT-VI	**Evaluation Activity**	**4 Hours**
Oral Evaluation and Activity- Mock Dialogue Vocabulary Dice, A Picture's Worth, Conversation Redo		

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Text Books:

T1. Netzwerk Deutsch als Fremdsprache A1, Stefanie DenglerG

T2. German Vocabulary for Beginners -Dorota Guzik

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S. Y. B. Tech (Computer Engineering)
Academic Year – 2021-2022 Semester -III
[HS2103] Language Proficiency-II [Japanese]

Teaching Scheme:	Credit	Examination Scheme:
PR: 2 Hours/Week	PR:1	Term Work : 25 Marks

Course Objective:
Inculcate the importance of Technical English Communication Skills Enhance their communicative competence Enable the students to communicate with clarity and precision Prepare the students to acquire structure and written expression required for their profession And enable them to acquire proper behavioural skills

Course Outcome:
After successful completion of the course, students will able to:
CO1: Solve questions based on Sentence Correction
CO2: Discuss and Learn the importance of grooming properly
CO3: Introduce himself/herself and others effectively
CO4: Present PPTs in group meetings/ seminars and take stand for his/her beliefs
CO5: Speak effectively in vocal competitions.

Course Contents

UNIT-I	**Hiragana**	**06 Hours**
Modified Kana, Contracted sounds, Long vowels ,To state the date in Year / Month / Date form		
UNIT-II	**Hiragana**	**06 Hours**
Pronunciation of " ん " (N), Pronunciation of" つ " (Tsu) To state one's Birthday		
UNIT-III	**Katakana**	**06 Hours**
Basic syllabary, Asking and stating Telephone numbers.		
UNIT-IV	**Katakana**	**06 Hours**
Katakana - Modified Kana, Self Introduction with Age and Nationality		
UNIT-V	**Katakana**	**06 Hours**
Contracted sounds, Long vowel, Pronunciation of " Tsu " Stating " Time "		

Guidelines for Assessment

There should be continuous assessment for the TW. Assessment must be based on continuous assessment based on work done, submission of work in the form of report / journal, timely completion, attendance, and understanding. At the end of the semester, the final grade for a Term Work shall be assigned based on the performance of the student.

Reference Books:
R1 . Minna No Nihongo, "Japanese for Everyone", Elementary Main Text book 1 (Indian Edition), Goyal Publishers & Distributors Pvt. Ltd

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S. Y. B. Tech (Computer Engineering)
Academic Year – 2021-2022 Semester -III
[HS2109] Language Proficiency-II [French]

Teaching Scheme:	Credit	Examination Scheme:
PR: -2 Hours/Week 24 hours Program	PR: 1	Term Work : 25 Marks Total : 25 Marks

Course Prerequisites:

1. Student should be good with basic Understanding of English Language.
2. Attendance in all the sessions is mandatory.

Course Objective:

1. To make the students understand the importance of learning a foreign language.
2. This module will help students learn the A1 level of French Language.
3. The learners should be able to engage in a simple buy and sell situation, day, date & time identification, accept or refuse a request and simple form filling and write a simple post card.
4. This A1.2 level will lay the foundation to the next B1 level learning of the language.

Course Outcome:

After successful completion of the course, students will able to:

CO1: Read/Write and understand French at an elementary level
CO2: Listen to basic spoken French and demonstrate understanding by responding appropriately.

Course Contents

UNIT-I	VOCABULARY	4 Hours

1. Family
2. Time
3. Prices
4. Weather / Climate
5. Date
6. Days of the week
7. Descriptions (small, big, old, young, etc)
8. Colours
9. Seasons
10. Places

Unit II	Grammar Topics	8 Hours

1. Affirmative and Negative sentences
2. Negation (not)

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3. Possessive 's to show belonging
4. Possessive adjectives
5. Partitive articles (of the)
6. Adverbs of quantity (a few, a lot)
7. Uncountable
8. Countable
9. Impersonal 'it' for the weather
10. Expressions of time (now, this morning, tomorrow)
11. Expressions of time (days, months, seasons, year)
12. Expressions of Place: go to / come from + a city or country; live in + a city or country
13. There is / There are
14. Connectors: and, or, but

Unit III	**Speaking Topics**	**8 Hours**

1. Talk about when something happens Tell the date, Tell the time
2. Talk about where something happens
3. Give directions about a city / a country
4. Give instructions or advice
5. Accept something: Agree to something
6. Refuse something: Disagree
7. Participate in a conversation
8. Say what you don't understand

Unit IV	**Socio Cultural Knowledge**	**8 Hours**

1. Difference between I want & I would like
2. How to write an informal letter
3. How to write a postcard

Guidelines for Assessment

1. Practical's for the subject shall be engaged in minimum three batches (batch size of 22 students maximum) per division.
2. Lab Evaluation is a continuous assessment based on submission of the assignments, timely completion, attendance and understanding.

List of Assignments

1.	Multiple choice questions online assessment after completion of every unit to evaluate the understanding of the grammar.
2.	Spoken exercises to evaluate the learning in the conversational aspect of the language.

Reference Books:

R1. Saison 1 (méthode de Français- Livre de l'eleve)(textbook)
R2. Saison 1 (cahier d'activités)(workbook)
R3. Collins dictionary (French-English) (French-French)

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S. Y. B. Tech (Computer Engineering)
Academic Year – 2021-2022 Semester -III
[CS2107] AUDIT COURSES

A student shall be awarded the bachelor's degree if he/she earns 170 credits and clears all the audit courses specified in the syllabus. The student shall be awarded grade as AP (Audit Course Pass) on successful completion of audit course. The student may opt for one of the audit courses per semester, starting from second year first semester. List of options offered is provided. Each student has to choose one audit course from the list per semester. Evaluation of audit course shall be done. Method of conduction and method of assessment for audit courses are suggested.

Criteria:

The student registered for audit course shall be awarded the grade AP (Audit Course Pass) and shall be included such AP grade in the Semester grade report for that course, provided student has at least 75% or above attendance and satisfactory in-semester performance and secured a passing grade in that audit course. No grade points are associated with this 'AP' grade and performance in these courses is not accounted in the calculation of the performance indices SGPA and CGPA.

Evaluation Criteria:

Guidelines for Conduction (Any one or more of following but not limited to)

• Lectures/ Guest Lectures • Visits (Social/Field) and reports • Demonstrations	• Surveys • Mini Project • Hands on experience on

Guidelines for Assessment (Any one or more of following but not limited to)

• Written Test • Demonstrations/ Practical Test • Poster presentation	• Presentations • IPR/Publication • Report

Audit Course I

HS2106	Indian Constitution
CE2113B	Environmental Awareness
CE2106B	Road Safety Management
CS2107	Online Certification Course

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Academic Year – 2021-2022 Semester -III
[HS2106]: INDIAN CONSTITUTION

Course Prerequisites: Enthusiasm to learn the subject.

Course Objective:

- To create an awareness on Government and Administration.
- Create awareness among engineers about their social responsibilities.
- To know features of our constitution.

Course Outcome:
After successful completion of the course, students will able to:
CO1: Understand Indian Constitution.
CO2: Aware of Rights and Responsibilities.
CO3: Aware of working of government bodies.

Course Contents

UNIT-I	Introduction
'Constitution', meaning of the term, Indian Constitution: Sources and constitutional history, Features: Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy.	
UNIT-II	**Union Government and its Administration**
Structure of the Indian Union: Federalism, Centre- State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha.	
UNIT-III	**State Government and its Administration**
Governor: Role and Position, CM and Council of ministers, State Secretariat: Organization, Structure and Functions.	
UNIT-IV	**Local Administration**
District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation, Panchayati raj: Introduction, PRI: Zila Panchayat, Elected officials and their roles, CEO Zila Panchayat: Position and role, Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.	
UNIT-V	**Election Commission**
Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women.	
UNIT-VI	**Administrative Organization and constitution**
Federalism in India – Features, Local Government -Panchayats –Powers and functions; 73rd and 74th amendments, Election Commission – Organization and functions, Citizen oriented measures – RTI and	

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PIL – Provisions and significance.
Text Books: **T1.** Constitution of India (Full Text), India.gov.in., National Portal of India, https://www.india.gov.in/sites/upload_files/npi/files/coi_part_full.pdf **T2.** Durga Das Basu, Bharatada Samvidhana Parichaya, Gurgaon; LexisNexis Butterworths Wadhwa, 2015. **T3.** Kb Merunandan, Bharatada Samvidhana Ondu Parichaya, Bangalore, Meragu Publications, 2015. **T4.** D.D. Basu, 'Indian Constitution'. **T5.** Avasti and Avasti ,'Indian Administration'
Reference Books: **R1.** Das Basu, Introduction to the Constitution of India, Gurgaon; LexisNexis, 2018 (23rd edn.) **R2.** M.V.Pylee, India's Constitution, New Delhi; S. Chand Pub., 2017 (16th edn.) **R3.** J.N. Pandey, The Constitutional Law of India, Allahabad; Central Law Agency, 2018 (55th ed.)

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Academic Year – 2021-2022 Semester -III
[CE2113B]: Environmental Awareness

Course Prerequisites: Enthusiasm to learn the subject**.**

Course Objective:
The main objective of this course is to aware students about an environment and impact of human activities on environment.

Course Outcome:
After successful completion of the course, students will able to:
CO 1: Understand the scope of Environmental Engineering
CO 2: Identify the Environmental impact due to Human activities
CO 3: Understand the concept of Disaster Management
CO 4: Identify the renewable and non renewable sources of energy.

Course Contents

UNIT-I	Environment and resources

Definition of Environment, Ecology and Eco-system, Structure and functions of ecosystem, balanced ecosystem, Introduction to Environmental Impact Assessment. Natural Resources: Material Cycles - Oxygen, Carbon, Nitrogen and Hydrological cycle. Importance of water quality, Water borne diseases, Water induced diseases, Significance of Fluoride in drinking water.

UNIT-II	Conventional and Non-Conventional Energy

Energy - Different types of energy, Conventional and Non - Conventional sources – Advantages and Limitations of Wind Mills, Hydro Electric, Fossil fuel, Nuclear, Solar, Biomass and Bio-gas, Geothermal energy

UNIT-III	Disaster And Pollution

Disasters - Natural Disasters: Meaning and nature of natural disasters, their types and effects (Floods, drought, cyclone, earthquakes, Tsunami). Man Made Disasters: Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire, oil fire. Pollution: Air pollution, water pollution, deforestation, industrial waste, e-waste and marine pollution

UNIT-IV	Legal aspects in Environmental Protection

Environmental Protection: Role of Government, Legal aspects, Initiatives by Non - Governmental Organizations (NGO), Environmental Education, Women Education. E waste and solid waste management rules.

Text Books:
T1. Benny Joseph (2005), "Environmental Studies", Tata McGraw – Hill Publishing Company Limited.
T2. Aloka Debi, "Environmental Science and Engineering", Universities Press (India) Pvt. Ltd. 2012.
T3. Basu, M. and Xavier, S., Fundamentals of Environmental Studies, Cambridge University Press, 2016.

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T4. E-Waste Managing the Digital Dump Yard, Edited by Vishakha Munshi, ICFAI University Press (Chapter 1).
T5. E-waste: Implications, Regulations and Management in India and Current Global Best Practices, Edited by Rakesh Johri, The Energy and Resources Institute, New Delhi (Chapter 1, 5)

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S. Y. B. Tech (Computer Engineering)
Academic Year – 2021-2022 Semester -III
[CE2106B]: Road Safety Management

Course Objective:

1. To provide basic overview on road safety & traffic management issues in view of the alarming increase in vehicular population of the country.
2. To explain the engineering & legislative measures for road safety.
3. To discuss measures for improving road safety education levels among the public.

Course Outcome:

After successful completion of the course, students will able to:

CO1: Summarize the existing road transport scenario of our country.
CO2: Explain the method of road accident investigation.
CO3: Describe the regulatory provisions needed for road safety.
CO4: Identify the safety issues for a road and make use of IRC's road safety manual for conducting road safety audit.

Course Contents

UNIT-I	Existing Road Transport Scenario

Introduction, national & international statistics related to road transport. Factors responsible for increase in vehicle growth. Share of public transport: importance and current scenario (national &international)Suggestion for effective content delivery: Displaying updated and authentic statistics & real time scenario images during the session.

UNIT-II	Road Accidents & its Investigation

Definition of road accident. National & international statistics related to road accidents. Causes of road accident. Remedies / Measures for control road accidents. Methods for accident investigation. Condition diagram & collision diagram. Black spots & its identification based on accident data.
Suggestion for effective content delivery:

1. Activity related to drawing condition & collision diagram based on actual accident data.
2. Activity related to identification of black spots based on actual accident data.

UNIT-III	Motor Vehicle Act & Central Motor Vehicle Rules

The Motor Vehicle Act of 1988. Central Motor Vehicle Rules (CMVR) of 1989. Amendments to CMVR – 2017 & 2019.
Suggestion for effective content delivery:

1. Guest lecture by RTO Officer / Traffic Police Officer.
2. Public awareness campaign.

UNIT-IV	Road Safety Audit (RSA)

Introduction & importance of RSA. Methodology, phases and checklists for Road Safety Audit as per IRC SP: 88 – 2010 (Manual on Road Safety Audit)
Suggestion for effective content delivery:
Mini project – Conducting Road Safety Audit on minimum 2 km (both directions included) road

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stretch in the nearby vicinity.

Reference Books:

R1. Kadiyali L.R., Traffic Engineering & Transport Planning, Khanna Publishers, 2003 CROWN AGENTS Ref: TEA/A369, 1995. (Unpublished contractors report for Ministry of Transport and Communications, Ghana). Road safety study and the institutional strengthening of the vehicle examination and licensing division.

R2. TRRL OVERSEAS UNIT, 1991. Towards safer roads in developing countries: a guide For planners and engineers. Crow Thorne: Transport and Road Research Laboratory

R3. Indian Roads Congress, Highway Safety Code, IRC: SP-44:1996

R4. Indian Roads Congress, Road Safety Audit Manual, IRC:SP-88-2010

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S. Y. B. Tech (Computer Engineering)
Academic Year – 2021-2022 Semester -III
[CS2107]: Online Certification Course

Course Prerequisites: Basics analysis or design concepts of the selected course.

Course Objective: The objective of this course is, to prepare students to learn the courses using online teaching aids

Course Outcome:
After successful completion of the course, students will able to:
CO1: Use modern ICT tools for self-learning
CO2: Demonstrate the ability of self- learning
CO3: Demonstrate the ability to abreast with advance technologies.

Course Contents

The students should complete at least one Certification course which shall be offered by NPTEL/Spoken tutorial/ Swayam/ IIT Bombay/ MOOC/or any other approved agency by the department during the same semester. The students should select the subjects relevant to Computer Engineering and which should not be included in the specified curriculum. Minimum duration of course should be 4 weeks and all assignments should be submitted. Certification done would be appreciated but not mandatory. In case a student does not go for certification, he/she should pass the internal test organized by department for the said course.

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SEMESTER IV

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Y. B. Tech (Computer Engineering)
Academic Year – 2021-2022 Semester -IV
[CS2108]: Operating Systems

Teaching Scheme:	Credit	Examination Scheme:
TH: 03 Hours/Week PR: 02 Hours/Week	TH: 03 PR: 01	In Sem. Evaluation:15 Marks Mid Sem. Exam : 25 Marks End Sem. Exam : 60 Marks Lab Evaluation : 25 Marks

Course Prerequisites: Data Structure and Algorithms [CS1104], Computer Organization and Architecture [CS2103]

Course Objective: To understand concept of Process, Memory, File, I/O and Disk Management of Operating System.

Course Outcome:
After successful completion of the course, students will able to:

CO 1: Comprehend basic concept of operating system and process management.
CO 2: Apply the concept of resource management and Process Scheduling.
CO 3: Comprehend concepts of Process Synchronization and deadlock
CO 4: Explain concept of Memory Management
CO 5: Illustrate concepts of File System Manipulation
CO 6: Demonstrate the concepts of disk management and Unix OS

Course Contents

UNIT-I	Induction to Operating System	6 Hours

Introduction: Concept of Operating Systems (OS), Generations of OS, Types of OS, OS Services, , Structure of an OS, Operating system operations, Process Management, Memory Management, Storage Management, Open-Source Operating Systems, Concept of Virtual Machine, . Processes: Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching. Thread: Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads. Self-Study: OS Booting System.

UNIT-II	Process Scheduling	6 Hours

Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, and Response Time. Scheduling algorithms: Pre-emptive and non-pre-emptive, FCFS, SJF, RR; Multiprocessor scheduling: Real Time

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scheduling: RM and EDF. Self-Study: Multi-processor Scheduling.		
UNIT-III	**Process Synchronization and Deadlock**	**6 Hours**
Over view of Process Synchronization, Inter-process Communication: Concurrent processes, The Critical-Section Problem, Race condition, Peterson's Solution, Synchronization Hardware, Semaphores, Classic Problems of Synchronization, Monitors. Deadlocks: Definition, Necessary and sufficient conditions, for Deadlock, Deadlock Prevention, and Deadlock Avoidance: Deadlock allocation graphs, Banker's algorithm, Deadlock detection algorithms and Recovery. Self-Study: IPC using pipe.		
UNIT-IV	**Memory Management**	**6 Hours**
Memory Management: Basic concept, Logical and Physical address maps, Memory allocation methods: Contiguous, linked and index, Fixed and variable partition–Internal and External fragmentation and Compaction. Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page allocation, Partitioning, Paging, Page fault, Working Set, Segmentation, Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used (LRU). Self-Study: Copy on Write.		
UNIT-V	**File and I/O Management**	**6 Hours**
File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency and performance. I/O Hardware: I/O devices, Device controllers, Direct Memory Access, Principles of I/O. Self-Study: Network File System.		
UNIT-VI	**Secondary Storage Management and Unix OS**	**6 Hours**
Disk Management: Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks. Case study: UNIX OS file system, shell, filters, shell programming, programming with the standard I/O, and UNIX system calls. Self-Study: RAID Structure.		
Lab Contents		
Guidelines for Assessment		
1) Continuous assessment shall be based on experiments performed, submission of results of program in the form of report/journal, timely completion, attendance ,understanding, efficient codes, punctuality and neatness. 2) Practical/Oral examination shall be based on the practical's performed in the lab. 3) Lab assessment of 25 marks shall be based on continuous assessment and performance in Practical/Oral examination.		

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List of Laboratory Assignments	
1	Write a Program to create A Process using fork.
2	Simulation of Scheduling algorithm. a) FCFS b) SJF c) RR.
3	Write a Program to simulate Deadlock.
4	Write a Program For Inter Process Communication using Pipe.
5	Write a Program to simulate page Replacement algorithm. a) FIFO b) LRU c) optimal.
6	Write a Program for File allocation Methods. a) continuous b) Linked c) Indexed.
7	Write a Program to simulate disk Scheduling Algorithm. a) FCFS b) SSTF c) SCAN d) CSCAN e) LOOK.
8	Write a Program to implement UNIX system call –open using shell Programming.
9	To Implement UNIX System call, CP and CAT.

Text Books:

T1. Operating System Concepts Essentials. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne.

Reference Books:

R1. Operating Systems: Internals and Design Principles. William Stallings.
R2. Operating System: A Design-oriented Approach. Charles Patrick Crowley.
R3. Operating Systems: A Modern Perspective. Gary J. Nutt.
R4. Design of the Unix Operating Systems. Maurice J. Bach.
R5. Understanding the Linux Kernel, Daniel Pierre Bovet, Marco Cesati.

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S. Y. B. Tech (Computer Engineering)
Academic Year – 2021-2022 Semester -IV
[CS2109]: Database Management Systems

Teaching Scheme:	Credit	Examination Scheme:
TH: 3 Hours/Week	TH:3	In Sem. Evaluation:15 Marks
PR: 2Hours/Week	PR: 1	Mid Sem. Exam : 25 Marks
		End Sem. Exam : 60 Marks
		Lab Evaluation : 25 Marks

Course Prerequisites: Data Structures and Algorithm

Course Objective:

- To understand the fundamental concepts of database management. These concepts include aspects of database design, database languages, and database-system implementation
- To provide a strong formal foundation in database concepts, technology and practice
- To give systematic database design approaches covering conceptual design, logical design and an overview of physical design
- Be familiar with the basic issues of transaction processing and concurrency control
- To learn and understand various Database Security, Architectures and Applications
- To learn a powerful, flexible and scalable general-purpose database to handle big data.

Course Outcome:

After successful completion of the course, students will able to:

CO 1: Demonstrate E-R Model for given requirements and convert the same into database tables using suitable SQL and PL/SQL Command
CO 2: Apply database normalization techniques for relational database design
CO 3: Explain transaction Management in relational database System.
CO 4: Describe database threats, database security techniques & different database architecture and its application in real life.

Course Contents

UNIT-I	Introduction	6 Hours

Introduction: Introduction to Database. Hierarchical, Network and Relational Models. Database system architecture: Data Abstraction, Data Independence, Data Definition Language (DDL), Data Manipulation Language (DML). Data models: Entity-relationship model, network model, relational and object-oriented data models, integrity constraints, data manipulation operations. Case Study: ER diagram on University Database

UNIT-II	Relational Language: SQL & PL/SQL	6 Hours

Relational query languages: Relational algebra, Tuple and domain relational calculus, SQL3, DDL, DCL and DML constructs, Open source and Commercial DBMS - MYSQL, ORACLE, DB2, SQL server. PL/SQL: concept of Stored Procedures & Functions, Cursors, Triggers, Assertions, roles and privileges, Embedded SQL, Dynamic SQL.

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UNIT-III	**Relational Database Design**	**6 Hours**
Relational database design: Domain and data dependency, Armstrong's axioms, Functional Dependencies, Normal forms, Dependency preservation, Lossless design. Self-Study: Apply normalization for University Database		
UNIT-IV	**Transaction processing and Query Optimization**	**8 Hours**
Transaction processing: Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp-based schedulers, Multi-version and optimistic Concurrency Control schemes, Database recovery. Query processing and optimization: Evaluation of relational algebra expressions, Query equivalence, Join strategies, Query optimization algorithms. Storage strategies: Indices, B-trees, Hashing.		
UNIT-V	**Data Security**	**6 Hours**
Database Security: Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQL injection		
UNIT-VI	**Advances in Database Management System**	**8 Hours**
Advanced topics: Object oriented and object relational databases, Logical databases, Web databases, Distributed databases, Data warehousing and data mining. Introduction to NoSQL Database, Types and examples of NoSQL Database- Key value store, document store, graph, Performance, Structured verses unstructured data, Distributed Database Model, CAP theorem and BASE Properties, Comparative study of SQL and NoSQL, NoSQL Data Models, Case Study-unstructured data from social media.		

Lab Contents

Guidelines for Assessment

1) Continuous assessment shall be based on experiments performed, submission of results of program in the form of report/journal, timely completion, attendance ,understanding, efficient codes, punctuality and neatness.
2) Practical/Oral examination shall be based on the practical's performed in the lab.
3) Lab assessment of 25 marks shall be based on continuous assessment and performance in Practical/Oral examination.

List of Laboratory Assignments

1	Design and Develop SQL DDL statements which demonstrate the use of SQL objects such as Table, View, Index, Sequence, Synonym.
2	Design at least 10 SQL queries for suitable database application using SQL DML statements: Insert, Select, Update, Delete with operators, functions, and set operator.
3	Design at least 10 SQL queries for suitable database application using SQL DML statements: all types of Join, Sub-Query and View.
4	Write a PL/SQL block of code using parameterized Cursor, that will merge the data available in the newly created table N_RollCall with the data available in the table O_RollCall. If the data in the first table already exist in the second table then that data should be skipped.
5	Design and Develop MongoDB Queries using CRUD operations. (Use CRUD operations, SAVE method, logical operators)
6	Design and Implement any 5-query using MongoDB

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7	Implement aggregation and indexing with suitable example using MongoDB.
8	Development of a 2-tier application using a suitable front end
9	Suggested Virtual Lab Assignments (http://vlabs.iitb.ac.in/bootcamp/labs/dbms/exp8/exp/index.php) http://vlabs.iitb.ac.in/bootcamp/labs/dbms/exp8/exp/procedure.php

Text Books:

T1. Silberschatz A., Korth H., Sudarshan S., "Database System Concepts", McGraw Hill Publishers, ISBN 0-07-120413-X, 6th edition

Reference Books:

R1. Principles of Database and Knowledge – Base Systems, Vol 1 by J. D. Ullman.

R2. R. Elmasri and S. Navathe, "Fundamentals of Database Systems", Pearson; 7 edition ISBN-13: 978-0-13-397077-7

R3. Kristina Chodorow, Michael Dirolf, "MangoDB: The Definitive Guide", O'Reilly Publications, ISBN: 978-1-449-34468-9.

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S. Y. B. Tech (Computer Engineering)
Academic Year – 2021-2022 Semester -IV
[ES2103]: Calculus and Transforms

Teaching Scheme:	Credit	Examination Scheme:
TH: 3 Hours/Week	TH:3	In Sem. Evaluation:15 Marks Mid Sem. Exam : 25 Marks End Sem. Exam : 60 Marks

Course Prerequisites: Differentiation & Integration, Partial differentiation, Multiple integrals and Vector algebra.

Course Objective: To familiarize the students with concepts and techniques in Differential calculus, Vector calculus, Ordinary differential equations, Numerical methods, Laplace transform, Fourier transform and Z-transform. The aim is to equip them with the techniques to understand advanced level mathematics and its applications that would enhance analytical thinking power, useful in their disciplines.

Course Outcome:
After successful completion of the course, students will able to:
CO1: Apply concepts of Mean value theorems and its generalizations leading to Taylors and Maclaurin's series useful in the analysis of engineering problems
CO2: Apply Vector calculus to modernized techniques in various computing systems
CO3: Solve Linear differential equations, essential in modelling and design of computer based systems
CO4: Obtain Interpolating polynomials, numerical differentiation and integration, numerical solutions of ordinary differential equations used in modern scientific computing.
CO5: Apply concepts of Laplace transform, Fourier transform & Z-transform and its applications to continuous & discrete systems and Image processing.

Course Contents

UNIT-I	Differential Calculus	8 Hours

Rolle's Theorem, Mean Value Theorems, Taylor's Series and Maclaurin's Series, Expansion of functions using standard expansions

UNIT-II	Vector Calculus	8 Hours

Vector differentiation, Gradient, Divergence and Curl, Directional derivative, Solenoidal and Irrotational fields, Vector identities. Line, Surface and Volume integrals, Green's Lemma, Gauss's Divergence theorem and Stoke's theorem

UNIT-III	Ordinary Differential Equations (ODE)	8 Hours

First Order ODE: Exact DE and equations reducible to exact form. Linear Differential equations (LDE): LDE of n^{th} order with constant coefficients, Complementary Function, Particular Integral: General method, Short methods, Method of variation of parameters, Cauchy's and Legendre's DE.

UNIT-IV	Numerical Methods	8 Hours

Interpolation: Finite Differences, Newton's and Lagrange's Interpolation formulae, Numerical Differentiation. Numerical Integration: Trapezoidal and Simpson's rules, Bound of truncation error.

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Solution of Ordinary differential equations: Euler's, Modified Euler's, Runge-Kutta 4th order methods and Predictor-Corrector methods		
UNIT-V	**Laplace Transforms**	**8 Hours**
Laplace Transform (LT): LT of standard functions, properties and theorems, Inverse LT, Application of LT to solve LDE		
UNIT-VI	**Fourier and Z Transforms**	**8 Hours**
Fourier Transform (FT): Complex exponential form of Fourier series, Fourier integral theorem, Fourier Sine and Cosine integrals, Fourier transform, Fourier Sine and Cosine transforms and their inverses, Discrete Fourier Transform. Z - Transform (ZT): Introduction, Definition, Standard properties, ZT of standard sequences and their inverses. Solution of difference equations.		

Text Books:

T1. Higher Engineering Mathematics by B.V. Ramana (Tata McGraw-Hill).

T2. Higher Engineering Mathematics by B. S. Grewal (Khanna Publication, Delhi)

Reference Books:

R1. Advanced Engineering Mathematics, 10e, by Erwin Kreyszig (Wiley India).

R2. Advanced Engineering Mathematics, 2e, by M. D. Greenberg (Pearson Education).

R3. Advanced Engineering Mathematics, 7e, by Peter V. O'Neil (Cengage Learning).

R4. Differential Equations, 3e by S. L. Ross (Wiley India).

R5. Introductory Methods of Numerical Analysis, 5e, by S S Sastry (PHI Learning Pvt. Ltd., 2012)

R6. Numerical Methods for Scientific and Engineers Computation,5e by M. K. Jain, S. R. K. Iyengar and R. K Jain (New Age international Publishers, Delhi)

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S. Y. B. Tech (Computer Engineering)
Academic Year – 2021-2022 Semester -IV
[CS2110]: Computer Graphics and Animation

Teaching Scheme:	Credit	Examination Scheme:
TH: 3 Hours/Week	TH: 3	In Sem. Evaluation: 15 Marks
PR: 2 Hours/Week	PR: 1	Mid Sem. Exam : 25 Marks
		End Sem. Exam : 60 Marks
		Lab Evaluation : 25 Marks

Course Prerequisites: Data Structure an Algorithms , Basic Mathematics

Course Objective:

- To understand the basic objectives and scope of computer graphics systems.
- To learn the various algorithms for generating and rendering graphical figures
- To understand the basic structures of 2D and 3D graphics systems with mathematics behind the graphical transformations.
- To understand and apply various methods and techniques regarding color spaces, projections, animation, shading, illumination and lighting.
- Identify computer graphics applications and common graphics APIs

Course Outcome:

After successful completion of the course, students will able to:

CO 1: Identify structure & operation of various hardware devices and to recognize file formats & graphics libraries used in computer graphics.

CO 2: Describe and analyze different scan conversion algorithms.

CO 3: Implement polygon filling, windowing and clipping algorithms and compare their performance.

CO 4: Interpret use 2D and 3D geometric transformations.

CO 5: Apply techniques of hidden surfaces, light effects, shading, curve generation and fractals in construction of natural objects.

CO 6: Experiment advanced animations and gaming techniques to create animation by using modern graphics tools.

Course Contents

UNIT-I	Introduction Graphics Primitives	6 Hours

Introduction to computer graphics, state of art applications of computer graphics, pixel, frame buffer, resolution, aspect ratio. Video display devices: CRT (Raster scan and random scan displays), flat panel displays. Interactive devices: joysticks, touch panels, light pens. Data generating devices: scanners and digitizers. Graphics Files: TIFF, JPEG.

UNIT-II	Scan Conversion	6 Hours

DDL and Line and line segments, line and circle drawing algorithms: DDA and Bresenham, Line styles: thick, dotted and dashed, aliasing and antialiasing techniques. Character generating methods:

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stroke and bitmap method, Concurrent line drawing using midpoint sub-division algorithm.		
UNIT-III	**Clipping and Windowing**	**6 Hours**
Polygon and Clipping Introduction to polygon, types: convex, concave and complex. Representation of polygon, Inside test, polygon filling algorithms – seed fill, scan line fill and filling with patterns. Windowing and clipping: viewing transformations, 2-D clipping: Cohen – Sutherland algorithm. Polygon clipping: Sutherland Hodgeman algorithm, generalized clipping		
UNIT-IV	**Geometric Transformations**	**6 Hours**
2-D transformations: introduction, matrices, Translation, scaling, rotation, homogeneous coordinates and matrix representation, translation, coordinate transformation, rotation about an arbitrary point, inverse and shear transformation. 3-D transformations: introduction, 3-D geometry, primitives, 3-D transformations and matrix representation, rotation about an arbitrary axis, concept of parallel and perspective projections, viewing parameters, 3-D clipping, 3-D viewing transformations.		
UNIT-V	**Light, Color Models, Hidden Surfaces, Curves, and Fractals**	**6 Hours**
Illumination Models: Light Sources, Ambient Light, Diffuse reflection, Specular Reflection, and the Phong model, Combined diffuse and Specular reflections with multiple light sources, warn model, Color models and tables: RGB, HIS Shading Algorithms: Halftone, Gauraud and Phong Shading. Hidden Surfaces Introduction, Back face detection and removal, Algorithms: Depth buffer (z), Depth sorts (Painter), Area subdivision (Warnock), BSP tree, and Scan line. Segment: Introduction, Segment table, Segment creation, closing, deleting and renaming, Visibility Curves: Introduction, Interpolation and Approximation, Blending function, B-Spline curve, Bezier curve, Fractals: Introduction, Classification, Applications, Fractal generation: snowflake		
UNIT-VI	**Animation and Gaming**	**6 Hours**
Animation: Introduction, Basic guidelines of animation, animation sequences, Key- frame, Morphing, Motion specification. animation languages: Introduction to OpenGL.Gaming Technologies: Gaming platforms: Graphics Memory Pipeline, Introduction to NVIDIA workstation, i860, Introduction to Interactive Graphics: 3D Studio, Maya, VFX		

Lab Contents

Guidelines for Assessment

1) Continuous assessment shall be based on experiments performed, submission of results of program in the form of report/journal, timely completion, attendance ,understanding, efficient codes, punctuality and neatness.
2) Practical/Oral examination shall be based on the practical's performed in the lab.
3) Lab assessment of 25 marks shall be based on continuous assessment and performance in Practical/Oral examination.

List of Laboratory Assignments

1	To implement DDA algorithms for line and circle.
2	To implement Bresenham's algorithms for line, circle and ellipse drawing
3	Write a program to draw a concave polygon and fill it with desired pattern using scan line algorithm. Use mouse interfacing to draw polygon
4	To implement Cohen–Sutherland 2D clipping Algorithm.
5	Implement 2D/ 3D Transformations.
6	Write a program to draw any object such as flower, waves using any curve generation

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	techniques.
7	Visualize basic data structure and their operations using OpenGL.
8	Render three-dimensional graphics using Direct3D/Maya/Blend.
9	Suggested Virtual Lab Assignments (http://vlabs.iitb.ac.in/vlabs-dev/labs/cglab/index.php

Text Books:

T1. S. Harrington, "Computer Graphics", 2nd Edition, McGraw-Hill Publications, 1987, ISBN 0 – 07 – 100472 – 6.

T2. D. Rogers, "Procedural Elements for Computer Graphics", 2nd Edition, Tata McGraw-Hill Publication, 2001, ISBN 0 – 07 – 047371 – 4.

Reference Books:

R1. J. Foley, V. Dam, S. Feiner, J. Hughes, "Computer Graphics Principles and Practice", 2nd Edition, Pearson Education, 2003, ISBN 81 – 7808 – 038 – 9.

R2. D. Hearn, M. Baker, "Computer Graphics – C Version", 2nd Edition, Pearson Education, 2002, ISBN 81 – 7808 – 794 – 4.

R3. D. Rogers, J. Adams, "Mathematical Elements for Computer Graphics", 2nd Edition, Tata McGraw-Hill Publication, 2002, ISBN 0 – 07 – 048677 – 8.

R4. Dave Shreiner, "OpenGL Programming Guide: The Official Guide to Learning OpenGL", Version 4.3 (8th Edition) Pearson Education 2018, ISBN-13: 978-0321773036.

R5. Jon Gress, "Visual Effects& Compositing", Pearson Education, ISBN 13: 978-0-321-98438-8

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S. Y. B. Tech (Computer Engineering)
Academic Year – 2021-2022 Semester -IV
[CS2111]: Operations Research

Teaching Scheme:	Credit	Examination Scheme:
TH: - 03 Hours/Week	TH: 03	In Sem. Evaluation:15 Marks Mid Sem. Exam : 25 Marks End Sem. Exam : 60 Marks

Course Prerequisites: Introductory topics in Probability [ES1106], Statistical Methods [ES1110], Discrete Mathematics [ES1108], Linear Algebra [ES1109]

Course Objective:

- Identify and develop Operation Research models from the verbal description of the real-world Problem.
- Develop various Linear Programming (LP) models
- Understand the mathematical tools that are needed to solve optimization problems.
- Use of CPM and PERT techniques, to plan, schedule, and control project activities.

Course Outcome:
After successful completion of the course, students will able to:
CO1: Describe characteristics and scope of OR.
CO2: Use appropriate decision-making approaches and tools.
CO3: Build various dynamic and adaptive models.
CO4: Apply Project scheduling techniques.
CO5: Develop critical thinking and objective analysis of decision problems.
CO6: Apply the OR techniques for efficacy.

Course Contents

UNIT-I	Introduction to OR	06 Hours

Origin of OR and its definition. Concept of optimizing performance measure, Types of OR problems, Deterministic vs. Stochastic optimization, Phases of OR problem approach – problem formulation, building mathematical models, deriving solutions, validating models, controlling and implementing solution.

UNIT-II	Linear Programming	06 Hours

Linear programming – Examples from industrial cases, formulation & definitions, Matrix form. Implicit assumptions of LPP. Some basic concepts and results of linear algebra – Vectors, Matrices, Linear Independence/Dependence of vectors, Rank, Basis, System of linear eqns., Hyperplane, Convex set, Convex polyhedron, Extreme points, Initial Basic Feasible Solutions (IBFS), Basic feasible solutions. Geometric method: 2-variable case, Special cases – infeasibility, unboundedness, redundancy & degeneracy, With examples. Simplex Algorithm – slack, surplus & artificial variables, computational details, big-M method, identification and resolution of special cases through simplex

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iterations. Duality – formulation, results, fundamental theorem of duality, dual-simplex and primal-dual algorithms.

UNIT-III	Transportation and Assignment problems	06 Hours

TP – Definitions, Examples – decision variables, supply & demand constraints, formulation of TP, Balanced & unbalanced situations, Solution methods –NWCM, minimum cost and VAM, test for optimality (MODI method), degeneracy and its resolution. AP - Definitions, Examples – decision variables, constraints, formulation of AP, Balanced & unbalanced situations, Solution method – Hungarian, test for optimality (MODI method), degeneracy & its resolution.

UNIT-IV	PERT – CPM	06 Hours

Project definition, Project scheduling techniques – Gantt chart, PERT & CPM, Determination of critical paths, Estimation of Project time and its variance in PERT using statistical principles, Concept of project crashing, time v/s cost trade-off. All estimates of Time, Examples from industrial cases.

UNIT-V	Inventory Control	06 Hours

Functions of inventory and its disadvantages, ABC analysis, Concept of inventory costs, Basics of inventory policy (order, lead time, types), Fixed order-quantity models – EOQ, POQ & Quantity discount models. EOQ models for discrete units, sensitivity analysis and Robustness, Special cases of EOQ models for safety stock with known/unknown stock out situations, models under prescribed policy, Probabilistic situations.

UNIT-VI	Queuing Theory and Simulation Methodology	06 Hours

Definitions – queue (waiting line), waiting costs, characteristics (arrival, queue, service discipline) of queuing system, queue types (channel vs. phase).

Kendall's notation, Little's law, steady state behavior, Poisson's Process & queue, Models with examples - M/M/1 and its performance measures; M/M/m and its performance measures; brief description about some special models. Examples from real world cases – Super Market, Network Router, etc.

Definition and steps of simulation, random number, random number generator, True v/s pseudo random number generators, Examples where random numbers are required, Hashing, Encryption, etc.

Discrete Event Systems Simulation – clock, event list, Application in Scheduling, Queuing systems and Inventory systems.

Text Books:

T1. Operations Research: An Introduction. H. A. Taha.

Reference Books:

R1. Linear Programming. K.G. Murthy.
R2. Linear Programming. G. Hadley.
R3. Principles of OR with Application to Managerial Decisions. H.M. Wagner.
R4. Introduction to Operations Research. F.S. Hiller and G.J. Lieberman.
R5. Elements of Queuing Theory. Thomas L. Saaty.
R6. Operations Research and Management Science, Hand Book: Edited By A. Ravi Ravindran.
R7. Management Guide to PERT/CPM. Wiest & Levy.
R8. Modern Inventory Management. J.W. Prichard and R.H. Eagle.

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S. Y. B. Tech (Computer Engineering)
Academic Year – 2021-2022 Semester -IV
[CS2115]: Software Testing & Quality Assurance

Teaching Scheme:	Credit	Examination Scheme:
TH: - 3 Hours/Week	TH:3	In Sem. Evaluation:15 Marks Mid Sem. Exam: 25 Marks End Sem. Exam: 60 Marks

Course Prerequisites: Software Engineering, Software Modeling and Design

Course Objective:

- To learn concept of Software Testing.
- To understand the levels of testing in the user environment.
- To understand white box, block box, object oriented, web based and cloud testing
- To learn and understand the importance software quality and assurance.
- To understand in details automation testing and tools for automation testing.

Course Outcome:

After successful completion of the course, students will able to:

CO1: Describe fundamental concepts in software testing such as manual testing, automation testing and software quality assurance.
CO2: Design and develop project test plan, design test cases, test data, and conduct test operations.
CO3: Apply various levels of testing for testing software.
CO4: Apply specialised testing environment.
CO5: Apply and analyze automation tool.
CO6: Apply and analyze effectiveness Software Quality Tools & management

Course Contents

UNIT-I	Introduction	8 Hours

Introduction, Constraints of Software product Quality assessment, Customer is a King, Quality and Productivity Relationship, Requirements of Product, Organization Culture, Characteristics of Software, Software Development Process, Types of Product, Criticality Definitions, Problematic areas of SDLC, Software Quality Management, Why Software has defects, Processes related to Software Quality, Quality Management System's Structure, Pillars of Quality Management System, Important aspects of quality management.

UNIT-II	Test Planning and Management	6 Hours

Review of Fundamentals of Software Testing, Testing during development life cycle, Requirement Traceability matrix, essentials, Work bench, Important Features of Testing Process, Misconceptions, Principles, salient and policy of Software testing, Test Strategy, Test Planning, Testing Process and number of defects found, Test teem efficiency, Mutation testing, challenges, test team approach, Process problem faced, Cost aspect, establishing testing policy, methods, structured approach, categories of defect, Defect/ error/ mistake in software, Developing Test Strategy and Plan, Testing process, Attitude towards testing, approaches, challenges, Raising management awareness for testing,

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skills required by tester.		
UNIT-III	**Levels of Testing**	**8 Hours**
The Need for Levels of Testing - Unit Test Planning, Designing the Unit Tests, The Test Harness, Running the Unit tests and Recording Results. Integration Tests – Designing Integration Tests, Integration Test Planning, Scenario Testing, Defect Bash Elimination. System Testing – Acceptance testing, Performance testing, Regression Testing, Alpha, Beta Tests-Testing OO systems, Usability and Accessibility Testing, Configuration Testing, Compatibility Testing, Testing the documentation, Website Testing. Case Study for Unit and Integration Testing.		
UNIT-IV	**Testing for specialized environment**	**6 Hours**
Agile Testing , Agile Testing Life Cycle, Testing in Scrum phases, Challenges in Agile Testing		
UNIT-V	**Selenium Tool**	**6 Hours**
Introducing Selenium, Brief History of The Selenium Project, Selenium's Tool Suite, Selenium IDE, Selenium RC, Selenium Web driver & Selenium Grid		
UNIT-VI	**Software Quality Tools & Quality Management**	**8 Hours**
Software Quality, Software Quality Dilemma, Achieving Software Quality, Software Quality Assurance. Elements of SQA, SQA Tasks, Goals, and Metrics, Formal Approaches to SQA, Statistical Software Quality Assurance, Six Sigma for Software Engineering, ISO 9000 Quality Standards, SQA Plan. Total Quality Management, Product Quality Metrics, In process Quality Metrics, Software maintenance and Ishikawa's 7 basic tools.		

Text Books

T1. M G Limaye, "Software Testing Principles, Techniques and Tools", Tata McGraw Hill, ISBN: 9780070139909 0070139903.

T2. Srinivasan Desikan, Gopalswamy Ramesh, "Software Testing Principles and Practices", Pearson, ISBN-10: 817758121X.

Reference Books:

R1. Srinivasan Desikan, Gopalswamy Ramesh, "Software Testing Principles and Practices", Pearson, ISBN-10: 817758121X.

R2. Srinivasan Desikan, Gopalswamy Ramesh, "Software Testing Principles and Practices", Pearson, ISBN-10: 817758121X.

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S. Y. B. Tech (Computer Engineering)
Academic Year – 2021-2022 Semester -IV
[HS2105]: Business Communication & Value Science III

Teaching Scheme: PR: 2 Hours/Week	Credit PR: 1	Examination Scheme: Lab Evaluation : 25 Marks

Course Prerequisites: Basic knowledge of high school English

Course Objective:

- Develop technical writing skills
- Introduce students to Self-analysis techniques like SWOT & TOWS
- Introduce students to key concepts of:
- Pluralism & cultural spaces
  a) Cross-cultural communication
  b) Science of Nation building

Course Outcome:

After successful completion of the course, students will able to:

CO 1: Apply SWOT in real life scenarios.
CO 2: Identify & respect pluralism in cultural spaces.
CO 3: Differentiate between the different cultures of India.
CO 4: Define & differentiate the terms global, local and trans locational.
CO 5: Identify implications & common mistakes made in cross-cultural communication.
CO 6: Apply technical writing in real-life scenarios

Course Contents

UNIT-I	Learning and Implications of SWOT - Motivation

Flash the projects they completed in the last semester &End with a Quiz in multiple format rounds testing the objectives. SWOT and Life Positions. https://www.youtube.com/watch?v=bbz2boNSeL0&t=24s Debrief on the video. How it relates to SWOT. SWOT Vs. TOWS The Balancing Act Ted talk on biomimicry: (Only first 8 mins): https://www.youtube.com/watch?v=RHrO4t86phA. Debrief on the Ted talk in which the facilitator gently guides the group towards the understanding that survival happens only when we seek ideas from the external world to turn the threat into opportunity. Motivation Stories. YouTube videos on Maslow's Theory. Scenario based activity on identifying and leveraging motivation. Present their findings and approaches as groups. They need to explain the idea of motivation with the help of examples. Rivers of India a. Divide participants into groups of 5. Each group should assign themselves a name from the Indian Rivers. These groups will continue throughout this Unit. b. Learn and Exchange Group activity in which participants need to learn the following four greetings of a state (different from their own) and exchange it with another group: Good morning, Thank you, Sorry

UNIT-II	Rhythms

a. Awareness and respect for pluralism in cultural spaces. Announce the Rhythms of India activity to be held in the next session. The rules of the activity will be detailed at this point. Teams to prepare for

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the performance beyond class hours. Rhythms of India (Cultures in India) Group activity: Each group to perform a short dance piece (3 mins) from any of the Indian states (to be decided by lots). They have to present the background and unique features of the dance form (5 min). a. Global, global, translocation Use Ted and YouTube videos to show examples. Announce debate to be held in the next session. They have to come prepared for the debate/discussion. Debate on Global, local, tans locational impacts (topics to be decided by the faculty or suggested by the students). Debate to be held in the presence of an external moderator. Eight groups will get four topics to debate upon.	
UNIT-III	**Cross-cultural communication**
Cross-cultural communication. Verbal and non-verbal communication (approach is through videos). Point out the obvious mistakes. From our perspective…how anyone would feel if someone else made mistakes about our culture. Let participants have a group discussion on the implications of cross-cultural communication. Suggested long-term activity: A VR game in which learners can visit different locations of the world and overcome challenges by using cross cultural skills. Culture shock Group activity to perform skits based on situations provided by the lecturer. Gender awareness Participants will view relevant scenarios in the class and then participate in a reflection activity in group. The scenarios can be presented using an Augmented Reality intervention. Gender awareness campaign Groups to present the detailed plan of Gender awareness campaigns with four different themes. College, Workplace, Family, Friends	
UNIT-IV	**Role of science in nation building**
Introduce the topic and discuss the role of scientists and mathematicians from ancient India. Break the students into groups and give them ten minutes to access internet and get information about ten eminent scientists and mathematicians of ancient India. Groups will be given five minutes to present on the next day. Groups will also frame two questions which they will ask after presenting. This can also be taught through Augmented Reality, where images of the scientists will be put up around the class and they will be able to gather the information by using their phones and AR app. Groups present their findings. Other groups note down their learning. At the end there will be a quiz to assess their learning. Role of science post- independence Groups to present using multiple formats on any one of the four given topics: Inventions, Inventors, Institutes, Information technology	
UNIT-V	**Introduction to technical writing**
Introduction to technical writing. Basic rules of technical writing through examples. Practice activity on technical writing. Assessment on technical writing on the following topic: Explain the following to a visually impaired person: DNA, Rings of Saturn, Structure of an oxygen atom, Structure of heart. “Voice of the Future” Activity How will a voice assistant evolve in 25 years from now? Each group will present a skit. AI in Everyday Life Discussion in groups on given topics and then cross sharing of discussion points amongst the groups. Design your college in the year 2090 Groups need to create the college of future with the future teachers, teaching methods, types of students, etc. We will end the session with the question: How will offices/workplaces change in future? Who do you think would be your colleagues?	
UNIT-VI	**Communicating with machines**
Theory and Ted talk videos. Debate in the presence of an external moderator. Will machines control us in future? Applying technical writing in profession Theory with YouTube and Dr Bimal Ray’s videos. Dr. Bimal Kumar Roy, a former Director of the Indian Statistical Institute, is a cryptologist from the Cryptology Research Group of the Applied Statistics Unit of ISI, Kolkata. Scenario-based Assessment on technical writing Each group will make a presentation on the following: a) Sell Analytics and Insight to the local tea seller.	

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b) Explain the concept of Cloud to your 87-year-old grandmother.
c) Introduce the concept of friendly robots to a class 3 kid.
d) Explain IOT to your helping hand at home

Lab Contents

Guidelines for Assessment

1) Continuous assessment based on experiments performed, submission of results of program in the form of report/journal, timely completion, attendance ,understanding, efficient codes, punctuality and neatness.
2) Lab assessment of 25 marks shall be based on continuous assessment and performance in Practical/Oral examination.

List of Laboratory Assignments

1	Guest lecture by a renowned personality to kick start this semester.
2	SWOT and Life Positions
3	SWOT Vs. TOWS
4	Presentation on what are the strengths they have identified to survive in the VUCA World.
5	Presentation of the concept of Motivation.
6	Identify pluralism and Respect pluralism in cultural spaces.
7	Differentiate between the different cultures of India.
8	Debate on Global, local, tans locational impacts
9	Cross-cultural communication
10	Group activity to perform skits based on situations provided by the lecturer

Text Books:

T1. English vocabulary in use – Alan McCarthy and O'Dell
T2. APAART: Speak Well 1 (English language and communication)
T3. APAART: Speak Well 2 (Soft Skills)

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S. Y. B. Tech (Computer Engineering)
Academic Year – 2021-2022 Semester -IV
[CS2112]: Engineering Design & Innovation - II

Teaching Scheme:	Credit	Examination Scheme:
PR: 4 Hours/Week	TUT:02	Term Work : 50 Marks
TU: 2 Hours/Week	PR: 02	Lab Evaluation : 50 Marks

Course Prerequisites: Fundamentals of Management [HS1106], Project Based Learning-I[CS2109]

Course Objective: The primary objective of this course is to develop critical thinking and problem-solving skills by exploring and proposing solutions to current computer engineering problems in real world. This course will help students begin to identify themselves as computer engineers and prepare them for opportunities for their undergraduate studies.

- Uncovering opportunities for innovation
- Building a business model to extract maximum value from your ideas
- Protecting intellectual property
- Financing new ventures.
- develop critical thinking and problem-solving skills by exploring and proposing solutions to current computer engineering problems in real world

Course Outcome:

After successful completion of the course, students will able to:

CO 1: Demonstrate creative and innovative thinking capabilities.
CO 2: Explain the process of founding a startup.
CO 3: Compare various types of IPR to protect competitive advantage.
CO 4: Identify/Prepare the dataset required for the system.
CO 5: Implement the system.
CO 6: Design test cases and test the system.
CO 7: Evaluate the performance of the system.

Course Contents

UNIT-I	Innovation: What and Why?	4 Hours
Innovation as a core business process, Sources of innovation, Knowledge push vs. need pull innovations. Class Discussion- Is innovation manageable or just a random gambling activity?		
UNIT-II	**Building an Innovative Organization**	**4 Hours**
Creating new products, a service, Exploiting open innovation and collaboration, Use of innovation for starting a new venture Class Discussion- Innovation: Co-operating across networks vs. 'go-it-alone' approach.		
UNIT-III	**Entrepreneurship**	**4 Hours**
Opportunity recognition and entry strategies, Entrepreneurship as a Style of Management Maintaining Competitive Advantage- Use of IPR to protect Innovation.		
UNIT-IV	**Entrepreneurship- Financial Planning**	**4 Hours**

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Financial Projections and Valuation, Stages of financing, Debt, Venture Capital and other forms of Financing		
UNIT-V	**Intellectual Property Rights (IPR)**	**4 Hours**
Introduction and the economics behind development of IPR: Business Perspective, IPR in India – Genesis and Development, International Context, Concept of IP Management, Use in marketing.		
UNIT-VI	**Types of Intellectual Property**	**4 Hours**
Patent- Procedure, Licensing and Assignment, Infringement and Penalty, Trademark- Use in marketing, example of trademarks- Domain name, Geographical Indications- What is GI, Why protect them? Copyright- What is copyright, Industrial Designs- What is design? How to protect? Class Discussion- Major Court battles regarding violation of patents between corporate companies.		

Tutor's Role

The fundamentals of problem-based learning, lies with the Tutors role.

2. Tutors are not the source of solutions rather they act as the facilitator and mentor.
3. The facilitator skills of the Tutors / Teacher are central to the success of PBL.
4. Students are not used to the constructivist approach to learning, it is important that they are carefully told what to expect in PBL.
5. Tutors need to explain the differences between PBL and traditional learning.
6. Tutors need to explain the principals involved and role of the students in PBL learning.

Students Role in Project Based Learning

1. Prepare students for PBL before starting the sessions.
2. Students must have ability to initiate the task/idea. they should not be mere imitators.
3. They must learn to think.
4. Students working in PBL must be responsible for their own learning.
5. Throughout the PBL process, students have to define and analyze the problem, generate learning issues and apply what they have learned to solve the problem and act for them-selves and be free.
6. Students must quickly learn how to manage their own learning, Instead of passively receiving instruction.
7. Students in PBL are actively constructing their knowledge and understanding of the situation in groups.
8. Students in PBL are expected to work in groups.
9. They have to develop interpersonal and group process skills, such as effective listening or coping creatively with conflicts.

Lab Contents

Guidelines for Assessment

Group A: Intellectual Property Rights

Case study materials book will be given to students. Students are required to meet in groups before coming to class and prepare on the case for the day. Instructor may ask the student groups to present their analysis and findings to the class. Further, the topic for class discussion will be mentioned beforehand and students should be ready to discuss these topics (in groups) in class. Students are required to meet in groups before coming to class and prepare on the topic. Few topics are mentioned below as examples. Instructor can add or change any topic as per requirement.

Topic 1- Is innovation manageable or just a random gambling activity?

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Topic 2- Innovation: Co-operating across networks vs. 'go-it-alone' approach

Topic 3- Major Court battles regarding violation of patents between corporate companies

Group B: Project Based Learning

PBL requires regular mentoring by faculty throughout the semester for successful completion of the idea/project tasks selected by the students per batch. PBL is monitored and continuous assessment is done by supervisor /mentor and authorities. It is recommended that all activities should to be recorded regularly, regular assessment of work need to be done and proper documents need to be maintained at college end by both students as well as mentor (PBL work book). In this PBL II, the student shall complete the work of the Project which will consist of problem statement, literature review, SRS, Model, design, implementation and testing. As a part of the progress report of PBL-II, the candidate shall deliver a presentation on the advancement in Technology pertaining to the selected project topic and its implementation. The student shall submit the duly certified progress report of project in standard format for satisfactory completion of the work by the concerned guide and head of the Department/Institute.

List of Laboratory Assignments

1	Prepare/Collect Data
2	Perform Preprocessing
3	Implementation of project modules
4	Design test cases.
5	Evaluate performance of the project.
6	Prepare paper for indexed journal/copyright/file patent

Text Books:

T1. A new model of problem-based learning. By Terry Barrett. All Ireland Society for higher education (AISHE). ISBN:978-0-9935254-6-9; 2017

T2. Problem Based Learning. By Mahnazmoallem, woe hung and Nada Dabbagh, Wiley Publishers. 2019.

T3. Stem Project based learning and integrated science, Technology, Engineering and mathematics approach. By Robert Capraro, Mary Margaret Capraro

T4. Hassan Gomaa, "Software Modeling and Design- UML, Use cases, Patterns and Software Architectures", Cambridge University Press, 2011, ISBN 978-0-521-76414-8.

Reference Books:

R1. De Graaff E, Kolmos A., red.: Management of change: Implementation of problem-based and project-based learning in engineering. Rotterdam: Sense Publishers. 2007.

R2. Gopalan," Project management core text book", 2 Indian Edition

R3. James Shore and Shane Warden, "The Art of Agile Development"

R4. Gardy Booch, James Rambaugh, Ivar Jacobson,"The unified modeling language user guide" , Pearson Education, Second edition, 2008, ISBN 0-321-24562-8

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S. Y. B. Tech (Computer Engineering)
Academic Year – 2021-2022 Semester -IV
[CS2113] AUDIT COURSES-II

A student will be awarded the bachelor's degree if he/she earns 170 credits and clears all the audit courses specified in the syllabus. The student will be awarded grade as AP (Audit Course Pass) on successful completion of audit course. The student may opt for one of the audit courses per semester, starting from second year first semester. List of options offered is provided. Each student has to choose one audit course from the list per semester. Evaluation of audit course will be done. Method of conduction and method of assessment for audit courses are suggested.

Criteria:

The student registered for audit course shall be awarded the grade AP (Audit Course Pass) and shall be included such AP grade in the Semester grade report for that course, provided student has at least 75% or above attendance and satisfactory in-semester performance and secured a passing grade in that audit course. No grade points are associated with this 'AP' grade and performance in these courses is not accounted in the calculation of the performance indices SGPA and CGPA.

Evaluation Criteria:

Guidelines for Conduction (Any one or more of following but not limited to)

• Lectures/ Guest Lectures • Visits (Social/Field) and reports • Demonstrations	• Surveys • Mini Project • Hands on experience on

Guidelines for Assessment (Any one or more of following but not limited to)

• Written Test • Demonstrations/ Practical Test • Poster presentation	• Presentations • IPR/Publication • Report

Audit Course II

HS2108	Indian Traditional Knowledge
ME2111-C	Innovations in Agriculture Engineering
CS2113	Critical Thinking
CS2116	Online Certification Course

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S. Y. B. Tech (Computer Engineering)
Academic Year – 2021-2022 Semester -IV
[HS2108]: Indian Traditional Knowledge

Course Prerequisites: Introduction of Indian Culture

Course Objective: • The course aims at imparting basic principles of thought process, reasoning and inferencing. Sustainability is at the core of Indian Traditional Knowledge Systems connecting society and Nature. Emergence of Indian society. Develop a better appreciation and understanding of Traditions and Practices of India.

Course Outcome:
After successful completion of the course, students will able to:
CO 1: Explain basics of Indian Traditional knowledge.
CO 2: Develop positive attitude towards Indian thoughts and traditions.

Course Contents

UNIT-I	Indian Society
Structure of Indian Society, Indian Social Demography-Social and Cultural, Differentiations: caste, class, gender and tribe; Institutions of marriage, Indian constitution. Affirmative Action Program of the Government- various reservations and commissions	
UNIT-II	**Yoga and Holistic Health Care**
Knowledge of the basic perspectives on health and disease from yoga and Ayurveda relevant to the practice of yoga therapy, including the concepts of subtle anatomy.	
UNIT-III	**Social Development**
Scientific approach to the study of human beings. Evolution of human kind, social change and evolution. Industrial revolution. National policy on education, health and health care and human development.	

Text Books:

T1. V. Sivaramakrishna (Ed.), Cultural Heritage of India-Course Material, Bharatiya Vidya Bhavan, Mumbai, 5th Edition.
T2. Swami Jitatmanand, Modern Physics and Vedant, Bharatiya Vidya Bhavan.

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[ME2111-C]: Innovations in Agriculture Engineering

Course Prerequisites : Knowledge of Mathematics, Physics, and Chemistry is necessary, Out of box/ unconventional thinking for solving typical problems, Adapting analytical tools traditionally, Application oriented thinking of learnt topics

Course Objective:

- To develop holistically built thinking habit needed for innovative ideas.
- To be aware about key field of agriculture contributing to sustenance and development of a mankind.
- To expose students' roles and responsibilities of building a nation through engineering insights in agriculture
- To update with innovations and technological advancements in respective fields of engineering

Course Outcome:

After successful completion of the course, students will able to:

CO1: Discuss what is thinking, its tools and process and its application to innovation
CO2:Explain and develop application of innovation in engineering
CO3: Use important terms like national productivity, sustainable development and inclusive growth
CO4: Demonstrate the various technologies in agriculture
CO5: Apply Interdisciplinary Engineering applications in Agriculture

Course Contents

UNIT-I	Thinking and thinking process
Thinking and thinking tools: Thinking, Types of thinking, Top-Down (Analysis) & Bottom-Up (Synthesis) thinking and combination of, Judgment and Creativity, Concept Maps Connecting the ideas, Generating ideas. Communicating ideas. Systems thinking and beyond. Critical thinking. Definition of innovation. Example of application of thinking process to any one practical innovation	
UNIT-II	**Engineering Innovation and its scope**
Incremental, radical and disruptive Innovation. Scope of innovation: Product innovation, Process innovation, Position innovation, Paradigm innovation. Innovation within the engineering profession. Awareness about latest technological advancements.	
UNIT-III	**Agriculture and innovation**
Definition of agriculture, Role of Agriculture in our life and in national productivity. Concept of sustainable development and inclusive growth. India's urban awakening. Innovation in agriculture and its types. Importance of agriculture innovation.	
UNIT-IV	**Interdisciplinary Engineering in Agriculture**

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Favorable conditions for Agriculture innovation. Dynamics of Innovation System. Role and responsibility of Engineers in agricultural innovations and making India the net exporter of major agricultural produces. FIN Ovation Awards. Ideas on developing technologies in agriculture viz. Vehicle automation, Engine emissions technology, Fire suppression technology etc. The future of robotics on farms. Technological innovations that are revolutionizing Indian agriculture. Case study presenting Interdisciplinary Engineering application in Agriculture.

Text Books:

T1. Barret, E.C. and Curits, L.F. "Introduction to Environmental Remote Sensing". John Wiley and Sons Inc. New York, 1976.

T2. Pillay, T.V.R "Aquaculture and: Environment Fishing News Books", Blackwell Science' Ltd, Oxford, 1995.

T3. Shroder. "Operations Management". McGraw Hill, 1994

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Academic Year – 2021-2022 Semester -IV
[CS2113]: Critical Thinking

Course Prerequisites : Natural curiosity

Course Objective: The objective is to improve your ability to identify, analyze, and evaluate arguments by other people (including politicians, used car salesmen, and teachers) and also to construct arguments of your own in order to convince others and to help you decide what to believe or do.

Course Outcome:
After successful completion of the course, students will able to:
CO 1: Critically read, listen, and write
CO 2: Analyze information and separate bad information from good information
CO 3: Determine whether or not an argument is deductively valid
CO 4: Analyze and assess five common forms of inductive arguments

Course Contents

UNIT-I	Introduction to Critical Thinking
What's "Critical Thinking?", why study it, a short history	
UNIT-II	**Argument**
understanding arguments as building blocks of reason; argument structure and analysis, Simple Argument. Definition and Structure, How to Analyze an Argument, Simple Argument Analysis. Practice, Complex Arguments , The Analysis of Complex Arguments, tricky arguments that seem right, but are not; how to spot them, Fair Play Principles in Argumentation	
UNIT-III	**Reasoning**
describing and analyzing the two main types of arguments ,Deductive Arguments vs. Inductive Arguments , Deductive Arguments, Validity. Soundness ,Syllogisms ,Inductive Arguments. Strength. Cogency, the scientific method as basis for all sciences; a short instructions manual on the use of inductive reasoning in day to day communication, The Scientific Theory. Is It All Just Guessing? The Scientific Method, Arguments from Analogy, Arguments from Generalization, Arguments from Causality	
UNIT-IV	**Irrationality. Cognitive Biases. Emotional Approach**
what is the place of emotions in persuasion? Cognitive Biases, Cognitive Biases, Persuasion. The Emotional Tools	

Text Books:
T1. Critical Thinking. N.p., Can Akdeniz, 2019.
T2. Cottrell, Stella. Critical Thinking Skills: Effective Analysis, Argument and Reflection. United Kingdom, Palgrave Macmillan, 2017.
T3. Sen, Maducchanda. An Introduction to Critical Thinking. India, Longman, 2012.

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S. Y. B. Tech (Computer Engineering)
Academic Year – 2021-2022 Semester -IV
[CS2116]: Online Certification Course

Course Prerequisites: Basics analysis or design concepts of the selected course.

Course Objective: The objective of this course is, to prepare students to learn the courses using online teaching aids

Course Outcome:
After successful completion of the course, students will able to:
CO1: Use modern ICT tools for self-learning
CO2: Demonstrate the ability of self- learning
CO3: Demonstrate the ability to abreast with advance technologies.

Course Contents

The students should complete at least one Certification course which will be offered by NPTEL/Spoken tutorial/ Swayam/ IIT Bombay/ MOOC/or any other approved agency by the department during the same semester. The students should select the subjects relevant to Computer Engineering and which should not be included in the specified curriculum. Minimum duration of course should be 4 weeks and all assignments should be submitted. Certification done would be appreciated but not mandatory. In case a student does not go for certification, he/she should pass the internal test organized by department for the said course.

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