



**CHRIST COLLEGE OF ENGINEERING
IRINJALAKUDA (AUTONOMOUS)**

**DEPARTMENT OF COMPUTER SCIENCE AND
BUSINESS SYSTEMS**

SYLLABUS

2025 REGULATION



A CMI INSTITUTION

CHRIST COLLEGE OF ENGINEERING (AUTONOMOUS)

DEPARTMENT OF COMPUTER SCIENCE AND BUSINESS SYSTEMS

SYLLABUS SEMESTER – S3 (GROUP - A) 2025 REGULATION

Approved by BoS meeting held on: 12 - 09 - 2025

Approved by Academic Council meeting held on: 23 - 06 - 2026


BoS Chairperson

Dr. Divya R.


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Irinjalakuda, Kerala



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SEMESTER – S3 CURRICULUM

THIRD SEMESTER: Computer Science and Business Systems															
Sl. No:	Slot	Course Code	Course Type	Course Category	Course Title (Course Name)	Credit Structure				SS	Total Marks		Credits	Hrs./Week	
						L	T	P	R		CIA	ESE			
THEORY															
1	A	B25SME301	BS	GC	Statistical Methods	3	0	2	0	5.5	40	60	4	5	
2	B	B25FLT302	PC	PC	Formal Languages and Automata Theory	3	1	0	0	5	40	60	4	4	
3	C	B25DBE303	PC	PC	Database Management Systems	3	0	2	0	5.5	40	60	4	5	
4	D	B25SET304	PC	PC	Software Engineering and Software Design	3	1	0	0	5	40	60	4	4	

5	E	B25DSE305	PC	PC	Data Structures & Algorithms	3	0	2	0	5.5	40	60	4	5
6	F	B25FET306	HM	PC	Fundamentals of Economics	3	0	0	0	4.5	40	60	3	3
PRACTICALS														
7	G	B25BCP307	BS	CC	Business Communication & Value Science – I	0	0	2	0	1	50	-	1	2
MANDATORY COURSES														
8	H	B25ICT308	MC	CC	Indian Constitution	2	0	0	0	3	40	60	P/F	2
9	-	A25APP311	MC	CC	Activity Point Programme ^{\$}									
VALUE ADDED COURSES														
10	M	-	VA	CC	Minor Course	3	1	0	0	5			4	4
Total										35/ 40*			24/ 28*	30/ 34*

EMESTER-S3**STATISTICAL METHODS**

Course Code	B25SME301	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3:0:2:0	ESE Marks	60
Credits	4	Exam Hours	2 Hr. 30 Min.
Prerequisites (if any)	Basic calculus	Course Type	Theory+Lab

Course Objective

To provide students with a strong foundation in probability theory, statistical distributions, statistical inference, regression analysis, time series analysis, and statistical computing using R/Python for analyzing data and solving engineering and business problems.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Probability, Random Variables and Probability Distributions: Concept of experiments, sample space, event. Definition of Combinatorial Probability. Conditional Probability, Bayes Theorem. Probability distributions: discrete & continuous distributions. Expected values: mathematical expectation, variance and its properties, Moment generating function.	11
2	Standard and Sampling Probability Distributions and Calculus: Standard Distributions-Discrete: Binomial, Poisson and Geometric distributions; Standard Distributions- Continuous: Uniform, Exponential, Normal distributions. Sampling Distributions: Chi-square, t and F distributions (Basic Concepts only).	11
3	Statistical Inference: Random sampling, Estimation: Point estimation, criteria for good estimates (un-biasedness, consistency), Methods of estimation including maximum likelihood estimation. Test of hypothesis: Concept & formulation, Type I and Type II errors, Neyman Pearson lemma, Procedures of testing. Non-parametric Inference: Comparison with parametric inference, Use of order statistics. Sign test, Wilcoxon signed rank test, Mann-Whitney test, Run test, Kolmogorov-Smirnov test. Spearman's and Kendall's test.	11
4	Linear Statistical Models: Scatter diagram. Linear regression and correlation. Least squares method. Rank correlation. Analysis of variance (one way, two-way with as well as without interaction)	11

Course Assessment Method

(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE)

Continuous Assessment	Internal Examination (Written)	Internal Examination (Written)	Internal Examination (Written)	Internal Lab Examination	Total
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10	30	30	30	10	40
Total 90 marks will be converted to 20					

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks (8x3 =24marks)	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. (4x9 = 36 marks)	60

Laboratory Tools: R/ Python

R statistical programming language: Introduction to R, Functions, Control flow and Loops, Working with Vectors and Matrices, Reading in Data, Writing Data, Working with Data, Manipulating Data, Simulation, Linear model, Data Frame, Graphics in R

Text Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	<i>Introduction of Probability Models</i>	S M Ross	Academic Press	11 th Edition 2014
2	<i>Fundamentals of Statistics</i>	A. Goon, M. Gupta and B. Dasgupta	World Press	Vol I and II 2013 and 2014

3	<i>Higher Engineering Mathematics</i>	B. S. Grewal	Khanna Publication	45 th Edition 1965
4	<i>Probability and Statistics for Engineers</i>	I.R. Miller, J.E. Freund and R. Johnson	Pearson College	2016
5	<i>The Analysis of Time Series: An Introduction</i>	Chris Chatfield.	Chapman and Hall.	6 th Edition 2003
6	<i>R for Everyone: Advanced Analytics and Graphics</i>	Jared P. Lander	Pearson Education	2 nd Edition 2018

Reference Books

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	<i>A first course in Probability</i>	S. M. Ross	Pearson Education	10 th Edition 2023
2	<i>Introduction to the Theory of Statistics</i>	A. M. Mood, F.A. Graybill and D.C. Boes	McGraw Hill Higher Education	3 rd Edition 1974
3	<i>Advanced Engineering Mathematics</i>	Peter V. O'Neil	Cengage Learning India Pvt. Ltd.	2023
4	<i>Advanced Engineering Mathematics</i>	M. D. Greenberg	Pearson Education	2 nd Edition 2024
5	Hands-on Programming with R	Garrett Grolemond	Shroff/O'Reilly	

CO	CO Statement	SDG	Modules	Blooms name and Level
CO1	Apply probability concepts, random variables, probability distributions, and mathematical expectation to model uncertainty and solve probabilistic problems.	SDG 4	1	Apply (2)
CO2	Analyze real-life phenomena using standard probability distributions and sampling distributions to select appropriate statistical models and interpret outcomes.		2	Analyse (3)
CO3	Analyze data using estimation techniques, hypothesis testing procedures, and non-parametric methods to draw valid statistical inferences and support decision-making.		3	Analyse (3)
CO4	Apply regression, correlation, analysis of variance, and time series techniques to investigate relationships among variables and identify temporal patterns in data.		4	Apply (2)
CO5	Apply statistical methods and computational tools such as R/Python to preprocess, analyze, visualize, and interpret real-world datasets for engineering and business applications.			Apply (2)

COs \ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3		2				2	3		2
CO2	3	3		3	2			2	3		2
CO3	3	3		3	2			2	3		2
CO4	3	3	2	3	2			2	3		2
CO5	3	3	2	3	3			2	3		2

SEMESTER S3**FORMAL LANGUAGE AND AUTOMATA THEORY**

Course Code	B25FLT302	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3:1:0:0	ESE Marks	60
Credits	4	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	Basic knowledge of discrete mathematics, including sets, relations, functions	Course Type	Theory

Course Objectives:

This course introduces the theoretical foundations of computation through the study of formal languages, automata, grammars, and Turing machines. It enables students to analyze the computational capabilities and limitations of different models of computation, including undecidable problems. The course also provides an understanding of computational complexity and the classification of problems into complexity classes such as P, NP, and NP-complete.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Introduction: Alphabet, languages and grammars, productions and derivation, Chomsky hierarchy of languages. Regular languages and finite automata: Regular expressions and languages, deterministic finite automata (DFA) and equivalence with regular expressions, nondeterministic finite automata (NFA) and equivalence with DFA, regular grammars and equivalence with finite automata, properties of regular languages, Kleene's theorem, pumping lemma for regular languages, Myhill-Nerode theorem and its uses, minimization of finite automata.	9

2	Context-free languages and pushdown automata: Context-free grammars (CFG) and languages (CFL), Chomsky and Greibach normal forms, nondeterministic pushdown automata (PDA) and equivalence with CFG, parse trees, ambiguity in CFG, pumping lemma for context-free languages, deterministic pushdown automata, closure properties of CFLs.	9
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3	Context-sensitive languages: Context-sensitive grammars (CSG) and languages, linear bounded automata and equivalence with CSG. Turing machines: 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.	9
4	Undecidability: Church-Turing thesis, universal Turing machine, the universal and diagonalization languages, reduction between languages and Rice's theorem, undecidable problems about languages. Basic Introduction to Complexity: Introductory ideas on Time complexity of deterministic and nondeterministic Turing machines, P and NP, NP-completeness, Cook's Theorem, other NP-Complete problems.	9

Course Assessment Method (CIE: 40 Marks, ESE: 60 Marks)

Continuous Internal Evaluation Marks (CIE):

Assignment (Activity based)	Internal Examination-I (Written)	Internal Examination-II (Written)	Internal Examination-III (Written)	Total
15*	30	30	30	
	A total of 90 marks will be scaled to 25.			40

*One or more assignments should be given, and the total marks should be consolidated and converted to 15 as per revised evaluation guidelines.

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions.

Part A	Part B	Total
2 questions from each module. - Total of 8 questions, each carrying 3 marks (8 x 3 = 24 Marks)	- Each question carries 9 marks. - Two questions will be given from each module, out of which 1 question should be answered. - Each question can have a maximum of 3 sub divisions. (4 x 9 = 36 Marks)	60

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Classify languages using the Chomsky hierarchy and construct automata for regular language recognition.	K3
CO2	Design and analyze context-free grammars and pushdown automata for recognizing context-free languages and evaluating their properties.	K3
CO3	Design and analyze Turing machines for solving computational problems.	K3
CO4	Analyze the decidability of computational problems	K4
CO5	Analyze computational complexity and classify problems into P, NP, and NP-complete classes.	K4

Note: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create

CO-PO Mapping Table:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	3	2	3						
CO2	3	2	2	2	3						
CO3	3	3	3	2	3						
CO4	3	3	3	2	3						
CO5	2	2	1	-	2						

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), : No Correlation

Text Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Introduction to Automata Theory, Languages, and Computation	John E. Hopcroft, Rameev Motwani and Jeffrey D. Ullman.	Addison-Wesley (Pearson Education)	2006

Reference Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Automata and Computability,	Dexter C. Kozen	Springer	1999
2	Introduction to Languages and the Theory of Computation	John C Martin	McGraw-Hill, (4th Edition)	2011
3	Computers and Intractability: A Guide to the Theory of NP Completeness, M. R. Garey and D. S. Johnson.	Michael R. Garey and David S. Johnson.	W. H. Freeman and Company	1979.

SEMESTER S3

DATABASE MANAGEMENT SYSTEMS

Course Code	B25DBE303	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3 : 0 : 2 : 0	ESE Marks	60
Credits	4	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	Nil	Course Type	Theory+Lab

Course Objectives:

1. The course aims to provide students with a strong foundation in database concepts, data models, database architecture, and relational database design principles. It enables students to design, create, query, and manage databases using SQL and normalization techniques for efficient data storage and retrieval.
2. The course also develops an understanding of transaction management, concurrency control, database security, and modern database technologies used in real-world applications.

Module No.	Syllabus Description	Contact Hours
1	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.	11
2	Relational query languages: Relational algebra, Tuple and domain relational calculus, SQL3, DDL and DML constructs, Open source and Commercial DBMS - MYSQL, ORACLE, DB2, SQL server.	11

	Relational database design: Domain and data dependency, Armstrong's axioms, Functional Dependencies, Normal forms, Dependency preservation, Lossless design. Query processing and optimization: Evaluation of relational algebra expressions, Query equivalence, Join strategies, Query optimization algorithms.	
3	Storage strategies: Indices, B-trees, Hashing. Transaction processing: Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp-based schedulers, multi-version and optimistic Concurrency Control schemes, Database recovery.	11
4	Database Security: Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQL injection. Advanced topics: Object oriented and object relational databases, Logical databases, Web databases, Distributed databases, NoSQL, Data warehousing and data mining.	11

LABORATORY

1. Design a database schema for an application with ER diagram from a problem description
2. Creation, modification, configuration, and deletion of databases using UI and SQL Commands
3. Creation of database schema - DDL (create tables, set constraints, enforce relationships, create indices, delete and modify tables).
4. Database initialization - Data insert, Data import to a database (bulk import using UI and SQL Commands)
5. Practice SQL commands for DML (insertion, updating, altering, deletion of data, and viewing/querying records based on condition in databases)
6. Implementation of built-in functions in RDBMS
7. Implementation of various aggregate functions in SQL
8. Implementation of Order By, Group By & Having clause

9. Implementation of set operators nested queries, and join queries
10. Practice of SQL TCL commands like Rollback, Commit, Savepoint
12. Practice of SQL DCL commands for granting and revoking user privileges
13. Practice of SQL commands for creation of views and assertions
14. Implementation of various control structures like IF-THEN, IF-THEN-ELSE, IF-THENELSEIF, CASE, WHILE using PL/SQL
15. Creation of Procedures, Triggers and Functions
16. Creation of Cursors
17. Creation of PL/SQL blocks for exception handling
18. Design a database application using any front-end tool for any problem selected. The application constructed should have five or more tables.

Course Assessment Method

(CIE: 40 Marks, ESE: 60 Marks)

Continuous Internal Evaluation Marks:

Assignment - (Activity based)	Assignment -2 (Activity based)	Internal Examination -I (Written)	Internal Examination -II (Written)	Internal Examination -III (Written)	Total
10	10	30	30	30	40
A total of 90 marks will be scaled to 20.					

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions.

Part A	Part B	Total
2 questions from each module. - Total of 8 questions, each carrying 3 marks (8 x 3 = 24 Marks)	- Each question carries 9 marks. - Two questions will be given from each module, out of which 1 question should be answered. - Each question can have a maximum of 3 sub divisions. (4 x 9 = 36 Marks)	60

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Apply the fundamental concepts of database systems, data models, database architecture, and the relational model.	K3
CO2	Apply relational query languages, database design principles, and query optimization techniques to design and manage efficient relational databases.	K3
CO3	Analyse indexing, hashing, transaction processing, concurrency control and recovery techniques to ensure efficient and reliable database operations.	K4
CO4	Recommend appropriate secure and scalable database solutions by evaluating advanced database technologies.	K5
CO5	Create a database-driven system to address practical requirements using appropriate database technologies and best practices.	K6

Note: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create

CO-PO Mapping Table:

COs\POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO10	PO11
CO1	3	2	-	-	1	-	-	-	-	-	1
CO2	3	3	2	-	3	-	-	-	-	1	1
CO3	2	3	1	2	3	-	-	-	-	-	1
CO4	2	3	3	2	3	2	1	2	-	1	3
CO5	2	2	3	2	3	1	1	1	2	2	2
Text Books											
Sl. No	Title of the Book		Name of the Author/s			Name of the Publisher		Edition and Year			
1	Database System Concepts		Abraham Silberschatz, Henry F. Korth and S. Sudarshan								

Reference Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Principles of Database and Knowledge – Base Systems	J. D. Ullman		Vol 1
2	Fundamentals of Database Systems	R. Elmasri and S. Navathe		
3	Foundations of Databases	Serge Abiteboul, Richard Hull, Victor Vianu.		

SEMESTER S3

SOFTWARE ENGINEERING AND SOFTWARE DESIGN

Course Code	B25SET304	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3:1:0: 0	ESE Marks	60
Credits	4	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	Nil	Course Type	Theory

Course Objectives:

- The course aims to provide students with a strong foundation in object-oriented software design principles and UML modelling techniques to analyse and represent software systems.
- The course also develops an understanding of designing and documenting software solutions using UML diagrams, architectural principles, and design patterns to develop maintainable and effective software systems.

Module No.	Syllabus Description	Contact Hours
1	Introduction: Programming in the small vs. programming in the large; software project failures and importance of software quality and timely availability; engineering approach to software development; role of software engineering towards successful execution of large software projects; emergence of software engineering as a discipline. Software Project Management: Basic concepts of life cycle models – different models and milestones; software project planning – identification of activities and resources; concepts of feasibility study; techniques for estimation of schedule and effort; software cost estimation models and concepts of software engineering economics; techniques of software project control and reporting; introduction to measurement of software size; introduction to the concepts of risk and its mitigation; configuration management.	11

2	Introduction to the UML Language. Standards, Elements of the language, General description of various models, The process of Object-Oriented software development, Description of Design Patterns, Technological Description of Distributed Systems. Requirements Analysis Using Case Modelling: Analysis of system requirements, Actor definitions, Writing a case goal, Use Case Diagrams, Use Case Relationships.	11
3	Transfer from Analysis to Design in the Characterization Stage: Interaction Diagrams, 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. The Logical View Design Stage: The Static Structure Diagrams, The Class Diagram Model Attributes descriptions, Operations descriptions, Connections descriptions in the Static Model Association, Generalization, Aggregation, Dependency, Interfacing, Multiplicity.	11
4	Package Diagram Model: Description of the model, White box, black box, Connections between packagers. • Interfaces, Create Package Diagram, Drill Down. Dynamic Model: State Diagram / Activity Diagram, Description of the State Diagram. • Events Handling, Description of the Activity Diagram, Exercise in State Machines. Component Diagram Model: Physical Aspect, Logical Aspect, Connections and Dependencies, User face. Initial DB design in a UML environment. Deployment Model: Processors. Connections, Components, Tasks, Threads, Signals and Events.	11

Course Assessment Method

(CIE: 40 Marks, ESE: 60 Marks)

Assignment (Activity based)	Internal Examination-I (Written)	Internal Examination-II (Written)	Internal Examination-III (Written)	Total
15*	30	30	30	

	A total of 90 marks will be scaled to 25.	40
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*One or more assignments should be given, and the total marks should be consolidated and converted to 15 as per revised evaluation guidelines.

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions.

Part A	Part B	Total
2 questions from each module. - Total of 8 questions, each carrying 3 marks (8 x 3 = 24 Marks)	- Each question carries 9 marks. - Two questions will be given from each module, out of which 1 question should be answered. - Each question can have a maximum of 3 sub divisions. (4 x 9 = 36 Marks)	60

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Apply software engineering principles, life cycle models, and project management techniques for planning and managing software projects.	K3
CO2	Apply UML language constructs and use case modelling techniques to analyse system requirements and effectively represent functional requirements.	K3
CO3	Analyse object interactions and system structures using sequence, collaboration, and class diagrams for software design.	K4
CO4	Analyse and model the dynamic and architectural aspects of software systems using state, activity, package, component, and deployment diagrams.	K4

CO5	Create complete UML-based software designs and corresponding object-oriented implementations for real-world applications.	K6
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Note: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create

CO-PO Mapping Table:

CO\PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO10	PO11
CO1	3	2	2	1	2				1	1	3
CO2	3	3	2	1	3				1	2	
CO3	3	3	3	2	3				1	1	
CO4	3	3	3	2	3				1	1	
CO5	3	3	3	3	3				2	2	1

Text Books

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	The Unified Modelling Language User Guide	Grady Booch, James Rumbaugh, Ivar Jacobson	Pearson Education	
2	Object-Oriented Software Engineering: using UML, Patterns, and Java	Bernd Bruegge and Allen H. Dutoit		
3	Software Engineering	Ian Sommerville Reference Books:		

Reference Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Design Patterns: Elements of Reusable Object-Oriented Software	Erich Gamma, Richard Helm, Ralph Johnson, and John M. Vlissides		

SEMESTER S3

DATA STRUCTURES AND ALGORITHMS

Course Code	B25DSE305	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3:0:2:0	ESE Marks	60
Credits	4	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	Basic Knowledge in Programming	Course Type	Theory+Lab

Course Objectives:

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Basic Terminologies and Introduction to Algorithm & Data Organisation: Algorithm specification, Recursion, Performance analysis, Asymptotic Notation - The Big-O, Omega and Theta notation, Programming Style, Refinement of Coding - Time-Space Trade Off, Testing, Data Abstraction Linear Data Structure: Array, Stack, Queue, Priority Queue, Linked-list and its types, Various Representations, Operations & Applications of Linear Data Structures	9

2	Non-linear Data Structure: Trees (Binary Tree, Threaded Binary Tree, Binary Search Tree, B & B+ Tree, AVL Tree, Splay Tree) and Graphs (Directed, Undirected), Various Representations, Operations & Applications of Non-Linear Data Structures	9
3	Searching and Sorting on Various Data Structures: Sequential Search, Binary Search, Comparison Trees, Breadth First Search, Depth First Search Insertion Sort, Selection Sort, Shell Sort, Divide and Conquer Sort, Merge Sort, Quick Sort, Heapsort, Introduction to Hashing	9
4	File: Organisation (Sequential, Direct, Indexed Sequential, Hashed) and various types of accessing schemes. Graph: Basic Terminologies and Representations, Graph search and traversal algorithms and complexity analysis.	9

Lab Experiments

Expt. No	Experiment
1	Towers of Hanoi using user defined stacks.
2	Reading, writing, and addition of polynomials.
3	Line editors with line count, word count showing on the screen.
4	Trees with all operations.
5	All graph algorithms.
6	Saving / retrieving non-linear data structure in/from a file

Course Assessment Method (CIE: 40 Marks, ESE: 60 Marks)

Continuous Internal Evaluation Marks (CIE):

Assignment (Activity based)	Internal Examination-I (Written)	Internal Examination-II (Written)	Internal Examination-III (Written)	Total
15*	30	30	30	

	A total of 90 marks will be scaled to 25.	40
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*One or more assignments should be given, and the total marks should be consolidated and converted to 15 as per revised evaluation guidelines.

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions.

Part A	Part B	Total
2 questions from each module. - Total of 8 questions, each carrying 3 marks (8 x 3 = 24 Marks)	- Each question carries 9 marks. - Two questions will be given from each module, out of which 1 question should be answered. - Each question can have a maximum of 3 sub divisions. (4 x 9 = 36 Marks)	60

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Design algorithms for computational problems using suitable data structures (arrays or linked lists) and determine their time and space complexities	K3
CO2	Design algorithms for computational problems by choosing suitable data structures, such as binary trees or graphs.	K3
CO3	Analyze and select appropriate searching, sorting, and hashing techniques for efficient data processing	K4
CO4	Select appropriate file organization and access schemes for efficient data management	K3

CO5	Apply graph representations and traversal algorithms to solve computational problems and analyze their complexity	K3
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Note: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create

CO-PO Mapping Table:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	2		2						
CO2	3	3	3		2						
CO3	3	3	2	2	2						
CO4	2	3	2		2						
CO5	3	3	2	2	2						

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), : No Correlation

Text Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Fundamentals of Data Structures	E. Horowitz, S. Sahni, S	A-Freed, Universities Press.	2008
2	Data Structures and Algorithms	A. V. Aho, J. E. Hopperoft, J. D. Ullman	Pearson.	1983

Reference Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	The Art of Computer Programming: Volume 1: Fundamental Algorithms	Donald E. Knuth.	Addison-Wesley Professional	3rd Edition, 1997.

2	Introduction to Algorithms	Thomas, H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein	The MIT Press.	3rd Edition, 2009.
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SEMESTER S3 FUNDAMENTALS OF ECONOMICS

Course Code	B25FET306	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3:0:0:0	ESE Marks	60
Credits	3	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	None	Course Type	Theory

Course Objectives:

This course introduces engineering students to fundamental economic concepts and their application in technology-driven business environments. The course develops an understanding of consumer behaviour, market structures, macroeconomic policy, and economic decision-making relevant to engineering, digital platforms, startups, and business systems.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
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1	Microeconomic Foundations: Nature and scope of economics, Microeconomics and macroeconomics, Law of demand and supply. Demand and Supply Analysis: Demand and supply curves, Law of demand and Supply, Changes in Demand and Supply, Elasticity of demand and supply (Numerical Problems), Market equilibrium (Numerical Problems), Comparative statics: shifts and movements of curves. Welfare Economics: Consumer surplus, Producer surplus, Price ceilings and price floors. Taxation and GST. Demand Forecasting methods (Linear Regression Method) and Market demand analysis in technology sectors.	8
2	Consumer Behaviour, Production and Cost Analysis: Consumer Behaviour, Axioms of consumer choice, Budget constraints, Indifference curve analysis, Consumer equilibrium, Income and substitution effects, Derivation of demand curve. Theory of Production: Factors of Production, Production functions, Isoquants and production optimization, Returns to scale. Cost Analysis: Cost minimization, Total, average and marginal costs, Short-run and long-run cost curves, Cost behaviour in software and digital service industries.	8

3	Market Structures and Project Evaluation: Market: Perfect Competition - Monopoly - Monopolistic Competition (features and equilibrium of a firm). National Income Accounting: GDP, GNP, NDP and NNP, Methods of measuring national income. Money and Banking: Functions of money, Demand and supply of money, Role of commercial banks and central bank. Capital Budgeting Techniques: Payback Period Method, Accounting Rate of Return (ARR), Net Present Value (NPV), Internal Rate of Return (IRR), Profitability Index (PI) (Numerical Problems).	9
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4	Macroeconomic Foundations: Consumption and Investment: Consumption function, Investment function, Keynesian theory of income determination, Keynesian multiplier. Economic Stability and Growth: IS-LM framework (Conceptual understanding), Business cycles, Inflation and unemployment, Monetary policy and fiscal policy, The Classical Paradigm - Price and Wage Rigidities - Voluntary and Involuntary Unemployment, Economic implications for technology industries and innovation ecosystems.	9
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Course Assessment Method (CIE: 40 Marks, ESE: 60 Marks)

Continuous Internal Evaluation Marks (CIE):

Assignment (Activity based)	Internal Examination-I (Written)	Internal Examination-II (Written)	Internal Examination-III (Written)	Total
15*	30	30	30	
	A total of 90 marks will be scaled to 25.			40

*One or more assignments should be given, and the total marks should be consolidated and converted to 15 as per revised evaluation guidelines.

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions.

Part A	Part B	Total
2 questions from each module. - Total of 8 questions, each carrying 3 marks (8 x 3 = 24 Marks)	- Each question carries 9 marks. - Two questions will be given from each module, out of which 1 question should be answered. - Each question can have a maximum of 3 sub divisions. (4 x 9 = 36 Marks)	60

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (K)
CO1	Explain fundamental economic concepts, demand-supply relationships, and market equilibrium for analysing economic decisions in business and engineering contexts	K2
CO2	Apply consumer behaviour theories, production principles, and cost analysis techniques to evaluate resource allocation and operational efficiency.	K3
CO3	Analyse different market structures and pricing strategies, including digital and technology-driven business models with various capital budgeting models.	K4
CO4	Interpret macroeconomic indicators, national income measures, and economic policies affecting business and technology environments.	K4
CO5	Evaluate economic problems and recommend appropriate economic solutions for engineering, entrepreneurial, and business decision-making.	K5

Note: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create

CO-PO Mapping Table:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	-	-	-	1	-	-	-	2	1
CO2	2	3	2	1	1	-	-	-	-	2	1
CO3	2	3	2	1	1	1	-	-	-	3	1
CO4	1	2	-	2	-	3	-	-	-	2	1

CO5	2	3	2	2	1	2	1	1	1	3	2
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1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), : No Correlation

Text Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Principles of Economics	N. Gregory Mankiw	Cengage Learning	10th Edition, 2024
2	Microeconomics	Robert S. Pindyck & Daniel L. Rubinfeld	Pearson	10th Edition, 2023
3	Macroeconomics	Olivier Blanchard	Pearson	9th Edition, 2024
4	Managerial Economics and Business Strategy	Michael Baye & Jeff Prince	McGraw-Hill	11th Edition, 2024

Reference Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Engineering Economics and Costing	S. K. Bhattacharya	Pearson India	5th Edition, 2022
2	Engineering Economy	Leland Blank & Anthony Tarquin	McGraw-Hill	9th Edition, 2023
3	Managerial Economics	D. N. Dwivedi	Vikas Publishing House	9th Edition, 2023
4	Economics for Engineers	C. S. Park	Pearson	Latest Indian Reprint, 2023
5	Principles of Microeconomics	Karl E. Case, Ray C. Fair & Sharon Oster	Pearson	13th Edition, 2022

SEMESTER S3

BUSINESS COMMUNICATION & VALUE SCIENCE - I

Course Code	B25BCP307	CIE Marks	50
Teaching Hours/Week (L:T:P:R)	0:0:2:0	ESE Marks	-
Credits	1	Exam Hours	0
Prerequisites (if any)	Basic Knowledge of high school English	Course Type	Lab

Course Objectives:

1. Develop self-awareness, leadership qualities, and essential life skills required for personal growth, stress management, and effective teamwork.
2. Enhance communication competence through effective listening, speaking, reading, writing, grammar, vocabulary enrichment, and business communication practices.
3. Foster values, emotional intelligence, interpersonal skills, and professional communication abilities necessary for academic, personal, and workplace success.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Module 1 Overview of Leadership Oriented Learning (LOL) Overview of Business Communication, Self-awareness – identity, body awareness, stress management.	8

2	Module 2 Essential Grammar-1: Refresher on Parts of Speech, Tenses: Applications of tenses in Functional Grammar, Sentence formation (general & Technical) , Common errors, Voices Communication Skills: Overview of Communication Skills, Barriers of communication, Effective communication, Types of communication – verbal and non-verbal, Role-play based learning, Importance of Questioning Listening Skills: Law of nature – Importance of listening skills, Difference between listening and hearing, Types of listening Personal Development, Expressing self, connecting with emotions, Visualizing and experiencing purpose	12
3	Module 3 Email Writing Formal and informal emails, Verbal Communication Pronunciation, Clarity of speech, Vocabulary Enrichment, Exposure to words from General Service List (GSL) by West, Academic Word List (AWL) Technical specific terms related to the field of technology, Phrases, Idioms, Significant abbreviations, Formal business vocabulary, Written Communication Summary writing, Story Writing, CV. Life Skills: Stress Management, Working with rhythm and balance, Colours and teamwork.	14

4	Module 4 Understanding Life Skills Introduction to life skills, Critical life skills, Multiple Intelligences, embracing diversity, Leadership, teamwork, dealing with ambiguity, Managing stress, motivating people, Creativity, Result orientation.	11
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Laboratory

No.	Activity	CO'S
1	Introduce Yourself Creatively – Students introduce themselves using 5 strengths, 3 goals, and 1 unique fact.	1
2	Personal SWOT Analysis – Identify strengths, weaknesses, opportunities, and threats; present findings.	1
3	Values in Action – Discuss a role model and identify the values and life skills demonstrated.	1
4	Stress Busters Workshop – Practice breathing exercises, meditation, and stress-relief techniques followed by reflection.	1/4
5	Parts of Speech Hunt – Analyze a newspaper article and identify parts of speech in teams.	
6	Grammar Correction Challenge – Correct common grammatical and sentence-formation errors in given passages.	2
7	Role Play on Communication Barriers – Demonstrate poor communication and then improve it using effective communication strategies.	2
8	Questioning Skills Activity – Students interview peers and practice open-ended and probing questions.	2
9	Listening for Details – Listen to an audio clip and answer comprehension questions; discuss listening styles.	2
10	Formal vs Informal Email Writing – Draft both types of emails for given scenarios and peer-review them.	3
11	Group Discussion on Current Affairs – Students use newly learned vocabulary from newspapers or magazines.	3
12	Toastmasters Table Topics – Impromptu speeches on random topics followed by peer feedback.	3
13	One-Minute Story Writing – Write and present a short story based on a prompt using appropriate vocabulary and grammar.	3

N o.	Activity	CO 'S
14	Team Challenge: Tower Building – Groups build the tallest paper tower, followed by reflection on teamwork and leadership.	4
15	Movie Clip Analysis – Watch a short inspirational clip and identify life skills, values, leadership qualities, and decision-making aspects.	4
16	Elevator Pitch & Mock Interview Objective: Develop confidence, professional communication, and self-presentation skills.	5

**Course Assessment
Method (CIE: 50 marks)**

Continuous Internal Evaluation Marks (CIE):

Assignments/Quiz/Micro Project/Presentation	Lab Evaluation	Total
25	25	50

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Understand the concepts of self-awareness, leadership-oriented learning, business communication, and stress management for personal development.	K2

CO2	Apply effective communication skills, including grammar, listening, speaking, and interpersonal communication techniques in various personal and professional contexts.	K3
CO3	Apply written and verbal communication skills to prepare emails, summaries, reports, CVs, and other professional documents using appropriate business and technical vocabulary.	K3
CO4	Apply life skills such as teamwork, leadership, emotional intelligence, creativity, stress management, and problem-solving to enhance personal effectiveness and workplace readiness.	K3
CO5	Apply professional communication, presentation, and interpersonal skills to enhance employability and workplace readiness.	K3

Note: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create
CO-PO Mapping Table:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1							2	2	2		2
CO2		1						2	3		2
CO3									3	2	2
CO4		1				2	2	3	2	2	2
CO5						2	2	3	3	2	2

Note: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation

Text Books:

There are no prescribed texts for Semester 1 – there will be handouts and reference links shared.

Reference Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	English vocabulary in use	Alan Mc'Carthy and O'dell		
2	APAART: Speak Well 1 (English language and communication)			

3	APAART: Speak Well 2 (Soft Skills)			
4	Business Communication	Dr. Saroj Hiremath		

Online Resources

Module No.	Link ID
1	https://www.coursera.org/learn/learning-how-to-learn
2	https://www.coursera.org/specializations/effective-business-communication

Evaluation for Lab Activity

Sl. No	Evaluation for	Allotted Marks
1	Performance Evaluation in Lab	15
2	Internal assessment	10
Total		25

Internal Examination Pattern:

The Internal examination shall be conducted for 50 marks, which will be converted to out of 10.

SEMESTER S3

INDIAN CONSTITUTION

Course Code: Indian Constitution	B25ICT308	CIE Marks	40
Teaching Hours/Week (L:T:P:R)	2:0:0:0	ESE Marks	60
Credits	Pass/Fail	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	NIL	Course Type	Theory

Course Objectives:

To provide students with an understanding of the constitutional framework of India, emphasize the significance of environmental awareness and human rights, and develop responsible citizenship. Through the study of these topics, students will acquire the knowledge, values, and confidence required to address societal challenges with integrity and a sense of national responsibility.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Module 1 Definition of Constitution - Historical Background - Salient Features of the Constitution - Preamble of the Constitution - Union and its Territory - Meaning of Citizenship - Types - Termination of Citizenship.	6
2	Module 2 Definition of State, Fundamental Rights: General Nature – Classification - Right to Equality - Right to Freedom - Right Against Exploitation - Right to Freedom of Religion - Cultural and Educational Rights - Right to Constitutional Remedies - Protection in Respect of Conviction for Offences. Directive Principles of State Policy, Classification of Directives, Fundamental Duties.	8
3	Module 3 The Union Executive - The President - The Vice President - The Council of Ministers - The Prime Minister – Attorney General - Functions. The Parliament - Composition - Rajya Sabha - Lok Sabha - Qualification and Disqualification of Membership - Functions of	8

	Parliament. Union Judiciary, The Supreme Court, Jurisdiction, Appeal by Special Leave.	
4	Module 4 The State Executive – Governor – Council of Ministers – Chief Minister – Advocate General – Union Territories – State Legislature – Composition – Qualification and Disqualification of Membership – Functions – State Judiciary – High Court – Jurisdiction – Writ Jurisdiction – Relations between the Union and the States – Legislative Relations – Administrative Relations – Financial Relations – Inter-State Council – Finance Commission – Local Self Government – Panchayats – Municipalities – Corporations – Functions – Emergency Provisions – Freedom of Trade, Commerce and Intercourse – Administrative Tribunals – Official Language – Elections – Special Provisions Relating to Certain Classes – Amendment of the Constitution.	10

**Course Assessment
Method (CIE: 40 marks,
ESE: 60 marks)**

Continuous Internal Evaluation Marks (CIE):

Assignment/Quiz/Project	Internal Ex-1	Internal Ex-2	Internal Ex-3	Total
10	30	30	30	40
	The total 90 marks, covert to 30			

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
2 Questions from each module. - Total of 8 Questions, each carrying 3 marks (8x3 =24 marks)	2 questions will be given from each module, out of which 1 question should be answered. - Each question can have a maximum of 2 subdivisions. Each question carries 9 marks. (4x9 = 36 marks)	60

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Explain the salient features and underlying principles of the Indian Constitution.	K2
CO2	Apply the Fundamental Rights in relevant social and legal contexts	K3
CO3	Demonstrate the importance of Fundamental Duties in promoting responsible citizenship.	K3
CO4	Analyze the structure and functioning of the three-tier system of government in India	K3
CO5	Examine the special constitutional provisions and their significance in governance and administration.	K3

Note: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create

CO-PO Mapping Table:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2				2		3		2	
CO2	2	3				3		3		2	
CO3	2	2				3	2	3	3	2	
CO4	3	3		2		2		2	2	2	
CO5	3	3	2	2		2		2	3	2	

Note: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation

Text Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Introduction to the Constitution of India	D.D. Basu	LexisNexis Butterworths Wadhwa , New Delhi,	24th Edition, 2019.
2	The Constitution of India	P.M. Bakshi	Universal Law Publishing Co. Pvt. Ltd. , New Delhi,	14th Edition, 2017.

Reference Books

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	India's Constitution	J.N. Pandey	Central Law Agency	51st Edition, 2019.
2	The Constitutional Law of India	M.V. Pylee	S. Chand & Company.	16th Edition, 2016.

Online Resources	
Module No.	Link ID
1	https://onlinecourses.nptel.ac.in/e-learning/preview/noc20_lw03
2	https://www.youtube.com/playlist?list=PLyqSpQzTE6M-Zj2GBVpJ3c7cfvMTcKrPL