



ST. JOSEPH'S
COLLEGE OF ENGINEERING
AND TECHNOLOGY,
- PALAI -
AUTONOMOUS

Choondacherry P.O., Pala, Kottayam - 686579
Kerala, India



SYLLABUS
OPEN ELECTIVE-1 Courses

offered by the Department of

Artificial Intelligence and Data Science

for the B.Tech students of other disciplines*

(B. Tech 2024 SCHEME)

*As per R 3.25 and R 3.26 of SJ CET B.Tech. Academic Regulations 2024

SEMESTER – 6 OPEN ELECTIVE 1

OPEN ELECTIVE 1	2
DATA STRUCTURES	3
DATA COMMUNICATION	6
FOUNDATIONS OF CRYPTOGRAPHY	10
MACHINE LEARNING FOR ENGINEERS	13
OBJECT ORIENTED PROGRAMMING	18

OPEN ELECTIVE – 1

Open elective offered to other branches

SLOT	COURSE CODE	COURSES	L-T-P-R	HOURS	CREDIT
O	24SJOECST611	Data Structures	3-0-0-0	3	3
	24SJOECST612	Data Communication	3-0-0-0		3
	24SJOECST613	Foundations of Cryptography	3-0-0-0		3
	24SJOECST614	Machine Learning for Engineers	3-0-0-0		3
	24SJOECST615	Object Oriented Programming	3-0-0-0		3

SEMESTER 6

DATA STRUCTURES

Course Code	24SJOECST611	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:

1. To provide the learner a comprehensive understanding of data structures and algorithms.
2. To prepare them for advanced studies or professional work in computer science and related fields.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Basic Concepts of Data Structures Definitions; Data Abstraction; Performance Analysis - Time & Space Complexity, Asymptotic Notations; Polynomial representation using Arrays, Sparse matrix (<i>Tuple representation</i>); Stacks and Queues - Stacks, Multi-Stacks, Queues, Circular Queues;	9
2	Linked List and Memory Management Singly Linked List - Operations on Linked List, Stacks and Queues using Linked List, Polynomial representation using Linked List; Doubly Linked List.	9
3	Trees and Graphs Trees:- Representation Of Trees; Binary Trees - Types and Properties, Binary Tree Representation, Tree Operations, Tree Traversals; Binary Search Trees - Binary Search Tree Operations; Graphs:- Definitions; Representation of Graphs; Depth First Search and Breadth First Search.	9

4	Sorting and Searching Sorting Techniques:- Selection Sort, Insertion Sort, Quick Sort, Merge Sort; Searching Techniques - Linear Search, Binary Search, Hashing - Hashing functions: Division; Collision Resolution: Linear probing, Open hashing.	9
----------	--	----------

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

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

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
<ul style="list-style-type: none"> 2 Questions from each module. Total of 8 Questions, each carrying 3 marks <p style="text-align: center;">(8x3 =24 marks)</p>	<ul style="list-style-type: none"> 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 subdivisions. <p style="text-align: center;">(4x9 = 36 marks)</p>	60

Course Outcomes (COs)

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

	Course Outcome	Bloom's Knowledge Level (KL)
CO1	Identify appropriate data structures for solving real world problems.	K3
CO2	Describe and implement linear data structures such as arrays, linked lists, stacks, and queues.	K3
CO3	Describe and Implement non linear data structures such as trees and graphs.	K3
CO4	Select appropriate searching and sorting algorithms to be used in specific circumstances.	K3

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

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

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

Note: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

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 in C	Ellis Horowitz, Sartaj Sahni and Susan Anderson-Freed,	Universities Press	2/e, 2007
2	Introduction to Algorithms	Thomas H Cormen, Charles Leisesrson, Ronald L Rivest, Clifford Stein	PHI	3/e, 2009

Reference Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Classic Data Structures	Samanta D.	Prentice Hall India.	2/e, 2018
2	Data Structures and Algorithms	Aho A. V., J. E. Hopcroft and J. D. Ullman	Pearson Publication.	1/e, 2003
3	Introduction to Data Structures with Applications	Tremblay J. P. and P. G. Sorenson	Tata McGraw Hill.	2/e, 2017
4	Theory and Problems of Data Structures	Lipschuts S.	Schaum's Series	2/e, 2014

Video Links (NPTEL, SWAYAM...)	
Sl. No.	Link ID
1	https://nptel.ac.in/courses/106102064
2	https://ocw.mit.edu/courses/6-851-advanced-data-structures-spring-2012/

SEMESTER S6**DATA COMMUNICATION**

Course Code	24SJOECST612	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:

1. To understand the details of data communication at the lower level and the associated issues.
2. To gain insight into the important aspects of data communication and computer networking systems and to apply the in practical applications.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Communication model - Simplex, Half duplex, Full duplex transmission. Periodic analog signals - Sine wave, Amplitude, Phase, Wavelength, Time and frequency domain, Bandwidth. Analog & digital data and signals. Transmission impairments - Attenuation, Delay distortion, Noise. Data rate limits - Noiseless channel, Nyquist bandwidth, Noisy channel, Shannon's capacity formula. Guided transmission media - Twisted pair, Coaxial cable, Optical fiber. Unguided media - Radio waves, Terrestrial microwave, Satellite microwave, Infrared. Wireless propagation - Ground wave propagation, Sky wave propagation, Line-of-Sight (LoS) propagation.	10
2	Digital data to digital signal – Non-Return-to-Zero (NRZ), Return-to-Zero (RZ), Multilevel binary, Biphase. Analog data to digital signal - Sampling theorem, Pulse Code Modulation (PCM), Delta Modulation (DM). Digital data to analog signal - Amplitude Shift Keying (ASK), Frequency Shift	9

	Keying (FSK), Phase Shift Keying (PSK). Analog data to analog signal - Amplitude Modulation (AM), Frequency Modulation (FM), Phase Modulation (PM).	
3	Multiplexing - Frequency Division Multiplexing (FDM), Wavelength Division Multiplexing (WDM), Time Division Multiplexing (TDM), Characteristics, Synchronous TDM, Statistical TDM. Spread spectrum techniques - Direct Sequence Spread Spectrum (DSSS), Frequency Hopping Spread Spectrum (FHSS), Code Division Multiplexing, Code Division Multiple Access (CDMA).	8
4	Digital data communication techniques - Asynchronous transmission, Synchronous transmission. Detecting and correcting errors - Types of errors, Parity check, Checksum, Cyclic Redundancy Check (CRC), Forward Error Correction (FEC), Hamming distance, Hamming code. Basic principles of switching - Circuit switching, Packet switching, Message switching.	9

Course Assessment Method

(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

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
<ul style="list-style-type: none"> 2 Questions from each module. Total of 8 Questions, each carrying 3 marks <p>(8x3 =24 marks)</p>	<ul style="list-style-type: none"> 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 subdivisions. <p>(4x9 = 36 marks)</p>	60

Course Outcomes (COs)

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

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Identify the characteristics of signals for analog and digital transmissions so as to define the associated real-world challenges.	K3
CO2	Select transmission media based on characteristics and propagation modes.	K3
CO3	Choose appropriate signal encoding techniques for a given scenario	K3
CO4	Illustrate multiplexing and spread spectrum technologies	K2
CO5	Use error detection, correction and switching techniques in data communication	K3

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

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

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

Note: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

Text Books

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Data Communications and Networking	Forouzan B. A	McGraw Hill	6/e, 2019
2	Data and Computer Communication	William Stallings	Pearson	10/e, 2016

Reference Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Mobile Communications	Schiller J	Pearson	2/e, 2009
2	Fundamentals of Networking and Communication	Curt M. White	Cengage	7/e, 2010

Video Links (NPTEL, SWAYAM...)	
Sl. No.	Link ID
1	https://nptel.ac.in/courses/106105082

SEMESTER S6**FOUNDATIONS OF CRYPTOGRAPHY**

Course Code	24SJOECST613	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:

1. Develop a foundational understanding of mathematical concepts in cryptography,
2. Gain comprehensive knowledge of cryptographic methods.
3. Understand the principles and need for computer security.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Integer Arithmetic – Divisibility, Greatest Common Divisor Euclid’s and Extended Euclid’s Algorithm for GCD; Modular Arithmetic – Operations, Properties, Polynomial Arithmetic; Algebraic Structures – Group Ring Field.	9
2	Prime numbers and Prime Factorisation - Primitive Roots, Existence of Primitive Roots for Primes, Fermat’s Theorem, Primality Testing, Euler’s Theorem, Euler’s Totient Function, Discrete Logarithms, Modular Arithmetic, Chinese Remainder Theorem.	9
3	Principles of security - Types of Security attacks, Security services, Security Mechanisms; Cryptography - Introduction, cryptographic notations, substitution techniques, Transposition Techniques, limitations of classical cryptography.	9
4	Symmetric key Ciphers - Block Cipher principles & Algorithms- DES, AES, Differential and Linear Cryptanalysis; Asymmetric Key Ciphers- RSA, ECC; Hash Functions - MD5, SHA-1.	9

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

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

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
<ul style="list-style-type: none"> ● 2 Questions from each module. ● Total of 8 Questions, each carrying 3 marks <p style="text-align: center;">(8x3 =24 marks)</p>	<ul style="list-style-type: none"> ● 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 subdivisions. <p style="text-align: center;">(4x9 = 36 marks)</p>	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 integer arithmetic operations including divisibility and GCD algorithms, modular arithmetic operations and properties, polynomial arithmetic, and algebraic structures such as groups, rings, and fields.	K2
CO2	Describe the number theory concepts essential for cryptographic applications and mathematical problem-solving.	K2
CO3	Explain the security principles, types of attacks, and protective measures, alongside a thorough understanding of cryptographic techniques and their applications in securing data.	K2
CO4	Discuss symmetric and asymmetric key cryptography, including block cipher principles, algorithms, public key cryptosystems, and hash functions	K2

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

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

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

Note: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High).

Text Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Cryptography & Network Security	Behrouz A. Forouzan	McGraw Hill	3/e, 2007
2	Security in Computing	Charles P. Pfleeger, Shari L. Pfleeger, Jonathan Margulies	Prentice Hall	5/e, 2015
3	Introduction to Cryptography: Principles and Applications	H. Delfs, H. Knebl	Springer	1/e, 2002
4	A Classical Introduction to Cryptography: Applications for Communications Security	Serge Vaudenay	Springer	1/e, 2009

Reference Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Cryptography and Network Security	William Stallings	Pearson Education	7/e, 2017

Video Links (NPTEL, SWAYAM...)	
Sl. No.	Link ID
1	https://nptel.ac.in/courses/106106221
2	https://onlinecourses.nptel.ac.in/noc22_cs90/preview

SEMESTER S6**MACHINE LEARNING FOR ENGINEERS**

Course Code	24SJOECST614	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:

1. To provide the basic concepts and algorithms in machine learning.
2. To discuss the standard and most popular supervised and unsupervised learning algorithms.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	<p>Introduction to ML Machine Learning vs. Traditional Programming, Machine learning paradigms - supervised, semi-supervised, unsupervised, reinforcement learning.</p> <p>Basics of parameter estimation - maximum likelihood estimation (MLE) and maximum a posteriori estimation (MAP), Bayesian formulation.</p> <p>Supervised Learning Feature Representation and Problem Formulation, Role of loss functions and optimization</p> <p>Regression - Linear regression with one variable, Linear regression with multiple variables - solution using gradient descent algorithm and matrix method.</p>	10
2	<p>Classification - Naïve Bayes, KNN</p> <p>Generalisation and Overfitting - Idea of overfitting, LASSO and RIDGE</p>	8

	regularization, Idea of Training, Testing, Validation Evaluation measures – Classification - Precision, Recall, Accuracy, F-Measure, Receiver Operating Characteristic Curve (ROC), Area Under Curve (AUC). Regression - Mean Absolute Error (MAE), Root Mean Squared Error (RMSE), R Squared/Coefficient of Determination.	
3	Neural Networks (NN) - Perceptron, Neural Network - Multilayer feed-forward network, Activation functions (Sigmoid, ReLU, Tanh), Back propagation algorithm. Decision Trees – Information Gain, Gain Ratio, ID3 algorithm	8
4	Unsupervised Learning Clustering - Similarity measures, Hierarchical Clustering - Agglomerative Clustering, partitional clustering, K-means clustering Dimensionality reduction - Principal Component Analysis, multidimensional scaling Ensemble methods - bagging, boosting Resampling methods - Bootstrapping, Cross Validation. Practical aspects - Bias-Variance trade-off	10

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

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

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
<ul style="list-style-type: none"> • 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks <p style="text-align: center;">(8x3 =24marks)</p>	<ul style="list-style-type: none"> • 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. <p style="text-align: center;">(4x9 = 36 marks)</p>	60

Course Outcomes (COs)

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

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Illustrate Machine Learning concepts and basic parameter estimation methods	K2
CO2	Demonstrate supervised learning concepts (regression, classification)	K3
CO3	Illustrate the concepts of Multilayer neural network and Decision trees	K3
CO4	Describe unsupervised learning concepts and dimensionality reduction techniques	K3
CO5	Use appropriate performance measures to evaluate machine learning models	K3

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

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

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

Note: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High).

Text Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Introduction to Machine Learning	Ethem Alpaydin	MIT Press	2/e, 2010
2	Data Mining and Analysis: Fundamental Concepts and Algorithms	Mohammed J. Zaki, Wagner Meira	Cambridge University Press	1/e, 2016

Reference Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Machine Learning	Tom Mitchell	McGraw-Hill	1997
2	Applied Machine Learning	M Gopal	Pearson	2/e, 2018
3	Neural Networks for Pattern Recognition	Christopher Bishop	Oxford University Press	1995
4	Machine Learning: A Probabilistic Perspective	Kevin P Murphy	MIT Press	1/e, 2012
5	The Elements of Statistical Learning	Trevor Hastie, Robert Tibshirani, Jerome Friedman	Springer	2/e, 2007

Video Links (NPTEL, SWAYAM...)	
Sl. No.	Link ID
1	https://youtu.be/fC7V8QsPBec?si=8kqBn-_7x1RG5V1J
2	https://youtu.be/yG1nETGyW2E?si=ySlxpeWuFAUQBf7-
3	https://youtu.be/zop2zuwF_bc?si=W7TpSHLdi4rykva4

SEMESTER S6**OBJECT ORIENTED PROGRAMMING**

Course Code	24SJOECST615	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:

1. To teach the core object-oriented principles such as abstraction, encapsulation, inheritance, and polymorphism, robust error-handling using exception mechanisms to ensure program reliability.
2. To equip the learner to develop object-oriented programs encompassing fundamental structures, environments, and the effective utilization of data types, arrays, strings, operators, and control statements for program flow in Java.
3. To enable the learner to design and develop event-driven graphical user interface (GUI) database applications using Swing and database connection components.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Introduction to Java - Java programming Environment and Runtime Environment (Command Line & IDE); Java compiler; Java Virtual Machine; Primitive Data types and Wrapper Types; Casting and Autoboxing; Arrays; Strings; Vector class; Operators - Arithmetic, Bitwise, Relational, Boolean Logical, Assignment, Conditional (Ternary); Operator Precedence; Control Statements - Selection Statements, Iteration Statements and Jump Statements; Functions; Command Line Arguments; Variable Length Arguments; Classes; Abstract Classes; Interfaces; OOP Concepts - Data abstraction, encapsulation, inheritance, polymorphism, Procedural and object oriented programming paradigm; Microservices; Object Oriented Programming in Java - Declaring Objects; Object Reference; Introduction to Methods; Constructors; Access Modifiers; <i>this</i> keyword.	10

2	Polymorphism - Method Overloading, Using Objects as Parameters, Returning Objects, Recursion; Static Members, Final Variables, Inner Classes. Inheritance - Super Class, Sub Class, Types of Inheritance, The <i>super</i> keyword, protected Members, Calling Order of Constructors; Method Overriding, Dynamic Method Dispatch, Using <i>final</i> with Inheritance.	8
3	Packages and Interfaces – Packages - Defining a Package, CLASSPATH, Access Protection, Importing Packages; Interfaces - Interfaces v/s Abstract classes, defining an interface, implementing interfaces, accessing implementations through interface references, extending interface(s); Exception Handling - Checked Exceptions, Unchecked Exceptions, <i>try</i> Block and <i>catch</i> Clause, Multiple catch Clauses, Nested <i>try</i> Statements, <i>throw</i> , <i>throws</i> and <i>finally</i> , Java Built-in Exceptions, Custom Exceptions.	9
4	Swings fundamentals – Overview of AWT, Swing v/s AWT, Swing Key Features, Swing Controls, Components and Containers, Swing Packages, Event Handling in Swings, Swing Layout Managers, Exploring Swings– JFrame, JLabel, The Swing Buttons, JTextField; Event handling – Event Handling Mechanisms, Delegation Event Model, Event Classes, Sources of Events, Event Listener Interfaces, Using the Delegation Event Model; Developing Database Applications using JDBC – JDBC overview, Types, Steps, Common JDBC Components, Connection Establishment.	9

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

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

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
<ul style="list-style-type: none"> 2 Questions from each module. Total of 8 Questions, each carrying 3 marks <p style="text-align: center;">(8x3 =24 marks)</p>	<ul style="list-style-type: none"> 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 subdivisions. <p style="text-align: center;">(4x9 = 36 marks)</p>	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 process of developing Java programs, including their structure and components, to demonstrate proficiency.	K2
CO2 Utilize object-oriented programming principles in the design and implementation of Java applications.	K3
CO3 Develop and manage Java packages and interfaces, enhancing code modularity and reusability.	K3
CO4 Implement error handling using Java's exception mechanisms and leverage interfaces for modular applications.	K3
CO5 Develop event-driven Java GUI applications with database connectivity.	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	3									3
CO2	3	3	3								3
CO3	3	3	3		3						3
CO4	3	3	3		3						3
CO5	3	3	3		3						3

Note: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High).

Text Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Java: The Complete Reference	Herbert Schildt	Tata McGraw Hill	13/e, 2024
2	Introduction to Java Programming, Comprehensive Version	Y Daniel Liang	Pearson	10/e, 2014
3	Head First Design Patterns	Eric Freeman, Elisabeth Robson, Bert Bates, Kathy Sierra	O'Reilly Media	1/e, 2004

Reference Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Head First Java: A Brain Friendly Guide	Kathy Sierra & Bert Bates	O'Reilly	3/e, 2022
2	JAVA™ for Programmers	Paul Deitel	PHI	11/e, 2018
3	Clean Code: A Handbook of Agile Software Craftsmanship	Robert C. Martin	Prentice Hall	1/e, 2008
4	Programming with Java	E Balagurusamy	McGraw Hill	6/e, 2019
5	Java For Dummies	Barry A. Burd	Wiley	8/e, 2022
6	Effective Java	Joshua Bloch	Pearson	3/e, 2018

Video Links (NPTEL, SWAYAM...)	
Sl. No.	Link ID
1	https://nptel.ac.in/courses/106105191



ST. JOSEPH'S
COLLEGE OF ENGINEERING
AND TECHNOLOGY,
- PALAI -
AUTONOMOUS

Choondacherry P.O., Pala, Kottayam - 686579
Kerala, India



SYLLABUS

OPEN ELECTIVE-1 Courses

offered by the Department of
Civil Engineering
for the B.Tech students of other disciplines*
(B. Tech 2024 SCHEME)

*As per R 3.25 and R 3.26 of SJ CET B.Tech. Academic Regulations 2024

List of Courses offered in Semester VI

OPEN ELECTIVE I: 24SJOECET61N					
SLOT	COURSE CODE	COURSES	L-T-P-R	HOURS	CREDIT
O	24SJOECET611	Introduction to Construction Engineering	3-0-0-0	3	3
	24SJOECET612	Environmental Laws and Policy	3-0-0-0		3
	24SJOECET613	Disaster Management	3-0-0-0		3
	24SJOECET614	Environmental Impact Assessment	3-0-0-0		3
	24SJOECET615	Structural Geology	3-0-0-0		3
	24SJOECET616	Applied Earth Systems	3-0-0-0		3

SEMESTER S6

INTRODUCTION TO CONSTRUCTION ENGINEERING

Course Code	24SJOECET611	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:

1. Identify the properties and applications of different construction materials
2. Understand the principles of concrete mix design and production
3. Learn various building systems and components
4. Comprehend the role of emerging trends and technology innovations in construction

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Construction Materials Mortar – Types – properties – uses. Timber products – properties & uses of plywood, fibre board, particle board. Cement - Manufacturing, chemical composition, Tests on cement – specific gravity, standard consistency, initial and final setting time, fineness, soundness, compressive strength, IS specifications Aggregates – types, Gradation, importance of gradation, bulking of fine aggregate Iron and Steel –Reinforcing steel – types – specifications. Structural steel – specifications Admixtures, uses – mineral admixtures – fly ash and ground granulated blast furnace slag and chemical admixtures – plasticizers, super plasticizers, accelerators, retarders (brief discussion only)	9

2	<p>Concrete Technology</p> <p>Process of manufacturing concrete – batching, mixing, transportation, placing, compacting, finishing, curing</p> <p>Properties of fresh concrete: Workability, factors affecting workability, test on workability (slump test), segregation and bleeding (brief discussion)</p> <p>Properties of hardened concrete: Strength, factors affecting strength, tests for strength of concrete in compression, tension and flexure</p> <p>Concrete quality control – statistical analysis of results – standard deviation – acceptance criteria – mix proportioning (B.I.S method) – nominal mixes.</p>	9
3	<p>Building Construction</p> <p>Preliminary considerations for shallow and deep foundations Masonry –</p> <p>Types of stone masonry</p> <p>Lintels and arches – types and construction details.</p> <p>Tall Buildings – Framed building – steel and concrete frame – structural systems erection of steel work–concrete framed construction– formwork – construction and expansion Joints. Introduction to prefabricated construction – slip form construction</p>	9
4	<p>Construction Technology</p> <p>Cost-effective construction – rapid wall construction, soil-cement block masonry, voided slab technology, filler slab technology</p> <p>Basic concept of prestressing – fundamental understanding of pre-tensioned and post-tensioned construction</p> <p>Construction 3D printing (brief discussion only)</p> <p>Building failures – General reasons – classification – Causes of failures in RCC and Steel structures, Failure due to Fire, Wind and Earthquakes.</p> <p>Foundation failure – failures by alteration, improper maintenance, overloading. Retrofitting of structural components - beams, columns and slabs</p>	9

Course Assessment Method

(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

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
<ul style="list-style-type: none"> • 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks <p style="text-align: center;">(8x3 =24marks)</p>	<ul style="list-style-type: none"> • 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

Course Outcomes (COs)

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

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Describe the characteristics and uses of common construction materials	K2
CO2	Design and specify concrete mixes for different applications	K3
CO3	Identify and explain various building systems and components	K2
CO4	Describe the impact of emerging trends and innovations on construction	K3

Note: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create
CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

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

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

Text Books				
Sl. No	Title of the Book	Name of the Author	Name of the Publisher	Edition and Year
1	Advanced Construction Technology	Roy Chudley, Roger Greeno	Prentice Hall	4 th Ed, 2006
2	Architectural Design with SketchUp	Alexander C. Schreyer	John Wiley & Sons	3rd Ed, 2023
3	Building materials & construction	Anil Kumar Mishra	S. Chand Publisher	1st Ed, 2018

Reference Books				
Sl. No	Title of the Book	Name of the Author	Name of the Publisher	Edition and Year
1	Fundamentals of Building Construction: Materials and Methods	Edward Allen, Joseph Iano	Wiley Publishers	7 th , 2019

Video Links (NPTEL, SWAYAM...)	
Module No.	Link ID
1	https://nptel.ac.in/courses/105102088

SEMESTER S6

ENVIRONMENTAL LAWS AND POLICY

Course Code	24SJOCET612	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:

1. To explain the role of law, policy and institutions in the conservation and management of natural resources as well as pollution control
2. To introduce the laws and policies both at the national and international level relating to environment
3. To equip the students with the skills needed for interpreting laws, policies and judicial decisions
4. To familiarise students in the concept of international environmental law

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Basic Concepts in Environmental Law An introduction to the legal system; Constitution, Acts, Rules, Regulations; Indian Judiciary, Doctrine of precedents, judicial review, Writ petitions, PIL– liberalization of the rule of locus standi, Judicial activism. Introduction to environmental laws in India; Constitutional provisions, Stockholm conference; Bhopal gas tragedy; Rio conference. General principles in Environmental law: Precautionary principle; Polluter pays principle; Sustainable development; Public trust doctrine. Overview of legislations and basic concepts	9

2	<p>Forest, Wildlife and Biodiversity related laws</p> <p>Evolution and Jurisprudence of Forest and Wildlife laws; Colonial forest policies; Forest policies after independence 2 Statutory framework on Forests, Wildlife and Biodiversity: IFA, 1927; WLPA, 1972; FCA, 1980; Biological Diversity Act, 2002; Forest Rights Act, 2006. Strategies for conservation–Project Tiger, Elephant, Rhino, Modulew leopard.</p>	9
3	<p>Air, Water and Marine Laws</p> <p>National Water Policy and some state policies Laws relating to prevention of pollution, access and management of water and institutional mechanism: Water Act, 1974; Water Cess Act, 1977, EPA, 1986. Pollution Control Boards Ground water and law Judicial remedies and procedures Marine laws of India; Coastal zone regulations. Legal framework on Air pollution: Air Act,1981;EPA, 1986</p>	9
4	<p>Hazardous Substances and Activities Legal framework</p> <p>EPA and rules made thereunder; PLI Act, 199 Principles of strict absolute liability;</p> <p>International Environmental law</p> <p>An introduction to international law; sources of international law; law of treaties; signature, ratification Evolution of international environmental law: Customary principles; Common but differentiated responsibility, Polluter pays.</p>	9

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

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

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
<ul style="list-style-type: none"> • 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks <p>(8x3 =24marks)</p>	<ul style="list-style-type: none"> • 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

Course Outcomes (COs)

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

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Familiar with the laws, policies and institutions in the field of environment	K1
CO2	Acquire the skills needed for interpreting laws, policies and judicial decisions in a holistic perspective	K2
CO3	Acquire the ability to evaluate the role of law and policy in conservation and management of natural resources and prevention of pollution	K2
CO4	Familiar with the concept of international environmental law	K2

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

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	-	-	-	-	2	1	-	1	-	2
CO2	2	-	-	-	-	2	1	-	1	-	2
CO3	3	-	-	-	-	2	1	-	2	-	2
CO4	2	-	-	-	-	2	1	-	1	-	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	Name of the Publisher	Edition and Year
1	Environmental Law and Policy in India	Divan S. and Rosencranz A.	Oxford, New Delhi	3 rd , 2022
2	Environmental Law in India	Leelakrishnan P.	Lexis Nexis, India	6 th , 2022
3	International Law and the Environment	Birnie P.	Oxford	3 rd , 2009

Reference Books				
Sl. No.	Title of the Book	Name of the Author	Name of the Publisher	Edition and Year
1	Hand Book on Environmental Law- Forest Laws, Wildlife Laws and the Environment; Vols. I, II and III	Upadhyay S. and Upadhyay V	Lexis Nexis- Butterworths-India, New Delhi.	2002
2	Principles of International Environmental Law,	Sands P	Cambridge	2003

Video Links (NPTEL, SWAYAM...)	
Module No.	Link ID
1	https://onlinecourses.swayam2.ac.in/cec20_ge12/preview

SEMESTER S6

DISASTER MANAGEMENT

Course Code	24SJOECET613	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:

1. To introduce the concept of disasters, their causes and their mitigation and management
2. To learn risk assessment, preparedness, mitigation, and response strategies for disaster management.
3. To develop skills in planning and implementing disaster management systems for community resilience.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Hazards and disasters: Introduction to key concepts and terminology: hazard, disasters and types of classifications, vulnerability, exposure, risk, crisis, emergency, capacity, resilience, Carbon footprint. Effect of subsystems of earth. Extent and nature of natural hazards, implications of climate change: Earth quakes, Volcanoes, Floods. Coastal disasters- Storm surges, Tsunamis, mitigation methods.	9
2	Landslides, Causes and prediction, Soil and soil degradation, erosion and Desertification, Forest fires, their mitigation methods.	9
3	Impacts and assessment: Risk Management and Assessment and Disaster Management cycle. SWOT Analysis- basic concepts, uses, limitations and advantage	9

	Disaster management plan and reports, participation of community in disaster management.	
4	Hazard and disaster management plans for floods, storm surges, landslides, earthquakes, forest fires: pre-disaster phase, actual disaster phase, post- disaster phase Relief and Amenities, Relief camps, organization, individual and community participation, camp layout, food requirement, water needs, sanitation, security, information administration. Technology in disaster management.	9

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

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

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
<ul style="list-style-type: none"> • 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks <p>(8x3 =24marks)</p>	<ul style="list-style-type: none"> • 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. <p>(4x9 = 36 marks)</p>	60

Course Outcomes (COs)

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

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Explain interaction between subsystems of earth that give rise to hazards and their potential for disasters	K2
CO2	Explain the evolving concepts and thoughts of management of hazards and disasters	K2
CO3	Apply the knowledge to find the causes behind natural disasters and evaluate their magnitude and impacts	K3
CO4	Develop management plans for hazards and disasters, and understand the roles of agencies involved	K3

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

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

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

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

Text Books				
Sl. No	Title of the Book	Name of the Author	Name of the Publisher	Edition and Year
1	Disaster Management	Mrinalini Pandey	Wiley	2 nd edition
2	Disaster Risk Reduction in South Asia	Ariyabandu, M. and Sahni P.	Prentice-Hall (India)	2003
3	Environmental Geology - Ecology, Resource and Hazard Management	Valdiya, K.S.	McGraw-Hill Education	2013
4	Disaster Management: Global Problems and Local Solutions	Shaw, R and Krishnamurthy, RR	Springer, Amsterdam	2010
5	Disaster Management - A Disaster Manager's Handbook	Nick Carter. W.,	Asian Development Bank, Philippines.	1991
6	Disaster management	Gupta, H.K.	Universities Press (India) Ltd.	2003
7	Natural and Anthropogenic Disasters Vulnerability, Preparedness and Mitigation	Jha, M.K.	Springer, Amsterdam.	2010

Reference Books				
Sl. No	Title of the Book	Name of the Author	Name of the Publisher	Edition and Year
1	Geological Hazards: Their assessment, avoidance and mitigation	Bell, F.G.	E & FN SPON Routledge, London.	1999
2	Natural Disasters	Alexander, D.,	Research Press, New Delhi	1993
3	Handbook of Disaster and Emergency Management	Khorrām - Manesh	Kompndiet (Gothenburg).	2017
4	Disaster Management in India Policies, Institutions, Practices	Rajendra Kumar Pandey	Routledge	2023

Video Links (NPTEL, SWAYAM...)	
	Link ID
1	https://nptel.ac.in/courses/105104183
2	https://onlinecourses.swayam2.ac.in/cec19_hs20/preview

SEMESTER S6

ENVIRONMENTAL IMPACT ASSESSMENT

Course Code	24SJOECET614	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:

1. To study the various types of environmental pollution and their impacts.
2. To study the process of environmental impact assessment and impact analysis methodologies.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Introduction Pollution and pollutants - general aspects, scale of impact- Global, local pollutants History of EIA - Global and Indian scenario, Need for EIA, EIA 2006 key features, General overview of Draft EIA 2020 EIA procedure in India, Public participation – Significance & steps Environment management plan - Role of an Environmental Engineer	9
2	Impact analysis- Adhoc, checklists, matrix methods, overlay analysis, Fault Tree Analysis method & Event Tree Analysis method - EIA case studies Water Pollution Point and Non-point Source of Pollution, Major Pollutants of Water, Physical, chemical and biological characteristics of	9

	water, Water borne diseases, Water Quality standards (IS 10500-2012)	
3	Solid Waste Classification and sources of Solid Waste, Characteristics of Solid Waste, E-waste, & Radioactive wastes – Types, management/disposal Hazardous waste -waste identification process and characteristics Solid Waste Management Rules 2016 Land/Soil Pollution Effects of urbanization on land degradation, Impact of Modern Agriculture on Soil, pesticide pollution, Effect Environment	9
4	Air Pollution Classification of Pollution and Pollutants, Primary and Secondary Pollutants, Criteria Pollutants and their impacts environment, human health, National Ambient Air Quality Standards by CPCB Noise Pollution Sources of Noise, Effects of Noise, measurement of noise, Equivalent sound pressure level, Control measures – Noise pollution (Regulation and control) Rule 2000	9

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

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

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
<ul style="list-style-type: none">• 2 Questions from each module.• Total of 8 Questions, each carrying 3 marks <p>(8x3 =24marks)</p>	<ul style="list-style-type: none">• 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. <p>(4x9 = 36 marks)</p>	60

Course Outcomes (COs)

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

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Demonstrate the process, need and significance of EIA	K2
CO2	Predict and analyse the possible environmental impact assessment on various projects	K3
CO3	Apply assessment methodologies for evaluating environmental impact assessment	K3
CO4	Identify the significant sources of pollution from any upcoming or existing project and their impacts on biotic and abiotic elements in the environment	K3

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

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	2	1	3	3	1	2	3	2
CO2	3	3	2	2	2	3	3	1	2	3	2
CO3	3	3	2	2	2	3	3	1	2	3	2
CO4	3	3	2	2	2	3	3	1	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 EIA	John Glasson, Riki Therivel & S Andrew Chadwick	University College London Press Limited	2005
2	Environmental Impact Assessment	Larry W Canter	McGraw Hill Inc., New York	1996
3	Waste Water Engineering	B.C. Punmia	Laxmi Publications Pvt. Ltd	1998
4	Sewage Treatment & Disposal and Waste water Engineering	P.N. Modi	Standard Book House	15th, 2008

Reference Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	EIA Analysis Hand Book	Rau G J and Wooten C.D.	McGraw Hill	1979
2	Introduction to Environmental Engineering	Mackenzie L Davis	McGraw hill Education	2013
3	Environmental Engineering	Peavy H S, Rowe, D. R. Tchobanaglou	Mc Graw Hill Education	1985
4	Standard Handbook of Environmental Engineering	Robert A Corbett	McGraw Hill	1999

Video Links (NPTEL, SWAYAM...)	
Module No.	Link ID
1	https://nptel.ac.in/courses/124107160
2	https://nptel.ac.in/courses/124107160
3	https://nptel.ac.in/courses/124107160
4	https://nptel.ac.in/courses/124107160

SEMESTER S6

STRUCTURAL GEOLOGY

Course Code	24SJOECET615	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:

1. Understand the evolution of earth from the deformed rocks and structures.
2. Identify areas of mineral, oil and gas deposits.
3. Get an idea about the structural instabilities which can lead to natural hazards

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Introduction to Structural Geology; Forces causing deformation in Earth's lithosphere; Concept of rock deformation: Stress and Strain in rocks; Strain ellipses of different types and their geological significance; Rheology of rocks; Concept of dip and strike; Outcrop patterns.	9
2	Foliation and lineation- Description and origin of foliations, axial plane cleavage and its tectonic significance; Description and origin of lineation and relationship with the major structures; Neotectonics-Introduction; Neo tectonic activity in Kerala.	9
3	Folds- Fold morphology; Geometric and genetic classification of folds; Introduction to the mechanics of folding: Buckling, Bending, Flexural slip and flow folding; Importance of structures in mineral, oil and gas deposits	9
4	Fractures and faults: Geometric and genetic classification fractures and faults; Effects of faulting on the	9

	outcrops; Geologic/geomorphic criteria for recognition of faults and fault plane solutions; Lineaments- Introduction; Major lineaments in Kerala and its possible implications.	
--	---	--

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

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination- 1(Written)	Internal Examination- 2(Written)	Total
5	15	10	10	40

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
<ul style="list-style-type: none"> • 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks <p style="text-align: center;">(8x3 =24marks)</p>	<ul style="list-style-type: none"> • 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. <p style="text-align: center;">(4x9 = 36 marks)</p>	60

Course Outcomes (COs)

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

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Understand about stress, strain and the deformation of rocks and the causes of deformation of rocks	K2
CO2	Evaluate the basic concepts in tectonics with respect to the geology of Kerala	K5
CO3	Identify the structures with probable mineral, oil and gas deposits	K1
CO4	Acquire the ability to describe and classify brittle and ductile structures, including faults and folds	K4
CO5	Anticipate the possibility of natural hazards	K6

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

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

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

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

Text Books				
Sl. No	Title of the Book	Name of the Author	Name of the Publisher	Edition and Year
1	Structural Geology	Marland P Billings	Pearson education	2016
2	Geology of Kerala	K Soman	Geological Society India	2023

3	An Introduction to Structural Geology	A.K. Jain	Geological Society India	2019
Reference Books				
Sl. No.	Title of the Book	Name of the Author	Name of the Publisher	Edition and Year
1	Structural Geology of Rocks and Regions	George H. Davis, Stephen J. Reynolds Charles F. Kluth	Wiley	3 rd , 2011

Video Links (NPTEL, SWAYAM...)	
Module No.	Link ID
1	https://onlinecourses.nptel.ac.in/noc19_ce47/preview

SEMESTER S6

APPLIED EARTH SYSTEMS

Course Code	24SJOECET616	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:

1. Appreciation of earth as a system of interrelated components
2. Understanding mechanisms that give rise to oceanographic and atmospheric phenomena
3. Comprehension of processes that result in characteristic land features in different climatic regimes

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Fundamental concepts of equilibrium. Geomorphic agents and processes. Basic concept of Earth as a system and its component sub systems. Climate Change vis-a-vis interrelationships of the subsystems- Green House Effect and Global warming, basic ideas about their causes and effects.	9
2	Weathering- relevance, influence of and on earth systems, types and controlling factors. Soil- formation and controls, soil profile, soil erosion and conservation methods. Fluvial processes- hydrological cycle, fluvial erosion, transportation and deposition, fluvial landforms. Stages of stream development; Drainage patterns.	9

3	Wagner's ideas of continental drift, Plate Tectonics- seafloor spreading. Plate boundaries and their features, mechanisms of plate movements Basics of oceanography: coastal upwelling and downwelling. Outlines of ocean floor topography, basic outlines of origin and circulation of deep sea surface currents (Atlantic and Pacific Oceans)	9
4	Basics of atmosphere and atmospheric processes: Structure and composition of the atmosphere. Heat budget, factors affecting solar radiation. Fundamental concepts of precipitation, global wind patterns. General weather systems of India, - Monsoon system, cyclone and jet stream	9

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

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

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
<ul style="list-style-type: none"> • 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks (8x3 =24marks) 	<ul style="list-style-type: none"> • 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

Course Outcomes (COs)

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

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Explain the concept of earth as a system of interrelated components and associated exogenic/endogenic processes.	K2
CO2	Appraise geological agents and their respective erosion, transportation and deposition regimes and landforms formed.	K5
CO3	Evaluate/investigate the significance of Plate tectonics theory to explain the geodynamic features and processes of earth's surface.	K5
CO4	Develop an understanding of oceanographic and atmospheric regimes and their sway on other subsystems and process thereof.	K6
CO5	Understand implications of human interaction with the Earth system.	K2

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

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

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

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

Text Books				
Sl. No	Title of the Book	Name of the Author	Name of the Publisher	Edition and Year
1	General Climatology	Critchfield H. J.	Prentice Hall, New Delhi	1983
2	Applied Hydrogeology	Fetter C. W.	CBS New Delhi	1990
3	Physical geology: Earth Revealed	Carlson D.H., Plummer C. C. and Mc Greary	McGraw Hill, New York,	2006
4	Oceanography–An Introduction to the Planet Oceanus	Pinet P R	West Publishing Co.,	1992
5	Environmental Geology: Ecology, Resource and Hazard Management	Valdiya K. S.	McGraw-Hill Education (India) Private Limited, New Delhi	2013

Reference Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Climatology and oceanography	D. S. Lal	Allahabad Sharda Pustak Bhawan	2001

Video Links (NPTEL, SWAYAM...)	
Module No.	Link ID
1	https://onlinecourses.nptel.ac.in/noc20_ce33/preview
2	https://onlinecourses.nptel.ac.in/noc20_ce33/preview
3	https://onlinecourses.nptel.ac.in/noc20_ce33/preview
4	https://onlinecourses.nptel.ac.in/noc20_ce33/preview



ST. JOSEPH'S
COLLEGE OF ENGINEERING
AND TECHNOLOGY.
- PALAI -
AUTONOMOUS

Choondacherry P.O., Pala, Kottayam - 686579
Kerala, India



SYLLABUS

OPEN ELECTIVE-1 Courses

offered by the Department of

Electrical and Electronics Engineering

for the B.Tech students of other disciplines*

(B. Tech 2024 SCHEME)

*As per R 3.25 and R 3.26 of SJCTET B.Tech. Academic Regulations 2024

OPEN ELECTIVE 1: 24SJOEEET61N (offered by EE Department)					
SLOT	COURSECODE	COURSES	L-T-P-R	HOURS	CREDIT
O	24SJOEEET611	Introduction to Control Systems	3-0-0-0	3	3
	24SJOEEET612	Energy Management	3-0-0-0		3
	24SJOEEET613	Renewable Energy Systems	3-0-0-0		3



**SEMESTER S6
INTRODUCTION TO CONTROL SYSTEMS**

Course Code	24SJOEEET611	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:

1. To introduce various classical tools for analysis of linear control system in time and frequency domain.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	<p>Introduction to Control Systems, mathematical modelling and Transfer function Based Analysis</p> <p>Open loop and Closed loop control systems; Automatic control systems; Necessity and significance. (1 hour)</p> <p><i>Modelling of LTI systems:</i> LTI Systems, Transfer function representation of differential equation in Laplace domain.</p> <p>Electrical, translational and rotational mechanical systems, DC servo-motor modelling. (4 hours).</p> <p>Block diagram representation - Signal flow graph - Mason's gain formula (Introduction and simple examples only) (4 hours)</p>	9
2	<p>Performance Analysis of Control Systems:</p> <p><i>Time domain analysis of control systems:</i> Impulse and Step responses of first and second order systems - Pole dominance for higher order systems. Time domain specifications. Steady state error analysis and static error constants (5 hours)</p> <p>Characteristic equation. Routh stability criterion. (3 hours)</p>	8
3	<p>Root Locus Analysis and Controllers:</p> <p><i>Root locus technique:</i> Construction of Root locus - stability analysis- effect of addition of poles and zeros; Effect of positive feedback systems on Root locus. (5 hours)</p> <p><i>Controller design:</i> Types of controllers and their control action-proportional (P), integral (I), derivative (D), PID control. PID tuning using Ziegler-Nichols method. (3 hours)</p>	8

4	<p>Frequency domain analysis:</p> <p><i>Bode Plot:</i> Construction, Concept of gain margin and phase margin-stability analysis. (4 hours)</p> <p>Frequency domain specifications - correlation between time domain and frequency domain responses (Resonant peak and resonant frequency). (2 hours)</p> <p>Polar plot: Gain margin and phase margin, Stability analysis. (2 hours)</p> <p>Nyquist stability criterion. Concept of Nichols Chart. (3 hours)</p>	11
----------	--	-----------

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

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

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
<ul style="list-style-type: none"> ● 2 Questions from each module. ● Total of 8 Questions, each carrying 3 marks <p style="text-align: center;">(8x3 =24marks)</p>	<ul style="list-style-type: none"> ● 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. <p style="text-align: center;">(4x9 = 36 marks)</p>	60

Course Outcomes (COs)

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

Course Outcome		Bloom's Knowledge Level (KL)
CO1	To represent continuous time systems in the classical domain.	K2
CO2	Analyse the time domain responses of linear systems and predict and diagnose transient response parameters of the system for standard input functions.	K2
CO3	Analyse dynamics systems for their performance and stability using Root locus.	K3
CO4	Analyse dynamics systems for their performance and stability in frequency domain..	K3

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

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

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

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	Control Systems Engineering	Norman S. Nise	Wiley	5th Edition, 2009
2	Control Systems Engineering	I. J. Nagrath, M. Gopal	New Age	5th Edition, 2009

Reference Books

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Automatic Control Systems,	Kuo B. C,	Prentice Hall of India	9th Edition, 2014
2	Control Systems Principles and Design	Gopal M.	Tata McGraw Hill.	4th Edition, 2012
3	Modern Control Systems	Dorf R. C. , Bishop R. H	Pearson Education India	12th Edition, 2013
4	Modern Control Engineering	Katsuhiko Ogata	Pearson	5th Edition, 2009

SEMESTER S6

ENERGY MANAGEMENT

Course Code	24SJOEEET612	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:

1. To apply energy conservation principles and management techniques to different energy conversion systems

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	<p>General aspects of energy management and energy audit: Energy Management – Definition, General principles of energy management and energy management planning</p> <p>Energy Audit: Definition, need, types and methodologies. Instruments for energy audit, Energy audit report - Power quality audit</p> <p>Energy conservation in buildings: ECBC code (basic aspects), Building Management System (BMS).</p>	9
2	<p>Energy Efficiency in Electrical Utilities:</p> <p>Electricity transmission and distribution system, cascade efficiency.</p> <p>Lighting: Modern energy efficient light sources, life and efficacy comparison with older light sources, energy conservation in lighting.</p> <p>Motors: Development of energy efficient motors and the present status, techniques for improving energy efficiency, necessity for load matching and selection of motors for constant and variable loads.</p> <p>Demand side Management: Introduction to DSM, benefits of DSM, different techniques of DSM. Power factor improvement, numerical examples.</p>	9

	Ancillary services: Introduction of ancillary services – Types of Ancillary services	
3	<p>Energy Management in Electrical Utilities:</p> <p>Boilers: working principle - blow down, energy conservation opportunities in boiler.</p> <p>Steam: properties of steam, distribution losses, steam trapping. Identifying opportunities for energy savings in steam distribution.</p> <p>Furnace: General fuel economy measures, energy conservation opportunities in furnaces.</p> <p>HVAC system: Performance and saving opportunities in Refrigeration and Air conditioning systems.</p> <p>Heat Recovery Systems: Waste heat recovery system - Energy saving opportunities.</p> <p>Cogeneration: Types and schemes, optimal operation of cogeneration plants, combined cycle electricity generation.</p>	9
4	<p>Energy Economics: Economic analysis: methods, cash flow model, time value of money, evaluation of proposals, pay-back period, average rate of return method, internal rate of return method, present value method, life cycle costing approach. Computer aided Energy Management Systems (EMS).</p>	9

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

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

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
<ul style="list-style-type: none"> 2 Questions from each module. Total of 8 Questions, each carrying 3 marks <p>(8x3 =24marks)</p>	<ul style="list-style-type: none"> 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. <p>(4x9 = 36 marks)</p>	60

Course Outcomes (COs)

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

Course Outcome	Bloom's Knowledge Level (KL)
CO1 Analyse the significance of energy management and auditing.	K2
CO2 Discuss the energy efficiency and management of electrical loads.	K2
CO3 Apply demand side management techniques	K2
CO4 Explain the energy management opportunities in industries.	K2
CO5 Compute the economic feasibility of the energy conservation measures	K3

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

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2					1		1			
CO2	2		1	1		1					
CO3	2		1	1		1					
CO4	2		1	1		1					
CO5	2									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	Publications of Bureau of Energy Efficiency (BEE).			
2	Energy Management and Conservation Handbook	D. Yogi Goswami, Frank Kreith,	CRC Press	2007
3	Energy management Hand Book	Wayne C. Turner	The Fairmount Press, Inc.	1997
4	Energy Management and Conservation Handbook	D. Yogi Goswami, Frank Kreith	CRC Press	2007
5	Industrial energy conservation	Charles M. Gottschalk	John Wiley & Sons	1996



SEMESTER S6
RENEWABLE ENERGY SYSTEMS

Course Code	24SJOEEET613	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)	NIL	Course Type	Theory

Course Objectives:

1. To understand energy scenario, energy sources and their utilization
2. To explore society's present needs and future energy demands
3. To study the principles of renewable energy conversion systems
4. To be exposed to energy conservation methods

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	<p>Introduction: Principles of renewable energy; energy and sustainable development, fundamentals and social implications. Worldwide renewable energy availability, renewable energy availability in India, types of renewable energy.</p> <p>Wind Energy: Properties of wind, availability of wind energy in India, wind velocity and power from wind (numerical problems); major problems associated with wind power, Basic components of wind energy conversion system (WECS); Classification of WECS- Horizontal axis- single, double and multi-blade system. Vertical axis - Savonius and Darrieus types.</p>	9
2	<p>Solar Energy: Fundamentals; Solar Radiation; Estimation of solar radiation on horizontal and inclined surfaces; Solar radiation Measurements - Pyrheliometers, Pyranometer, Sunshine Recorder. Solar Thermal systems: concentrating and non-concentrating collectors - Flat plate collectors; Solar tower electric power plant. Photovoltaic system for electric power generation- Classification of PV system - Principle of Solar cell, advantages, disadvantages and applications of solar photovoltaic system.</p>	9

3	<p>Biomass Energy: Introduction; Principle of biomass energy generation - Biofuels; Biomass Resources; Biomass conversion technologies-fixed dome type biogas plant; Urban waste to energy conversion; Biomass gasification (Downdraft).</p> <p>Tidal Power: Tides and waves as energy suppliers and their mechanics; fundamental characteristics of tidal power, classification of tidal power plants - harnessing tidal energy, advantages and limitations.</p>	9
4	<p>Ocean Thermal Energy Conversion: Principle of working, classification, OTEC power stations in the world, environmental impacts associated with OTEC.</p> <p>Introduction to geothermal energy</p> <p>Green Energy: Introduction, Fuel cells: Classification of fuel cells - Hydrogen energy; Operating principles, Zero-energy Concepts. Benefits of hydrogen energy, hydrogen production technologies (electrolysis method only), hydrogen energy storage, applications of hydrogen energy, problem associated with hydrogen energy.</p>	9

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

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Micro-project	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

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	PartB	Total
<ul style="list-style-type: none"> • 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks <p style="text-align: center;">(8x3 =24marks)</p>	<ul style="list-style-type: none"> • 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. <p style="text-align: center;">(4x9 = 36 marks)</p>	60

Course Outcomes (COs)

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

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Describe the environmental aspects of renewable energy resources in comparison with various conventional energy systems, their prospects and limitations.	KI
CO2	Understand the concepts of wind energy.	KI
CO3	Describe the use of solar energy and the various components used in the energy production with respect to applications like-heating, cooling, desalination, power generation.	K2
CO4	Understand the concept of biomass energy resources and conversion principles of tidal energy.	K2
CO5	Acquire the basic knowledge of ocean thermal energy conversion. Understand the principle of green energy and hydrogen energy.	KI

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

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3									2
CO2	3	3									2
CO3	3	3									2
CO4	3	3									2
CO5	3	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	Non-conventional energy sources	G. D. Rai	Khanna	4 th edition
2	Renewable energy systems	Thomas E. Kissell, David M. Buchla, Thomas L. Floyd,	Pearson	2017
3	Non-Conventional Energy Resources	Sawhney G. S.	PHI Learning	2012
4	Renewable energy systems	Thomas E. Kissell, David M. Buchla, Thomas L. Floyd,	Pearson	Pearson 2017



ST. JOSEPH'S
COLLEGE OF ENGINEERING
AND TECHNOLOGY,
- PALAI -
AUTONOMOUS

Choondacherry P.O., Pala, Kottayam - 686579
Kerala, India



SYLLABUS

OPEN ELECTIVE-1 Courses

offered by the Department of

Electronics and Computer Engineering

for the B.Tech students of other disciplines*
(B. Tech 2024 SCHEME)

*As per R 3.25 and R 3.26 of SJ CET B.Tech. Academic Regulations 2024

SEMESTER 6

ELECTRONICS AND COMPUTER ENGINEERING

OPEN ELECTIVE 1

SLOT	COURSE CODE	COURSES	L-T-P-R	HOURS	CREDIT
O	24SJOEERT 611	Basics of Analog and Digital Communication	3-0-0-0	3	3
	24SJOEERT 612	Robotics and Automation	3-0-0-0		3
	24SJOEERT 613	Object Oriented Concepts	3-0-0-0		3
	24SJOEERT 614	Internet of Things	3-0-0-0		3
	24SJOEERT 615	Introduction to Artificial Intelligence	3-0-0-0		3

SEMESTER S6**BASICS OF ANALOG AND DIGITAL COMMUNICATION**

Course Code	24SJOEERT 611	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:

1. To understand the main components and principles of analog and digital communication systems.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Introduction, Elements of communication systems, Amplitude modulation (AM), Double-side band suppressed carrier (DSB-SC) modulation Single sideband modulation (SSB) – spectrum, power, efficiency of all the three variants. (Study of only tone modulation in DSB-SC, AM, and SSB.) Amplitude-modulator implementations–balanced modulator. AM demodulators -. Envelope detector.	9
2	Frequency modulation – modulation index, frequency deviation, average power, spectrum of tone modulated FM, bandwidth of FM, Narrow band FM and wide-band FM. FM generation: Varactor diode modulator, Armstrongs method. FM demodulation – slope detection.	9
3	Elements of digital communication system. Sources, channels and receivers. Sampling theorem. Sampling and reconstruction. Pulse code modulation. Sampling, quantization and encoding. Differential PCM, adaptive PCM, Delta modulator and adaptive delta modulator. Issues in delta modulation. Slope overload.	9
4	Digital modulation schemes. Baseband BPSK system and the signal constellation. BPSK transmitter and receiver. Base band QPSK system and Signal constellations. Plots of BER Vs SNR (Analysis not required). QPSK transmitter and receiver. Quadrature amplitude modulation.	9

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

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

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
<ul style="list-style-type: none"> • 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks <p align="center">(8x3 =24marks)</p>	<ul style="list-style-type: none"> • 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. <p align="center">(4x9 = 36 marks)</p>	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 main components in analog and digital communication systems.	K2
CO2	Understand the different analog modulation schemes.	K2
CO3	Illustrate the main principles of pulse code modulation.	K2
CO4	Understand different digital modulation schemes.	K2

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

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

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

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	Electronic Communication Systems	Kennedy, Davis	TATA McGraw-Hill	Fourth Edition
2	Electronic Communication Systems – Fundamentals through Advanced	Wayne Tomasi	Pearson	Fifth edition
3	Communication Systems	Simon Haykin	Wiley	Fourth edition

Reference Books				
Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Digital and Analog Communication Systems	Leon W. Couch	Prentice Hall	Eighth edition
2	Digital Communications: Fundamentals and applications	Sklar	Pearson.	Third edition

Video Links (NPTEL, SWAYAM...)	
Module No.	Link ID
1	https://youtu.be/S8Jod9AtpN4
2	https://youtu.be/jqJpbPseX2c
3	https://youtu.be/l_SqkcP6hZ4
4	https://youtu.be/ZW1glqkIgcw?si=zJ_ijYp7t6uh9WHx

**SEMESTER -S6 (OPEN ELECTIVE)
ROBOTICS AND AUTOMATION**

Course Code	24SJOEERT 612	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3:0:0	ESE Marks	60
Credits	3	Exam Hours	2.30
Prerequisites (if any)	None	Course Type	Theory

Course objectives:

- To provide fundamental knowledge of robotic systems, their components, configurations, and applications across various domains.
- To develop an understanding of robot sensing, actuation, kinematics, and control techniques essential for analyzing and implementing robotic systems.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
I	Introduction to Robotics and Automation Introduction To Robotics: Definitions- Robots, Robotics; Types of Robots- Manipulators, Mobile Robots-wheeled & Legged Robots, Aerial Robots; Anatomy of a robotic manipulator-wrist configurations, links, joints, open kinematic vs closed kinematic chain; degrees of freedom; Robot Applications- medical, mining, space, defence, security, domestic, entertainment, Industrial Applications-Material handling, welding, Spray painting, Machining.	9 hrs
II	Sensors and Actuators: Sensor classification- touch, force, proximity, vision sensors. Internal sensors-Position sensors, velocity sensors, acceleration sensors, Force sensors; External sensors-contact type, noncontact type; Vision - Elements of vision sensor, image acquisition, image processing; Selection of sensors. Actuators for robots-classification-Electric, Hydraulic, Pneumatic actuators; their advantages and disadvantages; Electric actuators- Stepper motors, DC motors, DC servo motors, AC motors, Hydraulic actuators- Components and typical circuit, advantages and disadvantages; Pneumatic Actuators-Components and typical circuit, advantages and disadvantages	9 hrs
III	Robotic configurations and End effectors: Robot configurations-PPP, RPP, RRP, RRR; features of SCARA, PUMA Robots; Robot considerations for an application-number of axes, work volume, capacity & speed, stroke & reach, Repeatability,	9 hrs

	Precision and Accuracy, Operating environment, point to point control or continuous path control. Classification of End effectors - mechanical grippers, special tools, Magnetic grippers, Vacuum grippers, adhesive grippers, Active and passive grippers, selection and design considerations of grippers in robot.	
IV	Kinematics and Control of Robots: Robot Coordinate Systems- Matrix representation of a point, vector, frame and a rigid body in space, Representation of transformations-translation, Fundamental and composite rotations, homogeneous transformations, combined transformations, D-H representation. Control Techniques- Transfer function and state space representation.	9 hrs

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

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment	Internal Evaluation -1	Internal Evaluation-2	Total
5	15	10	10	40

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
<ul style="list-style-type: none"> • 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks (8x3 =24marks) 	<ul style="list-style-type: none"> • 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

Course Outcomes (COs)

At the end of the course the student will be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Familiarise with anatomy, specifications and applications of Robots.	K2
CO2	Choose the appropriate sensors and actuators for robots.	K2
CO3	Choose appropriate Robotic configuration and gripper for a particular application.	K2
CO4	Obtain kinematic model of robotic manipulators and design the controller for robotic manipulators	K2

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	2	1	-	-	-	-	-	-	-	-	3
CO2	2	1	-	-	-	-	-	-	-	-	3
CO3	2	1	-	-	-	-	-	-	-	-	3
CO4	3	2	2	-	-	-	-	-	-	-	3

Text Books

SL No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Introduction to Robotics	S K Saha	Mc Graw Hill Education	3 rd Edition
2	Fundamentals of robotics – Analysis and control	Robert. J. Schilling	Prentice Hall of India	2 nd Edition
3	Robotics and Control	R K Mittal and I J Nagrath	Mc Graw Hill Education	1 st Edition
4	Introduction to Robotics- Analysis, Systems, Applications	Saeed B Niku	PHI	Eastern Economy Edition

Reference Books

SL No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Introduction to Robotics (Mechanics and control)	John. J. Craig	Pearson Education Asia	2002
2	Robotics-Fundamental concepts and analysis	Ashitava Ghosal	Oxford University press	2006
3	Robotics Technology and Flexible Automation	S. R. Deb	Tata Mc Graw Hill Education	2 nd Edition
4	Fundamentals of Robotics	D.K. Pratihari	Narosa Publishing House, New-Delhi	1 st Edition, 2017
5	Control Systems	Les Fenical	Cenage Learning India Pvt. Ltd.	2 nd Edition 2011

Video Links (NPTEL, SWAYAM etc):	
Module No.	Link ID
1	Robotics, Prof. D. K Pratihar, IIT Kharagpur https://onlinecourses.nptel.ac.in/noc24_me88/preview Industrial Robotics: Theories for implementation, Prof. Arun Dayal Udai IIT (ISM Dhanbad) https://onlinecourses.nptel.ac.in/noc24_me117/preview
2	Robotics, Prof. D. K Pratihar, IIT Kharagpur https://onlinecourses.nptel.ac.in/noc24_me88/preview Industrial Robotics: Theories for implementation, Prof. Arun Dayal Udai IIT (ISM Dhanbad) https://onlinecourses.nptel.ac.in/noc24_me117/preview
3	Robotics, Prof. D. K Pratihar, IIT Kharagpur https://onlinecourses.nptel.ac.in/noc24_me88/preview Industrial Robotics: Theories for implementation, Prof. Arun Dayal Udai IIT (ISM Dhanbad) https://onlinecourses.nptel.ac.in/noc24_me117/preview
4	Robotics, Prof. D. K Pratihar, IIT Kharagpur https://onlinecourses.nptel.ac.in/noc24_me88/preview Industrial Robotics: Theories for implementation, Prof. Arun Dayal Udai IIT (ISM Dhanbad) https://onlinecourses.nptel.ac.in/noc24_me117/preview

SEMESTER 6
OBJECT ORIENTED CONCEPTS

Course Code	24SJOEERT 613	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)	24SJGXEST204 – Programming in C	Course Type	Theory

Course Objectives:

1. Understand and apply foundational object-oriented programming concepts in Java, including classes, objects, inheritance, polymorphism, encapsulation, and abstraction.
2. Design and implement Java applications that leverage OOP principles to achieve modularity, reusability, and scalability in software development.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Basic Object-Oriented concepts, Introduction to Java - Java programming and Runtime Environment, Development Platforms- Java Virtual Machine (JVM), Java compiler, Bytecode, Java Buzzwords, Java program structure, Comments.Primitive Data types - Integers, Floating Point Types, Characters, Boolean. Literals, Operators - Arithmetic Operators, Bitwise Operators, Relational Operators, Boolean Logical Operators, Assignment Operator, Conditional (Ternary) Operator, Operator Precedence. Control Statements - Selection Statements, Iteration Statements and Jump Statements.	9
2	Object Oriented Programming in Java - Class Fundamentals, Declaring Objects, Introduction to Methods, Constructors, this Keyword, Method Overloading, Using Objects as Parameters, Returning Objects. Static Members, Final Variables, Inner Classes.Inheritance - Super Class, Sub Class, The Keyword super, protected Members, Calling Order of Constructors, Method Overriding, the Object class, Abstract Classes and Methods, using final with Inheritance.Packages and Interfaces - Defining Package, CLASSPATH, Access Protection, Importing Packages, Interfaces.	9
3	Exception Handling - Checked Exceptions, Unchecked Exceptions, try Block and catch Clause, Multiple catch Clauses, Nested try Statements, throw, throws and finally. Java Library - String Handling – String Constructors,	9

	String Length, Special String Operations -Character Extraction, String Comparison, Searching Strings, Modifying Strings.Multithreaded Programming - The Java Thread Model, The Main Thread, Creating Thread, Creating Multiple Threads, Synchronization, Suspending, Resuming and Stopping Threads.	
4	Event handling - Event Handling Mechanisms, Delegation Event Model, Event Classes, Sources of Events, Event Listener Interfaces. Swings fundamentals-Swing Controls, Components and Containers, Swing Packages, Event Handling in Swings, Swing Layout Managers, Exploring Swings – JFrame, JLabel, Swing Buttons, JText Field.Java Database Connectivity (JDBC) - JDBC overview, Creating and Executing Queries – create table, delete, insert, select.	9

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

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

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
<ul style="list-style-type: none"> • 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks <p style="text-align: center;">(8x3 =24marks)</p>	<ul style="list-style-type: none"> • 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. <p style="text-align: center;">(4x9 = 36 marks)</p>	60

Course Outcomes (COs)

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

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Understand and apply fundamental Java programming concepts, including the runtime environment, primitive data types, operators, and control statements, to develop efficient and well-structured Java applications.	K2
CO2	Apply key object-oriented programming principles in Java, leveraging packages and interfaces effectively to design and implement Java applications.	K3
CO3	Confidently handle Java exceptions, manipulate strings effectively, and implement multithreaded programming techniques.	K3
CO4	Develop Java applications that integrate event handling, Swing-based graphical user interfaces, and JDBC database connectivity to create robust and user-friendly software solutions.	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	3	3	-	-	-	-	-	-	-	2
CO2	3	3	3	-	-	-	-	-	-	-	2
CO3	3	3	3	-	2	-	-	-	-	-	2
CO4	3	3	3	-	2	-	-	-	-	-	2

Text Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Java: The Complete reference	Herbert Schildt	Tata McGraw Hill	8/e, 2011
2	Java How to Program, Early Objects	Paul Deitel, Harvey Deitel	Pearson	11/e, 2018

Reference Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Introduction to Java Programming	Y. Daniel Liang	Pearson	7/e, 2013
2	Programming JAVA a Primer	Balagurusamy E	Tata McGraw Hill	5/e, 2014
3	Core Java: An Integrated Approach	Nageswararao R	Dreamtech Press	2008
4	Java in A Nutshell	Flanagan D	O'Reilly	5/e,2005

Video Links (NPTEL, SWAYAM...)	
Module No.	Link ID
1	https://nptel.ac.in/courses/106105191
2	https://nptel.ac.in/courses/106105191
3	https://nptel.ac.in/courses/106105191
4	https://nptel.ac.in/courses/106105191

SEMESTER S6
INTERNET OF THINGS

Course Code	24SJOEERT 614	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3:0:0:0	ESE Marks	60
Credits	3	Exam Hours	2 Hrs 30 Mins
Prerequisites (if any)	None	Course Type	Theory

Course Objectives:

1. This course aims to introduce IoT fundamentals.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Introduction to IoT technology: Definitions of IoT, Characteristics of IoT devices – power, computational constraints, IoT Architectural view – Middleware based architecture, Service oriented architecture, M2M Communication and IoT, Typical application areas of IoT technology - case studies: IoT for Home, Cities, Agriculture.	9
2	Components of IoT technology: Identification/Addressing – Electronic Product Codes, RFID, ubiquitous code, IPv4, IPv6. Sensors and Actuators. IoT Hardware, IoT Software – overview of Operating systems, Firmware, Middle ware, Application software used in IoT. Connectivity for IoT devices – characteristics.	9
3	Communication technologies for IoT : Zigbee - key features, architecture, limitations, Bluetooth technology - bluetooth stack, piconet, scatternet, limitations, Bluetooth Low Energy (key features, architecture, limitations), Wifi (IEEE 802.11) technology – key features, limitations, Cellular technology – GSM, 3G, 4GLTE (overview), features, limitations, LoRa technology – features, LoRaWAN architecture, 6LoWPAN – features, protocol stack, Narrow Band (NB- IoT) – features, applications, Sigfox –features, applications	9
4	IoT Data Management: Storage technologies for IoT hardware – Volatile, Non-volatile, Embedded (MTP/OTP), external flash (NAND/NOR), DRAM, eflash, UFS, eMMC (overview of technologies). Cloud and IoT, Cloud computing – architecture, advantages of cloud computing, Software as a Service (SaaS), Platform as a Service (PaaS), Infrastructure as a Service (IaaS). Case study of commercial cloud computing platforms like - Microsoft Azure IoT Suite, Google Cloud's IoT Platform, IBM Watson IoT Platform. IoT analytics.	9

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

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

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
<ul style="list-style-type: none"> • 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks <p align="center">(8x3 =24 marks)</p>	<ul style="list-style-type: none"> • 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 subdivisions. <p align="center">(4x9 = 36 marks)</p>	60

Course Outcomes (COs)

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

Course Outcome	Bloom's Knowledge Level (KL)
CO1 Explain in a concise manner the architecture of IoT	K2
CO2 Identify various hardware and software components used in IoT	K3
CO3 Discuss the various communication technologies and interfaces in IoT	K2
CO4 Describe the usage of modern technologies like cloud computing for data management in IoT	K2

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

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	2	-	-	-	-	-	-	2
CO2	3	2	2	2	-	-	-	-	-	-	2
CO3	3	2	2	1	-	-	-	-	-	-	2
CO4	3	2	2	1	-	-	-	-	-	-	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	Internet of Things: Architecture and Design Principles	Rajkamal	McGraw Hill (India) Private Limited.	2/e, 2022
2	Internet of Things (A Hands-on Approach)	Vijay Madiseti and Arshdeep Bahga	Orient Blackswan Private Limited – New Delhi	1/e, 2015

Reference Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Internet of things: A survey on enabling technologies, protocols, and applications	Al-Fuqaha	IEEE Communications Surveys & Tutorials	2015
2	The Internet of Things	Samuel Greengard	The MIT Press Essential Knowledge series Paperback	2015
3	The Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems	Ovidu Vermesan and Peter Friess	River Publishers	1/e, 2013
4	Internet of Things - From Research and Innovation to Market Deployment	Peter Friess, Ovidiu Vermesan	River Publishers	1/e, 2014

Video Links (NPTEL, SWAYAM...)	
Module No.	Link ID
1	INTRODUCTION TO IOT- PART-I https://youtu.be/WUYAjsxnwjU4?si=s58W-NKMrEQMaJ8m INTRODUCTION TO IOT- PART-II https://youtu.be/BXDxYh1EV2w?si=8oFtQB9vycC_c-t2
2	SENSING https://youtu.be/z3VEZPw15gA?si=tNuzG_By-KBU3ks ACTUATION https://youtu.be/SXz0XR68dwE?si=1tVN1g9FQcGp87li CONNECTIVITY TECHNOLOGIES-V https://youtu.be/TvzgzO6xKrY?si=gYzJstW51MTNsgKj
3	BASICS OF IOT NETWORKING-PART II https://youtu.be/qko-f1VDhCM?si=0tWM_OHS395ESV_w CONNECTIVITY TECHNOLOGIES-III https://youtu.be/d9QfVpCG00Y?si=qeHk8tPg_torr2yX CONNECTIVITY TECHNOLOGIES-IV https://youtu.be/1zQ8wbBozqI?si=7vOSHMt8OT3nQINO
4	IoT NPTEL- https://youtube.com/playlist?list=PLE7VH8RC_N3bpVne8QzOAHziEgmjQ2qE&si=rr5Fpuew5q9_Y4qg

SEMESTER S6

INTRODUCTION TO ARTIFICIAL INTELLIGENCE

Course Code	24SJOEERT 615	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:

1. To introduce basic principles that drive complex real world intelligence applications.
2. To introduce and discuss the basic concepts of AI Techniques and Learning.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Introduction to Artificial Intelligence: What is Artificial Intelligence (AI)? The Foundations of AI, History of AI, Applications of AI. Intelligent Agents, Types of agents and their environments, good behaviour: The concept of rationality, nature of Environments, Structure of Agents. Examples of practical agents.	9
2	Problem Solving: Solving Problems by searching-Problem solving Agents, Example problems, Searching for solutions, Uninformed search strategies- Depth First Search (DFS) and Breadth First Search (BFS), Informed search strategies- Greedy Search, A* Search, AO* Search, Hill Climbing Algorithm, Heuristic functions.	9
3	Adversarial search: Games, Optimal decisions in games, The Minimax algorithm, Alpha-Beta pruning. Constraint Satisfaction Problems – Defining CSP, Constraint Propagation- inference in CSPs, Backtracking search for CSPs, Structure of CSP problems.	9
4	Knowledge Representation and Reasoning: First Order Predicate Logic – Syntax and Semantics of First Order Logic, Knowledge representation in First Order Logic. Inference in First Order Logic – Unification and Lifting, Forward chaining, Backward chaining, Resolution. Basic concepts of Machine Learning: Learning from Examples – Forms of Learning, Supervised Learning/Unsupervised Learning.	9

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

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

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
<ul style="list-style-type: none"> • 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks <p align="center">(8x3 =24marks)</p>	<ul style="list-style-type: none"> • 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. <p align="center">(4x9 = 36 marks)</p>	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 fundamental concepts of intelligent systems and their architecture.	K2
CO2	Illustrate uninformed and informed search techniques for problem solving in intelligent systems.	K2
CO3	Solve Constraint Satisfaction Problems using search techniques.	K3
CO4	Represent AI domain knowledge using logic systems and use inference techniques for reasoning in intelligent systems.	K3
CO5	Illustrate different types of learning techniques used in intelligent systems	K2

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	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	-	-	-	-	-	-	-	3
CO3	3	3	3	2	-	-	-	-	-	-	3
CO4	3	3	3	2	-	-	-	-	-	-	3
CO5	3	3	-	-	2	-	-	-	-	-	3

Text Books

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Artificial Intelligence: A Modern Approach	Stuart Russell and Peter Norvig	Prentice Hall	3/e, 2010
2	Artificial Intelligence	E Rich, K Knight	Tata McGraw Hill	3/e, 2009
3	Artificial Intelligence- Structures and Strategies for Complex Problem Solving	George F. Luger	Pearson Education	4/e, 2002

Reference Books

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Artificial Intelligence - A New Synthesis	Nilsson N. J	Harcourt Asia Pvt. Ltd.	1998
2	Artificial intelligence, A modern approach	Stuart Jonathan Russell, Peter Norvig	Pearson Education	3/e, 2010
3	Artificial Intelligence and Machine Learning	Chandra SS And Hareendran S	PHI Learning	2014

Video Links (NPTEL, SWAYAM...)

Module No.	Link ID
1	An Introduction to Artificial Intelligence - Course (nptel.ac.in) https://onlinecourses.nptel.ac.in/noc22_cs56/preview
2	Fundamentals of Artificial Intelligence - Course (nptel.ac.in) https://onlinecourses.nptel.ac.in/noc22_ge29/preview
3	Artificial Intelligence - Course (swayam2.ac.in) https://onlinecourses.swayam2.ac.in/cec21_cs08/preview



ST. JOSEPH'S
COLLEGE OF ENGINEERING
AND TECHNOLOGY,
- PALAI -
AUTONOMOUS

Choondacherry P.O., Pala, Kottayam - 686579
Kerala, India



SYLLABUS

OPEN ELECTIVE-1 Courses

offered by the Departments of
AD, CA, CC & CS Engineering
for the B.Tech students of other disciplines*
(B. Tech 2024 SCHEME)

*As per R 3.25 and R 3.26 of SJ CET B.Tech. Academic Regulations 2024

www.sjcetpalai.ac.in

LIST OF OPEN ELECTIVE COURSES OFFERED IN SEMESTER 6

SLOT	COURSE CODE	COURSES	L-T-P-R	HOURS	CREDIT
O	24SJOECST611	Data Structures	3-0-0-0	3	3
	24SJOECST612	Data Communication	3-0-0-0		3
	24SJOECST613	Foundations of Cryptography	3-0-0-0		3
	24SJOECST614	Machine Learning for Engineers	3-0-0-0		3
	24SJOECST615	Object Oriented Programming	3-0-0-0		3



SEMESTER S6

DATA STRUCTURES

Course Code	24SJOECST611	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)	-	Course Type	Theory

Course Objectives:

1. To provide the learner a comprehensive understanding of data structures and algorithms.
2. To prepare them for advanced studies or professional work in computer science and related fields.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Basic Concepts of Data Structures Definitions; Data Abstraction; Performance Analysis - Time & Space Complexity, Asymptotic Notations; Polynomial representation using Arrays, Sparse matrix (<i>Tuple representation</i>); Stacks and Queues - Stacks, Multi- Stacks, Queues, Circular Queues;	9
2	Linked List and Memory Management Singly Linked List - Operations on Linked List, Stacks and Queues using Linked List, Polynomial representation using Linked List; Doubly Linked List.	9
3	Trees and Graphs Trees :- Representation Of Trees; Binary Trees - Types and Properties, Binary Tree Representation, Tree Operations, Tree Traversals; Binary Search Trees - Binary Search Tree Operations; Graphs :- Definitions; Representation of Graphs; Depth First Search and Breadth First Search.	9
4	Sorting and Searching Sorting Techniques :- Selection Sort, Insertion Sort, Quick Sort, Merge Sort; Searching Techniques - Linear Search, Binary Search, Hashing - Hashing functions : Division; Collision Resolution : Linear probing, Open hashing.	9

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

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

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
<ul style="list-style-type: none"> • 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks <p align="center">(8x3 =24 marks)</p>	<ul style="list-style-type: none"> • 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 subdivisions. <p align="center">(4x9 = 36 marks)</p>	60

Course Outcomes (COs)

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

Course Outcomes		Bloom's Knowledge Level (KL)
CO1	Identify appropriate data structures for solving real world problems.	K3
CO2	Describe and implement linear data structures such as arrays, linked lists, stacks, and queues.	K3
CO3	Describe and implement non-linear data structures such as trees and graphs.	K3
CO4	Select appropriate searching and sorting algorithms to be used in specific circumstances.	K3

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

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	✓	✓	✓								✓
CO2	✓	✓	✓								✓
CO3	✓	✓	✓								✓
CO4	✓	✓	✓								✓

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	Fundamentals of Data Structures in C	Ellis Horowitz, Sartaj Sahni and Susan Anderson-Freed,	Universities Press	2/e, 2007
2	Introduction to Algorithms	Thomas H Cormen, Charles Leiserson, Ronald L Rivest, Clifford Stein	PHI	3/e, 2009

Reference Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Classic Data Structures	Samanta D.	Prentice Hall India.	2/e, 2018
2	Data Structures and Algorithms	Aho A. V., J. E. Hopcroft and J. D. Ullman	Pearson Publication.	1/e, 2003
3	Introduction to Data Structures with Applications	Tremblay J. P. and P. G. Sorenson	Tata McGraw Hill.	2/e, 2017
4	Theory and Problems of Data Structures	Lipschuts S.	Schaum's Series	2/e, 2014

Video Links (NPTEL, SWAYAM...)	
Module No.	Link ID
1	https://nptel.ac.in/courses/106102064
2	https://ocw.mit.edu/courses/6-851-advanced-data-structures-spring-2012/

SEMESTER S6

DATA COMMUNICATION

Course Code	24SJOECST612	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:

1. To understand the details of data communication at the lower level and the associated issues.
2. To gain insight into the important aspects of data communication and computer networking systems and to apply the in practical applications.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Communication model - Simplex, Half duplex, Full duplex transmission. Periodic analog signals - Sine wave, Amplitude, Phase, Wavelength, Time and frequency domain, Bandwidth. Analog & digital data and signals. Transmission impairments - Attenuation, Delay distortion, Noise. Data rate limits - Noiseless channel, Nyquist bandwidth, Noisy channel, Shannon's capacity formula. Guided transmission media - Twisted pair, Coaxial cable, Optical fiber. Unguided media - Radio waves, Terrestrial microwave, Satellite microwave, Infrared. Wireless propagation - Ground wave propagation, Sky wave propagation, Line-of-Sight (LoS) propagation.	10
2	Digital data to digital signal – Non-Return-to-Zero (NRZ), Return-to-Zero (RZ), Multilevel binary, Biphasic. Analog data to digital signal - Sampling theorem, Pulse Code Modulation (PCM), Delta Modulation (DM). Digital data to analog signal - Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK), Phase Shift Keying (PSK). Analog data to analog signal - Amplitude Modulation (AM), Frequency Modulation (FM), Phase Modulation (PM).	9
3	Multiplexing - Frequency Division Multiplexing (FDM), Wavelength Division Multiplexing (WDM), Time Division Multiplexing (TDM), Characteristics, Synchronous TDM, Statistical TDM. Spread spectrum techniques - Direct Sequence Spread Spectrum (DSSS), Frequency Hopping Spread Spectrum (FHSS), Code Division Multiplexing, Code Division Multiple Access (CDMA).	8

4	Digital data communication techniques - Asynchronous transmission, Synchronous transmission. Detecting and correcting errors - Types of errors, Parity check, Checksum, Cyclic Redundancy Check (CRC), Forward Error Correction (FEC), Hamming distance, Hamming code. Basic principles of switching - Circuit switching, Packet switching, Message switching.	9
----------	--	----------

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

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

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
<ul style="list-style-type: none"> ● 2 Questions from each module. ● Total of 8 Questions, each carrying 3 marks <p style="text-align: center;">(8x3 =24 marks)</p>	<ul style="list-style-type: none"> ● 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 subdivisions. <p style="text-align: center;">(4x9 = 36 marks)</p>	60

Course Outcomes (COs)

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

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Identify the characteristics of signals for analog and digital transmissions so as to define the associated real world challenges.	K3
CO2	Select transmission media based on characteristics and propagation modes.	K3
CO3	Choose appropriate signal encoding techniques for a given scenario	K3
CO4	Illustrate multiplexing and spread spectrum technologies	K2
CO5	Use error detection, correction and switching techniques in data communication	K3

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

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

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

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	Data Communications and Networking	Forouzan B. A	McGraw Hill	6/e, 2019
2	Data and Computer Communication	William Stallings	Pearson	10/e, 2016

Reference Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Mobile Communications	Schiller J	Pearson	2/e, 2009
2	Fundamentals of Networking and Communication	Curt M. White	Cengage	7/e, 2010

Video Links (NPTEL, SWAYAM...)	
Module No.	Link ID
1	https://nptel.ac.in/courses/106105082



SEMESTER S6

FOUNDATIONS OF CRYPTOGRAPHY

Course Code	24SJOECST613	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:

1. Develop a foundational understanding of mathematical concepts in cryptography,
2. Gain comprehensive knowledge of cryptographic methods.
3. Understand the principles and need for computer security.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Integer Arithmetic – Divisibility, Greatest Common Divisor, Euclid's and Extended Euclid's Algorithm for GCD; Modular Arithmetic – Operations, Properties, Polynomial Arithmetic; Algebraic Structures – Group Ring Field.	9
2	Prime numbers and Prime Factorisation - Primitive Roots, Existence of Primitive Roots for Primes, Fermat's Theorem, Primality Testing, Euler's Theorem, Euler's Totient Function, Discrete Logarithms, Modular Arithmetic, Chinese Remainder Theorem.	9
3	Principles of security - Types of Security attacks, Security services, Security Mechanisms; Cryptography - Introduction, cryptographic notations, substitution techniques, Transposition Techniques, limitations of classical cryptography.	9
4	Symmetric key Ciphers - Block Cipher principles & Algorithms- DES, AES, Differential and Linear Cryptanalysis; Asymmetric Key Ciphers- RSA, ECC; Hash Functions - MD5, SHA-1.	9

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

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

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
<ul style="list-style-type: none"> ● 2 Questions from each module. ● Total of 8 Questions, each carrying 3 marks <p style="text-align: center;">(8x3 =24 marks)</p>	<ul style="list-style-type: none"> ● 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 subdivisions. <p style="text-align: center;">(4x9 = 36 marks)</p>	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 integer arithmetic operations including divisibility and GCD algorithms, modular arithmetic operations and properties, polynomial arithmetic, and algebraic structures such as groups, rings, and fields.	K2
CO2	Describe the number theory concepts essential for cryptographic applications and mathematical problem-solving.	K2
CO3	Explain the security principles, types of attacks, and protective measures, alongside a thorough understanding of cryptographic techniques and their applications in securing data.	K2
CO4	Discuss symmetric and asymmetric key cryptography, including block cipher principles, algorithms, public key cryptosystems, and hash functions	K2

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

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	✓	✓									✓
CO2	✓	✓									✓
CO3	✓	✓									✓
CO4	✓	✓									✓

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	Cryptography & Network Security	Behrouz A. Forouzan	McGraw Hill	3/e, 2007
2	Security in Computing	Charles P. Pfleeger, Shari L. Pfleeger, Jonathan Margulies	Prentice Hall	5/e, 2015
3	Introduction to Cryptography: Principles and Applications	H. Delfs, H. Knebl	Springer	1/e, 2002
4	A Classical Introduction to Cryptography: Applications for Communications Security	Serge Vaudenay	Springer	1/e, 2009

Reference Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Cryptography and Network Security	William Stallings	Pearson Education	7/e,2017

Video Links (NPTEL, SWAYAM...)	
Module No.	Link ID
1	https://onlinecourses.nptel.ac.in/noc22_cs90/preview

SEMESTER S6

MACHINE LEARNING FOR ENGINEERS

Course Code	24SJOECST614	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:

1. To provide the basic concepts and algorithms in machine learning.
2. To discuss the standard and most popular supervised and unsupervised learning algorithms.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Introduction to ML Machine Learning vs. Traditional Programming, Machine learning paradigms - supervised, semi-supervised, unsupervised, reinforcement learning. Basics of parameter estimation - maximum likelihood estimation (MLE) and maximum a posteriori estimation (MAP), Bayesian formulation. Supervised Learning Feature Representation and Problem Formulation, Role of loss functions and optimization Regression - Linear regression with one variable, Linear regression with multiple variables - solution using gradient descent algorithm and matrix method.	10
2	Classification - Naïve Bayes, KNN Generalisation and Overfitting - Idea of overfitting, LASSO and RIDGE regularization, Idea of Training, Testing, Validation Evaluation measures – Classification - Precision, Recall, Accuracy, F- Measure, Receiver Operating Characteristic Curve(ROC), Area Under Curve (AUC). Regression - Mean Absolute Error (MAE), Root Mean Squared Error (RMSE), R Squared/Coefficient of Determination.	8
3	Neural Networks (NN) - Perceptron, Neural Network - Multilayer feed- forward network, Activation functions (Sigmoid, ReLU, Tanh), Back propagation algorithm. Decision Trees – Information Gain, Gain Ratio, ID3 algorithm	8

4	Unsupervised Learning Clustering - Similarity measures, Hierarchical Clustering - Agglomerative Clustering, partitional clustering, K-means clustering Dimensionality reduction - Principal Component Analysis, Multidimensional scaling Ensemble methods - bagging, boosting Resampling methods - Bootstrapping, Cross Validation. Practical aspects - Bias-Variance trade-off	10
----------	--	-----------

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

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

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
<ul style="list-style-type: none"> • 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks <p style="text-align: center;">(8x3 =24marks)</p>	<ul style="list-style-type: none"> • 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. <p style="text-align: center;">(4x9 = 36 marks)</p>	60

Course Outcomes (COs)

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

Course Outcomes		Bloom's Knowledge Level (KL)
CO1	Illustrate Machine Learning concepts and basic parameter estimation methods	K2
CO2	Demonstrate supervised learning concepts (regression, classification)	K3
CO3	Illustrate the concepts of Multilayer neural network and Decision trees	K3
CO4	Describe unsupervised learning concepts and dimensionality reduction techniques	K3
CO5	Use appropriate performance measures to evaluate machine learning models	K3

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

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

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

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 Machine Learning	Ethem Alpaydin	MIT Press	2/e, 2010
2	Data Mining and Analysis: Fundamental Concepts and Algorithms	Mohammed J. Zaki, Wagner Meira	Cambridge University Press	1/e, 2016

Reference Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Machine Learning	Tom Mitchell	McGraw-Hill	1997
2	Applied Machine Learning	M Gopal	Pearson	2/e, 2018
3	Neural Networks for Pattern Recognition	Christopher Bishop	Oxford University Press	1995
4	Machine Learning: A Probabilistic Perspective	Kevin P Murphy	MIT Press	1/e, 2012
5	The Elements Of Statistical Learning	Trevor Hastie, Robert Tibshirani, Jerome Friedman	Springer	2/e, 2007

Video Links (NPTEL, SWAYAM...)	
Module No.	Link ID
1	https://youtu.be/fC7V8QsPBec?si=8kqBn-_7x1RG5V1J
2	https://youtu.be/g__LURKuIj4?si=Xj10NPfMfpQSOhVx
3	https://youtu.be/yG1nETGyW2E?si=ySlxpeWuFAUQBf7-
4	https://youtu.be/zop2zuwF_bc?si=W7TpSHLdi4rykva4

SEMESTER S6

OBJECT ORIENTED PROGRAMMING

Course Code	24SJOECST615	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:

1. To teach the core object-oriented principles such as abstraction, encapsulation, inheritance, and polymorphism, robust error-handling using exception mechanisms to ensure program reliability.
2. To equip the learner to develop object oriented programs encompassing fundamental structures, environments, and the effective utilization of data types, arrays, strings, operators, and control statements for program flow in Java.
3. To enable the learner to design and develop event-driven graphical user interface (GUI) database applications using Swing and database connection components.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Introduction to Java - Java programming Environment and Runtime Environment (Command Line & IDE); Java compiler; Java Virtual Machine; Primitive Data types and Wrapper Types; Casting and Autoboxing; Arrays; Strings; Vector class; Operators - Arithmetic, Bitwise, Relational, Boolean Logical, Assignment, Conditional (Ternary); Operator Precedence; Control Statements - Selection Statements, Iteration Statements and Jump Statements; Functions; Command Line Arguments; Variable Length Arguments; Classes; Abstract Classes; Interfaces; OOP Concepts - Data abstraction, encapsulation, inheritance, polymorphism, Procedural and object oriented programming paradigm; Microservices; Object Oriented Programming in Java - Declaring Objects; Object Reference; Introduction to Methods; Constructors; Access Modifiers; <i>this</i> keyword.	10
2	Polymorphism - Method Overloading, Using Objects as Parameters, Returning Objects, Recursion; Static Members, Final Variables, Inner Classes. Inheritance - Super Class, Sub Class, Types of Inheritance, The <i>super</i> keyword, protected Members, Calling Order of Constructors; Method Overriding, Dynamic Method Dispatch, Using <i>final</i> with Inheritance.	8

3	Packages and Interfaces – Packages - Defining a Package, CLASSPATH, Access Protection, Importing Packages; Interfaces - Interfaces v/s Abstract classes, defining an interface, implementing interfaces, accessing implementations through interface references, extending interface(s); Exception Handling - Checked Exceptions, Unchecked Exceptions, <i>try</i> Block and <i>catch</i> Clause, Multiple catch Clauses, Nested <i>try</i> Statements, <i>throw</i> , <i>throws</i> and <i>finally</i> , Java Built-in Exceptions, Custom Exceptions.	9
4	Swings fundamentals – Overview of AWT, Swing v/s AWT, Swing Key Features, Swing Controls, Components and Containers, Swing Packages, Event Handling in Swings, Swing Layout Managers, Exploring Swings– JFrame, JLabel, The Swing Buttons, JTextField; Event handling – Event Handling Mechanisms, Delegation Event Model, Event Classes, Sources of Events, Event Listener Interfaces, Using the Delegation Event Model; Developing Database Applications using JDBC – JDBC overview, Types, Steps, Common JDBC Components, Connection Establishment.	9

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

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

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
<ul style="list-style-type: none"> ● 2 Questions from each module. ● Total of 8 Questions, each carrying 3 marks <p style="text-align: center;">(8x3 =24 marks)</p>	<ul style="list-style-type: none"> ● 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 subdivisions. <p style="text-align: center;">(4x9 = 36 marks)</p>	60

Course Outcomes (COs)

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

Course Outcomes		Bloom's Knowledge Level (KL)
CO1	Explain the process of developing Java programs, including their structure and components, to demonstrate proficiency.	K2
CO2	Utilize object-oriented programming principles in the design and implementation of Java applications.	K3
CO3	Develop and manage Java packages and interfaces, enhancing code modularity and reusability.	K3
CO4	Implement error handling using Java's exception mechanisms and leverage interfaces for modular applications.	K3
CO5	Develop event-driven Java GUI applications with database connectivity.	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	✓	✓									✓
CO2	✓	✓	✓	✓							✓
CO3	✓	✓	✓	✓	✓						✓
CO4	✓	✓	✓	✓	✓						✓
CO5	✓	✓	✓	✓	✓						✓

Text Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Java: The Complete Reference	Herbert Schildt	Tata McGraw Hill	13/e, 2024
2	Introduction to Java Programming, Comprehensive Version	Y Daniel Liang	Pearson	10/e, 2014
3	Head First Design Patterns	Eric Freeman, Elisabeth Robson, Bert Bates, Kathy Sierra	O'Reilly Media	1/e, 2004

Reference Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Head First Java: A Brain Friendly Guide	Kathy Sierra & Bert Bates	O'Reilly	3/e, 2022
2	JAVA™ for Programmers	Paul Deitel	PHI	11/e, 2018
3	Clean Code : A Handbook of Agile Software Craftsmanship	Robert C. Martin	Prentice Hall	1/e, 2008
4	Programming with Java	E Balagurusamy	McGraw Hill	6/e, 2019
5	Java For Dummies	Barry A. Burd	Wiley	8/e, 2022
6	Effective Java	Joshua Bloch	Pearson	3/e, 2018

Video Links (NPTEL, SWAYAM...)	
Module No.	Link ID
1	https://nptel.ac.in/courses/106105191 (Lecture no: 9, 10, 1, 2, 3, 4)
2	https://nptel.ac.in/courses/106105191 (Lecture no: 1, 7, 8, 11, 12, 13, 14, 15, 16)
3	https://nptel.ac.in/courses/106105191 (Lecture no: 17, 18, 19, 20, 21, 22, 23, 24, 25, 26)
4	https://nptel.ac.in/courses/106105191 (Lecture no: 43, 44, 45, 46, 47, 50, 51, 52, 53, 54, 55)



ST. JOSEPH'S
COLLEGE OF ENGINEERING
AND TECHNOLOGY,
- PALAI -
AUTONOMOUS

Choondacherry P.O., Pala, Kottayam - 686579
Kerala, India



SYLLABUS

OPEN ELECTIVE-1 COURSES

offered by the Department of
Electronics and Communication Engineering
for the B.Tech students of other disciplines*
(B. Tech 2024 SCHEME)

*As per R 3.25 and R 3.26 of SJCET B.Tech. Academic Regulations 2024

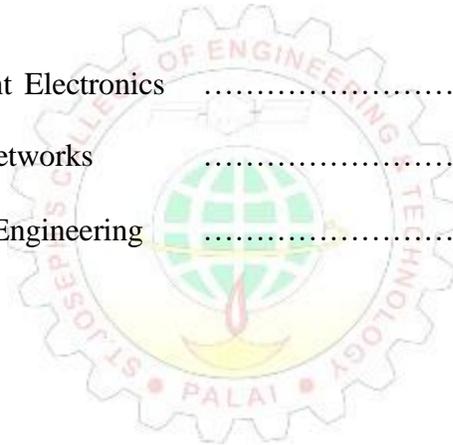
Curriculum of OPEN ELECTIVES offered by Dept. of ECE Sixth Semester- B.Tech

OPEN ELECTIVE 1: 24SJOEECT 61N					
SLOT	COURSE CODE	COURSES	L-T-P-R	HOURS	CREDIT
O	24SJOEECT611	Entertainment Electronics	3-0-0-0	3	3
	24SJOEECT612	Computer Networks	3-0-0-0		3
	24SJOEECT613	Biomedical Engineering	3-0-0-0		3

List of Open Electives

Semester 6

<u>Sl. No.</u>	<u>Name of the Course</u>	<u>Page No.</u>
1	Entertainment Electronics	3
2	Computer Networks	7
3	Biomedical Engineering	11



SEMESTER S6 ENTERTAINMENT ELECTRONICS

Course Code	24SJOEECT611	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 code)	Course Type	Theory

Course Objectives:

1. To provide broad knowledge on various industry standards, algorithms and technologies used to carry out digital audio and video broadcasting in infotainment industry.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Review of Analog Television: Scanning, Horizontal and Vertical Synchronization, Color information, Transmission methods. NTSC and PAL standards. Digital media streaming: Packetized elementary stream of audio-video data, MPEG data stream, MPEG-2 transport stream packet, Accessing a program, scrambled programs, program synchronization. PSI, Additional (Network information and service description) information in data streams for set-top boxes.	9
2	Digital Video Broadcasting (DVB): Satellite TV broadcasting – DVB-S Parameters, DVB-S Modulator, DVB-S set-top box, DVB-S2. Cable TV broadcasting – DVB-C Standard, DVB-C Modulator, DVB- C set-top box. Terrestrial TV broadcasting – DVB-T Standard, DVB-T Modulator, DVB-T Carriers and System Parameters, DVB-T receiver. Broadcasting for Handheld devices – DVB-H Standard DVB tele-text, DVB subtitling system. Digital Audio Broadcasting (DAB): Comparison of DAB with DVB. Physical layer of DAB. DAB Modulator, DAB Data Structure, DAB single frequency networks, Data broad casting using DAB.	9

3	High Definition Video and Audio: Pixel resolution, Comparison with Standard Definition TV, Review of Discrete Cosine Transforms (DCT), Video Compression - Quantization levels, Horizontal/Vertical blanking interval, Vertical Color resolution, DPCM of moving pictures, DCT, Run-length coding. MPEG-4 Video coding.	9
4	Display Technology: Block diagram of video reproduction system in a TV, Cathode Ray tubes, Basic principle of Plasma displays, LC displays, Light-emitting diode displays, Field emission displays, Organic light emitting device displays. Television of future: Holographic TV, Virtual Reality, Augmented Reality.	9



Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

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
<ul style="list-style-type: none"> 2 Questions from each module. Total of 8 Questions, each carrying 3 marks <p>(8x3 =24marks)</p>	<ul style="list-style-type: none"> 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. <p>(4x9 = 36 marks)</p>	60

Course Outcomes (COs)

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

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Explain packetized streaming of digital media happens in the field of infotainment industry.	K2
CO2	Realise the critical aspects of DVB and DAB standards used for media broadcasting	K2
CO3	Apply video coding/compression algorithms used to produce high-definition video in MPEG-4 standard	K3
CO4	Describe modern display technologies for video reproduction	K2

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

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2			1	2					2
CO2	3	3			1	1					2
CO3	3	3			2	1					2
CO4	3	3			1	2					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	Digital Video and Audio Broadcasting Technology: A Practical Engineering Guide (Signals and Communication Technology)	W. Fischer	Springer	2020
2	Understanding Digital Television An Introduction to DVB Systems with Satellite, Cable, Broadband and Terrestrial TV,.	Lars-Ingemar Lundström	Focal Press,Elsevier	2006
3	Newnes Guide to Television and Video Technology	K F Ibrahim	Newnes	2007
4	Introduction to Flat Panel Displays	Jiun-Haw Lee, David N. Liu, Shin-Tson Wu	Wiley	2008

Reference Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Digital Video and HD Algorithms and Interfaces,"	C. Poynton	Morgan Kaufmann	2012.
2	Digital audio broadcasting: principles and applications of DAB, DAB+ and DMB	Wolfgang Hoeg, Thomas Lauterbach	Wiley	2009.
3	Introduction to Digital Audio	John Watkinson	Focal Press	1994.
4	Art of Digital Video,	John Watkinson	Focal Press	2008
5	Introduction to Digital Video,	John Watkinson	Focal Press	2001

Video Links (NPTEL, SWAYAM...)	
Module No.	Link ID
1	https://www.youtube.com/watch?v=M_nTmRtAD98
2	https://www.youtube.com/watch?v=aTDr79yvUus
3	https://www.youtube.com/watch?v=g_ysg46q-jQ
4	https://www.youtube.com/watch?v=4BaDaGTUgIY

SEMESTER S6

COMPUTER NETWORKS

Course Code	24SJOEECT612	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 code)	Course Type	Theory

Course Objectives:

1. The course aims to expose students to computer networks taking a top-down approach of viewing from the layer of user applications and zooming into link layer protocols. The principles of various protocols used in every layer are studied in detail,

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Introduction to Computer Networks Components of computer networks. Transmission modes - serial and parallel transmission, asynchronous, synchronous, simplex, half duplex, full duplex communication. Switching: circuit switching and packet switching. Networks: Network criteria, physical structures, network models, categories of networks, Interconnection of Networks. Delay and loss in packet-switched networks Layered Architecture: OSI model	9

2	<p>TCP/IP protocol suite: Introduction</p> <p>Application Layer: Communication between processes, Web application: HTTP, Message format, Email application: SMTP, Message format, POP3, Domain Name System (DNS).</p> <p>Transport Layer connectionless and connection-oriented protocols. UDP-Protocols for reliable data transfer: ARQ protocols, stop-and-wait protocol, alternating-bit protocol, Go-back- N, Selective Repeat. TCP Connection, segment structure, RTT estimate, Flow control.</p> <p>Congestion Control General approaches. TCP congestion control.</p>	9
3	<p>Network Layer: Datagram versus virtual-circuit network service, Router architecture, Routing and Forwarding, Static routing and Dynamic routing. Address Resolution protocols (ARP, RARP) Subnetting, Classless Routing(CIDR), ICMP.</p> <p>IPv4: Datagram format, Fragmentation and reassembly, addressing, address assignment – manual and DHCP. IPv6- Datagram format, Transitioning from IPv4 to IPv6, IP security.</p> <p>Routing Algorithms Link-State (Dijkstra’s) Algorithm, Distance vector algorithm. Routing in Internet – RIP, OSPF, BGP.</p>	10
4	<p>Link Layer Services of link layer, Multiple access protocols – Channel partitioning, random access. ALOHA – pure and slotted, efficiency, CSMA, CSMA/CA, CSMA/CD. Link layer addressing: MAC address, Ethernet. Wireless Networks IEEE 802.11 wireless LAN.</p> <p>Physical Layer: Guided and unguided transmission media (Co-axial cable, UTP, STP, Fiber optic cable)</p>	10

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

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

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
<ul style="list-style-type: none"> 2 Questions from each module. Total of 8 Questions, each carrying 3 marks <p>(8x3 =24marks)</p>	<ul style="list-style-type: none"> 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. <p>(4x9 = 36 marks)</p>	60

Course Outcomes (COs)

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

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Summarize the principles and components of computer networks, switching, basic concepts of delay analysis and the layered network architecture.	K2
CO2	Demonstrate protocols and the functions of different layers.	K2
CO3	Apply the concept of routing and addressing protocols in the context of computer networking.	K3
CO4	Describe different physical communication standards in computer networks.	K2

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

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

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

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	Computer Networking: A Top-Down Approach Featuring the Internet.	James F. Kurose, Keith W. Ross,	Pearson	Sixth Edition, 2017
2	Data Communications and Networking	Behrouz A Forouzan	Tata McGraw-Hill	Fourth Edition, 2008

Reference Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Computer Networks – A Systems Approach,	Larry L. Peterson, Bruce S. Davie,	Morgan Kauffman	
2	Communication Networking – An Analytical Approach,	A. Kumar, D. Manjunath, J. Kuri,	Morgan Kauffman Series	
3	Computer Networks	A. S. Tanenbaum, D. J. Wetherall	Pearson	
4	Data Networks	D. Bertsekas, RG Gallager	Prentice Hall	

Video Links (NPTEL, SWAYAM...)	
Module No.	Link ID
1	https://onlinecourses.nptel.ac.in/noc22_cs19/preview
2	https://archive.nptel.ac.in/courses/106/105/106105183/
3	https://onlinecourses.swayam2.ac.in/cec21_cs04/preview

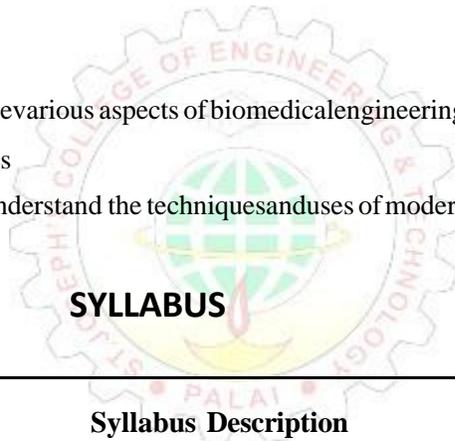
SEMESTER S6

BIOMEDICAL ENGINEERING

Course Code	24SJ0EECT613	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:

1. This course will introduce the various aspects of biomedical engineering and its applications described using engineering principles
2. The student will be able to understand the techniques and uses of modern diagnostic and therapeutic equipment.



Module No.	Syllabus Description	Contact Hours
1	Introduction to bio-medical engineering, Sources of bio-electric potential: Resting and action potential, propagation of action potentials. Various bioelectric potentials (ECG, EEG, EMG, ERG, EOG, EGG concept only.) Electrode theory: Nernst equation, Electrode skin interface Bio-potential electrodes: Microelectrodes, skin surface electrodes, needle electrodes Bio-potential amplifiers: instrumentation amplifiers, carrier amplifiers, isolation amplifiers, chopper amplifiers	9

2	<p>Heart and cardiovascular system: electro conduction system of the heart, ECG lead configurations, Einthoven triangle, Electrocardiography, ECG machine - block diagram, ECG recording system..</p> <p>The human nervous system: Neurons, action potential of brain, brain waves, placement of electrodes, EEG recording, evoked potential,</p> <p>Electrical activity of muscles: EMG signal acquisition and analysis. Myoelectric control system. Electrical stimulation of the muscle and nerve, Applications of EMG</p>	9
3	<p>Instruments for clinical laboratory: Oxymeters, blood cell counter, flame photometer, Spectrophotometer</p> <p>Therapeutic Equipments: Principles, block schematic diagram, working and applications of pacemakers, cardiac defibrillators, heart-lung machine, dialyzers, surgical diathermy equipment, ventilators</p> <p>Biomedical Telemetry system: Components of biotelemetry system, application of telemetry in medicine, single channel telemetry system for ECG.</p>	9
4	<p>Medical Imaging systems (Basic Principle only): X-ray imaging - X-ray machine, applications of X-rays in medicine.</p> <p>Computed Tomography: Principle, image reconstruction, scanning system and applications</p> <p>Ultrasonic imaging systems: Basic pulse echo system, Different types of Ultrasonics systems: A-Scan, B-Scan, M-Scan, applications, real-time ultrasonic imaging systems and probes.</p> <p>Magnetic Resonance Imaging – Basic NMR components, Biological effects and advantages of NMR imaging</p>	9

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

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

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
<ul style="list-style-type: none"> • 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks <p style="text-align: center;">(8x3 =24marks)</p>	<ul style="list-style-type: none"> • 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. <p style="text-align: center;">(4x9 = 36 marks)</p>	60

Course Outcomes (COs)

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

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Outline the basic bioelectric potentials and their implications in diagnostics	K2
CO2	Summarize the principles used for diagnosis of abnormalities in the cardiovascular system	K2
CO3	Identify the techniques used for diagnosis and therapy in the neuromuscular and myoelectric systems.	K2
CO4	Illustrate the principle and working of different types of bio medical equipment/devices	K2
CO5	State various diagnostic medical imaging techniques.	K2

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	2	1	-	-	-	2	-	-	-	-	2
CO2	2	1	-	-	-	2	-	-	-	-	2
CO3	2	1	-	-	-	2	-	-	-	-	2
CO4	2	1	-	-	-	2	-	-	-	-	2
CO5	2	1	-	-	-	2	-	-	-	-	2

Text Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	, Handbook of Biomedical Instrumentation	R. S. Khandpur	Tata Mc Graw Hill	Third edition
2	Biomedical Instrumentation and Measurement	Leslie Cromwell, Fred J. Weibell, Erich A. Pfeiffer,	, PHI	2nd Edition, 2004

Reference Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	“Medical Instrumentation application and design”,	John G Webster,	John Wiley	3 rd edition
2	Introduction to Biomedical Equipment Technology	J. J. Carr,	Pearson Education	4 th edition
3	Principle of Biomedical Instrumentation and Measurement	Richard Aston,	Merrill Education/Prentice Hall	
4	Introduction to Biomedical Instrumentation	Barbara Christe	Cambridge University Press,	2008

Video Links (NPTEL, SWAYAM...)	
Module No.	Link ID
1	https://www.youtube.com/watch?v=_fD9gOqiBVE
2	http://www.digimat.in/nptel/courses/video/127106134/L16.html

Programme Outcomes (POs)

- PO1: Engineering Knowledge:** Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.
- PO2: Problem Analysis:** Identify, formulate, review research literature and analyse complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)
- PO3: Design/Development of Solutions:** Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)
- PO4: Conduct Investigations of Complex Problems:** Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).
- PO5: Engineering Tool Usage:** Create, select and apply appropriate techniques, resources and modern engineering & ITtools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)
- PO6: The Engineer and The World:** Analyse and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).
- PO7: Ethics:** Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)
- PO8: Individual and Collaborative Team work:** Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.
- PO9: Communication:** Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences
- PO10: Project Management and Finance:** Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.
- PO11: Life-Long Learning:** Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

Knowledge and Attitude Profile (WK)

- WK1:** A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.
- WK2:** Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.
- WK3:** A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.
- WK4:** Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.
- WK5:** Knowledge, including efficient resource use, environmental impacts, whole-life cost, re-use of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.
- WK6:** Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.
- WK7:** Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development.
- WK8:** Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.
- WK9:** Ethics, inclusive behaviour and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes.

Department of Electronics and Communication Engineering

● — Vision — ●

Develop into a center of excellence in Electronics and Communication Engineering contributing to socio-economic progress.



● — Mission — ●

- To develop and maintain adequate infrastructure for a pace-setting Electronics and Communication engineering.
- To bring up a team of committed, proficient and research-oriented electronics and communication engineering faculty.
- To nurture students into ethical, emotionally strong and technically competent graduates to meet the dynamic challenges of the society.



ST. JOSEPH'S
COLLEGE OF ENGINEERING
AND TECHNOLOGY,
- PALAI -
AUTONOMOUS

Choondacherry P.O., Pala, Kottayam - 686579
Kerala, India



SYLLABUS

OPEN ELECTIVE-1 Courses

offered by the Department of

Mechanical Engineering

for the B.Tech students of other disciplines*

(B. Tech 2024 SCHEME)

*As per R 3.25 and R 3.26 of SJCET B.Tech. Academic Regulations 2024

Semester VI

Open Electives offered by ME department to students of other departments

OPEN ELECTIVE 1: 24SJOEMET61N					
SLOT	COURSE CODE	COURSES	L-T-P-R	HOURS	CREDIT
O	24SJOEMET611	Introduction to Business Analytics	3-0-0-0	3	3
	24SJOEMET612	Quantitative Techniques for Engineers	3-0-0-0		3
	24SJOEMET613	Automotive Technology	3-0-0-0		3
	24SJOEMET614	Renewable Energy Engineering	3-0-0-0		3
	24SJOEMET615	Quality Engineering and Management	3-0-0-0		3
	24SJOEMET616	Additive Manufacturing	3-0-0-0		3
	24SJOEMET617	Solar Energy Conservation Systems	3-0-0-0		3

OPEN ELECTIVE - 1

INTRODUCTION TO BUSINESS ANALYTICS

Course Code	24SJOEMET611	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.
Pre-requisites (if any)	None	Course Type	OE

Course Objectives:

- Understand the importance of analytics in decision making and problem solving.
- Understand the basic concepts in different levels of analytics and how it is used in data-driven decision making.

Course Outcomes (COs)

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

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Understand the fundamentals of business analytics and how it is becoming competitive strategy for many organisations.	K2
CO2	Understand the application of descriptive analytics tools in decision making.	K2
CO3	Apply correlation and regression models in predictive analytics problems.	K3
CO4	Apply prescriptive analytics techniques for decision making.	K3

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

CO-PO Mapping:

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

SYLLABUS

Module	Syllabus Description	Contact Hours	CO
1	<p>Introduction to Business Analytics: Why Analytics- Business Analytics: The Science of Data Driven Decision Making - Components of Business Analytics- Levels of Analytics – Descriptive Analytics, Predictive Analytics and Prescriptive Analytics- Framework for Data Driven Decision Making- Challenges in Data Driven Decision Making and Future.</p> <p>Data: Definition and its Importance- How Data Add Value to the Business- Data Analytics vs Data Analysis, Introduction to Big data Analytics –Characteristics- Sources of Big Data.</p>	9	1
2	<p>Descriptive Analytics: Data Types - Structured and Unstructured data - Types of Data Measurement Scales, Measures of Central Tendency: Arithmetic Mean-Mean of Grouped Data -Weighted Mean – Median-Median of Grouped Data- Mode- Mode of Grouped Data- Percentiles, Measures of Dispersion: Range – Inter Quartile Range -Standard Deviation - Variance and Coefficient of Variation, Measures of Shape-Skewness and Kurtosis.</p> <p>Data Visualization: Histogram- Bar Chart-Pie Chart-Scatter Plot-Coxcomb Chart-Box and Whisker Plot.</p>	9	2
3	<p>Predictive Analytics: Linear Regression: Simple Linear Regression Model - Least Squares Method, Correlation: Karl Pearson’s Correlation Coefficient - Spearman Rank Correlation - Coefficient of Determination.</p> <p>Time Series Forecasting: Stationary Time Series, Time Series with a Linear Trend, Time Series with Seasonality.</p>	9	3
4	<p>Prescriptive Analytics: Linear Programming Problem Formulation, Graphical solutions, Simplex method, Sensitivity Analysis (basic concepts only).</p> <p>Analytics in Business support functions: Sales and Marketing – Human Resources - Financial Analytics - Production and Operations Analytics.</p>	9	4

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

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

End Semester Examination Marks (ESE):

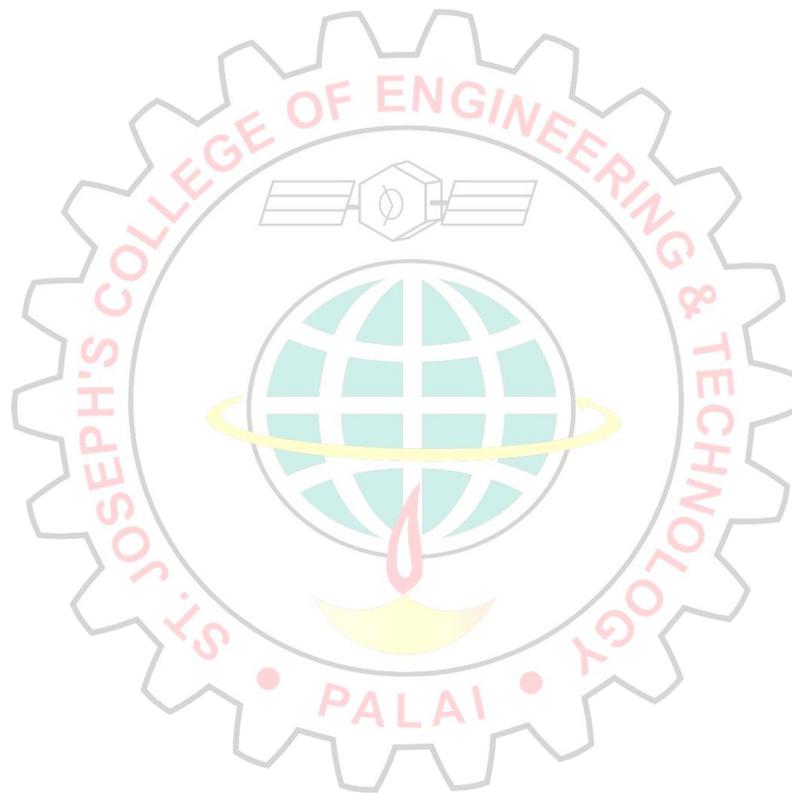
In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

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 one question should be answered. Each question can have a maximum of 3 sub divisions. (4x9 = 36 marks)	60

Text Books				
Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Business Analytics-The Science of Data Driven Decision Making	U Dinesh Kumar	Wiley	First Edition, 2017
2	Complete Business Statistics	Amir D. Aczel and J. Sounderpandian	Tata McGraw Hill	Seventh Edition, 2017
3	Business Intelligence, Analytics and Data Science: A Managerial Perspective	R. Sharda, D. Delen & E. Turban	Pearson	Fourth Edition, 2018
4	Operations Research: An Introduction	Hamdy A. Taha	Pearson	Tenth Edition, 2019

Reference Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Data Analytics	A. Maheshwari	McGraw Hill Education	First Edition, 2017
2	Business Analytics for Managers: Taking Business Intelligence Beyond Reporting	Gert H. N. Laursen & Jesper Thorlund	Wiley	First Edition, 2017
3	Business Analytics	J. R. Evans	Pearson	Third Edition, 2019
4	Fundamentals of Business Analytics	R. N. Prasad & Seema Acharya	Wiley	Second Edition, 2016

Video Links (NPTEL, SWAYAM...)		
Module No.	Topic	Link ID
1	Introduction to Business Analytics	https://youtu.be/YZf5q-ICf8Y
2	Descriptive Analytics	https://youtu.be/1MiT06JFNo4
3	Predictive Analytics	https://youtu.be/eY55ocm-VgM https://youtu.be/xXDoZLVjfbs
4	Operations Analytics	https://youtu.be/watch?v=HAVnjWcL-X0



QUANTITATIVE TECHNIQUES FOR ENGINEERS

Course Code	24SJOEMET612	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.
Pre-requisites (if any)	None	Course Type	OE

Course Objectives:

- To enable students to mathematically model real-life optimization problems encountered in engineering and related fields.
- To familiarize students with various analytical and computational methods for solving optimization models.
- To develop the ability to apply mathematical concepts and models to solve engineering problems efficiently.
- To promote optimal utilization of limited resources in engineering problem-solving through systematic modelling and analysis.

Course Outcomes (COs)

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

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Explain the basic ideas of quantitative techniques and use linear programming and decision-making methods to solve simple optimization problems.	K3
CO2	Solve transportation and assignment problems using suitable methods for better resource use.	K3
CO3	Apply sequencing and scheduling techniques, and analyze project networks using CPM and PERT for efficient resource and time management.	K3
CO4	Understand strategic situations using Game Theory and Queuing Models to support effective managerial decision-making.	K2

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

CO-PO Mapping:

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

SYLLABUS

Module	Syllabus Description	Contact Hours	CO
1	Introduction to Quantitative Techniques: Basics of Operations Research – Applications - Linear Programming - Problem Formulation, Graphical method, Simplex method, Big-M Method. Decision Making: Decision under certainty, risk and uncertainty: Decision trees, EMV method, EOL method, MaxiMin criterion	9	1
2	Transportation Problem: Mathematical Formulation, Balanced and unbalanced problems, Initial Basic Feasible Solution, North West Corner method, Least Cost method, Vogel's Approximation Method, Optimality test by MODI method, Assignment problem, Hungarian method.	9	2
3	Sequencing Problem: Basic terminologies, Processing of n Jobs through 2, 3 and m machines. Flow shop scheduling Techniques- Johnson's Algorithm, Palmers Heuristics, CDS Heuristics. Job shop scheduling methods. Network analysis – Basic terms – Network construction, time analysis, Critical Path Method (CPM), Programme Evaluation and Review Technique (PERT).	9	3
4	Game Theory: Games with saddle points, Games without saddle points – 2 x 2 games, Graphical method for m x 2 and 2 x n games. Queuing theory: Scope, terminology, classification, Importance and applications, Performance Measures in Queuing Systems, Single-server exponential arrival and service times. Queuing Simulation Models.	9	4

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

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

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 one question should be answered. Each question can have a maximum of 3 sub divisions. (4x9 = 36 marks)	60

Text Books				
Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Operations Research	Paneerselvam R.	PHI	Third edition, 2023
2	Operations Research	Taha	Pearson	Tenth edition, 2019

Reference Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Introduction to Operations Research	F. S. Hillier and G. J. Lieberman	McGraw Hill	Tenth edition, 2017
2	Discrete Event System Simulation	Banks, Carson, Nelson and Nicol	Pearson	Fifth edition, 2013

Video Links (NPTEL, SWAYAM...)		
Module No.	Topic	Link ID
1	Module 1	https://nptel.ac.in/courses/112106134
2	Module 2	https://nptel.ac.in/courses/112106134
3	Module 3	https://nptel.ac.in/courses/112106131
4	Module 4	https://www.nptelprep.in/courses/111103159 https://nptel.ac.in/courses/110104063

AUTOMOTIVE TECHNOLOGY

Course Code	24SJOEMET613	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.
Pre-requisites (if any)	None	Course Type	OE

Course Objectives:

- To understand the fundamental principles and technologies of automotive propulsion systems, including electric, hybrid, and internal combustion engines, along with their classifications and basic dynamics.
- To understand automotive components and systems such as power plants, fuel supply, ignition, transmission, chassis, steering, braking, suspension and Electrical/Electronic architecture.

Course Outcomes (COs)

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

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Understand the efficiency and performance characteristics of internal combustion, electric, and hybrid propulsion systems used in automobiles.	K2
CO2	Apply knowledge of IC engine components and transmission systems to identify and troubleshoot issues in vehicle propulsion and drivetrain systems.	K3
CO3	Describe the operation and integration of advanced automotive technologies such as fuel injection systems, ignition systems, and emission controls.	K3
CO4	Understand the basics of E&E architecture and analyse steering, braking, and suspension systems in relation to vehicle handling and safety.	K3

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

CO-PO Mapping:

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

SYLLABUS

Module	Syllabus Description	Contact Hours	CO
1	Introduction: History of automobiles: Classification of automobile L, M and N category - sub division according to body style (hatchback to station wagon), Internal Combustion Engines (ICE), Electric and Hybrid vehicles. Hybrid types – Mild & strong hybrids, series, parallel, and series parallel types. Power and Torque for propulsion (basic equations). Basic vehicle dynamics: Rolling, Air and Grade resistance.	8	1
2	IC Engine Power plant: SI & CI Engines, Single and multi-cylinder with arrangements, Components in an IC engine – head, block & sump, cylinder, piston, piston pin, crank, connecting rod and valve train. Fuel and Air: A/F ratio, self-ignition temperature, combustion process, Octane and cetane number, Carburetors(simple), MPFI, CRDI & GDI systems with components (line diagram). Working of solenoid and piezo injectors. Naturally aspirated and forced induction systems (turbo and super charger). Bi fuel & dual fuel, Flex fuel vehicles, H2-ICE, latest technologies in ICES. Ignition systems: Spark ignition systems –components, ignition timing, Single coil ignition system & coil over plug ignitions system, electronic ignition systems.	11	2
3	Lubrication, Cooling and exhaust system: Lubrication system – basic circuitry, oil grade and viscosity. Cooling system – basic circuit including thermostat valve. Exhaust system, Emission control – 3-way catalytic converter, DPF and SCR basics. Transmission & Chassis: Gear ratio, manual transmission: synchromesh, Automated and Automatic transmission basics, Friction and Fluid clutches basics. Different types chassis – tubular to integrated, functions of a chassis.	9	3
4	Steering, Braking and Suspension: Working of manual, electric and hydraulic steering system. Working of brake system – hydraulic, pneumatic and ABS. Suspension system – rigid & independent, coil & leaf, shock absorber basics. E & E architecture –ECUs, sensors and actuators other than ECM,	8	4

distributed and zonal electrical architecture. Basics of communication protocols – CAN, LIN and ethernet. Electric vehicle components and energy flow, On-board diagnostic basics – DTC code, basics of ADAS – sensors, levels of automation, examples – LDWS to Lane change assist, Adaptive cruise control, Automatic emergency braking, Driver monitoring system, Autonomous Vehicles.		
---	--	--

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

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

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 one question should be answered. Each question can have a maximum of 3 sub divisions. (4x9 = 36 marks)	60

Text Books				
Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Automobile Engineering, Vol.1 & Vol.2	Kirpal Singh	Standard Publishers	13 th edition, 2020
2	A textbook of Automobile Engineering	S K Gupta	S Chand	2 nd Edition, 2020
3	Fundamentals of motor vehicle technology	Hillier and Peter Coobes	New Age International Private Limited	6 th edition, 2006
4	Vehicle and engine technology	Heinz Heisler	Society of Automotive Engineers	2 nd edition, 1998
5	Automobile mechanical and electrical systems	Tom Denton & Hayley Pells	Routledge Publishers	3 rd edition, 2022
6	Automobile Electrical and Electronic systems	Tom Denton	Routledge Publishers	5 th edition, 2018

Reference Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Automotive Mechanics	Heitner J	East-West Press	2 nd edition, 1999
2	Automobile Engineering	Jain K.K. and Asthana R.B	Tata McGraw Hill	New Delhi, 2002
3	Electric and Hybrid Vehicles	Tom Denton	Routledge Publishers	2 nd edition, 2020
4	Fundamentals of modern vehicle technology	V.A.W. Hillier	Butterworth- Heinemann	2 nd edition, 1998

Video Links (NPTEL, SWAYAM...)		
Module No.	Topic	Link ID
1	Introduction to Electric & Hybrid Powertrain	https://youtu.be/q6BYr5-fq5U?si=vKEueY8BPW0cKg6-
2	IC Engines	https://youtu.be/CO2StedJtAc?si=c7K9Bfp8vJN4ikTE
3	Cooling & Lubrication Systems	https://youtu.be/AGm2QSxYsVA?si=-18cy2I9UdCBQKiG
4	Braking Systems	https://youtu.be/dBHOMtGquuo?si=T7OC3H1AReRXfap3
4	Suspension Systems	https://youtu.be/GinzMttVE1M?si=qOeRaI8dtko9MSORT
4	Steering Systems	https://youtu.be/fTnAoYBKXFU?si=uUIgN2RI4DfYATxM

RENEWABLE ENERGY ENGINEERING

Course Code	24SJOEMET614	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.
Pre-requisites (if any)	None	Course Type	OE

Course Objectives:

The course is aimed at imparting basic knowledge on the different types of renewable energy resources and utilization of these energy effectively so as to minimize the consumption of non-renewable energy to a greater extent.

Course Outcomes (COs)

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

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Explain solar energy collectors, storages, solar cell characteristics and applications	K2
CO2	Explain the different types of wind power machines and control strategies of wind turbines	K2
CO3	Explain the ocean energy and conversion devices and different Geothermal sources	K2
CO4	Explain biomass energy conversion systems, production pathways, and recent advances in hydrogen applications.	K2

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

CO-PO Mapping:

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

SYLLABUS

Module	Syllabus Description	Contact Hours	CO
1	The Energy Scenario: Commercial energy sources -World's production and reserves- India's production and reserves. Solar Energy collectors: Solar thermal collectors -Flat plate collectors –Solar concentrators (parabolic trough, parabolic dish, central tower collector) – Solar air heaters. Solar thermal electric power generation -Thermal Energy storage: sensible heat storage, latent heat storage, Thermo chemical storage, photovoltaic system for power generation, Solar pond -Solar cells-Types of solar cells , principle of working and performance characteristics, Production process (Block diagram only) Applications - Solar space heating and cooling of buildings, solar pumping, solar cooker, solar still, solar drier, solar refrigeration and air-conditioning, heliostat, solar furnace.	11	1
2	Wind Energy- classification of wind turbines and power performance curve, Energy in wind, calculation of energy content, Power coefficients, Betz limit theory, tip speed ratio, solidity of turbine, power control strategies, Basic principles of Wind Energy Conversion Systems (WECS), Classification of WECS, Parts of WECS	7	2
3	Ocean Energy – Devices for Wave energy conversion, Ocean Thermal Energy Conversion (OTEC): Principle of OTEC system, Methods of OTEC power generation – Open Cycle (Claude cycle), Closed Cycle (Anderson cycle) and Hybrid cycle (block diagram description of OTEC); Geothermal energy: Introduction, hot dry rock resources, magma resources, vapour and liquid dominated systems, binary cycle, advantages and disadvantages	10	3
4	Bio Mass Energy- Biomass conversion technologies –Bio Gasification, Bio ethanol, Bio Diesel, Biogas production from waste biomass, factors affecting biogas generation. Bio Gas -KVIC and Janata model. Hydrogen Energy – An overview of different production methods and the latest technological advancements in hydrogen-based applications.	8	4

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

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

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 one question should be answered. Each question can have a maximum of 3 sub divisions. (4x9 = 36 marks)	60

Text Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Solar Energy: Principles of Thermal Collection and Storage	S P Sukhatme , J K Nayak	Mc Graw Hill	3 rd edition, 2024
2	Fundamentals of renewable energy sources	Tiwari G N, Ghosal M K	Alpha Science International Ltd	2007
3	Renewable energy sources and emerging technologies	D.P. Kothari K.C. Singal Rakesh Ranjan	PHI Learning	3 rd edition, 2022
Reference Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Fundamentals and Applications of Renewable Energy	Mehmet Kanoğlu, Yunus A. Çengel John M. Cimbala	Mc Graw Hill	2020
2	Sustainable Energy Choosing among options	Jefferson W Tester, Elisabeth M. Drake, Michael J. Driscoll, Michael W. Golay, William A. Peters	Prentice Hall India Learning Private Limited	2005

Video Links (NPTEL, SWAYAM...)		
Modules	Topic	Link
1 to 4	Renewable Energy Engineering	https://www.youtube.com/watch?v=mh51mAUexK4&list=PLwdnzlV3ogoXUifhvYB65lJJCZ74o_fAk&index=1

QUALITY ENGINEERING AND MANAGEMENT

Course Code	24SJOEMET615	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.
Pre-requisites (if any)	None	Course Type	OE

Course Objectives:

- To impart knowledge on principles and practices of quality engineering and management.
- To enable use of various tools and techniques for continuous quality improvement.
- To provide ideas on implementation of quality standards.

Course Outcomes (COs)

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

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Understand the fundamental concepts, evolution, and principles of quality management and Total Quality Management (TQM).	K2
CO2	Explain the human aspects of TQM.	K2
CO3	Apply various quality tools and statistical techniques for quality control, process improvement, and inspection.	K3
CO4	Understand how to implement strategic quality management practices for continuous improvement.	K2

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

CO-PO Mapping:

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

SYLLABUS

Module	Syllabus Description	Contact Hours	CO
1	Introduction to Quality Management - Definitions of quality, Dimensions of Quality, Concepts of Product and Service Quality, Evolution of Quality Management, quality control, quality assurance, quality planning, quality management, Total Quality Management (TQM)-the TQM axioms - Consequences of total quality- Barriers to TQM, Deming approach, Juran's quality trilogy, Crosby's fourteen steps for quality improvement, Quality circles.	9	1
2	Human dimensions of TQM – Top management commitment- Leadership for TQM- Change management- resources for quality activities - Training for quality –Employee involvement, motivation, empowerment- teamwork- self managing teams - Role of the quality director-Quality System: ISO 9000 family of standards. Quality auditing- types and benefits.	9	2
3	Tools and Techniques in TQM: Affinity diagram -brainstorming – cause and effect analysis - process flow chart – check sheets- Scatter diagram -Pareto chart- Histogram. Quality control and Inspection, Fundamentals of statistics, accuracy and precision, causes of variation in quality, Statistical Process Control, control charts, \bar{x} and R chart problems, process capability, Acceptance sampling	9	3
4	Strategic Quality Management: Integrating quality into strategic management - obstacles to achieving successful strategic quality management-Cost of Quality-Customer satisfaction. Quality Function Deployment (QFD), Failure Mode and Effect Analysis, Analysis of Variance (ANOVA), Design and Analysis of Experiments (DOE), Concepts of 5S, Kaizen, Six Sigma, Total Productive Maintenance. Reliability Engineering - types and causes of failures - Bath tub curve - System reliability - Life testing.	9	4

Course Assessment Method (CIE: 40 marks, ESE: 60 marks)**Continuous Internal Evaluation Marks (CIE):**

Attendance	Assignment	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

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 one question should be answered. Each question can have a maximum of 3 sub divisions. (4x9 = 36 marks)	60

Text Books				
Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Total Quality Management (TQM)	B esterfield D. H., BesterfieldC, Besterfield G. H., Besterfield M, U. Hemant, U.Rashmi	Pearson Education	Fifth Edition, 2018
2	Total Quality Management	Subburaj Ramasamy	Tata McGraw Hill Education	First Edition, 2017
3	Introduction to Statistical Quality Control	D. C. Montgomery	John Wiley & Sons	Third Edition
4	Fundamentals of Quality Control and Improvement	Mitra A.	PHI	Second Edition, 1998

Reference Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	A First Course in Quality Engineering: Integrating Statistical and Management Methods of Quality	K. S. Krishnamoorthi & V. Ram Krishnan	CRC Press	2nd Edition, 2011
2	Juran's Quality Handbook: The Complete Guide to Performance Excellence	Joseph M. Juran & A. Blanton Godfrey	McGraw Hill Education	7th Edition, 2016
3	Quality Management	O. N. Pandey & Bhupesh Aneja	S. K. Kataria & Sons	2nd Edition, 2021
4	Lean Six Sigma and Quality Management	Jiju Antony & Ricardo de Souza	Routledge	2022

Video Links (NPTEL, SWAYAM...)		
Module No.	Topic	Link ID
1	Module1	https://nptel.ac.in/courses/110105088
2	Module2	https://nptel.ac.in/courses/110101010
3	Module3	https://nptel.ac.in/courses/110101010
4	Module4	https://nptel.ac.in/courses/110101010

ADDITIVE MANUFACTURING

Course Code	24SJOEMET616	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.
Pre-requisites (if any)	None	Course Type	OE

Course Objectives:

1. To demonstrate appropriate level of understanding on principles of additive manufacturing
2. To explore different additive manufacturing processes and suggest suitable methods for building a particular component
3. To design prototypes by identifying suitable process with optimum process parameters
4. Apply design for additive manufacturing guidelines in designing mass customized products

Course Outcomes (COs)

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

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Understand the concept of AM from conventional manufacturing systems and data processing techniques in AM process	K2
CO2	Understand the working principles and process parameters of additive manufacturing processes	K2
CO3	Understand the working principles and process parameters of High energy additive manufacturing (HEAM) processes	K2
CO4	Identify the need of design for additive manufacturing	K2

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

CO-PO Mapping:

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

SYLLABUS

Module	Syllabus Description	Contact Hours	CO
1	<p>Introduction to Additive Manufacturing (AM) –Basic principle of AM- Procedure of product development in AM process chain. Classification of additive manufacturing processes, Basic concept, Digitization techniques, Benefits and challenges in AM.</p> <p>Data processing for AM- CAD model preparation, Part orientation and support generation, Slicing methods, Tool path generation, STL Formats. Demonstration of slicing software packages.</p>	8	1
2	<p>Common AM technologies: Principle, materials, process parameters, advantages and applications of: Stereo Lithography (SLA), Digital Light Processing (DLP), Continuous Liquid Interface Production (CLIP), Laminated Object Manufacturing (LOM), Ultrasonic AM (UAM), 3D printing, Binder Jetting, Material Jetting, Fused Deposition Modelling (FDM), Direct Ink Writing (DIW).</p>	8	2
3	<p>Powder Bed Fusion AM Processes Principle, materials, process parameters, advantages and applications of: Selective Laser Sintering (SLS), Selection Laser Melting (SLM), Electron Beam Melting (EBM)</p> <p>Directed Energy Deposition AM Processes: Laser Engineering Net Shaping (LENS), Direct Metal Deposition (DMD), Electron Beam Based Metal Deposition, Processing-structure-properties, relationships, Benefits and drawbacks, Applications of Directed Energy Deposition Processes.</p> <p>Friction stir additive manufacturing: process, parameters, advantages, limitations and applications</p> <p>Wire Arc Additive Manufacturing (WAAM): Process, parameters, applications, advantages and disadvantages</p>	10	3
4	<p>Design for AM (DFAM)</p> <p>Introduction to geometric modelling, Modelling of Synthetic curves like Hermite, Bezier and B-spline, Parametric Representation of freeform surfaces, Design freedom with AM, Need for Design for Additive Manufacturing (DFAM), CAD tools vs. DFAM tools, Requirements of DFAM methods, General Guidelines for DFAM, The Economics of Additive Manufacturing, Design to Minimize Print Time, Design to Minimize Post-processing. AM unique capabilities, DFAM concepts and objectives, Design freedom and synthesis methods.</p> <p>Applications for AM</p> <p>Applications: Prototyping, Industrial tooling, Aerospace, Automobile, Medical etc.</p>	10	4

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

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

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

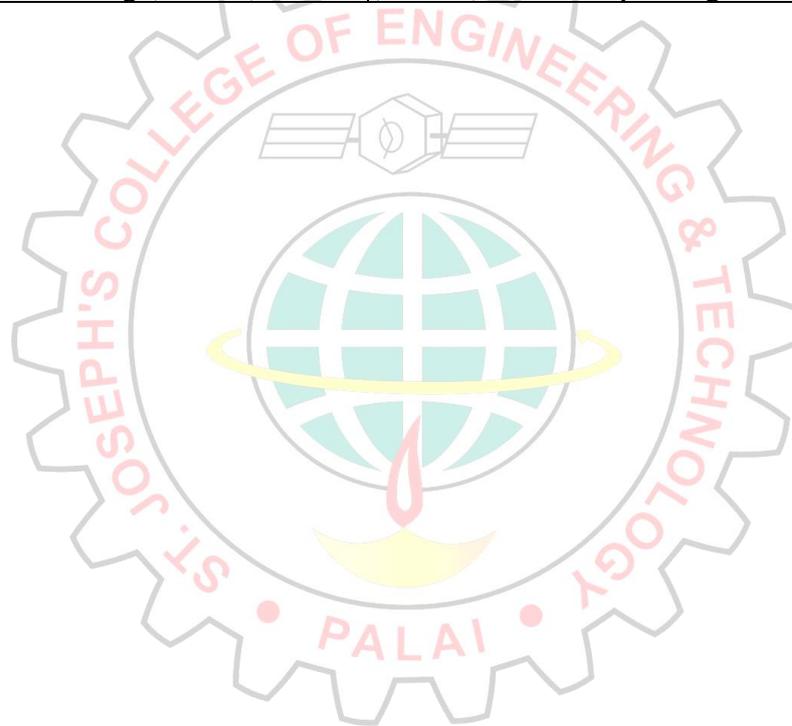
Part A	Part B	Total
2 Questions from each module. Total of 8 Questions, each carrying 3 marks (8x3 = 24marks)	Each question carries 9 marks. Two questions will be given from each module, out of which one question should be answered. Each question can have a maximum of 3 sub divisions. (4x9 = 36 marks)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

Text Books				
Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Additive Manufacturing Technologies-3D Printing, Rapid Prototyping, and Direct Digital Manufacturing	Gibson I D. W. Rosen I and B. Stucker	Springer	Second Edition, 2015
2	Additive Manufacturing	Amit Bandyopadhyay Susmita Bose	CRC Press Taylor & Francis Group	Second Edition, 2020
3	Rapid Prototyping: Laser-based and Other Technologies	Patri K. Venuvinod and Weiyin Ma	Springer	First Edition, 2004
4	Design for Advanced Manufacturing: Technologies and Process	Laroux K, Gillespie	Mc Graw Hill,	Second Edition, 2017

Reference Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Rapid Manufacturing: The Technologies and Applications of Rapid Prototyping and Rapid Tooling	D.T. Pham and S.S. Dimov	Springer London Ltd	Softcover reprint of the original 1st ed. 2001, 2011
2	Additive Manufacturing: Principles, technologies and Application	C.P. Paul, A.N. Junoop	McGraw Hill	First Edition, 2021
3	Additive Manufacturing Technologies	S. Shiva, Anuj K. Shukla	Wiley	First Edition, 2024
4	Additive Manufacturing:	Manu Srivastava,	CRC Press	First Edition,

	Fundamentals and Advancements	Sandeep Rathee, Sachin Maheshwari		2019
5	Laser-Induced Materials and Processes for Rapid Prototyping	L Lu, J. Y. H. Fuh and Y.S. Wong	Springer	First Edition, 2001

Video Links (NPTEL, SWAYAM...)		
Module No.	Topic	Link ID
1 to 3	Fundamentals of Additive Manufacturing Technologies	https://nptel.ac.in/courses/112103306
4	Design for Additive manufacturing (DFAM)	mod06lec23 - Design for Additive manufacturing (DFAM) for Metal printing



SOLAR ENERGY CONSERVATION SYSTEMS

Course Code	24SJOEMET617	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.
Pre-requisites (if any)	None	Course Type	OE

Course Objectives:

- To impart fundamental knowledge of solar radiation and various technologies for solar thermal and photovoltaic energy conversion.
- To enable students to evaluate the techno-economic feasibility of solar energy systems in the context of sustainable energy development.

Course Outcomes (COs)

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

Course Outcome		Bloom's Knowledge Level (KL)
CO1	<i>Explain</i> the fundamental concepts of solar radiation, sun–earth relationship, and methods of predicting solar energy availability.	K2
CO2	<i>Describe</i> the working principles and applications of solar thermal collectors and storage systems.	K2
CO3	<i>Analyze</i> the fundamentals of photovoltaic systems and <i>apply</i> the design principles for standalone and grid-connected configurations	K3
CO4	<i>Explain</i> basic economic analysis concepts and <i>describe</i> energy policies and regulations related to solar energy systems. .	K2

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

CO-PO Mapping:

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

SYLLABUS

Module	Syllabus Description	Contact Hours	CO
1	Introduction: Energy Scenario: India and world, Basic concepts related to solar radiation, the sun, spectral distribution, sun- earth relationship, extraterrestrial radiation, revolution of earth, seasons, position of sun in the sky, position of sun with respect to the centre of the earth. Role of atmosphere on solar radiation, air mass, terrestrial spectrum, prediction of solar radiation. Diffuse and direct radiation. Solar energy measuring instruments: Pyrheliometer, Pyranometer, Sun Shine recorder, Solar-cell-type sunshine recorder.	9	1
2	Over view of Solar Thermal collectors: Flat plate collector. Concentrating collectors, theoretical limit, classifications of concentrators. Parabolic trough collector, compound parabolic concentrators, Linear Fresnel Reflector, parabolic dish collector, central receiver tower. Tracking of solar concentrators. Solar ponds. Storage of heat in solar thermal power plants, storage media and heat transfer fluids	9	2
3	Non-thermal routes for solar energy conversion, Basics of photovoltaic effect, Fundamentals of PV: Principles and performance analysis, Photovoltaic materials, Modules, Array, Maximum Power Point Tracking (MPPT) etc.; standalone PV system: Components and design of standalone system, fundamentals of battery system; grid connected PV system: components and design of grid connected PV systems	9	3
4	Methods of fixing power tariff - Simple Methods to Calculate the Plant Economy - Life Cycle Cost - Payback Period – Relevance of financial and economic feasibility evaluation of energy technologies and systems, Energy- economy interaction, Energy Policy related acts and regulation. Economic Analysis for the Selection of Alternative Decisions and the future of the Power Plants.	9	4

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

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

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
<ul style="list-style-type: none"> ➤ 2 Questions from each module. ➤ Total of 8 Questions, each carrying 3 marks (8x3 = 24marks) 	<ul style="list-style-type: none"> ➤ Each question carries 9 marks. ➤ Two questions will be given from each module, out of which one question should be answered. ➤ Each question can have a maximum of 3 sub divisions. <p style="text-align: center;">(4x9 = 36 marks)</p>	60

Text Books				
Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Solar Energy	S P Sukhatme	McGraw Hill Education (India) Private Limited	Fourth edition (1 January 2017)
2	Principles of Solar Engineering	D. Yogi Goswami, Frank Kreith, and Jan F. Kreider	CRC Press	3rd Edition (2015)
3	Handbook of Solar Energy: Theory, Analysis and Applications	G. N. Tiwari	Publisher Springer	1st ed. 2016
4	Photovoltaic Systems Engineering	Roger A. Messenger and Jerry Ventre	CRC Press	4th Edition (2012)

Reference Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Renewable Energy: Power for a Sustainable Future	Godfrey Boyle	Oxford University Press	3rd Edition (2012)
2	Solar Photovoltaic Technology and Systems: A Manual for Technicians, Trainers and Engineers	Chetan Singh Solanki	PHI Learning Pvt. Ltd.	1st Edition (2013)
3	Handbook of Photovoltaic Science and Engineering	Antonio Luque and Steven Hegedus	John Wiley & Sons	2nd Edition (2011)
4	Solar Electricity Handbook: A Simple, Practical Guide to Solar Energy - Designing and Installing Solar Photovoltaic Systems	Michael Boxwell	Green stream Publishing	2020 Edition

Video Links (NPTEL, SWAYAM...)		
Module No.	Topic	Link ID
1	Basic concepts related to solar radiation, Sun earth angle, geometry.	https://youtu.be/WtZgSyhA294?si=sSStCBoMbm7HAAp
2	Fundamentals of non-flat plate solar collectors	https://youtu.be/mh51mAUexK4?si=WexBAkTitpM0-nzj
2	Fundamental of concentrating type solar collectors	https://youtu.be/hS1DclbOIEI?si=sM3qmnBsOvBqs bK6
3	Fundamentals of PV Technology.	https://youtu.be/VdYfTWOQrNs?si=jlVUcesZ8sJJXN3K
4	Fundamentals and methodology of evaluation of energy economics	https://youtu.be/ZdPsptbhtAI?si=MxTVa8TaqvWuhn_F