SAGI RAMA KRISHNAM RAJU ENGINEERING COLLEGE (AUTONOMOUS)
(Approved by AICTE, New Delhi, Affiliated to JNTUK, Kakinada)
Accredited by NAAC with 'A+' Grade, Accredited by NBA (UG: Civil, CSE, ECE, EEE, IT & ME)
Recognised as Scientific and Industrial Research Organisation
SRKR MARG, CHINA AMIRAM, BHIMAVARAM – 534204 W.G.Dt., A.P., INDIA
Estd:1980

LIST OF OPEN ELECTIVES
OFFERED BY VARIOUS DEPARTMENTS TO OTHER DEPARTMENTS
IN III YEAR II SEMESTER

Offered by	Course Code	Course Name	Offered to
ARTIFICIAL INTELLIGENCE & DATA SCIENCE	B23ADOE03	Operating Systems	**CE, ECE, EEE & ME**
	B23ADOE04	Software Engineering	
ARTIFICIAL INTELLIGENCE & MACHINE LEARNING	B23AMOE04	Database Management Systems	**CE, ECE, EEE & ME**
	B23AMOE05	Applied Machine Learning	
CIVIL ENGINEERING	B23CEOE03	Disaster Management	**AIDS, AIML, CIC, CSBS, CSE, CSG, CSIT, ECE, EEE, IT & ME**
	B23CEOE04	Green Buildings	
COMPUTER SCIENCE & BUSINESS SYSTEMS	B23CBOE03	Business Strategy	**CE, ECE, EEE & ME**
COMPUTER SCIENCE & ENGINEERING	B23CSOE03	Principles of Database Management Systems	**CE, ECE, EEE & ME**
CSE (Internet of Things and Cyber Security including Block Chain Technology)	B23CIOE03	Operating Systems	**CE, ECE, EEE & ME**
	B23CIOE04	Database Management Systems	
ELECTRONICS & COMMUNICATION ENGINEERING	B23ECOE02	Linear and Digital IC Applications	**AIDS, AIML, CE, CIC, CSBS, CSE, CSG, CSIT, EEE, IT & ME**
ELECTRICAL & ELECTRONICS ENGINEERING	B23EEOE03	Sensors & Transducers	**AIDS, AIML, CE, CIC, CSBS, CSE, CSG, CSIT, ECE, IT & ME**
	B23EEOE04	MATLAB Programming for Engineering Applications	
INFORMATION TECHNOLOGY	B23ITOE02	Software Engineering	**CE, ECE, EEE & ME**
MECHANICAL ENGINEERING	B23MEOE03	Industrial Management	**AIDS, AIML, CE, CIC, CSBS, CSE, CSG, CSIT, ECE, EEE & IT**
	B23MEOE04	Product Design and Development	
	B23MEOE05	Operations Management	
	B23MEOE06	Advanced Manufacturing Processes	
MATHEMATICS AND HUMANITIES	B23BSOE02	Mathematics for Quantum Computing	**AIDS, AIML, CE, CIC, CSBS, CSE, CSG, CSIT, ECE, EEE, IT & ME**

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23ADOE03	**OE**	**3**	**--**	**--**	**3**	**30**	**70**	**3 Hrs.**

OPERATING SYSTEMS

Offered by AIDS

(Offered to CE, ECE, EEE & ME)

Course Objectives:

1.	Understand the basic concepts and principles of operating systems, including process management, memory management, file systems, and Protection.
2.	Makeuseofprocessschedulingalgorithmsandsynchronizationtechniquestoachievebetter Performance of a computer system.
3.	Illustrate different conditions for the deadlock and their possible solutions.

Course Outcomes: By the end of the course, the student will be able to

S.No	Outcome	Knowledge Level
1.	**Describe** Operating System features and system structures.	K2
2.	**Apply** CPU Scheduling Algorithms for Multi Process and Multi-Threaded Operating systems.	K3
3.	**Solve** Process Synchronization problems to avoid the occurrence of Deadlock situations	K3
4.	**Apply** various Memory Management Schemes for Primary and Secondary memory.	K3
5.	**Describe** file Operations and protection methods.	K2

SYLLABUS

UNIT-I (10Hrs)	**Operating Systems Overview:** Introduction, Operating system functions/Operating systems operations, Types of Operating Systems, Free and Open-Source Operating Systems **System Structures**: Operating System Services, User and Operating-System Interface, system calls, Types of System Calls, system programs, Operating system Design and Implementation, Operating System Structure, Building and Booting on Operating System, Operating system debugging.
UNIT-II (10 Hrs)	**Processes**: Process Concept, Process scheduling, Operations on processes, Inter-process communication. **Threads and Concurrency**: Multithreading models, Thread libraries, Threading issues. **CPU Scheduling**: Basic concepts, Scheduling criteria, Scheduling algorithms, Multiple processor scheduling.

UNIT-III (10 Hrs)	**Synchronization Tools:** The Critical Section Problem, Peterson's Solution, Mutex Locks, Semaphores, Monitors, Classic problems of Synchronization. **Deadlocks:** system Model, Deadlock characterization, Methods for handling Deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from Deadlock's
UNIT-IV (10 Hrs)	**Memory-Management Strategies:** Introduction, Contiguous memory allocation, Paging, Structure of the Page Table, Swapping. **Virtual Memory Management:** Introduction, Demand paging, copy on-write, Page replacement, Frame Allocation, Thrashing, **Storage Management:** Overview of Mass Storage Structure, HDD Scheduling
UNIT-V (10 Hrs)	**File System:** File System Interface: File concept, Access methods, Directory Structure. **File system Implementation:** File-system structure, File-system Operations, Directory implementation, Allocation method, Free space management. **System Protection:** Goals of protection, Principles and domain of protection, Access matrix, Access control, Revocation of access rights.

Textbooks:	
1.	Operating System Concepts, Silberschatz A, Galvin P B, Gagne G,10th Edition Wiley, 2018.
2.	Modern Operating Systems, Tanenbaum A S,4th Edition, Pearson, 2016.
Reference Books:	
1.	Operating Systems-Internals and Design Principles, Stallings W,9th edition, Pearson,2018.
2.	Operating Systems: A Concept Based Approach, D.M Dhamdhere,3rd Edition, McGraw-Hill, 2013.
3.	Nutt G, Operating Systems,3rd edition, Pearson Education,2004.
4.	Operating Systems-Internals and Design Principles, Stallings W,9th edition, Pearson,2018.
5.	Operating Systems: A Concept Based Approach, D.M Dhamdhere,3rd Edition, McGraw-Hill, 2013.

e-Resources	
1.	https://nptel.ac.in/courses/106106144
2.	https://peterindia.net/OperatingSystems.html

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23ADOE04	OE	3	--	--	3	30	70	3 Hrs.

SOFTWARE ENGINEERING

Offered by AIDS

(Offered to CE, ECE, EEE & ME)

Course Objectives:

1.	The aim of the course is to provide an understanding of the working knowledge of the techniques for estimation, design, testing and quality management of large software development projects.
2.	Topics include process models, software requirements, software design, software testing, software process/product metrics, risk management, quality management and UML diagrams

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

S.No	Outcome	Knowledge Level
1.	**Decompose** the given project in various phases of a lifecycle and choose appropriate process model depending on the user requirements.	K3
2.	**perform** various life cycle activities like Analysis, Design, Implementation, Testing and Maintenance	K3
3.	**Apply** appropriate software architectures and patterns to carry out high level design of a system and be able to critically compare alternative choices.	K3
4.	have experience and/or awareness of testing problems and **develop** a simple testing report.	K3

SYLLABUS

UNIT-I (10Hrs)	**Introduction to Software Engineering:** The evolving role of software, changing nature of software, software myths. **A Generic view of process:** Software engineering- a layered technology, a process framework, the capability maturity model integration (CMMI), process patterns, process assessment, personal and team process models. Process models: The waterfall model, incremental process models, evolutionary process models, the unified process.
UNIT-II (10 Hrs)	**Software Requirements:** Functional and non-functional requirements, user requirements, system requirements, interface specification, the software requirements document. **Requirements engineering process:** Feasibility studies, requirements elicitation and analysis, requirements validation, requirements management. System models: Context models, behavioral models, data models, object models, structured methods.
UNIT-III (10 Hrs)	**Design Engineering:** Design process and design quality, design concepts, the design model. **Creating an architectural design:** software architecture, data design, architectural styles and patterns, architectural design, conceptual model of UML, basic structural

	modeling, class diagrams, sequence diagrams, collaboration diagrams, use case diagrams, component diagrams.
UNIT-IV (10 Hrs)	**Testing Strategies:** A strategic approach to software testing, test strategies for conventional software, black-box and white-box testing, validation testing, system testing, the art of debugging.
UNIT-V (10 Hrs)	**Metrics for Process and Products:** Software measurement, metrics for software quality. Product metrics: Software quality, metrics for analysis model, metrics for design model, metrics for source code, metrics for testing, metrics for maintenance. **Quality Management:** Quality concepts, software quality assurance, software reviews, formal technical reviews, statistical software quality assurance, software reliability, ISO 9000 quality standards.

Textbooks:	
1.	Software Engineering, A practitioner's Approach- Roger S. Pressman, 6 th edition, Mc Graw Hill International Edition
2.	Software Engineering- Sommerville, 7th edition, Pearson Education
Reference Books:	
1.	Software Engineering, an Engineering approach- James F. Peters, Witold Pedrycz, John Wiley.
2.	Software Engineering principles and practice- Waman S Jawadekar, The Mc Graw-Hill Companies.
3.	Fundamentals of object-oriented design using UML Meiler page-Jones: Pearson Education.
4.	The unified modeling language user guide Grady Booch, James Rambaugh, Ivar Jacobson, Pearson Education.

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23AMOE04	**OE**	**3**	**--**	**--**	**3**	**30**	**70**	**3 Hrs.**

DATABASE MANAGEMENT SYSTEMS

(Offered by AIML)

(Offered to CE, ECE, EEE & ME)

Course Objectives: This course aims to equip students with the following:

1.	Introduce database management systems
2.	Analyze database through systematic database design approaches
3.	Use SQL as a universal Database language
4.	Demonstrate normalization
5	Explain transaction management techniques

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

S.No	Outcome	Knowledge Level
1.	**Describe** database management systems fundamental concepts	K2
2.	**Analyze** databases using Conceptual and Logical database design	K4
3.	**Apply** SQL to Create, maintain and manipulate a relational database	K3
4.	**Apply** normalization for refining database schema	K3
5.	**Illustrate** Transaction management techniques.	K2

SYLLABUS

UNIT-I (08 Hrs)	Introduction: Databases and Database Management Systems, Characteristics of DBMS, DBMS Vs File System, Database Users, Database applications. Brief introduction of different Data Models, Introduction to Relational Database Management Systems, Concepts of Schema, Instance, three tier schema architecture for data independence, Database system structure, Centralized and Client Server architecture for the database.
UNIT-II (10 Hrs)	Relational Model: Introduction to relational model, concepts of domain, attribute, tuple, relation, importance of null values, constraints (Domain, Key constraints, integrity constraints) and their importance, Relational Algebra (select and project) . Entity Relationship Model: Introduction, Representation of entities, attributes, entity set, relationship, relationship set, constraints, extended features of ER model.
UNIT-III (12 Hrs)	SQL: Simple Database schema, data types, table definitions (create, alter), Creating tables with relationship, implementation of key and integrity constraints, different DML operations (insert, delete, update), Basic SQL querying (select and project) using where clause, nested queries, sub queries, grouping, aggregation, ordering, relational set operations, implementation of different types of joins, view (updatable and non-updatable).

UNIT-IV (10 Hrs)	Schema Refinement (Normalization): Purpose of Normalization or schema refinement, concept of functional dependency, closure of functional dependencies, normal forms based on functional dependencies, 1NF, 2NF and 3 NF, Boyce-Codd normal form (BCNF), Lossless join and dependency preserving decomposition.
UNIT-V (10 Hrs)	Transaction Concept: Transaction State, ACID properties, Concurrent Execution of transactions, Schedules, Serializability, Recoverability, Testing for Serializability, Lock based and timestamp-based concurrency protocols, Implementation of Isolation, Failure Classification, ARIES Recovery algorithm.
Textbooks:	
1.	Abraham Silberschatz, Henry F. Korth and S. Sudarshan (Author), Database System Concepts, 7th Edition, TMH, 2021.
2.	Raghu Ramakrishnan and Johannes Gehrke, Database Management Systems, 3rd Edition, Pearson, 2014
Reference Books:	
1.	C.J. Date, A. Kannan and S. Swamy Nathan, An Introduction to Database Systems, 8th Edition, Pearson, 2006.
2.	Elmasri Ramez and Navathe Shamkant, Fundamentals of Database System, 7th Edition, Pearson, 2017.
3.	Corlos Coronel, Steven Morris, Peter Robb, Database Principles Fundamentals of Design Implementation and Management, CBS publishers and Distributors, 2014.
e-Resources	
1.	https://nptel.ac.in/courses/106/105/106105175/
2.	https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0127580666728202245 6_shared/overview

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23AMOE04	**OE**	**3**	**--**	**--**	**3**	**30**	**70**	**3 Hrs.**

APPLIED MACHINE LEARNING

(Offered by AIML)

(Offered to CE, ECE, EEE & ME)

Course Objectives: This course aims to equip students with the following:

1.	Introduce the basic concepts and techniques of Machine Learning
2.	Demonstrate regression, classification and clustering methods.
3.	Introduce the concepts of dimensionality reduction, Regularization
4.	Illustrate the concepts of artificial neural networks and reinforcement learning

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

S.No	Outcome	Knowledge Level
1.	Use the concepts of Machine Learning and Feature Engineering	K3
2.	Apply data preprocessing techniques on real world datasets	K3
3.	Apply Classification metrics on different Supervised Algorithms	K3
4.	Apply Regression models and Support Vector Machines	K3
5.	Apply the concepts of Clustering and artificial neural networks	K3

SYLLABUS

UNIT-I (10Hrs)	**Introduction to Machine Learning:** Towards Intelligent Machines, Well-Posed Machine Learning Problems, Diversity of Data: Structured/Unstructured, forms of Learning, Supervised/Directed Learning, Unsupervised/Undirected Learning Reinforcement Learning **Features:** Kinds of features, Feature transformations: Thresholding and Discretization, Normalization, Incomplete Features
UNIT-II (10 Hrs)	**Data Preprocessing** Data quality – Data preprocessing: Data Cleaning: Handling missing data and noisy data, Data integration: Redundancy, Feature Selection, Data Reduction: Dimensionality reduction, Principal Components Analysis. **Decision Tree Learning:** Introduction, example of a Classification Decision Tree, Measures of Impurity for Evaluating splits in Decision Tree, Information gain/ Entropy reduction, Gain ratio.
UNIT-III (10 Hrs)	**Supervised Learning:** Learning from Observations, Bias and Variance, Estimating Generalization Errors: Holdout Method and Random Subsampling, Cross-validation,

	Bootstrapping, Metrics for Assessing Classification (Pattern Recognition) Accuracy: Misclassification Error, Confusion Matrix, Comparing Classifiers Based on ROC Curves **Bayesian Reasoning:** Bayes Theorem, Naive Bayes Classifier, Distance Measures, Non-Metric Similarity Functions, K-Nearest Neighbour (k-NN) Classifier
UNIT-IV (10 Hrs)	**Regression:** Metrics for Assessing Regression (Numeric Prediction) Accuracy: Mean Square Error, Mean Absolute Error, Linear Regression **Learning With Support Vector Machines (SVM)** Linear Discriminant Functions for Binary Classification, Linear Maximal Margin Classifier for Linearly Separable Data, Linear Soft Margin Classifier for Overlapping Classes
UNIT-V (10 Hrs)	**Learning With Neural Networks (NN):** Towards Cognitive Machine, Neuron Models: Biological Neuron, Artificial Neuron, Mathematical Model, Network Architectures: Feedforward Networks, Perceptron: Limitations of Perceptron Algorithm for Linear Classification Tasks, Multi-Layer Perceptron (MLP) Networks and the Error-Backpropagation Algorithm **Unsupervised Learning Techniques:** Clustering, Hierarchical Clustering, Partitional clustering: K-Means Clustering

Textbooks:	
1.	"Applied Machine Learning", M. Gopal, McGraw Hill Education (India) Private Limited, 2018.
2.	Thomas A. Runkler, Data Analytics: Models and Algorithms for Intelligent Data Analysis, Springer Vieweg, 2nd Edition, 2016.
Reference Books:	
1.	"Machine Learning Theory and Practice", M N Murthy, V S Ananthanarayana, Universities Press (India), 2024
2.	Machine Learning: An algorithmic perspective, Stephen Marsland, 2nd edition, CRC press, 2014.
3.	Machine Learning: The art and science of algorithms that make sense of data, Peter Flach, Cambridge, 2012
e-Resources	
1.	"Introduction to Machine Learning (IITKGP)" by Prof. Sudeshna Sarkar, on Swayam
2.	Applied Machine Learning - My BITS WILP Knowledge Base
3.	https://www.appliedaicourse.com/course/11/Applied-Machine-learning-course

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23CEOE03	OE	3	--	--	3	30	70	3 Hrs.

DISASTER MANAGEMENT

(Offered by Civil Engineering)

(Offered to AIDS, AIML, CSIT, CSBS, CSD, CSE, CIC, ECE, EEE, IT & ME)

Course Objectives:

1.	To provide an understanding of disasters, their types, causes, and the impact on communities, infrastructure, and the environment.
2.	To familiarize with disaster management frameworks, policies, and practices adopted at local, national, and international levels.

Course Outcomes: At the end of the course, the student will be able to

S. No	Outcome	Knowledge Level
1.	**Identify** the fundamental concepts of disasters, hazards, risks, and vulnerabilities, and apply them to analyze disaster impacts on people, property, and the environment.	K3
2.	**Classify** different types of natural and manmade disasters and utilize real-life case studies to understand their causes and consequences.	K3
3.	**Apply** the disaster management cycle and construct strategies for risk assessment, mitigation, and preparedness using national disaster management frameworks.	K3
4.	**Plan** and organize community-based disaster management and educational programs to strengthen disaster resilience and public awareness.	K3
5.	**Utilize** technological tools like GIS, remote sensing, and communication systems to construct disaster-resilient responses.	K3

SYLLABUS

UNIT-I (10Hrs)	**Fundamentals of Disasters and Their Impacts** Definition and concepts: Disaster, hazard, risk, vulnerability, capacity Classification: Natural and manmade disasters Impact of disasters: Loss of life, property, livelihood, environment Disaster profile of India and major hazard zones
UNIT-II (10 Hrs)	**Types of Disasters** Natural Disasters: Earthquake, Flood, Drought, Cyclone, Landslide Manmade Disasters: Industrial accidents, chemical spills, nuclear hazards, transport accidents Case studies of major national and global disasters
UNIT-III (10 Hrs)	**Disaster Management Framework** Disaster management cycle: Prevention, Mitigation, Preparedness, Response, Recovery, Risk assessment and vulnerability analysis, Structural vs. non-structural measures, Institutional frameworks: NDMA, SDMA, NDRF

UNIT-IV (10 Hrs)	**Community Preparedness and Education** Role of education in disaster risk reduction, Community-based disaster management (CBDM), School safety and public awareness, Role of social capital and local governance in disaster resilience.
UNIT-V (10 Hrs)	**Technology and Innovation in Disaster Management** Role of GIS, remote sensing, and early warning systems. Use of mobile apps, communication systems, and social media, Indigenous knowledge and modern practices, Technological innovations in disaster mitigation and response.
Textbooks	
1.	DisasterManagement–GlobalChallengesandLocalSolutions'byRajibshah&RRKrishnamurthy (2009), Universities press.
2.	'Disaster Management–Future Challenges and Opportunities' by Jagbir Singh (2007), IK International Publishing House Pvt. Ltd.
Reference Books	
1.	'Disaster Management' edited by HK Gupta (2003) Universities press.
2.	'Disaster Science & Management' by Tushar Bhattacharya, Tata McGraw Hill Education Pvt. Ltd., New Delhi.
e-Resources	
1.	https://onlinecourses.swayam2.ac.in/cec19_hs20/preview
2.	https://nptel.ac.in/courses/124107010

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23CEOE04	OE	3	--	--	3	30	70	3 Hrs.

GREEN BUILDINGS

(Offered by Civil Engineering)

(Offered to AIDS, AIML, CSIT, CSBS, CSD, CSE, CIC, ECE, EEE, IT & ME)

Course Objectives:

1.	Introduce the fundamentals and importance of green building design and operation.
2.	Familiarize students with voluntary environmental rating systems applicable in India.
3.	Develop an understanding of the logic and principles behind categories in IGBC, GRIHA, and LEED.

Course Outcomes: At the end of the course, the student will be able to

S. No	Outcome	Knowledge Level
1.	**Emphasize** the role of site selection and preparation in sustainable development of the built environment.	K2
2.	**Suggest** construction materials and finishes that meet the criteria of green building rating systems.	K2
3.	**Elaborate** on design options for energy and water conservation during building operation.	K2
4.	**Relate** building design elements to indoor environmental quality and describe relevant electromechanical systems.	K2
5.	**Paraphrase** the key requirements of IGBC, GRIHA, and LEED rating systems for green building certification.	K2

SYLLABUS

UNIT-I (8 Hrs)	**Site Selection and Preparation:** Introduction to green buildings – Benefits and features – Criteria for sustainable site selection – Greenfield and brownfield development – Resource preservation – Thermal comfort, daylighting, ventilation strategies – Stormwater management – Landscape and topsoil reuse.
UNIT-II (8 Hrs)	**Appropriate Materials and Design:** Green and renewable materials – FSC certification – Rapidly renewable resources: bamboo, eucalyptus, etc. – Alternative walling materials: rammed earth, adobe – Recycled content and waste reuse – Alternative roofing systems: vaults, domes – Thermal insulation solutions.
UNIT-III (8 Hrs)	**Energy & Water Conservation in Buildings:** Energy use in buildings: embodied and operational energy – Energy-saving opportunities in construction and operation – Water conservation techniques – Rainwater harvesting – Modular greywater/wastewater systems – Waste-to-energy initiatives in residential communities.
UNIT-IV (8 Hrs)	**Indoor Environment Quality:** Weather data and climate considerations – Climate change interactions with the built environment – Thermal, lighting, and acoustic comfort –

	Mechanical ventilation and HVAC basics – Passive design strategies – Green roofs – Case studies – Building automation and BMS.
UNIT-V (8 Hrs)	**Rating Systems and Sustainability Metrics:** Voluntary environmental rating systems in India – Overview of the National Building Code provisions – LEED: structure, process, levels – GRIHA: criteria, points system – IGBC: certification levels and procedures – Comparative insights and case-based interpretation.
Textbooks	
1.	Introduction to Green Buildings & Built Environment, Indian Green Building Council, BS Publications, 2023
2.	GRIHA Manual and Reference Guides by TERI Press (GRIHA Council)
Reference Books	
1.	Sun, Wind, and Light: Architectural Design Strategies, Mark DeKay, G.Z.Brown, 3rd Edition, John Wiley & Sons
2.	National Building Code of India (2016), Bureau of Indian Standards.
3.	LEED Reference Guides by GBCI
4.	IGBC Reference Guides by Indian Green Building Council
e-Resources	
1.	https://igbc.in/
2.	https://www.grihaindia.org/

Course Code	Category	L	T	P	C	I.M	E.M	Exam
B23CBOE03	OE	3	--	--	3	30	70	3 Hrs.

BUSINESS STRATEGY

(Offered by CSBS)

(Offered to CE, ECE, EEE & ME)

Course Objectives:

1.	To know the important aspects of strategic management in an organization.
2.	To provide basic insight into Internal Environment of a firm.
3.	To have a comprehensive view about the External Environment of a firm.
4.	To understand about the corporate strategy and growth strategies of business.
5.	To learn how to implement the strategy and to understand about Corporate governance.

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

S.No	Outcome	Knowledge Level
1.	To learn the fundamental concepts of strategic management to analyze business situations and apply these concepts to solve business problems.	K2
2.	To understand the fundamental principles of and interrelationships among business functions such as: R&D, production, marketing, finance, HR and information technology	K2
3.	To understand the inter-relationships of business to individuals, other organizations, government and society.	K2
4.	To predict the mode of strategy that a business can choose for its development in the future.	K2
5.	To relate the present business with competitors globally and implementing the appropriate strategy.	K2

SYLLABUS

UNIT-I (10 Hrs)	**Introduction to Strategic Management** Importance of Strategic Management, Vision and objectives, Schools of management thought in strategic management, Strategy Content, Process, and Practice, Fit concept and Configuration perspective in Strategic Management.
UNIT-II (10 Hrs)	**Internal Environment of Firm- Recognizing a Firm's Intellectual Assets** Core Competence as the Root of Competitive Advantage, sources of Sustained Competitive Advantage, Business Processes and Capabilities-based Approach to Strategy.
UNIT-III (10 Hrs)	**External Environments of Firm- Competitive Strategy** Five Forces of Industry Attractiveness that Shape Strategy, The concept of Strategic

	Groups, and Industry Life Cycle Generic Strategies, Generic Strategies and the Value Chain.
UNIT-IV (10 Hrs)	**Corporate Strategy, and Growth Strategies** The motive for Diversification, Related and Unrelated Diversification, Business Portfolio Analysis, Expansion, Integration and Diversification, Strategic Alliances, Joint Ventures, and Mergers & Acquisitions.
UNIT-V (10 Hrs)	**Strategy Implementation: Structure and Systems** The 7S Framework, Strategies for competing in the globalized markets and internet economy, Organizational values and their impact on strategies, Strategic Control and Corporate Governance.
Text Books:	
1.	Robert M. Grant (2012). *Contemporary Strategic Management*, Blackwell, 7th Edition.
Reference Books:	
1.	M.E. Porter, *Competitive Strategy*, 1980.M.E. Porter,
2.	*Competitive Advantage*, 1985 Richard Rumelt (2011).

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23CSOE03	OE	3	--	--	3	30	70	3 Hrs.

PRINCIPLES OF DATABASE MANAGEMENT SYSTEMS

(Offered by CSE)

(Offered to CE, ECE, EEE & ME)

Course Objectives: The main objectives of the course is to

1.	Introduce database management systems
2.	Analyze database through systematic database design approaches
3.	Use SQL as a universal Database language
4.	Demonstrate normalization
5	Explain transaction management techniques

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

S.No	Outcome	Knowledge Level
1.	**Describe** database management systems fundamental concepts	K2
2.	**Analyze** databases using Conceptual and Logical database design	K4
3.	**Apply** SQL to Create, maintain and manipulate a relational database	K3
4.	**Apply** normalization for refining database schema	K3
5.	**Illustrate** Transaction management techniques.	K2

SYLLABUS

UNIT-I (08 Hrs)	Introduction: Databases and Database Management Systems, Characteristics of DBMS, DBMS Vs File System, Database Users, Database applications. Brief introduction of different Data Models, Introduction to Relational Database Management Systems, Concepts of Schema, Instance, three tier schema architecture for data independence, Database system structure, Centralized and Client Server architecture for the database.
UNIT-II (10 Hrs)	Relational Model: Introduction to relational model, concepts of domain, attribute, tuple, relation, importance of null values, constraints (Domain, Key constraints, integrity constraints) and their importance, Relational Algebra (select and project) . Entity Relationship Model: Introduction, Representation of entities, attributes, entity set, relationship, relationship set, constraints, extended features of ER model.
UNIT-III (12 Hrs)	SQL: Simple Database schema, data types, table definitions (create, alter), Creating tables with relationship, implementation of key and integrity constraints, different DML operations (insert, delete, update), Basic SQL querying (select and project) using where clause, nested queries, sub queries, grouping, aggregation, ordering, relational set operations, implementation of different types of joins, view (updatable and non- updatable).

UNIT-IV (10 Hrs)	Schema Refinement (Normalization): Purpose of Normalization or schema refinement, concept of functional dependency, closure of functional dependencies, normal forms based on functional dependencies, 1NF, 2NF and 3 NF, Boyce-Codd normal form (BCNF), Lossless join and dependency preserving decomposition.
UNIT-V (10 Hrs)	Transaction Concept: Transaction State, ACID properties, Concurrent Execution of transactions, Schedules, Serializability, Recoverability, Testing for Serializability, Lock based and timestamp-based concurrency protocols, Implementation of Isolation, Failure Classification, ARIES Recovery algorithm.

Textbooks:	
1.	Abraham Silberschatz, Henry F. Korth and S. Sudarshan (Author), Database System Concepts, 7th Edition, TMH, 2021.
2.	Raghu Ramakrishnan and Johannes Gehrke, Database Management Systems, 3rd Edition, Pearson, 2014
Reference Books:	
1.	C.J. Date, A. Kannan and S. Swamy Nathan, An Introduction to Database Systems, 8th Edition, Pearson, 2006.
2.	Elmasri Ramez and Navathe Shamkant, Fundamentals of Database System, 7th Edition, Pearson, 2017.
3.	Corlos Coronel, Steven Morris, Peter Robb, Database Principles Fundamentals of Design Implementation and Management, CBS publishers and Distributors, 2014.
e-Resources	
1.	https://nptel.ac.in/courses/106/105/106105175/
2.	https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_ 01275806667282022456_shared/overview

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23CIOE03	**OE**	**3**	**--**	**--**	**3**	**30**	**70**	**3 Hrs.**

OPERATING SYSTEMS

(Offered by CIC)

(Offered to CE, ECE, EEE & ME)

Course Objectives: This course aims to equip students with the following:

1.	Understand the basic concepts and principles of operating Systems, including process management, memory management, file Systems, and Protection.
2.	Make use of process scheduling algorithms and synchronization techniques to achieve better performance of a computer System.
3.	Illustrate different conditions for deadlock and their possible solutions.

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

S.No	Outcome	Knowledge Level
1.	**Describe** various generations of Operating System and functions of Operating System, System calls	K2
2.	**Apply** various process scheduling algorithms and thread management techniques to optimize System performance.	K3
3.	**Apply** synchronization mechanisms and deadlock handling strategies to ensure efficient concurrent System operation.	K3
4.	**Analyze** the memory management strategies in OS to optimize the practical computing scenarios.	K4
5.	**Summarize** various file allocation methods, fundamental Protection techniques in OS to secure data integrity and accessibility.	K2

SYLLABUS

UNIT-I (10 Hrs)	**Operating Systems Overview:** Operating System Functions, Computing Environments, Free and Open-Source Operating Systems, **System Structures:** Operating System Services, User and Operating-System Interface, System Calls, Types of System Calls, System programs, Operating System Design and Implementation, Operating System Structure, Operating System debugging.
UNIT-II (10 Hrs)	**Processes:** Introduction, Process Scheduling, Operations on Processes, Inter-Process Communication. **Threads and Concurrency:** overview of threads**,** Multithreading models, Thread libraries, Threading issues. **CPU Scheduling:** Basic concepts, Scheduling criteria, Scheduling algorithms, Multiple processor scheduling.

UNIT-III (10 Hrs)	**Process Synchronization:** The Critical Section Problem, Peterson's Solution, Mutex Locks, Semaphores, Monitors, Classic problems of Synchronization. **Deadlocks:** System Model, Deadlock characterization, Methods for handling Deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock
UNIT-IV (10 Hrs)	**Memory-Management Strategies:** Introduction Contiguous memory allocation, Paging, Segmentation. **Virtual Memory Management:** Introduction, Demand paging, Page replacement. **Storage Management:** Overview of Mass Storage Structure, Disk Structure, Disk Scheduling.
UNIT-V (10 Hrs)	**File System:** File concept, Access methods, Directory Structure, File system Implementation, File-system structure, File-system Operations, Directory implementation, Allocation method**.** **Protection:** Goals of protection, Principles of protection, Protection Rings, Domain of protection, Access matrix.

Text Books:	
1.	Operating System Concepts, Silberschatz A, Galvin P B, Gagne G, 10th Edition, Wiley, 2018.
2.	Modern Operating Systems, Tanenbaum A S, 4th Edition, Pearson , 2016.
Reference Books:	
1.	Operating Systems -Internals and Design Principles, Stallings W, 9th edition, Pearson, 2018
2.	Operating Systems: A Concept Based Approach, D.M Dhamdhere, 3rd Edition, McGraw- Hill, 2013
e-Resources:	
1.	https://nptel.ac.in/courses/106/106/106106144/
2.	http://peterindia.net/OperatingSystems.html

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23CIOE04	**OE**	**3**	**--**	**--**	**3**	**30**	**70**	**3 Hrs.**

DATABASE MANAGEMENT SYSTEMS

(Offered by CIC)

(Offered to CE, ECE, EEE & ME)

Course Objectives: This course aims to equip students with the following:

1.	Introduce database management systems
2.	Analyze database through systematic database design approaches
3.	Use SQL as a universal Database language
4.	Demonstrate normalization
5	Explain transaction management techniques

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

S.No	Outcome	Knowledge Level
1.	**Describe** database management systems fundamental concepts	K2
2.	**Analyze** databases using Conceptual and Logical database design	K4
3.	**Apply** SQL to Create, maintain and manipulate a relational database	K3
4.	**Apply** normalization for refining database schema	K3
5.	**Illustrate** Transaction management techniques.	K2

SYLLABUS

UNIT-I (08 Hrs)	**Introduction:** Databases and Database Management Systems, Characteristics of DBMS, DBMS Vs File System, Database Users, Database applications. Brief introduction of different Data Models, Introduction to Relational Database Management Systems, Concepts of Schema, Instance, three tier schema architecture for data independence, Database system structure, Centralized and Client Server architecture for the database.
UNIT-II (10 Hrs)	**Relational Model:** Introduction to relational model, concepts of domain, attribute, tuple, relation, importance of null values, constraints (Domain, Key constraints, integrity constraints) and their importance, Relational Algebra (select and project). **Entity Relationship Model:** Introduction, Representation of entities, attributes, entity set, relationship, relationship set, constraints, extended features of ER model.
UNIT-III (12 Hrs)	**SQL:** Simple Database schema, data types, table definitions (create, alter), Creating tables with relationship, implementation of key and integrity constraints, different DML operations (insert, delete, update), Basic SQL querying (select and project) using where clause, nested queries, sub queries, grouping, aggregation, ordering, relational

	set operations, implementation of different types of joins, view (updatable and non-updatable).
UNIT-IV (10 Hrs)	**Schema Refinement (Normalization)**: Purpose of Normalization or schema refinement, concept of functional dependency, closure of functional dependencies, normal forms based on functional dependencies, 1NF, 2NF and 3 NF, Boyce-Codd normal form (BCNF), Lossless join and dependency preserving decomposition.
UNIT-V (10 Hrs)	**Transaction Concept:** Transaction State, ACID properties, Concurrent Execution of transactions, Schedules, Serializability, Recoverability, Testing for Serializability, Lock based and timestamp-based concurrency protocols, Implementation of Isolation, Failure Classification, ARIES Recovery algorithm.

Text Books:	
1.	Abraham Silberschatz, Henry F. Korth and S. Sudarshan (Author), Database System Concepts, 7th Edition, TMH, 2021.
2.	Raghu Ramakrishnan and Johannes Gehrke, Database Management Systems, 3rd Edition, Pearson, 2014
Reference Books:	
1.	C.J. Date, A. Kannan and S. Swamy Nathan, An Introduction to Database Systems, 8th Edition, Pearson, 2006.
2.	Elmasri Ramez and Navathe Shamkant, Fundamentals of Database System, 7th Edition, Pearson, 2017.
3.	Corlos Coronel, Steven Morris, Peter Robb, Database Principles Fundamentals of Design Implementation and Management, CBS publishers and Distributors, 2014.
e-Resources:	
1.	https://nptel.ac.in/courses/106/105/106105175/
2.	https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0127580666728202245 6_shared/overview

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23ECOE02	OE	3	--	--	3	30	70	3 Hrs

LINEAR AND DIGITAL IC APPLICATIONS

(Offered by ECE)

(Offered to AIDS, AIML, CE, CSIT, CSBS, CSD, CSE, CIC, EEE, IT & ME)

Course Objectives:

1.	To design linear and non-linear applications of operational amplifier
2.	To analyze the concepts of Active filters and waveform generators
3.	To design the basic applications using 555 IC Timer
	To analyze the concepts of Analog to digital and Digital to Analog converters
	To analyze the concepts of various Digital Logic Families

Course Outcomes

S.No	Outcome	Knowledge Level
1.	**Explain** the working of various op-amp based linear and nonlinear applications	**K2**
2.	**Describe** the principles and design of Active filters and oscillators	**K2**
3.	**Understand** the internal block diagram and operating modes of the 555 timer IC	**K2**
4.	**Explain** the architecture and working of ADC'S and DAC's	**K2**
5.	**Explain** the structure and working of basic combinational and sequential circuits	**K2**

SYLLABUS

UNIT-I (12 Hrs)	Applications of operational amplifiers: Basics of Op-Amp, Block Diagram, Ideal characteristics, op-amp parameters-definitions, open loop, and closed loop op-amp configurations, Applications of op-amp- summing amplifier, subtractor, Basic Integrator, Basic differentiator, Op-amp As a Comparators, Schmitt trigger
UNIT-II (9 Hrs)	Active filters and Oscillators: Introduction to Active filters- Butterworth type first order LPF, first order HPF, Introduction to oscillators-Op-Amp Phase Shift oscillator, Wein-bridge oscillator, Quadrature Oscillator, Voltage to current and current to voltage converters.
UNIT-III (10 Hrs)	Special IC's Introduction, Block diagram, 555 timer as an Astable and Monostable Multivibrator, Applications of 555 Timer as Monostable multivibrator- Frequency divider, Pulse stretcher, Pulse width modulation, Applications of 555 Timer as Astable Multivibrator- Square wave oscillator, Schmitt trigger, IC 565 PLL block diagram
UNIT-IV	D to A and A to D CONVERTERS: Introduction, basic DAC techniques – weighted

(08 Hrs)	resistor DAC, R-2R ladder DAC, inverted R-2R DAC, A to D converters – parallel comparator type ADC, counter type ADC, successive approximation ADC.
UNIT-V (10 Hrs)	CMOS LOGIC: Standard TTL, ECL, MOS LOGIC-Inverter, NOR NAND. CMOS Logic-Inverter, NAND, NOR Combinational logic circuits: Multiplexer(4x1), Demultiplexer(1x4), 4-bit Magnitude comparator Sequential circuits: Flip flops- SR FF,JK,T-FF, D-FF
Textbooks:	
1.	D. Roy Choudhury, Shail B. Jain (2012), Linear Integrated Circuit, 4th edition, New Age International Pvt., Ltd., New Delhi, India.
2.	Floyd, Jain (2009), Digital Fundamentals, 8th edition, Pearson Education, New Delhi.
Reference Books:	
1.	Ramakant A. Gayakwad, (2012), OP-AMP and Linear Integrated Circuits, 4th edition, Prentice Hall / Pearson Education, New Delhi.
e-Resources	
1.	**Op-Amp Practical Applications: Design, Simulation and Implementation https://nptel.ac.in/courses/108/108/108108114/**
2.	**https://www.youtube.com/watch?v=yt1Fwrc8ysk**

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23EEOE03	OE	3	--	--	3	30	70	3 Hrs.

SENSORS AND TRANSDUCERS

(Offered by EEE)

(Offered to AIDS, AIML, CE, CSIT, CSBS, CSD, CSE, CIC, ECE, IT & ME)

Course Objectives: Students will learn

1.	The basic principles of Sensors & Transducers, classification and their characteristics
2.	About the concepts of Electromechanical and Radiation Sensors
3.	About the basics of thermal sensors
4.	About the basics of Magnetic sensors
5.	The Recent Trends in Sensor Technologies and their applications

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

S.No	Outcome	Knowledge Level
1.	Apply the principles to understand the characteristics & classification of Sensors and Transducers	K3
2.	Explore the concepts and construction of Electromechanical and Radiation Sensors	K3
3.	Explore the concepts and construction of Thermal sensors	K3
4.	Explore the concepts and construction of Magnetic sensors	K3
5.	Illustrate the Recent Trends in Sensor Technologies and applications	K3

SYLLABUS

UNIT-I (10Hrs)	**Introduction to Sensors/Transducers:** Sensors/Transducers, Principles, Classification, Parameters (Characteristics), Environmental Parameters, Electrical, Mechanical and Thermal Characterizations.
UNIT-II (10 Hrs)	**Electromechanical and Radiation Sensors:** Introduction, Inductive Sensors- Sensitivity and Linearity of the Sensor, Ferromagnetic Plunger Type Transducers, Capacitive Sensors- The Parallel Plate Capacitive Sensor, Ultrasonic Sensors. Types of accelerometers- potentiometric type accelerometer, LVDT accelerometers, Piezo electric accelerometer. Basic Characteristics of radiation sensors, Types of Photosensistors /Photodetectors, Photoconductive Cell-The LDR.
UNIT-III (10 Hrs)	**Thermal Sensors:** Introduction-Gas Thermometric Sensors, Acoustic Temperature Sensor, Thermal Radiation Sensors-Detectors, Spectroscopic Thermometry, Noise Thermometry, Heat Flux Sensors.

UNIT-IV (10 Hrs)	**Magnetic Sensors:** Introduction - Hall Effect and Sensors, Inductance and Eddy Current Sensors- Variable Inductance Sensors- Variable gap sensor, Angular/Rotary Movement Transducers- Synchro's, Electromagnetic Flowmeter, Switching Magnetic Sensors- Pulse Wire Sensor, SQUID Sensors.
UNIT-V (10 Hrs)	**Recent Trends in Sensor Technologies & Applications:** Introduction- Film Sensors-Thick Film Sensors-Thin Film Sensors, Semiconductor IC Technology-Standard Methods, Microelectromechanical Systems (MEMS), Nano-sensors. On-board Automotive Sensors, Home Appliance Sensors, Aerospace Sensors, Medical Diagnostic Sensors, Sensors for Environmental Monitoring.
Textbooks:	
1.	SENSORS AND TRANSDUCERS by D. Patranabis © 2003 by PHI Learning Private Limited, Delhi, 2nd Edition ISBN-978-81-203-2198-4
2.	Sawhney A.K., "A Course in Electrical & Electronic Measurement and Instrumentation," Dhanpat Rai & Company Private Limited, New Delhi, 18th Edition, 2007.
Reference Books:	
1.	SENSORS AND TRANSDUCERS by I. Sinclair 2011, by Newes Publications, Delhi, 3rd Edition ISBN: 0756049321
2.	Measurement Systems: Application & Design, E.A. Doebelin, Mc Graw Hill, 4th Edition, 1989.
e-Resources:	
1.	nptel.ac.in/courses/108108147
2.	https://nptel.ac.in/courses/108102191

Course Code	Category	L	T	P	C	I.M	E.M	Exam
B23EEOE04	OE	3	--	--	3	30	70	3 Hrs.

MATLAB PROGRAMMING FOR ENGINEERING APPLICATIONS

(Offered by EEE)

(Offered to AIDS, AIML, CE, CSIT, CSBS, CSD, CSE, CIC, ECE, IT & ME)

Course Objectives: Students will learn about

1.	The MATLAB basics, built-in functions, matrix operations, plotting commands.
2.	The conditional and looping statements to write MATLAB programs.
3.	The different statistical approaches for better interpretation of data using MATLAB.
4.	The MATLAB programming to solve engineering systems described by the mathematical equations.
5.	The MATLAB programming for numerical methods.

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

S.No	Outcome	Knowledge Level
1.	Explore the MATLAB basics, built-in functions, matrix operations, plotting commands.	K3
2.	Apply the conditional and looping statements to write MATLAB programs.	K3
3.	Apply different statistical approaches for better interpretation of data using MATLAB.	K3
4.	Apply MATLAB programming to solve engineering systems described by the mathematical equations.	K3
5.	Apply MATLAB programming for numerical methods.	K3

SYLLABUS

UNIT-I (10 Hrs.)	**Introduction to MATLAB:** History, purpose and importance, data types, conversion of data types, operators, built-in functions, creating vectors, matrices, manipulation of vectors and matrices, Matrix Operations, addition, subtraction, multiplication, transpose, Inverse, Determinant, Identity matrix, simple 1-D, 2-D Plotting Functions, line plots, sub-plots, bar plots, surface plots, pie plots, Saving and loading data.
UNIT-II (10 Hrs.)	**MATLAB Programming:** Program Design and Development, Relational Operators and Logical Variables, Logical Operators, IF statement, Else-if statement, Else statement, Switch Statement, For Loops, While Loops, Debugging MATLAB Programs, MATLAB programs using conditional & Iterative loops.
UNIT-III (10 Hrs.)	**Statistics, Probability and Interpolation:** Statistics and Histograms, The Normal Distribution, Mean, Mode, Median and Standard Deviation, Uniformly Distributed Numbers, Normally Distributed Random Numbers,

	Generating Random Integers, one dimensional Interpolation, curve fitting using least square method.
UNIT-IV (10 Hrs.)	**Solving Equations:** Linear algebra, Rank, Eigen values, Eigen vectors, Linear algebraic equations solving using matrices (up to three variables), Gauss elimination method, Matrix inverse method, quadratic equation, ordinary differential equation (up to second order), solution of partial differential equation using MATLAB (two variable).
UNIT-V (10 Hrs.)	**Numerical Methods:** Gauss-seidal method, Newton Raphson method for solving nonlinear equations, Rungekutta-4 method for solving ordinary differential equations Trapezoidal method for solving numerical integration using MATLAB.
Textbooks:	
1.	MATLAB and Simulink Crash Course for Engineers by Eklas Hossain, Oregon Institute of Technology Klamath Falls, OR, USA, Springer publication, 1st Edition, 2022.
2.	Applied Numerical Methods Using Matlab, by Won Young Yang Chung, Wenwu Cao, Tae-Sang Chung, John Morris, A John Wiley & Sons, Inc., Publication, 1st Edition, 2005.
Reference Books:	
1.	MATLAB ® for Engineering Applications by William J. Palm III, 4th Edition, New York, NY: McGraw-Hill Education, 2018.
2.	MATLAB Programming for Engineers, Stephen J.Chapman, 3rd Edition, Thomson Learning publication, 2005.
e - Resources:	
1.	https://nptel.ac.in/courses/103106118
2.	https://nptel.ac.in/courses/111102137

Course Code	Category	L	T	P	C	C.I.E.	S.E.E	Exam
B23ITOE02	OE	3	--	--	3	30	70	3 Hrs.

SOFTWARE ENGINEERING

Offered by IT

(Offered to CE, ECE, EEE & ME)

Course Objectives: Students are expected to

1.	The aim of the course is to provide an understanding of the working knowledge of the techniques for estimation, design, testing and quality management of large software development projects.
2.	Topics include process models, software requirements, software design, software testing, software process/product metrics, risk management, quality management and UML diagrams

Course Outcomes: By the end of the course, the student will be able to:

S.No	Outcome	Knowledge Level
1.	Decompose the given project in various phases of a lifecycle and choose appropriate process model depending on the user requirements.	K3
2.	perform various life cycle activities like Analysis, Design, Implementation, Testing and Maintenance	K4
3.	Apply appropriate software architectures and patterns to carry out high level design of a system and be able to critically compare alternative choices.	K3
4.	Will have experience and/or awareness of testing problems and will be able to develop a simple testing report.	K3

SYLLABUS

UNIT-I (10Hrs)	Introduction to Software Engineering: The evolving role of software, changing nature of software, software myths. A Generic view of process: Software engineering- a layered technology, a process framework, the capability maturity model integration (CMMI), process patterns, process assessment, personal and team process models. Process models: The waterfall model, incremental process models, evolutionary process models, the unified process.
UNIT-II (10 Hrs)	Software Requirements: Functional and non-functional requirements, user requirements, system requirements, interface specification, the software requirements document. Requirements engineering process: Feasibility studies, requirements elicitation and analysis, requirements validation, requirements management. System models: Context models, behavioral models, data models, object models, structured methods.
UNIT-III (10 Hrs)	Design Engineering: Design process and design quality, design concepts, the design model. Creating an architectural design: software architecture, data design, architectural styles and patterns, architectural design, conceptual model of UML, basic structural modeling, class diagrams, sequence diagrams, collaboration diagrams, use case diagrams,

	component diagrams.
UNIT-IV (10 Hrs)	Testing Strategies: A strategic approach to software testing, test strategies for conventional software, black-box and white-box testing, validation testing, system testing, the art of debugging.
UNIT-V (10 Hrs)	Metrics for Process and Products: Software measurement, metrics for software quality. Product metrics: Software quality, metrics for analysis model, metrics for design model, metrics for source code, metrics for testing, metrics for maintenance. Quality Management: Quality concepts, software quality assurance, software reviews, formal technical reviews, statistical software quality assurance, software reliability, the ISO 9000 quality standards.

Textbooks:	
1.	Software Engineering, A practitioner's Approach- Roger S. Pressman, 6 th edition, Mc Graw Hill International Edition
2.	Software Engineering- Sommerville, 7th edition, Pearson Education
Reference Books:	
1.	Software Engineering, an Engineering approach- James F. Peters, Witold Pedrycz, John Wiley.
2.	Software Engineering principles and practice- Waman S Jawadekar, The Mc Graw-Hill Companies.
3.	Fundamentals of object-oriented design using UML Meiler page-Jones: Pearson Education.

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23MEOE03	OE	3	--	--	3	30	70	3 Hrs.

INDUSTRIAL MANAGEMENT

(Offered by ME)

(Offered to AIDS, AIML, CE, CSIT, CSBS, CSD, CSE, CIC, ECE, EEE & IT)

Course Objectives: The objectives of the course are to

1.	Introduce the scope and role of industrial engineering and the techniques for optimal design of layouts
2.	To know the production activities with reference to planning and control
3.	Illustrate how work study is used to improve productivity
4.	Explain TQM and quality control techniques
5.	Discuss human resource management and value analysis.

Course Outcomes: After completing this course, students will be able to:

S.No	Outcome	Knowledge Level
1.	**Use** principles and quantitative techniques to optimize plant layouts and productivity.	K3
2.	**Apply** production planning techniques to optimize scheduling and process control.	K3
3.	**Demonstrate** method study and time measurement techniques to optimize work processes.	K3
4.	**Apply** SQC techniques and TQM methods to analyze quality data and improve production systems	K3
5.	**Demonstrate** HRM strategies and value engineering for organizational improvement	K3

SYLLABUS

UNIT-I (10 Hrs)	**INTRODUCTION:** Definition of industrial engineering (I.E), development, applications, role of an industrial engineer, differences between production management and industrial Engineering, quantitative tools of IE and productivity measurement. concepts of management, importance, functions of management, scientific management, Taylor's Principles, theory X and theory Y, Fayol's principles of management. **PLANT LAYOUT:** Factors governing plant location, types of production layouts, advantages and disadvantages of process layout and product layout, applications, quantitative techniques for optimal design of layouts, plant maintenance, preventive and Break down maintenance.

UNIT-II (10 Hrs)	**PRODUCTION PLANNING AND CONTROL:** Types of productions, Production cycle, Product design and development, Process planning, Forecasting (simple problems), Loading, Scheduling, Dispatching, Routing, Progress control.
UNIT-III (10 Hrs)	**WORK STUDY:** Concept of productivity, Method study – Basic steps in work study, method study, Process charts, Diagrams, work sampling ,PMTS, Principles of motion economy, Micro motion study, Therbligs, SIMO chart, Work measurement – Stop watch procedure of time study, Performance rating, Allowances
UNIT-IV (10 Hrs)	**STATISTICAL QUALITY CONTROL:** Quality control, Quality assurance and its importance, SQC, attribute sampling inspection with single and double sampling, Control charts for variables and attributes, numerical examples. **TOTAL QUALITY MANAGEMENT:** Zero defect concept, quality circles, implementation, applications, ISO quality systems. Six Sigma–definition, basic concepts.
UNIT-V (10 Hrs)	**HUMAN RESOURCE MANAGEMENT:** Concept of human resource management, personnel management and industrial relations, functions of personnel management, Job evaluation, its importance and types, merit rating, quantitative methods, wage incentive Plans and types. **VALUE ANALYSIS:** Value engineering, implementation procedure, enterprise resource Planning and supply chain management.
Textbooks:	
1.	Industrial Engineering and Management by Dr. O P Khanna
2.	Mart and Telsang, Industrial Engineering and Production Management, S.Chand&Company Ltd.NewDelhi, 2006.
Reference Books:	
1.	Industrial Management/ Bhattacharya DK/Vikas publishers.
2.	Operations Management/ J.G Monks/ McGraw Hill Publishers.
3.	Industrial Engineering and Management Science/T.R.Banga, S.C.Sharma, N.K.Agarwal/, Khanna Publishers.
4.	Principles of Management/ KoontzO' Donnel/ McGraw Hill Publishers.
5.	Statistical Quality Control/ Gupta/Khanna Publishers.
6	Industrial Engineering and Management/ NVS Raju/ Cengage Publishers.
7	Production and Operations Management by Everette Adam & Ronald Ebert
e-Resources	
1.	https://nptel.ac.in/courses/112107292

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23MEOE04	OE	3	--	--	3	30	70	3 Hrs.

PRODUCT DESIGN AND DEVELOPMENT

(Offered by ME)

(Offered to AIDS, AIML, CE, CSIT, CSBS, CSD, CSE, CIC, ECE, EEE & IT)

Course Objectives:

1.	To impart the process of product design and Development
2.	To expose the various factors influencing product design.

Course Outcomes

S.No	Outcome	Knowledge Level
1.	**Apply** the product design and development process to solve engineering problems	**K3**
2.	**Demonstrate** concept generation, selection and robust design using design morphology.	**K3**
3.	**Use** product planning methods to convert needs into specifications.	**K3**
4.	**Use** creative thinking to generate, select and test product concepts.	**K3**
5.	**Apply** DFX principles to optimize designs, ensuring cost, legal and ethical compliance.	**K3**

SYLLABUS

UNIT-I (10Hrs)	**Introduction**: Classification/Specifications of Products, Product life cycle. Product mix, Introduction to product design, Modern product development process, Innovative thinking.
UNIT-II (10 Hrs)	**Morphology of design:** Conceptual Design: Generation, selection & embodiment of concept. Product architecture, Industrial design: process, need, Robust Design Development Economics - quantitative and qualitative analysis
UNIT-III (10 Hrs)	**Product planning:** Identify opportunities, prioritize projects, allocate resources, project planning, Identify customer needs, product specifications, target specifications and final specifications, concept generation and selection
UNIT-IV	**Creativity Techniques:** Creative thinking, concept generation: clarify the problem

(10 Hrs)	search external and internal explorer systematically, concept selection & testing, concurrent engineering, rapid prototyping, 3D printing and 3D scanning
UNIT-V (10 Hrs)	**Design for X(DFX):** Design for Manufacturing (DFM) & Assembly (DFA), Designs for Maintainability, Designs for Environment, Product costing, Legal factors, Engineering ethics and issues of society related to design of products, Forms of intellectual property and steps involved in patent filing.

Textbooks:	
1.	Karl T Ulrich, Steven D Eppinger, “Product Design & Development.” Tata McGrawhill New Delhi 2003.
2.	David G Ullman, “The Mechanical Design Process.” McGrawhill Inc Singapore 1992.
Reference Books:	
1.	Hollins B & Pugh S “Successful Product Design.” Butter worth London.
2.	Jones J C “Design Methods.” Seeds of Human Futures. John Willey New York.
3.	Bralla J G “Handbook of Product Design for Manufacture, McGrawhill NewYork.
4.	N J M Roozenberg, J Ekels, N F M Roozenberg “Product Design Fundamentals and Methods”
e-Resources	
1.	https://nptel.ac.in/courses/112107217
2.	https://onlinecourses.nptel.ac.in/noc21_me66/preview

Course Code	Category	L	T	P	C	I.M	E.M	Exam
B23MEOE05	OE	3	--	--	3	30	70	3 Hrs.

OPERATIONS MANAGEMENT

(Offered by ME)

(Offered to AIDS, AIML, CE, CSIT, CSBS, CSD, CSE, CIC, ECE, EEE & IT)

Course Objectives:

1.	Todevelopanunderstandingofhowtheoperations,havestrategicimportanceandcanprovidea Competitive advantage in the workplace.
2.	Tounderstandthemanagingofoperationsintheplanningandcontrollingphaseofa production/operations system.

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

S.No	Outcome	Knowledge Level
1.	**Apply** operations management principles and forecasting methods to solve basic production and prediction problems.	K3
2.	**Demonstrate** different plant layout types and interpret the criteria for selecting suitable facility locations.	K3
3.	**Use** aggregate planning and master scheduling principles to optimize operations planning and scheduling in assembly and process industries.	K3
4.	**Apply** the basic inventory control techniques in operation environment.	K3
5.	**Use** resource planning techniques to integrate planning objectives and scheduling logic for production efficiency.	K3

SYLLABUS

UNIT-I (10Hrs)	**Operations Management (OM):** Introduction and Definition; Operations/Production System Model and examples of various production or operating systems; Factors affecting OM; Typical operations under OM. **Forecasting:** Importance of forecasting in OM and different types of forecasting; Methods of Forecasting: qualitative and quantitative(simple problems only).
UNIT-II (8Hrs)	**Facility/ Plant Location:** Introduction; Factors affecting the plant location; Rural v/s Urban sites. **Facility/Plant Layout:** Introduction, Objectives of plant layout; Determinants and Types of layouts ; Comparison of layouts for Goods and Services.

UNIT-III (10 Hrs)	**Aggregate Planning and Master Scheduling:** Overview of Operations Planning and Scheduling system; The concept of aggregation, goals for aggregate planning and the costs associated with aggregate planning; Aggregate planning Guidelines; Aggregate planning strategies; Master Scheduling – Introduction, Functions, and guidelines; Assembly v/s Process industry scheduling; Difference between Master Scheduling and Shop Floor Scheduling.
UNIT-IV (10Hrs)	**Fundamentals of Inventory Control:** Inventory defined; Why inventories? Manufacturing v/s Distribution Inventory; Multistage Inventory v/s Multiechelon Inventory; Inventory systems: Q/R Inventory system, Periodic Inventory system, and JIT Inventory system; Inventory costs; Problems on basic EOQ model; Selective inventory control techniques: ABC analysis, VED analysis.
UNIT-V (10Hrs)	**Resource Requirement Planning:** MRP and CRP overview; objectives of MRP; Input sto MRPsystem, OutputstoMRP system, and MRP logic; Limitations and Advantages of MRP; MRP-II; ERP; Introduction to JIT Manufacturing philosophy and its benefits.

Text Books:	
1.	Operations Management by Norman Gaither and Greg Frazier
2.	Production and Operations management by Everett E.Adam,Jr.AndRonaldJ.Ebert
3.	Operations Management by Joseph. G.Monks, International(3rd)Edition
4.	Modern Production/operations management by Buffa & Rakesh Sarin
Reference Books:	
1.	Operations Management by S.N.Chary.
2.	Inventory Control Theory and Practice by Martin K.Starr and David W.Miller.
3.	Production And Operation Management by Mart and Telsang
4.	Production Control A Quantitative Approach by John E. Biegel.
5.	Production Control by Moore.
e-Resources:	
1.	https://nptel.ac.in/courses/110107141
2.	https://onlinecourses.nptel.ac.in/noc20_me30/preview

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23MEOE06	OE	3	--	--	3	30	70	3 Hrs.

ADVANCED MANUFACTURING PROCESSES

(Offered by ME)

(Offered to AIDS, AIML, CE, CSIT, CSBS, CSD, CSE, CIC, ECE, EEE & IT)

Course Objectives:

1.	To learn the basic principle of advanced machining processes.
2.	To know about the various additive manufacturing processes.
3.	To understand the principles of coating and processing of ceramics.
4.	To get insights about processing of composites and nanomaterials.
5.	To know the fabrication of microelectronic components.

Course Outcomes

S.No	Outcome	Knowledge Level
1.	**Apply** machining principles to determine the suitable process for specific material removal and surface quality requirements.	**K3**
2.	**Use** different Additive Manufacturing techniques to determine the suitable approach for a given product.	**K3**
3.	**Determine** surface treatment techniques and macroscopic properties of ceramics.	**K3**
4.	**Apply** macroscopic properties of composites and nanomaterials based on their processing techniques.	**K3**
5.	**Determine** microelectronic device fabrication and their interdependencies to achieve a functional circuit.	**K3**

SYLLABUS

UNIT-I (10Hrs)	**ADVANCED MACHINING PROCESSES:** Introduction, Need, AJM, WJM, Wire-EDM.ECM, LBM, EBM, PAM - Principle, working, advantages, limitations, Process Parameters and applications
UNIT-II (10 Hrs)	**ADDITIVE MANUFACTURING:** Working Principles, Methods, Stereo Lithography, LENS, LOM, Laser Sintering, Fused Deposition Method, 3DP Applications and Limitations, Direct and Indirect Rapid tooling techniques.
UNIT-III (10 Hrs)	**SURFACE TREATMENT:** Scope, Cleaners, Methods of cleaning, Surface coating types, Electro forming, Chemical vapour deposition, Physical vapour deposition, thermal spraying methods, ceramic and organic methods of coating and cladding methods. **PROCESSING OF CERAMICS:** Applications, characteristics, classification, Processing

	of particulate ceramics, Powder preparations, consolidation, hot compaction, drying, sintering, and finishing of ceramics.
UNIT-IV (10 Hrs)	**PROCESSING OF COMPOSITES:** Composite Layers, Particulate and fiber reinforced composites, Elastomers, Reinforced plastics, processing methods for MMC, CMC, Polymer matrix composites. **PROCESSING OF NANOMATERIALS:** Introduction, Top down Vs Bottom up techniques-Ball milling, Lithography, Plasma Arc Discharge, Pulsed Laser Deposition, Sputtering, Sol-Gel, Molecular beam Epitaxy
UNIT-V (10 Hrs)	**FABRICATION OF MICROELECTRONIC DEVICES:** Crystal growth and wafer preparation, Film Deposition, oxidation, lithography, bonding and packaging, reliability and yield, Printed Circuit boards, surface mount technology, Integrated circuit economics.

Textbooks:	
1.	Manufacturing Engineering and Technology/Kalpakijian / Adisson Wesley,1995.
2.	Process and Materials of Manufacturing / R. A. Lindburg / Ith edition, PHI,1990.
Reference Books:	
1.	Microelectronic packaging handbook / Rao. R. Thummala and Eugene, J. Rymaszewski/ Van NostrandRenihold,
2.	MEMS & Micro Systems Design and manufacture / Tai - Run Hsu / TMGH
3.	Advanced Machining Processes / V.K.Jain / Allied Publications.
4.	Introduction to Manufacturing Processes / John A Schey/McGraw Hill.
5.	Introduction to Nanoscience and Nano Technology/ Chattopadhyay K.K/A.N.Banerjee/ PHI Learing
e-Resources	
1.	https://archive.nptel.ac.in/courses/112/107/112107078/

Course Code	Category	L	T	P	C	C.I.E.	S.E.E.	Exam
B23BSOE02	**OE**	**3**	**--**	**--**	**3**	**30**	**70**	**3 Hrs.**

MATHEMATICS FOR QUANTUM COMPUTING

(Offered by M&H)

(Offered to AIDS, AIML, CE, CSIT, CSBS, CSD, CSE, CIC, ECE, EEE, IT & MECH)

Course Objectives: Students are expected

1.	To be proficient in basic Math concepts like Complex Numbers, Linear Algebra including Vector spaces and their representation through operators in quantum computing.
2.	To understand the key differences between qubits and classical bits, classical logical Gates and Quantum Gates and how these differences impact computation.
3.	To understand quantum algorithms such as Shor's algorithm or Grover's algorithm, and how they leverage quantum mechanics for computational speedups.

Course Outcomes: At the end of this course, Students will

S.No	Outcome	Knowledge Level
1.	**Use** the Dirac's Bra-Ket notations in Quantum Mechanics to represent a Quantum state.	**K3**
2.	**Apply** the concepts of Matrix algebra and Linear operators in Quantum Computing.	**K3**
3.	**Apply** the Classical Logical Gates and their limitations in Quantum Computers.	**K3**
4.	**Use** the concepts of Quantum Gates and its reversible property which is crucial in Quantum computation**.**	**K3**
5.	**Use** tensor products in the aspects of Superposition and Entanglement required in Quantum Computing. Transmit Quantum Data by sending classical bits with unique features – Teleportation and Superdense coding. Develop Quantum Algorithms.	**K3**

SYLLABUS

UNIT-I (10Hrs)	**Complex numbers, Vector Space and Dirac Notation:** Complex numbers, Complex Conjugation, Vector Space, Basis set, Dirac notation: Ket & Bra, their Properties, Inner product, Linearly Dependent and Independent Vectors, Dual Vector Space, Computational Basis and Outer Product.
UNIT-II (10 Hrs)	**Matrices and Operators:** Matrices, Square Matrices, Diagonal (or Triangular Matrix), Operators, Rules for Operators, Linear Operator, Commutator, Matrix representation of a Linear Operator, Symmetric Matrix, Transpose Operation, Orthogonal Matrices, Identity Operator, Adjoint Operator, Hermitian Operator, Unitary Operators, Properties of Unitary Operators and Projection Operator.

UNIT-III (10 Hrs)	**Boolean Algebra, Logic Gates and Qubits:** Boolean Algebra, Classical Circuit Computational Model, Universal Logic Gates, Quantum Computation, The Quantum Bit and its Representations, Superposition in Quantum Systems and Quantum Register.
UNIT-IV (10 Hrs)	**Quantum Gates and Circuits :** Introduction to Quantum Gates, Single Qubit Gates; Pauli-X, Y& Z Gates, $\sqrt{\text{NOT}}$ Gate, Hadamard Gate, Phase Gate or S-Gate, *T* Gate or 8-Gate, Reversible Logic, Multiple Qubit Gates; *CNOT* Gate, Controlled-$\mathcal{U}$ Gate, Reversible Gates: Fredkin Gate, Toffoli Gate, Peres Gate.
UNIT-V (10 Hrs)	**Tensor Products and Quantum Algorithms.** **Tensor Products, Superposition and Quantum Entanglement:** Tensor Products, Multi-Qubit Systems, Superposition, Entanglement, Decoherence. **Quantum Algorithms-** Grover's search algorithm and Shor's algorithm
Textbooks:	
1.	PARAG K. LALA**, Quantum Computing – A beginner's Introduction**, Mc Graw Hill, 2019 Edition or Later.
Reference Books:	
1.	David Mc Mahon, **Quantum Computing Explained,** A John Wiley & Sons, Inc., Publication
2.	Issac L. Chuang and Michael Nielsen**, Quantum Computation and Quantum Information** by, Cambridge University Press.
3.	Leonard S. Woody III**, Essential Mathematics for Quantum Computing**
4.	Chris Bernhardt**, Quantum Computing for Everyone**, The MIT Press, Cambridge.
5.	Wolfgang Scherer**, Mathematics of Quantum Computing – An Introduction**, Springer.
e-Resources	
1.	https://onlinecourses.nptel.ac.in/noc25_cs95/preview
2.	https://nptel.ac.in/courses/106106232
3.	https://onlinecourses.nptel.ac.in/noc19_cy31/preview