FIFTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
22II501T	Operating Systems	3	---	---	3	30	70	100

Course Objectives	Course Outcomes
This course is intended to • Make the students familiar with the basics of Operating system • Introduce the notation of process, various features of process, CPU scheduling algorithm • Discuss the goal and principles of system protection & Security in modern computer system	**Course Outcomes:** **Students will be able to** • Describe basic concept of Operating System. • Identify and solve problems involving process management & memory management. • Understand the Process synchronization in operating system. • Identify and solve problems involving in memory management issues. • Demonstrate security issues

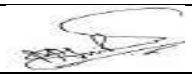
Unit I	**[8 Hrs]**
Unit I : Importance of Operating Systems, Basic Concepts, and Terminology, An Operating System Architecture, types of Operating System, Operating System as a Manager: Manager Memory Management Functions, Processor Management Functions, Device Management Functions, Information Management Functions, Files and Security, System calls for Process Management, File Management and Directory Management.	
Unit II	**[9 Hrs]**
Unit II : Management Processes Concept: Processes and Threads. Process Model and Thread Model. Job Scheduler, Process Scheduling, operation on the process,. Overview of Inter-process communication: Race Conditions, Critical Regions, Mutual Exclusion with busy waiting etc..CPU Scheduling: Introduction to Scheduling, Scheduling criteria, Scheduling Algorithms, Algorithm Evaluation and Scheduling in different Systems.	
Unit III	**[8 Hrs]**
Unit III :Process Synchronization Synchronization Hardware, Semaphores, and Classical Problem of Synchronization, Monitors and Atomic Transaction Introduction to Deadlocks: Graphical representation of a deadlock,Deadlock strategies: Ignore a deadlock,detect a deadlock ,Recover from a deadlock ,Prevent a deadlock,Avoid a deadlock	
Unit IV	**[8 Hrs]**
Memory Management :Single Contiguous Memory Management ,Fixed Partition Memory Management : Introduction ,Allocation Algorithm,swapping , relocation and address traslation Variable Parttion: Introduction ,Allocation Algorithm,swapping ,relocation and address traslation,Non-contiguous Allocation -general concepts	
Unit V	**[7 Hrs]**
Paging,Segmentation Virtual Memory Management system :general concepts, Page replacement algorithm Operating system Security and protection, Introduction, Security Threats, Attacks on Security, Security Violation through parameters, Computer Worms,	

Text Books

S.N	Title	Authors	Edition	Publisher
1	Operating System	A.Godbole	3rd Edition	The McGraw-Hill.

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Operating System Concepts	Silberschatz,Galvin	8 or 10th edition	Wiley

		July 2024	1.1	Applicable for 2024-25
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FIFTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
22II502T	Embedded Systems for IoT	3	-	-	3	30	70	100

Course Objectives	Course Outcomes
This course is intended ● To Understand the Requirements & Design issues of embedded systems design. ● To study the architecture and Programming of ARM processor using Assembly & Embedded C language ● To understand interfacing of various peripherals with ARM Processor. ● To study the concept of Real Time Operating System for embedded system design.	Student will be able to ● To Describe and analyse the Requirements & Design issues of embedded systems design. ● To apply the knowledge of architecture and Programming of for development of simple applications. ● To Describe and Demonstrate the interfacing of various peripherals with ARM Processor. ● To explain the concept of Real Time Operating System for embedded system design. ● To demonstrate the working of Raspberry Pi, its features and how various components can be used with Pi.

UNIT-I The concept of embedded systems design **[8 Hrs]**

History, Definition, and Classification of Embedded System, Design Metric & Its optimization, Embedded System Design Challenges, Processor selection Criteria, Building blocks of typical Embedded System – Core Types, Memory Architecture, Memory & Its Types, Sensors & Actuators, Communication Interfaces and Other system components and software architecture, Design tradeoffs due to process compatibility, thermal considerations, recent trends in embedded systems.

UNIT-II Technological aspects of embedded systems, Embedded microcontroller cores **[8 Hrs]**

Interrupt Service Mechanism, Context Switching, Device Drivers, Pin Configuration and Block Diagram of ARM7TDMI Microcontroller, Core of ARM7TDMI and Interrupt structure, Programming Model, Operating Modes, Exceptions and Interrupt Mechanism

UNIT-III Interfacing with external systems **[8 Hrs]**

Instruction set and Programming of ARM7TDMI Microcontroller using Assembly & Embedded C, Interfacing of external devices like LED's, 7--segment display, Switches, Multiplexed Keyboard, Stepper motor, concept of Timers and Counters ARM7TDMI Microcontroller. Analyzing Inbuilt of ADC and DAC of ARM7TDMI Microcontroller

UNIT-IV Power Management and Real time operating System **[7 Hrs]**

Power consumption in embedded systems, Techniques for power optimization, Energy harvesting solutions, Implementing low-power modes in microcontrollers, Introduction to RTOS concepts, Task scheduling and resource management, Implementing an RTOS in IoT devices, Resource Management and concepts of Semaphore, Mailbox, Message queues, Pipes, Events, Timers, Memory Management

UNIT-V Introduction to Raspberry Pi **[9 Hrs]**

Basic Architecture, Specification, Raspberry Pi GPIO, Raspberry Pi pin configuration, Communication with devices through the pins of the Raspberry Pi, RPi.GPIO library, Python Functions, setting up the pins, General purpose IO Pins, Protocol Pins, GPIO Access , Interfacing Hardware with the Raspberry Pi, GPIO Control over Web Browser

Text Books

S.N	Title	Authors	Edition	Publisher
1	Embedded Systems	Raj Kamal		TMH Publications
2	Embedded System Design	Frank Vahid	New edition 2001	Wiley Publications
3.	Programming the Raspberry Pi: Getting Started with Python	Simon Monk		McGraw Hill Professional

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Embedded System Design	Steve Heath		Neuwans Publications
2	Learning Python with Raspberry Pi	Oliver Theobald		JohnWiley & Sons

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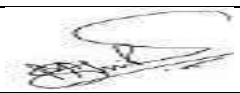
FIFTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
22II502P	Embedded Systems for IoT Lab	-	-	2	1	25	25	50

Course Objectives	Course Outcomes
To familiar with ARM7 software & KITS. To enhance the ability of logical thinking so that student will be design an algorithm and program	• Apply the knowledge of Instruction skill for the Development of Simple and Complex Programs. • Apply the programming skill for the Development of Simple application. • Apply and Demonstrate the Concept of Interfacing for the Development of Embedded System.

Expt. No.	Title of the experiment
1	To study the ARM Development Board.
2	To Write & Demonstrate the program display various pattern on leds Using ARM DEVELOPMENT BOARD.
3	To Write & Demonstrate the program to read switch status and displayed in point LEDs Using ARM Development Board.
4	To Write & Demonstrate the program for display of number from 0 to 9 on seven segment display Using ARM Development Board.
5	To Write and demonstrate the program for interfacing of a stepper motor and Rotate it in clockwise & anti-clock wise direction with equal delay Using ARM Development Board.
6	To Write and demonstrate the program for interfacing LCD Using ARM Development Board.
7	To Write & Demonstrate the program to demonstrate working of DAC Using ARM Development Board.
8	To Write & Demonstrate the program to demonstrate working of ADC Using Development Board.
9	To develop a 'C'code to create a mailbox and to understand the RTOS functions
10	To interface led with Arduino/ Raspberry Pi and write a program to control it through Wifi
11	Interfacing EPROM and interrupt

S.N	Title	Authors	Edition	Publisher
1	Embedded Systems	Raj Kamal		TMH Publications
2	Embedded System Design	Frank Vahid	New edition 2001	Wiley Publications
3.	Programming the Raspberry Pi: Getting Started with Python	Simon Monk		McGraw Hill Professional

		July 2024	1.1	Applicable for 2024-25
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FIFTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
22II503T	Machine Learning	4	-	-	4	30	70	100

Course Objectives	Course Outcomes
This course is intended to ❑ To introduce the basic concepts and techniques of machine learning. problems ❑ To understand major machine learning algorithms ❑ To identify machine learning techniques suitable for a given problem.	Student will be able to ❑ Apply various preprocessing techniques before solving the machine learning. problems ❑ Use supervised machine learning techniques to solve different problems. ❑ Apply probability-based models to solve different problems. ❑ Apply statistical approach to the problem of pattern classification ❑ Apply un-supervised and Reinforcement Learning techniques to solve different problems

Unit I **[10Hrs]**

Introduction to Machine Learning: What is Human Learning? Types of Human Learning, learning under expert guidance, Learning guided by knowledge gained from experts, learning by self, What is Machine Learning? How do machines learn? Well-posed learning problem, Types of Machine Learning, Problems Not to Be Solved Using Machine Learning, Applications of Machine Learning, State-of-The-Art Languages/Tools In Machine Learning, Issues in Machine Learning, Machine Learning Activities, Basic Types of Data in Machine Learning, Exploring Structure of Data, Data Quality and Remediation, Data Pre-Processing, Feature subset selection

Unit II **[8 Hrs]**

Machine Learning Foundation: Validation Techniques (Cross-Validations), Overfitting and under-fitting, Data Normalization, Hypothesis Evaluation, Feature Reduction/Dimensionality reduction, Linear and Logistic regression.

Unit III **[10 Hrs]**

Discriminative ML Methods: Classification and its use cases, Decision Tree, Algorithm for Decision Tree Induction, Creating a Perfect Decision Tree, Confusion Matrix, Random Forest algorithm, Bagging and Boosting

Unit IV **[12 Hrs]**

Supervised Learning: Bayes Decision Theory, Bayes decision rule, Minimum error rate classification, Normal density and discriminant functions, Naïve Bayes Classifiers, probably approximately correct (PAC) learning , Support Vector Machine, *k*-Nearest Neighbour (*k*NN).

Unit V **[12 Hrs]**

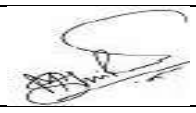
Unsupervised Learning: Unsupervised Learning: Clustering (K means, Hierarchical Clustering, Finding Pattern using Association Rule, Definition of common terms, Association rule, The apriori algorithm for association rule learning, Build the apriori principle rules

Text Books

S.N	Title	Authors	Edition	Publisher
1	Understanding Machine Learning: From Theory to Algorithms	Shalev-Shwartz,S., Ben-David,S		Cambridge University Press

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Machine Learning- an Artificial Intelligence Approach	Tom Mitchell	2nd Edition	Morgan Kaufmann
2	Introduction to Machine Learning	Ethem Alpaydin	2nd Edition	PHI

		July 2024	1.1	Applicable for 2024-25
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FIFTH SEMESTER

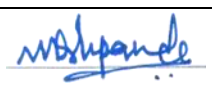
Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
22II503P	Machine Learning Lab	-	-	2	1	25	25	50

Course Objectives	Course Outcomes
This course is intended Make use of Data sets in implementing the machine learning algorithms Implement the machine learning concepts and algorithms in any suitable language of choice.	Students will be able to Learn the implementation procedures for the machine learning algorithms. Design programs for various Learning algorithms. Apply appropriate data sets to the Machine Learning algorithms. Identify and apply Machine Learning algorithms to solve real world problems.

Expt. No.	Title of the experiment
1	Introduction to different types of software available for Machine Learning
2	Practical based on Extraction of data from database
3	Practical based on Simple Linear Regression
4	Practical based on Logistic Regression using SCIKIT learn
5	Practical based on various classification algorithms
6	Practical based on Decision Tree – ID3 Algorithm
7	Practical based on Back-Propagation Algorithm
8	Practical based on various Clustering algorithms

Books and References

Machine Learning, Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das, I Edition, Pearson Education
Machine Learning, Tom Mitchell, II Edition, Mc Graw Hill Publication
Introduction to Machine Learning, Ethem Alpaydin, MIT Press

		July 2024	1.1	Applicable for 2024-25
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FIFTH SEMESTER

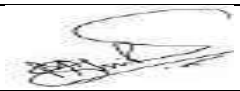
Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
22II504P	Internet of Things Lab-II	-	-	2	1	25	25	50

Course Objectives	Course Outcomes
To acquire the basic knowledge of Arduino boards, various sensors and actuators used in IoT and their programming	To understand and learn the art of writing programs and interfacing various sensors and actuators used in IoT with Arduino boards, Node MCU and Raspberry Pi To understand, analyze data generated through sensors and observe the data on server

Expt. No.	Title of the experiment
1	Study various types of Arduino and install Arduino IDE for NodeMCU.
2	To interface Bluetooth with Arduino/ Raspberry Pi and write a program to send the sensor data to smartphone using Bluetooth
3	To interface OLED with Arduino/ Raspberry Pi and write a program to print temperature and humidity.
4	To create a local server using NodeMCU in station mode.
5	Build a local server using NodeMCU and fetch humidity and temperature using DHT 11 sensor and sent it to local server.
6	Implement MQTT protocol using Arduino
7	Actuator controlling through cloud
8	Controlling LEDs, relay & buzzer using Blynk app
9	To interface LED with Arduino/ Raspberry Pi and write a program to control it through Wifi.
10	Mini Project

Books and References

S.N	Title	Authors	Edition	Publisher
1.	Introduction to IoT	Sudip Misra, Anandrup Mukherjee, Arijit Roy	I	Cambridge University Press
2.	Internet of Things	Jeeva Jose	I	Khanna Publishers
3.	Internet of Things– A Hands-on Approach	Arshdeep Bahga, Vijay Madisetti,	I	Universities Press

		July 2024	1.1	Applicable for 2024-25
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FIFTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
22II505T(i)	(Professional Elective – I) Computer Architecture & Organization	3	-	-	3	30	70	100

Course Objectives	Course Outcomes
This course is intended to provide comprehensive understanding of the basic principles and concepts in computer architecture and organization, including data representation, computer arithmetic, memory system and multiprocessors along with pipeline & vector processing	Students will be able To understand structure of computers, register transfer & micro-operations To understand basic computer organization & design To explain the micro-programmed and the concepts behind computer arithmetic To understand the concepts behind the memory system To explain the concepts involved in multiprocessors and pipeline & vector processing

Unit I **[6Hrs]**

STRUCTURE OF COMPUTERS: Computer types, functional units, basic operational concepts, Von-Neumann architecture, bus structures, software, performance, multiprocessors and multicomputer, Data representation. **REGISTER TRANSFER AND MICRO-OPERATIONS:** Register transfer language, register transfer, bus and memory transfers, arithmetic micro-operations, logic micro-operations, shift micro-operations, arithmetic logic shift unit.

Unit II **[9Hrs]**

BASIC COMPUTER ORGANIZATION AND DESIGN: Instruction codes, computer registers, computer instructions, instruction cycle, timing and control, memory-reference instructions, input-output and interrupt. **CENTRAL PROCESSING UNIT:** Stack organization, instruction formats, addressing modes, data transfer and manipulation, program control, Reduced Instruction Set Computer (RISC).

Unit III **[9Hrs]**

MICRO-PROGRAMMED CONTROL: Control memory, address sequencing, micro-program example, design of control unit. **COMPUTER ARITHMETIC:** Addition and subtraction, multiplication and division algorithms, floating-point arithmetic operation, decimal arithmetic unit, decimal arithmetic operations.

Unit IV

[6Hrs]

THE MEMORY SYSTEM: Basic concepts, semiconductor RAM types of read - only memory, (ROM), cache memory, performance considerations, virtual memory, secondary storage, RAID, direct memory access (DMA).

UNIT V **[10Hrs]**

MULTIPROCESSORS: Characteristics of multiprocessors, interconnection structures, inter processor arbitration, inter processor communication and synchronization, cache coherence, shared memory multiprocessors. **PIPELINE & VECTOR PROCESSING:** Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC pipeline, Vector Processing, Array Processors

Text Books& References

1. **Computer Organization, Carl Hamacher, Zvonko Vranesic, Safwat Zaky, V Edition, Mc Graw Hill**
2. **Computer System Architecture, M. Morris Mano, III Edition, Pearson Education**
3. **Computer Architecture & Organization, John P. Hayes, III Edition, Mc Graw Hill**
4. **Computer Organization & Architecture, William Stallings, Edition, Pearson Education**

FIFTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
22II505T(ii)	(Professional Elective – I) Robotics	3	-	-	3	30	70	100

Course Objectives	Course Outcomes
This course is intended To explore the evolution and principles of robotics, classify robotic systems, analyze resolution and dexterity, select robots based on usage, examine grippers and sensors including types and design guidelines, discuss robot cell layout programming methods and languages, and consider socio-economic impacts, safety standards, and AI integration.	Student will be able to ● Interpret terminologies related to Robotics technology. ● Understand various grippers and sensors for robotics. ● Apply logic for selection of robotic systems, cell layout and its programing. ● Integrate knowledge of AI techniques in the area of robotic technology.

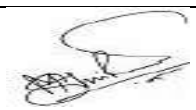
Unit I	**[7 Hrs]**
Introduction to robotics: Brief History, Basic Concepts of Robotics such as Definition , Elements of Robotic Systems i.e. Robot anatomy, DOF, etc., Classification of Robotic systems such as work volume, typeS of drive, Associated parameters i.e., accuracy, repeatability. Introduction to Principles & Strategies of Automation, Types & Levels of Automations, Need of automation, Industrial applications of robot.	
Unit II	**[9 Hrs]**
Grippers and Sensors for Robotics: Grippers for Robotics - Types of Grippers and applications. Sensors for Robots - Types of Sensors used in Robotics, Classification and applications of sensors, Characteristics of sensing devices, Selections of sensors. Need for sensors and vision system in the working and control of a robot.	
Unit III	**[9 Hrs]**
Drives and Control for Robotics: Drive - Types of Drives, Types of transmission systems, Actuators and its selection while designing a robot system. Control Systems: Types of Controllers, Introduction to closed loop control.	
Unit IV	**[8 Hrs]**
Robot Cell layouts and Languages for Robotics: Robot Cell layouts, multiple robots and machine interface, other considerations in work cell design. Robot Programming: Methods of robot programming, Programming Languages: Generations of Robotic Languages, Introduction to various types such as VAL, RAIL, AML, ROS	
Unit V	**[7 Hrs]**
Economical trends & Future aspects in Robotics: Socio-Economic aspect of robotisation. Economical aspects for robot design, Safety for robot and standards, Introduction to Artificial Intelligence, AI techniques, Need and application of AI, New trends & recent updates in robotics.	

Text Books

S.N	Title	Authors	Edition	Publisher
1.	Industrial Robotics	Groover.M.P.	1996.	McGraw – Hill International edition
2.	Introduction to Robotics	S. K. Saha	2014	TATA McGraw Hills Education
3.	Robotics and Control	R. K. Mittal, I. J. Nagrath	2003	TATA McGraw Hill Publishing Co Ltd

Reference Books

S.N	Title	Authors	Edition	Publisher
1.	Robotics Technology and Flexible Automation	Deb S R	1994	Tata McGraw Hill, New Delhi,
2.	Fundamentals of Robotics	Dilip Kumar Pratihar,	2019	Narosa Publishing House

		July 2024	1.1	Applicable for 2024-2025
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FIFTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
22II561O	(Open Elective – I) Fundamentals of Industry 4.0 & Industrial IoT	3	-	-	3	30	70	100

Course Objectives	Course Outcomes
This course is intended to • Define the concepts and technologies associated with Industry 4.0 and Industrial Internet of Things. • Identify the key drivers and applications of Industry 4.0 and IIoT in various industries • Analyze business models and reference architectures related to IIoT. • Demonstrate knowledge of off-site and on-site technologies, including cloud computing and fog computing, in the context of IIoT.	Student will be able to • To list the components of Industry 4.0 and Industrial Internet of Things. • To define the key drivers and applications of Industry 4.0 and IIoT in different industries. • To explain various business models and reference architectures associated with Industrial Internet of Things. • To demonstrate practical knowledge of off-site and on-site technologies in the context of IIoT.

Unit I : Overview of Industry 4.0 and Industrial Internet of Things **[8 Hours]**

Introduction, IoT Architecture, Application Based IoT Protocols, Cloud Computing, Fog Computing, Sensor Cloud, Big Data. Overview of Industry 4.0 and Industrial Internet of Things: Industry 4.0, IIoT, Basics of CPS, CPS and IIoT, Application of IIoT.

Unit II: Basics of Industry 4.0 and Industrial Internet of Things **[8 Hours]**

Introduction, Design requirements of Industry 4.0, Drivers of Industry 4.0, Sustainability Assessment of industries, Smart business perspective, cybersecurity, Impact of Industry 4.0, Industrial Internet Systems, Industrial sensing, Industrial Processes.

Unit III: Business Models and Reference Architecture of IIoT **[8 Hours]**

Introduction, Definition of a business model, Business models of IoT, Business models of IIoT, Reference architecture of IoT, Reference architecture of IIoT, IIRA, Key performance indicators for occupational Safety and health.

Unit IV: Key Technologies: off-site and on-site Technologies **[10 Hours]**

Introduction, Cloud Computing, Necessity of cloud computing, cloud computing and IIoT, Industrial cloud platform providers, SLA for IIoT, requirements of industry 4.0 and its solution, Fog computing for IIoT, Application of Fog and their solutions.

Unit V: Case Studies **[6 Hours]**

Introduction, Manufacturing Industry, Automotive Industry, Mining Industry, Background of the industry, challenges, Industrial IoT as a solution, benefits.

Text Books

S. N	Title	Authors	Edition	Publisher
1.	Introduction to Industrial Internet of Things and Industry 4.0	Sudip Misra, Chandana Roy, and Anandarup Mukherjee	First edition	2021

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FIFTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
22H104	Foundational Humanities Elective- Development of Societies	2	-	-	-	--	--	--

Course Objectives	Course Outcomes
This course will provide a natural link between engineering and humanities.	At the end of the course, students will be able to: 1. develop a larger view of social structures and systems. 2. understand the political systems and their comparative study. 3. Aware themselves of various economic systems and sustainable development. 4. understand the interaction of political and economic strategies. 5. apply learnt concepts and generate and evaluate models of development in current context.

Unit I Social Development	**[5Hrs]**
1. Concepts behind the origin of Family, Clan and Society 2. Different Social Systems 3. Relation between Human being and Society 4. Comparative studies on different models of Social Structures and their evolution	
Unit II Political Development	**[4Hrs]**
1. Ideas of Political Systems as learnt from History 2. Different models of Governing system and their comparative study	
Unit III Economic Development I	**[4Hrs]**
1. Birth of Capitalism, Socialism, Marxism	
Unit IV Economic Development II	**[7Hrs]**
1. Concept of development in pre-British, British and post British period- Barter, Jajmani 2. E. F. Schumacher's idea of development, Buddhist economics. Gandhian idea of development. Swaraj and Decentralization	
Unit V Economic Development III	**[4Hrs]**
1. Economic Development 2. Idea of development in current context.	

S.N	Title	Authors	Edition	Publisher
1.	Sociology: Basic concepts	H.K.Rawat	2007	Rawat Publication
2.	Sociology: Themes and Perspectives	Michael Haralambos, Martin Holborn and Robin Heald	2000	Collins Educational, London, United Kingdom

ST. VINCENT PALLOTTI COLLEGE OF ENGINEERING & TECHNOLOGY, NAGPUR

(An autonomous institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B. Tech. Scheme of Examination & Syllabus 2022-23

INDUSTRIAL IoT

FIFTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
22AS502T	English for Engineers	2	-	-	2	15	35	50

Course Objectives	Course Outcomes
To provide students with the skills and knowledge of communication in a business environment.	**At the end of the course, students will be able to:** 1. develop an understanding of basic grammar concepts and their applications. 2. prepare and equip themselves for competitive exams 3. deliver effective presentations in a professional environment, tackle group discussions and face interviews. 4. acquire hands-on experience in writing business letters 5. display written communication in line with different workplace requirements.

Unit I : Functional Grammar	**[6Hrs]**
1. Subject-Verb Agreement 2. Preposition, Pronoun and Articles 3. Tenses 4. Direct – Indirect Speech 5. Transformation of sentences – Simple, Complex, Compound and Degrees of comparison 6. Active and Passive Voice	
Unit II : English for Competitive Exams	**[5Hrs]**
1. Sentence improvement and construction 2. Paragraph ordering 3. One word substitution 4. Verbal Analogies 5. Idioms	
Unit III : Verbal Ability	**[4Hrs]**
1. Reading Comprehension 2. Listening to Conversation (formal and Informal) and Announcements. 3. Integrated Writing – Read, and listen to a short excerpt and write a response. 4. Speaking – Podcast, Group Discussion, Presentations and Mock Interviews	
Unit IV : Formal Correspondence	**[4Hrs]**
1. Describing, summarizing, comparing graphs or illustrations 2. Basic patterns of Business Letter Writing 3. Approaches to writing – Direct, Indirect and persuasive styles. 4. Cover letter, Resume, Applications.	
Unit V : Communication at Workplace	**[5Hrs]**
1. Drafting emails and reports 2. Circular and notices. 3. Meeting etiquette and recording Minutes of the Meeting 4. Writing a Press Release	

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Functional English for Technical Student	Dr. Pratibha Mahato and Dora Thompson	2020	Himalaya Publishing House
2.	Communication Skills for Engineer	C. Muralikrishna and Sunita Mishra	2022	Pearson
3.	Effective Technical Communication	Barun K Mitra	1	Oxford University Press
4.	Basic Business Communication	Lesikar, R. & Flately	9	Tata McGraw Hill