22SES511	EMBEDDED COMPUTING SYSTEMS	SEMESTER V

PREREQUISITES	CATEGORY	L	T	P	C
NIL	ES	3	0	0	3

Course Objectives	The objective of this course is to make the students understand about the basic hardware and software components and their selection for embedded computing Systems.	
UNIT – I	**INTRODUCTION TO EMBEDDED SYSTEMS AND ARM PROCESSOR**	**9 Periods**
Introduction to Embedded System: Characteristics of Embedded System – Application Areas – Real Time Examples of Embedded System – ES Hardware Design – Design and Development of Embedded Software – Real time ES. ARM Processor: Family – Application of ARM Processor – Compiler –Emulation and Debugging – Difference between RISC & CISC.		
UNIT – II	**EMBEDDED NETWORKING AND INTERRUPTS SERVICES MECHANISM**	**9 Periods**
Embedded Networking: Introduction, I/O Devices – Ports &Buses. Bus communication Protocols –RS232 Standard –RS422 – RS485 – CAN Bus – Serial Peripheral Interface (SPI) – Inter Integrated Circuit (I2C) – Interrupt Sources, Programmed –I/O busy-wait approach without Interrupt Service Mechanism – ISR concept – Multiple interrupt – context switching – Introduction to Devices Drivers.		
UNIT – III	**RTOS BASED EMBEDDED SYSTEM DESIGN**	**9 Periods**
Introduction to Basic concept of RTOS – Task, Process and Threads, Interrupt routines in RTOs , Multiprocessing & Multitasking, Preemptive & Non- Preemptive scheduling, Task communication – Shared Memory, Message Passing, Interprocess communication – Comparison of commercial RTOs Features – RTOS lite, Full RTOS, Vxworks, µc/os –II, RT Linux.		
UNIT – IV	**PROGRAM DESIGN AND ANALYSIS**	**9 Periods**
Component for Embedded Programs, Model's of Programs, Assembly, linking & loading , Basic Compilation Techniques, Program Optimization, Program Level Performance Analysis, Software Performance Optimization, Program-Level energy & Power Analysis , Analysis & Optimization of Program Size, Program Validation & testing.		
UNIT – V	**INTRODUCTION TO LPC2148 MICROCONTROLLER, SYSTEM CONTROL AND GPIO**	**9 Periods**
The LPC 2148: ARM7 Microcontroller – Features of LPC 2148 – Block diagram of LPC 2148 – Pin diagram of LPC 2148 – Architectural Overview – On-chip Flash Program Memory – On-chip StaticRAM. System Control: Crystal Oscillator – PLL – Rest & Wake – Up timer – Brownout Detector – External interrupt input – Memory Mapping control – Power Control. GPIO: General purpose parallel I/O: Features – 8 bit LED's and Switches – Relay & Buzzer.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOKS :

1.	*Wayne Wolf,* ***"Computers as Components, Principles of Embedded Computing Systems Design"*** *2nd Edition, Elsevier, 2008.(1,2,3,& 4 units)*
2.	*Shibu K V,* ***"Introduction to Embedded Systems"****, Tata McGraw Hill, 2009.(1 and 2 unit)*

REFERENCES :

1.	*James K. Peckol,* ***"Embedded Systems, A contemporary Design Tool",*** *Wiley India, 2008.*
2.	*Tammy Neorgaard,* ***"Embedded Systems Architecture"****, Elsevier, 2005.*
3.	*ARM Company Ltd.* ***"ARM Architecture Reference Manual– ARM DDI 0100E"****(5^{th} unit)*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Apply the microcontroller cores (ARM, RISC, CISC, and SOC) for the Embedded systems**.**	K3
CO2	Explain the design components of embedded systems.	K2
CO3	Comprehend simple real time embedded programs,	K2
CO4	Apply RTOS concepts of task and time management, memory management for embedded systems.	K3
CO5	Create Embedded applications using embedded systems development environment.	K6

COURSE ARTICULATION MATRIX :

a) CO and PO Mapping

COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PS O2**	**PS O3**
CO1	2	2	1	3	3	-		-	-	1	1	-	3	3	-
CO2	2	1	1	3	3	-		-	-		1	-	3	3	-
CO3	2	2	2	3	3	-	1	-	-	1	1	-	3	3	-
CO4	2	2	1	2	3	-		-	-		1	-	3	3	-
CO5	2	3	2	3	3	-	3	-	-	1	1	-	3	3	-
22SES511	**2**	**2**	**2**	**3**	**3**	**-**	**1**	**-**	-	**1**	**1**	**-**	**3**	**3**	**-**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping	
CO1	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.3, 2.2.4, 3.1.4, 3.2.1, 3.3.1, 4.1.1, 4.1.2, 4.1.4, 4.2.1, 4.3.1, 4.3.4, 5.1.1, 5.1.2, 5.2.2, 5.3.1, 5.3.2, 10.1.3, 11.3.2.
CO2	1.3.1, 1.4.1, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 3.1.4, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.2.1, 4.2.2, 4.3.1, 4.3.2 5.1.1, 5.1.2, 5.2.1,5.2.2,5.3.1, 5.3.2, 11.3.2.
CO3	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.4.1, 2.4.2, 2.4.4, 3.1.3,3.1.4, 3.2.1, 3.3.1, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.2.2, 4.3.1, 4.3.3, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 5.3,2, 7.1.2, 10.1.2, 11.3.2.
CO4	1.1.2, 1.3.1, 1.4.1, 2.1.2, 2.1.3, 2.2.3, 2.2.4, 2.4.3, 3.1.4, 3.2.3, 3.4.1, 4.1.2, 4.1.3, 4.2.1,4.3.3, 5.1.1, 5.1.2, 5.2.1, 5.3.1, 5.3.2,11.3.2.
CO5	1.1.2, 1.3.1, 1.4.1, 2.1.2, 2.1.3, 2.2.1,,2.1.2, 2.1.3, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.4.4, 3.1.1, 3.1.3,3.1.4, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.2.2, 4.3.1, 4.3.3, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 5.3,2, 7.1.1, 7.1.2, 7.2.1, 7.2.2, 10.1.2, 11.3.2.

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	20	30	30	20	-	-	100
CAT2	10	30	40	20	-	-	100
Individual Assessment 1/Case Study 1/Seminar 1/Project 1	20	30	30	10	10	-	100
Individual Assessment 2/Case Study 2/Seminar 2/Project 2	-	-	40	40	-	20	100
ESE	10	40	30	20	-	-	100

22SPC512	COMPUTER NETWORKS *(Common to ECE, CSE $ IT)*	SEMESTERV

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PC	3	0	0	3

Course Objectives	Upon completion of the course, the students will be familiar with, 1. The division of network functionalities into layers 2. The component required to build different types of networks 3. Identifying the solution for the functionalities in each layer.

UNIT – I	**INTRODUCTION AND PHYSICAL LAYER**	**9 Periods**

Overview of how the Internet works: browser, webserver, URL, domain name, IP address, packets, Hubs, Bridges, Switches.Overview of the design principles of the Internet: packet switching vs circuit switching, store-and forward networks, layering for modularity. Introduction to the various layers in the Internet. Introduction to performance metrics: end-to-end throughput, delay, jitter and drop rates in a network. Statement of Little's Law. How performance is measured.

Physical layer: signalto-noise ratio, bit error rate, modulation, multipath interference. Data Transmission – Transmission Media – Signal Encoding Techniques – Multiplexing – Spread Spectrum

UNIT – II	**DATALINK LAYER**	**9 Periods**

Medium access protocols: Polling vs. contention-based: TDM, Aloha, CSMA/CD. Data Link Layer: Mechanisms for error detection/recovery: Parity checks, CRC and data link layer protocols. Switched LANs: L2 addressing and ARP– Virtual LAN (VLAN) –Ethernet frame structure, Wireless LAN (802.11)

UNIT – III	**NETWORK LAYER**	**9 Periods**

Network Layer: Network architecture and performance: Network topology; Router architecture: queueing and switching. Performance evaluation of a network link: traffic characteristics, performance measures, Kendall's notation. IP Protocol: - Need for an Internet address, and its design. Hierarchical IP addressing, Subnetting, IPv4 and IPv6, structure of IP datagram, IP forwarding. Routing protocols: Link state routing. Distance vector routing: count-to-infinity, routing convergence. Structure of the Internet: end-user organizations and ISPs. difference between intra-domain (OSPF) and inter-domain (BGP) routing, Congestion Avoidance in Network Layer

UNIT – IV	**TRANSPORT LAYER**	**9 Periods**

Transport Layer: Importance of the transport layer; end-to-end principle. Transport layer protocols: TCP and UDP, process-to process delivery, multiplexing, port numbers, header structure - Reliable transmission of packets over an unreliable network: sequence numbers, ACKs, timeout, retransmissions. Stop and wait, and sliding window - TCP connection setup and teardown - Flow control and congestion control at the transport layer. Differences between the two. Overview of TCP congestion control: Slow start and reaction to timeouts - TCP congestion control: Slow start; congestion avoidance using loss-based and delay-based control. Introduction to Quality of services (QOS).

UNIT – V	**APPLICATION LAYER**	**9 Periods**

Application Layer: Internet names, how DNS works, Application layer protocols: HTTP, SMTP, SNMP, web applications. Security attacks and defences: DMZ, firewalls. Peer-to-peer applications. P2P file distribution. Audio and video streaming. Challenges of streaming over best effort IP

Contact Periods:
Lecture: 45 Periods **Tutorial: 0 Periods** **Practical: 0 Periods** **Total: 45 Periods**

TEXT BOOKS:

1	A.S. Tanenbaum and D.J. Wetherall, **"*Computer Networks"*,** 5th edition, Pearson, 2013.
2	J.F. Kurose and K.F. Ross, **"*Computer networking: a top-down approach"***, 6th edition, Pearson, 2017.

REFERENCES:

1	Larry L. Peterson, Bruce S. Davie, ***"Computer Networks: A Systems Approach",*** Fifth Edition, Morgan Kaufmann Publishers Inc., 2011.
2	William Stallings, ***"Data and Computer Communications",*** Eighth Edition, Pearson Education, 2011.
3	*Behrouz A. Forouzan and Firouz Mosharraf,* ***"Computer Networks a Top Down Approach",*** *Tata McGraw-Hill, 2011.*
4	R. Jain, **"*The art of computer systems performance analysis",*** Wiley India, 1991
5	S.K. Bose, **"*An Introduction to Queueing Systems",*** Springer Science + Business Media New York, 2012

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Summarize layering as a means of tackling complexity, layering applied to the Internet	K2
CO2	Explain protocols as a structured means of reliable communications	K3
CO3	Explain the architecture principles that have enabled the orders of magnitude expansion of the Internet	K3
CO4	Explain networked applications and their protocols, their installation, operation and performance tuning	K3
CO5	Choose the required functionality at each layer for a given application and trace the flow of information from one node to another node in the network.	K3

COURSE ARTICULATION MATRIX

a) CO and PO Mapping

COs/ POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	2	2	-	-	-	1	-	-	-	-	2	2
CO2	2	2	2	2	-	-	-	1	-	-	-	-	2	2
CO3	2	2	2	2	-	-	-	1	-	-	-	-	2	2
CO4	2	2	2	2	-	-	-	1	-	-	-	-	2	2
CO5	2	3	3	3	-	-	-	1	-	-	-	-	3	2
22SPC512	**2**	**3**	**3**	**3**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**3**	**2**

1– Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.1.1, 1.2.1, 2.1.1, 2.1.2, 3.1.1, 3.1.2, 4.1.1, 4.2.1, 8.1.1
CO2	1.1.1, 1.2.1, 2.1.1, 2.1.2, 3.1.1, 3.1.2, 4.1.1, 4.2.1, 8.1.1
CO3	1.1.1, 1.2.1, 2.1.1, 2.1.2, 3.1.1, 3.1.2, 4.1.1, 4.2.1, 8.1.1
CO4	1.1.1, 1.2.1, 2.1.1, 2.1.2, 3.1.1, 3.1.2, 4.1.1, 4.2.1, 8.1.1
CO5	1.1.1, 1.2.1, 2.1.1, 2.1.2, 2.3.1, 3.1.1, 3.1.2, 3.4.1, 4.1.1, 4.2.1, 4.2.2, 8.1.1

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	30	30	40	-	-	-	100
CAT2	30	30	40	-	-	-	100
Assignment 1	30	20	40	5	5	-	100
Assignment 2	30	20	30	10	5	5	100
Other mode of internal assessments, if any	-	-	-	-	-	-	-
ESE	30	30	40	-	-	-	100

22SPC513	ARTIFICIAL INTELLIGENCE *(Common to CSE and IT)*	SEMESTER V

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PC	3	0	0	3

Course Objectives	The objective of this course is to make the students understand about the importance and need of Artificial Intelligence in solving real world engineering problems.	
UNIT – I	**INTELLIGENT AGENTS**	**9 Periods**
Introduction to AI – Agents and Environments – concept of rationality – nature of environments – structure of agents. Problem solving agents – search algorithms – uninformed search strategies.		
UNIT – II	**PROBLEM SOLVING**	**9 Periods**
Heuristic search strategies – heuristic functions. Local search and optimization problems – local search in continuous space – search with non-deterministic actions – search in partially observable environments – online search agents and unknown environments		
UNIT – III	**GAME PLAYING AND CONSTRAINT SATISFACTION PROBLEM**	**9 Periods**
Game theory – optimal decisions in games – alpha-beta search – monte-carlo tree search – stochastic games – partially observable games,Limitations of Game Search Algorithms. Constraint satisfaction problems – constraint propagation – backtracking search for CSP – local search for CSP – structure of CSP		
UNIT – IV	**LOGICAL REASONING**	**9 Periods**
Knowledge-based agents – propositional logic – propositional theorem proving – propositional model checking – agents based on propositional logic. First-order logic – syntax and semantics – knowledge representation and engineering – inferences in first-order logic – forward chaining – backward chaining – resolution.		
UNIT – V	**PROBABILISTIC REASONING AND GENERATIVE AI**	**9 Periods**
Acting under uncertainty – Bayesian inference – naïve Bayes models. Probabilistic reasoning – Bayesian networks – exact inference in Bayesian network – approximate inference in Bayesian network – causal networks.Understanding Generative AI-Evolution of AI: From rule-based to generative models– Key generative AI models: RNNs, LSTMs, GPT, and more, Popular use cases for generative AI–Introduction to Prompt Engineering-What is prompt engineering and why it matters–Prompt types: explicit, implicit, and creative prompts–Best Practices for Crafting Effective Prompts		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOK:

1	*Stuart Russell and Peter Norvig, **"Artificial Intelligence – A Modern Approach",** Fourth Edition, Pearson Education, 2021.*
2	*Dan W. Patterson, **"Introduction to Artificial Intelligence and Expert Systems",** Pearson Education,2017*

REFERENCES :

1	*Deepak Khemani, **"Artificial Intelligence",** Tata McGraw Hill Education, 2016.*
2	*Kevin Night, Elaine Rich, and Nair B., **"Artificial Intelligence",** McGraw Hill, 2017.*
3	*Patrick H. Winston, **"Artificial Intelligence",** Third Edition, Pearson Education, 2016*
4	*Christopher M. Bishop, **"Pattern Recognition and Machine Learning",** Springer, 2016.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Identify the role of intelligent agents and associated frameworks.	K2
CO2	Apply problem solving techniques in real world problems.	K4
CO3	Apply game playing and CSP techniques in complex AI problems.	K4
CO4	Summarize logical reasoning techniques	K3
CO5	Evaluate probabilistic reasoning techniques to efficiently handle uncertain environments.	K5

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping

COs/Pos	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	3	3	3	2	2	-	-	-	-	-	2	1	3
CO2	3	3	3	3	2	2	-	-	-	-	-	2	1	3
CO3	3	3	3	3	2	2	-	-	-	-	-	2	1	3
CO4	3	3	3	3	2	2	-	-	-	-	-	2	1	3
CO5	3	3	3	3	2	2	-	-	-	-	-	2	1	3
22SPC513	**3**	**3**	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**2**	**1**	**3**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.2.1, 4.2.2, 4.3.1, 4.3.2, 5.1.1, 5.2.1, 5.3.2, 6.1.1, 6.1.2, 12.1.1, 12.1.2, 12.2.1, 12.3.2
CO2	1.1.1, 1.1.2, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.2.1, 4.2.2, 4.3.1, 4.3.2, 5.1.1, 5.2.1, 5.3.2, 6.1.1, 6.1.2, 12.1.1, 12.1.2, 12.2.1, 12.3.2
CO3	1.1.1, 1.1.2, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.3,4.1.4, 4.2.1, 4.2.2, 4.3.1, 4.3.2, 5.1.1, 5.2.1, 5.3.2, 6.1.1, 6.1.2, 12.1.1, 12.1.2, 12.2.1, 12.3.2
CO4	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 3.1.1,3.1.2,3.1.3, 3.1.6, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.3.2, 3.4.1, 3.4.2, 4.1.1,4.1.2,4.1.3,4.1.4, 4.2.1,4.2.2,4.3.1,4.3.2, 5.1.1, 5.2.1, 5.3.2, 6.1.1, 6.1.2, 12.1.1, 12.1.2, 12.2.1, 12.3.2
CO5	1.1.1,1.1.2,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.2,2.4.1,2.4.2,2.4.3,2.4.4, 3.1.6,3.2.1,3.2.2,3.2.3,3.3.1,3.3.2,3.4.1,3.4.2,4.1.1,4.1.2,4.1.3,4.1.4,4.2.1,4.2.2,4.3.1,4.3.2, 5.1.1, 5.2.1, 5.3.2, 6.1.1, 6.1.2, 12.1.1, 12.1.2, 12.2.1, 12.3.2

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	30	30	40	-	-	-	100
CAT2	10	20	30	20	20	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	-	-	50	50	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	-	-	-	50	50	-	100
ESE	10	20	35	35	-	-	100

22SPC514	WEB PROGRAMMING	SEMESTER V

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PC	3	0	0	3

Course Objectives	The objective of this course is to provide students with proficiency in full stack development by mastering the MEAN (MongoDB, Express.js, Angular, Node.js) framework stack.	
UNIT – I	**FRONTEND FUNDAMENTALS**	**9 Periods**
Understanding the Basic Web Development Framework – User – Browser – Webserver – Backend Services – MVC Architecture–HTML – CCS JavaScript - Defining Variables -Understanding JavaScript Data Types - Using Operators - Implementing Looping - Creating Functions - Understanding Variable Scope - Using JavaScript Objects – Strings –Arrays - Error Handling TypeScript - Learning the Different Types -Understanding Interfaces -Implementing Classes -Class Inheritance - Implementing Modules- Understanding Functions		
UNIT – II	**RUNTIME ENVIRONMENT**	**9 Periods**
Understanding Node.js - Working with Node Packages - Creating a Node.js Application - Using Events, Listeners, Timers, and Callbacks in Node.js -Implementing Timers - Handling Data I/O in Node.js - Working with JSON - Converting JSON to JavaScript Objects -Converting JavaScript Objects to JSON - Using the Buffer Module to Buffer Data - Understanding Buffered Data - Using the Stream Module to Stream Data - Accessing the File System from Node.js - Implementing HTTP Services in Node.js -Implementing HTTP Clients and Servers in Node.js - Implementing Socket Services in Node.js - Scaling Applications Using Multiple Processors in Node.js		
UNIT – III	**MIDDLEWARE**	**9 Periods**
Implementing Express in Node.js - Getting Started with Express - Configuring Routes -Implementing Routes - Applying Parameters in Routes - Using Requests Objects - Using Response Objects -Setting Headers - Setting the Status - Sending Response - Sending JSON Responses - Sending Files -Sending a Download Response - Redirecting the Response Implementing a Template Engine Understanding Middleware - Assigning Middleware Globally to a Path - Assigning Middleware to a Single Route - Adding Multiple Middleware Functions - Using the query Middleware -Serving Static Files - Handling POST Body Data - Sending and Receiving Cookies -Implementing Sessions Applying Basic HTTP Authentication - Implementing Session Authentication - Creating Custom Middleware		
UNIT – IV	**BACKEND DEVELOPMENT**	**9 Periods**
Understanding NoSQL and MongoDB - Getting Started with MongoDB and Node.js - Manipulating MongoDB Documents from Node.js - Understanding Database Change Options - Understanding Database Update Operators - Adding Documents to a Collection -Getting Documents from a Collection - Updating Documents in a Collection - Atomically Modifying Documents in a Collection - Understanding Query Objects - Understanding Query Options Objects - Applying MapReduce by Aggregating Results- Using Mongoose for Structured Schema and Validation		
UNIT – V	**WEB DEVELOPMENT FRAMEWORK**	**9 Periods**
Why Angular?- Angular Components – expressions -Interacting with the Component Class in - Data Binding - Built-in Directives - Custom Directives- Events and Change Detection - Implementing Angular Services in Web Applications - Understanding Angular Services - Using the Built-in Services - Sending HTTP GET and PUT Requests with the http Service -Configuring the HTTP Request- Implementing the HTTP Response Callback Functions -Implementing a Simple JSON File and Using the http Service to Access It - Using routes in Angular - Implementing a Simple Router - Implementing a Router with a Navigation Bar -Implementing a Router with - Creating Your Own Custom Angular Services.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOKS:

1	*Brad Dayley, Brendan Dayley, Caleb Dayley, '**Node.js, MongoDB and Angular Web Development**', Addison-Wesley, Second Edition, 2018*
2	*Pinakin Ashok Chaubal ,"**Mastering MEAN Stack**",bpb publications, 2023*

REFERENCES :

1	Paul Deitel, Harvey Deitel, Abbey Deitel "**Internet and World Wide Web- How to Program**" Sixth Edition, Pearson,2020
2	***Infosys Springerboard course : FullStack***
3	*https://javascript.info/*

COURSE OUTCOMES: On completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Design a web page using HTML , CSS ,java script and typescript	K6
CO2	Develop a basic Node.js application structure.	K6
CO3	Explore the role of Express.js in building web applications	K3
CO4	Develop a web application complete with MongoDB integration	K3
CO5	Design a simple application using MEAN framework	K6

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping

COs/ POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	2	2	1	1	2	-	-	-	-	-	-	1	2	2	1
CO2	2	2	1	1	2	-	-	-	-	-	-	1	2	2	1
CO3	2	2	1	1	2	-	-	-	-	-	-	1	2	1	1
CO4	2	2	1	1	2	-	-	-	-	-	-	1	2	1	1
CO5	2	2	1	1	2	-	-	-	-	-	-	2	2	1	1
22SPC514	**2**	**2**	**1**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**2**	**1**
1 – Slight, 2 – Moderate, 3 – Substantial															

b)CO and Key Performance Indicators Mapping	
CO1	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.4.2, 3.1.2, 3.1.3, 3.2.2, 4.1.2, 4.1.3, 4.3.1, 5.1.2, 5.2.1, 5.2.2, 12.1.1, 12.2.1
CO2	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.4.2, 3.1.2, 3.1.3, 3.2.2, 4.1.2, 4.1.3, 4.3.1, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 12.1.1, 12.2.1
CO3	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1 , 2.2.2, 2.4.2, 3.1.2,3.1.3,3.2.2, 4.1.2, 4.1.3, 4.3.1, 4.3.3, 4.3.4, 5.1.1,5.1.2, 5.2.1, 5.2.2, 12.1.1, 12.2.1
CO4	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.4 .2 , 3.1.2, 3.1.3, 3.2.2, 4.1.2,4.1.3,4.3.1, 5.1.1,5.1.25.2.1,5.2.2 ,12.1.1, 12.2.1
CO5	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.4.2, 3.1.2, 3.1.3, 3.2.2, 4.1.2, 4.1.3, 4.3.1, 5.1.1,5.1.2, 5.2.1, 5.2.2, 12.1.1, 12.2.1, 12.2.2, 12.3.2

ASSESSMENTPATTERN –THEORY							
Test /Bloom's Category *	**Remembering (K1)%**	**Understanding (K2)%**	**Applying (K3)%**	**Analyzing (K4)%**	**Evaluating (K5)%**	**Creating (K6)%**	**Total %**
CAT1	-	40	40	-	-	20	100
CAT2	-	20	40	20	-	20	100
IndividualAssessment1 /CaseStudy1/ Seminar 1 /Project1	-	-	50	-	-	50	100
IndividualAssessment2 /CaseStudy2/ Seminar2 / Project2	-	-	-	-	-	100	100
ESE	-	30	40	30	-	-	100

22SMC5Z2	CONSTITUTION OF INDIA *(Common to all Branches)*	SEMESTER III

PREREQUISITES	CATEGORY	L	T	P	C
NIL	MC	3	0	0	0

Course Objectives	*The objective of the course is to familiarize the students on the role, powers and functions of Indian government. Also understand the recent acts in India.	
UNIT- I	**INTRODUCTION AND EMERGENCY PROVISIONS**	**9 Periods**
Historical Background: The Company rule, The Crown rule - Constituent Assembly: Composition, Objectives - Preamble and Salient features of the Indian Constitution - Fundamental Rights, Fundamental Duties, Directive Principles of state policy, Emergency Provisions - National Emergency, President Rule, Financial Emergency.		
UNIT- II	**SYSTEM OF GOVERNMENT**	**9 Periods**
Parliamentary system: merits, demerits, reasons for adopting parliamentary system – Federal system: Evaluation of federal features – Centre-State relations: Legislative, Administrative and Financial relations – Local Government: Panchayat Raj and urban local government.		
UNIT- III	**UNION AND STATE GOVERNMENT**	**9 Periods**
President of India: Election, Powers and functions - Prime Minister and Cabinet: Structure and functions – Governor: Powers and functions - Chief Minister and Council of Ministers: Functions.		
UNIT- IV	**ORGANS OF GOVERNANCE AND RECENT ACTS**	**9 Periods**
Parliament: Lok Sabha and Rajya Sabha, Composition and powers - State Legislative Assembly and Legislative Council: Composition and powers - Judicial System in India: Structure and features - Supreme Court and High Court: Composition, Jurisdiction, Recent acts in significance-RTI, Citizenship act, POCSO act.		
UNIT- V	**POLITICAL DYNAMICS**	**9 Periods**
Political parties: Party system, Recognition of National and State parties – Elections: Electoral system and reforms – Pressure groups – National Integration: Obstacles, National Integration Council – Foreign Policy: Principles and Objectives.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Period**		

TEXT BOOK:

1	*National portal of India, "**The Constitution of India**" (Full Text), https://legislative.gov.in/constitution-of-india*
2	*Dr.B.R.Ambedkar, "**The Constitution of India**", SudhirPrakashan, 2020*

REFERENCES:

1	*Durga Das Basu, "**Introduction to the Constitution of India**, LexisNexis, 2022*
2	*P.M.Bakshi, "**The Constitution of India**", LexisNexis, 2020*
3	*Subash C Kashyap, "**Our Parliament**", National Book Trust, 2021*
4	*Subash C Kashyap, "**Our Political System**", National Book Trust, 2011*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		Bloom's Taxonomy Mapped
CO1	Know the evolution of Indian Constitution and its basic premises.	K1
CO2	Explain the system of governance in India.	K2
CO3	Describe the structure of Union and State Governments	K2
CO4	Obtain the knowledge of functions of Legislature and Judiciary	K1
CO5	Know the political system of India	K1

COURSE ARTICULATION MATRIX:

a) CO and PO Mapping															
COs/POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**	**PS O3**
CO1	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1
CO2	-	-	-	-	-	1	-	1	1	-	-	-	-	-	-
CO3	-	-	-	-	-	2	-	1	1	-	-	-	-	-	-
CO4	-	-	-	-	-	1	-	1	2	-	-	-	-	1	-
CO5	-	-	-	-	-	2	-	2	1	-	-	-	-	-	-
22SMC5Z2	-	-	-	-	-	**2**	-	**1**	**1**	-	-	-	1	1	1
1 – Slight, 2 – Moderate, 3 – Substantial															

b) CO and Key Performance Indicators Mapping	
CO1	6.1.1, 6.2.1, 8.1.1, 8.2.1, 8.2.2, 9.1.2
CO2	6.1.1, 6.2.1, 8.1.1, 8.2.1, 8.2.2, 9.1.2
CO3	6.1.1, 6.2.1, 8.1.1, 8.2.1, 8.2.2
CO4	6.1.1, 6.2.2, 9.1.2, 9.2.1
CO5	6.2.2, 8.1.1,8.2.2, 9.1.2, 9.2.1

ASSESSMENT PATTERN– THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	50	50	-	-	-	-	100
CAT2	50	50		-	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	50	50	-	-	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	50	50	-	-	-	-	100
ESE	50	50	-	-	-	-	100

22SPC515	SOFTWARE ENGINEERING METHODOLOGIES	SEMESTER V

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PC	3	0	2	4

Course Objectives	The objective of this course is to enable the students to understand the role of software process and a process model in a projects, the role of SRS in a project and how requirements are validated, the techniques for estimation, design, testing and project management of large software development projects.	
UNIT – I	**SOFTWARE PROCESS MODEL**	**9+6 Periods**
Principle of Software engineering–Software myths-Prescriptive process model:Waterfall Model-Incremental Process Models-Evolutionary Process Models-Concurrent Models–Unified process–Agile Development: Agility Principles-Extreme Programming– Test Driven Development – Fundamentals – Test Doubles and Mocking – Refactoring – Difference between TDD and BDD- Other Agile Process Model. Case study - Ruby on Rails ,JUnit and TestNG (not for Evaluation)		
UNIT – II	**SOFTWARE REQUIREMENT MODELING**	**9+6 Periods**
Requirement Engineering–Eliciting Requirement-Quality Function Deployment-Building Requirement model-Negotiating Requirement-Validating Requirement-Requirement Analysis-ScenarioBasedModeling-DataModeling-ClassBasedModeling-FlowOrientedModeling.		
UNIT – III	**SOFTWARE DESIGN AND ESTIMATION**	**9+6 Periods**
Design Process - Design Concepts – Design model - architectural design - component level design –User interface design .Software Project Estimation – Decomposition techniques- Empirical Estimation model–specialized estimation technique for Agile Development-project scheduling–risk management.		
UNIT – IV	**SOFTWARE QUALITY AND TESTING**	**9+6 Periods**
Software Quality–Review Techniques–Software Quality Assurance-Test Driven Development–Strategic approach to software testing–Testing Strategies for Conventional software-Object-Oriented software–Validation testing–system testing–Art of Debugging–Testing Conventional Application–Testing Object-Oriented Application-Case study Tarantula: Software testing tool for Agile Development.		
UNIT – V	**SOFTWARE PROJECT MANAGEMENT**	**9+6 Periods**
Software Configuration Management-The SCM repository-The SCM process-The Configuration Management for Web apps- Project Management-The management Spectrum – The People – The Product–The Process-The Project-The W5HH Principle-Critical Practices-Process and Project Metrics.		
Contact Periods: **Lecture: 45 Periods Tutorial: 0 Periods Practical: 15 Periods Total: 60 Periods**		

LISTOFEXPERIMENTS:

1.	Identify a software system that needs to be developed.
2.	Document the Software Requirements Specification (SRS) for the identified system.
3.	Identify use cases and develop the Use Case model.
4.	Identify the conceptual classes and develop a Domain Model and also derive a Class Diagram from that.
5.	Using the identified scenarios, find the interaction between objects and represent them using UML Sequence and Collaboration Diagrams.
6.	Draw relevant State Chart and Activity Diagrams for the same system.
7.	Implement the system as per the detailed design
8.	Test the software system for all the scenarios identified as per the use case diagram
9.	Improve the reusability and maintainability of the software system by applying appropriate design patterns.
10.	Implement the modified system and test it for various scenarios
11	Implement TDD rules(Red ,Green ,Refactor) to develop a typical model code using Ruby on Rails framework.
12	Implement below list of experiments and enhance customer experience for a fictional retail store using retail domain deep dive. • Inventory Management Optimization • Customer Behavior Analysis • Supply Chain Efficiency • Data Analytics and Machine Learning • Customer Satisfaction and Loyalty • Sustainability and Green Retailing

TEXT BOOK:

1	*RogerPressman.S,"**SoftwareEngineering:APractitioner'sApproach**",EighthEdition,McGrawHill, 2014.*

REFERENCES:

1.	*Ian Sommerville,"**Software Engineering**",Nineth Edition,Pearson Education Asia,2011*
2.	*Shari Lawrence P fleeger, Joanne M.Atlee,"**Software Engineering:Theory and Practice**",Fourth Edition, Pearson Education,2011.*
3.	*Victor Farci, Alex Garcia, "**Test-Driven Java Development**", Packt Publishing, 2015*
4	*Michael hartl,"**The Ruby on Rails Tutorial-Learn Web Development with Rails**", Third Edition, 2015.*

COURSE OUTCOMES: On completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Compare various Software Development Life cycle Models	K2
CO2	Design requirement model for a software project	K3
CO3	Perform architectural design, component level design and UI design as well as apply cost and schedule estimation strategies.	K3
CO4	Apply testing strategies to verify and validate a software application.	K3
CO5	Assess project progress using project management techniques	K5

COURSE ARTICULATION MATRIX:

a)CO and PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	2	3	-	-	-	-	-	2	-	3	2	2	2
CO2	2	3	2	3	-	-	-	-	-	2	-	-	2	2	2
CO3	2	3	2	3	-	-	-	-	-	2	-	-	2	2	2
CO4	2	3	2	3	2	-	-	-	-	2	-	3	2	2	3
CO5	2	3	2	3	2	-	1	1	-	2	-	3	2	2	3
22SPC515	**2**	**3**	**2**	**3**	**1**	**-**	**1**	**1**	**-**	**2**	**-**	**2**	**2**	**2**	**3**

1–Slight,2 –Moderate, 3– Substantial

b)CO and Key Performance Indicators Mapping

CO1	1.3.1,1.4.1, 2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.1,2.4.2,2.4.3,2.4.4, 3.1.3, 3.1.6, 3.2.1,3.2.2,3.2.3,3.3.1,3.4.1,3.4.2,4.1.1,4.1.2,4.1.3,4.1.4,4.2.1,4.2.2,4.3.1,4.3.2,4.3.4, 10.1.1,10.1.2,10.1.3, 12.1.1,12.1.2,12.2.1,12.2.2,12.3.1
CO2	1.3.1,1.4.1, 2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.1,2.4.2,2.4.3,2.4.4, 3.1.3, 3.1.6, 3.2.1,3.2.2,3.2.3,3.3.1,3.4.1,3.4.2,4.1.1,4.1.2,4.1.3,4.1.4,4.2.1,4.2.2,4.3.1,4.3.2,4.3.4,10.1.1,10.1.2,10.1.3
CO3	1.3.1,1.4.1, 2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.1,2.4.2,2.4.3,2.4.4,3.1.3, 3.1.6, 3.2.1, 3.2.2,3.2.3,3.3.1,3.4.1,3.4.2, 4.1.1,4.1.2,4.1.3,4.1.4,4.2.1,4.2.2,4.3.1,4.3.2,4.3.4, 10.1.1,10.1.2,10.1.3
CO4	1.3.1,1.4.1, 2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.1,2.4.2,2.4.3,2.4.4, 3.1.3, 3.1.6, 3.2.1,3.2.2,3.2.3,3.3.1,3.4.1,3.4.2, 4.1.1,4.1.2,4.1.3,4.1.4,4.2.1,4.2.2,4.3.1,4.3.2,4.3.4, 5.1.1,5.1.2,5.2.1,5.2.2, 10.1.1,10.1.2,10.1.3, 12.1.1,12.1.2,12.2.1,12.2.2,12.3.1
CO5	1.3.1,1.4.1, 2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.1,2.4.2,2.4.3,2.4.4, 3.1.3, 3.1.6, 3.2.1, 3.2.2,3.2.3,3.3.1,3.4.1,3.4.2, 4.1.1,4.1.2,4.1.3,4.1.4,4.2.1,4.2.2,4.3.1,4.3.2,4.3.4, 10.1.1,10.1.2,10.1.3, 12.1.1,12.1.2,12.2.1,12.2.2,12.3.1

ASSESSMENT PATTERN –THEORY							
Test /Bloom's Category*	**Remembering (K1)%**	**Understanding (K2)%**	**Applying (K3) %**	**Analyzing (K4)%**	**Evaluating (K5)%**	**Creating (K6)%**	**Total %**
CAT 1	-	30	30	40	-	-	100
CAT 2	-	20	40	40	-	-	100
IndividualAssessment1 /CaseStudy1/ Seminar 1 /Project1	-	-	50	50	-	-	100
IndividualAssessment2 /CaseStudy2/ Seminar 2 /Project2	-	-		50	-	50	100
ESE	-	20	40	40	-	-	100

22SPC516	COMPUTER NETWORKS LABORATORY *(Common to CSE & IT)*	SEMESTER V

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PC	0	0	3	1.5

Course Objectives	The objective of this course is to make the students familiar with Linux and web based tools, Socket programming,NS2/NS3 Simulators

LIST OF EXPERIMENTS

1. (i) Use Linux tools like ifconfig, dig, ethtool, route, netstat, nslookup, and ip to understand the networking configuration of the computer that the student is working on.
   (ii) Install and configure some network applications, e.g. Apache, Bind (DNS)
2. (i) Use Wireshark to capture packets when browsing the Internet. Examine the structure of packets: the various layers, protocols, headers, payload
   (ii) Understand various header fields and their usage in different application layer protocols using Wireshark packet capture
3. Socket programming:
   a. write a simple clientserver program using TCP and UDP sockets
   b. Modify server to handle multiple clients concurrently
4. Measure TCP throughput between two hosts in a network using tools like iperf. Modify TCP configuration parameters. Use the tc Linux utility or similar to control bandwidth, delay, loss. Observe impact on measured throughput.
5. Experiment with multiple applications running concurrently to generate congestion: Observe the behaviour of congestion control protocols in NS-2/NS-3, change various network parameters and observe evolution of the TCP congestion window.
6. Use tools like ping and trace route to explore various Internet paths to popular servers.
7. Use web-based tools like the who is utility to query Internet registries, and understand which IP addresses are allocated to the student's network. Find out which are the major ISPs, and which is the ISP of the student's network.
8. Configure a simple mesh network using computers in the lab, or using Mininet. Setup static routes to conform to the desired mesh topology.
9. Use NS-2/NS-3 to simulate a mesh of at least 4 nodes and 3 links to evaluate performance under various conditions
10. Use Linux network tools like ethtool to observe and analyze link layer packet statistics and errors
11. Use NS- 2/NS-3 to simulate medium access protocols. Observe contention, collisions and packet loss in medium access protocols. Observe the working of error detection/recovery mechanisms.
12. Understand the behavior of Wi-Fi using NS-2/NS-3.
13. Simulate transport protocols optimized for data centers in NS-2/NS-3.
14. Use cell phone to measure cellular signal strength (RSS) at various places in the campus. Draw a contour map with cell phone towers and RSS levels. Correlate with upload/download speed using tools like Measurement Lab speed test.
15. Implement a streaming audio/video server using open-source software.

Contact Periods:
Lecture: 0 Periods Tutorial: 0 Periods Practical: 45 Periods Total: 45 Periods

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Install and configure network applications	K3
CO2	Write a simple client server program using socket programming	K3
CO3	Measure TCP throughput between two hosts in a network using tools	K3
CO4	Use linux/web based tools to understand the network architecture	K3
CO5	Use NS- 2/NS-3 to simulate protocols	K3

COURSE ARTICULATION MATRIX

a) CO and PO Mapping

COs/ POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	1	1	1	1	3	1	-	1	-	-	-	-	1	1	1
CO2	2	2	2	2	2	1	-	1	-	-	-	-	2	2	2
CO3	2	2	2	2	2	1	-	1	-	-	-	-	2	2	2
CO4	1	1	1	1	3	1	-	1	-	-	-	-	1	1	1
CO5	1	1	1	1	3	1	-	1	-	-	-	-	1	1	1
22SPC516	**2**	**2**	**2**	**2**	**3**	**1**	-	**1**	-	-	-	-	**2**	**2**	**2**

1– Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.3.1, 2.1.2, 3.1.1, 4.1.1, 5.1.1, 5.2.1, 5.3.1, 8.1.1
CO2	1.1.1, 1.3.1, 2.1.1, 2.1.2, 3.1.1, 3.2.1, 4.1.1, 4.1.2, 5.1.1, 5.2.1, 8.1.1
CO3	1.1.1, 1.3.1, 2.1.1, 2.1.2, 3.1.1, 3.2.1, 4.1.1, 4.1.2, 5.1.1, 5.2.1, 8.1.1
CO4	1.3.1, 2.1.2, 3.1.1, 4.1.1, 5.1.1, 5.2.1, 5.3.1, 8.1.1
CO5	1.3.1, 2.1.2, 3.1.1, 4.1.1, 5.1.1, 5.2.1, 5.3.1, 8.1.1

22SEE501	EMBEDDED COMPUTING SYSTEMS LABORATORY	SEMESTER V

PREREQUISITES	CATEGORY	L	T	P	C
NIL	EEC	0	0	3	1.5

Course Objectives	The objective of this course is to implement assembly programs on ARM based Processor, Configuration of GPIO port pins and Usage of Timer and Interrupt handler.

LIST OF EXPERIMENTS

1. Study of ARM based Processor
2. Simple Assembly Program for
   a. Addition | Subtraction | Multiplication | Division
   b. Operating Modes, System Calls and Interrupts
   c. Loops, Branches, Operators.
3. Write an Assembly programs to configure and control General Purpose Input/output(GPIO) port pins.
4. Write an Assembly programs to read digital values from external peripherals and execute Them with the Target board.
5. Program to perform reading and writing from a file
6. Program to demonstrate Time delay program using built in Timer / Counter feature on IDE environment
7. Program to demonstrate a simple interrupt handler and setting up a timer.
8. Program to Interface 8 Bit LED and Switch Interface
9. Program to implement Buzzer Interface on IDE environment
10. Program to display a message in a 2 line x 16 Characters LCD display and verify the result in debug terminal.
11. Mini project

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Write simple Assembly program in an ARM based Processor.	**K3**
CO2	Analyze and implement program for configuring GPIO port pin, Timer and Interrupts.	**K4**
CO3	Demonstrate the Usage of Files.	**K2**
CO4	Create programs that interact with other devices like LED, Switch and LCD.	**K6**
CO5	Develop simple Embedded applications**.**	**K5**

COURSE ARTICULATION MATRIX :

a) CO and PO Mapping

COs/POs	PO 1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	2	2	1	3	3	-	-	-	-	1	1	-	3	3	-
CO2	2	1	1	3	3	-	-	-	-	-	1	-	3	3	-
CO3	2	2	2	3	3	-	1	-	-	1	1	-	3	3	-
CO4	2	2	1	2	3	-	-	-	-	-	1	-	3	3	-
CO5	2	3	2	3	3	-	3	-	-	1	1	-	3	3	-
22SEE501	2	2	2	3	3	-	1	-	-	1	1	-	3	3	-

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators Mapping

CO1	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.3, 2.2.4, 3.1.4, 3.2.1, 3.3.1, 4.1.1, 4.1.2, 4.1.4, 4.2.1, 4.3.1, 4.3.4, 5.1.1, 5.1.2, 5.2.2, 5.3.1, 5.3.2, 10.1.3, 11.3.2.
CO2	1.3.1, 1.4.1, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 3.1.4, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.2.1, 4.2.2, 4.3.1, 4.3.2 5.1.1, 5.1.2, 5.2.1,5.2.2,5.3.1, 5.3.2, 11.3.2.
CO3	1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.4.1, 2.4.2, 2.4.4, 3.1.3,3.1.4, 3.2.1, 3.3.1, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.2.2, 4.3.1, 4.3.3, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 5.3,2, 7.1.2, 10.1.2, 11.3.2.
CO4	1.1.2, 1.3.1, 1.4.1, 2.1.2, 2.1.3, 2.2.3, 2.2.4, 2.4.3, 3.1.4, 3.2.3, 3.4.1, 4.1.2, 4.1.3, 4.2.1,4.3.3, 5.1.1, 5.1.2, 5.2.1, 5.3.1, 5.3.2,11.3.2.
CO5	1.1.2, 1.3.1, 1.4.1, 2.1.2, 2.1.3, 2.2.1,,2.1.2, 2.1.3, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.4.4, 3.1.1, 3.1.3,3.1.4, 3.2.1, 3.2.2, 3.2.3, 3.3.1, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.2.2, 4.3.1, 4.3.3, 5.1.1, 5.1.2, 5.2.1, 5.2.2, 5.3.1, 5.3,2, 7.1.1, 7.1.2, 7.2.1, 7.2.2, 10.1.2, 11.3.2.