Koneru Lakshmaiah Education Foundation
(Category -1, Deemed to be University estd. u/s. 3 of the UGC Act, 1956)
Accredited by NAAC as 'A++' ❖Approved by AICTE ❖ ISO 9001-2015 Certified
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DEPARTMENT OF INTERNET OF THINGS

PROGRAM DEVELOPMENT DOCUMENT

B.TECH(IoT)

2022 R

Vision of University: To be a globally renowned university.

Mission of University:

To impart quality higher education and to undertake research and extension with emphasis on application and innovation that cater to the emerging societal needs through all-round development of students of all sections enabling them to be globally competitive and socially responsible citizens with intrinsic values.

Vision of Department:

To evolve into a globally recognized department in the frontier areas of Internet of Things (IoT).

Mission of Department:

Mission statements:

M1: To produce graduates having professional excellence

M2: To carry out quality research having social & industrial relevance

M3: To provide technical support to budding entrepreneurs and existing Industries.

Academic Goals:

G1: To offer academic flexibility by means of Choice based credit systems and the like.

G2: To identify and introduce new specializations and offer programs in emerging areas therein

G3: To incorporate into the curriculum the Application orientation and use high standards of competence for academic delivery

G4: To design and implement an educational system adhering to outcome-based International models.

G5: To introduce and implement innovation in the teaching and learning process to strengthen academic delivery

G6: To offer academic programs at UG which are industry-focused, and incorporate Trans-discipline, and inter-discipline aspects of the education system

G7: To deliver higher education that includes technologies and meeting the global requirements

Program Educational Objectives (PEOs):

- **PEO1:** Practice engineering in a broad range of industrial, societal, and real-worldapplications.
- **PEO2:** Pursue advanced education, research and development, and other creative and innovative efforts in science, engineering, and technology, as well as other professional careers.
- **PEO3:** Conduct themselves in a responsible, professional, and ethical manner.
- **PEO4:** Participate as leaders in their fields of expertise and in activities that support service and economic development throughout the world.

Program Outcomes (POs):

PO1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues, and the consequent

	responsibilities relevant to the professional engineering practice.
PO7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and teamwork**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-long learning**: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs):

PSO1	An ability to solve Electronics engineering problems, using **latest hardware and software tools,** to obtain appropriate solutions in the domain of embedded systems and Internet of things.
PSO2	Ability to **design web applications** by applying the knowledge of cyber security.

MAPPING OF ACADEMIC GOALS WITH MISSION Statements:

Academic Goals	Mission Statements		
	M1	M2	M3
G1	□		
G2		□	
G3		□	□
G4	□		
G5			□
G6	□		
G7	□	□	□

MAPPING OF PEO's with ACADEMIC GOALS:

	Academic Goals						
	G1	**G2**	**G3**	**G4**	**G5**	**G6**	**G7**
PEO1	□	□		□			
PEO2	□				□	□	□
PEO3			□			□	□
PEO4		□		□	□		

Mapping of PEOs with Mission Statements of the Department:

S.NO	**Description of PEOs**	**Key Components of Mission**		
		M 1	**M 2**	**M 3**
PEO 1	Practice engineering in a broad range of industrial, societal, and real-world applications.	□		□
PEO 2	Pursue advanced education, research and development, and other creative and innovative efforts in science, engineering, and technology, as well as other professional careers.	□	□	
PEO 3	Conduct themselves in a responsible, professional, and ethical manner.	□		□
PEO 4	Participate as leaders in their fields of expertise and in activities that support service and economic development throughout the world	□		□

MAPPING OF POs/PSOs with PEOs:

S.NO	Key Components of POs and PSOs	Description of PEO			
		Practice engineering in a broad range of industrial, societal, and real-world applications .	Pursue advanced education, research and development, and other creative and innovative efforts in science, engineering, and technology, as well as other professional careers.	Conduct themselves in a responsible, professional, and ethical manner.	Participate as leaders in their fields of expertise and in activities that support service and economic development throughout the world.
		PEO1	**PEO2**	**PEO3**	**PEO4**
PO1	Engineering knowledge	□			
PO2	Engineering knowledge	□			
PO3	Design/development of solutions		□	□	
PO4	Conduct investigations of complex problems:	□	□	□	□
PO5	Modern tool usage	□	□	□	
PO6	The engineer and society	□	□		
PO7	Environment and sustainability			□	□
PO8	Ethics			□	
PO9	Individual and teamwork	□	□		□
PO10	Communication	□	□		□
PO11	Project management and finance	□	□		□
PSO1	hardware and software tools	□	□		
PSO2	Web Designing and Cyber Security	□	□		□

Thrust areas of INTERNET OF THINGS			
LOCAL **(*APSSDC etc.,)***	**REGIONAL** **(APIIC & *Industry Policy-Telangana etc.,)***	**NATIONAL** ***(CII, NSDC, NASSCOM, etc.,)***	**GLOBAL** ***(World Economic Forum, O*NET, Gartner Report etc.,)***
Wireless communications	IOT	Management Science	Data Communication
Actuators	Machine learning and artificialintelligence	Basic electronics	Wireless Communication
Importance of communication	Sensors	Micro Controllers and Processors	Internet of Things
Data Analysis	Automated electronics	Embedded Systems	Robotics and automation
Computer Network	Cloud Computing	Web Services and APIS	Web Development and Security
https://www.apiic.in/	**https://nasscom.in/knowledge-centre**	**https://nsdcindia.org/**	**https://www.onetonline.org/link/summary/15-1241.00?redir=15-1143.00**

Mapping of Needs with Mission Statements:

Local, Regional, National, and Global Needs		**Mission Statements**		
		M1	**M2**	**M3**
Local Needs	Wireless communications	□		□
	Actuators		□	□
	Importance of communication	□		
	Data Analysis	□		□
	Computer Network	□		□
Regional Needs	IoT	□		□
	Machine learning and artificialintelligence		□	
	Sensors		□	
	Automated electronics	□		□
National Needs	Management Science	□	□	
	Basic electronics		□	
	Micro Controllers and Processors	□	□	
	Embedded Systems	□	□	
	Cloud and Web Services	□		□
Global Needs	Wireless Communication		□	
	Bio-medical Instrumentation	□		□
	Robotics and automation	□		□
	Web Development and Security	□	□	

Course Outcomes (COs) introduced / Revised in 2022-23 Curriculum as per Local, Regional, National, and Global Needs:

Local, Regional, National, and Global Needs		Course Outcome (CO)	Course Title
Local Needs	Wireless communications	Apply the concepts of IoT Architecture and Technologies	IoT Principles & Architecture
		Apply the logical design of IoT systems and communication technologies.	
		Apply IoT networking protocols and Authentication Protocols for the IoT Application layer.	
		Apply IoT protocols and programming concepts for real-world problems.	
	Actuators	To make the students understand the operating principles, signal conditioning, and A/D conversion	Sensors and Actuators
		The students must be able to trace of the Analog signal flow from the sensors till the time the data is received at the controller side.	
		The students must be able to trace of the Analog signal flow from the controller till the time the actual control is exercised	
		The students must be able to trace of the Digital signal flow from the digital sensors till the time the data is received at the controller side.	
	Importance of communication	Extend word power for developing effective speaking and writing skills	Corporate Readiness Skills
		Interpret Interpersonal Skills	
		Differentiate critical and general reading skills	
		Demonstrate the necessary skills to be employable	
	Data Analysis	Enumerate the statistics on transmitted data emanated from different embedded and IOT devices	Data Science and Data Analytics
		Analysis perspective on Data Repositories	
		Apply data Modelling, Structuring, and Analytics using R Language	
		Apply HADOOP and MAP reduce tools in the process of undertaking Analytics	
	Computer Network	Apply basic communication principles on computer networks to analyze the performance of computer networks	Network Protocols& Security
		Apply the knowledge of IP addressing to analyse and configure different routing and network layer protocols	
		Apply the knowledge of transport layer protocols and analyse congestion control algorithms with application layer protocols .	
		Apply basic cryptography methods to establish secure communication and analyze the different Security protocols, digital signatures, firewalls etc	
Regional Needs	IOT	Apply knowledge and demonstrate programming proficiency using the various addressing modes and instructions of 8086 microprocessor for the basic mathematical operations	Processors and Controllers
		Apply knowledge and demonstrate programming proficiency using the various addressing modes and instructions of 8051 microcontroller for basic programs	
		Develop systems by applying the Programming concepts of interfacing the peripheral devices to 8051	
		Apply the concepts of ARM 7 microcontrollers to design basic embedded systems.	
	Machine learning and artificial intelligence	To understand the basics of Probability, statistics and its applications.	Data Driven AI
		To Emphasis on the applications and tools of AI	
		To apply the concepts of AI searching techniques and ANN models	

		To Implement AI and ANN Models for real time problems	
	Sensors	To make the students understand the operating principles, signal conditioning, and A/D conversion	Sensors and Actuators
		The students must be able to trace the Analog signal flow from the sensors till the time the data is received at the controller side.	
		The students must be able to trace the Analog signal flow from the controller till the time the actual control is exercised	
		The students must be able to trace the Digital signal flow from the digital sensors till the time the data is received at the controller side.	
	Automated electronics	Apply Embedded programming concepts for embedded controller GPIOs programming	Embedded Systems Design
		Demonstrate interfacing of various peripherals to generate signals for realistic applications	
		Explore communication protocols and apply them to interface external devices to the embedded controller and devices.	
		Apply RTOS concepts in embedded controllers and Processors	
National Needs	Management Science	Realize and understand the basic aspiration, harmony in the human being.	Universal Human Values & Professional Ethics
		Envisage the roadmap to fulfill the basic aspiration of human beings.	
		Understanding the society and nature with the view of human values	
		Understand the profession and his role in this existence.	
	Basic electronics	Analyse the operation of lumped elements like transistors and illustrate their electronic behaviour.	Electronic Devices & Circuits
		Distinguish linear and nonlinear circuits using lumped elements and analyse their response	
		Interpret feedback in amplifiers and realize them through lumped element circuits and linear ICs	
		Design various electronic circuits using linear ICs and demonstrate their applications	
	Micro Controllers and Processors	Apply knowledge and demonstrate programming proficiency using the various addressing modes and instructions of 8086 microprocessor for the basic mathematical operations	Processors and Controllers
		Apply knowledge and demonstrate programming proficiency using the various addressing modes and instructions of 8051 microcontroller for basic programs	
		Develop systems by applying the Programming concepts of interfacing the peripheral devices to 8051	
		Apply the concepts of ARM 7 microcontrollers to design basic embedded systems.	
	Embedded Systems	Apply Embedded programming concepts for embedded controller GPIOs programming	Embedded Systems Design
		Demonstrate interfacing of various peripherals to generate signals for realistic applications	
		Explore communication protocols and apply them to interface external devices to the embedded controller and devices.	
		Apply RTOS concepts in embedded controllers and Processors	
Global Needs	Data Communication	Apply basic communication principles on computer networks to analyze the performance of computer networks	Data Networks & Protocols
		Apply the knowledge of IP addressing to analyse and configure different routing and network layer protocols	
		Apply the knowledge of transport layer protocols and analyse congestion control algorithms with application layer protocols .	
		Apply basic cryptography methods to establish secure communication and analyze the different Security protocols, digital signatures, firewalls etc	
	Wireless Communication	Apply the Design concepts of linear and nonlinear modulation systems	

		Apply different digital modulation Systems.	Analog and Digital Communication
		Apply various line coding procedures and signalling schemes to facilitate data communications	
		Analyze different multiple access schemes and different types of networks.	
	Internet of Things	Apply the concepts of IoT Architecture and Technologies	IoT Principles & Architecture
		Apply the logical design of IoT systems and communication technologies.	
		Apply IoT networking protocols and Authentication Protocols for the IoT Application layer.	
		Apply IoT protocols and programming concepts for real-world problems.	
	Robotics and automation	Apply Embedded programming concepts for embedded controller GPIOs programming	Embedded Systems Design
		Demonstrate interfacing of various peripherals to generate signals for realistic applications	
		Explore communication protocols and apply them to interface external devices to the embedded controller and devices.	
		Apply RTOS concepts in embedded controllers and Processors	

Distribution of Credits

Departments are required to highlight the distribution of credits across the various course categories.

Sl No	Course Category	Short Name	No. Of courses	Minimum Credits	Contact Hours	As per AICTE/Any other body Credits	As per ABET Credit Hours(if applicable)
1	Humanities & Social Sciences	HSS	9	12.0	26	12	
2	Basic Sciences	BS	15	25.5	39	25	
3	Engineering Sciences	ES	7	23.5	39	24	
4	Professional Core	PC	12	47.0	59	48	
5	Flexi Core	FC	2	8.0	10	-	
6	Professional Electives	PE	5	15.0	21	18	
7	Project Courses	PR	10	19.0	76	15	
8	Open Electives	OE	5	14.0	14	18	
Total			**65**	**164.0**	**284**	**160**	

Program Structure

The detailed structure of the program highlights all the courses and their credits

Course Code	Course Title	Category	L	T	P	S	Cr	CH	Pre-Requisite	New Course/Revised course/ Retained Course	Stakeholder feedback based on which change was proposed	Focused on Employability/ Entrepreneurship/ Skill Development	Justification
22UC1101	Integrated Professional English	HSS	0	0	4	0	2	4	Nil	retain		Employability	Covers the programming Concepts which helps students for attaining better employment
22UC1202	English Proficiency	HSS	0	0	4	0	2	4	Nil	retain		Employability	
22UC2103	Essential Skills for Employability	HSS	0	0	4	0	2	4	Nil	retain		Employability	
22UC2204	Corporate Readiness Skills	HSS	0	0	4	0	2	4	Nil	retain		Employability	
22UC0010	Universal Human Values & Professional Ethics	HSS	2	0	0	0	2	2	Nil	retain		Sociality	Basic course helps better to understand society
22UC0019	ESSENCE OF INDIAN KNOWLEDGE TRADITION	HSS	2	0	0	0	0	2	Nil	New course	External BoS member	Entrepreneurship	Concepts that help the students for attaining better entrepreneurship
22UC0008	INDIAN CONSTITUTION	HSS	2	0	0	0	0	2	Nil	retain		Entrepreneurship	
22UC0009	Ecology & Environment	HSS	2	0	0	0	0	2	Nil	retain		Entrepreneurship	
22UC0016	GENDER & SOCIAL EQUALITY	HSS	2	0	0	0	2	2	Nil	New course	External BoS member	Entrepreneurship	
22MT1101	Mathematics for Computing	BS	2	2	0	2	5	6	Nil	retain		Employability	Basic course helps better to understand society
22MT2102	Mathematics for Engineers	BS	2	1	0	0	3	3	Nil	retain		Employability	Basic course helps better employment
22MT2005	PROBABILITY, STATISTICS & QUEUEING THEORY	BS	2	2	0	0	4	4	MFC	New course	External BoS member	Employability	Basic course helps better employment
22MT2004	MATHEMATICAL PROGRAMMING	BS	2	2	0	0	4	4	MFE	New course	External BoS member	Employability	Basic course helps better employment
22PH1008	Physics for Electronics Engineering	BS							Nil	Retain		Employability	Basic course helps better to employment
22CY1101	Engineering Chemistry	BS							Nil	Retain		Employability	Basic course helps employment
22SC1101	Computational Thinking for Structured Design	ES	3	0	2	6	6	11	Nil	Retain		Employability	Basic course helps to develop problem solving skills and get employment
22ME1103	DESIGN TOOL WORKSHOP	ES	0	0	4	0	2	4	Nil	Retain		Employability & Skill Development	Basic course helps to get better employment
22SC1209	IOT WORKSHOP	ES	0	0	4	0	2	4	Nil	New course		Employability& Skill Development	Basic course helps better employment
22SC1202	DATA STRUCTURES	ES	3	0	2	4	5	9	CTSD	retain		Employability	It is needed for Developing Software

221EC1101	Digital Logic & Processors	ES	3	0	2	0	4	5	Nil	retain		Employability	It is needed for understanding processors and digital logic
22EC1202	Computer Organization & Architecture	ES	2	0	0	0	2	2	21EC1101	retain		Employability	Basic course helps better employment
22EC1203	Design of Basic Electronic Circuits	ES	3	0	0	0	3	3	Nil	retain		Employability	It is needed for Basic Electronics for Hardware
22UC3108	PROBLEM SOLVING AND REASONING SKILLS1	ES	0	0	0	4	1	4	Nil	retain		Employability	It is needed for students placement process-based tests
22UC3109	PROBLEM SOLVING AND REASONING SKILLS2	ES	0	0	0	4	1	4	Nil	retain		Employability	It is needed for students placement process-based tests
22EC2104R	ANALOG ELECTRONIC CIRCUIT DESIGN	PC	3	0	2	2	5	7	BEEC	retain		Employability	Core course helps better employment
22IN2205	COMMUNICATION TECHNOLOGY	PC	3	0	2	0	4	5	LACE	retain		Employability	Core course helps better employment
22IN2101	Processors and Controllers	PC	3	0	2	0	4	5	DDCA	retain		Employability	Core course helps better employment
22IN2202R	Embedded Systems Design	PC	2	0	2	0	3	4	PC	retain		Employability	Core course helps better employment
22EC2210R	NETWORK PROTOCOLS AND SECURITY	PC	3	0	2	0	4	5	DDCA	retain		Employability	Core course helps better employment
22IN2101R	IoT Principles & Architecture	PC	2	0	4	0	4	6	FITS	retain		Employability	Core course helps better employment
22IN2204R	CLOUD COMPUTING FOR IOT	PC	2	0	4	0	4	6	IOTPA	retain		Employability	Core course helps better employment
22EC3107	OBJECT ORIENTED PROGRAMMING	PC	3	0	2	0	4	5	CTSD	retain		Employability	Core course helps better employment
22AD2001R	DATA DRIVEN ARTIFICIAL INTELLIGENCE SYSTEMS	PC	3	0	2	0	4	5	CTSD	New course	Industry personal	Employability	Core course helps better employment
22IN2003R	REAL TIME OPERATING SYSTEMS	PC	2	0	2	0	3	4	DDCA	New course	Industry personal	Employability	Core course helps better employment
21IN3016	Wireless Ad-hoc Networks	FC	3	0	2	0	4	5	Nil	retain		Employability	Core course helps better employment
22CS2103R	ADVANCED OBJECT ORIENTED PROGRAMMING	FC	2	0	2	0	3	4	Nil	retain		Employability	Core course helps better employment
22CS2205F	DESIGN & ANALYSIS OF ALGORITHMS	FC	2	0	2	0	3	4	Nil	retain		Employability	Core course helps better employment
22CS4106F	PARALLEL & DISTRIBUTING COMPUTING	FC	2	0	2	0	3	4	Nil	retain		Employability	Core course helps better employment
22CS2002F	AUTOMATA THEORY & FORMAL LANGUAGES	FC	2	0	2	0	3	4	Nil	retain		Employability	Core course helps better employment
22EE3107F	CONTROL SYSTEMS	FC	2	0	2	0	3	4	Nil	retain		Employability	Core course helps better employment

22AD3104F	DATA WAREHOUSING AND MINING	FC	FC	2	0	2	0	3	Nil	retain		Employability	Core course helps better employment
22CI2002F	CONTINUOUS DELIVERY & DEVOPS	FC	FC	2	0	2	0	3	Nil	retain		Employability	Core course helps better employment
22AD3206F	DATA SCIENCE AND VISUALIZATION	FC	FC	2	0	2	0	3	Nil	retain		Employability	Core course helps better employment
22EC2211F	VLSI DESIGN	FC	FC	2	0	2	0	3	Nil	retain		Employability	Core course helps better employment
22IOT3101R	Industrial Internet of Things	PE	2	0	2	4	4	8	FIOT	retain		Employability	Professional elective course helps better employment
22IOT3202	Edge Computing	PE	2	0	2	0	3	4	ROS	retain		Employability	Professional elective course helps better employment
22IOT3305R	DEEP LEARNING	PE	2	0	2	4	4	8	ML	retain		Employability	Professional elective course helps better employment
22IOT3406M	DATA VISUALISATION TECHNIQUES	PE	3	0	0	0	3	3	DBMS	retain		Employability	Professional elective course helps better employment
22IOT3508	BIG DATA ANALYTICS	PE	2	0	2	0	3	4	DBMS	retain		Employability	Professional elective course helps better employment
22SDIN01R	IOT HARWARE PROGRAMMING (SDP1)	SDC	0	0	2	4	2	6	FITS	retain		SKILL DEVELOPMENT	helps to attain better employment
22SDIN02R	IOT FULL STACK DEVELOPMENT(SDP-2)	SDC	0	0	2	4	2	6	IOTHP	retain		SKILL DEVELOPMENT	helps to attain better employment
22SDIN03	IOT PRODUCT DEVELOPMENT(SDP-3)	SDC	0	0	2	4	2	6	Nil	retain		SKILL DEVELOPMENT	helps to attain better employment
22SDIN04	IOT ANALYTICS ON AWS CLOUD	SDC	0	0	2	4	2	6	Nil	retain		SKILL DEVELOPMENT	helps to attain better employment
22IE2040	Social Internship	PR	0	0	0	4	1	4	Nil	retain		Entrepreneurship	Project base course helps to attain better employment
22IE3041	Technical Internship	PR	0	0	0	4	1	4	Nil	retain		Entrepreneurship	Project base course helps to attain better employment
22IE4042	Industry Internship	PR	0	0	0	4	1	4	Nil	retain		Entrepreneurship	Project base course helps to attain better employment
22IE3043	Term paper	PR	0	0	0	4	1	4	Nil	New course		Skill development/	Project base course helps better
21IE3044	Mid Grad Capstone Project – I	PR	0	0	0	8	2	8	Nil	retain		Entrepreneurship	Project base course helps better employment and Entrepreneurship

22IE3045	Mid Grad Capstone Project – II	PR	0	0	0	8	2	8	Nil	retain		Entrepreneurship	Project base course helps better employment and Entrepreneurship
22IE4048	Project	PR	0	0	0	16	4	16	Nil	retain		Entrepreneurship	Project base course helps better employment and Entrepreneurship
21IE4049	Project	PR	0	0	0	16	4	16	Nil	retain		Entrepreneurship	Project base course helps better employment and Entrepreneurship
21IE4050	Practice School	PR	0	0	0	16	4	16	Nil	retain		Entrepreneurship	Project base course helps better employment and Entrepreneurship
21IE4051	Internship -1	PR	0	0	0	16	4	16	Nil	retain		Entrepreneurship	Project base course helps better employment and Entrepreneurship
21IE4052	Internship 2		0	0	0	16	4	16	Nil	retain		Entrepreneurship	Project base course helps better employment and Entrepreneurship

MAPPING OF COURSES WITH PROGRAM OUTCOMES (POs) and PROGRAM SPECIFIC OUTCOMES (PSOs)

Sl No	Course Code	Course Title	Category	L	T	P	S	Cr	CH	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	22UC1101	Integrated Professional English	HSS	0	0	4	0	2	4	2				1			2						
2	22UC1202	English Proficiency	HSS	0	0	4	0	2	4	3			1	3	3								
3	22UC2103	Essential Skills for Employability	HSS	0	0	4	0	2	4	3	3	3											
4	22UC2204	Corporate Readiness Skills	HSS	0	0	4	0	2	4	3	2	3											
5	22UC0010	Universal Human Values & Professional Ethics	HSS	2	0	0	0	2	2	3	1	3											
6	22UC0019	ESSENCE OF INDIAN KNOWLEDGE TRADITION	HSS	2	0	0	0	0	2	2	3	1											
7	22UC0008	INDIAN CONSTITUTION	HSS	2	0	0	0	0	2	1	2	1											
8	22UC0009	Ecology & Environment	HSS	2	0	0	0	0	2	3	3	3											
9	22UC0016	GENDER & SOCIAL EQUALITY	HSS	2	0	0	0	2	2	3	1	2											
10	22MT1101	Mathematics for Computing	BS	2	2	0	2	5	6	1	3	2											
11	22MT2102	Mathematics for Engineers	BS	2	1	0	0	3	3	2	2	2											
12	22MT2005	PROBABILITY, STATISTICS & QUEUEING THEORY	BS	2	2	0	0	4	4	2	2	1											
13	22MT2004	MATHEMATICAL PROGRAMMING	BS	2	2	0	0	4	4	3	1	1											
14	22PH1008	Physics for Electronics Engineering	BS							1	2	2											
15	22CY1101	Engineering Chemistry	BS							1	3	2											
16	22SC1101	Computational Thinking for Structured Design	ES	3	0	2	6	6	11	1	2	2											
17	22ME1103	DESIGN TOOL WORKSHOP	ES	0	0	4	0	2	4	3	2	1											

18	22SC1209	IOT WORKSHOP	ES	0	0	4	0	2	4	3	1	1												
19	22SC1202	DATA STRUCTURES	ES	3	0	2	4	5	9	2	1	1												
20	221EC1101	Digital Logic & Processors	ES	3	0	2	0	4	5	1	2	1												
21	22EC1202	Computer Organization & Architecture	ES	2	0	0	0	2	2	2	3	3												
22	22EC1203	Design of Basic Electronic Circuits	ES	3	0	0	0	3	3	1	2	1												
23	22UC3108	PROBLEM SOLVING AND REASONING SKILLS1	ES	0	0	0	4	1	4	3	2	1												
24	22UC3109	PROBLEM SOLVING AND REASONING SKILLS2	ES	0	0	0	4	1	4	2	3	1												
25	22EC2104R	ANALOG ELECTRONIC CIRCUIT DESIGN	PC	3	0	2	2	5	7	1	3	2	2											
26	22IN2205	COMMUNICATION TECHNOLOGY	PC	3	0	2	0	4	5	2	2	1	3											
27	22IN2101	Processors and Controllers	PC	3	0	2	0	4	5	2	2	3	1											
28	22IN2202R	Embedded Systems Design	PC	2	0	2	0	3	4	1	1	1	1											
29	22EC2210R	NETWORK PROTOCOLS AND SECURITY	PC	3	0	2	0	4	5	1	3	2	2											
30	22IN2101R	IoT Principles & Architecture	PC	2	0	4	0	4	6	1	1	1	1											
31	22IN2204R	CLOUD COMPUTING FOR IOT	PC	2	0	4	0	4	6	2	1	1	1											
32	22EC3107	OBJECT ORIENTED PROGRAMMING	PC	3	0	2	0	4	5	1				2	3									1
33	22AD2001R	DATA DRIVEN ARTIFICIAL INTELLIGENCE SYSTEMS	PC	3	0	2	0	4	5	3					1	3								3
34	22IN2003R	REAL TIME OPERATING SYSTEMS	PC	2	0	2	0	3	4	2	2	2						2						2
35	21IN3016	Wireless Ad-hoc Networks	FC	3	0	2	0	4	5	2							3	3						1
36	22CS2103R	ADVANCED OBJECT-ORIENTED PROGRAMMING	FC	2	0	2	0	3	4	2							2	2					1	1
37	22CS2205F	DESIGN & ANALYSIS OF ALGORITHMS	FC	2	0	2	0	3	4	1							1							3

38	22CS4106F	PARALLEL & DISTRIBUTING COMPUTING	FC	2	0	2	0	3	4	2	1								1				2
39	22CS2002F	AUTOMATA THEORY & FORMAL LANGUAGES	FC	2	0	2	0	3	4	2								2					2
40	22EE3107F	CONTROL SYSTEMS	FC	2	0	2	0	3	4	1							2	1					2
41	22AD3104F	DATA WAREHOUSING AND MINING	FC	FC	2	0	2	0	3	3							1	2					3
42	22CI2002F	CONTINUOUS DELIVERY & DEVOPS	FC	FC	2	0	2	0	3	1							3	1					1
43	22AD3206F	DATA SCIENCE AND VISUALIZATION	FC	FC	2	0	2	0	3	1							3	1					1
44	22EC2211F	VLSI DESIGN	FC	FC	2	0	2	0	3	2							1	1					3
45	22IOT3101R	Industrial Internet of Things	PE	2	0	2	4	4	8	1							3	2					2
46	22IOT3202	Edge Computing	PE	2	0	2	0	3	4	2					3							3	2
47	22IOT3305R	DEEP LEARNING	PE	2	0	2	4	4	8	1					3							2	1
48	22IOT3406M	DATA VISUALISATION TECHNIQUES	PE	3	0	0	0	3	3	1					3							1	3
49	22IOT3508	BIG DATA ANALYTICS	PE	2	0	2	0	3	4	1					2							2	3
50	22SDIN01R	IOT HARWARE PROGRAMMING (SDP1)	SDC	0	0	2	4	2	6	1					3							1	3
51	22SDIN02R	IOT FULL STACK DEVELOPMENT(SDP-2)	SDC	0	0	2	4	2	6	2					2							2	2
52	22SDIN03	IOT PRODUCT DEVELOPMENT(SDP-3)	SDC	0	0	2	4	2	6	1					2							3	2
53	22SDIN04	IOT ANALYTICS ON AWS CLOUD	SDC	0	0	2	4	2	6	2					3							3	3
54	22IE2040	Social Internship	PR	0	0	0	4	1	4	2					2							3	1
55	22IE3041	Technical Internship	PR	0	0	0	4	1	4	3					3							3	3
56	22IE4042	Industry Internship	PR	0	0	0	4	1	4	3					2							2	2
57	22IE3043	Term paper	PR	0	0	0	4	1	4	2					1							2	3

58	21IE3044	Mid Grad Capstone Project – I	PR	0	0	0	8	2	8	1					1							3	2
59	22IE3045	Mid Grad Capstone Project – II	PR	0	0	0	8	2	8	2					1							3	1
60	22IE4048	Project-1	PR	0	0	0	16	4	16	1	3	1							1				2
60	21IE4049	Project-2	PR	0	0	0	16	4	16	3	2	2							3				2
62	21IE4050	Practice School	PR	0	0	0	16	4	16	1	2	3							1				2
63	21IE4051	Internship -1	PR	0	0	0	16	4	16	2	1	3							1				3
64	21IE4052	Internship 2		0	0	0	16	4	16	3	2	1							1				1

Syllabus

B. Tech Internet of Things of courses under various categories as per the template in Annexure 3

SYLLABUS OF COURSES UNDER

HUMANITIES AND SOCIAL SCIENCES

AUDIT COURSES

1. GENDER & SOCIAL EQUALITY

COURSE CODE	22UC0011	MODE	OFFLINE	LTPS	2-0-0-0	PRE-REQUISITE	

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Students will have developed a better understanding of important issues related to gender in contemporary India	2	PO2
CO2	Students will be sensitized to basic dimensions of the biological, sociological, psychological, and legal aspects of gender. This will be achieved through group discussions.	3	PO4
CO3	Students will attain a finer grasp of how gender discrimination works in our society and how to counter it.	4	PO6
CO4	Students will acquire insight into the gendered division of labour and its relation to politics and economics.	4	PO10

Syllabus

Module 1	UNDERSTANDING GENDER: Socialization: Making Women, Making Men, Preparing for Womanhood, Growing up Male, First lessons in Caste, Different Masculinities. GENDER AND BIOLOGY: Missing Women: Sex Selection and Its Consequences, Declining Sex Ratio. Demographic Consequences. Gender Spectrum: Beyond the Binary Two or Many? Struggles with Discrimination.
Module 2	GENDER AND LABOUR: Housework: The Invisible Labor, Women's work: Its politics and Economics, Fact and Fiction. Unrecognized and Unaccounted work. Additional Reading: Wages and Conditions of Work.
Module 3	ISSUES OF VIOLENCE: Sexual Harassment: Say No! Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment, Domestic Violence: Speaking Out, Is Home a Safe Place? -When Women Unite [Film]. Rebuilding Lives. Additional Reading: New Forums for Justice. Thinking about Sexual Violence.
Module 4	GENDER: CO - EXISTENCE: Just Relationships: Being Together as Equals Mary Kom and Onler. Love and Acid just do not Mix. Love Letters. Mothers and Fathers.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	A World of Equals: A Textbook on Gender	*Edited by: Susie Tharu; A. Suneetha; Uma Maheswari Bhrugubanda*	Orient BlackSwan	
2	Seeing Like a Feminist	Menon Nivedita, Nivedita Menon	Penguin Zubaan	

3	Gender Sensitization: Issues and Challenges	Dr Raj Pal Singh, Dr Anupama Sihag	Raj Publications	

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Global Gender Policy Certificate	The George Washington University				https://elliott.gwu.edu/global-gender-policy

2. ESSENCE OF INDIAN KNOWLEDGE TRADITION

COURSE CODE	22UC0019	MODE	R	LTPS	2-0-0-0	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	understand the concepts of Indian traditional knowledge	2	PO1
CO2	develop the outstanding knowledge on Indian administration	2	PO1
CO3	understand the importance of traditional culture and knowledge	2	PO1
CO4	know the impact of western culture on Indian society	2	PO1

Syllabus

Module 1	Indian Knowledge System – An Introduction Number System and Units of Measurements Mathematics, Astronomy Concept of Culture-Culture and Civilization-General Characteristics of Indian culture Importance of Culture-Unity in Diversity
Module 2	Evolution of Indian Administration Arthashastra and Kautilya Sapthanga theory Traditions and Culture through the Ages
Module 3	Fundamental Unity of Harappa and Vedic Culture Jainism and Buddhism Mauryan Period Gupta Period-Pallavas and Cholas, Vijayanagar Period-Art Architecture and Literature
Module 4	Rise of the West and its impact on India-Social and Religious reformers in the 18th and 19th centuries-Press and growth of modern Indian literature-Rise of Indian Cinema-Indian Independence

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Indian heritage, culture, Art and Culture	Madhukumar Bhagat	GKP Publishers	2019
2	Traditional Knowledge System in India,	Amit Jha,	Springer	2009.

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1		SWAYAM	Y		NPTEL	https://onlinecourses.swayam2.ac.in/imb23_mg53/preview

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	NA		

3. INDIAN CONSTITUTION

COURSE CODE	22UC0008	MODE	R	LTPS	2-0-0-0	PRE-REQUISITE	Nil

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	To acquire knowledge of the historical developments that culminated in the drafting of the Indian Constitution	2	PO6
CO2	To understand the basic features of the Indian Constitution	2	PO6
CO3	To understand the structure of the Federal Government as defined by the Indian Constitution	2	PO6
CO4	To understand the Indian Judicial System and Election System of India.	2	PO6

Syllabus

Module 1	Making of the Constitution: A brief analysis of National Movement, Constitutional Development with reference to Government of India Act 1909, 1919, 1935 and Indian Independence Act 1947
Module 2	The Constituent Assembly of India. Basic features of the Indian Constitution and the Preamble, Fundamental Rights, Directive Principles of State Policy Fundamental Duties Government of the Union:
Module 3	The Union Executive – the President and the Vice-President – The Council of Ministers and the Prime Minister – Powers and functions The Union legislature – The Parliament – The Lok Sabha and the Rajya Sabha, Composition, powers, and functions – the role of the Speaker. Government of the State: The Governor – the Council of Ministers and the Chief Minister Powers and Functions, The State Legislature – composition, powers and functions
Module 4	The Indian Judicial System: The Supreme Court and the High Court's – composition, Jurisdiction and functions. judicial review, Judicial activism, Independence of Judiciary in India. Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Indian Polity	Laxmikanth	McGraw Hill Edge	7th Edition
2	Indian Administration	Subhash Kashyap	NATIONAL BOOKS TRUST	2017
3	Constitution of India	Shukla V.N.	Eastern Book Company	2019
4	The Indian Constitution:	Granville Austiin	Oxford	1999
5	Indian Constitutional Law'	M.P. Jain	Lexi Nexis	2018

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	NA					

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	NA		

4. ECOLOGY & ENVIRONMENT

COURSE CODE	22UC0009	MODE	R	LTPS	2-0-0-0	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Define to articulate basic understanding of the importance of Environmental education and conservation of natural resources. conservation of natural resources and Energy resources.	2	PO 7
CO2	Understand concepts of ecosystems and learn methods for conservation of habitats and biodiversity.	2	PO 7
CO3	Identify critically about individual roles in prevention of pollution. An Environmental Studies will be enabled to do independent research on human interactions with the environment.	2	PO 7
CO4	Recognize the knowledge on environmental legislation, disaster management and EIA process.	2	PO 6

Syllabus

Module 1	The Multidisciplinary nature of Environmental Studies: Introduction to Environment: Definition – scope – importance –Multidisciplinary nature of Environmental Studies, Need for public awareness. Institutions and people in Environment. Natural Resources: Renewable and Non-Renewable Resources: Forest resources: Uses –Deforestation– causes, effects and impacts, Afforestation Programmes-Socio-forestry, Agro-forestry, Vanasamrakshana programmes, Mining its impact on environment: mining, dams and their effects on forests and tribal people. . Water resources: Distribution of surface and

	ground water, Aquifers, – floods – drought – conflicts over water, dams - benefits and problems, Water conservation – rainwater harvesting – watershed management, Cloud seeding Mineral resources: Use – exploitation – environmental effects –. Food resources: Changes in agricultural methodologies, comparison between old and new methods of farming, Green Revolution, Environmental Impact Assessment of conversion of agricultural lands– effects of modern agriculture, Drip Irrigation – fertilizer-pesticide problems, Eutrophication, Vermicompost – waterlogging, Blue baby syndrome – Energy resources: Growing energy needs – renewable and non-renewable energy sources – Solar, wind, geothermal, tidal, bio energies. Land resources: Land as a resource – land degradation-. Soil erosion: Importance of soil, Types of soil erosion, Causes and effects of soil erosion. How to control soil erosion. Role of an individual in conservation of natural resources
Module 2	Ecosystems: Concept of an ecosystem: Structure and function of an ecosystem - Producers – consumers – decomposers with examples, Energy flow in the ecosystem – Ecological succession– Food chains – food webs and ecological pyramids. Types of ecosystems. characteristic features, structure, and function of the following ecosystem a Forest ecosystem b. Grassland ecosystem c. Desert ecosystem e. Aquatic ecosystem (ponds, streams, lakes, rivers, oceans, estuaries). Biodiversity and its Conservation: Introduction – Introduction — Definition: genetic, species and ecosystem diversity. • Biogeographical classification of India • Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values Biodiversity at global, National, and local levels • India as a mega-diversity nation • Hotspots of biodiversity. • Threats to biodiversity: habitat loss, poaching of wildlife, man- wildlife conflicts. • Endangered and endemic species of India • Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.
Module 3	Environmental Pollution: Definition •Causes, effects and control measures of - a. Air pollution b. Water pollution c. Soil pollution d. Marine pollution. e. Noise pollution f. Thermal pollution g. nuclear hazards • Solid waste Management Causes, effects and control measures of urban and industrial wastes. • Role of an individual in prevention of pollution. Pollution case studies. • Diaster management floods, earthquake, cyclone and landslides. Social Issues and the Environment • From Unsustainable to Sustainable development • Urban problems related to energy • Water conservation. rainwater harvesting, watershed management Resettlement and rehabilitation of people its problems and concerns. Case studies.
Module 4	Environmental ethics issues and possible solutions. Climate change. global warm acid rain, ozone layer depiction. nuclear accidents and holocaust. Case studies. Wasteland reclamation. •Environmental Protection Act, Air (Prevention and Control of Pollution) Act Water (Prevention and control of Pollution) Act • Wildlife Protection Act• Forest Conservation Act • Issues involved in enforcement of environmental legislation. • Public awareness.: Human Population and the Environment• Population growth, • Population explosion Family Welfare Programme. • Environment and human health. • Human Rights. Value Education. • HIV /AIDS. • Case Studies.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Textbook of Environmental Studies	Erach Bharucha	Universities Press (India) Pvt Ltd	2010
2	Environmental Studies	Benny Joseph	Tata McGraw Hill	2009
3	Textbook of Environmental Studies	Deeksha Deve and S.S. Kateswa	Cengage learning India pvt ltd	2009

4	Environmental Studies	Anubha Kaushik, C.P. Kaushik	New Age International	2007

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	NA					

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	NA		

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	10	25
	Home Assignment & Textbook	10	
	Attendance	5	
In-Sem Summative	In-Sem 1	17.5	35
	In-Sem 2	17.5	
End-Sem Summative	End-Sem Exam (Paper Based)	40	40

INDIAN KNOWLEDGE SYSTEMS - **ENGINEERING ELECTIVE**

ANCIENT INDIAN COMPUTING: A HISTORICAL AND CULTURAL PERSPECTIVE (AIC)

COURSE CODE	22UC0020T	MODE	R	LTPS	2-0-0-0	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Summarize the contributions of ancient Indian mathematics, linguistics, logic, and philosophy to computational thinking.	2	PO1, PO12, PSO1
CO2	Apply the philosophical implications of ancient Indian computing.	3	PO2, PO3, PO6, PSO1
CO3	Implement ethical ancient Indian computing and its relevance in contemporary society.	3	PO2, PO3, PO4, PSO1
CO4	Analyze the historical and cultural context of ancient Indian computing systems	4	PO2, PO6, PSO1

Syllabus"

Module 1	**Foundations of Ancient Indian Computing**: Introduction to ancient Indian knowledge systems and their historical context, Overview of mathematics, linguistics, logic, and philosophy in ancient India, Study of key ancient Indian texts and treatises related to computing, Exploration of the decimal place value system and the concept of zero in ancient India

Module 2	**Mathematics and Computing in Ancient India:** Examination of mathematical concepts and advancements in ancient India, Study of ancient Indian mathematicians and their contributions to number systems, algebra, and geometry, Analysis of computational techniques and algorithms in ancient Indian mathematical texts, Connections between ancient Indian mathematics and modern computational principles
Module 3	**Linguistics, Logic, and Computing:** Exploration of linguistic theories and grammatical principles in ancient Indian languages, Examination of formal systems of logic and debate in ancient Indian philosophy, Analysis of the role of Sanskrit in ancient Indian knowledge systems and its relevance to computer science, Study of computational linguistics and natural language processing in the context of ancient Indian linguistics
Module 4	**Philosophical and Cultural Perspectives on Computing:** Exploration of the philosophical underpinnings of ancient Indian computing systems, Analysis of the cultural and societal influences on the development of ancient Indian knowledge systems, Examination of the ethical considerations and social implications of ancient Indian computing, Critical evaluation of the relevance and applicability of ancient Indian computing concepts to modern-day computer science

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Computing in Ancient India: A Historical Perspective	Subhash Kak	Springer	2005
2	The Mathematics of India: Ancient and Modern	Kim Plofker	Princeton University Press	2009
3	The Language of the Gods in the World of Men: Sanskrit, Culture, and Power in Premodern India"	Sheldon Pollock	University of California Press	2006
4	Indian Philosophy and Computer Science: A Primer"	Rohit Parikh	Indiana University Press	1991

Global Certifications:

Mapped Global Certifications:

Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	NA					

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	NA		

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Home Assignments	8	24
	Quiz	8	
	Tutorial Continuous Evaluation	8	
In-Sem Summative	In-Sem 1	18	36
	In-Sem 2	18	
End-Sem Summative	End-Sem Exam (Paper Based)	40	40

HUMANITIES AND SOCIAL SCIENCES(HSS)

INTEGRATED PROFESSIONAL ENGLISH

INTEGRATED PROFESSIONAL ENGLISH(IPE)

COURSE CODE	22UC1101	MODE	R	LTPS	0-0-4-0	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Understanding the language Mechanics in Basic Grammar & Interactive Listening & Speaking	2	PO9 & PO10 PSO 1
CO2	Applying Integrated Reading skills & Ttechniques of Writing	3	PO9 & PO10 PSO 1

Syllabus

Module 1	A. Discuss people you admire (review of tenses, Character adjectives) Discuss a challenge questions) B.Discuss a challenge (Questions, Trying and succeeding)C. Explain what to do and check understanding (Rapid Speech)D. Give advice on avoiding danger (Future time clauses and conditionals) Breaking off a conversation, Explaining and checking understanding.E. Discuss dangerous situations (Narrative tenses, Expressions with 'get')F. Give and respond to compliments (Intonation in Question Tags, Agreeing using question tags; giving compliments and responding)
Module 2	Discuss ability and achievement (multi-word verbs, Ability and achievement) Discuss sports activities and issues (present perfect and present perfect continuous, words connected with sports). C. Make careful suggestions (Keeping to the topic of the conversation; Making careful suggestions) D. Discuss events that changed your life (used to and would, cause and result)
Module 3	A. Discuss choices, discuss changes (infinitives and ing forms, the passive) B. Introduce requests and say you are grateful (Consonant sounds) C. Discuss living in cities (too / enough; so / such, Describing life in cities) D. Discuss changes to a home (Causative have / get Film and TV; Houses) E. Imagine how things could be (Stress in compound nouns) F. Discuss personal finance (First and second conditionals)
Module 4	A. Discuss moral dilemmas and crime (Third conditional; should have + past participle), Stressed and unstressed words; Sound and spelling B. Discuss new inventions (Relative clauses), Discuss people's lives and achievements Reported speech; Reporting verbs, verbs describing thought and knowledge. C. Express uncertainty (Linking and intrusion, Clarifying a misunderstanding) D. Speculate about the past (Past modals of deduction Adjectives with prefixes) E. Discuss life achievements (Wishes and regrets, Verbs of effort) F. Describe how you felt (Consonant clusters, describing how you felt; Interrupting and announcing news)

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	EMPOWER	Andrian Doff, Craig Thaine, Herbert Puchta, Jeff Stranks, Peter Lewis-Jones	Cambridge University Press	2022

2	PRACTICAL ENGLISH USAGE, 4TH EDN: Michael Swan's guide to problems in English (Practical English Usage, 4th edition)	Michael Swan	OXFORD	2022
3	Word Power Made Easy	Norman Lewis	OXFORD	2022

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Linguaskills	Cambridge University	y	Online	Cambridge University	https://www.cambridgeenglish.org/exams-and-tests/linguaskill/

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Padlet		OPEN SOURCE
2	Lexipedia		OPEN SOURCE

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Quiz	12.5	
	Project Continuous Evaluation	12.5	
			25
In-Sem Summative	Sem-in 1	17.5	
	Sem-in 2	17.5	
			35

ENGLISH PROFICIENCY (EP)

COURSE CODE	23UC1202	MODE	R	LTPS	0-0-4-0	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Understanding Language Mechanics in aadvanced Grammar and aadvanced Communicative Listening & Speaking	2	PO9,10 PSO 1
CO2	Applying the aadvanced Reading techniques and Advanced Techniques of Writing	3	PO9,10 PSO 1

Syllabus

Module 1	A. Talk about learning a second language (adverbs and adverbial language learning noun forms, word stress and noun forms with – *tion* and -*ity*) B. Describe extreme sensory experiences (Comparison, multi-word verbs, C. Talk about crime and punishment (relative clauses) D. Talk about using instinct and reason (noun phrases); Express yourself in an inexact way. E. Describe photos and hobbies (simple and continuous verbs and adjectives) F. Idioms: body parts, movement, landscapes, crime and feelings
Module 2	A. Talk about plans, intensions, and arrangements (intensions and arrangements, verbs of movement); Give advice (advising a friend about a problem) B. Emphasis positive and negative experiences by describing journeys and landscapes; architecture and buildings (future in the past, narrative tenses, ellipsis, and substitutions) C. Listen to Job Profiles. Talk about job requirements and fair pay (obligation, necessity, and permission) D. Listen to/Tell a descriptive narrative – a personal story (participle clauses) E. Emphasis opinions about the digital age- explain how you would overcome a hypothetical problem. F. Describe sleeping habits, routines, lifestyles, and life expectancy (gerunds, infinitives, and conditionals)
Module 3	A. Paraphrasing and summarising B. Read and talk about memories and remembering (structures with have and get) C. Speculate about inventions and technology (compound adjectives) D. City life and urban space (reflexive and reciprocal pronouns, verbs with re-) E. Superstitions and rituals (passive reporting verbs) F. Read a review, report, and recommendation of a committee.
Module 4	A. Write a web forum post (expressing opinions) B. Write a report and travel review. C. Write a profile article (read an Interview of a celebrity and write an article) D. Write an essay: opinion essay and discussion essay. E. Write an application e-mail. F. Write promotional material using persuasive language.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Empower 3rd Edition	Andrian Doff, Craig Thaine, Herbert Puchta, Jeff Stranks, Peter Lewis-Jones	Cambridge	2022
2	The Cambridge Guide to English Usage	Pam Peters	Cambridge	2020
3	Academic English	Letty Chan	Hong Kong: Hong Kong University Press; London: Eurospan distributor	2021

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Lingua Skills Business	Cambridge university	y	online	Cambridge university	https://www.cambridgeenglish.org/exams-and-tests/linguaskill/information-about-the-test/test-formats-and-task-types/

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	padlet		Open source
2	lexipedia		Open source

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Quiz	12.5	
	Project continuous evaluation	12.5	
			25
In-Sem Summative	Sem in 1	17.5	
	Sem in 2	17.5	
			35
End-Sem Summative	Closed book/paper-based exam		40

ESSENTIAL SKILLS FOR EMPLOYABILITY

COURSE CODE	22UC2103	MODE	R	LTPS	0-0-4-0	PRE-REQUISITE	NA

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Developing basic grammar Identify and organize sentence structures based on grammar and apply in writing skills	3	PO5
CO2	Develop effective interpersonal skills, cultivate a positive attitude, apply positive self-talk techniques, and use SWOC analysis to enhance employability.	3	PO6
CO3	Develop drafting skills through Cloze Test, Passage completion, E-mail writing, Paragraph writing, Essay writing	3	PO5
CO4	Develop effective communication skills through JAM and extempore, describing products and processes through JAM and extempore, demonstrating proper email and phone etiquette, and improving listening skills to enhance personal and professional relationships.	3	PO 5

Syllabus

Module 1	Grammar: Tenses, Voice, Reported Speech, Spotting Errors, Sentence Improvement, Sentence Rearrangement
Module 2	SWOC, Self-awareness, Attitude, Self-Confidence & Positive Self-Talk, Grooming, Intrapersonal skills, and Interpersonal Skills.
Module 3	Writing Skills: Cloze Test, Passage completion, E-mail writing, Paragraph writing, Essay writing
Module 4	Speaking from the script through JAM & Extempore, Product & Process Description through JAM & Extempore, Transactional Analysis, Persuasion & Negotiation, Etiquettes (E-Mail & Phone), Listening Skills.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Objective English for Competitive Examination	Hari Mohan Prasad and Uma Sinha.	McGraw Hill	2017
2	English Language Communication Skills, C	Y. Prabhavati	Cenage	2014
3	Bridging the Soft skills Gap	Bruce Tulgan	Jossey-Bass	2015
4	The Soft Skills Book-The Key Difference to Becoming Highly Effective & Valued	Dan White	LID Publishing	2121

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	LINGUA SKILLS	LINGUA SKILLS	yes	online	CAMBRIDGE UNIVERSITY	https://www.cambridgeenglish.org/exams-and-tests/qualifications/business/
2	IELTS	IELTS	yes	online	BRITISH COUNCIL	https://www.britishcouncil.in/teach/teacher-training/masterclass-ielts-trainers

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	LINGUA SKILLS INTERMEDIATE	CAMBRIDGE UNIVERSITY	https://www.cambridgeenglish.org/exams-and-tests/qualifications/business/
2	LINGUA SKILLS VANTAGE	CAMBRIDGE UNIVERSITY	https://www.cambridgeenglish.org/exams-and-tests/qualifications/business/

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative			
	ALM	12.5	20
	Group Discussion (CO2)	6.25	10
	Quiz (CO4)	6.25	10

In-Sem Summative	Project Evaluation	8.75	25
	Sem in -1 (Co1)	8.75	25
	Exercise (CO2)	8.75	25
	Semester In Exam II (CO4)	8.75	25
End-Sem Summative			
	End Semester Exam (online MCQ) (CO1, CO2, CO3 &CO4)	40	100

CORPORATE READINESS SKILLS (CRS)

COURSE CODE		MODE	R	LTPS	0-0-4-0	PRE-REQUISITE	ESE

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Extend word power for developing effective speaking and writing skills	3	PO10, PO12
CO2	Apply Interpersonal Skills in day-to-day life	3	PO10, PO12
CO3	Differentiate and enhance critical and general reading skills	3	PO10, PO12
CO4	Demonstrate necessary skills to be employable	3	PO10, PO12

Syllabus

Module 1	Verbal Ability: Synonyms and Antonyms, Sentence Completion, Idioms & Phrases, One Word Substitutes, Analogies, Spellings, Selecting words, Sentence Formation.
Module 2	Life Skills: Goal Setting, Team Building, Leadership, Time Management, Managing Stress, Work Ethics.
Module 3	Reading Skills: Reading Comprehension and Types of Questions and Critical Reading.
Module 4	Employability Skills: Empathy, Assertiveness, Group Discussion, CV, Video Resume, and Interview Skills.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	The 7 Habits of Highly Effective College Students: Succeeding in College...and in Life	Covey, Stephen R.	Franklin Covey	2014
2	The Complete Guide to Mastering Soft Skills for Workplace Success	Adams, John	Adams Media	2019
3	Objective English for Competitive Examination	Hari Mohan Prasad, Uma Sinha	McGraw Hill Education	2017
4	The Business Student's Handbook: Skills for Study and Employment	Fisher, Julie and Bailey, Peter	Cengage Learning	2017
5	Writing Tools: 55 Essential Strategies for Every Writer	Roy Peter Clark	Little, Brown and Company	2006

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1		LINGUA SKILLS	YES	ONLINE	CAMBRIDGE UNIVERSITY	https://www.cambridgeenglish.org/exams-and-tests/qualifications/business/
2		IELTS	YES	ONLINE	BRITISH COUNCIL	https://www.britishcouncil.in/teach/teacher-training/masterclass-ielts-trainers

Tools used in Practical / Skill:

S. No.	Tool Name	Parent Industry	Open Source/ Commercial
1	LINGUA SKILLS INTERMEDIATE	CAMBRIDGE UNIVERSITY	https://www.cambridgeenglish.org/exams-and-tests/qualifications/business/
2	LINGUA SKILLS VANTAGE	CAMBRIDGE UNIVERSITY	https://www.cambridgeenglish.org/exams-and-tests/qualifications/business/

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Lab Weekly Exercise/ Continuous Evaluation	12.5	
	Project Continuous Evaluation	12.5	
In-Sem Summative	Semester in Exam-I	17.5	
	Semester in Exam-II	17.5	
End-Sem Summative	Viva	7	
	Exercise	20	
	Report	5	

UNIVERSAL HUMAN VALUES & PROFESSIONAL ETHICS

COURSE CODE	22UC0010	MODE	Offline	LTPS	2-0-0-0	PRE-REQUISITE	

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Understand and analyse the essentials of human values and skills, self-exploration, happiness and prosperity.	2	PO1
CO2	Evaluate coexistence of the “I” with the body.	3	PO4
CO3	Identify and associate the holistic perception of harmony at all levels of existence.	4	PO5

CO4	Develop appropriate technologies and management patterns to create harmony in professional and personal lives.	4	PO10

Syllabus

Module 1	Introduction to Value Education: Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness, and Prosperity - The Basic Human Aspirations, Right Understanding, Relationship and Physical Facilities, Happiness, and Prosperity – Current Scenario, Method to fulfil the Basic Human Aspirations.
Module 2	Harmony in the Human Being: Understanding the Human Being as Co-existence of Self ('I') and Body, discriminating between the Needs of the Self and the Body, The Body as an Instrument of 'I', Understand Harmony in the Self ('I'), Harmony of the Self ('I') with the Body, Program to Ensure Sanyam and Svasthya.
Module 3	Harmony in the Family and Society: Harmony in the Family - the Basic Unit of Human Interaction, Values in Human-to-Human Relationships, 'Trust' – the Foundational Value in Relationships, 'Respect' – as the Right Evaluation, Understand Harmony in the Society, Vision for the Universal Human Order.
Module 4	Harmony in the Nature (Existence): Understand Harmony in the Nature, Interconnectedness, Self-regulation, and Mutual Fulfilment among the Four Orders of Nature, realizing 'Existence is Co-existence' at All Levels, The Holistic Perception of Harmony in Existence.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	A FOUNDATION COERSE IN HUMAN VALUES & PROFESSIONAL ETHICS	R.R. Gaur, R. Sangal, G.P. Bagaria	Excel Books, New Delhi	1996
2	UNIVERSAL HUMAN VALUES AND PROFESSIONAL ETHICS	Dr. ARCHANA CHAUDHARY	Book Rivers	2001
3	UNIVERSAL HUMAN VALUES AND PROFESSIONAL ETHICS	Dr. Ritu Soryan	katson print	2001
4	HUMAN VALUES AND PROFESSIONAL ETHICS	B.S. Raghavan	S. Chand	2004

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1		AICTE	Yes	Online	AICTE	https://www.uhv.org.in/

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	ALMs	10	10
	Home assignments	10	10

In-Sem Summative	Sem in 1	20	20
	Sem in 2	20	20
End-Sem Summative	40	40	40

DESIGN THINKING AND INNOVATION

COURSE CODE	22UC1203	MODE	R	LTPS	0-0-4-0	PRE-REQUISITE	Nil

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Understand the importance of Design thinking mindset for identifying contextualized problems	2	PO2, PO6
CO2	Analyze the problem statement by empathizing with user	4	PO3, PO7
CO3	Develop ideation and test the prototypes made	3	PO5, PO7
CO4	Explore the fundamentals of entrepreneurship skills for transforming the challenge into an opportunity	2	PO5, PO8

Syllabus

Module 1	Introduction to Design Thinking and Innovation • Introduction to design thinking and its principles • Learning, listening, observation, dialogue, and reading in the context of design thinking. • Design definitions and stories: desirability, feasibility, viability, mystery, heuristics, algorithm, requirements, patterns, connect, blind spots. • Laws of Design Thinking: less is more, last 2% equals 200%, theory of prioritization. • Design mind: definitions, 5 forces of growth (SEPIA), 5 frictional forces (DCAFE), 3 capacity levers (VAL)
Module 2	Design Thinking Process • Overview of the design thinking process • Design thinking for contextualized problem-solving • Incorporating sustainable development goals into design thinking • Design framework (L0) • Empathy research: understanding user needs and perspectives. • Persona development: creating user profiles. • Customer journey mapping: visualizing user experiences • Define phase: asking the right questions and problem statement formulation
Module 3	Ideation and Prototyping • Ideation techniques: brainstorming and generating creative ideas. • Identifying patterns and anti-patterns in ideation

	• Evaluation of ideas using different criteria (10/100/1000 gm) • Prototyping and testing: translating ideas into tangible prototypes
Module 4	Entrepreneurial Innovation • Introduction to innovation management • Basics of business models and their role in innovation • Financial estimation for innovation projects • Pitch decks: creating persuasive presentations for innovation. • Considerations for intellectual property rights (IPR) in innovation

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Design Thinking in Classroom	David Lee	Ulysses Press	2018
2	The Art of Innovation Lessons in Creativity from IDEO	Tom Kelley	IDEO	2001
3	The Design Thinking *Play Book*	Michael Lewrick, Patrick Link & Larry Leifer	Wiley Press	2018
4	Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation	Tim Brown	Harper Business	2009
5	Unmukt-Science and Art of Design Thinking	Arun Jain	Arun Jain and School of Design Thinking	2019

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Certified Design Thinking Professional (CDTP)	Global innovative Institute	Y	Written	Global innovative Institute	https://www.gini.org/cdtp
2	Design Thinking for Innovation	University of Virginia	Y	Online	Coursera	https://www.coursera.org/learn/uva-darden-design-thinking-innovation
3	IBM Enterprise Design thinking	IBM	N	Online	IBM	https://www.ibm.com/design/thinking/page/courses/Practitioner

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
	NA		

Evaluation Components:

Evaluation	Component	Weightage	Total

In-Sem Formative	Active Participation (Breakout Activities)	10	60
	Continuous Evaluation Project (Work in Progress)	30	
	Quiz	20	
End-Sem Summative	SEM-End Project	40	40

INNOVATION MANAGEMENT

COURSE CODE	22UC0012	MODE	R	LTPS	0-0-4-0	PRE-REQUISITE	Nil

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Develop value proposition for the problem identified	3	PO2, PO3, PO11
CO2	Build MVP for the solution developed	3	PO3, PO5, PO11
CO3	Devise go to market strategy	4	PO2, PO4, PO11
CO4	Create a Pitch-deck with funding strategy	6	PO5, PO10, PO11

Syllabus

Module 1	**Problem Identification and Opportunity Discovery** • Conduct Opportunity Discovery: Learn techniques to identify potential opportunities in the market and explore new ideas. • Problem Validation: Understand how to validate the identified problems by gathering data, conducting market research, and analyzing customer needs. • Sharpen the Problem Pitch: Develop effective pitching skills to communicate the identified problem clearly and persuasively.
Module 2	**Customer and Markets** • Identify the Market Type: Learn about different market types such as B2B, B2C, and C2C, and understand their characteristics and dynamics. • Explore Market Segments: Discover various customer segments within a target market and identify their unique needs and preferences. • Determine Market Positioning: Define the positioning strategy for a product or service to differentiate it from competitors and attract the target market. • Create Customer Persona: Develop detailed profiles of target customers, including demographics, behaviours, and preferences.
Module 3	**Creating a Compelling Value Proposition** • Craft your Core Value Proposition: Define the unique value your product or service offers to customers and how it solves their problems or fulfils their needs. • Create Sustainable Differentiation Strategy: Identify and implement strategies to create sustainable competitive advantages over competitors. • Deliver Value: Explore techniques for delivering value to customers, including customer experience design, service delivery, and product innovation.
Module 4	**Competitive Advantage** • Identify Competitors: Analyze the competitive landscape and identify direct and indirect competitors.

	• Identify Critical Product Features: Determine the key features and attributes that will differentiate your product or service in the market. • Conduct Feature Ranking: Prioritize and rank product features based on their importance and impact on customer satisfaction and market success.
Module 5	**Business Model and MVP Development** • Build and Test a Business Model: Develop and refine a business model that outlines the key elements of your venture, such as revenue streams, cost structure, and customer acquisition channels. • Pivot or Persevere: Learn how to assess and adapt your business model based on market feedback and changing circumstances. • Identify the Riskiest Assumptions: Identify the assumptions underlying your business model and test them systematically to mitigate risks. • Build your MVP: Develop a minimum viable product (MVP) or prototype to test with early adopters and gather feedback for further iteration and improvement.

Reference Books

Sl No	Title	Author(s)	Publisher	Year
1	"The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses"	Eric Ries	Crown Publishing Group	2011
2	"Value Proposition Design: How to Create Products and Services Customers Want"	Alexander Osterwalder, Yves Pigneur, Gregory Bernarda, Alan Smith	Wiley	2014
3	"The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail"	Clayton M. Christensen	Harvard Business Review Press	1997
4	"Disciplined Entrepreneurship: 24 Steps to a Successful Startup"	Bill Aulet	Wiley	2013
5	"The Startup Owner's Manual: The Step-by-Step Guide for Building a Great Company"	Steve Blank, Bob Dorf	K&S Ranch Inc.	2012

Global Certifications

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Certified Innovation Professional (CInP)	Global innovative Institute	Y	Written	Global innovative Institute	https://www.gini.org/cinp

Evaluation Component:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Participation (Breakout Activities)	10	60
	Continuous Evaluation Project (Work in Progress)	30	
	Quiz	20	
End-Sem Summative	SEM-End Project	40	40

MANAGEMENT ELECTIVE

BASICS OF MARKETING FOR ENGINEERS (BME)

COURSE CODE	22MB0001	MODE	Regular	LTPS	2-0-0-0	PRE-REQUISITE	Nil

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Understand the basic concepts of marketing management	2	PO11
CO2	Understand the concepts of Marketing environment, consumer behaviour and Segmentation, Targeting and Positioning (STP)	2	PO11
CO3	Apply the marketing mix strtegies with special focus on technology products	3	PO11
CO4	Apply appropriate strategy for the marketing of high-tech products and services	3	PO11

Syllabus

Module 1	Introduction and Nature of Marketing: Evolution of Marketing Concept - Core concepts of marketing - Scope and Importance of Marketing. -Difference between Selling and Marketing - Marketing Myopia - Consumer Marketing Vs. Industrial Marketing.
Module 2	Marketing Environment and factors of marketing environment -Understanding Consumer Behaviour: nature, scope and importance of consumer behavior – Factors influencing Consumer Behavior - Buying decision making process - Market Segmentation, Targeting and Positioning (STP).
Module 3	Marketing mix - Product definition, levels of product, product classification, difference between goods and services, Product Life Cycle, New Product Development – Technology and Product Management - Concept of Pricing – Factors influencing the pricing policy – Pricing strategies - Pricing Considerations in High-Tech Markets.
Module 4	Promotion mix - Marketing Communication Tools for High-Tech Markets - Channels of distribution - Supply Chain Management in High-Tech Markets - Technology Marketing, Green Marketing, and Concept of market study.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Marketing Management	V. S. Ramaswamy and S. Namakumari	Prentice Hall	2018
2	Marketing Management	Kotler and Keller	PHI New Delhi	2019
3	Marketing Management	Philip Kotler & Gary Armstrong	Prentice Hall	2017
4	Marketing Management	RajanSaxena	TataMcGrahill	2019

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	HubSpot Content Marketing Certification	HubSpot	N		HubSpot	https://academy.hubspot.com/

Tools used in Practical / Skill: NA

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	NA		

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	ALM	10	20
	Home Assignment and Textbook	10	
In-Sem Summative	Semester in Exam-I	20	40
	Semester in Exam-II	20	
End-Sem Summative	End Semester Exam	40	40

PARADIGMS IN MANAGEMENT THOUGHT (PIMT)

COURSE CODE	22MB0002	MODE	Regular	LTPS	2-0-0-0	PRE-REQUISITE	Nil

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Understand the basic management concepts along with an insight into levels of management.	2	PO11
CO2	Understand the key contributions of classical approach to Management	2	PO11
CO3	Understand and apply Quantitative methods to improve Management performance.	2	PO11

CO4	Understand the key contributions of Behavioural and contemporary approaches to Management.	2	PO9

Syllabus

Module 1	Management Introduction - Early management thought - Management Concept – Nature - Management as art, science, profession - Scope and functions of Management - Levels of Management - Importance of management.
Module 2	Classical Approach to Management: (a) Scientific Management- The advent of Scientific Management – Frederick W Taylor's contributions, - Contribution by Henry L Gantt - Contribution by Frank, Lillian Gilberth. General Administrative Approach: Henry Fayol's contributions towards general management – Max Weber's Bureaucracy Approach.
Module 3	Quantitative Approach: Important contributions – TQM – implications in today's management – Six sigma,
Module 4	Behavioral Approach: Organizational Behaviour – Contributions of Elton Mayo's – Hawthorne studies – contributions of Mary Parker Follett – Chester Bernard. Contemporary Approach: Systems Theory – Contingency Theory – Chao's Theory - Peter F Drucker Contributions – C K Prahlad's Contribution – Porter's theory – Worker Management – Employee Engagement – People Capability Maturity Model.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Management	Stephen P Robbins, Mary Coulter, Neeharika Vohra	Pearson	2008
2	Management	Stoner, Freeman, Gilbert	PHI	2018
3	The evolution of management thought	Daniel A Wren, Arther G Bedeian	John wiley& sons	2020
4	"Essentials of Management", 11th Edition	Harold Koontz, Heinz Weihrich, Mark V. Cannice,	Mc Graw Hill	2020

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Leadership Skills	IIMA	Yes	Online	Coursera	https://shorturl.at/dhJO8

Tools used in Practical / Skill: NA

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
	NA		

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	ALM	10	20
	Home Assignment and Textbook	10	

In-Sem Summative	Semester in Exam-I	20	40
	Semester in Exam-II	20	
End-Sem Summative	End Semester Exam	40	40

Organization Management (OMG)

COURSE CODE	22MB0004	MODE	Regular	LTPS	: 2-0-0-0	PRE-REQUISITE	Nil

Course Outcomes

CO #	CO Description	BTL	PO Mapping
CO 1	Remember and understand the various management theories and management approaches.	2	PO1, PO9
CO 2	Remember and understand organization theories, structures and organization principles.	2	PO1, PO9
CO 3	Have basic knowledge and understanding of motivation, motivational theories, leadership theories, moral and behavioral sciences and also understand the management concept, administration and management objectives.	2	PO1, PO9
CO 4	Understand the various issues in industrialrelations, trade unions and college bargaining and industrialsafety.	2	PO1, PO9

Syllabus

Module 1	Development of Management thought – Introduction, Various theories; Functional approach, scientific management approach, human relations approach, latest management thoughts, organisation theory- classical organisation, neo-classical organisation theory, modern organisation theory.
Module 2	Organization Structure--Principles of organisation, organizational theories, departmentalism, authority, power, organizing, organizational effectiveness, structuring the organisation, organizational change, organisation charts; types of organisations—line, functional and line and staff relations, Organisational manuals
Module 3	Motivation, Morale and behavioural science—Motivation: Characteristics, importance, Kinds of motivation. Thoughts of motivational philosophy: Douglass McGregore—X and Y theory; Herzberg's theory. Human needs, Incentive as motivators, Managing dissatisfaction and frustration. Morale, Absenteeism, Behavioral science, Group dynamics, Group behavior. Leadership— Meaning, importance, styles, theories, leaders Vs managers. Management concept—Management, Administration, Organisation, Difference and Relationship between Management, Administration and Organisation, Importance of Management, Characteristics of management, Managerial Skills, Managerial Objectives, Harmonization of Objectives, Hierarchy of Objectives
Module 4	Industrial Relations, Trade Union and Collective Bargaining—Industrial relations, Industrial Psychology, Industrial disputes, Conflict management, Views about conflict, Labor Policy. Worker's grievances, Suggestion system. Trade Unions. Collective Bargaining, Negotiations, Industrial Safety—working conditions, Accidents, Preventive measures, Safety training

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Organizational behavior,	Stephen P. Robins	Pearson education	2008
2	Essentials of Management	Koontz & Wehrich	Tata Mc Grawhill	2007

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Organisation & people effectiveness	University of Cambridge business school	yes	online	University of Cambridge business school	https://shorturl.at/pACJU
2	Certificate in Global Management	Insead	Yes	online	INSEAD	https://www.insead.edu/executive-education/certificate-global-management

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	NA		

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	ALM	10	20
	Home Assignment and Textbook	10	
In-Sem Summative	Semester in Exam-I	20	40
	Semester in Exam-II	20	
End-Sem Summative	End Semester Exam	40	40

FINANCIAL MANAGEMENT FOR ENGINEERS (FME)

COURSE CODE	22MB0003	MODE	Regular	LTPS	2-0-0-0	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	To enable the students to understand the finance functions and types of businesses.	2	PO2
CO2	To evaluate the investment decisions - Capital Budgeting Decisions (Long-Term)	3	PO4
CO3	To evaluate the investment decisions - Working Capital Decisions (Short-Term)	3	PO4
CO4	To be able to understand the uses of various sources of finance as well as the dividend policies in practice.	3	PO4

Syllabus

Module 1	Introduction to Finance: Financial Management, Definitions, Investment Decision, Finance Decision, Dividend Decision, Types of Business, Proprietary company, Partnership Company, Company, Features, Merits and Demerits, Private Limited Company Vs. Public Limited Company, Classification of companies, Franchisee, Cooperative Society. How to start a limited company, Public Issue
Module 2	Capital Budgeting Meaning, Features, Techniques of Capital Budgeting, Traditional methods- Payback Period, ARR and Modern Methods- NPV, IRR & Profitability Index, Case studies on Capital Budgeting
Module 3	Working Capital Management- Gross working capital, Net working Capital, operating cycle, computation of working capital Requirement, determinants of working capital requirements in a company, Cash Management, Receivables Management, and Inventory Management. Case studies on Working Capital.
Module 4	Sources of Finance and Dividend: Short-term sources - Cash credit limit, Overdraft, Bill Discounting, Short term loans, long-term sources Equity, Preference, Bond/ Debenture, Term loans, Venture capital financing. Dividends, Meaning, Types of Dividends, Dividend Policies in Practice

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Financial Management	I M Pandey	Vikas	
2	Financial Management: Theory & Practice	Prasanna Chandra	Tata McGraw Hill	

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1		NA				

Tools used in Practical / Skill: NA

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	ALM	10	20
	Home Assignment and Textbook	10	
In-Sem Summative	Semester in Exam-I	20	40
	Semester in Exam-II	20	
End-Sem Summative	End Semester Exam	40	40

FOREIGN LANGUAGE ELECTIVE

FRENCH LANGUAGE (FLG)

COURSE CODE	22FL3054	MODE	R	LTPS	2-0-0-0	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Acquire a working knowledge of the basic elements of the French language viz. letters, vowels, accents, articles, useful expressions, etc.	2	PO10
CO2	Frame questions and respond in the affirmative or negative with être and avoir and form plurals	3	PO10
CO3	Understand and apply the adjectives and essential verbs.	3	PO10
CO4	Comprehend and use in speech, vocabulary, reading, questions and answers on passages pertaining to monuments of France	3	PO10

Syllabus

Module 1	L'Alphabet et les Voyelles, Les Accents, Les Noms, Le Pluriel, Les Articles Indéfinis, Les Articles Définis, Les Expressions Utiles, Les Nombres Cardinaux, Les Nombres Ordinaux, Les Jours de la Semaine, Les Mois de l'Année,
Module 2	Le temps (Quelle heure est-il?) Les Pronoms Personnels (Sujets), L'Interrogatif, Le Négatif, Le Verbe Être – Forme Affirmatif, Forme Interrogatif, Le Verbe Avoir – Forme Affirmatif, Forme Interrogatif, Les Prépositions.

Module 3	Les Articles Contractés, Les Adjectifs Qualificatifs, Les Adjectifs Possessifs, Les Adjectifs Démonstratifs, Les Verbes de Premier Groupe, Deuxième groupe, Troisième groupe Les Verbes Irréguliers.
Module 4	Les animaux Les pays et les nationalités Les parties du corps Le Futur proche. Le passe recent La famille Présentez-vous?

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Le Nouvel Esprit, Méthode de Français,	Meenal Tiwari	Langers international private limited	2016
2	Cours de Langue et de Civilisation Françaises, Tome Un	G. Mauger Blue	publié par Hachette.	2011
3	Dondo Modern French Course écrit par Mathurin Dondo, Publié par OUP.	Mathurin marius Dondo	Oxford	1997
4	Grammaire progressive du Francais	Maia Gregoire	CLE international	2020

Global Certifications: NA

Tools used in Practical / Skill: NA

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	ALM	10	20
	Home Assignment and textbook	10	
In-Sem Summative	Semester in Exam-I	20	40
	Semester in Exam-II	20	
End-Sem Summative	End semester Exam	40	40

GERMAN LANGUAGE (GLG)

COURSE CODE	22FL3055	MODE	R	LTPS	2-0-0-0	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Understand the German language Basic Proficiency: Students will develop and apply a solid foundation in German, allowing them to introduce themselves, engage in basic conversations, and understand everyday expressions.	3	PO10

CO2	Determine the German Vocabulary and Grammar: Students will learn essential vocabulary and grasp German grammar rules, enabling them to construct simple sentences accurately.	3	PO10
CO3	Comprehensive Reading and Listening practices: Students will comprehend basic written and spoken German, understanding short texts, signs, and following straightforward conversations.	3	PO10
CO4	Examining and interpreting the German Cultural Awareness: Students will gain insights into German-speaking countries' culture, enhancing their ability to communicate respectfully and appreciate the customs and traditions.	3	PO10

Syllabus

Module 1	Begrüssing – Alfabets-die Zahlen- die Addition-die Subtraktion-die Division-dieMultiplikation - Personal Pronomen - sein form - haben form - der Infinitiv - konjugationimPräsens
Module 2	DieArtekel– bestimmter Artikel – unbestimmter Artikel – Verneinung – KonjugationimPerfekt..Partizip II -Future
Module 3	Präpositionen – W-Frage - possessivPronomen - deutsche 4 Fälle – wohnen – die Familie
Module 4	Orientierung - Farben – Wochen,Monaten, Jahren, Jahreszeiten, - Einkaufen, Urlaub machen, sport, Gesundheit

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Studio d A1, Deutsch als Fremdsprache	Cornelsen/Goyal SaaB	GoylPublishers and Distributors(P) Ltd. New Delhi 110007	2004
2	Netzwerk for A1,	Stefanie Dengler Paul Rusch Helen Schmitz Tamka Siener	GoylPublishers and Distributors(P) Ltd. New Delhi 110007	2018
3	Deutsch ganz leicht A1, A German selfstudy course for beginners	Huebner	GoylPublishers and Distributors(P) Ltd. New Delhi 110007	2018
4	Collins, easy learning German Grammar & Practice	collins	Collins	2014

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
		NA				

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
	NA		

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	ALM	10	20
	Home Assignment and textbook	10	
In-Sem Summative	Semester in Exam-I	20	40
	Semester in Exam-II	20	
End-Sem Summative	End semester Exam	40	40

JAPANESE LANGUAGE (JLG)

COURSE CODE	22FL3058	MODE	R	LTPS	2-0-0-0	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Understand the Japanese language Basic Proficiency	2	PO10
CO2	Determine the Japanese Vocabulary and Grammar	3	PO10
CO3	Examine and interpret Japan Cultural Awareness	3	PO10
CO4	Comprehensive Reading and Listening practice and apply the language skills	3	PO10

Syllabus

Module 1	1.1 Introduce about Japanese and its alphabets writing system (hiragana, katakana, kanji). (日本語について) 1.2 Greeting あいさつ. 1.3 Vocabulary　ごい 1.4 numbers 数字. 1.5 Weekdays, Months, dates. （平日、月、） 1.6 Time.　(時間）
Module 2	2.1 Tenses- Past tense, Present, Future Tense. (過去形、現在形) 2.2 Verbs – first form, second form and third form. （同士） 2.3 daily based Conversation. （会話） 2.4 name of transportation (vehicles). （乗り物） 2.5 feelings. （気持ち） 2.6 Japanese culture. （日本文化）
Module 3	3.1 Family relationships (家族） 3.2 Healthcare Body parts. 3.3 countries' name, and nationalities. 国の名前 3.4 National holidays. 国の休み 3.5 Foods and vegetables. 3.6 classroom instructions.
Module 4	4.1 Animals.　動物の名前. 4.2 Shopping. 買い物 4.3 Colours.色の名前 4.4 Hobbies　趣味 4.5 listening practice skills.　ちょかい 4.6 Passage reading ability.　どっかい 4.7 Self-Introduction.　じこうしょじゃい

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Minna No Nihongo- N5 Level	Japan Foundation	Goyal Publisher	2018

Global Certifications: NA

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
		NA				

Tools used in Practical / Skill: NA

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
	NA		

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	ALM	10	20
	Home Assignment and textbook	10	
In-Sem Summative	Semester in Exam-I	20	40
	Semester in Exam-II	20	
End-Sem Summative	End semester Exam	40	40

SYLLABUS OF COURSES UNDER

BASIC SCIENCES

BASIC SCIENCES(BS)

22MT1101 - MATHEMATICS FOR COMPUTING

L-T-P-S: 2-2-0-2 **Credits: 4.5** **Pre-requisite: Nil**

Course Outcomes (COs)–Program Outcomes (POs)–Blooms Taxonomy Levels (BTL) Mapping Table:

CO#	Course Outcome (CO)	PO/PSO	BTL
CO1	Model a system of equations for real world applications in engineering, physical and biological sciences, computer science, finance, economics and solve them through matrix algebra	PO1	3
CO2	Model basic and computational techniques on discrete structures like relations, orders, functions & FSM, Lattices, and propositional &predicate logic	PO1	3
CO3	Model real world structures and their related applications using advanced discrete structures like graphs and trees.	PO1	3
CO4	Model the given Statistical data for real world applications in Engineering science, Economics and Management.	PO1	3
CO5	Demonstrate the Aptitude and Reasoning skills (Tests in skilling hours)	PO1	2

Syllabus:

Linear Algebra: Matrix Algebra: Introduction, Types of Matrices, Rank of matrix, Solutions of linear Equations by Gauss elimination and Gauss Seidel methods, Eigen values, Eigen vectors. Quadratic forms. **Introduction to Discrete Structures & Discrete Computation:** *Relations:* Closures of relations. Orders, Equivalence Relations, Functions, Finite-State Machines. *Lattices:* Partial order relation, Hesse Diagrams, Properties of Lattices and applications. *Logic and Proofs:* Propositional Logic, Rules of Inferences, Applications of Propositional, Propositional Equivalences, Predicates and Quantifiers, Predicate logic, Consequences, Introduction to proofs, Proof methods and strategy. *Counting Techniques:* Permutations and Combinations Fibonacci series, Divide-and-Conquer Algorithms, Recursive definitions, Generating Functions. Solving Linear Recurrence Relations. **Advanced Discrete Structures & Computation:** *Graphs & Trees:* Terminology, Types of Graphs, Bipartite graphs, Graph Isomorphism, Connectivity, Euler and Hamilton Paths, Shortest-Path, Planar Graphs, Trees, Tree Traversal Applications of trees, spanning trees and Minimal spanning trees. **Modelling Statistical data for real world applications:** Axiomatic definitions of probability, addition rule and conditional probability, multiplication rule, total probability, Correlation, Regression and Curve fitting.

Arithmetic: (Focus on Shakuntala devi puzzles**)** *Foundations in Arithmetic:* Numbers, Ratio, Proportion, Variation, Averages, Percentages, Profit & loss, Time & Distance, Time & Work. *Applications of Number theory*: Fermat's theorem, Euclidean Algorithm. *Geometry:* Lines, Triangles, Quadrilaterals, Polygons, Practical applications of common solids, irregular solids and their application in various engineering problems. **Logic & Reasoning:** (Focus on Shakuntala devi puzzles) Sets and Venn diagrams Deductions, Logical Connectives, Linear and circular arrangements. Clocks, Calendars, Blood Relations, Cubes, Number and letter series, Coding and Decoding, Symbolic representations of given data, Binary Logic, Non-Verbal reasoning.

Textbooks:

1. John Bird, Basic Engineering Mathematics**,** Sixth edition, Taylor & Francis Ltd., 2017, UK.
2. Kenneth H Rosen, Discrete Mathematics and its Applications, Seventh edition, McGraw Hill, 2007, USA.
3. Linear Algebra and Its Applications, Gilbert Strang, Fourth Edition

Reference Books:

1. Advanced Engineering Mathematics 10th Edition, Erwin Kreyszig
2. R.E. Walpole, R.H. Myers, S.L. Myes, Keying Ye, Probability and Statistics for engineers and scientist, Ninth edition, Pearson publications, 2012, USA.
3. Mott, J.L., Kandel, A. and Baker, T.P., Discrete Mathematics for Computer Scientists and Mathematicians, Second edition, Prentice Hall India Pvt Ltd, 1986, India.
4. Tremblay J P and Manohar R, "Discrete Mathematical Structures with Applications to Computer Science", First edition, Tata McGraw Hill, 1975, India.
5. R. S. Agarwal, A Modern Approach to Verbal and Non-verbal Reasoning, S Chand Publications, 2018, New Delhi, India.

Web References:

1.https://www.youtube.com/watch?v=PmO_QdLrRZg

2.https://nptel.ac.in/noc/individual_course.php?id=noc18-cs53
3.https://www.khanacademy.org/partner-content/pixar/crowds/crowds2/v/combinatorics11
4.https://nptel.ac.in/courses/106106094/16
5.https://onlinecourses-archive.nptel.ac.in/noc18_cs53

22MT2102- MATHEMATICS FOR ENGINEERS

L-T-P-S: 2-1-0-0 **Pre-requisite: Nil**

Course Outcomes (COs)–Program Outcomes (POs)–Blooms Taxonomy Levels (BTL) Mapping Table:

CO#	Course Outcome (CO)	PO/PSO	BTL
CO1	Apply differential and integral calculus to find maxima & minima of functions, evaluate the integrals and solve the differential equations.	PO1	3
CO2	Demonstrate the Fourier series and Laplace transforms.	PO1	3
CO3	Describe probability, Random Variables	PO1	3
CO4	Explain complex variables, analytic functions and introduction to stochastic process and Algebraic structures.	PO1	3

Syllabus:

Calculus: Differential and Integral Calculus: Taylor's series for function of two variables, Maxima and Minima for functions of two variables, Evaluation of double and triple integrals, change of order of Integration, Change of Variables, in polar, cylindrical and spherical coordinates. **Vector Calculus**: Scalar and vector point functions, Gradient, Directional Derivative, Divergence and Curl, Evaluation of line integrals , Introduction to Greens and Stoke's theorems and their applications. **Ordinary Differential Equations:** Solution of first order equations and their Applications, Newton law of cooling, Growth and Decay, Solution of second and higher order Differential Equations. **Partial Differential Equations**: Formation of PDE, Solution of first order linear equations – Lagrange's method, Solution of second order PDE by separation of variables, Laplace's equation in two dimensions.

Introduction to Advanced Matrix Algebra: Decomposition, Complex Matrices. **Laplace Transforms:** Laplace and Inverse Laplace transforms and their properties. **Fourier series:** Definition, Dirchelt conditions, Fourier series for simple functions. **Complex Variables**: Complex functions - Exponential, Logarithmic and Trigonometric functions, Analytic function, Cauchy - Riemann equations, Introduction to Milne Thomson method. **Probability and Random Variables:** Probability, Addition, Multiplication and Baye's theorems. Random variables, Probability Distributions – Binomial, Poisson and Gaussian distributions, Introduction to Markov process. **Algebraic Structures**: Introduction to Structure of Algebras, Semi groups, Monoids and Groups, Homomorphism's, Normal subgroups and congruence Relations, Rings**.**

Textbooks:

1. Erwin Kreyszig, Advanced Engineering Mathematics, John Willey & Sons, 10th edition, 2010, New Delhi, India.

Reference Books:

1. R.E. Walpole, R.H.Myers, S.L.Myes, Keying Ye, Probability and Statistics for Engineers and Scientists, Pearson's Publications , 9th edition, 2012, USA.
2. Mott, J.L., Kandel, A. and Baker, T.P., Discrete Mathematics for Computer Scientists and Mathematicians, Prentice Hall of India Private Ltd, 1986, India.
3. Tremblay J P and Manohar R, Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw Hill publishers, 1st edition, 2001, India.

Web References:

1. https://www.maplesoft.com/applications/view.aspx?sid=1591&view=html
2. https://x-engineer.org/graduate-engineering/electronics/circuits/rl-circuit-detailed-mathematical-analysis/
3. http://www.ugrad.math.ubc.ca/coursedoc/math100/notes/diffeqs/cool.html
4. https://www.slideshare.net/mohammadimran85/solved-numerical-problems-of-fourier-series

PROBABILITY, STATISTICS & QUEUEING THEORY(PSQT)

COURSE CODE	22MT2005	MODE	R	LTPS	2-2-0-0	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	understand the importance of probabilistic concepts in a wide spectrum of problems arising in engineering applied science	PO2, PSO1	3
CO2	Identify the relationship between variables using correlation and regression techniques	PO1, PO2,PSO1	4
CO3	Explain the role of Statistical tests of significance in solving real world engineering problems	PO2, PSO1	3
CO4	To formulate Stochastic process in terms of Markov chains and solve problems in queueing systems, and networks	PO2, PSO1	4

Syllabus

Module 1	Introduction to Probability: Sample Space and Events, Probabilities Defined on Events, Conditional Probabilities, Independent Events, Bayes Formula, Random Variables, Probability Distribution Function, Cumulative Distribution Function, Discrete Random Variables: Bernoulli, Binomial, and Poisson process.
Module 2	Continuous Random Variables: Uniform, Exponential and Normal Random Variables Expectation of a Random Variable: Discrete and Continuous Case Expectation of Function of a Random Variable: Higher Order Moments, Variance, Standard Deviation Jointly Distributed Random Variables: Joint Distribution Functions, Independent Random Variables. Measures of central tendency: Mean, Median, Mode, Measure of Dispersion: Variance, Standard deviation, coefficient of variation. Correlation and Linear regression.
Module 3	Sample and population, Confidence limits and intervals, Statistical tests of significance: Null and Alternate Hypothesis, t-test, Chi Square Test, ANOVA.
Module 4	Introduction to queues, measures of system performance, characteristics of queueing systems. Stochastic processes overview, discrete-time Markov chains, Continuous-time Markov chain, birth-death processes, Poisson process and exponential distribution, Birth-death queueing systems, non-birth-death Markovian queueing systems, Queueing networks.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	An Introduction to Probability Theory and Its Applications:	William Feller	Wiley & Sons	1991
2	Fundamentals of Queueing Theory, 4th Edition.	D. Gross, J.F. Shortle, J.M. Thompson, and C.M. Harris,	Wiley	2008
3	Probability and Statistics for Engineers and Scientists	Ronald E. Walpole, Sharon L. Myers and Keying Ye	8th Edition Pearson Hub	2008

4	“Probability and Statistics”	Rukmangadachari E. and E. Keshava Reddy	First Edition Pearson Hub	2015
5	Probability & Statistics for engineers	Dr. J. Ravichandran	WILEY-INDIA	2010

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Statistical Business Analyst	SAS	Y	PROCTORED	SAS	https://www.sas.com/en_us/certification/exam-integrity.html
2	IBM Data Science Professional	COURSEERA	Y	PROCTORED	COURSEERA	https://www.coursera.org/professional-certificates/ibm-data-science

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	SAS	SAS	OPEN SOURCE

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	8	24
	Home Assignments	8	
	Tutorial Continuous Evaluation	8	
In-Sem Summative	In-Sem 1	18	36
	In-Sem 2	18	
End-Sem Summative	End-Sem Exam	40	40

MATHEMATICAL PROGRAMMING

COURSE CODE	22MT2004	MODE	R	LTPS	2-2-0-0	PRE-REQUISITE	Nil

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Apply various methods for finding the optimal solution of Linear Programming Problem	3	PO1, PO2

CO2	Apply Integer and Fractional programming approaches for solving optimization problems	3	PO1, PO2, PSO1
CO3	To express a practical problem, such as an engineering analysis or design problem and to optimize a multivariate quadratic function subject to linear constraints on the variables.	3	PO2, PO3, PSO1
CO4	To apply the search and optimization methodologies applicable to the resolution of multi-disciplinary decision problems, under a decision support framework.	3	PO2, PO3, PSO1

Syllabus

Module 1	Linear Programming: Formulation of LP Problem (LPP), Graphical method, Simplex method, Transportation problem, Duality concept in LPP, Feasibility of solution using Farka's Lemma, Ellipsoid method, Karmarkar's Algorithm.
Module 2	Combinatorial Optimization, Integer Programming, Branch & bound algorithms, valid inequalities & cuts. Fractional Programming. Combinatorial Optimization: Approximation Algorithms, Submodular functions, Matroids, Continuous approximation algorithms. Dynamic programming: Knapsack problem, Travelling salesman problem
Module 3	Non-Linear Programming: Quadratic programs – Constrained quadratic programming problems, Beale's method, Wolfe method, Karush-Kuhn Tucker (KKT) Conditions. Geometric Programming: Problems with one-degree of difficulty with positive coefficients, Geometric programming with constraints, Problems with positive and negative coefficients
Module 4	Infinite Dimensional Optimization: Heuristic and Meta heuristics, Single solution vs. population-based, Parallel meta heuristics, Evolutionary algorithms, Nature-inspired metaheuristics, Genetic Algorithm, Ant-colony optimization, Particle swarm optimization, Simulated annealing.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Applied Mathematical Programming	Bradley, Hax, and Magnanti	Addison-Wesley	2009
2	Non-Linear Programming Theory and Algorithms	Mokhtar S. Bazaraa, Hanif D. Sherali, C. M. Shetty	Wiley	2006
3	An Introduction to Computational Leaning Theory	Michael Kearns and Umesh Vazirani	MIT press	1994
4	Evolutionary Optimization Algorithm by Dan Simon, Willey Edition	Dan Simon	Wiley	2013
5	Introduction to Mathematical Programming	Russell C. Walker	Pearson	2006

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	5	24
	Home Assignments	5	
	Tutorial Continuous Evaluation	10	
	MOOCs Review	4	
In-Sem Summative	In-Sem-1	13	36
	In-sem-2	13	
	MOOCs Exam	10	
End-Sem Summative	Project Demonstration	10	40
	End-Sem-Exam	30	

SEMI CONDUCTOR PHYSICS

Course Code: 22PH1211 LTPS: 3-1-0-0

Course Title: **Science Elective - 1(Semiconductor Physics) Prerequisite: NIL**

Course Outcomes (Cos) – Program Outcomes (Pos) – Blooms Taxonomy Levels (BTL) Mapping Table:

CO No.	**Course out come**	**PO**	**BTL**
1	Understand semiconductor in terms of its electrical and optical properties.	PO1, PSO1	2
2	Understand junction properties of semiconductor device.	PSO1, PO1	2
3	Understand the characteristics of devices like BJT, FET	PO1, PSO1	2
4	Understand the applications of photonic devices.	PO1, PSO1	2

Syllabus:

Semiconductors: **Energy Band and Charge Carriers**: Energy bands in semiconductors, Types of semiconductors, Charge carriers, Intrinsic and extrinsic materials. Carrier concentration: Fermi Level, Electron and hole concentration equilibrium, Temperature dependence of carrier concentration, Compensation, and charge neutrality. Conductivity and mobility, Effect of temperature, Doping and high electric field.

Optical Excitation in Semiconductor: Optical absorption, carrier generation, Carrier lifetime, diffusion length and photo conductivity, Direct and indirect recombination and trapping, Photoconductive devices. Diffusion of carriers, Einstein relation, Continuity equation, Carrier injection, Diffusion length. Haynes-Shockley experiment.

Junctions: p-n junction and contact potential, Fermi levels, Space charge, Reverse and Forward bias, Zener, and Avalanche breakdown. Capacitance of p-n junction, Schottky barriers; Schottky barrier height, C-V characteristics, current flow across Schottky barrier: thermionic emission, Rectifying contact and Ohmic contact.

Field Effect Transistors: JEFT amplifying and switching, Pinch off and saturation, Gate control, I-V characteristics. MOSFET, Operation, MOS capacitor, Debye screening length, Effect of real surfaces; Work function difference, Interface charge, Threshold voltage and its control, MOS C-V analysis and time dependent capacitance. Output and transfer characteristics of MOSFET.

Bipolar Junction Transistors (BJT): Fundamentals of BJT operation. Minority carrier distribution, Solution of diffusion equation in base region, Terminal current, Current transfer ratio, Ebers-Moll equations, Charge control analysis. BJT switching: Cut off, Saturation, Switching cycle.

Photonics: LED: Radiative transition, Emission spectra, Luminous efficiency and LED materials, Solar cell and photodetectors: Ideal conversion efficiency, Fill factor, Equivalent circuit, Voc, Isc and Load resistance, Spectral response. Reverse saturation current in photodetector.

Reference Books:

1. Streetman, B. and Banerjee, S., Solid State Electronics, Prentice Hall India, (2006).
2. Sze, S.M., Physics of Semiconductor Devices, John Wiley, (1981).
3. Tyagi, M.S., Introduction to semiconductor materials and devices, John Wiley, (2000).
4. Mishra, Umesh K. and Singh, Jaspreet, Semiconductor Device Physics and Design, Springer, (2008).
5. Pierret, R.F., Semiconductor Device Fundamentals, Pearson Education Inc., (2006)

Web Links :1) http://www.faadooengineers.com/online-study/unit/eee/advanced-semiconductordevices/review-of-fundamentals-of-semiconductors

2) http://www.faadooengineers.com/onlinestudy/post/eee/advanced-semiconductor-devices/977/steady-state-carrier-generation-quasi-fermi-levels

MOOCS:

1.http://www.fulviofrisone.com/attachments/article/403/Semiconductor%20Physics%20And%20Devices%20-%20Donald%20Neamen.pdf

2. NPTEL:: Electrical Engineering - NOC:Fundamentals of semiconductor devices

3. NPTEL:: Electrical Engineering - NOC:Introduction to Semiconductor Devices

ENGINEERING CHEMISTRY

COURSE CODE	22CY1001	MODE	General	LTPS	3-0-2-0	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Apply the operation of electrochemical systems to produce electric energy and storage devices.	3	PO 1, PO 6
CO2	Use the fundamental aspects of electrochemistry and materials science relevant to corrosion phenomena.	3	PO 1, PO 2, PO 6
CO3	Examine water quality and apply appropriate purification technique for intended problem.	3	PO 1, PO 2, PO 7
CO4	Employ the fundamental principles and general properties of materials in various engineering applications.	3	PO 1, PO 3, PO 6
CO5	Analyse the data, develop skills in chemical analysis and their application in engineering.	4	PO 1, PO 3, PO 7

Syllabus

Module 1	Electrochemistry: Single electrode potential and its measurement, Electrochemical cells, EMF series, Nernst equation, Cell emf measurement, Reversible and irreversible cells, Concentration cells, Reference Electrodes-Determination of pH using glass electrode. Gas Sensors: Capacitance Manometer and Mass Spectrometer. Batteries: Chemistry, construction, and engineering aspects of Primary (mercury battery) and secondary (lead-Acid cell, Ni-Metal hydride cell, Lithium cells) and fuel cells– Hydrogen–Oxygen fuel cell, methanol fuel cell advantages of fuel cell.
Module 2	CORROSION & ITS CONTROL: Causes and different types of corrosion and effects of corrosion. Theories of corrosion– Chemical, Electrochemical corrosion, Pitting corrosion, stress corrosion, Galvanic corrosion. Factors affecting corrosion– Nature of metal, galvanic series, over voltage, purity of metal, nature of oxide film, nature of corrosion product. Nature of environment-effect of temperature, effect of pH, Humidity, effect of oxidant. Cathodic protection, sacrificial anode, impressed current cathode, electroplating.

Module 3	WATER Technology: Introduction, Hardness: Causes, expression of hardness –units – types of hardness, estimation of temporary and permanent hardness of water, numerical problems. Alkalinity and estimation of alkalinity of water, numerical problems. Boiler troubles – Scale &sludge formation, caustic embrittlement, Boiler corrosion, priming &foaming. Softening of water: Internal and external treatments -Lime soda, Ion exchange process. Desalination-reverse osmosis and electrodialysis.
Module 4	Molecules and Materials: polymers- Types of polymerization-Mechanisms, Plastics – Thermoplastic resins and thermosetting resins -Preparation, properties and engineering applications of polyethylene, PVC, Teflon, Bakelite, Urea Formaldehyde. Conducting Polymers: Polyacetylene, polyaniline, conduction, doping and applications. Carbon nano tubes and Applications.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Engineering Chemistry	Jain & Jain	Dhanpat Rai Publishing Company	2015
2	Chemistry in Engineering and Technology	J C Kuriacose & J Rajaram,	Tata McGraw Hill	2001
3	Chemistry for Engineers	Rajesh Agnihotri	Wiley	2014
4	Engineering Chemistry: Fundamentals and Applications	Shikha Agarwal	Cambridge University Press	2016

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	NA	NA	NA	NA	NA	NA

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	NA	NA	NA

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	8	22
	Home Assignment & Textbook	7	
	Practical Continuous Evaluation	7	
In-Sem Summative	In-Sem 1	15	38
	In-Sem 2	15	
	Practical In-Sem	8	
End-Sem Summative	End-Sem Exam (Paper Based)	24	40
	Lab End-Sem Exam	16	

SYLLABUS OF COURSES UNDER

ENGINEERING SCIENCES

ENGINEERING SCIENCES(ES)

COMPUTATIONAL THINKING FOR STRUCTURED DESIGN

COURSE CODE	22SC1101	MODE	R	LTPS	3-0-2-6(R)	PRE-REQUISITE	Nil

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Develop and apply logical building blocks to solve real world problems	3	PO1, PO2
CO2	Apply computational thinking for designing solutions	3	PO1, PO2
CO3	Develop and apply the CRUD operations on arrays	3	PO1, PO2
CO4	Apply CRUD operations on Linear Data Structures	3	PO4
CO5	Apply the structured programming paradigm with logic building skills on Basic and Linear Data Structures for solving real world problems	3	PO1, PO2, PO4, PSO1
CO6	Skill the students in such a way that students will be able to develop logic that help them to create programs as well as applications in C	3	PO1, PO2, PO4

Syllabus

Module 1	Structured Programming Paradigm: Problem Solving Approach, Algorithms and Algorithm Analysis, Program Development Steps, Structure of C Program, Pre-Processor Directives, Design of Building Blocks for solving real world problems: Modularization: Functions, Scope of Variables and Storage classes, Data Types: Primitive, Extended and Derived Including Pointers, Operators: Types of operators, Precedence, Associativity, Formatted I/O, Decision Making using conditional statements.
Module 2	Definite and indefinite Iterative statements. Recursion, logic building using complex building blocks, Bitwise operators, Redirecting I/O: Files and File Operations.
Module 3	Command line arguments, CRUD operations on Basic Data Structures: Basic Data Structure: Arrays, 2-D Arrays, Dynamic Memory Allocation Searching: Linear Search and Binary Search Sorting: Bubble Sort.
Module 4	CRUD operations on Linear Data Structures: Stacks, Queues, Single Linked List, Introduction to nonlinear data structures.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	The C Programming Language: ANSI C Version	Brian W. Kernighan, Dennis M. Ritchie	Prentice-Hall/Pearson Education-2005	2005
2	Fundamentals of Data structures in C	Horowitz, Sahni, Anderson Freed	Pearson Education	1993
3	Data structures and Program Design in C	Robert Kruse, C. L. Tondo, Bruce Leung, Shashi Mogalla.	Pearson Education	2006
4	Programming in ANSI C	E. Balagurusamy	Tata McGraw-Hill Education, Edition	2019
5	Programming in ANSI C	Mark Allen Weiss	Pearson Education	2014

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	C Programming Language Certified Associate	C++ institute	Yes	Online/Multiple Choice	Pearson Vue	https://cppinstitute.org/cla-exam-syllabus

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Dev C++	Software Development	Open Source
2	Coding platforms	Skill development	Open Source

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Home Assignments	5	22
	Quiz	5	
	Global Challenges Participation	2	
	Practical Continuous Evaluation	5	
	Skill Continuous Evaluation	5	
In-Sem Summative	In-Sem 1	12	38
	In-Sem 2	12	
	Practical In-Sem	7	
	Skill In-Sem	7	
End-Sem Summative	End-Sem Exam (Paper Based)	24	40
	Lab End-Sem Exam	8	
	Skill End-Sem Exam	8	

DATA STRUCTURES

COURSE CODE	22SC1202	MODE	R	LTPS	2-0-2-4 (R)	PRE-REQUISITE	CTSD

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Understand various sorting algorithms and analyse the efficiency of the algorithms.	4	PO1, PO2
CO2	Implement and evaluate Linear Data Structures and Demonstrate their applications.	4	PO2, PO3, PO1
CO3	Implement and evaluate tree data structures and understand hashing techniques	4	PO1, PO2, PO3
CO4	Understand graph data structures and apply graphs to solve problems	3	PO1, PO2

CO5	Design, Develop and evaluate common practical applications for linear and nonlinear data structures.	4	PO7, PO10, PO9
CO6	Skill the students in such a way that students will be able to develop logic that help them to create programs on both linear and non-linear data structures and its applications.	3	PO7, PO9, PO10

Syllabus

Module 1	Understand various sorting algorithms and analyse the efficiency of the algorithms.
Module 2	Implement and evaluate Linear Data Structures and Demonstrate their applications.
Module 3	Implement and evaluate tree data structures and understand hashing techniques
Module 4	Understand graph data structures and apply graphs to solve problems

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Data Structures and Algorithms	A.V. Aho, J. E. Hopcroft, and J. D. Ullman	Pearson Education"	2003
2	Fundamentals of data structures in C	Horowitz, Sahni, Anderson Freed	Pearson Education"	2007
3	Data Structures	R. F. Gilberg, B. A. Forouzan,	Thomson India Edition	2004
4	Data Structures & Program Design in C	Robert Kruse, C.L. Tondo, Bruce Leung, Shashi Mogalla	Thomson India Edition	2007

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Dev C++	Software Development	Open Source
2	Online GDB	Software Development	Open Source
3	Coding platforms	Skill development	Open Source

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	4	20
	Home Assignments	2	
	Global Challenges Participation	2	
	Practical Continuous Evaluation	6	
	Skill Continuous Evaluation	6	
In-Sem Summative	In-Sem 1	12	40
	In-Sem 2	12	
	Practical In-Sem	8	
	Skill In-Sem	8	
End-Sem Summative	End-Sem Exam (Paper Based)	24	40
	Lab End-Sem Exam	8	
	Skill End-Sem Exam	8	

DESIGN TOOL WORKSHOP

COURSE CODE	22ME1103	MODE	R	LTPS	0-0-4-0	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Demonstrate proficiency in typing sentence, paragraph, report, presentations along spread sheets using office tools, LaTeX tools and PowerBI	2	PSO2, PO5
CO2	Build a static website and blog with using html along with Special features of HTML5, CSS and JavaScript	3	PO10, PO5
CO3	Develop a virtual environment with cos pace and construct a marker based Augmented Reality and create a 3D terrain	3	PSO1, PO3
CO4	Utilising the software's of Autodesk Fusion 360 and the same can be printed in 3D printer as physical prototype, Fundamentals of electrical circuit: Ohms law, KCL and KVL law	3	PSO1, PO3

Syllabus

Module 1	Office management and documentation
Module 2	Basics of Web Development
Module 3	Augmented Reality, Virtual Reality, Mixed Reality and Extended Reality
Module 4	Conceptual Design, Modelling and Prototyping

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	MS-Office		Laxmi Publications Pvt Limited	2008
2	LaTeX Cookbook	Kottwitz, Stefan	Packt Publishing	2015
3	HTML & CSS: Design and Build Web Sites	Duckett, Jon	Wiley	2011
4	3D Printing: Understanding Additive Manufacturing	Thurn, Laura, et al	Carl Hanser Verlag GmbH & Company KG	2018
5	Augmented Reality and Virtual Reality: New Trends in Immersive Technology		Springer International Publishing	2021

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Fusion 360	Autodesk	Y	Online	Certiport	www.certiport.com
2	Power BI Data Analyst	Microsoft	Y	Online	Microsoft	https://learn.microsoft.com/en-us/certifications/exams/pl-300/

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Office	Microsoft	Commercial
2	Overleaf	Overleaf	Open source
3	Power BI	Microsoft	Commercial
4	Notepad++	Notepad++	Open source
5	Cospaces	Cospacesedu	Open source
6	Fusion 360	Microsoft	Commercial
7	Tinker cad	Microsoft	Commercial

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Practical Continuous Evaluation	15	25
	Project Continuous Evaluation	10	
In-Sem Summative	In-Sem 1	17.5	35
	In-Sem 2	17.5	
End-Sem Summative	Lab End-Sem Exam	40	40

IOT WORKSHOP

COURSE CODE	22SC1209	MODE	R	LTPS	0-0-4-0	PRE-REQUISITE	NIL

CO	**Course Outcome (CO)**	BTL	PO Mapping
CO1	To make the students to understand about the programming fundamentals of Arduino Software and Tinkercad	2	PO1
CO2	To demonstrate the Interfacing of Arduino UNO and ESP32 with LCD, LED, buzzer, and Push Button	3	PO1, PO3
CO3	To design and configure the sensors with Arduino UNO and ESP32 Boards	3	PSO2, PO3
CO4	To design and configure the actuators with Arduino UNO and ESP32 Boards and build Arduino and ESP32 based application	3	PSO2, PO3

Syllabus:

Module 1	Getting started with Arduino UNO and ESP32, Programming basics for Arduino and ESP32.Getting Started with Tinkercad

Module 2	Interfacing of Arduino UNO and ESP32 with LCD, LED, buzzer, and Push Button
Module 3	sensors with Arduino UNO and ESP32 Boards
Module 4	design and configure the actuators with Arduino UNO and ESP32 Boards and build Arduino and ESP32 based application

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Electronics for Beginners a Practical Introduction to Schematics Circuits and Microcontrollers	Jonathan Bartlet	Apress	2020
2	Internet of Things: A Hands-on Approach	Arshdeep Bahga and Vijay Madisetti	VPT	2022
3	"Getting Started with the Internet of Things: Connecting Sensors and Microcontrollers to the Cloud (Make: Projects)	Cuno Pfister	O'Reilly Media	1st Edition
4	Technologies & Sensors for the Internet of Things Businesses & Market Trends	Dr. Guillaume Girardin, Antoine Bonnabel, Dr. Eric Mounier		2014 - 2024

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Arduino Software	IOT	Commercial
2	Tinkercad	IOT	Open source

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Practical Continuous Evaluation	15	25
	Project Continuous Evaluation	10	
In-Sem Summative	In-Sem 1	17.5	35
	In-Sem 2	17.5	
End-Sem Summative	Lab End-Sem Exam	40	40

22EC1202: COMPUTER ORGANIZATION AND ARCHITECTURE

L-T-P-S:2-0-0-0 **Prerequisite:22EC1101**

Mapping of Course outcomes (CO) with program outcomes (PO):

CO	Course Outcome (CO)	PO	BTL
CO1	Understand the functionality of CPU functional units - control unit, registers, the arithmetic and logic unit, instruction execution unit	1,5	2
CO2	Understand the concepts of CPU and the operation of main, cache and virtual memory organizations.	1,5	2
CO3	Understand the concepts of the different types of I/O modules and I/O transfer techniques in computer modules	1,5	2
CO4	Apply the concept of pipelining in instruction execution and design issues of RISC, CISC and parallel computing architectures	1,5	3

Syllabus:

Computer Architecture, Computer system and its sub modules: State Diagram various Architectures, Moore Machine, Mealey Machine, Van Neuman architecture and hardware implementation of Arithmetic and Logic Unit, Bus Types, Specifications of a computer, Concepts of Machine level programming, Assembly level programming and High-level programming. Various addressing modes and designing of an Instruction set. Concepts of subroutine and subroutine call, use of stack for handling subroutine call and return.

CPU design: Introduction to CPU design, Instruction interpretation and execution, Micro- operation, and their RTL specification. Hardwired control CPU design. Micro programmer control CPU design. Concepts of semiconductor memory, CPU-memory interaction, organization of memory modules. Cache memory and related mapping and replacement policies. Virtual memory, paging concepts, VAS to PAS and Vice-versa mapping.

Input / Output Devices: Introduction to input/output processing, working with video display unit and keyboard and routine to control them. Program controlled I/O transfer. Interrupt controlled I/O transfer, DMA controller. Secondary storage and type of storage devices. Introduction to buses and connecting I/O devices to CPU and memory, TRAP, and Interrupts.

Pipelining: Introduction to RISC and CISC paradigm. Design issues of a RISC processor and example of an existing RISC processor. Introduction to pipelining and design issues of pipeline architecture. Introduction to parallel computing.

Reference Books:

1. William Stallings, Computer Organization and Architecture: Designing for Performance, 8/e, Pearson Education India. 2010.
2. D. A. Patterson and J. L. Hennessy, Computer Organization and Design, 4/e, Morgan Kaufmann, 2008.
3. V. C. Hamacher, Z. G. Vranesic and S. G. Zaky, Computer Organization, 5/e, McGraw Hill, 2002
4. Morris Mano, Computer System Architecture, 3/e, Pearson, 2008.Web References

Web References:

1. NPTEL Computer Organization and Architecture Lecture by IIT Guwahati. https://onlinecourses.nptel.ac.in /noc19_cs04/
2. MOOCS: https://www.edx.org/course/computation-structures-3-computer-mitx-6-004-3x-0

DIGITAL LOGIC AND PROCESSORS

22EC1101: Digital Logic & Processors L-T-P-S: 3-0-2-0 Prerequisite: Nil

Mapping of Course outcomes (CO) with program outcomes (PO):

CO	Course Outcome	PO/ PSO	BTL
CO1	Understand numerical and character representations in digital logic,number system, data codes and the corresponding 8design of arithmetic circuitry. Understanding Logic gates, Logic theorems, Boolean algebra, and SOP/POS'S expressions.	1,2	1,2
CO2	Combinational systems design using standard gates and minimization. methods	1,2	3
CO3	Sequential systems: Design of counters using flip flops.	1,2	3
CO4	Understanding PLA's, PAL's, FPGAs, and processors	2	1
CO5	Analyzing and realization of Boolean functions, half adder, encoders, decoders, flip flops, and counters.	5	3

Syllabus

Basics of Logic Design: Number systems: Binary, Octal and Hexa decimal; Boolean Algebra and De Morgan's Theorem, SOP & POS forms, Karnaugh map, Digital waveform characteristics; Codes: BCD, ASCII, Parity and Alphanumeric; Code Conversion, Logic Gates TTL and CMOS ICs, IC Data sheet parameters, Clock Buffer (7440) and level shifter (CD 4504).

Combinational Logic design: Half Adder/Subtractor (7486, 7408 and 7404); Full adder using 7483, Full Subtractor using simple gates, Decoders (74HC238,74LS154), Encoders (CD4532,74184), Multiplexers/Demultiplexers (4051, 4052, 4053), Magnitude Comparators (4585, 7485), Parity Generators and Checkers (74180), BCD to seven segment decoder (74LS47), Verilog HDL design for Combinational Logic Functions.

Sequential Logic design: NAND/NOR Latches Gated Latches (4011/4001), JK (7476/4027) and D Flip- flops (7474/4013), Shift registers (SISO, SIPO, PISO, PIPO), Design of Synchronous counters (7476, 7490, 7493) and Asynchronous Counters (4013), Up-down counters (74193/CD4510), Ring and Johnson counters, Digital Clock design, Verilog HDL design for Sequential Logic Functions.

Programmable Logic Devices: Programmable Logic Array (PLA), Programmable Array Logic (PAL), Logic implementation using Programmable Devices. Introduction to Complex Programmable Logic Devices and Field Programmable Gate Arrays, Applications of CPLDs and FPGAs. **Processors:** Block diagram of generic processors, ALU, Instruction register, Instruction decoder, execution of micro instructions (Adding two HEXA Numbers).

Textbooks:

1. Digital Principles and Logic Design by ArijitSaha and Nilotpal Manna ISBN: 978-1-934015-03-2 Jones & Bartlett Publishers 2007
2. M. Morris Mano, "Digital Logic and Computer Design", Pearson.

Web References:

1. https://onlinecourses.nptel.ac.in/
2. https://onlinecourses.nptel.ac.in/noc18_ee33/previe
3. https://drive.google.com/file/d/1lpksgYbRX2kD7LXLk62B-LSnd8tSXz2k/view

PROBLEM SOLVING & REASONING SKILLS-1 (PSRS-1)

COURSE CODE	22UC3108	MODE	R	LTPS	0-0-0-4	PRE-REQUISITE	NONE

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Apply the concepts of Linear Equations, concepts of Ratios, Averages, Partnership, Percentages, and Interest to solve the problems related to Ages, Ratio & Proportion, Variation& Partnership, Percentages, Profit, Loss& Discounts, Simple & Compound Interest, Averages & Allegations or Mixtures.	3	1,5
CO2	Apply the concepts of Co-primes, Divisibility rules, LCM & HCF concepts to solve problems in Numbers, Apply the concepts of Algebra to solve the problems based on Sets, Relations, Functions and Graphs, Surds & Indices, Logarithms, Quadratic Equations, Inequalities & Progressions.	3	1,5
CO3	Apply Venn diagrams and other applicable diagrams to solve questions in Syllogism, Logical Venn Diagrams, Cubes & Dice. Understand the principles used in forming Number& letter series, Number, letter & word Analogy, Odd man out, Coding & Decoding.	3	1,5
CO4	Understand the underlying assumptions in the arguments presented in the topics: Statements & conclusions, statements & Arguments (Critical Reasoning), statements & Assumptions, logical connectives, Binary logic.	2	1,5

Syllabus

Module 1	Simple Equations, Problem on Ages, Ratio & Proportion, Variation& Partnership, Percentages, Profit, Loss & Discounts, Simple & Compound Interest, Averages & Allegations or Mixtures.
Module 2	Numbers, Divisibility, Decimal Fractions, LCM & HCF, Simplification, Sequence, Series & Progressions, Linear Algebra, Quadratic Equations & Inequalities, Theory of Equations. Sets, Relations, Functions and Graphs, Surds & Indices, Logarithms
Module 3	Syllogism, Number& letter series, Number, letter & word Analogy, Odd man out, coding & decoding, Cubes & Dice, Logical Venn Diagrams, Ranking, Logical choice, Analytical reasoning
Module 4	Statements & conclusions, statements & Arguments (Critical Reasoning), statements & Assumptions, logical connectives, Binary logic, Statement - Courses of Action, Inferred meaning, Logical order

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Quantitative Aptitude	R S Aggarwal	S Chand	
2	A Modern Approach to Verbal Reasoning	R S Aggarwal	S Chand	

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	ALM	10	20
	SKILLING CONTINUOUS EVALUATION	10	
In-Sem Summative	SKILL IN SEM	20	40
	SEM IN 1	10	
	SEM IN 2	10	

End-Sem Summative	SKILL SEM END EXAM	24	40
	END SEM EXAM (ONLINE MCQ)	16	

PROBLEM SOLVING & REASONING SKILLS-2 (PSRS-2)

COURSE CODE	22UC3209	MODE	R	LTPS	0-0-0-4	PRE-REQUISITE	PSRS-1

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Apply the concepts of Unitary method in solving problems in Time & Work, Chain Rule, Pipes & Cisterns. Apply the concept of Average speed and Relative speed to solve the problems related to Time, Speed &Distance, Trains, Boats & Streams, Races & games. Apply the concept of counting principles to solve the problems related to Permutations & Combinations and Probability.	3	1,5
CO2	Apply the concepts of Perimeter, Area, Surface Area & Volume to solve the problems in 2D & 3D Geometry. Apply the concepts of Trigonometry to solve problems related to Heights & Distances. Apply the concepts of Lines, Angles, Triangles, Quadrilaterals & Polygons to solve the problems related to Geometry, Analyzing the data given in the Table, Bar Graph, Pie Chart and Line Graph to solve the problems in Data Interpretation. Data Sufficiency, Statistics, Crypt arithmetic.	3	1,5
CO3	Apply the fundamental relationships and principles in solving questions in Blood Relations, Directions, Clocks, Calendars, Alphabet Test, Number, ranking & Time sequence test, Seating Arrangements, Mathematical Operations, Data Sufficiency, Nonverbal - series, analogy, classification.	3	1,5
CO4	Apply the conditions mentioned in the question statement to solve questions in Input & Output, Assertion and Reason, dot situation. embedded figures, figure matrix, mirror and water images, paper cutting, paper folding pattern completion, rule detection, flowcharts, Puzzles, Sudoku puzzles	3	1,5

Syllabus

Module 1	Time & Work, Chain Rule, Pipes & Cisterns, Time, Speed & Distance, Problems on Trains, Boats & Streams, Races & games, Permutations & Combinations, Combinatorics, Probability
Module 2	Areas & Perimeters, Mensuration, Trigonometry, Heights & Distances, Geometry, Coordinate Geometry, Data Interpretation, Data Sufficiency, Statistics, Simplification, Crypt arithmetic, Spatial Ability
Module 3	Blood Relations, Directions, clocks, calendars, Alphabet Test, Number, ranking & Time sequence test, Seating Arrangements, Mathematical Operations, Data Sufficiency, Nonverbal - series, analogy, classification, Team Formations, Rule detection
Module 4	Input & Output, Assertion and reason, dot situation, embedded figures, figure matrix, mirror and water images, paper cutting, paper folding pattern completion, rule detection, flowcharts, Logical Puzzles, Sudoku, playing cards puzzles, Attention to details, Grouping of images, Shape construction, Game based puzzles (Gamification)

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Quantitative Aptitude	R S Aggarwal	S Chand	
2	A Modern Approach to Verbal Reasoning	R S Aggarwal	S Chand	

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	ALM	10	20
	SKILLING CONTINUOUS EVALUATION	10	
In-Sem Summative	SKILL IN SEM	20	40
	SEM IN 1	10	
	SEM IN 2	10	
End-Sem Summative	SKILL SEM END EXAM	24	40
	END SEM EXAM (ONLINE MCQ)	16	

DESIGN OF BASIC ELECTRONIC CIRCUITS

22EC1203: Design of Basic Electronic Circuits L-T-P-S: 3-0-0-0 Prerequisite: NIL

Mapping of Course outcomes (CO) with program outcomes (PO):

CO	Course Outcome (CO)	PO	PSO	BTL
CO1	Understand the basic electronic components.	1,5	1	2
CO2	Understand the basic circuit analysis techniques	1,5	1	2
CO3	Understand the active circuit elements and working.	1,5	1	2
CO4	Analyse the applications of semiconductor devices	1,5	1	4

Syllabus:

Introduction to Electronic Components: Components, types of components, color coding, types of resistors, types of capacitors, types of inductors, switches, diodes, transistors, Induction coils, transformers.

Introduction to Circuit Theory: Mesh analysis, Nodal Analysis, Thevenin's theorem, Norton's theorem, Super position theorem, Maximum power transfer theorem.

Diodes: P-type and N-type semiconductors (brief discussion), P-N junction, forward bias and reverse bias, V-I characteristics, ideal and practical diodes, approximate model, diode data sheet, types of diodes and variants (Introductory level only). BJTs: Types of transistors (PNP and NPN), switching transistors, power transistors (low,medium and large power), key parameter from data sheet. (Gain, Bandwidth, β, α... etc.

Applications of diodes: Clippers, Clampers, Rectifiers - HWR, FWR, BR with and without capacitive filters. **Power supply:** Power supply with ripple reduction and regulation. Zener Diode: Difference between ordinary diode and zener diode, zener diode as a voltage regulator, Avalanche and Zener breakdown, Zener characteristics, Applications. Analog & Digital ICs: 7805,7905, IC 741, IC 555, LM 339, LM723.

Reference Books:

1. John Bird. Electrical Circuit Theory and Technology, Routledge publishers, 6th edition, 2017.
2. Electronic Devices and Circuit Theory 12th Edition - Robert L. Boylestad
3. A Sudhakar, Shyam Mohan S Palli, Circuits and Networks: Analysis and Synthesis, TMH, 5e
4. David A. Bell, Electronic Devices and Circuits, 5th Edition

SYLLABUS OF COURSES UNDER

PROFESSIONAL CORE

OBJECT ORIENTED PROGRAMMING

COURSE CODE	22CS1201	MODE	R	LTPS	2-0-2-0 (R)	PRE-REQUISITE	CTSD

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Apply the concepts of Basic Data types, Operators, Decision and Looping Control Statements, Strings	3	PO3, PO5
CO2	Apply the concepts of Lists, Tuples, Dictionaries. Functions, Modules, Class, Object, OOPS principles.	3	PO3, PO5
CO3	Apply Concepts of OOP principles, classes and objects, Call by value vs. Call by reference, recursion, and Nested classes	3	PO3, PO5
CO4	Apply Concepts of Files, Interfaces, Packages, Threads	3	PO3, PO5
CO5	Design, implement, and evaluate Python programs using basic data types, variables, expressions, conditional statements, loops, functions, built-in data structures, object-oriented programming concepts, Python libraries and modules, debugging techniques, and file I/O to solve programming problems.	4	PO7, PO9, PO10, PSO1
CO6	Apply object-oriented programming concepts to write programs and Analyses requirements and design to implement lab-based project with SDLC in a group of students	4	PO7, PO9, PO10, PSO1

Syllabus

Module 1	**Python interpreter and interactive mode:** values and types: int, float, Boolean, string, and list, variables, expressions, statements, tuple assignment, precedence of operators, comments .Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Strings: string slices, immutability, string functions and methods, string module
Module 2	**Fruitful functions**: functions, function definition and use, flow of execution, parameters and arguments return values, parameters, local and global scope, recursion; List, Tuples, Set, Dictionary data types, Classes, Object: command line arguments, Class, object, methods, constructors, OOP's principles.
Module 3	**Polymorphism:** Static and Dynamic Polymorphism (Overloading, Overriding), Inheritance – Super classes- sub classes –Protected members – constructors in sub classes, Super keyword, Encapsulation: Data Encapsulation and Data Abstraction, Object as argument and return value: Call by value vs. Call by reference, recursion, and Nested classes.
Module 4	**Files, Interfaces, Packages, and Threads: Introduction To files:** Create, Read Write, Append, Delete Interfaces – defining an interface, implementing interface, differences between classes and interfaces and extending interfaces, Packages, importing packages, differences between classes and interfaces, Implementing & Applying interface. Exception Exceptions – exception hierarchy – throwing and catching exceptions – built-in exceptions, creating own exceptions fundamentals, Threads: Difference between multi-threading and Multitasking, Different Thread objects.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Think Python: How to Think like a Computer Scientist	Allen B. Downey	O'Reilly Publishers, 2016	2016

2	Python for Programmers	Paul Deitel and Harvey Deitel	Pearson Education	2021
3	Python: The Complete Reference	Martin C. Brown	Mc-Graw Hill, 2018	2018
4	Python 3 Object-oriented Programming	Dusty Phillips	Packet Publishing	2010

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	PCAP	Python Institute	Yes	Objective Type	PearsonVue	https://pythoninstitute.org/pcap

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	IDLE	Software Development	Open Source
2	Pycham (Community Version)	Software Development	Open Source
3	Coding platforms	Skill development	Open Source

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Home Assignments	6	24
	Quiz	6	
	Global Challenges Participation	4	
	Practical Continuous Evaluation	8	
In-Sem Summative	In-Sem 1	12	36
	In-Sem 2	12	
	Practical In-Sem	12	
End-Sem Summative	End-Sem Exam (Paper Based)	26	40
	Lab End-Sem Exam	14	

PROCESSORS AND CONTROLLERS

COURSE CODE	**22EC2106**	MODE	Regular	LTPS	3-0-2-2	PRE-REQUISITE	**NIL**

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Apply the architectural features of CISC type of General-purpose processor Intel 8086.	3	PO2, PO7/PSO1
CO2	Apply the architectural features of CISC type of microcontroller Intel 8051 Microcontroller	3	PO2, PO7 /PSO1
CO3	Analyze the Interfacing of Peripherals to the 8051 Microcontroller through programming using MCU8051 IDE.	4	PO5, PO7/PSO1

CO4	Apply the basic architecture concepts of ARM - CORTEX STM-32 Microcontroller	3	PO2, PO7/PSO1
CO5	Analyze the programming & interfacing of 8051 and 8086 using the hardware/software tool.	4	PO2, PO5, /PSO1
CO6	Analyze the programming & interfacing of 8051 using the proteus and keil tool.	4	PO2, PO5, /PSO1

Syllabus

Module 1	**8086-Microprocessor:** Basics of processor, Introduction, and History of Processors, pinout, Architecture, addressing modes, Instruction set, Timing Diagram for Minimum and Maximum mode, ALU programming, and examples.
Module 2	**8051-Microcontroller:** Architecture, Pin Diagram, addressing modes, Instruction sets, Programs involving Arithmetic and Logical Instructions, Timers/Counters, Interrupts & Serial port Assembly level programming.
Module 3	**8051-Microcontroller Applications:** Peripherals and Input Output with 8051 Microcontroller - Timers and Interfacing Seven Segment, LCD, ADC, DAC & Motor Control, Keypad). Case studies: Traffic signal, home automation & Industrial applications.
Module 4	**PIC & ARM Microcontroller:** Architecture & features of PIC, Architecture of ARM Microcontroller, ARM series of microcontrollers, Evolution of ARM microcontrollers, ARM features, Basic concepts of pipeline processing, ARM processor modes and registers, Special registers and exception handling, ARM and Thumb modes of execution.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	"Microprocessor and Interfacing", 2nd Edition Tata McGraw Hill Publishing Company,2006.	D.V. Hall	Tata McGraw Hill Publishing Company,	2006.
2	)51 Micro controller and Embedded systems: using assembles and C,	Mazidi & McKinley	Scientific Research Publishing	2nd edition, 2007.
3	"Embedded System Design",	Frank Vahid,	Wiley.	Student edition (2006).
4	'Advanced Microprocessors and Peripherals	A K Ray and K M Bhurchandi	The McGraw Companies,	2nd Edition,2006
5	Practical Microcontroller Engineering with ARM Technology	Ying Bai	ARM	2007

NETWORK PROTOCOLS & SECURITY (NPS)

COURSE CODE	22EC2210R	MODE	R	LTPS	3-0-2-0	PRE-REQUISITE	DDCA

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Apply the knowledge of communication to understand and analyse the physical and data link layer in networks	3	PO1, PO2, PO3, PSO2

CO2	Analyse different Network layer protocols and Routing algorithms	4	PO2, PO3, PSO2
CO3	Analyse different Transport layer, Session Layer, Presentation Layer and Application Layer Protocols	4	PO2, PO3, PSO2
CO4	Analyse different cryptography algorithms	4	PO2, PO3, PSO2
CO5	Analysis of different protocols with different topologies in networks	4	PO2, PO5, PSO2
CO6	Analysis of different enterprise network protocols using Cisco Packet Tracer	4	PO2, PO5, PSO2

Syllabus

Module 1	CO1: Introduction to Computer networks and Data Link Layer: Use of Computer Networks, Network Hardware, Network software, Reference models: OSI and TCP/IP, Example Networks, Physical Layer: The theoretical basis for Data Communication, Guided and Unguided Transmission Media, Switching. Data Link Layer: DLL design issues. Error Detection and Correction, Elementary data link protocols, sliding window protocols. Medium Access Control Sub layer: Channel allocation problem, multiple access protocols, Ethernet.
Module 2	Design issues of Network layer, Inter-networking Devices: Distinguishing of Networking Devices and Inter-networking Devices, Analysis of Router Processing: Access, core and distribution. VLANS, addressing: IP addressing (IPV4 & IPV6), subnetting; Types of Routing: static, default and dynamic. Networking Protocols: RIP, OSPF, BGP; Access Control list for IPV4, IPV6, Other Protocols: NAT, ARP, Port Address Translation (PAT), IP Tunnelling; DHCP
Module 3	Transport Layer: Process to Process Delivery; UDP; TCP; FCP Fiber Channel Protocol; Stream Control Transmission Protocol (SCTP); Congestion Control: Open Loop, Closed Loop Choke Packets; Quality of Service: Techniques to Improve QoS: Leaky bucket algorithm, Token bucket algorithm. Session Layer: ISNS Internet Storage Name Service. Presentation Layer: Preface of Socket, Secure Socket Layer Application Layer: Telnet, DNS, SMTP, SNMP
Module 4	Introduction to Security, Security goals, Security Attacks, Security Services and Mechanisms, A Security Model, Asymmetric & Symmetric key Ciphers, Substitution Techniques, Transposition Techniques, DES, RSA algorithm. Network Security: Essential Steps for Configuring a New Server and firewalls, Digital signatures.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Data Communication and Networking	Behrouz A. Forouzan	TMH	2012
2	Computer Networks	A.S. Tanenbaum, David J. Weteral	Pearson Education	2013
3	Cryptography and Network Security	William Stallings	Pearson Education	2015
4	Engineering Approach to Computer Networking	Srinivasan Keshav	Pearson Education (AICTE)	2012
5	Computer Networking: A Top-Down Approach	Bhavneet Sidhu	Khanna Publications	2019

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Huawei - Data Com	Huawei	Y	Online	Huawei	https://e.huawei.com/en/talent/
2	Junos - associate	Juniper	Y	Online	Juniper	https://www.juniper.net/us/en/training/certification/tracks/junos/jncia-junos.html

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Cisco packet tracer	Cisco	Open
2	Huawei Hardware	Huawei	

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	8	22
	Home Assignments	7	
	Lab weekly exercise	7	
In-Sem Summative	In-Sem 1	15	38
	In-Sem 2	15	
	Practical In-Sem	8	
End-Sem Summative	End-Sem Exam (Paper Based)	40	40

NETWORK PROTOCOLS & SECURITY (NPS)

COURSE CODE	22EC2210A	MODE	A	LTPS	4-0-4-0	PRE-REQUISITE	DDCA

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Apply the knowledge of communication to understand and analyse the physical and data link layer in networks	3	PO1, PO2, PO3, PSO2
CO2	Analyse different Network layer protocols and Routing algorithms	4	PO2, PO3, PSO2
CO3	Analyse different Transport layer, Session Layer, Presentation Layer and Application Layer Protocols	4	PO2, PO3, PSO2
CO4	Analyse different cryptography algorithms	4	PO2, PO3, PSO2
CO5	Analyse different enterprise network Protocols	4	PO2, PO3, PSO2
CO6	Analysis of different protocols with different topologies in networks	4	PO2, PO5, PSO2
CO7	Analysis of different enterprise network protocols using Cisco Packet Tracer	4	PO2, PO5, PSO2

Syllabus

Module 1:	CO1: Introduction to Computer networks and Data Link Layer: Introduction to Computer networks Use of Computer Networks, Network Hardware, Network software, Reference models: OSI and TCP/IP, Example Networks, Physical Layer: The theoretical basis for Data Communication, Guided and Unguided Transmission Media, Switching, Modems, ADSL, Trunks AND Multiplexing. Data Link Layer: DLL design issues. Error Detection and Correction, Elementary data link protocols, sliding window protocols. Medium Access Control Sub layer: Channel allocation problem, multiple access protocols, Ethernet.
Module 2:	Inter-networking Devices: Preamble to Network Layer, Distinguishing of Networking Devices and Inter-networking Devices, Analysis of Router Processing: Access, core and distribution. VLANS, Ethernet Inter-networking Technologies: Wired Router, Wireless Router, Gateway, CSU/DSU; Addressing: IP addressing (IPV4 & IPV6), subnetting; Types of Routing: static, default and dynamic. Networking Protocols: RIP, OSPF, BGP; Access Control list for IPV4, IPV6, Other Protocols: NAT, ARP, Port Address Translation (PAT), IP Tunneling; DHCP
Module 3:	Transport Layer: Process to Process Delivery; UDP; TCP; FCP Fiber Channel Protocol; Stream Control Transmission Protocol (SCTP); Congestion Control: Open Loop, Closed Loop Choke Packets; Quality of Service: Techniques to Improve QoS: Leaky bucket algorithm, Token bucket algorithm. Session Layer: ISNS Internet Storage Name Service. Presentation Layer: SSL, preface of Socket, Secure Socket Layer Application Layer: Telnet, TFTP, POP3, DNS, SMTP, SNMP, FTP, NTP, SSDP.
Module 4:	Introduction to Security, Security goals, Security Attacks, Security Services and Mechanisms, A Security Model, Asymmetric & Symmetric key Ciphers, Substitution Techniques, Transposition Techniques, DES, RSA algorithm. Network Security: Essential Steps for Configuring a New Server and firewalls, Digital signatures.
Module 5:	HDLC, PPP, PPoE, AAA, IPsec, Generic Routing algorithm, IPv6 and routing, MPLS and SR Routing, Link Aggregation, OSPF: Router ID, DR, BDR and their election, loopback address and its use, OSPFv1 to OSPFv3, Wild card mask, Application Services DHCPv6.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Data Communication and Networking	Behrouz A. Forouzan	TMH	2012
2	Computer Networks	A.S. Tanenbaum, David J. Weteral	Pearson Education	2013
3	Cryptography and Network Security	William Stallings	Pearson Education	2015
4	Engineering Approach to Computer Networking	Srinivasan Keshav	Pearson Education (AICTE)	2012
5	Computer Networking: A Top-Down Approach	Bhavneet Sidhu	Khanna Publications	2019

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Huawei - Data Com	Huawei	Y	Online	Huawei	https://e.huawei.com/en/talent/

2	Junos - associate	Juniper	Y	Online	Juniper	https://www.juniper.net/us/en/training/certification/tracks/junos/jncia-junos.html

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Cisco packet tracer	Cisco	Open
2	Huawei Hardware	Huawei	

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	5	24
	Home Assignments	5	
	Lab weekly exercise	5	
	Skill Continuous Evaluation	5	
	MOOCs Review	4	
In-Sem Summative	In-Sem 1	12	36
	In-Sem 2	12	
	Practical In-Sem	6	
	Skill In-Sem	6	
End-Sem Summative	End-Sem Exam (Paper Based)	40	40

NETWORK PROTOCOLS & SECURITY (NPS)

COURSE CODE	22EC2210P	MODE	P	LTPS	4-0-4-0	PRE-REQUISITE	DDCA

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Apply the knowledge of communication to understand and analyse the physical and data link layer in networks	3	PO1, PO2, PO3, PSO2
CO2	Analyse different Network layer protocols and Routing algorithms	4	PO2, PO3, PSO2
CO3	Analyse different Transport layer, Session Layer, Presentation Layer and Application Layer Protocols	4	PO2, PO3, PSO2
CO4	Analyse different cryptography algorithms	4	PO2, PO3, PSO2
CO5	Analyse different enterprise network Protocols	4	PO2, PO3, PSO2
CO6	Analysis of different protocols with different topologies in networks	4	PO2, PO5, PSO2
CO7	Analysis of different enterprise network protocols using Cisco Packet Tracer	4	PO2, PO5, PSO2

Syllabus

Module 1:	CO1: Introduction to Computer networks and Data Link Layer: Introduction to Computer networks Use of Computer Networks, Network Hardware, Network software, Reference models: OSI and TCP/IP, Example Networks, Physical Layer: The theoretical basis for Data Communication, Guided and Unguided Transmission Media,

	Switching, Modems, ADSL, Trunks AND Multiplexing. Data Link Layer: DLL design issues. Error Detection and Correction, Elementary data link protocols, sliding window protocols. Medium Access Control Sub layer: Channel allocation problem, multiple access protocols, Ethernet.
Module 2:	Inter-networking Devices: Preamble to Network Layer, Distinguishing of Networking Devices and Inter-networking Devices, Analysis of Router Processing: Access, core and distribution. VLANS, Ethernet Inter-networking Technologies: Wired Router, Wireless Router, Gateway, CSU/DSU; Addressing: IP addressing (IPV4 & IPV6), subnetting; Types of Routing: static, default and dynamic. Networking Protocols: RIP, OSPF, BGP; Access Control list for IPV4, IPV6, Other Protocols: NAT, ARP, Port Address Translation (PAT), IP Tunneling; DHCP
Module 3:	Transport Layer: Process to Process Delivery; UDP; TCP; FCP Fiber Channel Protocol; Stream Control Transmission Protocol (SCTP); Congestion Control: Open Loop, Closed Loop Choke Packets; Quality of Service: Techniques to Improve QoS: Leaky bucket algorithm, Token bucket algorithm. Session Layer: ISNS Internet Storage Name Service. Presentation Layer: SSL, preface of Socket, Secure Socket Layer Application Layer: Telnet, TFTP, POP3, DNS, SMTP, SNMP, FTP, NTP, SSDP.
Module 4:	Introduction to Security, Security goals, Security Attacks, Security Services and Mechanisms, A Security Model, Asymmetric & Symmetric key Ciphers, Substitution Techniques, Transposition Techniques, DES, RSA algorithm. Network Security: Essential Steps for Configuring a New Server and firewalls, Digital signatures.
Module 5:	HDLC, PPP, PPoE, AAA, IPsec, Generic Routing algorithm, IPv6 and routing, MPLS and SR Routing, Link Aggregation, OSPF: Router ID, DR, BDR and their election, loopback address and its use, OSPFv1 to OSPFv3, Wild card mask, Application Services DHCPv6.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Data Communication and Networking	Behrouz A. Forouzan	TMH	2012
2	Computer Networks	A.S. Tanenbaum, David J. Weteral	Pearson Education	2013
3	Cryptography and Network Security	William Stallings	Pearson Education	2015
4	Engineering Approach to Computer Networking	Srinivasan Keshav	Pearson Education (AICTE)	2012
5	Computer Networking: A Top-Down Approach	Bhavneet Sidhu	Khanna Publications	2019

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Huawei - Data Com	Huawei	Y	Online	Huawei	https://e.huawei.com/en/talent/
2	Junos - associate	Juniper	Y	Online	Juniper	https://www.juniper.net/us/en/training/certification/tracks/junos/jncia-junos.html

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial

1	Cisco packet tracer	Cisco	Open
2	Huawei Hardware	Huawei	

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	4	22
	Home Assignments	4	
	Lab weekly exercise	5	
	Skill Continuous Evaluation	5	
	MOOCs Review	4	
	Practical In-Sem	8	
	Skill In-Sem	8	
	MOOCs Exam	22	
End-Sem Summative	Lab End-Sem Exam	8	40
	Skill End-Sem Exam	8	

Analog Electronic Circuit Design (AECD)

COURSE CODE	22EC2104	MODE	R	LTPS	3-0-2-2	PRE-REQUISITE	BEEC

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Apply the knowledge of Semiconductor physics and discuss BJT configurations and its applications	3	PO1/PSO1
CO2	Apply the limitations of BJT and discuss the characteristics and applications of Field Effect Transistors	3	PO1/PSO1
CO3	Apply the linear and nonlinear circuits approaches and realise the characteristics of operational Amplifiers	4	PO1, PO2/ PSO1
CO4	Apply the concept of feedback system and realise the working principles of Oscillators and multivibrators	4	PO1, PO2/PSO1
CO5	Design and analyse analog circuits for real time applications using Passive and Active Components.	4	PO2, PO3/ PSO1
CO6	Simulate and analyse Electronic Circuit using Multisim and myDAQ.	4	PO2, PO3, PO5/ PSO1

Syllabus

Module 1	Bipolar Junction Transistors (BJT): BJT Biasing, DC load line analysis and operating point, variation of operating point and its stability, Small Signal Models, Concept of feedback, Design of BJT amplifier, Analysis of amplifier using small signal model
Module 2	Junction Field Effect Transistors (JFET): JFET and its characteristics: Pinch-off Voltage, Drain Saturation Current, JFET biasing, Metal Oxide Semiconductor Field Effect Transistor (MOSFET): – Enhancement and Depletion Modes, MOSFET biasing, small signal models, Analysis of amplifier
Module 3	Operational Amplifiers: Op-Amp Basics, Inverting & Non-Inverting Amplifier, Linear and Nonlinear applications of Op-Amp: adder, subtractor, integrator, differentiator, comparator, Schmitt Trigger, instrumentation amplifier, active filters
Module 4	Feedback & Oscillator Circuits: Feedback topologies & their properties, Oscillators: RC Phase Shift, Wien-Bridge, Hartley & Colpitts. IC 555 timer: Monostable and A stable Multivibrator.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Electronic Devices and Circuit Theory	Robert L. Boylestad and Louis Nashelsky	7th Edition, Prentice Hall Publication	1998
2	Op-Amps and Linear IC Applications	Ramakanth A. Gaykwad	4th Edition, Pearson Education	2015
3	Electronic Devices – Electron Flow Version	Thomas L. Floyd	4th Edition, Pearson Education	2001
4	Microelectronics Circuits	A.S. Sedra & K.C.	7th Edition, Oxford University Press	2014
5	Electronic Devices and Circuits	Jacob Millman	4th Edition, McGraw Hill Education	2015

Global Certifications:

Mapped Global Certifications:

Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	NI-CLAD	National Instruments	Y	MCQ	National Instruments	https://www.examtopics.com/exams/ni/clad/?gclid=Cj0KCQjw4s-kBhDqARIsAN-ipH2Zq6_HhvjyQiG6kSQWV-VjbNDQsRRW4wBkQ126cIii05K2zXa4s-YaAv1UEALw_wcB

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	MultiSim	Multisim	Open Source

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	ALM (LTC, in-class Quiz, etc.)	7	24
	Home Assignment and Book. (Min. 4 Assignments etc.)	7	
	Lab Weekly exercise	5	
	Continuous Skill evaluation	5	
In-Sem Summative	In-Sem Exam-I	12	36
	In-Sem Exam-II	12	
	In Semester Exam (Lab)	6	
	In Semester Exam (Skilling)	6	
End-Sem Summative	End Semester Exam	24	40
	Lab Skill End Exam	8	
	Skill End Exam	8	

DATABASE MANAGEMENT SYSTEMS (DBMS)

COURSE CODE	22AD2102R	MODE	R	LTPS	2-0-2-0	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Choose the functional components of DBMS and Design an ER Model for a database.	3	PO1, PO2,PO3, PSO1

CO2	Utilize a relational model for a database & Implement SQL concepts and relational algebra.	3	PO1, PO2,PO3, PSO1
CO3	Examine the PL/SQL programs, normalization techniques, indexing to construct and access database	4	PO1, PO3,PO8,PSO1
CO4	List the importance of transaction Processing, concurrency control and recovery techniques.	4	PO1, PO3, PO8,PSO1
CO5	Categorize a database and implement SQL queries and PL/SQL programs to do various operations on data.	4	PO1, PO3, PO5,PSO1

Syllabus

Module 1	Database Fundamentals: DBMS Characteristics & Advantages, Database Environment, Database Users, Database Architecture, Data Independence, Languages, Tools and Interface in DBMS, DBMS types. Data Modelling: ER Model, Notation used in ER Diagram, Constraint, Types, Relationships in ER Model, and other considerations in designing ER diagram. Enhanced, ER data Model, EER Diagram
Module 2	Relational Model: concepts, constraints, schemas, ER to Relational Model. SQL & Relational Algebra: Data Definition and other languages in SQL, creating tables and Data types, Constraints, DML statements, Functions and writing SQL statements using nested sub queries, complex queries, joining relations, views, compound statements, user defined functions, user defined procedures, cursors, Triggers, Relational Algebra: Operators in relational algebra
Module 3	Database Design: Guidelines for good database design, Normalization- Normal Forms, First, Second, Third Normal Forms, BCNF, Multi value and join dependencies, 4th, and 5th normal forms. Decomposition algorithms for normalization. File and Storage Structures: File storage, Index structures, Indexing and hashing, Query processing and optimization.
Module 4	Transaction Management: Transaction processing issues, Transaction states, problems during multiple transactions processing, ACID properties, system log and concurrency control Techniques: Lock based techniques, and Timestamp based techniques, Multi version-based Techniques. Recovery Techniques: Recovery concepts, shadow paging, ARIES

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Database System Concepts	Abraham Silberschatz, Yale University Henry, F. Korth Lehigh University, S. Sudarshan Indian Institute of Technology, Bombay.	tata mcgraw hill books	2010
2	Fundamentals of Database Systems	RamezElmasri, University of Texas at Arlington, Shamkant B. Navathe, University of Texas at Arlington.	Pearson	2011
3	An Introduction to Database Systems	Bipin C. Desai	Galgotia Publications Pvt Ltd	2010
4	Principles of Database Systems	Jeffrey D. Ullman	Galgotia Publications	1982
5	Database Management Systems	Raghu Ramakrishnan, Johannes Gehrke	Tata McGraw Hill, 2014.	2002

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	MongoDB	MongoDB University	YES	Multiple choice	MongoDB University	https://learn.mongodb.com/pages/certification-program
2	Azure Database Administrator Associate - Global Certification	Microsoft	YES	Multiple choice	Microsoft	https://learn.microsoft.com/en-us/certifications/azure-database-administrator-associate/

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	PostgreSQL	PostgreSQL	Open Source
2	MongoDB	Server-Side Public License (SSPL)	Commercial

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	ALM	8	22
	Home Assignment and Book	7	
	Lab Weekly exercise	7	
In-Sem Summative	In-Sem Exam-I	15	38
	In-Sem Exam-II	15	
	Lab In Semester Exam	8	
End-Sem Summative	End Semester Exam	24	40
	Lab End Exam	16	

DATABASE MANAGEMENT SYSTEMS (DBMS)

COURSE CODE	22AD2102A	MODE	A	LTPS	3-0-4-0	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Choose the functional components of DBMS and Design an ER Model for a database.	3	PO1, PO2,PO3, PSO1
CO2	Utilize a relational model for a database & Implement SQL concepts and relational algebra.	3	PO1, PO2,PO3, PSO1
CO3	Examine the PL/SQL programs, normalization techniques, indexing to construct and access database	4	PO1, PO3,PO8,PSO1

CO4	List the importance of transaction Processing, concurrency control and recovery techniques.	4	PO1, PO3, PO8,PSO1
CO5	Categorize the MangoDB to perform CURD, Indexing, Aggregation, Replication, Sharding, Performance analysis for distributed Databases	4	PO1, PO3, PO5,PSO1
CO6	Assume the MongoDB and implement SQL queries and PL/SQL programs to do various operations on data.	4	PO1, PO3, PO5,PSO1

Syllabus

Module 1	Database Fundamentals: DBMS Characteristics & Advantages, Database Environment, Database Users, Database Architecture, Data Independence, Languages, Tools and Interface in DBMS, DBMS types. Data Modelling: ER Model, Notation used in ER Diagram, Constraint, Types, Relationships in ER Model and other considerations in designing ER diagram. Enhanced, ER data Model, EER Diagram
Module 2	Relational Model: concepts, constraints, schemas, ER to Relational Model. SQL & Relational Algebra: Data Definition and other languages in SQL, creating tables and Data types, Constraints, DML statements, Functions and writing SQL statements using nested sub queries, complex queries, joining relations, views, compound statements, user defined functions, user defined procedures, cursors, Triggers, Relational Algebra: Operators in relational algebra
Module 3	Database Design: Guidelines for good database design, Normalization- Normal Forms, First, Second, Third Normal Forms, BCNF, Multi value and join dependencies, 4th and 5th normal forms. Decomposition algorithms for normalization. File and Storage Structures: File storage, Index structures, Indexing and hashing, Query processing and optimization.
Module 4	Transaction Management: Transaction processing issues, Transaction states, problems during multiple transactions processing, ACID properties, system log and concurrency control Techniques: Lock based techniques, and Timestamp based techniques, Multiversion based Techniques. Recovery Techniques: Recovery concepts, shadow paging, ARIES
Module 5	Mongo DB: Introduction to NOSQL, CRUD-INDEXING, AGGREGATE. Distributed database: Replication, Sharding, Performance analysis.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Database System Concepts	Abraham Silberschatz, Yale University Henry, F. Korth Lehigh University, S. Sudarshan Indian Institute of Technology, Bombay.	tata mcgraw hill books	2010
2	Fundamentals of Database Systems	RamezElmasri, University of Texas at Arlington, Shamkant B. Navathe, University of Texas at Arlington.	Pearson	2011
3	An Introduction to Database Systems	Bipin C. Desai	Galgotia Publications Pvt Ltd	2010
4	Principles of Database Systems	Jeffrey D. Ullman	Galgotia Publications	1982
5	Database Management Systems	Raghu RamaKrishnan, Johannes Gehrke	Tata McGraw Hill, 2014.	2002

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	MongoDB	MongoDB University	YES	Multiple choice	MongoDB University	https://learn.mongodb.com/pages/certification-program
2	Azure Database Administrator Associate - Global Certification	Microsoft	YES	Multiple choice	Microsoft	https://learn.microsoft.com/en-us/certifications/azure-database-administrator-associate/

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	PostgreSQL	PostgreSQL	Open Source
2	MongoDB	Server-Side Public License (SSPL)	Commercial

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	ALM	7.5	22
	MOOCs Review	7.5	
	Continuous Evaluation -Lab Exercise	7	
In-Sem Summative	In-Sem Exam-I	12	38
	In-Sem Exam-II	12	
	Lab In Semester Exam	8	
	Mock Test	6	
End-Sem Summative	End Semester Exam	25	40
	Lab End Exam	15	

Data Driven Artificial Intelligent Systems (DDAIS) - Regular

COURSE CODE	22AD2001	MODE	R	LTPS	2-0-2-0	PRE-REQUISITE	CTSD

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Understand and apply the concepts of intelligent agents and various search algorithms, to solve real-world problems.	3	PO1, PO2, PSO2
CO2	Analyse satisfaction problems, discover knowledge using logic, and analyse reasoning techniques to make informed decisions in uncertain environments.	4	PO2, PO3, PSO1

CO3	Apply and analyse various Machine Learning algorithms, Examine CNN, and Deep Learning techniques	4	PO1, PO3, PSO2
CO4	Apply various Data Visualization Techniques, Analyse Data analytics techniques, Discover the insights from complex datasets.	4	PO3, PO5, PSO2
CO5	Examine AI for Data science lab in the python environment.	4	PO2, PO3, PSO1

Syllabus

Module 1	Foundations of Artificial Intelligence, Intelligent agents, their environments, heuristic search techniques, including A* search and other best-first search algorithms, Constraint Satisfaction and Reasoning, solve constraint satisfaction problems using backtracking, forward checking, and other methods, knowledge representation techniques, such as propositional and first order logic.
Module 2	Probabilistic reasoning for AI, including Bayesian networks and inference algorithms, Machine Learning and Neural Networks: machine learning algorithms, such as supervised and unsupervised learning techniques, and how to pre-process and analyse data, Find S, Concept learning search and Candidate Elimination Algorithm (CEA), evaluating a hypothesis, probably learning approximately correct hypothesis, and function approximation.
Module 3	Artificial Neural Networks (ANN), including the structure and functionality of feedforward and recurrent networks. Architecture, learning and inference. Performance measures. Convolutional Neural Networks (CNN) and Deep Learning techniques for tasks like image recognition, natural language processing, and reinforcement learning.
Module 4	Data Science and Analytics: This module focuses on the essentials of data science, including data classification, analytics, visualization, and processing techniques. various data science algorithms, such as decision trees, k-means clustering, and principal component analysis, Linear Regression, Logistic Regression, Decision Trees different types of data analytics, including descriptive, diagnostic, predictive, and prescriptive analytics, and understand how they can be applied to real-world problems.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Artificial Intelligence	Russel and Norvig	Pearson Education, PHI	(2015)
2	Artificial Intelligence	Elaine Rich & Kevin Knight	Tata McGraw-Hill Edition, Reprint	(2008)
3	Data science Handbook	Field cady	Wiley	
4	Artificial Intelligence	Patrick Henry Winston	Pearson Education	(2003)
5	Introducing Data science	Davy Cielen	Manning	(2016)

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Azure AI Engineer Associate	Microsoft	Y	MCQ	Microsoft / KLU	Microsoft Certified: Azure AI Engineer Associate - Certifications | Microsoft Learn

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Python Programming	The Python Software Foundation	Open Source
2	Matlab	MathWorks	Commercial

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Home Assignments	5	22
	Quiz	5	
	Practical Continuous Evaluation	7	
	MOOCs Review	5	
In-Sem Summative	In-Sem 1	15	38
	In-Sem 2	15	
	Practical In-Sem	8	
End-Sem Summative	End-Sem Exam (Paper Based)	24	40
	Lab End-Sem Exam	16	

Data Driven Artificial Intelligent Systems (DDAIS) - Peer

COURSE CODE	22AD2001	MODE	P	LTPS	3-0-4-0	PRE-REQUISITE	CTSD

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Understand and apply the concepts of intelligent agents and various search algorithms, to solve real-world problems.	3	PO1, PO2, PSO2
CO2	Analyse satisfaction problems, discover knowledge using logic, and analyse reasoning techniques to make informed decisions in uncertain environments.	4	PO2, PO3, PSO1
CO3	Apply and analyse various Machine Learning algorithms, Examine CNN and Deep Learning techniques	4	PO1, PO3, PSO2
CO4	Apply various Data Visualization Techniques, Analyse Data analytics techniques, Discover the insights from complex datasets.	4	PO3, PO5, PSO2
CO5	Evaluate performance measures, different types of data analytics including descriptive, diagnostic, predictive and prescriptive analytics.	5	PO2, PO3, PSO1
CO6	Examine AI for Data science lab in the python environment.	4	PO3, PO5, PSO2

Syllabus

Module 1	Foundations of Artificial Intelligence, Intelligent agents, their environments, heuristic search techniques, including A* search and other best-first search algorithms, Constraint Satisfaction and Reasoning, solve constraint satisfaction problems using backtracking, forward checking, and other methods, knowledge representation techniques, such as propositional and first order logic.
Module 2	Probabilistic reasoning for AI, including Bayesian networks and inference algorithms, Machine Learning and Neural Networks: machine learning algorithms, such as supervised and unsupervised learning techniques, and how to pre-process and analyse data, Find S, Concept learning search and Candidate Elimination Algorithm (CEA), evaluating a hypothesis, probably learning approximately correct hypothesis, and function approximation.

Module 3	Artificial Neural Networks (ANN), including the structure and functionality of feedforward and recurrent networks. Architecture, learning and inferencing. Performance measures. Convolutional Neural Networks (CNN) and Deep Learning techniques for tasks like image recognition, natural language processing, and reinforcement learning.
Module 4	Data Science and Analytics: This module focuses on the essentials of data science, including data classification, analytics, visualization, and processing techniques. various data science algorithms, such as decision trees, k-means clustering, and principal component analysis, Linear Regression, Logistic Regression, Decision Trees different types of data analytics, including descriptive, diagnostic, predictive, and prescriptive analytics, and understand how they can be applied to real-world problems.
Module 5	Adversarial Search (Minimax, Alpha-Beta pruning), ML algorithms: Classification Techniques (ID3, CART, ADABOOST Classifier), Introduction of Recurrent Neural Network (RNN), Data Visualisation techniques using Tableau tool on complex datasets (Only for advanced/peer mentoring courses)

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Artificial Intelligence	Russel and Norvig	Pearson Education, PHI	(2015)
2	Artificial Intelligence	Elaine Rich & Kevin Knight	Tata McGraw-Hill Edition, Reprint	(2008)
3	Data science Handbook	Field cady	Wiley	
4	Artificial Intelligence	Patrick Henry Winston	Pearson Education	(2003)
5	Introducing Data science	Davy Cielen	Manning	(2016)

Global Certifications:

Mapped Global Certifications:

Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Azure AI Engineer Associate	Microsoft	Y	MCQ	Microsoft / KLU	Microsoft Certified: Azure AI Engineer Associate - Certifications | Microsoft Learn

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Python Programming	The Python Software Foundation	Open Source
2	Matlab	MathWorks	Commercial

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Quiz	7	22
	Practical Continuous Evaluation	7	
	MOOCs Review	8	
In-Sem Summative	Global Challenges - Leaderboard	10	38
	Practical In-Sem	8	
	MOOCs Exam	20	

End-Sem Summative	Poster Presentation	10	40
	Lab End-Sem Exam	16	
	Global Challenges - Rating/Points	10	
	Global Certification	4	

Data Driven Artificial Intelligent Systems (DDAIS) - Advanced

COURSE CODE	22AD2001	MODE	A	LTPS	3-0-4-0	PRE-REQUISITE	CTSD

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Understand and apply the concepts of intelligent agents and various search algorithms, to solve real-world problems.	3	PO1, PO2, PSO2
CO2	Analyse satisfaction problems, discover knowledge using logic, and analyse reasoning techniques to make informed decisions in uncertain environments.	4	PO2, PO3, PSO1
CO3	Apply and analyse various Machine Learning algorithms, Examine CNN and Deep Learning techniques	4	PO1, PO3, PSO2
CO4	Apply various Data Visualization Techniques, Analyse Data analytics techniques, Discover the insights from complex datasets.	4	PO3, PO5, PSO2
CO5	Evaluate performance measures, different types of data analytics including descriptive, diagnostic, predictive and prescriptive analytics.	5	PO2, PO3, PSO1
CO6	Examine AI for Data science lab in the python environment.	4	PO3, PO5, PSO2

Syllabus

Module 1	Foundations of Artificial Intelligence, Intelligent agents, their environments, heuristic search techniques, including A* search and other best-first search algorithms, Constraint Satisfaction and Reasoning, solve constraint satisfaction problems using backtracking, forward checking, and other methods, knowledge representation techniques, such as propositional and first order logic.
Module 2	Probabilistic reasoning for AI, including Bayesian networks and inference algorithms, Machine Learning and Neural Networks: machine learning algorithms, such as supervised and unsupervised learning techniques, and how to pre-process and analyse data, Find S, Concept learning search and Candidate Elimination Algorithm (CEA), evaluating a hypothesis, probably learning approximately correct hypothesis, and function approximation.
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3	Data science Handbook	Field cady	Wiley	
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5	Introducing Data science	Davy Cielen	Manning	(2016)

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Azure AI Engineer Associate	Microsoft	Y	MCQ	Microsoft / KLU	Microsoft Certified: Azure AI Engineer Associate - Certifications | Microsoft Learn

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	Python Programming	The Python Software Foundation	Open Source
2	Matlab	MathWorks	Commercial

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Quiz	5	22
	Global Challenges Participation	4	
	Practical Continuous Evaluation	5	
	Project Continuous Evaluation	4	
	MOOCs Review	4	
In-Sem Summative	In-Sem 1	12	38
	In-Sem 2	12	
	Practical In-Sem	9	
	MOOCs Exam	5	
End-Sem Summative	End-Sem Exam (Paper Based)	24	40
	Lab End-Sem Exam	16	

COMMUNICATION TECHNOLOGY

Course Short Name: CT

Course Code: 22IN2205

Pre-Requisites:

LTPS: 3-0-2-0

Course Rationale: A significant aspect of digital communication system design involves optimizing the tradeoffs among various system parameters. Students will learn to analyze and manage tradeoffs such as signal-to-noise ratio (SNR), bandwidth allocation, data rate, error rate, and power efficiency. This knowledge enables students to make informed design decisions based on specific requirements and constraints.

Course Outcomes:			
CO#	CO Description	BTL	Mapped PO & PSOs
CO1	Understanding the concepts of signals and systems	2	PO 1 & PSO 2
CO2	Applying the concepts of Analog Modulation	2	PO 2, 3 & PSO 2
CO3	Applying the concepts of Digital Modulation	3	PO 1 & PSO 2
CO4	Applying various line coding procedures and signaling schemes to facilitate data communications	4	PO 2, 3 & PSO 2
CO5	Design and analyze analog and digital communication circuits through modern tools.	4	PO 2, 3 & PSO 2
CO6	Design and analyze analog and digital communication circuits through modern tools.	4	PO 2, 3 & PSO 2

Course Syllabus	
Module	Syllabus
Module 1:	**Basic Signals & Systems** Signals – Signals and their representation, classification of signals (Analog and discreate), – Types of signals & Systems, Impulse response, Convolution, Fourier Transforms, Sampling of Analog Signals.
Module 2:	**Analog Modulation Techniques** Introduction to Communication Systems – base band, pass band – Modulation – Need for Modulation. Theory of Amplitude Modulation and Demodulation – Theory of Angle Modulation and Demodulation. – Comparison of Analog Communication Systems.
Module 3:	**Pulse Modulation Techniques** Pulse Communication: Sampling Theorem, Pulse Amplitude Modulation (PAM) – Pulse Time Modulation (PWM & PPM) –Pulse code Modulation (PCM) – DPCM – DM – ADM. Digital Transmission via Carrier Modulation Concepts on measure of Information: Bits, Bit Rate, Baud Rate, Channel Capacity (Hartly - Shannon Theorem).

Module 4:	Amplitude Shift Keying (ASK) – Frequency Shift Keying (FSK)–Phase Shift Keying (PSK) – QPSK – QAM - Bandwidth Efficiency. Introduction to Wireless Communication Systems. Emerging Technologies and Applications: Bluetooth technology, Zigbee technology, LoRa Technology, Wi-Fi, and Z-Wave, NB-IoT technology, Software-defined radio (SDR).. communication systems:Cellular systems and wireless standards (e.g., GSM, CDMA, LTE) 5G technology for the Internet of Things (IoT), and beyond. Cognitive radio and dynamic spectrum access.
Module 5:	Case studies: Software Defined Radio, 5G Technologies, Broadband internet.

Reference Books:

Book Sl No	Title	Author(s)	Edition	Publisher
Book 1:	Communication Systems	Simon Haykin.	3Rd Ed.	
Book 2:	Advanced Electronic Communication Systems	Wayne Tomasi	5th	
Book 3	Digital communications	Proakis, J. G.		

Course Title: EMBEDDED SYSTEM DESIGN

Course Short Name: ESD

Course Code: 22IN2202R

Pre-Requisites:

LTPS:2-0-2-0 credits:3

Course Rationale: Course rationale to include the following aspects:

Embedded systems are self-contained control systems or computer systems designed for a particular purpose with bare necessary peripherals needed to run them. In the contemporary world, embedded systems are the systems of the future with cellular phones, smartphones, and tablets becoming the dominant platforms for computing and communication. The ubiquity of information and the associated need for the computation that accompanies it is driving this revolution only to be accelerated by new paradigms such as the Internet of Things (IoT). These platforms are clearly very different in terms of their processing requirements which are unique: real-time needs, high performance but at low energy, compact code and data segments, and most importantly ever-changing software stack. The course introduces various interfacing techniques for input devices including sensors, output devices, and communication protocols."

Course Outcomes:

CO#	CO Description	BTL	Mapped PO & PSOs
CO1	Apply Embedded programming concepts for embedded controller GPIOs programming	BTL (<=3)	PO1, PO2, PO3 & PSO1
CO2	Apply the A-D and D-A concepts to interface anlog signals.	BTL (<=4)	PO1, PO2, PO3 & PSO1

CO3	Explore communication protocols and apply them to develop Embedded sytem applications	BTL (>=3)	PO1, PO2, PO3 & PSO1
CO4	Apply RFID ,RTC and SD card interfacing techniques to develop reat time systems.	BTL (>=4)	PO2, PO4, PO5 & PSO2
CO5	Anlyse various interfacing techniques and develop using micr controllers	BTL (>=4)	PO3, PO4, PO5 & PSO2
CO6	Understanding the Embedded IDE and develop programs.	BTL (>=3)	PO2,PO3, PO5 & PSO2

Course Syllabus				
Module	Syllabus			
Module 1:	Introduction to Embedded systems Comparison with Loaded Systems, Progress and Classification of Embedded Systems, Application of Embedded Systems. Design Challenges, Common Design Metrics Embedded System Development. Processor types and selection: General Purpose and Domain-Specific Processors, ASICs, PLDs. Embedded C, Data types, Bit-wise Operations, control structures, functions, Microcontroller GPIO (General Purpose 1/0) Programming and Interfacing			
Module 2:	Interfacing concepts of Microcontroller: LCD,Interfacing Relay , Successive Approximation Analog-Digital, Digital-Analog conversion, ADC, ADC Programming , sensor interfacing ,Timers, PWM			
Module 3:	Interrupt Exception Programming , Communication interfacing: Serial Communication, l2C Bus Interface,I2C Programming,SPI Bus ,SPI Programming,			
Module 4:	RTC Interfacing, Bluetooth Protocols, RFID, SD card interfacing , Case studies: Home automation, Industry applications, Surveillance applications.			
Module6 (Skilling)	Introduction to IDE , MBED IDE tool,Interfacing the different components and serial communication protocols			
Text Books:				
Book Sl No	Title	Author(s)	Edition	Publisher
Book 1:	STM32 Arm Programming for Embedded Systems	Mazidi, Muhammad Ali Chen, Shujen Ghaemi		
Book 2:	Embedded C: Embedded C	Michael Pont Addison-Wesley	1st edition	15-Mar-02

Course Title: INTERNET OF THINGS: PRINCIPLES & ARCHITECTURES

Course Short Name: IOTPA

Course Code: 22IN2101

Pre-Requisites:

LTPS: 2-0-2-0

Course Rationale: The IoT is an environment where smart devices sense, anticipate and respond to our needs as we manage them remotely. These smart devices often act as the gateway between our digital and physical world. The IoT touches many aspects of life including transportation, health care, safety, environment, energy, and more. The purpose of this course is to make the students to understand and build the IoT application using Python Language.

Course Outcomes:			
CO#	CO Description	BTL	Mapped PO & PSOs
CO1	Apply the concepts of IoT Architecture and technologies	3	PO1,PO7,PSO1
CO2	Apply the logical design of IoT system and communication technologies.	3	PO1,PO7,PSO1
CO3	Apply IoT networking protocols and Authentication Protocols for IoT Application layer.	3	PSO1,PO1,P2,PO5
CO4	Apply IoT protocols and programming concepts for real-world problems.	3	PO2,PSO1,PO1,PO5
CO5	Create IoT based applications using IoT Protocols	5	PSO1,PO5,PO2

Course Syllabus	
Module	Syllabus
Module 1:	IoT Reference Architecture: Introduction to IoT, Characteristics of IoT, IoT Architecture, Physical Design of IOT, Logical design of IoT, IoT enabling Technologies, IoT Levels & Development Templates, Difference between IoT and M2M, SDN and NFV for IoT. RFIDs, and wireless sensor networks technology.
Module 2:	Embedded devices for IoT and Sensor Technology. IoT Systems-Logical using Python: Installing Python, Python Data Types & Data Structures, Control Flow, Functions, Modules, Packages, Date/ Time Operations, Classes, Python Packages. IoT Design Methodology, Case study using weather monitoring. IoT Physical Devices & Endpoints: What is an IoT Device, Exemplary Device, Board, Linux on Raspberry Pi, Programming of IoT.
Module 3:	IoT Communication Technologies: wired - UART, USART, SPI, I2C, ModBUS, CAN, Ethernet, USB. Wireless - Bluetooth, BLE, IEEE 802.11, IEEE 802.15, Zigbee, SIGFOX. IoT Networking Protocols: IPv4 and IPv6.6lowPAN, TCP/IP, IP addressing of IoT devices MAC addresses of communication circuit. Web connectivity for connected devices Application Protocols – HTTP, Web sockets, Node, MQTT, UDP, CoAP, XMPP, AMQP and gateway protocols. Link Layer protocols: 802.3 – Ethernet 802.11 – WiFi 802.16 – WiMax 802.15.4 – LR-WPAN,2G/ 3G/ 4G. Cloud storage Models and Communication APIs. Web application management protocol, Python web application framework.
Module 4:	IoT Design Technologies: Case studies illustrating IoT design: Home Automation: Smart lighting, Smart Appliances, Cities: Smart Parking, Smart Lighting, Smart Roads, Emergency response, Environment: Weather monitoring, Air Pollution Monitoring, Noise pollution, Forest fire, River flood, Agriculture: Smart irrigation, Green House control.

Reference Books:				
Book Sl No	Title	Author(s)	Edition	Publisher

Book 1:	From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence	Jan Holler, VlasiosTsiatsis	1st Edition	Jan Holler
Book 2:	Internet of Things - A Hands-on Approach	ArshdeepBahga and Vijay Madisetti	1st Edition	Peter Vahir
Book 3	Building the Internet of Things with IPv6 and MIPv6	Daniel Minoli	1st Edition	Bernd Scholz
Book 4	Internet of Things A Hands-on-Approach	Arshdeep Bahga & Vijay Madisetti	1st Edition	Springer

Course Title: CLOUD COMPUTING FOR IOT Course Short Name: CCIoT

Course Code: 22IN2204R

Pre-Requisites:

LTPS:2-0-4-0 credits 4

Course Rationale: Course rationale to include the following aspects:

To elaborate the reason why this course is included and towards what skills does this map

To elaborate how the course will be offered mentioning if it is offered through a project based learning or through case-studies or through experiential learning.

Course Outcomes:			
CO#	CO Description	BTL	Mapped PO & PSOs
CO1	To understand the cloud computing services , deployment models, enabling technology and architecture	2	Max. of 3 Pos + PSOs
CO2	understand and apply different cloud infrastructures virtualization and storage in different virtualization	3	Max. of 3 Pos + PSOs
CO3	Analyze the concept of Data security and privacy in virtual machine	4	Max. of 3 Pos + PSOs
CO4	Analyze the different case studies on healthcare, agriculture and parking system	4	Max. of 3 Pos + PSOs
CO5	To analyze and integrate sensors reading values and uploading to Azure.	6	Max. of 3 Pos + PSOs

Course Syllabus	
Module	**Syllabus**
Module 1:	Introduction to cloud computing: Responsibility models, Characteristics, cloud model, consumption-based models, deployment models, benefits of cloud services, Cloud service types: IaaS, PaaS, SaaS Cloud Deployment models, Cloud enabling Technology, Cloud Architectures.

Module 2:	Virtualization: Virtualization in Cloud Computing, Different approaches to virtualization, Hypervisors, Machine Image Data virtualization hardware virtualization, server virtualization. Case study: Healthcare provider sees benefits of virtualization, Financial services company running out of space, Architectural firm uses storage area network technology in its virtualization rollout. Storage: Storage options in the cloud, Structured and unstructured storage in the cloud Storage, Storage services, data migration, file movement.
Module 3:	Security Issues in IoT and Cloud Computing Service Models: Cloud Security Challenges, Software-as-a-Service Security: Security Management, Security Governance, Virtual Machine Security, Data Privacy, Data security. improving performance through load balancing, system and storage redundancy. intergacebetween IoT Devices and IoT-based Clouds.
Module 4:	Cloud Computing in IoT case study1: (Examples: Smart parking in cloud-based IoT, indecision Service delivery, home automation in cloud-based IoT, planting and farming in cloud-based IoT) . Case study 2: (example: Cloud Applications Scientific Applications, Healthcare: ECG Analysis in the Cloud, Biology: Protein Structure Prediction, Biology: Gene Expression Data Analysis for Cancer Diagnosis)

Text Books:

Book Sl No	Title	Author(s)	Edition	Publisher
Book 1:	Cloud Computing, A Practical Approach	Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi	2009	Tata-McGraw-Hill Osborne Media
Book 2:	Cloud computing:Saas, paas, laas, virtualization, business models, mobile, security, and more, Jones & Bartlett Leaming	Jamsa, Kris	2012	Jones & Bartlett
Book 3	Amazon Web Services in Action	Andreas Wittig, Michael Wittig		

Reference Books:

Book Sl No	Title	Author(s)	Edition	Publisher
Book 1:	Robert Elsenpeter: Cloud Computing: A Practical Approach	Anthony T. Velte, Toby J. Velte,		
Book 2:	Cloud computing: Data intensive computing and scheduling,	Magoules, Frederic		
Book 3	Cloud and virtual data storage networking: Your journey to efficient and effective information services,	Schulz, Greg		Auerbach Publications
Book 4	Velte, Anthony T. Cloud computing, McGraw-Hill Osborne	Hurwitz J., Bloor R., Kaufman M., Halper F	1 edition	

Course Title: REAL TIME OPERATING SYSTEMS

Course Short Name: RTOS

Course Code: 22IN2003R

Pre-Requisites: Nil

LTPS: 2-0-2-0,3-0-4-0

Course Rationale: Real time systems requires the software to meet timing constraints. This is achieved selecting suitable scheduling algorithms. The problem becomes challenging when tasks share resources. Priority inversions can take place in this case, unless suitable techniques are deployed. The course starts with introducing different types of real time systems/ Important real-time process scheduling algorithms discussed next followed by resource sharing protocols. Portable Operating System Interface (POSIX) standardization for real time systems named POSIX-RT is also reviewed towards the end. The course will brief on open source real time system and programming assignments will be given.

Course Outcomes:			
CO#	CO Description	BTL	Mapped PO & PSOs
CO1	Understand subsystem components of the Kernel and apply the CPU Scheduling algorithms.	3	PO10 /PSO1
CO2	Understand memory and process virtualization and Paging, apply Page Replacement Algorithms	3	PO9
CO3	Understand and Apply the threading issues for RTOS	3	PO9
CO4	Understand and Apply the memory management concepts in RTOS	3	PO10
CO5	Understand and Apply the Kernel Design Issues	3	PO10
CO6	Able to perform experimentation Real-Time Operating Systems Other Basic Operating System Functions	3	PO10

Course Syllabus	
Module	Syllabus
Module 1:	Basics: Operating System Functionalities, Types of Operating Systems, Process Virtualization: Processes, Process API code, Direct Execution, CPU Scheduling, Multi-level Feedback, Lottery Scheduling code, Multiprocessor Scheduling.
Module 2:	Memory Virtualization: Address Spaces, Memory API, Address Translation, Segmentation, Free Space Management, CPU Virtualization Basics, Introduction to Paging, Translation Look Aside Buffer, Swapping, Demand Paging, Thrashing, Page replacement algorithms.
Module 3:	Concepts, scheduling, IPC, RPC, CPU Scheduling, scheduling criteria, scheduling algorithms Threads: Multi-threading models, threading issues, thread libraries, synchronization Mutex: creating, deleting, prioritizing mutex, mutex internals.
Module 4:	Messages, Buffers, mailboxes, queues, semaphores, deadlock, priority inversion, PIPES MEMORY MANAGEMENT: - Process stack management, run-time buffer

	size, swapping, overlays, block/page management, replacement algorithms, real-time garbage collection
Module 5:	Case study Linux POSIX system, RTLinux / RTAI, Windows system,Vxworks, uItron Kernel Design Issues: structure, process states, data structures, inter-task communication mechanism, Linux Scheduling

Reference Books:

Book Sl No	Title	Author(s)	Edition	Publisher
Book 1:	MicroC/OS-II: The Real –Time Kernel	J. J Labrosse	2002	Newnes
Book 2:	Real-time systems	Jane W. S. Liu	2000	Prentice Hall
Book 3:	Real-Time Concepts for Embedded Systems	Qing Li with Caroline Yao		CMP Book

WIRELESS AD-HOC NETWORKS

Course Short Name: WAN

Course Code: 21IN3016F

Pre-Requisites: Nil

LTPS: 2-0-2 credits :3

COURSE CODE	OEEC0020	MODE	R	LTPS	3-0-0-0	PRE-REQUISITE	NPS

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Apply the knowledge of Communication networks and wireless technologies to realize Wireless Adhoc Networks	3	PO1, PO2, PSO2
CO2	Apply the concepts of different routing protocols in real scenarios.	3	PO2, PO3, PSO2
CO3	Analyse the concepts of MAC, transport layer and security protocols.	3	PO2, PO3, PSO2
CO4	Analyse the concepts of wireless sensor network and implementation of hardware architecture.	3	PO2, PO3, PSO2

Syllabus

Module 1	Introduction to WAN, Difference between cellular and Adhoc network, Necessity and Applications of WAN, Challenges, and Issues for WAN: Medium Access Scheme, Transport Layer Protocol, Routing, Multicasting, Energy Management, Self-Organization, Security, Addressing & Service discovery, Deployment considerations, Scalability, Pricing Scheme, Quality of Service Provisioning, Dynamic Topology of WAN, Classification based on Topology, Adhoc wireless internet

Module 2	Routing Protocols of WAN, Classifications with examples, Classification based on Routing Topology Utilization: Table Driven Routing Protocol, On Demand Routing Protocol, Adhoc on demand distance Vector Routing Protocol, Classification based on Specific Resources: Flat topology routing protocols, Hierarchical topology routing protocols, Classification based on Routing Information update mechanism: Power-aware routing, Geographical information assisted routing.
Module 3	MAC Protocols, Types of protocols used in MAC, Fixed Allocation MAC, Demand Based MAC, Content based MAC, Challenges of MAC, Issues and Design goals of TLP, Network security of WAN, Issues and Network Security attacks and various approaches for key management
Module 4	Introduction to WSN, Application of WSN, Challenges of WSN: Characteristic requirements and Required mechanisms, Hardware description and block diagram for single-node architecture, Architecture of WSN: layered architecture and clustered architecture.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Ad hoc wireless networks-Architectures and protocols	C. Siva Ram Murthy, B.S. Manoj	Pearson Education	2012
2	Wireless Ad Hoc and Sensor Networks: Management, Performance, and Applications	By Jing (Selina) He, Mr. Shouling Ji, Yingshu Li, Yi Pan	CRC press	2013
3	Wireless Ad Hoc Networking: Personal-Area, Local-Area, and the Sensory-Area Networks (Wireless Networks and Mobile Communications)	Shih-Lin Wu, Yu-Chee Tseng	Auerbach Publications	2015
4	The Handbook of Ad Hoc Wireless Networks	Mohammad Ilya	CRC Press Ic	2012

DATA WAREHOUSING AND MINING

Course Short Name: DWM

Course Code: 22AD3104F

Pre-Requisites: Nil

LTPS: 2-0-2 credits :3

COURSE CODE	22AD3104F	MODE	R	LTPS	**2-0-2-0**	PRE-REQUISITE	DBMS

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Illustration of Warehouse & Mining, ETL, OLAP & OLTP, Data Cube Operations and Data Warehouse architecture	3	PO1, PO2, PO3, PSO1
CO2	Demonstration of Data Preprocessing through different methods	3	PO1, PO2, PO3, PSO1

CO3	Apply Different Classification Algorithms to Segregate Input data into different class levels and find out Hidden relationship between transactional dataset using Association Rule Mining.	3	PO1, PO2, PO3, PSO2
CO4	Analyse different Clustering Models using the predefined dataset.	4	PO2, PO3, PO5, PSO1
CO5	Implementation of warehousing and mining algorithms using suitable tools and programming languages	4	PO3, PO5, PO9, PSO2

Syllabus

Module 1	Introduction to Data Warehouse and Mining, OLAP Vs. OLTP, Architecture and OLAP Server Types, Multidimensional Cubes and Concept Hierarchy, Data Cube Computation Methods, Sampling and Ranking Methods, Multi-Dimensional Modeling, Attribute Oriented Induction
Module 2	KDD, Data Objects and Attribute Types, Basic StatisticalDescriptions of Data, Descriptive Data Summarization & Data Preprocessing (Introduction), Data Preprocessing Methods, Simple Regression Analysis, Multiple Regression Analysis
Module 3	Data Mining Techniques (Association Rules Outer detection Sequential Pattern, Prediction), Classification by Decision Tree Induction, Bayesian Classification, Back Propagation, Association Rule Mining, Rule-based Classification, Support Vector Machine (SVM),Understanding Accuracy of Classification
Module 4	Supervised Vs Unsupervised learning, Clustering Methods, Partitioning Methods, Hierarchical Clustering, Density-Based Clustering Methods, Grid-Based Methods.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Data Mining: Concepts and Techniques	Han J &Kamber M	Elsevier	2012
2	Introduction to Data Mining	Pang-Ning Tan, Michael Steinback, Vipin Kumar	Pearson Education	2005
3	Data Warehousing: Architecture and Implementation	M.Humphires, M. Hawkins, M.Dy	Pearson Education	1999
4	Data Warehousing in the Real World	Anahory, Murray,	Pearson Education	2006
5	Data Mining: Next Generation Challenges and Future Directions	Kargupta, Joshi	Prentice Hall of India Pvt Ltd	2004

CONTINUOUS DELIVERY & DEVOPS

Course Short Name: CDD

Course Code: 22CI2002F

Pre-Requisites: Nil

LTPS: 2-0-2 credits :3

COURSE CODE	22CI2002F	MODE	R	LTPS	2-0-2-0	PRE-REQUISITE	Software Engineering

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Illustrate Need of DevOps and Version Control system to track the latest version of Software	2	po1, po3,pso1
CO2	Apply Continuous Integration and Continuous Deployment using Infrastructure as Code using Pipeline.	3	po1, po5,pso2
CO3	Analyze the need for Containerization in Devops and Examine the Kubernetes Pod Configuration.	4	po1, po5,pso2
CO4	Inspect about continuous monitoring and container orchestration process	4	po3, po5,pso2
CO5	Inspect and deploy an application associated with various tools in devops.	4	po5, po11,pso1

Syllabus

Module 1	Introduction to DevOps, Overview of DevOps, Relationship Between Agile and DevOps, Principles of DevOps, DevOps Tools, Best Practices for DevOps. Version Control Systems: Role of Version Control System in DevOps Environment, GitHub, Deploy the files to Bitbucket via Git. Need for Cloud in DevOps: Popular Cloud Providers, CI/CD in AWS and Azure, CI/CD Services in AWS.
Module 2	Continuous Integration and Continuous Deployment using Jenkins, Continuous Integration with Jenkins, Git, and Maven, Build Applications using Pipeline on azure platform. Software and Automation Testing Frameworks: Popular Testing Tools, Test Driven Development Cycle, Behavior driven development, Automated Testing using Cucumber.
Module 3	Docker as Containerization: Virtualization, Docker on Windows Desktop, Creating an Account in Docker Hub, MySQL in Docker Kubernetes, Kubernetes: Components, Kubernetes Architecture, Minikube, Pod Configuration on Windows. Cofiguration management-Chef, puppet Role of Infrastructure as Code in DevOps Environment
Module 4	Continuous Monitoring: Role of Monitoring Systems, Types of Monitoring, Popular Monitoring Tools: Nagios, Orchestrating application deployment.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	DevOps for Web Development	Mitesh Soni	Packt	2019
2	Beginning DevOps with Docker	Joseph Muli	Packt	
3	Kubernetes Up and Running Divine into the Feature of Infrastructure	Brendan Burns, Joe Beda & Kelsey Hightower	Oreilly	2019

4	The DevOps Handbook: How to Create World-Class Agility, Reliability, & Security in Technology Organizations	Gene Kim, Jez Humble , et al.	Revolution Press; 2nd ed. edition (30 November 2021); BOOKZONE PATEL BUILDING R.NO 8/9 1ST FLOOR M.K AMIN MARG FORT MUMBAI 400001 – 7738588170	2021
5	Continuous Delivery for Java Apps: Build a CD Pipeline Step by Step Using Kubernetes, Docker, Vagrant, Jenkins, Spring, Maven and Artifactory	Jorge Acetozi	Leanpub (14 December 2017)	2017

IOT HARDWARE PROGRAMMING (SDP1)

Course Short Name: IOTHP

Course Code: 22SDIN01R

Pre-Requisites: Nil

LTPS: 0-0-2-4 credits :2

COURSE CODE	22SDIN01R	MODE	R	LTPS	0-0-2-4	PRE-REQUISITE	FITS

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Apply the concepts of IoT use cases using various IoT platforms	3	PO1, PO5, PO6, PSO1
CO2	Apply the basic to advanced features of Python programming language	3	PO2, PO5, PO6, PSO1
CO3	Design and Build object-oriented programs using python	4	PO2, PO5, PO6, PSO1

Syllabus

Module 1	Getting Started with Raspberry Pi: Basic functionality of Raspberry Pi B+ board, Basics of Linux and its use, overview of the graphic user interface for Raspian Linux distribution, Different Models of Raspberry Pi, Preparing Raspberry Pi for First Use, Different Operating Systems for Raspberry pi, NOOBS OS inside out. Booting for the First time., Updating Pi to Latest software's,Setting various Options and Personalizing. Open-Source Software Library. The Linux Files Organization Structure. OverviewofLinuxOSanditssub-systems:Process:Memory Management: Multi-Threading, NOOBS Configuration Files. Connecting to the Network and Troubleshooting. Introduction to various Functions, Getting Familiar with the GPIO Pins of your Pi
Module 2	Interfacing Hardware with the Raspberry Pi, Basics of the Python programming language, programming on the Raspberry Pi. Python on Raspberry Pi, Python Programming Environment, Python Expressions, Strings, Functions and Function arguments, Lists, List Methods, Control Flow. 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, applying digital voltages, and

	generating Pulse Width Modulated signals, Tkinter Python library, accessing pins through a graphic user interface, Raspberry Pi interact with online services through the use of public APIs and SDKs.
Module 3	IoTCommunicationModelsandProtocols, Request-Response, Publish-Subscribe,Push-Pull,ExclusivePair, Application Protocols, Communication APIs:REST-based. Buildingpythonbasedprogramstocommunicatetocloudserverusingvariousapplication protocols, Develop a complete python based application IoT application, Rpiasadevice, InterfacingwithcameraonRpi. Applications of IoT using Raspberry Pi in Social media (Use case), Installation of LAMP Web Server on Raspberry Pi. Communicating using RPi- GSM interfacing

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Programming the Raspberry Pi: Getting Started with Python	Simon Monk	McGraw Hill Professional	
2	Getting Started with Arduino	Massimo Banzi	O'Reilly Media, Inc	

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Microsoft Certified Azure IoT Developer: Best For Azure Users	Microsoft	Yes	MCQ	Microsoft Azure	https://learn.microsoft.com/en-us/certifications/azure-iot-developer-specialty/

IOT FULL STACK DEVELOPMENT(SDP-2)

Course Short Name: WAN

Course Code: 22SDIN02R

Pre-Requisites: Nil

LTPS: 0-0-2-4 credits :2

COURSE CODE	22SDIN02R	MODE	R	LTPS	0-0-2-4	PRE-REQUISITE	IOTHP

Course Outcomes

CO#	CO Description	BTL	PO Mapping

CO1	Apply the concepts of IoT use cases using various IoT platforms	3	PO1, PO5, PO6, PSO1
CO2	Apply the basic to advanced features of Python programming language	3	PO2, PO5, PO6, PSO1
CO3	Design and Build object-oriented programs using python	4	PO2, PO5, PO6, PSO1

Syllabus

Module 1	Getting Started with Raspberry Pi: Basic functionality of Raspberry Pi B+ board, Basics of Linux and its use, overview of the graphic user interface for Raspian Linux distribution, Different Models of Raspberry Pi, Preparing Raspberry Pi for First Use, Different Operating Systems for Raspberry pi, NOOBS OS inside out. Booting for the First time., Updating Pi to Latest software's,Setting various Options and Personalizing. Open-Source Software Library. The Linux Files Organization Structure. OverviewofLinuxOSanditssub-systems:Process:Memory Management: Multi-Threading, NOOBS Configuration Files. Connecting to the Network and Troubleshooting. Introduction to various Functions, Getting Familiar with the GPIO Pins of your Pi
Module 2	Interfacing Hardware with the Raspberry Pi, Basics of the Python programming language, programming on the Raspberry Pi. Python on Raspberry Pi, Python Programming Environment, Python Expressions, Strings, Functions and Function arguments, Lists, List Methods, Control Flow. 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, applying digital voltages, and generating Pulse Width Modulated signals, Tkinter Python library, accessing pins through a graphic user interface, Raspberry Pi interact with online services through the use of public APIs and SDKs.
Module 3	IoTCommunicationModelsandProtocols, Request-Response, Publish-Subscribe,Push-Pull,ExclusivePair, Application Protocols, Communication APIs:REST-based. Buildingpythonbasedprogramstocommunicatetocloudserverusingvariousapplication protocols, Develop a complete python based application IoT application, Rpiasadevice, InterfacingwithcameraonRpi. Applications of IoT using Raspberry Pi in Social media (Use case), Installation of LAMP Web Server on Raspberry Pi. Communicating using RPi- GSM interfacing

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Programming the Raspberry Pi: Getting Started with Python	Simon Monk	McGraw Hill Professional	
2	Getting Started with Arduino	Massimo Banzi	O'Reilly Media, Inc	

IOT PRODUCT DEVELOPMENT(SDP-3)

Course Short Name: IOTPD

Course Code: 22SDIN03

Pre-Requisites: Nil

LTPS: 0-0-2-4 credits :2

COURSE CODE	22SDIN03R	MODE	R	LTPS	0-0-2-4	PRE-REQUISITE	IOTPA

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Identify hardware dependent, independent and customizing bootloader.	3	PO1, PO5, PO6, PSO1
CO2	Identifying the diverse root file systems	3	PO2, PO5, PO6, PSO1
CO3	Construct of PCB layouts of the IoT products	3	PO2, PO5, PO6, PSO1

Syllabus

Module 1	Introduction to Bootloader, Customizing Bootloader, Modifying Bootloader for new feature, , Command Line Arguments & ATAG, Booting with SD Card, Setting up NFS Server, Booting with NFS Server, Linux Kernel Compilation, Linux Kernel, Introduction to Linux Kernel Arch, Kernel Dir Structure, Kernel Layers H/W dependent and independent (BSP), Kernel Build System (KConfig), Kernel Porting & Compilation, How to configure and compile for ARM Hardware, Type of kernel images (vmlinux, zImage, uImage), Kernel initialization process, How to port Kernel on New ARM Hardware, Kernel Modification, How to modify the Kernel code, How to integrate new driver / module in kernel image, Building static and dynamic kernel modules,
Module 2	Root File System, Components of RootFS, Types of RootFS, Different types of Flash Device (NOR / NAND), Building RootFS from scratch and using Build System (Buildroot), Embedded Application Development, How to develop embedded applications, Debugging application on target using GDB, Running sample WebServer Application
Module 3	Hardware Design (Designing Application): Starting a new project, Useful folder structure; importing reference schematics; collecting and sorting documents, Schematics design, drawing schematics; conventions and useful tips to create readable schematics, selecting components and creating libraries, Drawing schematics: conventions and useful tips to create readable schematics, Footprints, 3D models and starting a new PCB, How to create footprints and a 3D model of your PCB;

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Linux Command Line and Shell Scripting Bible	Richard Blum	Wiley	
2	Building Embedded Linux Systems	Philippe Gerum, Karim Yaghmour, Jon Masters, Gilad Ben-Yossef	O'Reilly Media Inc	
3	Mastering Embedded Linux Programming	Frank Vasquez, Chris Simmond	Packt	
4	Embedded Linux System Development: Practical Labs	Bootlin	CreateSpace Independent	

			Publishing Platform	

IOT ANALYTICS ON AWS CLOUD

Course Short Name: IOTAC

Course Code: 22SDIN04

Pre-Requisites: Nil

LTPS: 0-0-2-4 credits :2

COURSE CODE	22SDINO4R	MODE	R	LTPS	0-0-2-4	PRE-REQUISITE	CCIOT

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Able to understand IoT analytics challenges	2	PO1, PO2-PSO1
CO2	Applying IoT protocols to connect cloud	3	PO1,PO5 - PSO1
CO3	Apply Elastic concepts for IoT Analytics	3	PO1,PO5 - PSO1
CO4	Applying big data, Data Science Machine learning and Deep learning concepts for IoT Analytics	3	PO1,PO5 - PSO1

Syllabus

Module 1	Defining IoT analytics, IoT analytics challenges, Business value concerns, AWS IoT Management Console, AWS IoT Device SDK, Setting up AWS IoT for your IoT project, Setting up the development environment, Building an AWS IoT program, Connecting IoT Devices to AWS IoT Platform, Introducing a connectivity model for AWS IoT, Selecting your IoT devices for AWS IoT, Configuring IoT devices to AWS IoT, AWS IoT development for Raspberry Pi 3, , AWS IoT development for boards based on ESP32
Module 2	IoT Devices and Networking Protocols, IoT devices Networking basics, IoT networking connectivity protocols, IoT networking data messaging protocols, Analyzing data to infer protocol and device characteristics Creating an AWS Cloud Analytics Environment, The AWS CloudFormation overview, The AWS Virtual Private Cloud (VPC) setup walk-through
Module 3	IoT Analytics for the Cloud, building elastic analytics, Elastic analytics concepts, designing for scale, Cloud security and analytics the basics of geospatial analysis, Vector-based methods, Raster-based methods, Storing geospatial data Processing geospatial data
Module 4	Collecting All That Data - Strategies and Techniques, designing data processing for analytics, applying big data technology to storage, Apache Spark for data processing, To stream or not to stream, Handling change Data Science for IoT Analytics, Machine learning (ML), Anomaly detection using R, Forecasting using ARIMA, Deep learning

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Analytics for the Internet of Things (IoT)	Andrew Minteer	Packt Publisher	
2	Learning AWS IoT	Agus Kurniawan	Packt Publishing	

SYLLABUS OF COURSES UNDER

PROFESSIONAL ELECTIVES

22IOT3101R-INDUSTRIAL INTERNET OF THINGS

L-T-P-S: 2-0-2-4 **Credits: 4** **Pre-requisite: Nil**

Mapping of Course outcomes (CO) with program outcomes (PO):

CO	Course Outcome	PO	BTL
CO1	Apply the theory and practice related to Industrial IoT Systems	1,2	2
CO2	Identify, formulate, and solve engineering problems by using Industrial IoT	2,3	2
CO3	Design and analysis of Cyber-Physical System	1,2	3
CO4	Implement real field problems by gaining knowledge of Industrial applications with IoT capability.	1,2,3	3

Syllabus:

Introduction to Industrial IoT (IIoT) Systems: The Various Industrial Revolutions, Role of Internet of Things (IoT) & Industrial Internet of Things (IIoT) in Industry, Industry 4.0 revolutions, Support System for Industry 4.0, Smart Factories. Implementation systems for IIoT- Sensors and Actuators for Industrial Processes, Sensor networks, Process automation, and Data Acquisitions on IoT Platform. **IIoT Data Monitoring & Control:** Microcontrollers and Embedded PC roles in IIoT, Wireless Sensor nodes with Bluetooth, WiFi, and LoRa Protocols and IoT Hub systems, IoT Gateway, IoT Edge Systems, and Its Programming, Cloud computing, Real-Time Dashboard for Data Monitoring, Data Analytics and Predictive Maintenance with IIoT technology. **Cyber-Physical Systems:** Next Generation Sensors, Collaborative Platform, and Product Lifecycle Management, Augmented Reality and Virtual Reality, Core elements of Cyber-Physical Systems and Cyber-Physical Production Systems, Control theory, and real-time requirements, Self-organization principles ("Self-X", autonomy, negotiations), Communication in cyber-physical systems. Applications of CPS existing or future applications in the field of manufacturing, traffic, medical technology, etc. **Industrial IoT-Applications:** Healthcare, Power Plants, Inventory Management & Quality Control, Plant Safety and Security (Including AR and VR safety applications), Facility Management. Case Studies of IIoT Systems: IIoT application development with Embedded PC-based development boards, Development of mini-Project on the new version of Operating systems, and Edge development board. That project should also address the current societal needs.

Textbooks

1. Industry 4.0: The Industrial Internet of Things Alasdair Gilchrist Publications: A press
2. The Concept Industry 4.0 An Empirical Analysis of Technologies and Applications in Production Logistics Authors: Bartodziej, Christoph Jan Springer: Publication in the field of economic science.
3. Hands-on Industrial Internet of Things by GiacomoVeneri and Antonio Capasso, Packt publisher. 2018 edition (e-book).
4. Anandarup Mukherjee, Chandana Roy, and Sudip Misra - Introduction to Industrial Internet of Things and Industry 4. 0 (2020)

Reference Books

1. Embedded System: Architecture, Programming, and Design by Rajkamal, TMH3.
2. Dr. OvidiuVermesan, Dr. Peter Friess, “Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems”, River Publishers

Web References

1. https://nptel.ac.in/courses/106105195
2. https://www.shodan.io/

EDGE COMPUTING

COURSE CODE	22IOT3202A	MODE	A	LTPS	2-0-2-0	PRE-REQUISITE	

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Define Edge and Fog Computing and infer the opportunities and challenges	2	PO1 ,PO2,PSO2
CO2	Examine the Architectural detail of Edge Computing and explore the issues that are being addressed by the industry	4	PO2,PO4, PSO2
CO3	Interpret the Security Requirements for Edge Computing and its Middleware needed	4	PO2,PO4, PSO2
CO4	Analyze the applicability and need for Edge/Fog Computing in various real-time projects	5	PO2, PO4,PSO2
CO5	Evaluate computing paradigms using various applications in Edge Computing	5	PO1,PO2, PSO2
CO6	Implementation of sensor based IOT applications	4	PO1,PO3,PSO2

Syllabus

Module 1	Internet of Things (IoT) and New Computing Paradigms: Introduction, New Computing Paradigms, Fog and Edge Computing Completing the Cloud, Advantages of FEC, Hierarchy of Fog and Edge Computing, Opportunities and Challenges, Addressing the Challenges in Federating Edge Resources
Module 2	Architecture: Integrating IoT + Fog + Cloud Infrastructures, System Modeling, and Research Challenges, Network Slicing Management in Edge and Fog, Optimization in Fog Computing, Formal Modeling Framework for Fog Computing,
Module 3	Middleware for Fog and Edge Computing: Design Issues, State-of-the-Art Middleware Infrastructures, A Lightweight Container Middleware for Edge Cloud Architectures, Security and Data Management
Module 4	Security Management for Edge Cloud Architectures, Applications, and Issues: Exploiting Fog Computing in Health Monitoring, Smart Surveillance Video Stream Processing at the Edge for Real-Time Human Objects Tracking, Fog Computing Model for Evolving Smart Transportation Applications

Module 5	introduction to Docker container and cabrnets in edge computing, edge design of IoT storage system like kye value store

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Edge Computing: A Primer	Jie CaoQuan Zhang Weisong Shi	1st (2018)	2018
2	Fog and Edge Computing-Simply In-depth	Singh Ajit	2nd Edition	2009
3	Fog and Edge Computing: Principles and Paradigms	Rajkumar Buyya (Editor), Satish Narayana Sri rama	1st (2019)	2009
4	IoT and Edge Computing for Architects: Implementing edge and IoT systems from sensors to clouds with communication systems, analytics, and security	Perry Lea	2nd Edition	2009
5	Edge Computing: A Primer	Jie CaoQuan Zhang Weisong Shi	1st (2018)	2018

Evaluation Components:

TIME	CATEGORY	EVALUATION COMPONENT	WEIGHTAGE	TOTAL
IN-SEM	**In Semester Formative Evaluation Total= 25 %**	Active Learning		**22**
		Home Assignments	**4**	
		Quiz	**2**	
		Article Writing	**4**	
		Global Challenges Participation		
		Case Study - Analysis		
		Tutorial Continuous Evaluation		
		Practical Continuous Evaluation	**8**	
		Skill Continuous Evaluation		
		Project Conitnuous Evaluation		
		MOOCs Review	**4**	
	In Semester Summative Evaluation Total= 35 %	In-Sem 1		**38**
		In-Sem 2		
		Practical In-Sem	**13**	
		Skill In-Sem		

		Global Challenges - Leaderboard	**10**	
		MOOCs Exam	**15**	
END-SEM	**End Semester Summative Evaluation Total= 40 %**	Project Demonstration		40
		End-Sem Exam (Paper Based)		
		End-Sem Exam (MCQ based)	**24**	
		Lab End-Sem Exam	**5**	
		Skill End-Sem Exam		
		Poster Presentation		
		Paper Publication	**5**	
		MOOCs Exam		
		Global Challenges - Rating/Points		
		Global Certification	**6**	
		Oral Examination		

edge Computing (EC)

COURSE CODE	22IOT3202A	MODE	A	LTPS	2-0-2-0	PRE-REQUISITE	

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Define Edge and Fog Computing and infer the opportunities and challenges	2	PO1 ,PO2,PSO2
CO2	Examine the Architectural detail of Edge Computing and explore the issues that are being addressed by the industry	4	PO2,PO4, PSO2
CO3	Interpret the Security Requirements for Edge Computing and its Middleware needed	4	PO2,PO4, PSO2
CO4	Analyze the applicability and need for Edge/Fog Computing in various real-time projects	5	PO2, PO4,PSO2

CO5	Evaluate computing paradigms using various applications in Edge Computing	5	PO1,PO2, PSO2
CO6	Implementation of sensor based IOT applications	4	PO1,PO3,PSO2

Syllabus

Module 1	Internet of Things (IoT) and New Computing Paradigms: Introduction, New Computing Paradigms, Fog and Edge Computing Completing the Cloud, Advantages of FEC, Hierarchy of Fog and Edge Computing, Opportunities and Challenges, Addressing the Challenges in Federating Edge Resources
Module 2	Architecture: Integrating IoT + Fog + Cloud Infrastructures, System Modeling, and Research Challenges, Network Slicing Management in Edge and Fog, Optimization in Fog Computing, Formal Modeling Framework for Fog Computing,
Module 3	Middleware for Fog and Edge Computing: Design Issues, State-of-the-Art Middleware Infrastructures, A Lightweight Container Middleware for Edge Cloud Architectures, Security and Data Management
Module 4	Security Management for Edge Cloud Architectures, Applications, and Issues: Exploiting Fog Computing in Health Monitoring, Smart Surveillance Video Stream Processing at the Edge for Real-Time Human Objects Tracking, Fog Computing Model for Evolving Smart Transportation Applications
Module 5	introduction to Docker container and cabrnets in edge computing, edge design of IoT storage system like kye value store

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Edge Computing: A Primer	Jie CaoQuan Zhang Weisong Shi	1st (2018)	2018
2	Fog and Edge Computing-Simply In-depth	Singh Ajit	2nd Edition	2009
3	Fog and Edge Computing: Principles and Paradigms	Rajkumar Buyya (Editor), Satish Narayana Sri rama	1st (2019)	2009
4	IoT and Edge Computing for Architects: Implementing edge and IoT systems from sensors to clouds with communication systems, analytics, and security	Perry Lea	2nd Edition	2009
5	Edge Computing: A Primer	Jie CaoQuan Zhang Weisong Shi	1st (2018)	2018

Evaluation Components:

TIME	CATEGORY	EVALUATION COMPONENT	WEIGHTAGE	TOTAL
IN-SEM	**In Semester Formative Evaluation Total= 25 %**	Active Learning		**22**
		Home Assignments	**4**	
		Quiz	**2**	
		Article Writing	**4**	
		Global Challenges Participation		
		Case Study - Analysis		
		Tutorial Continuous Evaluation		
		Practical Continuous Evaluation	**8**	
		Skill Continuous Evaluation		
		Project Continuous Evaluation		
		MOOCs Review	**4**	
	In Semester Summative Evaluation Total= 35 %	In-Sem 1		**38**
		In-Sem 2		
		Practical In-Sem	**13**	
		Skill In-Sem		
		Global Challenges - Leaderboard	**10**	
		MOOCs Exam	**15**	
END-SEM	**End Semester Summative Evaluation Total= 40 %**	Project Demonstration		40
		End-Sem Exam (Paper Based		
		End-Sem Exam (MCQ based)	**24**	
		Lab End-Sem Exam	**5**	
		Skill End-Sem Exam		
		Poster Presentation		
		Paper Publication	**5**	
		MOOCs Exam		

		Global Challenges - Rating/Points		
		Global Certification	**6**	
		Oral Examination		

Edge Computing (EC)

COURSE CODE	22IOT3202	MODE	R	LTPS	2-0-2-0	PRE-REQUISITE	OS

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Define Edge and Fog Computing and infer the opportunities and challenges	2	PO1 ,PO2,PSO2
CO2	Examine the Architectural detail of Edge Computing and explore the issues that are being addressed by the industry	4	PO2,PO4, PSO2
CO3	Interpret the Security Requirements for Edge Computing and its Middleware needed	4	PO2,PO4, PSO2
CO4	Analyze the aplicability and need for Edge/Fog Computing in various real-time projects	5	PO2, PO4,PSO2
CO5	Evaluate computing paradigms using various applications in Edge Computing	5	PO1,PO2, PSO2

Syllabus

Module 1	Internet of Things (IoT) and New Computing Paradigms: Introduction, New Computing Paradigms, Fog and Edge Computing Completing the Cloud, Advantages of FEC, Hierarchy of Fog and Edge Computing, Opportunities and Challenges, Addressing the Challenges in Federating Edge Resources
Module 2	Architecture: Integrating IoT + Fog + Cloud Infrastructures, System Modeling, and Research Challenges, Network Slicing Management in Edge and Fog, Optimization in Fog Computing, Formal Modeling Framework for Fog Computing,
Module 3	Middleware for Fog and Edge Computing: Design Issues, State-of-the-Art Middleware Infrastructures, A Lightweight Container Middleware for Edge Cloud Architectures, Security and Data Management
Module 4	Security Management for Edge Cloud Architectures, Applications, and Issues: Exploiting Fog Computing in Health Monitoring, Smart Surveillance Video Stream Processing at the Edge for Real-Time Human Objects Tracking, Fog Computing Model for Evolving Smart Transportation Applications

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Edge Computing: A Primer	Jie CaoQuan Zhang Weisong Shi	1st (2018)	2018
2	Fog and Edge Computing-Simply In-depth	Singh Ajit	2nd Edition	2009
3	Fog and Edge Computing: Principles and Paradigms	Rajkumar Buyya (Editor), Satish Narayana Sri rama	1st (2019)	2009
4	IoT and Edge Computing for Architects: Implementing edge and IoT systems from sensors to clouds with communication systems, analytics, and security	Perry Lea	2nd Edition	2009
5	Edge Computing: A Primer	Jie CaoQuan Zhang Weisong Shi	1st (2018)	2018

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Continuous Evaluation - Lab Exercise	10	24
	Home Assignment and Textbook	7	
	ALM	7	
In-Sem Summative	In-Sem 1	12	36
	In-Sem 2	12	
	Practical In-Sem	12	
End-Sem Summative	Lab End Semester Exam	16	40
	SEM End Exam	24	

DEEP LEARNING

COURSE CODE	22IOT3305	MODE	A	LTPS	2-0-2-4	PRE-REQUISITE	ML

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Apply optimization algorithms to solve neural networks	3	PO1,PO2, PSO2
CO2	Apply CNN model and its variants to real time data	3	PO2,PO3,PO4, PSO1, PSO2
CO3	Able to apply Sequence models -RNN & LSTM	3	PO1, PSO2,PO3, PSO2

CO4	construct the attention networks and Generative Neural models	3	PPO2,O3,PO4, PSO2
CO5	Implement basic Neural Networks, optimization algorithms, , various types of auto encoders, batch normalization, convolutional neural networks , RNN and LSTM	4	PO2, PO3,PO4, PSO1, PSO2
CO6	Implement Deep learning case studies using keras and pytorch	5	PO3, PO4, PO5, PSO2

Syllabus

Module 1	Deep Learning Introduction and history, Convolutional neural networks: Convolution neural networks (CNN), building blocks of CNN, fundamentals of CNN, the architecture of CNN, Convolution and Pooling Layers, Activations in CNN, loss functions, Need for optimization , , Challenges in Neural Network Optimization SGD and Adam Optimizers, Momentum Based GD, AdaGrad, RMSProp,Surrogate Loss Functions and Early Stopping,, LeNet, AlexNet, ZFNet, VGGNet, GoogLe Net, ResNet Object Detection, Transfer learning and Adversarial attacks,
Module 2	Object Detection and Segmentation using RCNN, Fast RCNN, YOLO,Dataset augmentation, Parameter sharing and tying, Injecting noise at input, Ensemble methods, Batch Normalization, Dropout, Autoencoders, Denoising autoencoders, Sparse and contractive autoencoders, Recurrent NN,.
Module 3	Language modelling and Long Short Term Memory(LSTM), GRU, Time sequence model with LSTM, Restricted Boltzmann Machines, Deep Dream, Neural style transfer, self-Attention networks, Dot product attention, additive attention,transformers
Module 4	Variational autoencoders, Autoregressive Models: NADE, MADE, Pixel RNN, Generative Adversarial Networks (GANs), Cycle GAN, Superresolution and Conditional GAN, how to train DCGAN , Deep Reinforcement learning, Implementing RL algorithms with deep neural networks.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Deep Learning with Python	Francois Chollet	Manning publications, 2018	2018
2	Grokking Deep Learning	Andrew Trask	Manning publications, 2019	2019
3	Deep Learning Book.	Ian Goodfellow and Yoshua Bengio and Aaron Courville	2016	2016
4	Deep Learning with PyTorch: A practical approach to building neural network models using PyTorch	Vishnu Bramania	Manning publications, 2018	2018
5	Deep Learning with Python	Francois Chollet	Manning publications, 2019	2019

Global Certifications:

Mapped Global Certifications:

Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	TensorFlow Developer Certificate	Google	N	subjective		

Evaluation Components:

TIME	CATEGORY	EVALUATION COMPONENT	WEIGHTAGE	TOTAL
IN-SEM	FORMATIVE	Prototype Review		24
		Videos		
		Quiz	7	
		Practical Continuous Evaluation	5	
		Skill Continuous Evaluation	5	
		Project Continuous Evaluation		
		MOOCs Review	7	
	SUMMATIVE	Semester in Exam-I	12	36
		Semester in Exam-II	12	
		Skill In-Sem	6	
		Lab in-sem	6	
END-SEM	SUMMATIVE	Project Demonstration		40
		End-Sem Exam (Paper Based)	24	
		Lab End-Sem Exam	8	
		Skill End-Sem Exam	8	

DEEP LEARNING(DL)

COURSE CODE	22IOT3305	MODE	P	LTPS	2-0-2-4	PRE-REQUISITE	ML

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Apply optimization algorithms to solve neural networks	3	PO1,PO2, PSO2
CO2	Apply CNN model and its variants to real time data	3	PO2,PO3,PO4, PSO1, PSO2
CO3	Able to apply Sequence models -RNN & LSTM	3	PO1, PSO2,PO3, PSO2

CO4	construct the attention networks and Generative Neural models	3	PPO2,O3,PO4, PSO2
CO5	Implement basic Neural Networks, optimization algorithms, , various types of auto encoders, batch normalization, convolutional neural networks , RNN and LSTM	4	PO2, PO3,PO4, PSO1, PSO2
CO6	Implement Deep learning case studies using keras and pytorch	5	PO3, PO4, PO5, PSO2

Syllabus

Module 1	Deep Learning Introduction and history, Convolutional neural networks: Convolution neural networks (CNN), building blocks of CNN, fundamentals of CNN, the architecture of CNN, Convolution and Pooling Layers, Activations in CNN, loss functions, Need for optimization , , Challenges in Neural Network Optimization SGD and Adam Optimizers, Momentum Based GD, AdaGrad, RMSProp,Surrogate Loss Functions and Early Stopping,, LeNet, AlexNet, ZFNet, VGGNet, GoogLe Net, ResNet Object Detection, Transfer learning and Adversarial attacks,
Module 2	Object Detection and Segmentation using RCNN, Fast RCNN, YOLO, Dataset augmentation, Parameter sharing and tying, Injecting noise at input, Ensemble methods, Batch Normalization, Dropout, Autoencoders, Denoising autoencoders, Sparse and contractive autoencoders, Recurrent NN,.
Module 3	Language modelling and Long Short Term Memory (LSTM), GRU, Time sequence model with LSTM, Restricted Boltzmann Machines, Deep Dream, Neural style transfer, self-Attention networks, Dot product attention, additive attention, transformers
Module 4	Variational autoencoders, Autoregressive Models: NADE, MADE, Pixel RNN, Generative Adversarial Networks (GANs), Cycle GAN, Super resolution and Conditional GAN, how to train DCGAN , Deep Reinforcement learning, Implementing RL algorithms with deep neural networks.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Deep Learning with Python	Francois Chollet	Manning publications, 2018	2018
2	Grokking Deep Learning	Andrew Trask	Manning publications, 2019	2019
3	Deep Learning Book.	Ian Goodfellow and Yoshua Bengio and Aaron Courville	2016	2016
4	Deep Learning with PyTorch: A practical approach to building neural network models using PyTorch	Vishnu Bramania	Manning publications, 2018	2018
5	Deep Learning with Python	Francois Chollet	Manning publications, 2019	2019

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	TensorFlow Developer Certificate	Google	N	subjective		

Evaluation Components:

TIME	CATEGORY	EVALUATION COMPONENT	WEIGHTAGE	TOTAL
IN-SEM	FORMATIVE	Prototype Review		24
		Videos		
		Quiz	7	
		Practical Continuous Evaluation	5	
		Skill Continuous Evaluation	5	
		Project Continuous Evaluation		
		MOOCs Review	7	
	SUMMATIVE	Semester in Exam-I	12	36
		Semester in Exam-II	12	
		Skill In-Sem	6	
		Lab in-sem	6	
END-SEM	SUMMATIVE	Project Demonstration		40

		End-Sem Exam (Paper Based)	24	
		Lab End-Sem Exam	8	
		Skill End-Sem Exam	8	

DEEP LEARNING(DL)

COURSE CODE	22IOT3305	MODE	R	LTPS	2-0-2-4	PRE-REQUISITE	ML

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Apply optimization algorithms to solve neural networks	3	PO1,PO2, PSO2
CO2	Apply CNN model and its variants to real time data	3	PO2,PO3,PO4, PSO1, PSO2
CO3	Able to apply Sequence models -RNN & LSTM	3	PO1, PSO2,PO3, PSO2
CO4	construct the attention networks and Generative Neural models	3	PPO2,O3,PO4, PSO2
CO5	Implement basic Neural Networks, optimization algorithms, , various types of auto encoders, batch normalization, convolutional neural networks , RNN and LSTM	4	PO2, PO3,PO4, PSO1, PSO2
CO6	Implement Deep learning case studies using keras and pytorch	5	PO3, PO4, PO5, PSO2

Syllabus

Module 1	Deep Learning Introduction and history, Convolutional neural networks: Convolution neural networks (CNN), building blocks of CNN, fundamentals of CNN, the architecture of CNN, Convolution and Pooling Layers, Activations in CNN, loss functions, Need for optimization , , Challenges in Neural Network Optimization SGD and Adam Optimizers, Momentum Based GD, AdaGrad, RMSProp,Surrogate Loss Functions and Early Stopping,, LeNet, AlexNet, ZFNet, VGGNet, GoogLe Net, ResNet Object Detection, Transfer learning and Adversarial attacks,
Module 2	Object Detection and Segmentation using RCNN, Fast RCNN, YOLO,Dataset augmentation, Parameter sharing and tying, Injecting noise at input, Ensemble methods, Batch Normalization, Dropout, Autoencoders, Denoising autoencoders, Sparse and contractive autoencoders, Recurrent NN,.
Module 3	Language modelling and Long Short Term Memory(LSTM), GRU, Time sequence model with LSTM, Restricted Boltzmann Machines, Deep Dream, Neural style transfer, self-Attention networks, Dot product attention, additive attention,transformers

Module 4	Variational autoencoders, Autoregressive Models: NADE, MADE, Pixel RNN, Generative Adversarial Networks (GANs), Cycle GAN, Superresolution and Conditional GAN, how to train DCGAN , Deep Reinforcement learning, Implementing RL algorithms with deep neural networks.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Deep Learning with Python	Francois Chollet	Manning publications, 2018	2018
2	Grokking Deep Learning	Andrew Trask	Manning publications, 2019	2019
3	Deep Learning Book.	Ian Goodfellow and Yoshua Bengio and Aaron Courville	2016	2016
4	Deep Learning with PyTorch: A practical approach to building neural network models using PyTorch	Vishnu Bramania	Manning publications, 2018	2018
5	Deep Learning with Python	Francois Chollet	Manning publications, 2019	2019

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	TensorFlow Developer Certificate	Google	N	subjective		

Evaluation Components:

TIME	CATEGORY	EVALUATION COMPONENT	WEIGHTAGE	TOTAL
IN-SEM	FORMATIVE	Prototype Review		24
		Videos		
		Quiz	7	
		Practical Continuous Evaluation	5	
		Skill Continuous Evaluation	5	
		Project Conitnuous Evaluation		
		MOOCs Review	7	
	SUMMATIVE	Semester in Exam-I	12	36
		Semester in Exam-II	12	

		Skill In-Sem	6	
		Lab in-sem	6	
END-SEM	SUMMATIVE	Project Demonstration		40
		End-Sem Exam (Paper Based)	24	
		Lab End-Sem Exam	8	
		Skill End-Sem Exam	8	

DATA VISUALISATION TECHNIQUES

COURSE CODE	22IOT3406M	MODE	R	LTPS	3-0-0-0	PRE-REQUISITE	DBMS

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Understand the modelling of various types of data and the Visualization fundamentals	BTL 2	PSO2,P03
CO2	Apply methods and tools for Non-Spatial Data Visualization	BTL3	PSO2,PO2
CO3	Apply methods for Scientific/ Spatial Data Visualization and Web data visualization	BTL3	PSO2,PO5
CO4	Use Dashboard and its categories	BTL3	PS02,PO5
CO5	Evaluate Data Visualization through python and Tableau	BTL5	PS02,PO5
CO6	Evaluate Data Visualization Skill through Python & Tableau	BTL5	PS02,PO5

Syllabus

Module 1	Data Modeling : Conceptual models, Spread sheet models, Relational Data Models, object-oriented models, semi structured data models, unstructured data models. Visualization Fundamentals, Design principles, The Process of Visualization, Data Abstraction, Visual Encodings, Use of Color, Perceptual Issues, Designing Views, Interacting with Visualizations, Filtering and Aggregation
Module 2	Design Studies Information / Non-Spatial Data Visualization, Tabular Data, Tree Data, Graph Data, Text Data, Flow Data, Time-Series Data, Topological Visualization, Uncertainty, Visual Analytics.
Module 3	Scientific / Spatial Data Visualization, Scalar Volumes, Iso-surfacing, Volume Rendering, Transfer Function Design, Vector Fields, Maps, Spatial Uncertainty Web data visualization: web structure data, web usage data ,web content data multimedia data visualization

Module 4	Information dashboard – categorizing dashboards – typical dashboard data – dashboard design issues and best practices. Visual perception – limits of short-term memory – visually encoding data – Gestalt principles – principles of visual perception for dashboard design Characteristics of dashboards – key goals in visual design process – dashboard display media – designing dashboards for usability – meaningful organization – maintaining consistency – aesthetics of dashboards – testing for usability – case studies: sales dashboard, CIO dashboard, Telesales dashboard, marketing analysis dashboard.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Visualizing Data	Fry	O'Reilly Media	O'Reilly Media
2	Visualization Analysis and Design	Munzner	O'Reilly Media	
3	Information Visualization: Perception for Design	Ware, Morgan Kaufmann		

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Microsoft Certified: Azure Enterprise Data Analyst Associate	Microsoft	N	QUIZ	MICROSOFT	https://learn.microsoft.com/en-us/certifications/azure-enterprise-data-analyst-associate/

Evaluation Components:

TIME	CATEGORY	EVALUATION COMPONENT	WEIGHTAGE	TOTAL
IN-SEM	FORMATIVE	Active Learning	7	24
		Home Assignments	7	
		Quiz		
		Article Writing		
		Global Challenges Participation		
		Case Study - Analysis		
		Tutorial Continuous Evaluation		
		Practical Continuous Evaluation	5	
		Skill Continuous Evaluation	5	
		Project Continuous Evaluation		
		MOOCs Review		
	SUMMATIVE	In-Sem 1	12	36

		In-Sem 2	12	
		Practical In-Sem	6	
		Skill In-Sem	6	
		Global Challenges - Leaderboard		
		MOOCs Exam		
END-SEM	SUMMATIVE	Project Demonstration		
		End-Sem Exam (Paper Based)	24	40
		End-Sem Exam (MCQ based)		
		Lab End-Sem Exam	8	
		Skill End-Sem Exam	8	
		Poster Presentation		
		Paper Publication		
		MOOCs Exam		
		Global Challenges - Rating/Points		
		Global Certification		
		Oral Examination		

Data Visualization Techniques (DVT)

COURSE CODE	22IOT3406A	MODE	A	LTPS	3-0-4-4	PRE-REQUISITE	

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Understand the modelling of various types of data and the Visualization fundamentals	BTL 2	PSO2,P03
CO2	Apply methods and tools for Non-Spatial Data Visualization	BTL3	PSO2,PO2
CO3	Apply methods for Scientific/ Spatial Data Visualization and Web data visualization	BTL3	PSO2,PO5
CO4	Use Dashboard and its categories	BTL3	PS02,PO5
CO5	Apply visual analytics on dashboards	BTL3	PS02,PO5
CO6	Evaluate Data Visualization through python and Tableau	BTL5	PS02,PO5
CO7	Evaluate Data Visualization Skill through Python & Tableau	BTL5	PS02,PO5

Syllabus

Module 1	Data Modeling : Conceptual models, Spread sheet models, Relational Data Models, object-oriented models, semi structured data models, unstructured data models. Visualization Fundamentals, Design principles, The Process of Visualization, Data Abstraction, Visual Encodings, Use of Color, Perceptual Issues, Designing Views, Interacting with Visualizations, Filtering and Aggregation
Module 2	Design Studies Information / Non-Spatial Data Visualization, Tabular Data, Tree Data, Graph Data, Text Data, Flow Data, Time-Series Data, Topological Visualization, Uncertainty, Visual Analytics.
Module 3	Scientific / Spatial Data Visualization, Scalar Volumes, Iso-surfacing, Volume Rendering, Transfer Function Design, Vector Fields, Maps, Spatial Uncertainty Web data visualization: web structure data, web usage data ,web content data multimedia data visualization
Module 4	Information dashboard – categorizing dashboards – typical dashboard data – dashboard design issues and best practices. Visual perception – limits of short-term memory – visually encoding data – Gestalt principles – principles of visual perception for dashboard design Characteristics of dashboards – key goals in visual design process – dashboard display media – designing dashboards for usability – meaningful organization – maintaining consistency – aesthetics of dashboards – testing for usability – case studies: sales dashboard, CIO dashboard, Telesales dashboard, marketing analysis dashboard.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Visualizing Data	Fry	O'Reilly Media	O'Reilly Media
2	Visualization Analysis and Design	Munzner	O'Reilly Media	
3	Information Visualization: Perception for Design	Ware, Morgan Kaufmann		

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Microsoft Certified: Azure Enterprise Data Analyst Associate	Microsoft	N	QUIZ	MICROSOFT	https://learn.microsoft.com/en-us/certifications/azure-enterprise-data-analyst-associate/
2						

Evaluation Components:

TIME	CATEGORY	EVALUATION COMPONENT	WEIGHTAGE	TOTAL
IN-SEM	FORMATIVE	Active Learning	7	24
		Home Assignments	7	
		Quiz		
		Article Writing		
		Global Challenges Participation		
		Case Study - Analysis		
		Tutorial Continuous Evaluation		
		Practical Continuous Evaluation	5	
		Skill Continuous Evaluation	5	
		Project Continuous Evaluation		
		MOOCs Review		
	SUMMATIVE	In-Sem 1	12	36
		In-Sem 2	12	
		Practical In-Sem	6	

		Skill In-Sem	6	
		Global Challenges - Leaderboard		
		MOOCs Exam		
END-SEM	SUMMATIVE	Project Demonstration		
		End-Sem Exam (Paper Based)	24	40
		End-Sem Exam (MCQ based)		
		Lab End-Sem Exam	8	
		Skill End-Sem Exam	8	
		Poster Presentation		
		Paper Publication		
		MOOCs Exam		
		Global Challenges - Rating/Points		
		Global Certification		
		Oral Examination		

Data Visualization Techniques

COURSE CODE	22IOT3406M	MODE	P	LTPS	3-0-4-4	PRE-REQUISITE	

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Understand the modelling of various types of data and the Visualization fundamentals	BTL 2	PSO2,P03
CO2	Apply methods and tools for Non-Spatial Data Visualization	BTL3	PSO2,PO2
CO3	Apply methods for Scientific/ Spatial Data Visualization and Web data visualization	BTL3	PSO2,PO5
CO4	Use Dashboard and its categories	BTL3	PS02,PO5
CO5	Apply visual analytics on dashboards	BTL3	PS02,PO5
CO6	Evaluate Data Visualization through python and Tableau	BTL5	PS02,PO5
CO7	Evaluate Data Visualization Skill through Python & Tableau	BTL5	PS02,PO5

Syllabus

Module 1	Data Modeling : Conceptual models, Spread sheet models, Relational Data Models, object-oriented models, semi structured data models, unstructured data models. Visualization Fundamentals, Design principles, The Process of Visualization, Data Abstraction, Visual Encodings, Use of Color, Perceptual Issues, Designing Views, Interacting with Visualizations, Filtering and Aggregation
Module 2	Design Studies Information / Non-Spatial Data Visualization, Tabular Data, Tree Data, Graph Data, Text Data, Flow Data, Time-Series Data, Topological Visualization, Uncertainty, Visual Analytics.
Module 3	Scientific / Spatial Data Visualization, Scalar Volumes, Iso-surfacing, Volume Rendering, Transfer Function Design, Vector Fields, Maps, Spatial Uncertainty Web data visualization: web structure data, web usage data ,web content data multimedia data visualization
Module 4	Information dashboard – categorizing dashboards – typical dashboard data – dashboard design issues and best practices. Visual perception – limits of short-term memory – visually encoding data – Gestalt principles – principles of visual perception for dashboard design Characteristics of dashboards – key goals in visual design process – dashboard display media – designing dashboards for usability – meaningful organization – maintaining consistency – aesthetics of dashboards – testing for usability – case studies: sales dashboard, CIO dashboard, Telesales dashboard, marketing analysis dashboard.
Module 5	Evaluate data visualization through Python & Tableau

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Visualizing Data	Fry	O'Reilly Media	O'Reilly Media
2	Visualization Analysis and Design	Munzner	O'Reilly Media	
3	Information Visualization: Perception for Design	Ware, Morgan Kaufmann		

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Microsoft Certified: Azure Enterprise Data Analyst Associate	Microsoft	N	QUIZ	MICROSOFT	https://learn.microsoft.com/en-us/certifications/azure-enterprise-data-analyst-associate/

Evaluation Components:

TIME	CATEGORY	EVALUATION COMPONENT	WEIGHTAGE	TOTAL
IN-SEM	FORMATIVE	Active Learning		24
		Home Assignments		
		Quiz	5	
		Article Writing	5	
		Global Challenges Participation	5	
		Case Study - Analysis	5	
		Tutorial Continuous Evaluation		
		Practical Continuous Evaluation		
		Skill Continuous Evaluation		
		Project Continuous Evaluation		
		MOOCs Review	4	
	SUMMATIVE	In-Sem 1		36
		In-Sem 2		
		Practical In-Sem	8	
		Skill In-Sem	8	
		Global Challenges - Leaderboard	10	
		MOOCs Exam	10	
END-SEM	SUMMATIVE	Project Demonstration		40

		End-Sem Exam (Paper Based)	
		End-Sem Exam (MCQ based)	24
		Lab End-Sem Exam	8
		Skill End-Sem Exam	8
		Poster Presentation	
		Paper Publication	
		MOOCs Exam	
		Global Challenges - Rating/Points	
		Global Certification	
		Oral Examination	

BIG DATA ANALYTICS

COURSE CODE	22IOT3508	MODE	R	LTPS	2-0-2-0	PRE-REQUISITE	DBMS

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	Illustrate the concepts of big data, Initial exploration of analysis of data and Data visualization.	2	PO1,PO2,PSO1
CO2	Apply Initial exploration of data and advanced data analytics by using R	3	PO2,PO3,PSO1
CO3	Apply advanced algorithms & Statistical modelling for big data using HDFS, HIVE, and PIG.	3	PO3,PO4,PSO1
CO4	Apply advanced SQL functions for in-database analytics by MADlib, Greenplum along with common deliverables of analytics life cycle project	4	PSO1,PO3,PO4
CO5	Build and Evaluate the Big Data Analytical problems using R, Hadoop, HIVE Programming concepts.	5	PO1,PSO2

Syllabus

Module 1	Introduction to BigData Analytics: BigData Overview, State of the Practice of Analytics, Big Data Analytics in Industry Verticals. It also covers Overview of Data Analytics Life cycle, Discovery, Data Preparation, Model Planning, Model Building, Communicating Results and Findings, Operationalizing. Initial Analysis of the Data: Initial Exploration and Analysis of the Data, Basic Data Visualization. Basic data analytics, reporting, and apply basic data visualization techniques to your data. Apply basic analytics methods such as distributions, statistical tests and summary operations, and differentiate between results that are statistically sound vs statistically significant. Identify a model for your data and define the null and alternative hypothesis. Experimentation and demonstration of initial analysis of data using R.
Module 2	Advanced Analytics and Statistical Modeling for BigData — Theory and Methods: Need of analytic and select an appropriate technique based on business objectives; initial hypotheses; and the data's structure and volume. Apply some of the more methods in Analytics solutions, algorithms and the technical foundations for the methods. The environment (usecase) in which each technique can provide the most value. Use appropriate diagnostic methods to validatethe models created Use R and in-database analytical functions to fit, score and evaluate models. Advanced Analytics and Statistical Modeling for BigData.

Module 3	Technology &Tools: Tool to Perform Analytic on Unstructured data using Map Reduce Programming paradigm. Use Hadoop, HDFS, HIVE, PIG and other products in the Hadoop ecosystem for unstructured data analytics, Effectively use advanced SQL functions and Greenplum extensions for in-database analytics.
Module 4	Use MADlib to solve analytics problems in-database. Endgame-perationalizing an Analytics Project: Task sneeded to operationalize an analytics project .Four common deliverables of ananalytics life cycle project meet the needs of key stakeholders. Use a framework for creating final presentations for sponsors and analysts. Evaluate data visualization and identify ways to improve it. Apply these concepts to a bigdata analytics problem in the final lab.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Big Data: A Revolution That Will Transform How We Live, Work, and Think	Viktor Mayer-Schonberger and Kenneth Cukier	Atlantic Publishers	
2	Data Science for Business: What You Need to Know about Data Mining and Data-Analytic Thinking	Foster Provost and Tom Fawcett	O'Reilly Media	
3	Hadoop: The Definitive Guide	Tom White	O'Reilly Media	
4	Data Analytics Made Accessible	Anil Maheshwari	Apress	
5	Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph	David Loshin	Morgan Kaufmann	

Global Certifications:

Mapped Global Certifications:						
Sl No	Title	Certification Provider	Proctored (Y/N)	Format of the Exam	Exam Provider	URL of the Certification
1	Cloudera Certified Administrator for Apache Hadoop (CCAH)	Cloudera Inc.	Y	Multiple Choice Exam	Cloudera	https://www.cloudera.com/more/training/certification/ccah.html

Tools used in Practical / Skill:

Sl No	Tool Name	Parent Industry	Open Source/ Commercial
1	HADOOP	HADOOP	OPEN

Evaluation Components:

TIME	CATEGORY	EVALUATION COMPONENT	WEIGHTAGE	TOTAL
IN-SEM	FORMATIVE	Active Learning		22
		Home Assignments	7	
		Quiz	8	
		Article Writing		
		Global Challenges Participation		
		Case Study - Analysis		
		Tutorial Continuous Evaluation		
		Practical Continuous Evaluation	7	

		Skill Continuous Evaluation		
		Project Continuous Evaluation		
		MOOCs Review		
	SUMMATIVE	In-Sem 1	15	38
		In-Sem 2	15	
		Practical In-Sem	8	
		Skill In-Sem		
		Global Challenges - Leaderboard		
		MOOCs Exam		
END-SEM	SUMMATIVE	Project Demonstration		40
		End-Sem Exam (Paper Based)	24	
		End-Sem Exam (MCQ based)		
		Lab End-Sem Exam	16	
		Skill End-Sem Exam		
		Poster Presentation		
		Paper Publication		
		MOOCs Exam		
		Global Challenges - Rating/Points		
		Global Certification		
		Oral Examination		

SYLLABUS OF COURSES UNDER

OPEN ELECTIVES

Course Title: Energy Harvesting Technologies for IoT

COURSE CODE	OEEC0015	MODE	Regular	LTPS	3-0-0-0	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Apply the concepts of renewable energy systems, energy harvesting, and storage.	3	PO1, PO2 & PSO1
CO2	Apply the solar energy harvesting technologies and design of solar power systems.	3	PO1, PO2 & PSO1
CO3	Analyse the mechanical energy harvesting technology and design a system for real-world problems.	3	PO2, PO3 & PSO1
CO4	Analyse the Electromagnetic energy harvesting technologies for small-power applications and current research on hybrid systems.	3	PO2, PO3 & PSO1

Syllabus

Module 1	**Alternate Sources of Energy:** Energy sources: Non-renewable and renewable energy sources, Energy demand, and crisis nexus. Introduction to energy harvesting for autonomous systems; Energy harvesting circuits and architectures. Power management electronics, Relevant circuits, and systems. Energy storage-Primary and Secondary batteries, Supercapacitors.
Module 2	**Solar Energy Harvesting:** Solar cells Structure, operations, and characteristics of solar cells. Modules and device technologies. Photovoltaic Systems, Power Electronic Interfaces for PV Systems. Evolution of PV materials and devices. Thermoelectric: Principles, thermoelectric theory, Devices, Existing and Future Capabilities.
Module 3	**Mechanical Energy Harvesting:** Transduction Mechanisms, Principle of piezoelectricity, piezoelectric materials, their characterizations, e.g., PZT, ZnO. Triboelectric nanogenerators: materials, performance, and example devices. Power Electronic Interfaces for Piezoelectric and TENG. Examples: Harvesters driven by muscle power, knee joint movement harvesting, etc.
Module 4	**Electromagnetic Energy Harvesting:** RF Energy Harvesting: System, Techniques, RF Concepts and Principles, Evaluation of Wireless Power Harvesting Metrics, Circuits, Applications. Hybrid: PV-Piezoelectric-Electromagnetic-Thermoelectric Energy Harvesting. Case Studies: Health Condition Monitoring, Forest Surveillance and Monitoring, Energy and Environment Monitoring, Automotive.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Energy Harvesting for Autonomous Systems	Stephen Beeby, Neil White	Artech House	2010
2	Energy Harvesting Technologies	Shashank Priya, Daniel J. Inman	Springer	2009
3	Energy Harvesting for Self-Powered Wearable Devices	Mohammad Alhawari	Springer	2018
4	CMOS Indoor Light Energy Harvesting System for Wireless Sensing Applications	Carlos Manuel Ferreira Carvalho, Nuno Filipe Silva VeríssimoPaulino	Springer	2016
5	Energy Harvesting Systems for IoT Applications: Generation, Storage, and Power Management	Yen Kheng Tan, Mark Wong	CRC	2019

Wireless Ad-hoc Networks -- WAN

COURSE CODE	OEEC0020	MODE	R	LTPS	3-0-0-0	PRE-REQUISITE	NPS

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Apply the knowledge of Communication networks and wireless technologies to realize Wireless Adhoc Networks	3	PO1, PO2, PSO2
CO2	Apply the concepts of different routing protocols in real scenarios.	3	PO2, PO3, PSO2
CO3	Analyse the concepts of MAC, transport layer and security protocols.	3	PO2, PO3, PSO2
CO4	Analyse the concepts of wireless sensor network and implementation of hardware architecture.	3	PO2, PO3, PSO2

Syllabus

Module 1	Introduction to WAN, Difference between cellular and Adhoc network, Necessity and Applications of WAN, Challenges, and Issues for WAN: Medium Access Scheme, Transport Layer Protocol, Routing, Multicasting, Energy Management, Self-Organization, Security, Addressing & Service discovery, Deployment considerations, Scalability, Pricing Scheme, Quality of Service Provisioning, Dynamic Topology of WAN, Classification based on Topology, Adhoc wireless internet
Module 2	Routing Protocols of WAN, Classifications with examples, Classification based on Routing Topology Utilization: Table Driven Routing Protocol, On Demand Routing Protocol, Adhoc on demand distance Vector Routing Protocol, Classification based on Specific Resources: Flat topology routing protocols, Hierarchical topology routing protocols, Classification based on Routing Information update mechanism: Power-aware routing, Geographical information assisted routing.
Module 3	MAC Protocols, Types of protocols used in MAC, Fixed Allocation MAC, Demand Based MAC, Content based MAC, Challenges of MAC, Issues and Design goals of TLP, Network security of WAN, Issues and Network Security attacks and various approaches for key management
Module 4	Introduction to WSN, Application of WSN, Challenges of WSN: Characteristic requirements and Required mechanisms, Hardware description and block diagram for single-node architecture, Architecture of WSN: layered architecture and clustered architecture.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Ad hoc wireless networks-Architectures and protocols	C. Siva Ram Murthy, B.S. Manoj	Pearson Education	2012
2	Wireless Ad Hoc and Sensor Networks: Management, Performance, and Applications	By Jing (Selina) He, Mr. Shouling Ji, Yingshu Li, Yi Pan	CRC press	2013
3	Wireless Ad Hoc Networking: Personal-Area, Local-Area, and the Sensory-Area Networks (Wireless Networks and Mobile Communications)	Shih-Lin Wu, Yu-Chee Tseng	Auerbach Publications	2015
4	The Handbook of Ad Hoc Wireless Networks	Mohammad Ilya	CRC Press Ic	2012

Global Certifications: NA

Tools used in Practical / Skill: NA

Evaluation Components:

Evaluation	Component	Weightage	Total
In-Sem Formative	Active Learning	6	22
	Home Assignments	8	
	Quiz	8	
In-Sem Summative	In-Sem 1(Paper based)	19	38
	In-Sem 2(Paper based)	19	
End-Sem Summative	End-Sem Exam (Paper Based)	40	40

Course Title: Energy Harvesting Technologies for IoT

COURSE CODE	OEEC0015	MODE	Regular	LTPS	3-0-0-0	PRE-REQUISITE	NIL

Course Outcomes

CO#	CO Description	BTL	PO/PSO Mapping
CO1	Apply the concepts of renewable energy systems, energy harvesting, and storage.	3	PO1, PO2 & PSO1
CO2	Apply the solar energy harvesting technologies and design of solar power systems.	3	PO1, PO2 & PSO1
CO3	Analyse the mechanical energy harvesting technology and design a system for real-world problems.	3	PO2, PO3 & PSO1
CO4	Analyse the Electromagnetic energy harvesting technologies for small-power applications and current research on hybrid systems.	3	PO2, PO3 & PSO1

Syllabus

Module 1	**Alternate Sources of Energy:** Energy sources: Non-renewable and renewable energy sources, Energy demand, and crisis nexus. Introduction to energy harvesting for autonomous systems; Energy harvesting circuits and architectures. Power management electronics, Relevant circuits, and systems. Energy storage-Primary and Secondary batteries, Supercapacitors.
Module 2	**Solar Energy Harvesting:** Solar cells Structure, operations, and characteristics of solar cells. Modules and device technologies. Photovoltaic Systems, Power Electronic Interfaces for PV Systems. Evolution of PV materials and devices. Thermoelectric: Principles, thermoelectric theory, Devices, Existing and Future Capabilities.
Module 3	**Mechanical Energy Harvesting:** Transduction Mechanisms, Principle of piezoelectricity, piezoelectric materials, their characterizations, e.g., PZT, ZnO. Triboelectric nanogenerators: materials, performance, and example devices. Power Electronic Interfaces for Piezoelectric and TENG. Examples: Harvesters driven by muscle power, knee joint movement harvesting, etc.
Module 4	**Electromagnetic Energy Harvesting:** RF Energy Harvesting: System, Techniques, RF Concepts and Principles, Evaluation of Wireless Power Harvesting Metrics, Circuits, Applications. Hybrid: PV-Piezoelectric-Electromagnetic-Thermoelectric Energy Harvesting. Case Studies: Health Condition Monitoring, Forest Surveillance and Monitoring, Energy and Environment Monitoring, Automotive.

Reference Books:

Sl No	Title	Author(s)	Publisher	Year
1	Energy Harvesting for Autonomous Systems	Stephen Beeby, Neil White	Artech House	2010

2	Energy Harvesting Technologies	Shashank Priya, Daniel J. Inman	Springer	2009
3	Energy Harvesting for Self-Powered Wearable Devices	Mohammad Alhawari	Springer	2018
4	CMOS Indoor Light Energy Harvesting System for Wireless Sensing Applications	Carlos Manuel Ferreira Carvalho, Nuno Filipe Silva VeríssimoPaulino	Springer	2016
5	Energy Harvesting Systems for IoT Applications: Generation, Storage, and Power Management	Yen Kheng Tan, Mark Wong	CRC	2019