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)

2021 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:

To produce graduates with professional excellence, conduct quality research addressing social and industrial relevance, and provide technical support to budding entrepreneurs and industries.

Mission statements:

M1: To produce graduates who have 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 engineeringproblems.
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, andmodern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PO6	**The engineer and society**: Apply reasoning informed by the contextual knowledge toassess 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 theknowledge 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 orleader 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 giveand 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 memberand 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 toengage 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:

AcademicGoals	**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 2021-22Curriculum 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	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	
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.	AI, ANN Tools, and Applications
		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 fulfil 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 non linear modulation systems	Analog and Digital Communication
		Apply different digital modulation Systems.	
		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
20UC1101	Integrated Professional English	HSS	0	0	4	0	2	4	Nil	New course		Employability	Covers the programming Concepts which helps students for attaining better employment
20UC1202	English Proficiency	HSS	0	0	4	0	2	4	Nil	New course		Employability	
21UC2103	Essential Skills for Employability	HSS	0	0	4	0	2	4	Nil	New course	Employers Feedback the recruiters felt that the students were excellent in soft skills and good in technical skills	Employability	
21UC2204	Corporate Readiness Skills	HSS	0	0	4	0	2	4	Nil	New course	Employers Feedback the recruiters felt that the students were excellent in soft skills and good in technical skills	Employability	
21UC0010	Universal Human Values & Professional Ethics	HSS	2	0	0	0	2	2	Nil	New course		Sociality	Basic course helps better to understand society
20UC0007	Indian Heritage and Culture	HSS	2	0	0	0	0	2	Nil	New course		Entrepreneurship	Concepts that helps the students for attaining better entrepreneurship
20UC0008	Indian Constitution	HSS	2	0	0	0	0	2	Nil	New course		Entrepreneurship	
20UC0009	Ecology & Environment	HSS	2	0	0	0	0	2	Nil	New course		Entrepreneurship	
21UC0011	Gender Sensitization	HSS	2	0	0	0	2	2	Nil	New course		Entrepreneurship	
20MT1101	Mathematics for Computing	BS	2	2	0	2	5	6	Nil	New course		Employability	Basic course helps better to understand society
21MT2102	Mathematics for Engineers	BS	2	1	0	0	3	3	Nil	New course		Employability	Basic course helps better employment
BS	Mathematics-3(Department Specific)	BS	3	0	0	0	3	3	Nil	New course		Employability	Basic course helps better to understand society
20UC1203	Design Thinking and Innovation-2	BS	1	0	0	4	2	5	Nil	New course		Entrepreneurship	Basic course helps better to understand society
	Science Elective - 1	BS	3	1	0	0	4	4	Nil	New course		Fundamental	Basic course to engineers must know.
21PH1008	Physics for Electronics Engineering	BS							Nil	New course		Employability	Basic course helps better to understand society
21PH1004	Solid State Physics	BS							Nil	New course		Employability	Basic course helps better employment
21PH2101	Quantum Mechanics for Engineers	BS							Nil	New course		Employability	Basic course helps better to understand society
	Science Elective - 2	BS	3	0	2	0	4	5	Nil	New course		Fundamental	Basic course to engineers must know.
21CY1101	Engineering Chemistry	BS							Nil	New course		Employability	Basic course helps better to

													understand society
21CY1003	Chemistry & Bio-Informatics for Engineers	BS							Nil	New course		Employability	Basic course helps better employment
21CY1004	Organic Electronics	BS							Nil	New course		Employability	Basic course helps better to understand society
21UC3105	Problem Solving Skills-I	BS	0	0	2	2	2	4	Nil	New course		Employability	Basic course helps better to understand society
21UC3206	Problem Solving Skills-II	BS	0	0	2	2	2	4	Nil	New course		Employability	Basic course helps better employment
21SC1101	Computational Thinking for Structured Design	ES	3	0	2	6	6	11	Nil	New course		Employability	Basic course helps better to understand society
20ME1103	Design Tools Workshop – I	ES	0	0	4	0	2	4	Nil	New course		Employability	Basic course helps better to understand society
21SC1209	Design Tools Workshop – II	ES	0	0	4	0	2	4	Nil	New course		Employability	Basic course helps better employment
21SC1202	Design of Data Structures	ES	3	0	2	4	5	9	20SC1101	New course		Employability	It is needed for Developing Software
21EC1101	Digital Logic & Processors	ES	3	0	2	0	4	5	Nil	New course		Employability	It is needed for Developing Software
20EC1202	Computer Organization & Architecture	ES	2	0	0	0	2	2	21EC1101	New course		Employability	Basic course helps better employment
21EC1203	Design of Basic Electronic Circuits	ES	3	0	0	0	3	3	Nil	New course		Employability	It is needed for Basic Electronics for Hardware
21EC2104	Electronic Devices & Circuits	PC	3	0	2	2	5	7	Nil	New course	Academic Peers o Include Hardware Based Skilling courses	Employability	Core course helps better employment
21EC2208	Analog and Digital Communication	PC	3	0	3	0	5	6	Nil	New course		Employability	Core course helps better employment
21IN2101	Processors and Controllers	PC	3	0	2	0	4	5	Nil	New course	Academic Peers o Include Hardware Based Skilling courses	Employability	Core course helps better employment
21EC2107	AI, ANN Tools and Applications	PC	3	0	0	0	3	3	Nil	New course	To Include courses on IOT Analytics	Employability	Core course helps better employment
21IN2102	Sensors and Actuators	PC	3	0	2	0	4	5	Nil	New course	Academic Peers o Include Hardware Based Skilling courses	Employability	Core course helps better employment
21IN2103	Data Science and Data Analytics	PC	3	0	2	0	4	5	Nil	New course	To Include courses on IOT Analytics	Employability	Core course helps better employment
21IN2201	Embedded Systems Design	PC	3	0	2	0	4	5	Nil	New course	Employers Feedback: • Required programming skills and hands-on training in embedded system	Employability	Core course helps better employment
21EC2210	Data Networks & Protocols	PC	3	0	2	0	4	5	Nil	New course		Employability	Core course helps better employment
21IN2202	IoT Principles & Architecture	PC	3	0	0	0	3	3	Nil	New course	Students requested to Lab related to Python	Employability	Core course helps better employment

											programming, Raspberry pi, etc		
21IN3101	Cloud Computing for IoT	PC	3	0	2	0	4	5	Nil	New course	To Include courses on IOT Analytics	Employability	Core course helps better employment
21IN3201	Internet Programming and Web Technologies	PC	3	0	2	0	4	5	Nil	New course		Employability	Core course helps better employment
	OOPS	PC	3	0	2	0	4	5	Nil	New course		Employability	Core course helps better employment
21IN3016	Wireless Ad-hoc Networks	FC	3	0	2	0	4	5	Nil	New course		Employability	Core course helps better employment
21IN3083	Advanced Robotics	PE	2	0	2	0	3	4	Nil	New course		Employability	Professional elective course helps better employment
21IN3084	Computer Vision & Applications	PE	2	0	2	0	3	4	Nil	New course		Employability	Professional elective course helps better employment
21IN3085	Human Machine Interface & Brain Machine Interface	PE	2	0	2	0	3	4	Nil	New course		Employability	Professional elective course helps better employment
21IN3091	AI Applications Design	PE	3	0	0	0	3	3	Nil	New course		Employability	Professional elective course helps better employment
21IN3084	Computer Vision & Applications	PE	2	0	0	4	3	6	Nil	New course		Employability	Professional elective course helps better employment
21IN3085	Human Machine Interface & Brain Machine Interface	PE	2	0	2	0	3	4	Nil	New course		Employability	Professional elective course helps better employment
21IN3094	Advanced Machine Learning, DNN & CNN	PE	2	0	2	0	3	4	Nil	New course		Employability	Professional elective course helps better employment
21IN3095	Automated Vehicles & Avionics	PE	2	0	2	0	3	4	Nil	New course		Employability	Professional elective course helps better employment
21IN3101	Speech Signal Processing	PE	3	0	0	0	3	3	Nil	New course		Employability	Professional elective course helps better
21IN3102	Computer Vision & Applications	PE	2	0	0	4	3	6	Nil	New course		Employability	Professional elective course helps better employment
21IN3103	Natural Language Processing & Applications	PE	2	0	2	0	3	4	Nil	New course		Employability	Professional elective course helps better employment
21IN3104	Big Data Analytics	PE	2	0	2	0	3	4	Nil	New course	To Include courses on IOT Analytics	Employability	Professional elective course helps better employment
21IN3105	Digital Twin Technologies	PE	2	0	2	0	3	4	Nil	New course	To Include courses on IOT Analytics	Employability	Professional elective course helps better
21IN3111	Big Data Analysis & Decision Making	PE	3	0	0	0	3	3	Nil	New course	To Include courses on IOT Analytics	Employability	Professional elective course helps better employment
21IN3112	Block Chain & Cyber Security	PE	2	0	0	4	3	6	Nil	New course	To Include courses on IOT Analytics	Employability	Professional elective course helps better employment
21IN3113	Cloud Computing Network Security	PE	2	0	2	0	3	4	Nil	New course		Employability	Professional elective course helps better

21IN3114	NLP & Sentiment Analysis	PE	2	0	2	0	3	4	Nil	New course		Employability	Professional elective course helps better employment
21IN3094	Advanced Machine Learning, DNN & CNN	PE	2	0	2	0	3	4	Nil	New course		Employability	Professional elective course helps better employment
21IN3121	TCP/IP & Other Protocol Suite	PE	3	0	0	0	3	3	Nil	New course		Employability	Professional elective course helps better employment
21IN3122	VoIP Systems & Broad Band Networks	PE	3	0	0	0	3	3	Nil	New course		Employability	Professional elective course helps better employment
21IN3123	5G Mobile, Wireless Technologies & IEEE 802 Standards	PE	3	0	0	0	3	3	Nil	New course		Employability	Professional elective course helps better employment
21IN3113	Cloud-Computing & Network Security / (Hardware Security)	PE	3	0	0	0	3	3	Nil	New course		Employability	Professional elective course helps better employment
21IN3125	IP Multimedia Sub-System & Emerging Technologies	PE	3	0	0	0	3	3	Nil	New course		Employability	Professional elective course helps better employment
21IE2040	Social Internship	PR	0	0	0	4	1	4	Nil	New course	Parents' Feedback: • Guidance in internship and project-based learning to be implemented • Discuss on this point in BOS and already as per Y21 Curriculum	Entrepreneurship	Project base course helps better
21IE3041	Technical Internship	PR	0	0	0	4	1	4	Nil	New course	Parents' Feedback: • Guidance in internship and project-based learning to be implemented • Discuss on this point in BOS and already as per Y21 Curriculum	Entrepreneurship	Project base course helps better
21IE4042	Industry Internship	PR	0	0	0	4	1	4	Nil	New course	Parents' Feedback: • Guidance in internship and project-based learning to be implemented • Discuss on this point in BOS and already as per Y21 Curriculum	Entrepreneurship	Project base course helps better
21IE2046	Project Based Learning -1 (Electronic System Design Workshop)	PR	0	0	0	6	2	6	Nil	New course		Entrepreneurship	Project base course helps better
21IE2047	Project based learning -2 (IoT Tools and Applications Workshop)	PR	0	0	0	6	2	6	Nil	New course		Entrepreneurship	Project base course helps better

21IE3043	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	New course		Entrepreneurship	Project base course helps better employment and Entrepreneurship
21IE3045	Mid Grad Capstone Project – II	PR	0	0	0	8	2	8	Nil	New course		Entrepreneurship	Project base course helps better employment and Entrepreneurship
21IE4048	Project	PR	0	0	0	16	4	16	Nil	New course		Entrepreneurship	Project base course helps better employment and Entrepreneurship
21IE4049	Project	PR	0	0	0	16	4	16	Nil	New course		Entrepreneurship	Project base course helps better employment and Entrepreneurship
21IE4050	Practice School	PR	0	0	0	16	4	16	Nil	New course		Entrepreneurship	Project base course helps better employment and Entrepreneurship
21IE4051	Internship -1	PR	0	0	0	16	4	16	Nil	New course		Entrepreneurship	Project base course helps better employment and Entrepreneurship
21IE4052	Internship 2		0	0	0	16	4	16	Nil	New course		Entrepreneurship	Project base course helps better employment and Entrepreneurship

Percentage of Syllabus Revision= 0%

Percentage of Courses focusing on Employability= 78/100=78%

Percentage of Courses focusing on Entrepreneurship= 17/100=1.7%

Percentage of Courses focusing on Skill Development or career advancement= 13/100=1.3%

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	20UC1101	Integrated Professional English	HSS	0	0	4	0	2	4	2				1			2						
2	20UC1202	English Proficiency	HSS	0	0	4	0	2	4	3			1	3	3								
3	21UC2103	Essential Skills for Employability	HSS	0	0	4	0	2	4	3	3	3											
4	21UC2204	Corporate Readiness Skills	HSS	0	0	4	0	2	4	3	2	3											
5	21UC0010	Universal Human Values & Professional Eth	HSS	2	0	0	0	2	2	3	1	3											
6	20UC0007	Indian Heritage and Culture	HSS	2	0	0	0	0	2	2	3	1											
7	20UC0008	Indian Constitution	HSS	2	0	0	0	0	2	1	2	1											
8	20UC0009	Ecology & Environment	HSS	2	0	0	0	0	2	3	3	3											
9	21UC0011	Gender Sensitization	HSS	2	0	0	0	2	2	3	1	2											
10	20MT1101	Mathematics for Computing	BS	2	2	0	2	5	6	1	3	2											
11	21MT2102	Mathematics for Engineers	BS	2	1	0	0	3	3	2	2	2											
	BS	Mathematics-3(Department Specific)	BS	3	0	0	0	3	3	2	2	1											
13	20UC1102	Design Thinking and Innovation-1	BS	1	0	0	4	2	5	3	1	1											
14	20UC1203	Design Thinking and Innovation-2	BS	1	0	0	4	2	5	1	2	2											
15		Science Elective - 1	BS	3	1	0	0	4	4	1	3	2											
	21PH1008	Physics for Electronics Engineering	BS							1	2	2											
	21PH1004	Solid State Physics	BS							3	2	1											
	21PH2101	Quantum Mechanics for Engineers	BS							3	1	1											

16		Science Elective - 2	BS	3	0	2	0	4	5	2	1	1											
	21CY1101	Engineering Chemistry	BS							1	2	1											
	21CY1003	Chemistry & Bio-Informatics for Engineers	BS							2	3	3											
	21CY1004	Organic Electronics	BS							1	2	1											
17	21UC3105	Problem Solving Skills-I	BS	0	0	2	2	2	4	3	2	1											
18	21UC3206	Problem Solving Skills-II	BS	0	0	2	2	2	4	2	3	1											
19	21SC1101	Computational Thinking for Structured Desi	ES	3	0	2	6	6	11	1	3	2	2										
20	20ME1103	Design Tools Workshop – I	ES	0	0	4	0	2	4	2	2	1	3										
21	21SC1209	Design Tools Workshop – II	ES	0	0	4	0	2	4	2	2	3	1										
22	21SC1202	Design of Data Structures	ES	3	0	2	4	5	9	1	1	1	1										
23	21EC1101	Digital Logic & Processors	ES	3	0	2	0	4	5	1	3	2	2										
24	20EC1202	Computer Organization & Architecture	ES	2	0	0	0	2	2	1	1	1	1										
25	21EC1203	Design of Basic Electronic Circuits	ES	3	0	0	0	3	3	2	1	1	1										
26	21EC2104	Electronic Devices & Circuits	PC	3	0	2	2	5	7	1				2	3								1
27	21EC2208	Analog and Digital Communication	PC	3	0	3	0	5	6	3					1	3							3
28	21IN2101	Processors and Controllers	PC	3	0	2	0	4	5	2	2	2						2					2
29	21EC2107	AI, ANN Tools and Applications	PC	3	0	0	0	3	3	2							3	3					1
30	21IN2102	Sensors and Actuators	PC	3	0	2	0	4	5	2							2	2				1	1
31	21IN2201	Embedded Systems Design	PC	3	0	2	0	4	5	1							1						3
32	21EC2210	Data Networks & Protocols	PC	3	0	2	0	4	5	2	1								1				2
33	21IN2202	IoT Principles & Architecture	PC	3	0	0	0	3	3	2								2					2
34	21IN2203	Data Science and Data Analytics	PC	3	0	2	0	4	5	1							2	1					2

35	21IN3101	Cloud Computing for IoT	PC	3	0	2	0	4	5	3							1	2					3
37	21IN3201	Internet Programming and Web Technologie	PC	3	0	2	0	4	5	1							3	1					1
38		OOPS	PC	3	0	2	0	4	5	1							3	1					1
39	FC-1	Flexi Core -1	FC	3	0	2	0	4	5	2							1	1					3
40	FC-2	Flexi Core -2	FC	3	0	2	0	4	5	1							3	2					2
41	PE-1	Professional Elective – 1	PE	3	0	0	0	3	3	2					3							3	2
42	PE-2	Professional Elective – 2	PE	2	0	0	4	3	6	1					3							2	1
43	PE-3	Professional Elective – 3	PE	2	0	2	0	3	4	1					3							1	3
44	PE-4	Professional Elective – 4	PE	2	0	2	0	3	4	1					2							2	3
45	PE-5	Professional Elective – 5	PE	2	0	2	0	3	4	1					3							1	3
46	OE	Open Elective – 1	OE	3	0	0	0	3	3	2					2							2	2
47	OE	Open Elective – 2	OE	3	0	0	0	3	3	1					2							3	2
48	OE	Open Elective – 3	OE	3	0	0	0	3	3	2					3							3	3
49	OE	Management Elective(OE-4)	OE	3	0	0	0	3	3	2					2							3	1
50	OE	Foreign Language Elective(OE-5)	OE	2	0	0	0	2	2	3					3							3	3
51	21IE2040	Social Internship	PR	0	0	0	4	1	4	3					2							2	2
52	21IE3041	Technical Internship	PR	0	0	0	4	1	4	2					1							2	3
53	21IE4042	Industry Internship	PR	0	0	0	4	1	4	1					1							3	2
54	21IE2046	Project Based Learning -1 (Electronic Syste	PR	0	0	0	6	2	6	2					1							3	1
55	21IE2047	Project based learning -2 (IoT Tools and Ap	PR	0	0	0	6	2	6	1	3	1							1				2
56	21IE3043	Term paper	PR	0	0	0	4	1	4	3	2	2							3				2
57	21IE3044	Mid Grad Capstone Project – I	PR	0	0	0	8	2	8	1	2	3							1				2

58	21IE3045	Mid Grad Capstone Project – II	PR	0	0	0	8	2	8	2	1	3							1				3
59	21IE4048/21	Project / Internship -1/Practice School	PR	0	0	0	#	4	16	3	2	1							1				1
60	21IE4049/21	Project / Internship 2/Practice School	PR	0	0	0	#	4	16	2	1	1							1				1

List of Professional Electives for 2021-22 admitted batch of B.Tech IoT									
Specialization Name: Data Science & Analytics									
Sl No	**Course Code**	**Course Title**	**Type**	**L**	**T**	**P**	**S**	**Cr**	**CH**
1	21CS3051R	DATA VISUALIZATION TECHNIQUES	**PE**	2	0	2	4	4	8
2	21CS3052R	DATA WAREHOUSING AND MINING	**PE**	2	0	2	0	3	4
3	21CS3275R	BIG DATA ANALYTICS	**PE**	2	0	2	4	4	8
4	21CS3276R	BIG DATA OPTIMIZATION	**PE**	2	0	2	0	3	4
5	21CS3279R	ADVANCED DATABASES	**PE**	3	0	0	0	3	3
Specialization Name:IoT analytics									
1	21IN3121	INDUSTRIAL IOT	**PE**	2	0	2	4	4	8
2	21CS3253R	EDGE COMPUTING	**PE**	2	0	2	0	3	4
3	21AD3104R	DEEP LEARNING	**PE**	2	0	2	4	4	8
4	21EL3216	BIG DATA ANALYTICS	**PE**	2	0	2	0	3	4
5	21IN3224	DATA ANALYTICS AND VISUALIZATION	**PE**	3	0	0	0	3	3
Specialization Name: Artificial Intelligence & Intelligent Process Automation									
1	21AD3105	SOFT COMPUTING	**PE**	2	0	2	4	4	8
2	21CS3026R	ARTIFICIAL NEURAL NETWORKS	**PE**	2	0	2	0	3	4
3	21AD3104R	DEEP LEARNING	**PE**	2	0	2	4	4	8
4	21CS3271R	PERCEPTION AND COMPUTER VISION	**PE**	2	0	2	0	3	4
5	21AD3202	NATURAL LANGUAGE PROCESSING	**PE**	3	0	0	0	3	3

List of OPEN Electives,Manegement Electives and Foreign Language Courses for 2021-22 admitted batch of B.TECH									
Sl No	**Course Code**	**Course Title**	**L**	**T**	**P**	**S**	**Cr**	**CH**	**Pre-requisite**
1	21BT40A1	IPR & Patent Laws	3	0	0	0	3	3	NIL
2	21BT40A9	Biomaterials	3	0	0	0	3	3	NIL
3	21BT40C5	Computer Aided Drug Design	3	0	0	0	3	3	NIL
4	21CE40A2	Environmental Pollution Control Methods	3	0	0	0	3	3	NIL
5	21CE40A3	Solid and Hazardous waste management	3	0	0	0	3	3	NIL
6	21CE40A4	Remote Sensing & GIS	3	0	0	0	3	3	NIL
7	21CE40A5	Disaster Management	3	0	0	0	3	3	NIL
8	21CS40A7	Fundamentals of Software Engineering	3	0	0	0	3	3	NIL
9	21CS40A6	Fundamentals of DBMS	3	0	0	0	3	3	NIL
10	21CS40A8	Fundamentals of IT	3	0	0	0	3	3	NIL
11	20ME40B4	Robotics	3	0	0	0	3	3	NIL
12	20ME40B5	Mechatronics	3	0	0	0	3	3	NIL

13	20ME40B6	Operations Research	3	0	0	0	3	3	NIL
14	20ME40B7	Hybrid Electric vehicles	3	0	0	0	3	3	NIL
15	20ME40B8	Industry 4.0	3	0	0	0	3	3	NIL
16	20ME40B9	Industrial Automation	3	0	0	0	3	3	NIL
17	20ME40C1	Logistics & Supply chain management	3	0	0	0	3	3	NIL
18	20ME40C2	Total Quality Management	3	0	0	0	3	3	NIL
19	20ME40C3	Smart Mobility	3	0	0	0	3	3	NIL
20	20ME40C4	Managerial Economics for Engineers	3	0	0	0	3	3	NIL
21	21EL40B1	Linux Programming	3	0	0	0	3	3	NIL
22	21EL40B2	E-Commerce	3	0	0	0	3	3	NIL
23	21GN40C1	Self Development	3	0	0	0	3	3	NIL
24	21GN40C3	Emotional Intelligence	3	0	0	0	3	3	NIL
25	21GN40C5	Behavioural Sciences	3	0	0	0	3	3	NIL
26	21GN40D1	National Caded Cops-1	2	0	2	0	3	4	NCC
27	21GN40D2	National Caded Cops-2	2	0	2	0	3	4	NCC
28	21GN40D3	National Caded Cops-3	2	0	2	0	3	4	NCC
29	21GN40D4	National Service Scheme-1	2	0	2	0	3	4	NSS
30	21GN40D5	National Service Scheme-2	2	0	2	0	3	4	NSS
31	21GN40D6	National Service Scheme-3	2	0	2	0	3	4	NSS
32	21MB4056	Resources Safety and Quality Management	2	0	0	0	2	2	NIL
33	21MB4058	Construction project Management	2	0	0	0	2	2	NIL
34	21MB4051	Paradigms in Management Thought	3	0	0	0	3	3	NIL
35	21MB4052	Indian Economy	3	0	0	0	3	3	NIL
36	21MB4053	Managing Personal Finances	3	0	0	0	3	3	NIL
37	21MB4054	Basics of Marketing for Engineers	3	0	0	0	3	3	NIL
38	21MB4055	Organization Management	3	0	0	0	3	3	NIL
39	21MB4057	Economics for Engineers	3	0	0	0	3	3	NIL

SYLLABUS OF COURSES UNDER

HUMANITIES AND SOCIAL SCIENCES

20UC1101 – INTEGRATED PROFESSIONAL ENGLISH

L-T-P-S : 0-0-4-0
Credits 2
Contact Hours 4
Pre-requisite : NIL

Mapping of Course Outcomes with PO/PSO:

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the concepts of grammar to improve communication, reading, and writing skills	PO10	2
CO2	Demonstrate required knowledge over Dos and Don'ts of speaking in the corporate context. Demonstrate ability to face formal situations / interactions.	PO9	2
CO3	Understand the varieties of reading and comprehend the tone and style of the author. Skim and scan effectively and appreciate rhetorical devices	PO9	2
CO4	Apply the concepts of writing to draft corporate letters, emails, and memos	PO10	3

Course Objective:

- To express themselves in English with greater fluency, accuracy and confidence
- To communicate with others in practical, business-oriented situations
- To handle variety of business contexts, from negotiating, to using telephone, making presentation.

Syllabus:

COMPETENCY: 1

A) Basic Grammar - Countable and uncountable nouns, present simple and continuous, past simple and continuous – classroom practice – Understand and interpret Texts and work place situations B)Structural Pattern - Present continuous for future arrangements State verbs, Regular and irregular verbs, Voice, Modal verbs – Reporting on going tasks in the corporate world C)Descriptive and Qualitative Patterns: Adjectives and Adverbs classroom practice) Time Expressions, Comparatives and superlatives, Pronouns, Conditionals, Phrases and clauses (Including Relative)

COMPETENCY: 2

a) Formal contexts: Being a PA, describing changes in a company Taking orders over the phone
b) Listening & Speaking: Participate in conversation with proper contextual language markers and turn taking. Classroom practice - Presenting context, reason, problem – Case analysis (short).

c) Body Language: Dos and Don'ts of one to one interaction, Telephone interaction Video/ web conferencing. Culture specific practices.
d) Work Etiquette- situation, ambience, team skills, time management and leadership ability.

COMPETENCY: 3

a) Understand and assimilate main ideas and specific details. (250-300 words text of moderate difficulty)
b) Read for general understanding, interpreting, factual or specific information, for grammatical accuracy and information transfer.
c) Understand the general meaning of corporate context and office correspondence.
d) Understand short reports of predictable nature.

COMPETENCY: 4

a) Internal Correspondence. Making notes on routine matters, such as, taking/ placing orders
b) Emails: Types of emails, salutations, vocabulary used in formal and informal (Including beginnings and endings)
c) Writing straight-forward, routine letters of factual nature

Reference Books:

1. Business Benchmark Book- Preliminary- 2nd edition Cambridge Press 2019.
2. Business Benchmark Book- Pre Intermediate to Intermediate- 2nd edition Cambridge Press 2019

Web Links:

1. https://www.cambridgeenglish.org/
2. https://learnenglish.britishcouncil.org,https://apps.apple.com/in/app/bec-from-cambridge/id1351207688https://play.google.com/store/apps/details?id=com.liqvid.bec

20UC1202 – ENGLISH PROFICIENCY

L-T-P-S : 0-0-4-0
Credits 2
Contact Hours 4
Pre-requisite : NIL

Mapping of Course Outcomes with PO/PSO:

CO#	Course Outcome	PO/PSO	BTL
CO1	Demonstrating different interpersonal skills for employability	PO 8	2
CO2	Distinguishing business essential skills	PO9	2
CO3	Classifying social media and corporate communication skills	PO 12	2
CO4	Applying analytical thinking skills	PO 12	3

Course Objective:

- To communicate with others in practical, business-oriented situations
- To express themselves in English with greater fluency, accuracy, and confidence
- To handle themselves in English in a variety of business contexts, from negotiating, to using the telephone, to making presentations, to socializing

Syllabus:

COMPETENCY 1:

Job description- Advice on job applications – getting the right job- importance of doing a job interview -Launching and promoting a new product-Persuasive and negotiation skills -Types of emails: giving information, making an enquiry, answering enquiries -Marketing Report

COMPETENCY 2:

Becoming an entrepreneur- buying a franchise- franchising start -up -presenting business idea-signaling parts of presentation - arranging business travel- business conferences and meetings-spending sales budget

COMPETENCY 3:

Social media and business- introducing company using social media- staff survey- survey report-off-shoring and outsourcing- customer satisfaction and loyalty- communication with customers-corresponding with customers- business across cultures

COMPETENCY 4:

Underlying assumptions, finding the conclusions, Argument strengthening, Argument weakening, finding the fallacies

Reference Books:

1. Business Benchmark Book- Upper Intermediate - 2nd edition Cambridge Press 2019.
2. Business Benchmark Book- Pre-Intermediate to Intermediate- 2nd edition Cambridge Press 2019.

3. Business Benchmark Book-Upper Intermediate: 2nd Edition Cambridge Press, 2019
4. Pillai, Sabina, et.al, Soft Skills and Employability Skills, New Delhi: CUP. 2018. Print.
5. Peterson, Reading Skill, New York: Peterson. 2007
6. Verbal and Non-Verbal Reasoning, R. S. Aggarwal, S Chand Publications.
7. R S Agarwal, S Chand, _A modern approach to Logical reasoning‘
8. GRE Barron‘s, Mc Graw Hills
9. Logical Reasoning, Edgar Thorpe, Pearson Publications

Web Links:

1. https://www.cambridgeenglish.org/
2. https://learnenglish.britishcouncil.org,
3. https://apps.apple.com/in/app/bec-from-cambridge/id1351207688
4. https://play.google.com/store/apps/details?id=com.liqvid.bec
5. https://www.cambridgeenglish.org/exams-and-tests/business-preliminary/exam-format/
6. https://www.cambridgeenglish.org/exams-and-tests/business-preliminary/preparation/
7. www.bbclearningenglish.com
8. www.indiabix.com
9. www.freshersworld.com
10. www.managementparadise.com
11. www.coolavenues.com
12. www.indiaedu.com/entrance-exams/cat.../books.html
13. www.mycatprep.com

20UC2103 – PROFESSIONAL COMMUNICATION SKILLS

L-T-P-S : 0-0-4-0
Credits 2
Contact Hours 4
Pre-requisite : NIL

Mapping of Course Outcomes with PO/PSO:

CO#	Course Outcome	PO/PSO	BTL
CO1	Developing critical and analytical reading skills	PO12	2
CO2	Discovering different interpersonal skills to develop people skills	PO12	2
CO3	To enhance the problem-solving skills of the students through the concepts of Simple Equations, Ratio, Proportion &Variation, Percentages, Profit & Loss, Averages, Allegations, Simple & Compound Interest.	PO5	2
CO4	Apply diagrammatic representation of the given data to find the possible outcomes in the topics of Deductions, Cubes, Venn Diagrams and Arrangements	PO2	2

Course Objective:

- To develop comprehending skills
- To discover core thinking skills for problem solving
- To interpret logical thinking skills for better thinking ability

Syllabus:

COMPETENCY-1: Verbal Ability

- Reading for Gist & Summarizing
- Reading for Information & Inference
- Critical Reading
- Analytical Reading
- Logical Reading

COMPETENCY-2: Critical Thinking Skills

- Core Thinking Skills
- Categories of Thinking
- Problem Solving
- Decision Making

COMPETENCY -3: Quantitative Aptitude:

- Simple Equations, Ratio

- Proportion &Variation
- Percentages
- Profit & Loss
- Averages
- Alligations
- Simple & Compound Interest

COMPETENCY -4: Reasoning

- Deductions
- Cubes
- Venn Diagrams
- Linear arrangements
- Circular arrangements
- Ordering and Sequencing
- Selections

Reference Books:

1. Soft Skills by Dr. Alex S CHAND Publications
2. Objective English by Showarick Thrope, Pearson
3. Quantitative Aptitude by R S Agarwal, S CHAND Publications.
4. Quantitative Aptitude by Abhijit Guha, Mc Graw Hills.
5. Verbal and Non-Verbal Reasoning, R. S. Aggarwal, Schand Publications.
6. R S Agarwal, S.Chand , _A modern approach to Logical reasoning‘ GL Barrons, McGraw Hills

Web References / MOOCs:

1. Online resource: cssklu.bolgspot.com
2. www.indiabix.com
3. www.freshersworld.com
4. www.managementparadise.com
5. www.coolavenues.com
6. www.indiaedu.com/entrance-exams/cat.../books.html
7. www.mycatprep.com

20UC2204 – CORPORATE COMMUNICATION SKILLS

L-T-P-S : 0-0-4-0
Credits 2
Contact Hours 4
Pre-requisite : NIL

Mapping of Course Outcomes with PO/PSO:

CO#	Course Outcome	PO/PSO	BTL
CO1	To distinguish product and process and quote them in speaking and writing activities	PO12	2
CO2	To apply interpersonal skills	PO12	2
CO3	To enhance the problem-solving skills of the students through the concepts of Numbers, Time & Work, Time & Distance, Permutations & Combinations, Probability which will enable them to improve their problem solving abilities which in turn improve their programming skills.	PO 5	2
CO4	To apply known facts to find the unknowns in the topics Clocks, Calendars, Binary Logic. Identify the rule set by analyzing the given observations in the topics Series, Analogy, Odd Man, Coding-Decoding	PO2	2

Course Objective:

- To demonstrate speaking, and writing skills
- To apply interpersonal skills
- To develop logical thinking skills for better thinking ability

Syllabus:

COMPETENCY-1: Verbal Ability

Speaking from the script, Product & Process Description, Presenting Arguments, Paragraph writing.

COMPETENCY-2: Soft Skills

Goal Setting, Team Building, Leadership, Time Management, Managing Stress

COMPETENCY -3: Quantitative Aptitude:

Numbers, Time & Work, Time & Distance, Permutations & Combinations, Probability

COMPETENCY -4: Reasoning

Clocks, Calendars, Binary logic, Number and letter series, Number and letter analogy, Finding the odd man, Coding-Decoding, Direction sense

Reference Books:

1. Soft Skills by Dr. Alex S CHAND Publications
2. Objective English by Showarick Thrope, Pearson
3. Quantitative Aptitude by R S Agarwal, S CHAND Publications.
4. Quantitative Aptitude by Abhijit Guha, Mc Graw Hills.
5. Verbal and Non-Verbal Reasoning, R. S. Aggarwal, Schand Publications.
6. R S Agarwal, S.Chand , _A modern approach to Logical reasoning‘ GL Barrons, McGraw Hills.

Web References / MOOCs:

1. Online resource: cssklu.bolgspot.com
2. www.indiabix.com
3. www.freshersworld.com
4. www.managementparadise.com
5. www.coolavenues.com
6. www.indiaedu.com/entrance-exams/cat.../books.html
7. www.mycatprep.com

20UC3005 – APTITUDE BUILDER-I

L-T-P-S : 0-0-4-0
Credits 2
Contact Hours 4
Pre-requisite : NIL

Mapping of Course Outcomes with PO/PSO:

CO#	Course Outcome	PO/PSO	BTL
CO1	To discuss and interpret English language skills necessary for placements	PO12	2
CO2	To demonstrate skills to get selected in interviews and retain job	PO12	2
CO3	To enhance the problem-solving skills of the students through the concepts of Mensuration, Quadratic Equations & Inequalities, Progressions, Logarithms, Data Interpretation, Data Sufficiency which will enable them to improve their problem-solving abilities which in turn improve their programming skills.	PO5	2
CO4	To apply deductive logic to solve questions in Connectives, Blood relations, Ranking and time sequence, Symbols and notations. Apply principles of reflection and rotation to solve picture puzzles.	PO2	2

Course Objective:

- To identify different components of verbal ability and interview skills
- To apply the skills acquired in the placement tests to succeed.
- To develop logical reasoning for better thinking ability

Syllabus:

COMPETENCY-1:

a) Verbal Ability: Sentence Completion, Idioms & Phrases, One Word Substitutes, Sentence Improvement, Sentence Equivalence, Analogies

b) Life Skills: Attitude for Success, Connecting with People, Employment Communication (CV & Interview), Workplace Etiquette

COMPETENCY-2:

a) Attitude for Success: Stimulus and Response, Choosing the Response, Determinisms, Changing the attitude for success, Proactive and reactive Attitude

b) Connecting with People: Empathy, Assertiveness, Saying what you want to say, Saying what you do not want to say – saying ‗No'

COMPETENCY-3: Quantitative Aptitude

Mensuration, Quadratic Equations & Inequalities, Progressions, Logarithms, Data Interpretation,Data Sufficiency

COMPETENCY-4: Reasoning

Connectives, Blood relations, Ranking and time sequence, Symbols and notations, Non-verbal reasoning (Picture puzzles), Data sufficiency

Reference Books:

1. Soft Skills by Dr. Alex S CHAND Publications
2. Objective English by Showarick Thrope, Pearson
3. Quantitative Aptitude by R S Agarwal, S CHAND Publications.
4. Quantitative Aptitude by Abhijit Guha, Mc Graw Hills.
5. Verbal and Non-Verbal Reasoning, R. S. Aggarwal, Schand Publications.
6. R S Agarwal, S.Chand , _A modern approach to Logical reasoning‘ GL Barrons, McGraw Hills.

Web References / MOOCs:

1. Online resource: cssklu.bolgspot.com
2. www.indiabix.com
3. www.freshersworld.com
4. www.managementparadise.com
5. www.coolavenues.com
6. www.indiaedu.com/entrance-exams/cat.../books.html
7. www.mycatprep.com

20UC3006 – APTITUDE BUILDER-II

L-T-P-S : 0-0-4-0
Credits 2
Contact Hours 4
Pre-requisite : NIL

Mapping of Course Outcomes with PO/PSO:

CO#	Course Outcome	PO/PSO	BTL
CO1	Apply the strategies and techniques for conversations in different contexts. Analyze the different parameters and formats of written technical communication and apply in everyday work and life.	PO8, PO10	3
CO2	Analyze the concepts of critical and analytical reading skills. Apply the strategies and techniques learnt in handling interviews in different contexts.	PO8, PO10	3
CO3	Apply the concepts of Ratio & Proportion, Percentages, Profit &Loss, Simple & Compound Interest	PO1, PO5	3
CO4	Analyze the series of numbers or letters to predict the next number in the series or to find the analogy. Analyze the data to find the codes in the process of encoding and decoding. Apply the given set of conditions to select a team from a group of members.	PO1	4

Course Objective:

- To identify different components of verbal ability and interview skills
- To apply the skills acquired in the placement tests to succeed.
- To develop logical reasoning for better thinking ability

Syllabus:

Critical Reading: Reading to Identify the Theme**,** Reading to Identify the Central Idea**;** Reading to Identify the Tone, Reading to Identify Writer's Attitude, Reading to Identify Parallel Ideas, Reading to Identify Logical Conclusions.

Writing Skills: Note- making and Note- taking, Report Writing.

Presentation Skills- Preparing for the Presentation, Audience Analysis, Processing Information, Ice-breakers, Quotations, Presentation Structure**,** Say what you want to say- Say it, Say what you have said to say**,** Preparing for Question Hour, Funnel Effect and How to Overcome it.

Trinity Guild Hall - Communication Skills - Graded Evaluation and Testing-1-8 grades

Quantitative Aptitude: Ratio and Proportion, Percentages, Profit and Loss, Simple Interest and Compound Interest

Reasoning: Number and Letter Series, Number and Letter Analogy, Coding and decoding, Odd man out.

Selections

Reference Books:

1. Dr. Meenakshi Raman and Dr. SangeethaSarma: *Technical Communication*.Oxford University Press: Delhi.2016.
2. M. Ashraf Rizvi: *Effective Technical Communication.* New Delhi: McGraw Hill Education(India) Private Limited

20UC0007 – INDIAN HERITAGE AND CULTURE

L-T-P-S : 2-0-0-0
Credits : NIL
Contact Hours : 2 Pre-
requisite : NIL

Mapping of Course Outcomes with PO/PSO:

CO#	Course Outcome	PO/PSO	BTL
CO1	To familiarize with various aspects of the culture and heritage of India through ages.	PO1	1
CO2	To acquaint with the contributions of Indians in the areas of languages and literature, religion and philosophy	PO1	1
CO3	To understand the Social structure and the spread of Indian culture abroad	PO1	1
CO4	To know the development of Science and Technology in India through ages and to appreciate the contributions of some of the greatIndian scientists	PO1	1

Syllabus:

Introduction-Concept of Culture-Culture and Civilization-General Characteristics of Indian Culture-Importance of Culture-Unity in Diversity

History and Culture through the Ages – Fundamental Unity of Harappan and Vedic Culture – Jainism and Buddhism-Mauryan Period-Post-Mauryan Period-Gupta Period-Pallavas and Cholas

Advent of Islam in India-Islam and Sufism-Islamic Art and Architecture-Bhakti Movement-Vijayanagar Period-Art and Architecture and Literature

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:

1. Facets of Indian Culture- Spectrum Publications
2. Ancient India: National Council of Educational Research and Training
3. Medieval India: Part I & Part II: National Council of Educational Research and Training.
4. Modern India: National Council of Educational Research and Training.
5. An Advance History of India: R.C. Majumdar, H.C. Raychaudhuri & KalikinkarDatt: Macmillan India Ltd.
6. The Wonder that was India : A.L.Bhasham

20UC0008 – INDIAN CONSTITUTION

L-T-P-S : 2-0-0-0
Credits : NIL
Contact Hours : 2 Pre-
requisite : NIL

Mapping of Course Outcomes with PO/PSO:

CO#	Course Outcome	PO/PSO	BTL
CO1	To understand Constitutional development after Independence	PO12	2
CO2	To learn the fundamental features of the Indian Constitution	PO12	2
CO3	To get a brief idea of the powers and functions of Union and State Governments	PO12	2
CO4	To understand the basics of working of Indian Judiciary and the Election Commission	PO12	2

Syllabus:

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. The Constituent Assembly of India.
Basic features of the Indian Constitution: the Preamble, Fundamental Rights, Directive Principles of State Policy – Fundamental Duties

Government of the Union : 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 LokSabha and the RajyaSabha, Composition, powers and functions – therole 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.
The Indian Judicial System: the Supreme Court and the High Courts – 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:

1. Indian Polity‘ by Laxmikanth
2. Indian Administration‘ by SubhashKashyap
3. Indian Constitution‘ by D.D. Basu
4. Indian Administration‘ by Avasti and Avasti
5. Constitutional Law of India‘ by Seervai H.M.

20UC0009 – ECOLOGY AND ENVIRONMENT

L-T-P-S : 2-0-0-0
Credits : NIL
Contact Hours 2
Pre-requisite : NIL

Mapping of Course Outcomes with PO/PSO:

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the importance of Environmental education and conservation of natural resources.	PO6	1
CO2	Understand the importance of ecosystems and biodiversity.	PO12	1
CO3	Apply the environmental science knowledge on solid waste management, disaster management and EIA process.	PO6	3
CO4	Understand the importance of Environmental education and conservation of natural resources.	PO6	1

Syllabus:

The Multidisciplinary nature of Environmental Studies, Natural Resources, Forest resources, Mining and its impact on environment

Water resources, Mineral resources, Energy resources, Land resources, Soil erosion, Ecosystems, Biodiversity and its Conservation Environnemental Pollution

Soil waste management, Electronic waste management, biomedical waste management Disaster management, Environmental Legislation Environmental Impact Assessment Process.

Text Books:

1. Anubha Kaushik, C.P.Kaushik, –Environmental Studies‖, New Age International, (2007).
2. Benny Joseph, –Environmental Studies‖, Tata McGraw-Hill companies, New Delhi, (2009).

20UC0010 – UNIVERSAL HUMAN VALUES & PROFESSIONAL ETHICS

L-T-P-S : 2-0-0-0
Credits 2
Contact Hours 3
Pre-requisite : NIL

Mapping of Course Outcomes with PO/PSO:

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand and identify the basic aspiration of human beings	PO8	2
CO2	Envisage the roadmap to fulfill the basic aspiration of human beings.	PO8	4
CO3	Analyze the profession and his role in this existence.	PO8	4

Syllabus:

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 fulfill the Basic Human Aspirations.

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.

Harmony in the Family and Society: Harmony in the Family - the Basic Unit of HumanInteraction, Values in Human-to-Human Relationships, _Trust‘ – the Foundational Value in Relationships, _Respect‘ – as the Right Evaluation, Understand Harmony in the Society, Vision forthe Universal Human Order.

Harmony in the Nature (Existence): Understand Harmony in the Nature, Interconnectedness, Self-regulation and Mutual Fulfillment among the Four Orders of Nature, Realizing _Existence is Co-existence‘ at All Levels, The Holistic Perception of Harmony in Existence.

Implications of the Right Understanding – a Look at Professional Ethics: Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics, Holistic Technologies, Production Systems and Management Models - Typical Case Studies, Strategies for Transition towards Value-based Life and Profession.

Text Books:

1. R R Gaur, R Sangal and G P Bagaria, ―A Foundation Course in Human Values and Professional Ethics‖, 1st Edition, Excel Books.

20UC0011 – ENTREPRENEURSHIP

L-T-P-S : 2-0-0-0
Credits 2
Contact Hours 3
Pre-requisite : NIL

Mapping of Course Outcomes with PO/PSO:

CO#	Course Outcome	PO/PSO	BTL
CO1	Analyze the business environment in order to identify business opportunities,	PO11, PO12	4
CO2	Identify the elements of success of entrepreneurial ventures	PO11, PO12	2
CO3	Consider the legal and financial conditions for starting a business venture	PO11, PO12	2
CO4	Evaluate the effectiveness of different entrepreneurial strategies	PO11, PO12	4

Syllabus:

Conceptual definition of entrepreneurs and entrepreneurship, Entrepreneurship in economic theory,Historical development of entrepreneurship, Entrepreneurial practice, The importance of small business, Entrepreneurial economy, Entrepreneurship and Economic Development, Type of Entrepreneurship, Entrepreneur and small business, Features and types of businesses and entrepreneurs, Sources of business ideas, The role of entrepreneurship in economic development, Terms of entrepreneurship, Innovation and entrepreneurship, Entrepreneurship and small business, The life cycle of a small company, Small business sector in Croatia, Forms of entrepreneurial organization, Sources of capital, Entrepreneurial process, Entrepreneurial strategies. Starting a new company, Buying an existing business, Franchising, Family business. Entrepreneurial project: an entrepreneurial venture and entrepreneurial development chain.

Text Books:

1. ‑How to think like an entrepreneur‖ by Philip Delves Broughton
2. ‑Teaching Entrepreneurship: A Practice-Based Approach‖ by Heidi M. Neck

SYLLABUS OF COURSES UNDER

BASIC SCIENCES COURSES

20MT1101 - 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. **Modeling 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.

Text books:

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

21MT2102- MATHEMATICS FOR ENGINEERS

L-T-P-S: 2-1-0-0 **Credits: 3** **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

21UC1203 - DESIGN THINKING AND INNOVATION

L-T-P-S: 1-0-0-4 **Credits: 2** **Pre-requisite: NIL**

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

CO#	Course Outcome (CO)	PO/PSO	BTL
CO1	Understand the importance of Design thinking process for contextualized problems	PO2,PO6	2
CO2	Analyze, define, and ideate for solutions	PO7,PO3	4
CO3	Develop and test the prototype made	PO5,PO7	3
CO4	Explore the fundamentals of entrepreneurship skills for transforming the challenge into an opportunity	PO5,PO8	2

Syllabus

Design thinking an overview, Design Thinking for Contextualized Problem-Solving: Problem Selection/Definition Need for Cultural Relevance (Time, Space, and Environment). Empathy: definition, Empathic research: framing interview questions, focus groups, procedure to conduct skilled interviews, Insights from Empathetic research, Define: Developing user personas, nuggets from insights, laying customer journey maps, POV statements and POV questions to define user needs. Ideate: Techniques to generate shortlist and evaluate Ideas: Rapid Estimation form and Solution concept form. Prototyping and Testing: Products vs. Services, Rough Prototypes, Testing Techniques, User Experience High-Fidelity Prototypes. Entrepreneurial Innovation: Innovation Management, Business Model Basics, Financial Estimation, Pitch Decks, IPR Considerations.

Reference books

1. Michael Lewrick, Patrick Link & Larry Leifer: The Design Thinking *Play Book.* Wiley Press: 2018.
2. Design Thinking for Innovation: Research and Practice – Walter Brenner and FalkUeber nickel
3. Different Thinking: Creative Strategies for developing the innovative business 01 – Peter Kreuz and Anja Foerster
4. Design Thinking: Integrating Innovation, Customer Experience and Brand Value –Thomas Lockwood
5. Building Smart Cities: Analytics, ICT, and Design Thinking – Carol L. Stimmel

Course Code: 21MT3101 Course Title: **Probability and Statistics**

L-T-P-S: 2-0-2-0 Credits:3 Prerequisite: NIL

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

CO No.	Course out come	PO	BTL
1	understand the terminologies of basic probability, two types of random variables and their probability functions	1	2
2	observe and analyze the behavior of various discrete and continuous probability distributions	1	4
3	understand the central tendency, correlation, and correlation coefficient and regression	2	2
4	apply the statistics for testing the significance of the given large and small sample data by using t- test, F- test and Chi-square test	2	3

Basic Probability: Experiment, definition of probability, conditional probability, independent events, Bayes' rule, Bernoulli trials, Random variables, discrete random variable, probability mass function, continuous random variable, probability density function, cumulative distribution function, properties of cumulative distribution function, Two dimensional random variables and their distribution functions, Marginal probability function, Independent random variables.

Some special Probability Distributions: Binomial distribution, Poisson distribution, Poisson approximation to the binomial distribution, Normal, Exponential and Gamma densities, Evaluation of statistical parameters for these distributions.

Basic Statistics: Measure of central tendency: Moments, Expectation, dispersion, skewness, kurtosis, expected value of two-dimensional random variable, Linear Correlation, correlation coefficient, rank correlation coefficient, Regression, Bounds on probability, Chebyshev's Inequality

Applied Statistics: Formation of Hypothesis, Test of significance: large sample test for single proportion, Difference of proportions, Single mean, Difference of means, and Difference of standard deviations. Test of significance for small samples: t- Test for single mean, difference of means, t-test for correlation coefficients, F- test for ratio of variances, Chi-square test for goodness of fit and independence of attributes

Reference Books:

1. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall.
2. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India.
3. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, Wiley.
4. D. C. Montgomery and G. C. Runger, Applied Statistics and Probability for Engineers, Wiley.
5. J. L. Devore, Probability and Statistics for Engineering and the Sciences, Cengage Learning.

- List of Open-Source Software/learning website: MIT Open courseware. NPTEL.

Software Tool: R programming

21CY1001 - ENGINEERING CHEMISTRY

L-T-P-S: 3-0-2-0 Credits: 4 Pre-requisite: Nil

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

CO#	Course Outcome (CO)	PO/ PSO	BTL
CO1	Predict potential complications from combining various chemicals or metals in an engineering setting	PO-1, PO-3, PO-7	2
CO2	Discuss fundamental aspects of electrochemistry and materials science relevant to corrosion phenomena	PO-1, PO-3	2
CO3	Examine water quality and select appropriate purification technique for intended problem	PO-1, PO-7	2
CO4	Explain the role of chemical kinetics in the formation and destruction of ozone in the atmosphere and predict the connection between molecular behavior and observable	PO-1, PO-7	2
CO5	An ability to analyze and generate experimental skills	PO-1, PO-4	3

Syllabus:

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, advantages of fuel cell;*Energy and Chemistry***:** Energy Use and the World Economy, Defining Energy, Energy Transformation and Conservation of Energy, Heat Capacity and Calorimetry. Enthalpy, Hess's Law and Heats of Reaction, Energy and Stoichiometry.

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

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 electro dialysis:Chemical Kinetics: Ozone Depletion, Rates of Chemical Reactions, Rate Laws and the Concentration Dependence of Rates, Integrated Rate Laws, Temperature and Kinetics, Reaction Mechanisms, Catalysis, insight into Troposphere Ozone. **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.

Text Books:

1. Engineering Chemistry, Jain & Jain, Dhanpat Rai Publishing Company. NewDelhi.
2. Engineering Chemistry, O G Palanna, The Tata McGraw Hill, NewDelhi.

Reference Books:

1. Chemistry in Engineering and Technology, Volume2, J C Kuriacose & J Rajaram, Tata Mc Graw Hill, New Delhi.
2. Chemistry for Engineers Rajesh Agnihotri, Wiley, NewDelhi.
3. Engineering Chemistry, B.Sivasankar, The Tata Mc Graw Hill, New Delhi.
4. A text book of Engineering Chemistry, Shashi Chawla, Dhanpat Rai & Co. New Delhi.
5. Engineering Chemistry, C Parameswara Murthy, C V Agarwal and Andra Naidu, B S Publications, Hyderabad.
6. Engineering Chemistry, Shikha Agarwal, Cambridge University Press.

Web References:

1. http://www.chem1.com/acad/webtext/elchem/
2. https://nptel.ac.in/downloads/122101001/
   https://www2.chemistry.msu.edu/faculty/reusch/virttxtjml/polymers.htm

21UC3105 – PROBLEM SOLVING SKILLS - I

L-T-P-S: 0-0-2-2 **Credits: 1.5** **Pre-Requisite :Nil**

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

CO#	Course Outcomes	PO/PSO	BTL
CO1	Apply the concepts of mathematical principles besides logic and identifying certain basic mathematical formulae to solve these kinds of problems	PO12	3
CO2	Formulate the concepts of mathematical principles of equations that contain the data related to real life situations which requires basic logic to analyze	PO12	2
CO3	Solve concepts of Venn diagrams and number patterns and illustrate logic behind connectives, series, and analogies respectively	PO12	3
CO4	Differentiate assumptions and arguments in critical reasoning	PO12	2

Syllabus:

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

Textbooks:

1. Quantitative Aptitude by R.S. Agarwal, SCHAND Publications.
2. A Modern Approach to Verbal Reasoning by R.S. Agarwal, SCHAND Publications.
3. Logical Reasoning, Arun Sharma, McGraw Hill.

Reference books:

1. Quantitative Aptitude Quantum CAT by Sarvesh KVerma, Arihant Publications.
2. Quantitative Aptitude for CAT by Arun Sharma, Mc Graw Hill Education.
3. Analytical & Logical Reasoning, Peeyush Bhardwaj, Arihant Publications.

Web References:

1. www.freshersworld.com
2. www.managementparadise.com
3. www.coolavenues.com
4. www.indiaedu.com/entrance-exams/cat.../books.html
5. www.mycatprep.com

21UC3206 - PROBLEM SOLVING SKILLS - II

L-T-P-S: 0-0-2-2 **Credits: 1.5** **Pre-Requisite : Nil**

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

CO#	Course Outcomes	PO	BTL
CO1	Implement problem solving ability through analyzing the given data and formulate solutions for real world problems based on time, travel and wages	PO12	3
CO2	Determine the fundamental concepts of areas, volumes and derive solutions using simple mathematical principles besides interpreting the data through smart tricks to check the number analytics	PO12	2
CO3	Estimate inductive reasoning, to categorize the rules-set from a given list of observations and relate them to predict the conclusions according to the given conditions	PO12	2
CO4	Integrate verbal and non-verbal reasoning and to identify the logic behind the given arrangement based on the given conditions to bring out the possible outcome	PO12	3

Syllabus:

Time & Work, Chain Rule, Pipes & Cisterns, Time, Speed & Distance, Problems on Trains, Boats & Streams, Races & games, Permutations & Combinations, Combinatorics, Probability Areas & Perimeters, Mensuration, Trigonometry, Heights & Distances, Geometry, Coordinate Geometry, Data Interpretation, Data Sufficiency, Statistics, Simplification, Cryptarithmetic Blood Relations, Directions, clocks, calendars, Alphabet Test, Number, ranking & Time sequence test, Seating Arrangements, Mathematical Operations, Data Sufficiency, Nonverbal - series, analogy, classification 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.

Textbooks:

1. Quantitative Aptitude by R.S. Agarwal, SCHAND Publications.
2. A Modern Approach to Verbal Reasoning by R.S. Agarwal, SCHAND Publications.
3. Logical Reasoning, Arun Sharma, McGraw Hill.

Reference books:

1. Quantitative Aptitude Quantum CAT by Sarvesh K Verma, Arihant Publications.
2. Quantitative Aptitude for CAT by Arun Sharma, Mc Graw Hill Education.

Analytical & Logical Reasoning, Peeyush Bhardwaj, Arihant Publications.

PHYSICS FOR ELECTRONICS ENGINEERS(science elective-1)

Course Title : PHYSICS FOR ELECTRONICS ENGINEERS

Course Code :21PH1008

L-T-P-S Structure : 3-0-2-0

Pre-requisite :

Credits : 4

Syllabus :Crystal structure: Atomic structure, atomic mass, and atomic number, Types of bonds- Diamond, Copper, and NaCl, Force vs interatomic distance curve, PE curve, Crystal Structures (Space lattice, basis, unit cell, Seven Crystal systems, Bravais lattices, coordination number, Atomic packing fraction of SC, BCC, FCC,), miller indices, Crystal planes and defects (Point Defects, Line Defects, Surface Defects, Volume Defects, and Effects of Defects on Crystalline Properties), Energy bands in solids, Classification of electronic materials: metals, semiconductors, and insulators. Electrical properties: Classical Free Electron Theory: Drude and Lorentz model for metals. Temperature dependence of resistivity, Matthiessen's rule. Conductivity in metals and Concepts of Fermi level, effective mass and holes, Concept of phonons, Thermoelectricity, Intrinsic and extrinsic semiconductors, Fermi level variation by carrier concentration and temperature, p-n junction, drift and diffusion currents, Direct (LED) and indirect band (Solar cell) gap semiconductors, Dielectrics: Dielectrics and electrical polarization, Depolarization field, Polarisation mechanisms, Electronic polarization and its mechanisms, Dielectric breakdown, the frequency dependence of polarisation, Clausius-Mossotti relation; Piezoelectricity, Pyroelectricity, and Ferroelectricity. Optical properties (Optical reflectance, Optical Absorption, Snell's law, Total Internal reflection in optical fibers). Magnetism in materials – Basic definitions, classification of magnetic materials, Origin of magnetic moment, Types of interactions, Magnetic susceptibility, Curie and Neel temperatures; Domain ferromagnetism, Hysteresis, Hard and Soft magnetic materials. Magnetic anisotropies, Spin-orbit interaction, Applications: magnetic recording,

Text Books :1. Kasap, S.O. Principles of Electronic Materials and Devices. McGraw-Hill, 3/e. ISBN-10: 0073104647.

Reference Books :1. Hummel Rodolf, Electronic Properties of Materials, ISBN 0-387-98303-1. 2. Kittel. C, Solid State Physics, Wiley student 8th edition, ISBN: 978-0-471-41526-8.

MOOCS :https://nptel.ac.in/courses/112/106/112106227/ https://www.youtube.com/watch?v=XaId7WR0mGo https://nptel.ac.in/courses/113/104/113104090/ https://www.youtube.com/watch?v=QQZ6EGf0Ju8

Course Title :TRANSFORM TECHNIQUES & NUMERICAL METHODS

Course Code :21MT3102

L-T-P-S Structure : 3-0-0-0

Pre-requisite :

Credits : 3

Syllabus :Solving Partial Differential Equations and Integral Equations by Fourier Transform Techniques: Introduction, Fourier Transforms, Fourier Sine Transforms, Fourier Cosine Transforms. Inverse Fourier Transforms. Apply Fourier Transform Techniques to Solve PDE and Integral Equations. Solving Difference Equations Using Z-Transforms: Standard Z Transforms, Inverse Z Transforms, Apply Z-Transform Techniques to Solve Difference Equations. Hankel Transforms: Introduction to Hankel Transforms, Elementary Transformation, Applications of Hankel Transforms. Solution of Algebraic and Transcendental Equations: Bisection Method, Regula-Falsi Method, Newton-Raphson Method. Iterative Methods: Finite Difference, Forward, Backward, and Central Differences, Operators: Shift Operators, Average Operators, and Relations between Difference Operators. Interpolation: Lagrange and Newton's Divided Difference Formula. Numerical methods for solving ODEs: Taylors, Euler Method, Modified Euler Method, Runge-Kutta Method of Second Order, Runge-Kutta Method of Fourth Order. Numerical Integration: Trapezoidal Rule, Simpson's 1/3rd Rule, Simpson's 3/8th Rule.

Text Books :Higher Engineering Mathematics by B.S. Grewal, Khana Publishers, 2015.

Reference Books :1. Numerical Methods for Scientific and Engineering Computation by M.K. Jain, S. R. K. Iyengar and R.K. Jain, New Age International Publishers, 2008. 2. Advanced Engineering Mathematics by Erwin Kreyszing, John Wiley, 2020. 3. The Hankel Transforms by R. Piessens, CRC Press LLC, 2000.

Web Links :1. https://onlinecourses.nptel.ac.in/noc21_ma45/preview 2. https://archive.nptel.ac.in/courses/111/106/111106111/

SYLLABUS OF COURSES UNDER

ENGINEERING SCIENCES

21SC1101: **COMPUTATIONAL THINKING FOR STRUCTURED DESIGN (CSTD)**

L-T-P-S: 2-0-2-4 Credits:4 Prerequisite: Nil

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

CO	Course Outcome (CO)	PO	BT
CO1	Design Basic and Complex Building Blocks for real world problems using structured programming paradigm	PO 1,P	3
CO2	Translate computational thinking into Logic Design for Solving real world problems.	PO 2,P	3
CO3	Apply and Analyse CRUD operations on Basic Data Structures using Asymptotic Notations	PO1,P O2	4
CO4	Apply and Analyse CRUD operations on Linear Data Structures using Asymptotic Notations.	PO4	4
CO5	Apply the structured programming paradigm with logic building skills on Basic and Linear Data Structures for solving real world problems	PO1,P O2,PO 4	3
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	PO2,P O4,PO 1	6

Syllabus:

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, User I/O: Formatted I/O, Command line arguments, Redirecting I/O: Files and File Operations. Logic Design for Computational Thinking: Control Flow Statements: Decision Making using conditional statements, Definite and indefinite Iterative statements. Recursion, logic building using complex building blocks. 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 CRUD operations on Linear Data Structures: Stacks, Queues and Single Linked List. Introduction to Trees.

Textbooks:

1. Brian W. Kernighan, Dennis M. Ritchie, “The C Programming Language: ANSI C Version”, 2/e, Prentice-Hall/Pearson Education-2005.
2. E. Balagurusamy, “Programming in ANSI C” 4thed., Tata McGraw-Hill Education, 2008.
3. R. F. Gilberg, B. A. Forouzan, “Data Structures”, 2nd Edition, Thomson India Edition-2005.

Reference Books:

1. Brian W. Kernighan, Dennis M. Ritchie, “The C Programming Language: ANSI C Version”, 2/e, Prentice-Hall/Pearson Education-2005.
2. E. Balagurusamy, “Programming in ANSI C” 4thed., Tata McGraw-Hill Education, 2008.
3. R. F. Gilberg, B. A. Forouzan, “Data Structures”, 2nd Edition, Thomson India Edition-2005.

20ME1103 - DESIGN TOOLS WORKSHOP -I
L-T-P-S : 0-0-4-0 Credits : 2 Contact Hours : 4 Pre-requisite: Nil

Mapping of Course Outcomes with PO/PSO:

CO	Course Outcome (CO)	PO	BTL
CO1	Practice design thinking by developing artistic skills, Visualize and complete his/her innovative design by final drafting using 3D modelling	PO3	3
CO2	Understand the concept of web page, web browser, web server, and able to create Static webpages	PO5	3
CO3	Understand the concept of report writing using a markup language Latex	PO5	3
CO4	Understand the concept of data visualization and creating data visualization dashboards, Understand the basic concept of VR/AR	PO5	3

Syllabus:

Introduction to Design tools: Introduction to design tools course, its objective, advantages 3D Modeling: - Conceptual Design, 2D Sketches to 3D Solid Model using AUTODESK FUSION 360. HTML: Introduction to web browser and URL, Introduction to HTML, Creating a simple HTML page, HTML documents, Concept of tags, Basic structure of HTML document, Head, Body, Paragraph creation, line breaks, text, list, tables, Hyperlinks and images. HTML5: Basic of HTML5, Special features of HTML5, Canvas, audio, video, Geo location, drag and drop. CSS: Concept of CSS, Need of CSS, Creating style sheet, CSS properties, CSS styling (Background, text, format, controlling fonts), Styling with lists and tables, CSS Ids and class, CSS color, Creating page layouts and site design. Data Visualization: Introduction to data visualization, Data, types, Importance of data visualization, Different tools for visualization and comparisons in brief. Excel data explanation, Creation of column Chart, stacked bar chart and Heat map, Creation of excel dashboard. Creation of Dashboards in Power BI. Creation of bar charts, date tables and pie charts in Power BI, creating slicers and maps in power BI. Latex Report Writing: Understanding Latex compilation, Basic syntax, Writing equations, Tables, Figures handling, List of figures, List of tables, Generating index. Applications: Writing resume, Writing project reports. Virtual Reality & Augmented Reality: Introduction to Virtual reality, Virtual 360 Environments, Creating basic 360 Virtual frame. Introduction to Augmented reality, Different types of AR, Platforms to create AR interfaces.

Text Books:

1. “Complete Design Thinking Guide for Successful Professionals” by Daniel Ling
2. “Rapid Prototyping: Principles and Applications by Chua C.K., Leong and Lim. C.S, 2nd Edition, World Scientific.
3. Learn HTML & CSS by John Duckett.
4. HTML5 and CSS3 All-in-One for Dummies
5. Mastering Microsoft Power BI Expert techniques for effective data analytics and business intelligence by Brett Powell
6. LaTeX Tutorials: A Primer by Indian TeX Users Group by Indian TeX Users Group (https://www.tug.org/twg/mactex/tutorials/ltxprimer-1.0.pdf)

Web Links:

1. https://www.coursera.org/learn/3d-model-creation-fusion-360
2. https://www.coursera.org/learn/html/home/welcome
3. https://www.udemy.com/course/become-a-good-latex-user-to-create-professional-documents/ 4. https://www.udemy.com/course/microsoft-power-bi-latest-2020-beginner-to-expert-modules

21SC1209- Design Tools Workshop – II

L-T-P-S: 0-0-4-0 Credits: 2 Prerequisite: NIL

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

CO No	Course Outcome (CO) Description	PO/PSO	BTL
CO1	Practice the design ideology by 3D printing, 3D scanning techniques	PO3	2
CO2	Visualize the design ideology by incorporating VR technique and VR technology, Visualize and present his design idea by applying AR technique and Hologram	PSO2,PO5	3
CO3	Practice on PCB technology	PO4	2
CO4	Practice of Arduino based skill with different interfaces	PO4	2

Syllabus: Design Thinking in 3D Printing technology, Photogrammetry. Introduction to 3D printing, Part Model 3D printing through FDM process, Assembly Model 3D printing through FDM process. Introduction to Photogrammetry, Photogrammetry by 3D scanning technology. Virtual Reality: Hardware and History,VR Applications, Psychology of VR: the three illusions, challenges in virtual reality, Future of Embodiment in VR, Realism, Graphics, Real-Time 3D Graphics in Games, Basic Concepts in 3D Computer Graphics, Realism Animation, Navigation, Nausea. Room Scale VR, Holography, Mirror Reality. Setting up room scale VR, Simulation of virtual environment, Stereoscopic Vision, Perspective, Interference and Diffraction, Laser Viewable Holograms, Real and Virtual Images, Introduction to mirror reality. Augmented Reality: Augmented Reality, characteristics of AR systems and main components of an AR architecture, Augmented Reality with Geolocation, Customizing an augmented reality game. Arduino: Interfacing with display, sensors and actuators. Interfacing of LED with Arduino, Interfacing of LED with push button with Arduino, Interfacing of temperature sensor with Arduino, Interfacing of LCD to display data with Arduino,Interfacing of DC motor.

Textbooks :

1. “Complete Design Thinking Guide for Successful Professionals” by Daniel Ling
2. “Project Management” by K. Nagarajan, 7th Edition, New Age International Publishers.
3. “Augmented Reality and Virtual reality” by Timothy Jung, M.Claudia Tom Dieck, Springer.
4. “Rapid Prototyping: Principles and Applications”by Chua C.K., Leong and Lim. C.S, 2nd Edition, World Scientific.
5. “Artificial Intelligence: A Modern Approach” by Stuart Russell and Peter Norvig, 3rd Edition, Prentice Hall.

21EC1202: Computer Organization and Architecture

L-T-P-S:2-0-0-0 **Credits: 2** **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 programmed 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.

Textbooks:

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.

Reference Books:

1. V. C. Hamacher, Z. G. Vranesic and S. G. Zaky, Computer Organization, 5/e, McGraw Hill, 2002
2. 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

20EC1101: Digital Logic & Processors

L-T-P-S: 3-0-2-0 **Credits: 4** **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

21EC1203: Design of Basic Electronic Circuits

L-T-P-S: 3-0-0-0 **Credits: 3** **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.

Textbooks:

1. John Bird . Electrical Circuit Theory and Technology, Routledge publishers, 6th edition, 2017.
2. Electronic Devices and Circuit Theory 12th Edition - Robert L. Boylestad

Reference Books:

1. A Sudhakar, Shyam Mohan S Palli , Circuits and Networks: Analysis and Synthesis, TMH, 5e
2. David A. Bell, Electronic Devices and Circuits, 5th Edition

21EC2104: Electronic Devices and Circuit Design

L-T-P-S: 3-0-2-2 **Credits: 5** **Prerequisite: Nil**

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

CO	Course Outcome (CO)	PO	PSO	BTL
CO1	Understand the BJT operations and a circuit function.	1,4	1	2
CO2	Understand the FET operations and circuit functions	1,4	1	2
CO3	Understand the Op.-Amp operations and circuit functions	1,4,5	1,2	2
CO4	Understand the Op-Amp filters and Oscillator circui functions	1,4,5	1,2	2

Syllabus:

Bipolar Junction Transistor: Transistor Construction and Operation, CB, CE and CC Configurations. BJT DC biasing, Current Mirror, Current Source circuits, BJT AC Analysis, Analysis of Transistor Amplifier Circuits, Power amplifiers.

Field Effect Transistors: JFET and its characteristics Pinch off Voltage, Drain Saturation Current, JFET biasing. MOSFET: DMOS, EMOS, CMOS, VMOS – Enhancement and Depletion Modes, MOSFET biasing, MOSFET first and second order effects and characteristics.

Operational Amplifiers: Introduction, Characteristics of an Op-Amp., an Op-Amp. with negative feedback circuits, the practical Op-Amp analysis, General Op-Amp Linear applications.

Active Filters and Oscillators: Frequency Response of Op-Amp., Design of an Op- Amp filters, design of an Op-Amp Oscillators, Op-Amp as comparators and convertors, Specialized IC Applications.

Textbooks:

1. Robert L. Boylestad and Louis Nashelsky - "Electronic Devices and Circuit Theory"
2. Ramakanth A. Gaykwad – "Op-Amps and Linear IC Applications"
3. Thomas L. Floyd – "Electronic Devices – Electron Flow Version"

Reference Books:

1. Jacob Millman - "Electronic Devices and Circuits"
2. D Roy Choudhury and Shail B. Jain – "Linear Integrated Circuits"
3. David A. Bell - "Electronic Devices and Circuits"
4. Behzad Razavi – "Design of Analog CMOS Integrated Circuits

Course Code: 21SC1202 **Course Name: Data Structures**

L-T-P-S: 3-0-2-4 Credits: 5 Prerequisite: 21SC1101

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

CO#	Course Outcome (CO)	PO/PSO	BTL
CO1	Understand various sorting algorithms and analyze the efficiency of the algorithms	PO1, PO2	4
CO2	Implement Linear Data Structures and Demonstrate their applications.	PO1, PO2	4
CO3	Understand hashing techniques and Implement tree data structures.	PO1, PO2	4
CO4	Understand graph data structures and apply graphs to solve problems	PO1, PO2	3
CO5	Develop and evaluate common practical applications for linear and nonlinear data structures.	PO1, PO2	5

Syllabus:

Algorithm Analysis: Mathematical Background, Model, Analyze, Running Time Calculations. **Sorting**: Introduction to Sorting Algorithm, Insertion Sort, Shell sort, Heap sort, Merge sort, Quick sort, Bucket Sort, External Sorting.

Dynamic Memory implementation of linear data structures: Singly **Linked list**, doubly linked list, circularly linked list, *applications of data structures:* Polynomial Manipulation, Implementation of **Stacks and Queues** using Linked Lists, Circular Queue, Deque (Double ended queue), Applications of Stacks and Queues. **Priority Queues (Heaps):** Model, Simple Implementations, Binary Heap, Applications of Priority Queues**.** **Hashing**: Introduction to Hashing, Hash Function, Separate Chaining, Hash Tables without Linked Lists, Rehashing, Hash Tables in the Standard Library, Extendible Hashing. **Trees:** Introduction to trees, Binary Trees, Tree Traversals, The Search Tree: Binary Search Trees, AVL Trees, Splay Trees, B-Trees, Red black trees.

Graph Data Structure: Introduction to Graph data structure – basic terminologies- transitive closure - representation of graphs: adjacency matrix, linked list- Graph traversals: Breadth First Search, Depth First Search)- minimal spanning trees: Prim's & Kruskal's Algorithm.

Textbooks:

1) Mark Allen Weiss, Data Structures and Algorithm Analysis in C, 2010 , Second Edition, Pearson Education.
2) Ellis Horowitz, Fundamentals of Data Structures in C: Second Edition, 2015

Reference Books:

1. A.V.Aho, J. E. Hopcroft, and J. D. Ullman, "Data Structures And Algorithms", Pearson Education, First Edition Reprint2003.
2. Horowitz, Sahni, Anderson Freed, "Fundamentals of datastructures in C" , Second Edition-2007.
3. R. F. Gilberg, B. A. Forouzan, "Data Structures", Second Edition, Thomson India Ed ition, 2005
4. Robert Kruse, C.L. Tondo, Bruce Leung, Shashi Mogalla, "Data Structures & Program Design in C", FourthEdition-2007.

WEB REFERNCES/MOOCS:

1. https://nptel.ac.in/courses/106102064
2. https://nptel.ac.in/courses/106101060/4
3. https://www.edx.org/course/algorithms-and-data-structures-1
4. https://in.udacity.com/course/intro-to-algorithms--cs215
5. https://www.coursera.org/learn/data-structures?action=enroll

Course Code: 21EL2102 **Course Title**: Object Oriented Programming
L-T-P-S: 2-0-2-4 **Credits:4** **Prerequisite:** 21SC1210

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

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand basic Concepts of OOP, fundamentals of java and apply the concepts of classes and objects through Java Language. Apply constructors, Overloading, parameter passing.	PO3, PO5, PSO2	3
CO2	Apply access control, Inheritance, Packages.	PO3, PO5, PSO2	3
CO3	Apply Interfaces, Exception Handling, multi- threading, I/o.	PO3, PO5, PSO2	3
CO4	Apply collection framework and event driven programming.	PO3, PO5, PSO2	3
CO5	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.	PO7, PO9, PO10, PSO1	4

Syllabus:

Introduction: Object-Oriented Programming, OOP Principles, Encapsulation, Inheritance and Polymorphism Java as a OOPs & Internet Enabled language, The Byte code, Data types, Variables, Dynamic initialization, scope and lifetime of variables, Arrays, Operators, Control statements, Type Conversion and Casting, Compiling and running of simple Java program.
Classes and Objects: Concepts of classes and objects, declaring objects, Assigning Object Reference Variables, Methods, Constructors, Access Control, Garbage Collection, Usage of static with data and methods, usage of final with data, Overloading methods and constructors, parameter passing - call by value, recursion, Nested classes.
Inheritance: Inheritance Basics, member access rules, Usage of super key word, forms of inheritance, Method Overriding, Abstract classes, Dynamic method dispatch, Using final with inheritance, String handling functions.
Packages and Interfaces: Packages, Class path, importing packages, differences between classes and interfaces, Implementing & Applying interface.
Exception Handling: Exception Handling fundamentals, Collections Framework.

Textbooks:
1. Herbert Schildt, “The Complete Reference Java”, 7th edition TMH.
2. Timothy A. Budd, “An Introduction to Object-Oriented Programming”, 3/e, Pearson, 2008.
Reference Books:
1. Deitel&Deitel, “‘Java – How to program”, 6th edition, PHI, 2007
2. Cay.S.Horstmann and Gary Cornell “Core Java 2, Vol 1, Fundamentals”, Seventh Edition, Pearson Education.

SYLLABUS OF COURSES UNDER
PROFESSIONAL CORE COURSES

Course Code: 21EL2202 **Course Title** :Embedded Systems Design

L-T-P-S: 2-0-2-0 Credits: 3 Prerequisite: Nil

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

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand the architecture and programming concepts of 8086 Microprocessor	**1,2**	**2**
CO2	Apply the Programming concepts of 8051 Microcontroller	**5**	**3**
CO3	Analyse the Interfacing of Peripherals to the 8051 microcontrollers through programming. Understand the basic architectures of PIC and ARM 7 microcontrollers	**3**	**4**
CO4	Understand the basic concepts of CORTEX STM-32 microcontroller and RTOS	**2**	**2**
CO5	Analyze the applications of programming with 8051 and 8086 on hardware / software. Analyze the applications of programming with Arduino	**5**	**4**

Syllabus:

Basics of Embedded System: Basics, Introduction and History of Processors, 8086 Architecture, Instruction set, 8086 programming and examples.

Microcontroller Fundamentals: 8051 Architecture, addressing modes, Instruction set, Simple Programs involving Arithmetic and Logical Instructions, Timers/Counters, Interrupts.

Serial Data Communication and RS-232C Standard with 8051 Programming, Peripherals and Input Output with 8051 Microcontroller (PIO, Timers and Interfacing).

Modern Microcontrollers: Introduction and Architecture of PIC Microcontroller, Introduction of ARM7 (LPC2148), Basic Architecture of ARM7, Pin Description, Advanced Microcontroller Bus Architecture (AMBA).

Advanced Topics: Introduction to CORTEX (STM 32), Architecture and Introduction to RTOS (Real Time operating systems). Basic concepts and applications of RTOS.

Textbooks

1. Mazidi & McKinley “The 8051 Micro controller and Embedded systems: using assembles and C, 2nd edition, 2007.
2. Frank Vahid, “Embedded System Design”, Wiley; Student edition (2006).
3. A K Ray and K M Bhurchandi “Advanced Microprocessors and Periperals “ The McGraw Companies,2nd Edition,2006

Reference Books

1. Make: Arduino Bots and Gadgets: Six Embedded Projects with Open Source Hardware and Software by Tero Karvinen, Kimmo Karvinen
2. Practical Microcontroller Engineering with ARM Technology by Ying Bai

Web References

1. https://www.youtube.com/watch?v=DmwOSdwzZ3E
https://www.youtube.com/watch?v=GPz_mR7Flas
https://www.youtube.com/watch?v=fI20Bsx3EPM
https://www.youtube.com/watch?v=S2_KtA_6y80

21EC2210: **Data Networks and protocols**

L-T-P-S: 3-0-2-0 **Credits: 4** **Prerequisite: NIL**

CO	Course Outcome (CO)	PO	PSO	BTL
CO1	Introduction to Computer networks and Data Link Layer	1,2	1,2	1,2
CO2	Network layer and Internetworking	1,2,5	1,2	2,3
CO3	Transport layer, Session Layer, Presentation Layer and Application Layer	1,2,5	1,2	2,3
CO4	Advanced Topics: Cryptography, Advancements in Application layer, Wireless LANs, Network Security	1,2	1,2	1,2

Syllabus:

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.

Network layer and Internetworking: Internetworking Devices: Preamble to Network Layer**,** Distinguishing of Networking Devices and **Internetworking Devices**, Analysis of Router Processing: Access, core and distribution. VLANS, Ehternet. **Internetworking 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

Transport layer, Session Layer, Presentation Layer and Application Layer: Transport Layer: Process to Process Delivery; UDP; TCP; FCP Fibre 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

Advanced Topics: Cryptography: Public and Private Key based) Digital Signature, Firewalls **Advancements in Application layer:** ISDN services & ATM, DSL technology, wired and wireless Modem: Architecture & Operation in brief. **Wireless LANs**: IEEE 802.11; Multi-Band Routers (Tri Band Wireless Routers); Network **Security:** Essential Steps for Configuring a New Server and firewalls, Different types of network layer attacks and IP security.

Textbooks:

1. B. A. Frouzan – "Data Communications and Networking (3rd Ed.) "– TMH
2. S. Tanenbaum – "Computer Networks (4th Ed.)" – Pearson Education/PHI
3. W. Stallings – "Data and Computer Communications (5th Ed.)" – PHI/ Pearson Education
4. Zheng & Akhtar, Network for Computer Scientists & Engineers, OUP
5. Black, Data & Computer Communication, PHI
6. Miller, data Communication & Network, Vikas
7. Miller, Digital & Data Communication, Jaico
8. Shay, Understanding Data Communication & Network, Vikas

Reference Books:

1. Kurose and Rose – "Computer Networking -A top down approach featuring the internet"– Pearson Education
2. Leon, Garica, Widjaja – "Communication Networks" – TMH
3. Walrand – "Communication Networks" – TMH.
4. Comer – "Internetworking with TCP/IP, vol. 1, 2, 3(4th Ed.)" – Pearson Education/PHI

Web References

1. https://www.coursera.org/programs/ece-faculty-courses-sm7xl/browse?productId=X2bX61doEeerkQ5vdwUqtA&productType=course&query=The+Bits+and+Bytes+of+Computer+Networking&showMiniModal=true
2. https://nptel.ac.in/courses/106/105/106105183/
3. https://www.udacity.com/course/computer-networking--ud436

Course Code: 21EL2203 Course Title: Database Management Systems
L-T-P-S: 2-0-2-4 Credits: 4 Prerequisite: NIL

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

CO#	Course Outcome (CO)	PO	PSO	BTL
CO1	Illustrate the functional components of DBMS and Design an ER Model for a database.	PO1,PO2, PO3, PO4	2	5
CO2	Design a relational model for a database & Implement SQL concepts and relational algebra.	PO3, PO5	2	5
CO3	Implement PL/SQL programs, normalization techniques, indexing to construct and access database	PO3, PO4	2	4
CO4	Analyze the importance of transaction Processing, concurrency control and recovery techniques.	PO1,PO2,PO5	2	4
CO5	Design a database and implement SQL queries and PL/SQL programs to do various operations on data.	PO3,PO5	2	6
CO6	Design and query database using database programming skills	PO3, PO4	2	6

Syllabus:

Database Fundamentals: DBMS Characteristics & Advantages, Database Environment, Database Users, Database Architecture, Data Independence, Languages, Tools and Interface in DBMS, DBMS types. **DataModelling: 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, **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. Operators in relation algebra **Normalization**- Normal Forms, First, Second, Third Normal Forms, BCNF, Multi value and join dependencies, 4th and 5th normal forms**. File and storage structures**: File storage, Index structures, Indexing and hashing, Query processing and optimization**. 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.

Textbook(s):

1. Database System Concepts, Sixth Edition, Abraham Silberschatz, Yale University Henry, F. Korth Lehigh University, S. Sudarshan Indian Institute of Technology, Bombay.
2. Fundamentals of Database Systems, 7th Edition, RamezElmasri, University of Texas at Arlington, Shamkant B. Navathe, University of Texas at Arlington.

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Reference Book(s):

1. An Introduction to Database Systems by Bipin C. Desai
2. Pr1nc1ples of database and knowledge -base systems volume jeffrey d. 11 man.
3. Raghu RamaKrishnan, Johannes Gehrke, “Database Management Systems”, 3rd edition, Tata McGraw Hill, 2014.

Web Links:

1. https://www.coursera.org/learn/intro-sql
2. http://ilearning.oracle.com/ilearn/en/learner/jsp/user_home.jsp
3. http://www.ict.griffith.edu.au/~jw/normalization/ind.php#findCandidateKeys

MOOCs Courses

1. **https://www.coursera.org/projects/intermediate-rdb-sql**
2. **https://www.coursera.org/projects/advanced-rdb-sql**

Course Title :ANALOG AND DIGITAL COMMUNICATION

Course Code :19EC2105

L-T-P-S Structure : 3-0-3-0

Pre-requisite :

Credits : 4.5

Syllabus :CO1: Fundamentals of Analog Communications Introduction Modulation types: AM, FM, Pulse Mod, SNR, Bandwidth, Power Spectrum. (a) AM Concept : DSB-SC, SSB, Coherent detection, Modulation Index. (b) FM Concept: Modulation Index of FM and Phase Modulation (c) Pulse Mod. Concept: Sampling, PAM, PWM, PPM : Modulation and Demodulation (d) Transceiver: Super Heterodyne Receiver (e) Noise and types of noise; Related Problems CO2: Digital Communication Basics (a) PCM: Quantization noise, SQNR, SNR vs Bandwidth; (b) DPCM, DM, ADM coders. (c) Vocoders: LPC, CELP, RPE-LTP; Related Problems CO3: Introduction to Digital Carrier Systems, Switching and Signalling (a) ASK, PSK, FSK, QPSK, QAM, MSK, bandwidth consideration. (b) RZ, NRZ, Bipolar RZ AMI, Manchester, HDB3 and B8ZS and circuit implementations, Bits and Bauds. (c) Telecommunication Systems: circuit switching, T1/E1, SS7 signalling, PDH and SDH, DSL/ADSL,PSTN Switching. CO4: Modern Communication Methods (a) Multiplexing and Multi access, FDMA, TDMA, CDMA, CSMA; OFDMA, Rake Receiver, Spread spectrum Techniques. (b) Data Communication Systems: Packet Switching, PAN, LAN, WAN, MAN, Internetworking, VoIP.

Text Books :1. Simon Haykin and Michael Moher, “An Introduction to Analog and Digital Communications”, 2nd Ed., Wiley, (2007). 2. Wayne Tomasi,” Advanced Electronic Communication Systems”, 6th Ed., Pearson Education. 3. B. Forouzan,” Data Communications and Networking”, 4th Ed., Mcgraw Hill. 4. W. Stallings,” Data and Computer Communications”,8thEd.,Pearson Education. 5. T. Rappaport,” Wireless Communications Principles and Practice”, 2nd Ed., Pearson Education (2009).

Reference Books :1. H Taub & Schilling, Gautam Sahe,” Principles of Communication Systems”, TMH, 3rd Edition, (2007). 2. R.P. Singh & S.D. Sapre,” Communication Systems: Analog and Digital”, Mc Graw Hill, 3rd edition.

AI, ANN Tools and Applications

Course Title :AI, ANN TOOLS AND APPLICATIONS

Course Code :20EC2209

L-T-P-S Structure : 3-0-0-0

Pre-requisite :

Credits : 3

Syllabus :Random Processes and Random Variables -Probability: Coin experiment, Ball experiment, Card experiment, Dice Experiment; -Combination, Permutation, Random Processes and random variables; -Introduction to Sequence of Coin tossing: Joint probability examples and Hidden Markov Model Applications of AI &Tools -Introduction to MATLAB, Python, R tools for Statistical analysis; -AI Virtual Agents, AI Chatbots, AI for Personalized Shopping Experience; -Artificial Intelligence in Agriculture; - Introduction to 3rd party AI tools Basics of AI &ANN -Introduction: Overview and Historical Perspective, Turing Test, Physical Symbol Systems and the scope of Symbolic AI. -State Space Search: Depth First Search, Breadth First Search,DFID -Overview of Artificial Neural Networks, Different Learning Methods and Architectures. -Supervised and Un-supervised learning concepts: Activation functions and its classification, Perceptron; Neural Network Classifiers: Multi-Layer Feedforward Neural networks, Multi-Layer Feedback Neural Networks. AI, ANN Models, Implementation and Case Studies -Implementation of AI: Programming implementation with Artificial Intelligence; -Implementation of Search techniques for pattern recognition;Hill Climbing, Travelling salesman problem; -Implementation of 2-class pattern recognition; -Image recognition using Feedback Neural networks; -Introduction to CNN

Text Books :Probability, Random Variables and Random Signal Principles By Peyton Peebles., Tata Mc Graw-hill [2]. Ronald J. Brachman, Hector J. Levesque: Knowledge Representation and Reasoning, Morgan Kaufmann, Elsevier Science & Technology, 2011.

Reference Books : [3]. R.O.Duda, P .E.Hart and D.G.Stork, Pattern Classification, John Wiley, 2002. [4]. Artificial Neural Networks by Prof. B. Yegnanarayana.PHI [5]. Artificial Neural Networks by Simon Haykins [6]. C.M.Bishop, Neural Networks and Pattern Recognition, Oxford University Press (Indian Edition), 2003

Web Links :1 https://www.coursera.org/learn/probability-statistics 2 https://www.coursera.org/learn/probability-intro 3 https://www.coursera.org/specializations/ai-foundations-for-everyone 4 https://www.coursera.org/learn/neural-networks-deep-learnin

Sensors and Actuators

Course Title :Sensors and Actuators

Course Code :17EM5101

L-T-P-S Structure : 3-0-0-0

Syllabus :Introduction to Sensors and Actuators: Role of sensors and actuators, sensors and Actuators in Automobile Systems, Sensors and Actuators in feedback control system, Importance of estimation in sensing, Innovative Sensor technologies, Application scenarios, Analog and digital transducers and Actuators Components inter connections and signal conditioning: Component interconnection. Signal modification conditioning, Importance of Impedance Matching in Component Interconnection, Impendence matching methods Analog Sensors: Principle of operation. Transduction concept, signal amplification, timing, scaling, range calibration, interfacing considering Temperature sensors, Humidity sensors, LDR, stepper motor, Level sensor, pressure, Piezo Vibration sensor, and Flow sensor, Potentiometers, differential transformers, tachometers, piezoelectric devices, gyros, Keyboards Analog Actuators: Principle of operation. Transduction concept, signal amplification, timing, scaling, range calibration, interfacing considering Stepper Motors, Piezo Actuator, Solenoid Valve, relay systems, Ultrasonic Motor Actuator Digital Sensors: Principle of operation. Transduction concept, signal amplification, timing, scaling, range calibration, interfacing considering Temperature sensors, Humidity sensors, LDR, Level sensor, pressure, and Flow sensor Digital Actuators: Principle of operation. Transduction concept, signal amplification, timing, scaling, range calibration, interfacing considering DC, servo Motors, PieZo Actuator, Solenoid Valve, relay systems, Ultrasonic Motor Actuator

Text Books :1. Sensors and actuators, Engineering System for instrumentation, 2nd Edition, Clarence W d Selva, CRC Press

Reference Books :1. Sensors and Transducers, 2nd Edition, D.Patranabis, PHI 2. Transducers and Instrumentation, 2nd Edition, D.V.S.Murty, PHI

Web Links :1. https://www.edx.org/course/sensors-and-devices-in-the-iot 2. https://www.coursera.org/specializations/embedding-sensors-motors 3. https://www.coursera.org/learn/pressure-force-motion-humidity-sensors 4. https://www.coursera.org/learn/internet-of-things-sensing-actuation 5. Data Sheets downloaded from different WEB sites 6. NPTEL

IoT Principles & Architecture

Course Title :IOT PRINCIPLES & ARCHITECTURE

Course Code :21IN2202

L-T-P-S Structure : 3-0-0-0

Pre-requisite :

Credits : 3

Syllabus : 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. 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. 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. 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.

Text Books:

1. Bernd Scholz-Reiter, Florian Michahelles, “Architecting the Internet of Things”, ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer
2. Vijay Madisetti, Arshdeep Bahga, Adrian McEwen (Author), Hakim Cassimally “Internet of Things A Hands-on-Approach” Arshdeep Bahga & Vijay Madisetti, 2014.

Reference Books :

1. Bassi, Alessandro, et al, “Enabling things to talk”, Springer-Verlag Berlin An, 2016.

2. Buyya, Rajkumar, and Amir Vahid Dastjerdi, eds. Internet of Things: Principles and paradigms. Elsevier, 2016.

3. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, “IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things”, CISCO Press, 2017

4. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, “From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence”, 1st Edition, Academic Press,2014.

Data Science and Data Analytics

Course Title :Data Science and Data Analytics

Course Code :21IN2103

L-T-P-S Structure : 3-0-2-0

Pre-requisite :

Credits : 4

Syllabus :Introduction to Data Science: Mathematical & Statistical Skills, Machine Learning, Coding, Statistical Foundations for Data Science, Data Structures & Algorithms, Scientific Computing, Optimization Techniques, Data Visualization, Matrix Computations, Experimentation, Evaluation. Sources of data through embedded systems: Video, audio, spectral, transactional, WEB Data, and Different kinds of data structures. Analyst Perspective on Data Repositories: Data Definitions and Analysis Techniques: Elements, Variables, and Data categorization. Levels of Measurement, Data management, and indexing State of the Practice in Analytics - Current Analytical Architecture - Overview of data capturing through Embedded Systems and IoT devices, the transmission of the same through different stages, and storage of the same in Clouds. Data analytics: lifecycle Discovery, Data Preparation - Model Planning – Model Building – and communication Results - Operationalize Case Study. Initial Analysis of the Data using R: Introduction to R: Graphical User Interface, data import, and Export: Attributes and data types, Descriptive statistics. Statistical methods for evaluation: Hypothesis testing, difference of means, Ranking tests, Sampling, ANOVA, Introduction to HADOOP and Map reduce and the uses of the same for

effecting the data analytics. Understanding business scenarios, Feature engineering and visualization, Scalable and parallel computing with Hadoop and Map-Reduce, Sensitivity Analysis.

Text Books :

1. Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data by EMC Education Services 2014

2. David Dietrich, Barry Heller, Beibei Yang, ―Data Science and Big Data Analytics‖, EMC Education Series, John Wiley, ISBN: 978-1-118-87613-8, 2015.

3. Peter Bühlmann, Petros Drineas, Michael Kane, Mark van der Laan, "Handbook of Big Data", CRC Press, 2016.

Reference Books :

1. MapReduce Design Patterns, Author: Donald Miner, Publisher: O'Reilly (2012), ISBN13:- 9789350239810
2. Agile data science: building data analytics applications with Hadoop-Russell JourneyO'Reilly Media-2013

3. An Introduction to Applied Multivariate Analysis with R -Brian Everett, Torstein Hothorn-Springer-2011

4. Statistical Modeling and Analysis for Database Marketing: Effective Techniques for Mining Big Data-Bruce Ratner-Chapman and Hall/CRC-2003

Web Links :https://nptel.ac.in/courses/106106179 https://nptel.ac.in/courses/110106072 https://www.coursera.org/learn/big-data-introduction https://www.hw.ac.uk/uk/study/postgraduate/data-science.htm https://cse.iitkgp.ac.in/~dsamanta/courses/da/index.html https://www.crampete.com/blogs/data-science-course-syllabus/

Cloud Computing for IoT

Syllabus :

Introduction to data emanation from ES and IOT devices: Devices, Data flow, data Storage Overview of Computing Paradigm: Recent trends in Computing: Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Cloud Computing. Evolution of cloud computing: Business driver for adopting cloud computing. Introduction to Cloud Computing: Cloud Computing (NIST Model): Introduction to Cloud Computing, History of Cloud Computing, Cloud service providers; Properties, Characteristics & Disadvantages: Pros and Cons of Cloud Computing, Benefits of Cloud Computing, Cloud computing vs. Cluster computing vs. Grid computing; Role of Open Standards. Computing Architecture: Cloud computing stack, Comparison with traditional computing architecture (client/server), Services provided at various levels, Role of Networks in Cloud computing, Protocols used, Role of Web services; Service Models (XaaS): Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS); Deployment Models: Public cloud, Private cloud, Hybrid cloud, Community cloud. Embellishing and using a private cloud: Network topology, HW-SE specification, installing open stack, configuring open stack availing services through open stacks, establishing virtual networks Infrastructure as a Service (IaaS): Introduction to IaaS, IaaS definition, Introduction to virtualization, Different approaches to virtualization, Hypervisors, Machine Image, and Virtual Machine (VM). Resource Virtualization: Server, Storage, Network, Virtual Machine (resource) provisioning and manageability, Storage as a service, Examples Applications: Amazon EC2, Google Drive, one drive, drop box. Developing applications that use IaaS. Overview on data capturing through IOT devices, transmission of the same through different stages, and storage of the same in Clouds. demonstrate thing speak cloud, AWS IoT,IBMwatson IoT.

Text Books :

1. Kris Jamsa, Cloud Computing, Jones & Bartlett,2012

2. Russell Dean Vines and Ronald L. Krutz ,Cloud Security: A Comprehensive Guide To Secure Cloud Computing, Wiley India Pvt Ltd, 2010

3. Barrie Sosinsky, Cloud Computing Bible, Wiley India,2011

Reference Books :

1. Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.

2. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach", TMH, 2009.

3. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud" O'Reilly, 2009.

4. Colin Dow - Internet of Things Programming Projects_ Build modern IoT solutions with the Raspberry Pi 3 and Python-Packt Publishing (2018)

Web Links :https://www.coursera.org/learn/iot-wireless-cloud-computing

MOOCS :https://www.coursera.org/learn/internet-of-things-cloud-services-version2
https://www.coursera.org/learn/cloud-computing?specialization=cloud-computing
https://www.coursera.org/learn/cloud-computing-2?specialization=cloud-computing

Internet Programming and Web Technologies

Course Title :Internet Programming and Web Technologies

Course Code :21IN3201

L-T-P-S Structure : 3-0-2-0

Pre-requisite :

Credits : 4

Syllabus :

Introduction to Web Technologies: Overview of the web and its evolution, Key concepts and components of web technologies, Setting up a development environment HTML Fundamentals: HTML syntax and structure, Working with HTML elements and attributes, Creating hyperlinks and anchors, HTML forms and form elements Advanced HTML and HTML5: HTML5 semantic elements, HTML5 multimedia elements (audio and video), Geolocation and local storage, Responsive web design with HTML5 Cascading Style Sheets (CSS): Introduction to CSS, Selectors and styles, CSS layout techniques (Flexbox and Grid), CSS transitions and animations JavaScript Fundamentals: Introduction to JavaScript, Variables, data types, and operators, Control structures (if statements, loops), Functions and scope Document Object Model (DOM) Manipulation: Working with the DOM, Event handling and event delegation, Dynamic content creation and manipulation, Form validation with JavaScript Asynchronous JavaScript: Introduction to asynchronous programming, Promises and async/await, XMLHttpRequest and Fetch API, Handling asynchronous data (AJAX) Introduction to JDBC (Java Database Connectivity): Overview of database connectivity, JDBC architecture and drivers, Establishing database connections, Executing SQL queries and handling results Advanced JDBC: Prepared statements and parameterized queries, Batch processing and transactions, Connection pooling and optimization, Error handling and best practices Java Servlets: Introduction to web applications, The role of Servlets in web development, Servlet life cycle and deployment, Handling HTTP requests and responses Servlet Filters and Event Listeners: Working with Servlet Filters, Implementing Event Listeners, Session management and cookies, Security considerations in Servlets. Java Server Pages (JSP) Basics: Introduction to JSP, JSP syntax and directives, Integrating Java code into JSP pages, Building dynamic web pages with JSP. Advanced JSP: JSP custom tags and tag libraries, Model-View-Controller (MVC) architecture, Error handling and exception pages, Internationalization and localization with JSP. Developing a Web Application: Combining HTML, CSS, JavaScript, Servlets, and JSP, Implementing user authentication and authorization, Integrating databases using JDBC, Deploying a web application to a server. Web Application Security: Common web application vulnerabilities, Authentication and authorization best practices, Data encryption and secure coding practices, Security testing and auditing.

Text Books :

1. Deitel & Deitel & Nieto, "Internet & World Wide Web – How to Program", PEA, Fifth Edition.2010.

2. Core SERVLETS ANDJAVASERVER PAGES VOLUME 1: CORE TECHNOLOGIES By Marty Hall and Larry Brown Pearson

Reference Books :

1. Chris Bates, “Web Programming Building Internet Applications”, 3rd Edition, Wiley India, 2006.

2. Anders Moller, Michael Schwartzbach, “An Introduction to XML and Web Technologies”, 1st Edition, Pearson Education, 2006.

3. Ivan BayRoss, “Web Enabled Commercial Application Development using HTML, DHTML, JavaScript, Perl”, BPB Publication, 3rd Edition, 2005.

4. Uttam K Roy, “Web Technologies”, OXFORD University Press, 2012.

5. “Advanced Java 2 Platform -HOW TO PROGRAM” by H. M.Deitel, P. J. Deitel, S. E. Santry – Prentice Hall.

6. “Beginning Java™ EE 6 Platform with GlassFish 3 From Novice to Professional” by Antonio Goncalves - Apress publication.

SYLLABUS OF COURSES UNDER

PROFESSIONAL ELECTIVES

Specialization Name: Data Science & Analytics

DATA VISUALIZATION TECHNIQUES

Syllabus :

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 , 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. Scientific / Spatial Data Visualization , Scalar Volumes , Isosurfacing ,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

Text Books :

a. Fry, Visualizing Data. O'Reilly Media, 2008, ISBN0596514557.

b. Munzner, Visualization Analysis and Design, 2014, ISBN 1466508914(available c. electronically through the Clemson Universitylibraries).

d. Ware, Information Visualization: Perception for Design, 3rd ed. Morgan Kaufmann, 2012, ISBN 0123814642 (available electronically through the Clemson University libraries)

Reference Books :

1. Munzner, Visualization Analysis and Design, 2014, ISBN 1466508914 (available electronically through the Clemson University libraries).

2. Ware, Information Visualization: Perception for Design, 3rd ed. Morgan Kaufmann, 2012, ISBN 0123814642 (available electronically through the Clemson Universitylibraries)

3. Paulraj Ponniah, "DATA MODELING FUNDAMENTALS", A Practical Guide for IT Professionals.

4. Big Data Data for Dummies by Judith Hurwitz, Alan Nugent, Dr. Fern Halper, and Marcia Kaufman

Web Links :1. https://onlinecourses.nptel.ac.in/noc16_cs03/preview

MOOCS :1. https://www.coursera.org/learn/datavisualization/home/welcome 2. https://www.coursera.org/learn/data-visualization-tableau/home/welcome 3. https://www.udemy.com/course/learning-python-for-data-analysis-and-visualization/learn/lecture/2345238?start=0#overview

DATA WAREHOUSING AND MINING

Syllabus :

KDD Process, Introduction to Data Warehouse, Data Pre processing- Data Cleaning methods, Descriptive Data Summarization, Data Reduction, Data Discretization and Concept hierarchy generation Overview of ETL and OLAP OLTP integration – comparison of OLAP with OLTP systems, ROLAP, MOLAP and DOLAP, Data Cube Computation methods, Advanced SQL support for OLAP, multi-dimensional modelling, Attribute-oriented Induction Data Warehouse architecture and implementation - Parallel execution, Materialized views. Data Mining Techniques: Basic concepts of Association Rule Mining, Frequent Item set mining, Mining various kinds of association rules, Classification by decision tree induction, Bayesian Classification, Rule-based Classification, Classification Back-propagation, Associative Classification, Lazy Learners, Rough set approach Clustering methods, Data Objects and Attribute Types, Basic Statistical Descriptions of Data, Measuring Data Similarity and Dissimilarity Partitioning-Based Clustering Methods; Hierarchical Clustering Methods; Density Based and Grid-Based Clustering Methods

Text Books :

1. Han J &Kamber M, “Data Mining: Concepts and Techniques”, Third Edition, Elsevier, 2011 2.
2. Pang-Ning Tan, Michael Steinback, Vipin Kumar, “Introduction to Data Mining”, Pearson Education, 2008

Reference Books :

1. M.Humphires, M.Hawkins, M.Dy,“Data Warehousing: Architecture and Implementation”, Pearson Education, 2009.

2. Anahory, Murray, “Data Warehousing in the Real World”, Pearson Education, 2008.

3. Kargupta, Joshi,etc., “Data Mining: Next Generation Challenges and Future Directions”, Prentice Hall of India Pvt Ltd, 2007.

Web Links :1.https://onlinecourses.nptel.ac.in/noc21_cs06/preview
2.https://onlinecourses.swayam2.ac.in/cec19_cs01/preview

BIG DATA ANALYTICS

Syllabus :

Understanding BigData:Defining Data, Types of Data, Structured Data, Semi Structured Data, Unstructured Data, How data being Generated, Different source of Data Generation, Rate at which Data is being generated, Different V’s, Volume, Variety, Velocity, Veracity, Value, How single person is contributing towards BigData, Significance for BigData, Reason for BigData, Understanding RDBMS and why it is failing to store BigData. Future of BigData, BigData use cases for major IT Industries.Introduction to Hadoop : What is Hadoop, Apache Community, Cluster, Node, Commodity Hardware, Rack Awareness, History of Hadoop, Need for Hadoop, How is Hadoop Important, Apache Hadoop Ecosystem, Different Hadoop offering , Hadoop 1.x Architecture, Apache Hadoop Framework, Master- Slave Architecture, Advantages of Hadoop. Storage Unit : Hadoop Distributed File System, Design of HDFS, HDFS Concept, How files are stored in HDFS, Hadoop File system, Replication factor, Name Node, Secondary Name Node, Job Tracker, Task tracker, Data Node, FS Image, Edit-logs, Check-pointing Concept, HDFS federation, HDFS High availability Architectural description for Hadoop Cluster, When to use or not to use HDFS, Block Allocation in Hadoop Cluster, Read operation in HDFS, Write operation in HDFS, Hadoop Archives, Data Integrity in HDFS, Compression & Input Splits.Processing Unit : What is MapReduce, History of MapReduce, How does MapReduce works, Input files, Input Format types Output Format Types, Text Input Format, Key Value Input Format, Sequence File Input Format, Input split, Record Reader, MapReduce overview, Mapper Phase, Reducer Phase, Sort and Shuffle Phase, Importance of MapReduce Data Flow, Counters, Combiner Function, Partition Function, Joins, Map Side Join, Reduce Side Join, MapReduce Web UI, Job Scheduling, Task Scheduling, Fault Tolerance, Writing MapReduce Application, Driver Class, Mapper Class, Reducer Class, Serialization, File Based Data Structure, Writing a simple MapReduce program to Count Number of words, MapReduce Work Flows.YARN &Hadoop Cluster :YARN, YARN Architecture, YARN Components, Resource Manager, Node Manager, Application Master, Concept of Container, Difference between Hadoop 1.x and 2.x Architecture, Execution of Job in Yarn Cluster, Comparing and Contrasting Hadoop with Relational Databases Cluster Specification, Cluster Setup and Installation, Creating Hadoop user, Installing Hadoop, SSH Configuration, Hadoop Configuration, Hadoop daemon properties, Different modes of Hadoop, Standalone Mode, Pseudo Distributed Mode, Fully Distributed Modes.

Text Books :

1. Hadoop: The Definitive Guide, By: Tom White, O’REILLY

2.Practical Big Data Analytics:: hands-on techniques to implement enterprise analytics and machine learning using Hadoop By Nataraj Dasgupta,Packt Publishing Ltd.

Reference Books :

1. Hadoop for Dummies, By: Dirk deRoos, Paul C. Zikopoulos, Bruce Brown, Rafael Coss, and Roman B. Melnyk, A Wiley brand

2. Hadoop in Action, Writer: Chuck Lam Published By: Manning Publications

Web Links :1. https://www.simplilearn.com/ courses/2810/Big-Data-Hadoop-and-Spark-Developer/ 2. https://www.sas.com/en_us/insights/analytics/big-data-analytics.html

BIG DATA OPTIMIZATION

Syllabus

:Introduction: Motivation, Why R, Representation of a Solution , Evaluation Function , Constraints , Optimization Methods , Demonstrative Problems Foundation of r -R Basics: Introduction , Basic Objects and Functions, data structures,about usage, understanding data structures, functions, list,arrays,control structures, data manipulations, date and string manipulations Blind Search: Introduction, Full Blind Search, Grid Search , Monte Carlo Search , Local Search: Introduction , Hill Climbing, Simulated Annealing , Tabu Search, Comparison of Local Search Methods, Population Based Search: Introduction , Genetic and Evolutionary Algorithms ,Differential Evolution ,Particle Swarm Optimization ,Estimation of Distribution Algorithm ,Comparison of Population Based Methods, Bag Prices with Constraint Genetic Programming Applications: Introduction, Travelling Salesman Problem , Time Series Forecasting , Wine Quality Classification Implementing R programming on various problems.(Given below in lab list)

Text Books :

1. Paulo Cortez, “Modern Optimization with R “ , Springer, (2014). 2. Nicholas J. Horton & Ken Klein man, “ Using R and R Studio for Data Management, Statistical Analysis, and Graphics”, Second Edition , CRC Press, (2015).

Reference Books :1. Carlo Zaniolo, “Advanced database systems”, Morgan Kaufmann, Elsevier, (1997). 2. Jan L. Harrington, “Relational Database Design”, Morgan Kaufmann, Elsevier, (2009)

ADVANCED DATABASES

Course Title :ADVANCED DATABASES

Course Code :20CS3279RA

L-T-P-S Structure : 2-0-2-0

Pre-requisite :

Credits : 3

Syllabus :

Query optimization, Heuristic in query optimization, selectivity and cost estimates in query optimization. Database tuning: An overview of databases Tuning in relational systems. Database Recovery Protocols: Recovery concepts, NO-UNDO/REDO Recovery Based on Deferred Update, Recovery techniques Based on Immediate Update, Shadow Paging, ARIES Recovery Algorithm. Advanced Database Models and Applications: Active Database Concepts, Temporal Database Concepts, Spatial Database Concepts, Deductive Databases. Emerging Database Technologies and Applications: Mobile Data Management, Geographical Information Systems (GIS), Genomic Databases. Distributed Databases: distributed database concepts, Types of Distributed database systems, Distributed database Architecture, Data Fragmentation, Allocation Techniques for Distributed Database Design, Query Processing and optimization in distributed database design, Overview of Transaction Management in distributed databases. Overview Of Concurrency Control and Recovery in distributed database design. Object Oriented database systems: Object DBMSs, Weakness of RDBMSs, Object Oriented Concepts, Storing Objects in a Relational Database, Advantages and disadvantages of OODBMSs. Object Oriented DBMSs-Standards and Systems: Object Management Group, Object Data Standard ODMG 3.0, Object Store. Object Relational DBMS: Query Processing and Optimization, New Index Types, Object Oriented Extension in Oracle, Comparison of ORDBMS and OODBMS. Multimedia Databases: Multimedia databases, Multimedia Data, SQL and Multimedia-Manipulating Large objects, Querying Multimedia-Introduction, Manipulating Multimedia data. Multimedia modelling data, Multimedia Database Architecture and performance. Dealing with Multimedia text, image, and video.

Textbooks:

1. Ramez Elmasri, Shamkanth B. Navathe, “Fundamentals of Database Systems”, 5th Edition Pearson, 2007.

2. Thomas Connolly, Carolyn Begg “Database Systems”, 4th Edition, Pearson, 2012.

Reference Books :

1. Dunckley Lynne, “Multimedia Databases: An Object Relational Approach”, 1st Edition, Pearson Education, 2009.

2. Carlo Zaniolo, “Advanced database systems”, Morgan Kaufmann, Elsevier, 1997.

3. Peter Rob and Corlos coronel,”Database Systems-Design, Implementation and Management “, 5th Edition, Thompson Learning, Course Technology, 2005

Web Links: MongoDB Certification: https://university.mongodb.com/certification/developer/about MongoDB Certified Developer Associate Exam

Specialization Name: IoT analytics

INDUSTRIAL IOT

Course Title : INDUSTRIAL IOT

Course Code :21EM3213

L-T-P-S Structure : 2-0-2-0

Pre-requisite :

Credits : 3

Syllabus :

The Industrial Internet of Things (IIoT), Industry 4.0. in digital oilfield, advanced manufacturing, power grid automation, and smart cities”. Factors enabled the IIo, platforms are, and also market information on Software and Services, the top application areas are (examples include manufacturing and oil & gas), the top operating systems are that are used in IIoT deployments. IIOT Advanced Manufacturing company how to staff, plan and execute a project, how to build a bill of materials for a product, how to calibrate sensors and validate sensor measurements, how basic file systems operate, and types of file systems used to store big data, how machine learning algorithms work - a basic introduction to study big data and how to prepare data for machine learning algorithms. IIoT networking and wireless communication protocols used in IIoT deployments and computer security; encryption techniques and secure methods for insuring data integrity and authentication. IIOT SystemC and how it can be used to create models of cyber-physical systems, embedded systems in the Automotive and Transportation market segment. How to debug deeply embedded systems, Lauterbach's TRACE32 debugging tools, study engineering failures.

Text Books :

1. S. Misra, A. Mukherjee, and A. Roy, Introduction to IoT. Cambridge University Press, 2020

2. S. Misra, C. Roy, and A. Mukherjee, Introduction to Industrial Internet of Things and Industry 4.0. CRC Press.2020

3. Dr. Guillaume Girardin , Antoine Bonnabel, Dr. Eric Mounier, 'Technologies Sensors for the Internet of Things Businesses & Market Trends 2014 -2024',Yole Development Copyrights ,2014

4. Peter Waher, 'Learning Internet of Things', Packt Publishing, 2015. 5. Industry 4.0: The Industrial Internet of Things Paperback – by Alasdair Gilchrist

Reference Books:

1. Hands-On Industrial Internet of Things: Create a powerful Industrial IoT infrastructure using Industry 4.0 by Giacomo Veneri, Antonio Capasso

2. “Industrial Internet of Things: Cyber manufacturing Systems “by Sabina Jeschke, Christian Brecher, Houbing Song, Danda B. Rawat (Springer)

Web Links :1. https://archive.nptel.ac.in/courses/106/105/106105195/. 2. https://onlinecourses.nptel.ac.in/noc20_cs24/preview

MOOCS :

https://professional.mit.edu/course-catalog/industrial-internet-things-theory-applications. https://www.my-mooc.com/en/mooc/industrial-iot-markets-and-security/ https://www.edx.org/course/iot-systems-and-industrial-applications-with-design-thinking https://www.coursera.org/specializations/developing-industrial-iot https://mooc.es/course/introduction-to-industry-4-0-and-industrial-internet-of-things/

EDGE COMPUTING

Course Code :20CS3253RA

L-T-P-S Structure : 2-0-2-0

Pre-requisite :

Credits : 3

Syllabus:

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, Architecture: Integrating IoT + Fog + Cloud Infrastructures, System Modelling, and Research Challenges, Network Slicing Management in Edge and Fog, Optimization in Fog Computing, Formal Modelling Framework for Fog Computing, Middleware: 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: 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

Text Books :

1.Rajkumar Buyya (Editor), Satish Narayana Sri rama(Editor),"Fog and Edge Computing: Principles and Paradigms", Wiley Publications, ISBN: 978-1-119-52498-4, January 2019.

2. Perry Lea,"IoT and Edge Computing for Architects: Implementing edge and IoT systems from sensors to clouds with communication systems, analytics, and security", 2nd Edition,Paperback.

Reference Books :

1. Edge Computing: A Primer by Jie CaoQuan ZhangWeisong Shi.

2. Fog and Edge Computing-Simply Indepth (English, Paperback, Singh Ajit), ISBN: 9798725825428

Web Links : RPI: Edge Computing, 1. https:// Fog-Edge-Computing-Principles- Distributed/dp/1119524989 2. https://link.springer.com/chapter/10.1007/978-3-030-34957-8_8

MOOCS :1. https://www.udemy.com/course/introduction-to-edge-computing/ 2. https://www.coursera.org/lecture/iot-wireless-cloud-computing/5-10-edge-computing-pOK8T 3. https://www.linkedin.com/learning/iot-foundations-operating-system-applications

DEEP LEARNING

Syllabus :

History of Deep Learning, McCulloch Pitts Neuron, Thresholding Logic, Perceptron's, Perceptron Learning Algorithm and Convergence, Multilayer Perceptron's (MLPs), Representation Power of MLPs, Sigmoid Neurons, Feedforward Neural Networks, Backpropagation, Gradient Descent (GD), Momentum Based GD, Eigenvalues and eigenvectors, Eigenvalue Decomposition, Principal Component Analysis, Singular Value Decomposition, Bias Variance Tradeoff, L2 regularization, Early stopping, Dataset augmentation, Parameter sharing and tying, Injecting noise at input, Convolutional Neural Networks, LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet, Autoencoders, Denoising autoencoders, Sparse Autoencoder, Ensemble methods, Batch Normalization, text and sequences, Recurrent NN, GRU, Long Short-Term Memory (LSTM), RCNN, Fast RCNN, Faster RCNN, Object Detection, YOLO, Deep learning for computer vision, Deep Dream, Neural style transfer, Markov chains, Markov models, Markov networks, Restricted Boltzmann Machines, Variational autoencoders, Autoregressive Models: NADE, MADE, PixelRNN, Generative Adversarial Networks (GANs), how to train DCGAN, limitations of deep learning.

Text Books :

1.Ian Goodfellow and Yoshua Bengio and Aaron Courville (2016)

2.Deep Learning Book. eep Learning with Python, Francois Chollet , Manning publications, 2018

3. Grokking Deep Learning ,Andrew Trask, Manning publications, 2019

Reference Books :

1. Deep Learning with PyTorch: A practical approach to building neural network models using PyTorch by Vishnu Bramanian

2. Neural Networks: A Systematic Introduction, Raúl Rojas, 1996 Pattern Recognition and Machine Learning, Christopher Bishop, 2007

Web Links:

1.https://online.stanford.edu/courses/cs230-deep-learning

2.https://towardsdatascience.com/feed-forward-neural-networks-how-to-successfully-build-them-in-python-74503409d99a 3.https://ruder.io/optimizing-gradient-descent/ 4.https://medium.com/@snaily16/what-why-and-which-activation-functions-b2bf748c0441

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Application, Driver Class, Mapper Class, Reducer Class, Serialization, File Based Data Structure, Writing a simple MapReduce program to Count Number of words, MapReduce Work Flows.YARN &Hadoop Cluster :YARN, YARN Architecture, YARN Components, Resource Manager, Node Manager, Application Master, Concept of Container, Difference between Hadoop 1.x and 2.x Architecture, Execution of Job in Yarn Cluster, Comparing and Contrasting Hadoop with Relational Databases Cluster Specification, Cluster Setup and Installation, Creating Hadoop user, Installing Hadoop, SSH Configuration, Hadoop Configuration, Hadoop daemon properties, Different modes of Hadoop, Standalone Mode, Pseudo Distributed Mode, Fully Distributed Modes.

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2. Practical Big Data Analytics: hands-on techniques to implement enterprise analytics and machine learning using Hadoop By Nataraj Dasgupta,Packt Publishing Ltd.

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2. Hadoop in Action, Writer: Chuck Lam Published By: Manning Publications

Web Links :1. https://www.simplilearn.com/ courses/2810/Big-Data-Hadoop-and-Spark-Developer/ 2. https://www.sas.com/en_us/insights/analytics/big-data-analytics.html

DATA ANALYTICS AND VISUALIZATION

Syllabus:

Introduction: AI, Machine Learning and Data Science, what is data Science? Extracting Meaningful patterns, building representative models, Combination of Statistics, Machine Learning, and Computing, Learning Algorithms, associated fields, Data Science Classification, Data objects and Attribute Types, Measuring Data similarity and dissimilarity, Data Collection and Data Pre-Processing overview. Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization. Descriptive Statistics Sampling Techniques – Data Classification – Measures of Central Tendency – Measures of Variation – Quartiles and Percentiles – Moments - Skewness and Kurtosis. Exploratory Data Analytics Descriptive Statistics – Mean, Mode, and Standard Deviation. Box Plots – Pivot Table – Heat Map – Correlation Statistics – ANOVA. Data Wrangling with NumPy & Pandas: Python list vs NumPy arrays – What's the Difference? Creating a NumPy Array, Shape and Reshaping of NumPy Array, Indexing and Slicing of NumPy Array, Stacking and Concatenating NumPy Arrays, Broadcasting in NumPy Arrays, Time series, Sorting in NumPy Arrays, Pandas Series, Data Frame, indexing, sorting, loading data from CSV, Aggregation, concatenation, group by. Visualization and simple metrices: Data Analytics Communication Data Types for Plotting Data Types and Plotting, Simple Line Plots, Simple Scatter Plots, Visualizing Errors, Density and Contour Plots, Histograms, Binning's, and Density, Customizing Plot Legends, Customizing Colour bars, Multiple Subplots, Text and Annotation, Customizing Ticks

Textbooks:

1. The Data Science Handbook Field Cady - Wiley Book
2. Python for Data Analysis: Data Wrangling with pandas, numpy & Ipython Wes Mc Kinney- O'Reilly 2nd edition Book
3. Statistical inference for data science Brian Caffo Global Edition Leanpub

Reference Books:

1. Doing Data Science, Straight talk from the front line- Rachel schutt & cathy o'neil ,o'reilly
2. Probability and Statistics for Data Science-Carlos Fernandez-Granda
3. Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing, and Presenting Data 1st Edition
4. Hands-On Exploratory Data Analysis with Python, Suresh Kumar Mukhiya Usman Ahmed, Pack
5. Data Science & Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data EMC Education Services, Willey.