J.N.N INSTITUTE OF ENGINEERING

AUTONOMOUS

NAAC 'A' Grade | Approved by AICTE | Affiliated to Anna University

ACADEMIC CURRICULUM
(REGULATION 2022)
FOR

UNDER GRADUATE PROGRAMMES
CHOICE BASED CREDIT SYSTEM

(Applicable to the students admitted from the Academic Year 2022 – 2023 onwards)

B.Tech ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

B. Tech ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

ABOUT THE DEPARTMENT

The Department of Artificial Intelligence and Data Science is established in the year 2020. The programme offered by the department is B.Tech. degree in Artificial Intelligence and Data Science. The department provides quality and excellent education in Artificial Intelligence and Data Science to students.

This B.Tech. Programme combines two areas, namely, Artificial intelligence and Data science. Artificial intelligence (AI) is wide-ranging branch of computer science concerned with creating smart machines capable of performing tasks that typically require human intelligence. Data science (DS) is an interdisciplinary field that uses scientific methods, processes, algorithms and systems to extract knowledge and insights from structured and unstructured data, and apply knowledge and actionable insights from data across a broad range of application domains. The job market for data science and AI professionals is booming across the world, making it a desirable career choice. Hence, the demand for the programmes in Artificial Intelligence and Data Science (AI & DS) areas has increased. JNNIE is offering the specialization in Artificial Intelligence and Data Science under
B. Tech degree from this academic year. This Programme mainly covers computer science, mathematics, artificial intelligence, machine learning, and their applications in various domains.

VISION

To impart quality-education, inculcate professionalism and enhance the problem-solving skills of the students in the domain of Artificial Intelligence & Data Science by applying recent technological tools and incorporating collaborative principles with a focus to make them industry ready.

MISSION

1. To enhance the knowledge of the students with most recent advancements and refresh their insights in the field of Artificial Intelligence and Data Science.
2. To equip the students with strong fundamental concepts, analytical capability, programming and problem-solving skills.
3. To make the students industry ready and to enhance their employability through training, internships and real-time projects.
4. To guide the students to perform research on Artificial Intelligence and Data Science, with the aim to provide solutions to the problems of the industry.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs):

PEO 1:To provide graduates with the proficiency to utilize the fundamental knowledge of basic sciences, mathematics, Artificial Intelligence, data science and statistics to build systems that require management and analysis of large volume of data.

PEO 2 :To enrich graduates with necessary technical skills to pursue pioneering research in the field of AI and Data Science and create disruptive and sustainable solutions for the welfare of ecosystems.

PEO 3 :To enable graduates to think logically, pursue lifelong learning and collaborate with an ethical attitude in a multidisciplinary team

PROGRAM OUTCOMES POs:

Engineering Graduates will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
2. **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.
3. **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.
4. **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.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
6. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
7. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
8. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as,

being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

9. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

10. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OBJECTIVES (PSOs)

1. Exhibit design and programming skills to build and automate business solutions using cutting edge technologies.
2. Strong theoretical foundation leading to excellence and excitement towards research, to provide elegant solutions to complex problems.
3. Ability to work effectively with various engineering fields as a team to design, build and develop system applications.

CHOICE BASED CERDIT SYSTEM
B. Tech ARTIFICIAL INTELLIGENCE AND DATA SCIENCE CURRICULUM FOR SEMESTERS I TO VIII AND SYLLABI FOR SEMESTERS I AND IV
SEMESTER I

S.No	COURSE CODE	COURSE TITLE	MODE	PERIODS PER WEEK				TCP	C	CATEGORY
				L	T	P	J			
MANDATORY COURSE										
*	22IP100	Induction Programme	-	-	-	-	-	03 Weeks	0	-
THEORY COURSES										
1	22HST101	Professional English	L+P	2	0	4	0	6	4	HSMC
2	22BST101	Basic Mathematics for Engineers	L	3	2	0	0	5	4	BSC
3	22BST102	Engineering Physics	L	3	0	0	0	3	3	BSC
4	22BST103	Engineering Chemistry	L	3	0	0	0	3	3	BSC
5	22EST101	Problem Solving and Python Programming/ICC1	L	3	0	0	0	3	3	ESC
6	22HSM101	Heritage of Tamils	L	1	0	0	0	1	1	HSMC
EMPLOYABILITY ENHANCEMENT COURSE										
7	22EET101	Engineeringand Professional Skills	L+P	1	0	2	0	3	2	EEC
PRACTICAL COURSES										
8	22ESP101	Problem Solving and Python Programming Laboratory	P	0	0	4	0	4	2	ESC
9	22BSP101	Physics and Chemistry Laboratory	P	0	0	4	0	4	2	BSC
EMPLOYABILITY ENHANCEMENT COURSE										
10	22EEP101	Product Tinkering Laboratory	P	0	0	2	0	2	1	EEC
			TOTAL	**16**	**02**	**16**	**00**	**34**	**25**	

L-Theory, T-Tutorial, P-Practical, J-Project

SEMESTER II

S.No	COURSE CODE	COURSE TITLE	Mode	PERIODS PER WEEK				TOTAL CONTACT PERIODS	CREDITS	CATEGORY
				L	T	P	J			
THEORY COURSES										
1		Language Elective	L	3	0	2	0	5	4	HSMC
2	22BST201	Statistics and Transforms	L	3	2	0	0	5	4	BSC
3	22ADT201	Data Structures	L	3	0	0	0	3	3	PCC
4	22EST205	Basic Electrical and Electronics Engineering	L	3	0	0	0	3	3	ESC
5	22EST202	Engineering Graphics	L	1	0	4	0	5	3	ESC
6	22ADT202	Computer Architecture / ICC2	L+P	3	0	0	0	3	3	PCC
7	22HSM201	Tamils and Technology	L	0	1	0	0	1	1	HSMC
EMPLOYABILITY ENHANCEMENT COURSE										
8	22EET201	Innovation and Design Thinking*	L	2	0	0	0	2	2	EEC
MANDATORY COURSE										
9	22NCC201	NCC/NSS/YRC Credit Course Level*	L	1	0	0	0	1	1#	-
PRACTICAL COURSES										
10	22ESP201	Engineering Product Laboratory	P	0	0	3	0	3	1.5	EEC
11	22ADP201	Data Structures Laboratory	P	0	0	3	0	3	1.5	PCC
Total				**19**	**03**	**12**	**0**	**36**	**26**	

***Specific concerned Branch**

L- Lecture T- Tutorial P- Practical J- Project TCP- Total Contact Period
C- Credits CAT- Category

 # NCC Credit Course level 1 is offered for NCC students only. The grades earned by the students will be recorded in the Mark Sheet, however the same shall not be considered for the computationof CGPA.
***Common for all branches**

SEMESTER III

S.No	COURSE CODE	COURSE TITLE	Mode	PERIODS PER WEEK				TOTAL CONTACT PERIODS	CREDITS	CATEGORY
				L	T	P	J			
THEORY COURSES										
1	22BST301	Discrete Mathematics	L	3	2	0	0	5	4	BSC
2	22ADT301	System Software	L	3	0	0	0	3	3	PCC
3	22ADT302	Design and Analysis of Algorithms	L+P	2	0	2	0	4	3	PCC
4	22ADT303	Database management Systems	L	3	0	0	0	3	3	PCC
5	22ADT304	Software Engineering / ICC3	L	3	0	0	0	3	3	PCC
6	22ADT305	Artificial Intelligence	L	3	0	0	0	3	3	PCC
7	22GET306	Entrepreneurship and startups*	L	1	0	0	0	1	1	HSMC
PRACTICAL COURSES										
8	22ADP301	Artificial Intelligence Laboratory	P	0	0	3	0	3	1.5	PCC
9	22ADP302	Database Design Management Laboratory	P	0	0	3	0	3	1.5	PCC
EMPLOYABILITY ENHANCEMENT COURSE										
11	22EEP301	Soft Skills *	P	0	0	2	0	2	1	EEC
Total				**18**	**2**	10	**0**	**29**	**24**	

***Common to all Branches**
**** Common to all Branches, selection from one minor vertical/approved honors subjects**

L-Theory, T-Tutorial, P-Practical, J-Project

SEMESTER IV

S.No	COURSE CODE	COURSE TITLE	Mode	PERIODS PER WEEK				TOTAL CONTACT PERIODS	CREDITS	CATEGORY
				L	T	P	J			
THEORY COURSES										
1	22BST402	Probability and Statistics	L	3	2	0	0	5	4	BSC
2	22ADT401	Operating Systems / ICC4	L+P	3	0	2	0	5	4	PCC
3	22ADT402	Machine Learning	L	3	0	0	0	3	3	PCC
4	22ADT403	Fundamentals of Data Science and Analytics	L+P	2	0	2	0	4	3	PCC
MANDATORY COURSE										
5	22EST401	Environmental Science and Sustainability	L	2	0	0	0	2	2	BSC
6	22EST401	NCC/NSS/YRC CreditCourse Level*	L	1	0	0	0	1	1#	-
PRACTICAL COURSES										
7	22ADP401	Machine Learning Laboratory	P	0	0	4	0	4	2	PCC
EMPLOYABILITY ENHANCEMENT COURSE										
8	22EEP401	Quantitative Analysis and Logical Reasoning I	P	0	0	2	0	2	1	EEC
Total				**14**	**2**	**10**	**00**	**26**	19	

 # Common to all Branches and product is specific to their domain
**** Common to all Branches, selection from one minor vertical/approved honors subjects**
@ three seminars for each student, one topic from subject extension, one topic from journal paper and last one topic given by the faculty

SEMESTER V

S.No	COURSE CODE	COURSE TITLE	Mode	PERIOD SPER WEEK				TOTAL CONTACT PERIODS	CREDITS	CATEGORY
				L	T	P	J			
THEORY COURSES										
1	22ADT501	Deep Learning	L	3	0	0	0	3	3	PCC
2	22ADT601	Cloud Computing	L	2	0	2	0	4	3	PCC
MANAGEMENT ELECTIVE										
3		Management Elective	L	3	0	0	0	3	3	PEC
EMPLOYABILITY ENHANCEMENT COURSE										
4	22HST501	Engineering Economics and Financial Management*	L	3	0	0	0	3	3	EEC
5	22ADT503	Big data Analytics / ICC5	L	3	0	0	0	3	3	PCC
PROFESSIONAL ELECTIVE										
6		Professional Elective I	L	3	0	0	0	3	3	PEC
7		Professional Elective II	L	3	0	0	0	3	3	PEC
MANDATORY COURSE										
8		Mandatory Course I	L	3	0	0	0	3	0	MCC
ENROLLMENT FOR B.E. / B. TECH. (HONOURS) / MINOR DEGREE (OPTIONAL)										
9		Minor/ Honour / Remedial class **	T	3	0	0	0	3	3**	PEC**
PRACTICAL COURSES										
10	22ADP501	Deep Learning Laboratory	P	0	0	4	0	4	2	PCC
EMPLOYABILITY ENHANCEMENT COURSE										
11		Internship *	P	0	0	0	0	0	1	EEC
Total				**26**	**00**	**6**	**0**	**32**	**24**	

*** Common to all Branches**

**** Common to all Branches, selection from one minor vertical/approved honors subjects**

SEMESTER VI

S.No	COURSE CODE	COURSE TITLE	Mode	PERIODS PER WEEK				TOTAL CONTACT PERIODS	CREDITS	CATEGORY
				L	T	P	J			
THEORY COURSES										
1	22ADT602	Distributed Systems	L	3	0	0	0	3	3	PCC
2	22ADT603	Multimedia and Animation / ICC6	L+J	3	0	0	2	5	4	PCC
OPEN ELECTIVE										
3		Open elective 1	L	3	0	0	0	3	3	OEC
PROFESSIONAL ELECTIVE										
4		Professional Elective III	L	3	0	0	0	3	3	PEC
5		Professional Elective IV	L	3	0	0	0	3	3	PEC
MANDATORY COURSE										
6		Mandatory Course II	L	3	0	0	0	3	0	MCC
7		NCC Credit course level 3#	L	3	0	0	0	3	3#	PEC**
ENROLLMENT FOR B.E. / B.TECH. (HONOURS) / MINOR DEGREE (OPTIONAL)										
8		Minor/Honour / Remedial class**		3	0	0	0	3	3**	PEC**
PRACTICAL COURSES – EMPLOYABILITY ENHANCEMENT COURSE										
9	22EEP601	Quantitative Analysis and Logical Reasoning‡	P	0	0	2	0	2	1	EEC
10	22EEP602	Comprehensive Assessment*	P	0	0	2	0	2	1	EEC
Total				**24**	**0**	**4**	**2**	**30**	**18**	

*** Common to all Branches**
**** Common to all Branches, selection from one minor vertical/approved honors subjects**

SEMESTER VII

S.No	COURSE CODE	COURSE TITLE	Mode	PERIODS PER WEEK				TOTAL CONTACT PERIODS	CREDITS	CATEGORY
				L	T	P	J			
THEORY COURSES										
1	22ADT701	Human values and ethics	L	3	0	0	0	2	3	HSMC
2	22ADT702	Internet of Things	L	3	0	2	0	5	4	PCC
3	22ADT703	Software Testing / ICC7	L	3	0	0	0	3	3	PCC
4	22ADT704	Engineering Predictive Analytics	L	3	0	0	0	3	3	PEC
OPEN ELECTIVE										
5		Open Elective II	L	3	0	0	0	3	3	OEC
ENROLLMENT FOR B.E. / B.TECH. (HONOURS) / MINOR DEGREE (OPTIONAL)										
6		Minor/Honor/remedial Class**	L	3	0	0	0	3	3**	PEC**
PRACTICAL COURSES - EMPLOYABILITY ENHANCEMENT COURSE										
7	22CSP702	Product Design and Development*	J	0	0	0	6	6	3	EEC
8		Internship*	P	0	0	0	0	0	1	EEC
Total				**18**	**00**	**02**	**06**	**25**	**20**	

*** Common to all Branches**
**** Common to all Branches, selection from one minor vertical/approved honors subjects**

SEMESTER VIII

S.No	COURSE CODE	COURSE TITLE	Mode	PERIODS PER WEEK				TOTAL CONTACT PERIODS	CREDITS	CATEGORY
				L	T	P	J			
PRACTICAL COURSES - EMPLOYABILITY ENHANCEMENT COURSE										
1	22ADP801	Project Work	J	0	0	0	16	16	08	EEC
ENROLLMENT FOR B.E. / B.TECH. (HONOURS) / MINOR DEGREE (OPTIONAL)										
2		Minor/Honour/remedial class**	L	3	0	0	0	3	3**	PEC**
		Total		**3**	**0**	**0**	**16**	**19**	**08**	

**** Common to all Branches, selection from one minor vertical/approved honors subjects**

Following is the Industry Core Courses (ICC) which will be offered as Choice Based Courses in the following semesters

S.No	COURSE CODE	COURSETITLE	MODE	PERIODS PER WEEK				TCP	C	CAT
				L	T	P	J			
1	ICC1	Python programming	L	3	0	0	0	3	3	ICC
2	ICC2	Data Visualisation with R, Watson	L	3	0	0	0	3	3	ICC
3	ICC3	Business Intelligence with Cognos BI	L	3	0	0	0	3	3	ICC
4	ICC4	Predictive Modelling using SPSS Modeller	L	3	0	0	0	3	3	ICC
5	ICC5	Design Thinking / Devops / Agile	L	3	0	0	0	3	3	ICC
6	ICC6	Spark and Scala fundamentals	L+P	3	0	2	0	3	4	ICC
7	ICC7	AI Analyst	L	3	0	0	0	3	3	ICC
		TOTAL		**21**	**0**	**2**	**0**	**21**	**22**	

CREDIT DISTRIBUTION

Semester	HSMC	BSC	ESC	PCC	PEC	OEC	EEC	MCC	TOTAL	Total PER %
I	5	12	5				3		25	14
II	5	4	6	7.5			3.5		26	15
III	1	4		18			1		24	15
IV		6		12			1		19	12
V				11	9		4		24	13
VI				7	6	3	2		18	16
VII	3			7	3	3	4		20	10
VIII							8		08	5
TOTAL	14	26	11	62.5	18	6	26.5		164	100

CATEGORY		Breakup of Credits	PER % in Total
HSM	Humanities & Social Science Including Management	14	9
BSC	Basic Science Courses	26	16
ESC	Engineering Science Courses	11	7
PCC	Professional Core Courses	62.5	38
PEC	Professional Elective Courses	18	11
OEC	Open Elective Courses	6	4
EEC	Employment Enhancement Courses	26.5	16
MCC	Mandatory Courses		
	Total Credits	164	100

PROFESSIONAL ELECTIVE COURSES: VERTICALS

Verticals for AI&DS	Vertical II Full Stack Development for IT	Vertical III Cloud Computing and Data Center Technologies	Vertical IV Cybersecurity and Data Privacy	Vertical V CreativeMedia	Vertical VI Emerging Technologies	Vertical for AIDSII
Knowledge Engine erring	Cloud Computing	Cloud Computing	Ethical Hacking	Augmented Reality/ Virtual Reality	Augmented Reality/Virtual Reality	Bio- Inspired Optimization Techniques
Recommender Systems	App Development	Virtualization	Digital and Mobile Forensics	Multimedia and Animation	Robotic Process Automation	App Development
Soft Computing	Cloud Services Management	Cloud ServicesManagement	Social Network Security	Video Creation and Editing	Neural Networks and Deep Learning	Health Care Analytics
Text and Speech Analysis	UI and UX Design	Data Warehousing	Modern Cryptography	UI And UX Design	Cyber Security	Cyber Security
Business Analytics	Software Testing and Automation	Storage Technologies	Engineering Secure Software Systems	Digital marketing	Quantum Computing	Optimization Techniques
Image and video analytics	Web Application security	Software Defined Networks	Cryptocurrency and Block chain Technologies	Multimedia Data Compression and Storage	Cryptocurrency and Block chain Technologies	Game Theory
Computer Vision	DevOps	Stream Processing	Network Security	Game Development	Game Development	Cognitive Science
Big Data Analytics	Principles of programming Languages	Security and Privacy in Cloud	Security and Privacy in Cloud	Visual Effects	3D Printing and Design	Ethics and AI

Registration of Professional Elective Courses from Verticals:

Professional Elective Courses will be registered in Semesters V and VI. These courses are listed in groups called verticals that represent a particular area of specialization / diversified group. Students are permitted to choose all the Professional Electives from a particular vertical or from different verticals. Further, only one Professional Elective course shall be chosen in a semester horizontally (row-wise). However, two courses are permitted from the same row, provided one course is enrolled in Semester V and another in semester VI.

The registration of courses for B.E./B.Tech (Honors) or Minor degree shall be done from Semester V to VIII. The procedure for registration of courses explained above shall be followed for the courses of B.E/B.Tech (Honors) or Minor degree also. For more details on B.E./B.Tech (Honors) or Minor degree refer to the Regulations 2021, Clause 4.10

PROFESSIONAL ELECTIVE COURSE I

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	22ADPE01	Knowledge Engineering	PEC	2	0	2	4	3
2.	22ADPE02	Recommender Systems	PEC	2	0	2	4	3
3.	22ADPE03	Soft Computing	PEC	2	0	2	4	3
4.	22ADPE04	Text and Speech Analysis	PEC	2	0	2	4	3
5.	22ADPE05	Business Analytics	PEC	2	0	2	4	3
6.	22ADPE06	Image and video analytics	PEC	2	0	2	4	3
7.	22ADPE07	Computer Vision	PEC	2	0	2	4	3
8.	22ADPE08	Big Data Analytics	PEC	2	0	2	4	3
9.	22ADPE09	Graph Analytics and Algorithm	PEC	2	0	2	4	3
10.	22ADPE10	Cognitive Systems	PEC	2	0	2	4	3
11	22ADPE11	Computer Networks	PEC	2	0	2	4	3

PROFESSIONAL ELECTIVE COURSE II

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	22ADPE12	Cloud Computing	PEC	2	0	2	4	3
2.	22ADPE13	App Development	PEC	2	0	2	4	3
3.	22ADPE14	Cloud Services Management	PEC	2	0	2	4	3
4.	22ADPE15	UI and UX Design	PEC	2	0	2	4	3
5.	22ADPE16	Software Testing and Automation	PEC	2	0	2	4	3
6.	22ADPE17	Web Application Security	PEC	2	0	2	4	3
7.	22ADPE18	Dev-ops	PEC	2	0	2	4	3
8.	22ADPE19	Principles of Programming Languages	PEC	2	0	2	4	3
9.	22ADPE20	Brain Computer Interaction	PEC	2	0	2	4	3
10.	22ADPE21	Steganography and Digital Watermarking	PEC	2	0	2	4	3

PROFESSIONAL ELECTIVE COURSE III

S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PERIODS PER WEEK**			**TOTAL CONTACT PERIODS**	**CREDITS**
				L	**T**	**P**		
1.	22ADPE22	Cloud Computing	PEC	2	0	2	4	3
2.	22ADPE23	Virtualization	PEC	2	0	2	4	3
3.	22ADPE24	Cloud Services Management	PEC	2	0	2	4	3
4.	22ADPE25	Data Warehousing	PEC	2	0	2	4	3

5.	22ADPE26	Storage Technologies	PEC	3	0	0	3	3
6.	22ADPE27	Software Defined Networks	PEC	2	0	2	4	3
7.	22ADPE28	Stream Processing	PEC	2	0	2	4	3
8.	22ADPE29	Security and Privacy in Cloud	PEC	2	0	2	4	3
9.	22ADPE30	Dot Net Framework Essentials	PEC	2	0	2	4	3
10.	22ADPE31	Biometric Systems	PEC	2	0	2	4	3

PROFESSIONAL ELECTIVE COURSE IV

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	22ADPE32	Ethical Hacking	PEC	2	0	2	4	3
2.	22ADPE33	Digital and Mobile Forensics	PEC	2	0	2	4	3
3.	22ADPE34	Social Network Security	PEC	2	0	2	4	3
4.	22ADPE35	Modern Cryptography	PEC	2	0	2	4	3
5.	22ADPE36	Engineering Secure Software Systems	PEC	2	0	2	4	3
6.	22ADPE37	Cryptocurrency and Block chain Technologies	PEC	2	0	2	4	3
7.	22ADPE38	Network Security	PEC	2	0	2	4	3

MANDATORY COURSES I
(Semester V)

S.No	Course Code	Course Name	L	T	P	J	Contact Hours	Credits
1	22MCT001	Introduction to Women and Gender Studies	3	0	0	0	3	0
2	22 MCT002	Elements of Literature	3	0	0	0	3	0
3	22 MCT003	Film Appreciation	3	0	0	0	3	0
4	22MCT004	Well Being with Traditional Practices (Yoga, Ayurveda and Siddha)	3	0	0	0	3	0
5	22MCT006	Indian Constitution	3	0	0	0	3	0
6	22MCT007	Industrial Safety	3	0	0	0	3	0

MANDATORY COURSES II

S.No	Course Code	Course Name	L	T	P	J	Contact Hours	Credits
1	22 MCT008	Essential of Indian Traditional Values	3	0	0	0	3	0
2	22 MCT009	History of Science and Technology in India	3	0	0	0	3	0
3	22MCT010	Political and Economic Thought for a Humane Society	3	0	0	0	3	0
4	22MCT011	State, Nation Building and Politics in India	3	0	0	0	3	0
5	22MCT012	Disaster Management	3	0	0	0	3	0

LANGUAGE ELECTIVE COURSES
(Semester II)

S.No	Course Code	Course Name	L	T	P	J	Contact Hours	Credits
1	22LET201	Technical English	2	0	2	0	4	3
2	22LET202	French Language	2	0	2	0	4	3
3	22LET203	German Language	2	0	2	0	4	3
4	22LET204	Japanese Language	2	0	2	0	4	3

OPEN ELECTIVES

(Students shall choose the open elective courses, such that the course contents are not similar to any other course contents/title under other course categories).

OPEN ELECTIVE I

S.No	Course Code	Course Name	L	T	P	J	Contact Hours	Credits
1	22RAO001	Robotics	3	0	0	0	3	3
2	22RAO002	Selection of Materials	3	0	0	0	3	3
3	22RAO003	Testing of Materials	3	0	0	0	3	3
4	22RAO004	Marine Vehicles	3	0	0	0	3	3
5	22RAO005	Introduction To Nanotechnology	3	0	0	0	3	3
6	22RAO006	Lean Manufacturing	3	0	0	0	3	3
7	22ADO001	Ethics in Data Science	2	0	2	0	4	3
8	22ADO002	Software Testing	2	0	2	0	4	3
9	22ADO003	Principles of Programming Language	2	0	2	0	4	3
10	22ADO004	Digital Marketing	2	0	2	0	4	3
11	22BMO001	Biology for Engineer	3	0	0	0	3	3
12	22BMO002	Basic of Biomedical Instrumentation	3	0	0	0	3	3
13	22BMO003	Basics of Bioinformatics	3	0	0	0	3	3
14	22BMO004	Biomedical Nanotechnology	3	0	0	0	3	3
15	22ECO001	Arduino for Engineers	3	0	0	0	3	3
16	22ECO002	Introduction to Embedded system	3	0	0	0	3	3
17	22ECO003	Space Time Wireless Communication	3	0	0	0	3	3
18	22ECO004	Telecommunication Network Management	3	0	0	0	3	3
19	22CSO001	System Software	3	0	0	0	3	3
20	22CSO002	Computer Graphics	3	0	0	0	3	3
21	22CSO003	Mobile Application Development	3	0	0	0	3	3

OPEN ELECTIVE II

S.No	Course Code	Course Name	L	T	P	J	Contact Hours	Credits
1	22RAO007	Fundamentals of Combustion	3	0	0	0	3	3
2	22RAO008	Basics in Manufacturing and Metal Cutting Process	3	0	0	0	3	3
3	22RAO009	Fundamentals of Planetary Remote Sensing	3	0	0	0	3	3
4	22RAO010	Lean Six Sigma	3	0	0	0	3	3
5	22RAO011	Low Cost Automation	3	0	0	0	3	3
6	22RAO012	Production of Automotive Components	3	0	0	0	3	3
7	22ADO005	Professional Ethics	2	0	2	0	4	3
8	22ADO006	Cloud Computing	2	0	2	0	4	3
9	22ADO007	Cloud Service Management	2	0	2	0	4	3
10	22ADO008	Operating System	2	0	2	0	4	3
11	22BMO005	Troubleshooting in Medical Devices	3	0	0	0	3	3
12	22BMO006	Quality Assurance and Safety in Hospitals	3	0	0	0	3	3
13	22BMO007	Medical Electronics	3	0	0	0	3	3
14	22BMO008	Assist Devices	3	0	0	0	3	3
15	22ECO005	Introduction to Industrial Engineering	3	0	0	0	3	3
16	22ECO006	Space Engineering	3	0	0	0	3	3
17	22ECO007	Wavelet and its Applications	3	0	0	0	3	3
18	22ECO008	Introduction to Control Systems	3	0	0	0	3	3
19	22CSO004	Ubiquitous Computing	3	0	0	0	3	3
20	22CSO005	User Interface Design	3	0	0	0	3	3
21	22CSO006	Multimedia Systems	3	0	0	0	3	3

Course Code	Course Title	L	T	P	J	C
22HST101	PROFESSIONAL ENGLISH	3	0	2	0	4
		Syllabus version			v. 1.0	

Course Objectives:

1. To improve the communicative competence of learners
2. To help learners use language effectively in academic /work contexts
3. To build on students' English language skills by engaging them in listening, speaking and grammar learning activities that are relevant to authentic contexts.
4. To develop learners' ability to read and write complex texts, summaries, articles, blogs, definitions, essays and user manuals.
5. To use language efficiently in expressing their opinions via various media.

Course Outcome:

1. To listen and comprehend complex academic texts
2. To read and infer the denotative and connotative meanings of technical texts
3. To write definitions, descriptions, narrations and essays on various topics
4. To speak fluently and accurately in formal and informal communicative contexts
5. To express their opinions effectively in both oral and written medium of communication

Unit-1	INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION	9+6 hours

Listening –for general information-specific details- conversation: Introduction to classmates - Audio/ video (formal & informal); Telephone conversation; Listening to voicemail & messages; Listeningand filling a form

Speaking - Self Introduction; Introducing a friend; Conversation - politeness strategies; Telephone conversation; Leave a voicemail; Leave a message with another person; asking for information to fill details in a form.

Reading - Reading brochures (technical context), telephone messages / social media messages relevant to technical contexts and emails.

Writing - Writing emails / letters introducing oneself

Grammar - Present Tense (simple and progressive); Framing questions

Vocabulary - Synonyms; One word substitution; Abbreviations & Acronyms (as used in technical contexts)

Unit-2	**NARRATION AND SUMMATION**	**9+6 hours**

Listening - Listening to podcast, anecdotes / stories / event narration; documentaries and interviewing a celebrity.

Speaking - Narrating personal experiences / events; Interviewing a celebrity; Reporting / and summarizing of documentaries / podcasts/ mock interviews- online/face to face.

Reading - Reading biographies, travelogues, newspaper reports, Excerpts from literature, and travel& technical blogs.

Writing - Guided writing-- Paragraph writing Short Report on an event (field trip etc.)

Grammar –Past tense (simple); Subject-Verb Agreement; and Prepositions

Vocabulary - Word forms (prefixes& suffixes); Synonyms and Antonyms. Phrasal verbs.

Unit-3	**DESCRIPTION OF A PROCESS / PRODUCT**	**9+6 hours**

Listening - Listen to a product and process descriptions; a classroom lecture; and advertisements about a products.

Speaking – Picture description; Giving instruction to use the product; Presenting a product;and Summarising a lecture.

Reading – Reading advertisements, gadget reviews; user manuals.

Writing - Writing definitions; instructions; and Product /Process description.

Grammar - Imperatives; Adjectives; Degrees of comparison; Present & Past Perfect Tenses.

Vocabulary - Compound Nouns, Homonyms; and Homophones, discourse markers(connectives &sequence words)

Unit-4	**CLASSIFICATION ND RECOMMENDATIONS**	**9+6 hours**

Listening – Listening to TED Talks; Scientific lectures; and educational videos. Speaking – SmallTalk; Mini presentations and making recommendations.

Reading – Newspaper articles; Journal reports –and Non Verbal Communication (tables, pie chartset,)

Writing – Note-making / Note-taking (*Study skills to be taught, not tested); Writing recommendations; Transferring information from non-verbal (charts, graph etc, to verbal mode)**Grammar** – Articles; Pronouns - Possessive & Relative pronouns.

Vocabulary - Collocations; Fixed / Semi fixed expressions.

Unit-5	**EXPRESSION**	**9+6 hours**

Listening – Listening to debates/ discussions; different viewpoints on an issue; and panel discussions. **Speaking** –group discussions, Debates, and Expressing opinions through Simulations & Role play. **Reading** – Reading editorials; and Opinion Blogs; **Writing** – Essay Writing (Descriptive or narrative), Instructions **Grammar** – Future Tenses, Punctuation; Negation (Statements & Questions); and Simple, Compound& Complex Sentences.

Vocabulary - Cause & Effect Expressions – Content vs Function words.	
Total Lecture and Laboratory hours:	**45+30 hours**
Text Book(s)	
1.	Hewings, Martin. Advanced Grammar In Use. New Delhi: CUP,2008 MLA Handbook for Writers of Research Papers, 7th Edition
2.	English for Science & Technology Cambridge University Press, 2021. Authored by Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Joevani, Department of English, Anna University.
Reference Books	
1.	Technical Communication – Principles And Practices, Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press, 2016, New Delhi.
2.	A Course Book On Technical English By Lakshminarayanan, Scitech Publications (India) Pvt. Ltd.
3.	Effective Communication Skill, Kulbhusan Kumar, RS Salaria, Khanna Publishing House.
List of Experiments :	
1. Listening and filling a form	
2. Self-Introduction and introducing a friend	
3. Listening to podcast, anecdotes / stories / event narration	
4. Narrating personal experiences/ events	
5. Listening to Process/product descriptions	
6. Picture descriptions	
7. Listening to TED Talks/scientific lectures	
8. Mini Presentations	
9. Listening to debates and discussions	
10. Group discussion	

Course Code	Course Title	L	T	P	J	C
22BST101	BASIC MATHEMATICS FOR ENGINEERS	3	2	0	0	4
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

After studying this course, you should be able to:

1. To develop the use of matrix algebra techniques that are needed by engineers for practical applications.
2. To acquaint the students with differential calculus.
3. To explain the student with functions of several variables.
4. To make the students understand various techniques of integration and its applications.
5. To acquaint the student with mathematical tools needed in evaluating multiple integrals and their applications.

COURSE OUTCOME:

After completion of this course, the students should be able to

1. Use the matrix algebra methods for solving practical problems.
2. Apply differential calculus tools in solving various application problems.
3. Able to use differential calculus ideas on several variable functions.
4. Apply different methods of integration in solving practical problems.
5. Apply multiple integral ideas in solving areas, volumes and other practical problems.

UNIT-1	MATRICES	9+3 HOURS

Characteristic equation – Properties of Eigenvalues and Eigenvectors – Cayley - Hamilton theorem – Diagonalization of matrices by orthogonal transformation – Reduction of a quadratic form to canonical form by orthogonal transformation

UNIT-2	DIFFERENTIAL CALCULUS	9+3 HOURS

Representation of functions - Limit of a function- Derivatives - Differentiation rules (sum, product, quotient, chain rules) - Logarithmic differentiation - Maxima and Minima of functions of one variable.

UNIT-3	FUNCTIONS OF SEVERAL VARIABLES	9+3 HOURS

Partial differentiation – Homogeneous functions and Euler's theorem – Total derivative – Change of variables – Jacobians – Taylor's series for functions of two variables – Maxima and minima of functions of two variables and Lagrange's method of undetermined multipliers.

UNIT-4	INTEGRAL CALCULUS	9+3 HOURS

Definite and Indefinite integrals - Substitution rule - Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction		
UNIT-5	**MULTIPLE INTEGRALS**	**9+3 HOURS**
Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of solids		
	TOTAL LECTURE AND TUTORIAL HOURS:	**45+15 HOURS**

TEXT BOOK(S):

1.	Kreyszig.E, "Advanced Engineering Mathematics", John Wiley and Sons,10th Edition, New Delhi, 2016.
2.	Grewal.B.S., “Higher Engineering Mathematics”, Khanna Publishers, New Delhi, 44th Edition , 2018.
3.	James Stewart, “Calculus: Early Transcendentals”, Cengage Learning, 8th Edition, New Delhi, 2015. [For Units II & IV - Sections 1.1, 2.2, 2.3, 2.5, 2.7 (Tangents problems only), 2.8, 3.1 to 3.6, 3.11, 4.1, 4.3, 5.1 (Area problems only), 5.2, 5.3, 5.4 (excluding net change theorem), 5.5, 7.1 - 7.4 and 7.8].

REFERENCE BOOKS:

1.	Anton. H, Bivens. I and Davis. S, "Calculus", Wiley, 10th Edition, 2016
2.	Bali. N., Goyal. M. and Watkins. C., “Advanced Engineering Mathematics”, Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.
3.	Jain. R.K. and Iyengar. S.R.K., “Advanced Engineering Mathematics”, Narosa Publications, New Delhi, 5th Edition, 2016.
4.	Narayanan. S. and Manicavachagom Pillai. T. K., “Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2009.
5.	Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.
6.	Srimantha Pal and Bhunia. S.C, “Engineering Mathematics" Oxford University Press, 2015.
7.	Thomas. G. B., Hass. J, and Weir. M.D, " Thomas Calculus", 14th Edition, Pearson India, 2018.

Course Code	Course Title	L	T	P	J	C
22BST102	Engineering Physics	3	0	0	0	3
Pre-requisite	NIL	Syllabus version			v. 1.0	

COURSE OBJECTIVES:

1. To make the students effectively achieve an understanding of mechanics.
2. To enable the students to gain knowledge of electromagnetic waves and its applications.
3. To introduce the basics of oscillations, optics and lasers.
4. Equipping the students to successfully understand the importance of quantum physics.
5. To motivate the students towards the applications of quantum mechanics.

COURSE OUTCOME:

After completion of this course, the students should be able to

CO1: Understand the importance of mechanics.

CO2: Express their knowledge in electromagnetic waves.

CO3: Demonstrate a strong foundational knowledge in oscillations, optics and lasers.

CO4: Understand the importance of quantum physics.

CO5: Comprehend and apply quantum mechanical principles towards the formation of energy bands

UNIT I	MECHANICS	9 hours

Multi-particle dynamics: Center of mass (CM) – CM of continuous bodies – motion of the CM – kinetic energy of the system of particles. Rotation of rigid bodies: Rotational kinematics – rotational kinetic energy and moment of inertia - MI of a diatomic molecule - theorems of MI –moment of inertia of continuous bodies –- torque – rotational dynamics of rigid bodies – conservation of angular momentum – rotational energy state of a rigid diatomic molecule.

UNIT II	ELECTROMAGNETIC WAVES	9 hours

The Maxwell's equations - wave equation; Plane electromagnetic waves in vacuum, Conditions on the wave field - properties of electromagnetic waves: speed, amplitude, phase, orientation and waves in matter - polarization - Producing electromagnetic waves - Energy and momentum in EM waves: Intensity, waves from localized sources, momentum and radiation pressure – basic introduction to Satellite Communication (qualitative treatment)

UNIT III	OSCILLATIONS, OPTICS AND LASERS	9 hours
Simple harmonic motion - resonance –analogy between electrical and mechanical oscillating systems - waves on a string - standing waves - traveling waves - Energy transfer of a wave - – interference–Michelson interferometer – Theory of laser – characteristics - Spontaneous and stimulated emission - Einstein's coefficients - population inversion - Nd-YAG laser, CO2 laser, semiconductor laser –Basic applications of lasers in industry.		
UNIT IV	**BASIC QUANTUM MECHANICS**	**9 hours**
Photons and light waves - Electrons and matter waves – Photoelectric effect - The Schrodinger equation (Time dependent and time independent forms) - interpretation of wave function –Free particle - particle in an infinite potential well: 1D,2D and 3D Boxes- Normalization and probabilities – Bohr's correspondence principle (concept only).		
UNIT V	**APPLIED QUANTUM MECHANICS**	**9 hours**
The harmonic oscillator(qualitative)- Barrier penetration and quantum tunnelling (qualitative)- Tunnelling microscope - Resonant diode – Principle of quantum superposition – concept of quantum entanglement – concepts of quantum communication and quantum teleportation		
	Total Lecture hours:	**45 hours**

Text Book(s)

1.	D.Kleppner and R.Kolenkow. An Introduction to Mechanics. McGraw Hill Education (Indian Edition), 2017.
2.	E.M.Purcell and D.J.Morin, Electricity and Magnetism, Cambridge Univ.Press, 2013.
3.	Arthur Beiser, Shobhit Mahajan, S. Rai Choudhury, Concepts of Modern Physics, McGraw- Hill (Indian Edition), 2017.

Reference Books

1.	R. Wolfson. Essential University Physics. Volume 1 & 2. Pearson Education (Indian Edition), 2009.
2.	Paul A. Tipler, Physic – Volume 1 & 2, CBS, (Indian Edition), 2004.
3.	K. Thyagarajan and A.Ghatak. Lasers: Fundamentals and Applications, Laxmi Publications, (Indian Edition), 2019.
4.	D.Halliday, R.Resnick and J.Walker. Principles of Physics, Wiley (Indian Edition), 2015.
5.	N.Garcia, A.Damask and S.Schwarz. Physics for Computer Science Students. Springer Verlag, 2012.

Course Code	Course Title	L	T	P	J	C
22BST103	Engineering Chemistry	3	0	0	0	3
Pre-requisite	NIL	Syllabus version			v. 1.0	

COURSE OBJECTIVES:

1. To inculcate a sound understanding of water quality parameters and water treatment techniques.
2. To impart knowledge on the basic principles and preparatory methods of nanomaterials.
3. To introduce the different polymers and composites for engineering applications.
4. To facilitate the understanding of different types of fuels, their preparation, properties and combustion characteristics.
5. To familiarize the students with the operating principles, working processes and applications of energy conversion and storage devices.

COURSE OUTCOME:

1. To infer the quality of water from quality parameter data and propose suitable treatment methodologies to treat water.
2. To identify and apply basic concepts of nanoscience and nanotechnology in designing the synthesis of nanomaterials for engineering and technology applications.
3. To analyze the properties of different polymers and distinguish the polymers which can be degraded and demonstrate their usefulness and composites for material selection requirements.
4. To recommend suitable fuels for engineering processes and applications.
5. To recognize different forms of energy resources and apply them for suitable applications in energy sectors.

Unit-1	**WATER AND ITS TREATMENT**	9 hours

Water: Sources and impurities, Requirements of water for municipal use, Municipal water treatment: primary treatment and disinfection (UV, Ozonation, break-point chlorination). Desalination of brackish water: Reverse Osmosis. Requirements of water for industrial use, Boiler troubles: Scale and sludge, Boiler corrosion, Caustic embrittlement, Priming &foaming. Treatment of boiler feed water: Internal treatment (phosphate, colloidal, sodium aluminate and Calgon conditioning) and External treatment -Ion exchange demineralization and zeolite process.

Unit-2	**NANOCHEMISTRY**	9 hours

Basics: Distinction between molecules, nanomaterials and bulk materials; Size-dependent properties (optical, electrical, mechanical and magnetic); Types of nanomaterials: Definition, properties and uses of – nanoparticle, nanocluster, nanorod, nanowire and nanotube. Preparation of nanomaterials: sol-gel, solvothermal, laser ablation, chemical vapour deposition, electrochemical deposition and electro spinning. Applications of nanomaterials in medicine, agriculture, energy, electronics and catalysis.

Unit-3	**POLYMERS AND COMPOSITES**	9 hours

Definition of biodegradable polymers- Classification of biodegradable Polymers – Advantages, conducting polymers- examples - Mechanism of conduction – applications, recycling of e-plastic waste (waste to wealth). Composites: Introduction: Definition & Need for composites; Constitution: Matrix materials (Polymer, matrix, metal matrix and ceramic matrix) and Reinforcement (fibre, particulates, flakes and whiskers). Properties and applications of Metal matrix composites (MMC), Ceramic matrix composites and Polymer matrix composites. Hybrid composites - definition and examples.		
Unit-4	**FUELS AND COMBUSTION**	9 hours
Fuels: Introduction: Classification of fuels; Coal and coke: Analysis of coal (proximate and ultimate), Carbonization, Manufacture of metallurgical coke (Otto Hoffmann method). Petroleum and Diesel: Manufacture of synthetic petrol (Bergius process), Knocking - octane number, diesel oil-cetane number; Power alcohol and biodiesel. Combustion of fuels: Calorific value - higher and lower calorific values, Flue gas analysis - ORSAT Method. CO2 emission and carbon footprint.		
Unit-5	**ENERGY SOURCES AND STORAGE DEVICES**	9 hours
Nuclear energy: light water nuclear power plant, breeder reactor. Solar energy conversion: Principle, working and applications of solar cells; Wind energy; Batteries: a brief introduction to electrochemical cell (Daniel cell), Types of batteries, Primary battery - dry cell, Secondary battery - lead acid battery and lithium-ion- battery; Electric vehicles; Fuel cells: H2-O2 fuel cell, microbial fuel cell; Super capacitors: Storage principle, types and examples.		
	Total Lecture hours:	45 hours

Text Book(s)

1.	P. C. Jain and Monica Jain, “Engineering Chemistry”, 17th Edition, Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 2018.
2.	Sivasankar B., “Engineering Chemistry”, Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2008.
3.	S.S. Dara, “A Text book of Engineering Chemistry”, S. Chand Publishing, 12th Edition.

Reference Books

1.	B. S. Murty, P. Shankar, Baldev Raj, B. B. Rath and James Murday, “Textbook of nanoscience and nanotechnology”, Universities Press-IIM Series in Metallurgy and Materials Science, 2018.
2.	O.G. Palanna, “Engineering Chemistry” McGraw Hill Education (India) Private Limited, 2nd Edition, 2017.
3.	Friedrich Emich, “Engineering Chemistry”, Scientific International PVT, LTD, New Delhi, 2014.
4.	ShikhaAgarwal, “Engineering Chemistry-Fundamentals and Applications”, Cambridge University Press, Delhi, Second Edition, 2019.
5.	O.V. Roussak and H.D. Gesser, Applied Chemistry-A Text Book for Engineers and Technologists, Springer Science Business Media, New York, 2nd Edition, 2013.

Course Code	Course Title	L	T	P	J	C
22EST101	PROBLEM SOLVING AND PYTHON PROGRAMMING	3	0	0	0	3
		Syllabus version		v. 1.0		

Course Objectives:

1. To understand the basics of algorithmic problem solving.
2. To learn to solve problems using Python conditionals and loops.
3. To define Python functions and use function calls to solve problems.
4. To use Python data structures - lists, tuples, dictionaries to represent complex data.
5. To do input/output with files in Python.

Course Outcome:

At the end of the course, the students will be able:

6. Develop algorithmic solutions to simple computational problems.
7. Develop and execute simple Python programs.
8. Write simple Python programs using conditionals and loops for solving problems.
9. Decompose a Python program into functions.
10. Represent compound data using Python lists, tuples, dictionaries etc. CO6: Read and write data from/to files in Python programs

Unit-1	COMPUTATIONAL THINKING AND PROBLEM SOLVING	9 hours

Fundamentals of Computing – Identification of Computational Problems -Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

Unit-2	DATA TYPES, EXPRESSIONS, STATEMENTS	9 hours

Python interpreter and interactive mode, debugging; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points, electrochemical deposition and electro spinning. Applications of nanomaterials in medicine, agriculture, energy, electronics and catalysis.

Unit-3	CONTROL FLOW, FUNCTIONS, STRINGS	9 hours

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if- elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

Unit-4	**LISTS, TUPLES, DICTIONARIES**	9 hours
Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: simple sorting, histogram, Students marks statement, Retail bill preparation.		
Unit-5	**FILES, MODULES, PACKAGES**	9 hours
Files and exceptions: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file, Voter's age validation, Marks range validation (0-100).		
Total Lecture hours:		45 hours

Text Book(s)	
1.	Allen B. Downey, "Think Python: How to Think like a Computer Scientist", 2ndEdition, O'Reilly Publishers, 2016.
2.	Karl Beecher, "Computational Thinking: A Beginner's Guide to Problem Solving and Programming", 1st Edition, BCS Learning & Development Limited, 2017.
Reference Books	
1.	Paul Deitel and Harvey Deitel, "Python for Programmers", Pearson Education, 1stEdition, 2021.
2.	G Venkatesh and Madhavan Mukund, "Computational Thinking: A Primer forProgrammers and Data Scientists", 1st Edition, Notion Press, 2021.
3.	John V Guttag, "Introduction to Computation and Programming UsingPython: With Applications to Computational Modeling and Understanding Data", Third Edition, MIT Press , 2021
4.	Eric Matthes, "Python Crash Course, A Hands - on Project Based Introduction toProgramming", 2nd Edition, No Starch Press, 2019.
5.	https://www.python.org/
6.	Martin C. Brown, "Python: The Complete Reference", 4th Edition, Mc-Graw Hill, 2018.

Course Code	Course Title	L	T	P	J	C
22HSM101	**HERITAGE OF TAMILS**	**0**	**1**	**0**	**0**	**1**
Pre-requisite		Syllabus version			v. 1.0	

Unit-1	**LANGUAGE AND LITERATURE**	**03 hours**

Language Families in India - Dravidian Languages – Tamil as a Classical Language - Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature - Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.

Unit-2	**HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE**	**03 hours**

Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.

Unit-3	**FOLK AND MARTIAL ARTS**	**03 hours**

Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leather puppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

Unit-4	**THINAI CONCEPT OF TAMILS**	**03 hours**

Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.

Unit-5	**CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE**	**03 hours**

Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books

Total Lecture hours:	15 hours

TEXT BOOK(S)

1.	The Contributions of the Tamils to Indian Culture (Dr. M. Valarmathi) (Published by: International Institute of Tamil Studies.)
2.	Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation,
3.	Tamilaga Varalaru, Makalum Panpadum- Dr. K.K. Pillai
4.	Kanini Tamil- Munaivar L. Sundaram

REFERENCE BOOKS

1.	Social Life of Tamils (Dr. K. K. Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
2.	Social Life of the Tamils - The Classical Period (Dr. S. Singaravelu) (Published by: International Institute of Tamil Studies.

3.	Historical Heritage of the Tamils (Dr. S. V. Subatamanian, Dr. K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
4.	Studies in the History of India with Special Reference to Tamil Nadu (Dr. K.K. Pillay) (Published by: The Author)
5.	Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

Course Code	Course Title	L	T	P	J	C
22EET101	**ENGINEERING AND PROFESSIONAL SKILLS**	**1**	**0**	**2**	**0**	**2**
		Syllabus version			**v. 1.0**	

COURSE OBJECTIVES: After studying this course, you should be able to:

UNIT-1 EVOLUTION OF ENGINEERING 6 HOURS

Evolution of Engineering: Description of Engineering, Early stages of Engineering, Outline of Ancient Engineering, Case studies of historic engineers.

Introduction to Engineering Career: Engineering as a career and common qualities of employ able engineers History of Engineering Domains Impact of engineering on society. Roles of Engineers and Career Paths.

UNIT-2	ENGINEERING APPROACH	6 HOURS

Introduction, problem statement: Detailing Customer Requirements, Setting Objectives, Identifying Constraints, Establishing Functions, generating solution Alternatives and Choosing a solution.

Steps in problem-solving: Problem Solving Techniques, Six Thinking Hats, Mind Mapping, Forced Connections. Analytical Thinking, Numeric, symbolic, and graphic reasoning. seven steps in solving engineering problems, reverse engineering, forward engineering, concurrent engineering, and Value Engineering.

UNIT-3	MS WORD	6 HOURS

Create and format a document, Working with tables, Working with Bullets and Lists, Working with styles, shapes, smart art, charts Inserting objects, charts and importing objects from other office tools, Creating and Using document templates, Inserting equations, symbols and special characters, Working with Table of contents and References, citations Insert and review comments, Create bookmarks, hyperlinks, endnotes footnote, Viewing document in different modes, Working with document protection and security, Inspect document for accessibility.

UNIT-4	MS EXCEL	6 HOURS
Create worksheets, insert and format data, Work with different types of data: text, currency, date, numeric etc. Split, validate, consolidate, Convert data Sort and filter data Perform calculations and use functions: (Statistical, Logical, Mathematical, date, Time etc.,) Work with Lookup and reference formulae, Create and Work with different types of charts, Use pivot tables to summarize and analyse data, Perform data analysis using own formulae and functions, Combine data from multiple worksheets using own formulae and built-in functions to generate results, Export data and sheets to other file formats, Working with macros, Protecting data and Securing the workbook		
UNIT-5	**MS POWERPOINT**	**6 HOURS**
Hours Select slide templates, layout and themes, Formatting slide content and using bullets and numbering, Insert and format images, smart art, tables, charts Using Slide master, notes and handout master, Working with animation and transitions, Organize and Group slides Import or create and use media objects: audio, video, animation, Perform slideshow recording and Record narration and create presentable videos.		
	TOTAL LECTURE HOURS:	**30 HOURS**

TEXT BOOK(S):

1.	Remesh S., Vishnu R. G., Life Skills for Engineers, Ridhima Publications, 1 stEdition,2016.
2.	Barun K. Mitra, Personality Development & Soft Skills, Oxford Publishers, Third impression, 2017.
3.	Dorothy House, Microsoft Word, Excel, and PowerPoint: Just for Beginners, Import, 29 January 2015

REFERENCE BOOKS:

1.	Paul H .Wright, Introduction to Engineering, School of Civil and Environmental Engineering, 3rd Edition, John Wiley & Sons, Inc,

Course Code	Course Title	L	T	P	J	C
22ESP101	**PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY**	**0**	**0**	**4**	**0**	**2**
Pre-requisite		Syllabus version			v. 1.0	

Course Objectives:

.	1. To understand the problem solving approaches. 2. To learn the basic programming constructs in Python. 3. To practice various computing strategies for Python-based solutions to real world problems. 4. To use Python data structures - lists, tuples, dictionaries. 5. To do input/output with files in Python.	

Course Outcome:

1. Develop algorithmic solutions to simple computational problems
2. Develop and execute simple Python programs.
3. Implement programs in Python using conditionals and loops for solving problems.
4. Deploy functions to decompose a Python program.
5. Process compound data using Python data structures.
6. Utilize Python packages in developing software applications.

LIST OF EXPERIMENTS:

1. Identification and solving of simple real life or scientific or technical problems, and developing flow charts for the same. (Electricity Billing, Retail shop billing, Sin series, weight of a motorbike, Weight of a steel bar, compute Electrical Current in Three Phase AC Circuit, etc.)

2. Python programming using simple statements and expressions (exchange the values of two variables, circulate the values of n variables, distance between two points).

3. Scientific problems using Conditionals and Iterative loops. (Number series, Number Patterns, pyramid pattern)
4. Implementing real-time/technical applications using Lists, Tuples. (Items present in a library/Components of a car/ Materials required for construction of a building –operations of list & tuples)
5. Implementing real-time/technical applications using Sets, Dictionaries. (Language, components of an automobile, Elements of a civil structure, etc.- operations of Sets & Dictionaries)
6. Implementing programs using Functions. (Factorial, largest number in a list, area of shape)
7. Implementing programs using Strings. (reverse, palindrome, character count, replacing characters)
8. Implementing programs using written modules and Python Standard Libraries (pandas, numpy. Matplotlib, scipy)
9. Implementing real-time/technical applications using File handling. (copy from one file to another, word count, longest word)
10. Implementing real-time/technical applications using Exception handling. (divide by zero error, voter's age validity, student mark range validation)
11. Exploring Pygame tool.
12. Developing a game activity using Pygame like bouncing ball, car race etc.

Total Lecture hours:	**60hours**

Course Code	Course Title	L	T	P	J	C
22BSP101	**PHYSICS CHEMISTRY LABORATORY (CHEMISTRY)**	**0**	**0**	**4**	**0**	**2**
Pre-requisite	NIL	Syllabus version			v. 1.0	

Course Objectives:

1. To impart practical skills in the estimation of water quality parameters by volumetry and gravimetry.
2. To familiarize the students with the estimation of impurities in aqueous solutions through electro-analytical techniques such as pH metre, potentiometry and conductometry.
3. To demonstrate the analysis of metals by UV-Visible spectroscopy.

Course Outcome:

1. To independently estimate the water quality parameters, such as acidity, alkalinity, hardness, DO, TDS, chloride and copper contents by appropriate wet chemical analyses.
2. To quantitatively analyze the impurities in aqueous solution by electroanalytical techniques.
3. To determine the amount of metal ions in aqueous samples by spectroscopic techniques.

LIST OF EXPERIMENTS: ANY SEVEN

1. Preparation of Na_2CO_3 as a primary standard and estimation of acidity of a water sample using the primary standard
2. Determination of types and amount of alkalinity in water sample.
3. Determination of total, temporary & permanent hardness of water by EDTA method.
4. Determination of DO content of water sample by Winkler's method.
5. Determination of chloride content of water sample by Argentometric method.
6. Estimation of TDS of a water sample by gravimetry.
7. Determination of strength of given hydrochloric acid using pH meter.
8. Determination of strength of acids in a mixture of acids using conductivity meter.
9. Conductometric titration of barium chloride against sodium sulphate (precipitation titration)
10. Estimation of iron content of the given solution using potentiometer.
11. Estimation of iron content of the water sample using spectrophotometer (1,10-Phenanthroline / thiocyanate method).

Total Laboratory hours:	**30hours**

Course Code	Course Title	L	T	P	J	C
22BSP101	**ENGINEERING PHYSICS LABORATORY**	**0**	**0**	**4**	**0**	**2**
Pre-requisite	NIL	Syllabus version			v. 1.0	

COURSE OBJECTIVES:

1. To learn the proper use of various kinds of physics laboratory equipment.
2. To learn how data can be collected, presented and interpreted in a clear and concise manner.
3. To learn problem solving skills related to physics principles and interpretation of experimental data.
4. To determine error in experimental measurements and techniques used to minimize such error.
5. To make the student an active participant in each part of all lab exercises.

COURSE OUTCOME:

1. Understand the functioning of various physics laboratory equipment.
2. Use graphical models to analyse laboratory data.
3. Use mathematical models as a medium for quantitative reasoning and describing physical reality.
4. Access, process and analyse scientific information.
5. Solve problems individually and collaboratively.

LIST OF EXPERIMENTS (Any Seven Experiments)

1. Torsional pendulum - Determination of rigidity modulus of wire and moment of inertia of regular and irregular objects.
2. Simple harmonic oscillations of cantilever.
3. non-uniform bending - Determination of Young's modulus
4. Uniform bending – Determination of Young's modulus
5. Laser- Determination of the wavelength of the laser using grating
6. Air wedge - Determination of thickness of a thin sheet/wire
7. a) Optical fibre -Determination of Numerical Aperture and acceptance angle
   b) Compact disc- Determination of width of the groove using laser.
8. Acoustic grating- Determination of velocity of ultrasonic waves in liquids.
9. Ultrasonic interferometer – determination of the velocity of sound and compressibility of liquids
10. Post office box -Determination of Band gap of a semiconductor.
11. Photoelectric effect
12. Michelson Interferometer.
13. Melde's string experiment
14. Experiment with lattice dynamics kit.

Total Laboratory hours:	**30hours**

Course Code	Course Title	L	T	P	J	C
22EEP101	PRODUCT TINKERING LABORATORY	0	0	2	0	1
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

1. Hands on practical training, maintenance and troubleshooting on mechanical and electrical appliances in day-to-day life.
2. Analyse single phase and three phase residential building wiring (Energy meter, fuse, earthing)
3. Understand the internal structure and layout of the computer system.
4. Learn to diagnose minor problems with the computer functioning.
5. Know the proper usage and threats of the world wide web.

COURSE OUTCOME:

1. Students will able to understand domestic wiring procedures practically.

2. Students are capable of assembling a personal computer, and can perform installation of system software like MS Windows and required device drivers.

3. Students can detect and perform minor hardware and software level troubleshooting.

4. Capacity to work on Internet & World Wide Web and make effective usage of the internet for academics.

LIST OF EXPERIMENTS:

1. **MECHANICAL EQUIPMENT STUDY**

(a) Hand drilling machine, Screw Jack and centrifugal pump

(b) Two wheeler, Refrigeration and Air Conditioning system.

2. **ELECTRICAL EQUIPMENT STUDY**

Light fittings, LED, Stabilizer, UPS, Iron box, calling bell, Fan regulator

3. ELECTRONIC EQUIPMENT STUDY

a) Study the elements of a smart phone.

b) Assembly and dismantle of LED TV.

c) Assembly and dismantle of computer/ laptop

4. COMPUTER PERIPHERALS STUDY

PC HARDWARE Identification of the peripherals of a computer, components in a CPU and its functions. Block diagram of the CPU along with the configuration of each peripheral. Functions of Motherboard. Assembling and Disassembling of PC. System Software and application software installation.

5. BIOMEDICAL EQUIPMENT

a) Assembly and dismantle of Electrocardiogram (ECG)

b) Assembly and dismantle of ventilator.

c) Assembly and dismantle of Doppler Ultra sound Scanner.

TROUBLESHOOTING

Hardware Troubleshooting: Students are to be given a PC which does not boot due to proper assembly or defective peripherals and the students should be taught to identify and correct the problem.

Software Troubleshooting: Students have to be given a malfunctioning CPU due to system software problems. They should identify the problem and fix it to get the computer back to working condition.

Internet: Web Browsers, Access of websites, Surfing the Web, Search Engines, Customization of web browsers, proxy settings, bookmarks, search toolbars, pop-up blockers. Antivirus downloads, Protection from various threats.

TOTAL LECTURE HOURS:	**30 HOURS**

Course Code	Course Title	L	T	P	J	C
22LET201	TECHNICAL ENGLISH	3	0	2	0	4
		Syllabus version			v. 1.0	

Course Objectives:

1. Gain confidence to respond in English in both academic and professional contexts
2. Improve presentation skills to make effective presentations
3. Foster the ability to write effectively in all contexts
4. Strengthen the skills related to teamwork and leadership roles in society as well as in workplace

Course Outcome:

1. To communicate fluently in professional situations
2. To express flexibility and appropriacy on Technical Events
3. To demonstrate complex forms and sentence structures with adequate vocabulary
4. To report events and the processes of technological & Industrial firms.
5. To present effective Profile in context of job search

Unit-1	COMMUNICATIVE COMPETENCE	9+6 hours

Speaking: Interactive skills- Initiation & turn taking, relevance to the topic, puzzles & riddles

Reading – Skimming, Scanning, Churning & Assimilation

Writing – Professional emails, Etiquette & Netiquette, Formal letters-Requisition & Business letters, Opinion paragraph

Grammar – Order of Adjectives, Auxiliary Verbs

Vocabulary – Synonyms and Antonyms, Nominal compounds

Unit-2	SITUATIONAL CONVERSATIONS	9+6 hours

Speaking – Practicing fluency- cohesion, coherence and speed of delivery **Reading** – Reading brochures and user manuals **Writing** – Essay types -Compare & Contrast essay/ Argumentative Essay, Checklist **Grammar** – Infinitives, Gerunds and Participles, Relative and Reflexive Pronoun **Vocabulary** – Word formation- Prefix, One-word substitution		
Unit-3	**REPORT ON TECHNICAL EVENTS**	**9+6 hours**
Speaking –Mock TV news Reading/ anchoring **Reading** – Motivational essays on famous Engineers and Technologists **Writing** – Report Writing- Survey and Accident, Project proposals and Project Reports **Grammar** – Reported Speech, Modal Verbs **Vocabulary** – Technical Vocabulary, Jargons		
Unit-4	**DEVELOPING DISCUSSION SKILLS**	**9+6 hours**
Speaking – Giving short talks on technical topics **Reading** - Descriptive passages - newspapers / magazines/ articles **Writing** – Problem solution essay, Opinion Essay, Statement of Purpose, Recommendations **Grammar** – If conditional sentences, Articles **Vocabulary** - Compound Words, Abbreviations & acronyms		
Unit-5	**PRESENTATION SKILLS**	**9+6 hours**
Speaking – Presentations - visual aids- Visumes using appropriate body language and gestures, stating and asking for opinions and clarifications **Reading** – Predicting the content, speed reading techniques **Writing** – Note taking & Precis Writing, Minutes of Meeting, Profile writing **Grammar** – Mixed Tenses, Relative Clauses **Vocabulary** – Error Spotting, Sentence Completion		
	Total Lecture and Laboratory hours:	**45+30 hours**
Text Book(s)		
1.	English for Engineers & Technologists (2020 edition) Orient Blackswan Private Ltd. Department of English, Anna University	
2.	Functional English for Communication (2022 edition) Ujjwala Kakarla, Guru Nanak Institutions Technical Campus (Autonomous), Hyderabad.	

Reference Books	
1.	Raman. Meenakshi, Sharma. Sangeeta (2019). Professional English. Oxford university press. New Delhi.
2.	Hewings, Martin.Advanced Grammar In Use. New Delhi: CUP,2008 MLA Handbook for Writers of Research Papers, 7th Edition
3.	Klaus Bruhn Jensen. A handbook of Media and Communication Research. Routledge, 2003

Course Code	Course Title	L	T	P	J	C
22LET202	FRENCH LANGUAGE	3	0	2	0	4
		Syllabus version			v. 1.0	

Course Objectives:

1. To acquire an understanding of basic French language parts of speech
2. To facilitate learner's ability to learn the French language grammar.
3. To nurture learner's ability to understand the sentence structure
4. To foster technical writing skills through tenses and numbers
5. To comprehend various lectures and talks

Course Outcome:

1. Read and write technical basic French language parts of speech
2. Speak appropriately learner's ability to learn the French language grammar.
3. Listen and comprehend lectures learner's ability to understand the sentence structure
4. Write correctly, clearly and concisely technical writing skills through tenses andnumbers
5. Prepare self-introduction comprehend various lectures and talks

Unit-1	PARTS OF SPEECH	12 hours

1. inviter et répondre à une invitation, Pronoms sujets 2. L'article définis, l'article indéfinis

3. Conjugation : présent, adjectifs possessifs 4. interrogation, décrire les personnes 5. Lavie de quatre parisiens de professions différentes

Unit-2	ELEMENTS OF GRAMMAR:	12 hours

1. Demander l'autorisation-passé récent, futur proche

2. l'adjectif possessifs, l'article partitif, l'article démonstratif, négation ne

3. pas, l'article contracté 4. verbe pronominaux 5. prepositions

Unit-3	SENTENCE STRUCTURE:	12 hours

1. le discours rapporté, décrire un lieu exprimer ses préférences 2. décrire la carrière discuter le système éducation de France 3. parler de la technologie de l'information

Unit-4	TENSES AND NUMBERS	12 hours

1: Exprimer l'ordre et l'obligation demander et commander 51

2. La vie administrative et régionale. Pluriel des noms, moyens de transport

Unit-5	DISCOURSE	12 hours

1. Raconter et reporter-donner son avis	Total Lecture hours:	45 hours
2. Futur simple, pronom complètement d'objet direct, passé composé		
3. plusieurs region de France, imparfait, pronom y en, imparfait		

Text Book(s)

1.	Christine Andant étal."À propos (livre de l'élève", LANGER., NEW DELHI,2012
2.	Myrna Bell Rochester "Easy French Step By Step", MCGraw Hill Companies., USA, 2008

Reference Books

1.	Michael D. Oates "Entre Amis: An Interactive Approach", 5 th Edition, Houghton Mifflin., 2005
2.	Bette Hirsch, Chantal Thompson "Moments Literaries : An Anthology for intermediate French"
3.	Simone Renaud, Dominique van Hooff "En bonne forme

Course Code	Course Title	L	T	P	J	C
22LET203	GERMAN LANGUAGE	3	0	2	0	4
		Syllabus version		v. 1.0		

Course Objectives:

1. To acquire an understanding of basic German language parts of speech
2. To facilitate learner's ability to learn the German language grammar.
3. To nurture learner's ability to understand the sentence structure
4. To foster technical writing skills through tenses and numbers
5. To comprehend various lectures and talks

Course Outcome:

1. Read and write technical basic German language parts of speech
2. Speak appropriately learner's ability to learn the German language grammar.
3. Listen and comprehend lectures learner's ability to understand the sentence structure
4. Write correctly, clearly and concisely technical writing skills through tenses and numbers
5. Prepare self-introduction comprehend various lectures and talks

Unit-1	GUTEN TAG!	10 hours

1. To greet, learn numbers till 20, practice telephone numbers & e mail address, learn alphabet, speak about countries & languages
2. Vocabulary: related to the topic
3. 3. Grammar: W – Questions, Verbs & Personal pronouns I

Unit-2	FREUNDE, KOLLEGEN UND ICH	10 hours

1. To speak about hobbies, jobs, learn numbers from 20; build dialogues and frame simple questions & answers
2. Vocabulary: related to the topic
3. Grammar: Articles, Verbs & Personal pronouns II, sein & haben verbs, ja/nein Frage, singular/plural

Unit-3	**IN DER STADT**	**12 hours**
1. To know places, buildings, question, know transport systems, understand international words; build dialogues and write short sentences 2. Vocabulary: related to the topic 3. Grammar: Definite & indefinite articles, Negotiation, Imperative with Sien verbs		
Unit-4	**GUTEN APPETIT!**	**13 hours**
1. To speak about food, shop, converse; Vocabulary: related to the topic; build dialogues and write short sentences 2. Grammar: Sentence position, Accusative, Accusative with verbs, personal pronouns & prepositions, Past tense of haben & sein verbs		
Unit-5	**TAG FŸR TAG/ZEIT MIT FREUNDEN**	**15 hours**
1. To learn time related expressions, speak about family, about birthdays, understand & write invitations, converse in the restaurant; ask excuse, fix appointments on phone 2. Vocabulary: related to the topic 3. Grammar: Time related prepositions, Possessive articles, Modalverbs		
	Total Lecture hours:	**60 hours**

Text Book(s)	
1.	Dengler Stefanie "Netzwerk A1.1", Klett-Langenscheidt Gmbh., München,2013
2.	Sandra Evans, Angela Pude "Menschen A1", Hueber Verlag., Germany, 2012
Reference Books	
1.	Stefanie Dengler "Netzwerk A1", Klett-Langenscheidt Gmbh., München, 2013
2.	Hermann Funk, Christina Kuhn "Studio d A1", Goyal Publishers & Distributors Pvt. Ltd., New Delhi, 2009
3.	Rosa-Maria Dallapiazza "Tangram Aktuell 1 (Deutsch als Fremdsprache)", Max Hueber Verlag., Munchen, 2004
4.	Christiane Lemcke und Lutz Rohrmann "'Grammatik Intensivtrainer A 1", Goyal Publishers & Distributors Pvt. Ltd., New Delhi, 2012

Course Code	Course Title	L	T	P	J	C
22LET204	JAPANESE LANGUAGE	3	0	2	0	4
		Syllabus version		v. 1.0		

Course Objectives:

1. To acquire an understanding of basic Japanese language parts of speech
2. To facilitate learner's ability to learn the Japanese language grammar.
3. To nurture learner's ability to understand the sentence structure
4. To foster technical writing skills through tenses and numbers
5. To comprehend various lectures and talks

Course Outcome:

1. Read and write technical basic Japanese language parts of speech
2. Speak appropriately learner's ability to learn the Japanese language grammar.
3. Listen and comprehend lectures learner's ability to understand the sentence structure
4. Write correctly, clearly and concisely technical writing skills through tenses and numbers
5. Prepare self-introduction comprehend various lectures and talks

Unit-1	JAPANESE PEOPLE AND CULTURE	12 hours

1. Basic greetings and responses

2. Basic script–Method of writing hiragana and katakana –Combination sounds and simple words

3. Self-introductions:"Hajimemashite" -Demonstratives "Kore", "Sore", "Are"–Demonstrative "Kono","Sono","Ano"

4. Possessive noun particle "no" –Japanese apartments: Greeting your neighbor

Unit-2	PATICLE "NI (AT)" FOR TIME	12 hours

: 1. kara (from) ~ made(until) – Particle "to (and)"

2. Time periods: Days of the week, months, time of day –Verbs (Present / future and pasttense)

3. Telephone enquiry: Asking for a phone no. And business hours- Destination particle "e".

Unit-3	LIKES AND DISLIKES	12 hours

1. Potential verbs (wakarimasu and dekimasu) – "Kara (~ because)"

2. Adverbs –Asking some one out over the phone-Verbs denoting presence

3. Introduction to Adjectives (na and ii type) -Verb groups – I, II and III – Exercises to groupverbs-Please do (te kudasai)

4. Present continuous tenses (te imasu) – Shall I? (~ mashou ka) – Describing a naturalphenomenon(It is raining) (12)

Unit-4	DIFFERENT USAGES OF ADJECTIVES	12 hours

1. Comparison –Likes and dislikes –Going to a trip- Need and desire (ga hoshii) – Wantingto…(Tabeti desu)- Going for a certain purpose (mi –ni ikimasu)
2. Choosing from a menu-Adjectives (“i” and “na” type) – Adjectives (Positive and negativeuseage)

Unit-5	ROLE PLAYS IN JAPANESE	12 hours

1. Framing simple questions & answers
2. Writing Short paragraphs & Dialogues
3. A demonstration on usage of chopsticks and Japanese tea party (12)

Total Lecture hours:	60 hours

Text Book(s)

1.	Minna no Nihongo, Honsatsu Roma "ji ban (Main Textbook Romanized Version)", International publisher – 3A Corporation., Tokyo, 2012

Reference Books

1.	Eri Banno et.al "Genki I: An Integrated Course in Elementary Japanese I -Workbook", ., 1999
2.	Tae Kim "A Guide to Japanese Grammar: A Japanese Approach to Learning Japanese Grammar", 2014
3.	Minna No Nihongo "Translation & Grammatical Notes In English Elementary",

Course Code	Course Title	L	T	P	J	C
22BST201	STATISTICS AND TRANSFORMS	3	2	0	0	4
		Syllabus version				v. 1.0

COURSE OBJECTIVES:

1. This course aims at providing the necessary basic concepts of a few statistical and numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology.
2. To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
3. To acquaint the student with Fourier series techniques in solving heat flow problems used in various situations.
4. To familiarize the student with Fourier, transform techniques used in wide variety of situations.
5. To explain the student with Z, transform techniques used in wide variety of situations.

COURSE OUTCOME:

1. Apply the concept of testing of hypothesis for small and large samples in real life problems.
2. Apply the basic concepts of classifications of design of experiments in the field of agriculture.
3. Solve differential equations using Fourier series analysis which plays a vital role in engineering applications.
4. Understand the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.
5. Use the effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems.

UNIT-1 TESTING OF HYPOTHESIS 12 HOURS

Sampling distributions - Tests for single mean, proportion and difference of means (Large and small samples) – Tests for single variance and equality of variances – Chi square test for goodness of fit

UNIT-2 DESIGN OF EXPERIMENTS 12 HOURS

One way and two-way classifications - Completely randomized design – Randomized block design – Latin square design.

UNIT-3 FOURIER SERIES 12 HOURS

Dirichlet's conditions — General Fourier series — Odd and even functions — Half range sine series — Half range cosine series — Parseval's identity — Harmonic analysis.

UNIT-4 FOURIER TRANSFORMS 12 HOURS

Fourier transform pair — Fourier sine and cosine transforms — Properties — Transforms of simple functions — Convolution theorem- Parseval's identity

UNIT-5 Z — TRANSFORMS 12 HOURS

Z-transforms — Elementary properties — Inverse Z-transform (using partial fraction and residues)— Convolution theorem.

TOTAL LECTURE HOURS: 60 HOURS

TEXT BOOK(S)

1. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.
2. Grewal B.S., "Higher Engineering Mathematics", 43rd Edition, Khanna Publishers, New Delhi, 2014.
3. Narayanan S., Manicavachagom Pillay. T. K and Ramanaiah. G "Advanced Mathematics for Engineering Students", Vol. II & III, S. Viswanathan Publishers Pvt. Ltd, Chennai, 1998.

REFERENCE BOOKS

1. Gupta S.C. and Kapoor V. K., “Fundamentals of Mathematical Statistics”, Sultan Chand & Sons, New Delhi, 12th Edition, 2020.
2. Devore. J.L., "Probability and Statistics for Engineering and the Sciences”, Cengage Learning, New Delhi, 8th Edition, 2014
3. Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum’s Outlines on Probability and Statistics ", Tata McGraw Hill Edition, 4th Edition, 2012.
4. Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., “Probability and Statistics for Engineers and Scientists", 9th Edition, Pearson Education, Asia, 2010
5. Andrews, L.C and Shivamoggi, B, “Integral Transforms for Engineers” SPIE Press, 1999.
6. Bali. N.P and Manish Goyal, “A Textbook of Engineering Mathematics”, 9th Edition, Laxmi Publications Pvt. Ltd, 2014.
7. Erwin Kreyszig, “Advanced Engineering Mathematics “, 10th Edition, John Wiley, India, 2016.
8. James, G., “Advanced Modern Engineering Mathematics”, 3rd Edition, Pearson Education, 2007.
9. Ramana. B.V., “Higher Engineering Mathematics”, McGraw Hill Education Pvt. Ltd, New Delhi,2016.
10. Wylie, R.C. and Barrett, L.C., “Advanced Engineering Mathematics “Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.

Course Code	Course Title	L	T	P	J	C
22ADT201	**DATA STRUCTURES**	**3**	**0**	**0**	**0**	**3**
		Syllabus version		v. 1.0		

Course Objectives:

1. To understand the concepts of ADTs
2. To design linear data structures – lists, stacks, and queues
3. To understand sorting, searching and hashing algorithms
4. To apply Tree and Graph structures

Course Outcome:

COURSE OUTCOMES:

At the end of the course, the student should be able to:

CO1: explain abstract data types

CO2:design, implement, and analyses linear data structures, such as lists, queues, and stacks, according to the needs of different applications

CO3:design, implement, and analyses efficient tree structures to meet requirements such as searching, indexing, and sorting

CO4:model problems as graph problems and implement efficient graph algorithms to solve them

Unit-1	**ABSTRACT DATA TYPES**	9 hours

Abstract Data Types (ADTs) – ADTs and classes – introduction to OOP – classes in Python – inheritance – namespaces – shallow and deep copying

Introduction to analysis of algorithms – asymptotic notations – recursion – analyzing recursive algorithms

Unit-2	**LINEAR STRUCTURES**	9 hours

List ADT – array-based implementations – linked list implementations – singly linked lists – circularly linked lists – doubly linked lists – applications of lists – Stack ADT – Queue ADT – double ended queues

Unit-3	**SORTING AND SEARCHING**	9 hours

Bubble sort – selection sort – insertion sort – merge sort – quick sort – linear search – binary search – hashing – hash functions – collision handling – load factors, rehashing, and efficiency.

Unit-4	**TREE STRUCTURES**	9 hours

Tree ADT – Binary Tree ADT – tree traversals – binary search trees – AVL trees – heaps – multiway search trees

Unit-5	**GRAPH STRUCTURES**	9 hours

Graph ADT – representations of graph – graph traversals – DAG – topological ordering – shortest paths – minimum spanning trees

Total Lecture hours:	45 hours

Text Book(s)

1.	Michael T. Goodrich, Roberto Tamassia, and Michael H. Goldwasser, “Data Structures and Algorithms in Python” (An Indian Adaptation), Wiley, 2021
2.	Lee, Kent D., Hubbard, Steve, “Data Structures and Algorithms with Python” Springer Edition 2015.
3.	Narasimha Karumanchi, “Data Structures and Algorithmic Thinking with Python” Careermonk, 2015.

Reference Books

1.	Rance D. Necaise, “Data Structures and Algorithms Using Python”, John Wiley & Sons, 2011.
2.	Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, “Introduction to Algorithms", Third Edition, PHI Learning, 2010.
3.	Mark Allen Weiss, “Data Structures and Algorithm Analysis in C++”, Fourth Edition, Pearson Education, 2014
4.	Aho, Hopcroft, and Ullman, “Data Structures and Algorithms”, Pearson Education India, 2002

Course Code	Course Title	L	T	P	J	C
22EST205	**BASIC ELECTRICAL AND ELECTRONICS ENGINEERING**	**3**	**0**	**0**	**0**	**3**
		Syllabus version		v. 1.0		

OBJECTIVES:

1. To introduce the basics of electric circuits and analysis
2. To impart knowledge in the basics of working principles and application of electrical machines
3. To introduce analog devices and their characteristics
4. To educate on the fundamental concepts of digital electronic
5. To introduce the functional elements and working of measuring instruments.

OUTCOMES:

1. Compute the electric circuit parameters for simple problems
2. Explain the working principle and applications of electrical machines
3. Analyze the characteristics of analog electronic devices
4. Explain the basic concepts of digital electronics
5. Explain the operating principles of measuring instruments.

UNIT-I ELECTRICAL CIRCUITS 9

DC Circuits: Circuit Components: Conductor, Resistor, Inductor, Capacitor – Ohm’s Law - Kirchhoff’s Laws –Independent and Dependent Sources – Simple problems- Nodal Analysis, Mesh analysis with Independent sources only (Steady state) Introduction to AC Circuits and Parameters: Waveforms, Average

value, RMS Value, Instantaneous power, real power, reactive power and apparent power, power factor – Steady state analysis of RLC circuits (Simple problems only)

UNIT II ELECTRICAL MACHINES 9

Construction and Working principle- DC Separately and Self excited Generators, EMF equation, Types and Applications. Working Principle of DC motors, Torque Equation, Types and Applications. Construction, Working principle and Applications of Transformer, Three phase Alternator, Synchronous motor and Three Phase Induction Motor.

UNIT III ANALOG ELECTRONICS 9

Resistor, Inductor and Capacitor in Electronic Circuits- Semiconductor Materials: Silicon &Germanium – PN Junction Diodes, Zener Diode –Characteristics Applications – Bipolar Junction Transistor-Biasing, JFET, SCR, MOSFET,IGBT – Types, I-V Characteristics and Applications, Rectifier and Inverters

UNIT IV DIGITAL ELECTRONICS 9

Review of number systems, binary codes, error detection and correction codes, Combinational logic - representation of logic functions-SOP and POS forms, K-map representations - minimization using K maps (Simple Problems only).

UNIT V MEASUREMENTS AND INSTRUMENTATION 9

Functional elements of an instrument, Standards and calibration, Operating Principle , types - Moving Coil and Moving Iron meters, Measurement of three phase power, Energy Meter, Instrument Transformers-CT and PT,DSO- Block diagram- Data acquisition

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Kothari DP and I.J Nagrath, “Basic Electrical and Electronics Engineering”, Second Edition, McGraw Hill Education, 2020. Curriculum and Syllabus | B.E. Biomedical Engineering | R2022 | Page 43
2. S.K.Bhattacharya “Basic Electrical and Electronics Engineering”, Pearson Education, Second Edition, 2017

REFERENCES:

1. Kothari DP and I.J Nagrath, “Basic Electrical Engineering”, Fourth Edition, McGraw Hill Education, 2019.
2. Thomas L. Floyd, ‘Digital Fundamentals’, 11th Edition, Pearson Education, 2017.
3. Albert Malvino, David Bates, ‘Electronic Principles, McGraw Hill Education; 7 th edition, 2017

Course Code	Course Title	L	T	P	J	C
22EST202	ENGINEERING GRAPHICS	1	0	4	0	3
		Syllabus version			v. 2.0	

COURSE OBJECTIVES:

1. To develop students, graphic skills for communication of concepts, ideas and design of engineering products.
2. To expose them to existing National standards related to technical drawings.
3. To Familiarize with basic geometrical constructions and orthographic projections.
4. To make the students to draw the different projections of the solids.
5. To view the true shape and apparent shape of the sectioned solids and their developments.
6. To get an idea about 3D views through isometric projections.

COURSE OUTCOME:

1. Perform basic geometrical constructions and principles of orthographic projections.
2. Project orthographic projections of lines and plane surfaces.
3. Draw projections of solids and development of surfaces.
4. Visualize and to project isometric views and conversion of Isometric views to Orthographic views.
5. Understand the basics of AUTO CAD and fundamentals of perspective projections.

UNIT-0	CONCEPTS AND CONVENTIONS (Not for Examination)	3+9 HOURS

Importance of graphics in engineering applications — Use of drafting instruments - BIS conventions and specifications — Size, layout and folding of drawing sheets — Lettering and dimensioning.

UNIT-1	PLANE CURVES, PROJECTIONOF POINTS AND LINES	3+9 HOURS

Conic Sections - Construction of Ellipse, Parabola & hyperbola by eccentricity method – Construction of cycloid. Introduction of Orthographic projection.

First angle projection - projection of points and Projection of Lines (only for understanding)

UNIT-2	PROJECTION OF PLANES AND SOLIDS	3+9 HOURS

Projection of simple planes (Square, circular, Hexagon, Pentagon) inclined to both the principal planes by rotating object method. Projection of simple solids like Prism, Pyramid, Cylinder& Cone when the axis is inclined to one of the principal planes by rotating object method.

UNIT-3	SECTION AND DEVELOPMENT SURFACES OF SOLIDS	3+9 HOURS

Sectioning of simple solids (Prism, Pyramid, Cylinder& Cone) in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of surfaces of right regular sectioned solids

UNIT-4	ISOMETRIC AND ORTHOGRAPHIC PROJECTIONS	3+9 HOURS

Principles of Isometric Projections-Isometric scale- Isometric Views of simple and truncated solids. Conversion of Isometric views of the objects to Orthographic views Exercises using free hand sketching.		
UNIT-5	**COMPUTER AIDED DRAFTING (Only for Internal Evaluation)**	**3+9 HOURS**
Introduction to engineering graphics CAD tools, Drawing Orthographic views from Isometric views using CAD tools--Floor plans of simple buildings- Exercise of circuit diagram (2D Orthographic Views) and 3D modeling (Isometric Views) using AutoCAD Software.		
Special points applicable to University Examinations on Engineering Graphics: 1. There will be five questions, each of either or type covering all units of the syllabus. 2. All questions will carry equal marks of 20 each making a total of 100. 3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size 4. The examination will be conducted in appropriate sessions on the same day		
	TOTAL LECTURE HOURS:	**60 HOURS**
TEXT BOOK(S):		
1.	Bhatt N.D. and Panchal V.M., “Engineering Drawing”, Charotar Publishing House, 53rd Edition, 2019.	
2.	Natrajan K.V., “A Text Book of Engineering Graphics”, Dhanalakshmi Publishers, Chennai, 2018.	
3.	Parthasarathy, N. S. and Vela Murali, “Engineering Drawing”, Oxford University Press, 2015	
REFERENCE BOOKS:		
1.	Basant Agarwal and Agarwal C.M., “Engineering Drawing”, McGraw Hill, 2nd Edit ion, 2019.	
2.	Gopalakrishna K.R., “Engineering Drawing” (Vol. I&II combined), Subhas Publications, Bangalore, 27th Edition, 2017.	
3.	Luzzader, Warren.J. and Duff,John M., “Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.	
4.	Parthasarathy N. S. and Vela Murali, “Engineering Graphics”, Oxford University, Press, New Delhi, 2015.	
5.	Shah M.B., and Rana B.C., “Engineering Drawing”, Pearson Education India, 2nd Edition, 2009.	
6.	Venugopal K. and Prabhu Raja V., “Engineering Graphics", New Age International (P) Limited, 2008.	
LIST OF EQUIPMENTS		
S. NO	**DESCRIPTION OF EQUIPMENT**	**QUANTITY**

1.	Computer nodes or systems with suitable graphics facility	30 Nos
2.	Software for Drafting and Modelling	30 Nos
3.	Laser Printer or Plotter to print / plot drawings	1 No

LIST OF EXPERIMETS:

1. Drawing of a title block with necessary text, projection symbol and lettering using drafting software.
2. Drafting of Conic curves - Ellipse, Parabola and Hyperbola
3. Drawing orthographic view of simple solids like Prism, Pyramids, Cylinder, Cone, etc, and dimensioning.
4. Drawing of simple solids like prism and pyramids when the axis is inclined to HP.
5. Drawing of simple solids like cylinder and cone when the axis is inclined to HP.
6. Drawing isometric projection of simple solids.
7. Drawing of star –delta starter circuit
8. Drawing an electrical circuit of three-point starter.
9. Drawing of an electrical power supply circuit.
10. Drawing of Hartley oscillator.

Course Code	Course Title	L	T	P	J	C
22BST202	**COMPUTER ARCHITECTURE**	**3**	**0**	**0**	**0**	**3**
Pre-requisite	Engineering Physics	Syllabus version			v. 1.0	

Course Objectives:

• To make students understand the basic structure and operation of digital computer.

• To understand the hardware-software interface.

• To familiarize the students with arithmetic and logic unit and implementation of fixed point and floating-point arithmetic operations.

• To expose the students to the concept of pipelining.

• To familiarize the students with hierarchical memory system including cache memories and virtual memory.

• To expose the students with different ways of communicating with I/O devices and standard I/O interfaces.

Course Outcome:

• • Design arithmetic and logic unit. • Design and anlayse pipelined control units • Evaluate performance of memory systems. • Understand parallel processing architectures.		
UNIT I	**OVERVIEW & INSTRUCTIONS**	**9 hours**
	Eight ideas – Components of a computer system – Technology – Performance – Power wall – Uniprocessors to multiprocessors; Instructions – operations and operands – representing instructions – Logical operations – control operations – Addressing and addressing modes..	
UNIT II	**ARITHMETIC OPERATIONS**	**9 hours**
	ALU - Addition and subtraction – Multiplication – Division – Floating Point operations – Subword parallelism.	
UNIT III	**PROCESSOR AND CONTROL UNIT**	**9 hours**
	Basic MIPS implementation – Building datapath – Control Implementation scheme – Pipelining – Pipelined datapath and control – Handling Data hazards & Control hazards – Exceptions.	
UNIT IV	**PARALLELISM**	**9 hours**
	Instruction-level-parallelism – Parallel processing challenges – Flynn's classification – Hardware multithreading – Multicore processors.	
UNIT V	**MEMORY AND I/O SYSTEMS**	**9 hours**
	Memory hierarchy - Memory technologies – Cache basics – Measuring and improving cache performance - Virtual memory, TLBs - Input/output system, programmed I/O, DMA and interrupts, I/O processors.	
	Total Lecture hours:	**45 hours**
Text Book(s)		
1.	David A. Patterson and John L. Hennessey, “Computer organization and design", Morgan Kauffman / Elsevier, Fifth edition, 2014.	
Reference Books		

1.	V.Carl Hamacher, Zvonko G. Varanesic and Safat G. Zaky, “Computer Organisation“, VI th edition, Mc Graw-Hill Inc, 2012.
2.	William Stallings “Computer Organization and Architecture” , Seventh Edition , Pearson Education, 2006.
3.	Vincent P. Heuring, Harry F. Jordan, “Computer System Architecture”, Second Edition, Pearson Education, 2005.
4.	Govindarajalu, “Computer Architecture and Organization, Design Principles and Applications", first edition, Tata McGraw Hill, New Delhi, 2005.
5.	John P. Hayes, “Computer Architecture and Organization”, Third Edition, Tata Mc Graw Hill, 1998.

Course Code	Course Title	L	T	P	J	C
22HSM201	**TAMILS AND TECHNOLOGY**	**0**	**1**	**0**	**0**	**1**
Pre-requisite		Syllabus version			v. 1.0	

Unit-1	**WEAVING AND CERAMIC TECHNOLOGY**	**03 hours**

Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.

Unit-2	**DESIGN AND CONSTRUCTION TECHNOLOGY**	**03 hours**

Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.

Unit-3	**MANUFACTURING TECHNOLOGY**	**03 hours**

Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting, steel -Copper and gold- Coins as source of history - Minting of Coins – Beads making-industries Stone beads -Glass beads - Terracotta beads -Shell beads/ bone beats - Archeological evidences - Gem stone types described in Silappathikaram.

Unit-4	**AGRICULTURE AND IRRIGATION TECHNOLOGY**	**03 hours**

Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.

Unit-5	**SCIENTIFIC TAMIL & TAMIL COMPUTING**	**03 hours**

Development of Scientific Tamil - Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.

Total Lecture hours:	15 hours

TEXT BOOK(S)

1.	The Contributions of the Tamils to Indian Culture (Dr. M. Valarmathi) (Published by: International Institute of Tamil Studies.)
2.	Keeladi - ‘Sangam City Civilization on the banks of river Vaigai’ (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation,
3.	Tamilaga Varalaru, Makalum Panpadum- Dr. K.K. Pillai
4.	Kanini Tamil- Munaivar L. Sundaram

5.	Porunai- Attrangarai Nagarigam
REFERENCE BOOKS	
1.	Social Life of Tamils (Dr. K. K. Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
2.	Social Life of the Tamils - The Classical Period (Dr. S. Singaravelu) (Published by: International Institute of Tamil Studies.
3.	Historical Heritage of the Tamils (Dr. S. V. Subatamanian, Dr. K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
4.	Studies in the History of India with Special Reference to Tamil Nadu (Dr. K.K. Pillay) (Published by: The Author)
5.	Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
6.	Journey of Civilization Indus to Vaigai (R. Balakrishnan) (Published by: RMRL) – Reference Book

Course Code	**Course Title**	**L**	**T**	**P**	**J**	**C**
22EET201	**INNOVATION AND DESIGN THINKING**	**2**	**0**	**0**	**0**	**2**
Pre-requisite	NIL	Syllabus version			v. 1.0	

Course Objectives:

1. Learn design thinking concepts and principles
2. Use design thinking methods in every stage of the problem
3. Learn the different phases of design thinking
4. Apply various methods in design thinking to different problems

Course Outcome:

1. Innovation of the new environmental conditions
2. Define key concepts of design thinking
3. Practice design thinking in all stages of problem-solving
4. Apply design thinking approach to real-world problems

Unit-1	**INNOVATIONS**	6 hours

Introduction, innovation in current environment, types of innovation, schools of innovation, analyzing the current business scenario, challenges of innovation, steps of innovation management, experimentation in innovation management, participation for innovation, co-creation for innovation, prototyping to incubation. blue ocean strategy –I, blue ocean strategy-II. marketing of innovation, technology innovation process.

Unit-2	**DESIGN THINKING**	6 hours

Design Thinking Approach:-Introduction to Design Thinking, Iterative Design Thinking Process Stages. Design Thinking as Divergent-Convergent Questioning. Design Thinking in a Team Environment, System Thinking, Product Thinking,

Unit-3	**UNDERSTAND, OBSERVE AND DEFINE THE PROBLEM**	6 hours
Search field determination - Problem clarification - Understanding of the problem - Problem analysis - Reformulation of the problem - Observation Phase - Empathetic design - Tips for observing - Methods for Empathetic Design - Point-of-View Phase - Characterization of the target group - Description of customer needs.		
Unit-4	**IDEATION AND PROTOTYPING**	6 hours
Ideate Phase - The creative process and creative principles - Creativity techniques - Evaluation of ideas - Prototype Phase - Lean Startup Method for Prototype Development - Visualization and presentation techniques.		
Unit-5	**TESTING AND IMPLEMENTATION**	6 hours
Test Phase - Tips for interviews - Tips for surveys - Kano Model - Desirability Testing - How to conduct workshops - Requirements for the space - Material requirements - Agility for Design Thinking. Design Thinking meets the corporation – The New Social Contract – Design Activism – Designing tomorrow.		
	Total Lecture hours:	30 hours

Text Book(s)

1.	Christian Mueller-Rotenberg, Handbook of Design Thinking - Tips & Tools for how to design thinking.
2.	Designing for Growth: a design thinking tool kit for managers by Jeanne Liedtka and Tim Ogilvie.
3.	Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation by Tim Brown
4.	John. R. Karsnitz, Stephen O'Brien and John P. Hutchinson, "Engineering Design", Cengage Learning (International edition) Second Edition, 2013

Reference Books

1.	Johnny Schneider, "Understanding Design Thinking, Lean and Agile", O'Reilly Media, 2017.
2.	Roger Martin, "The Design of Business: Why Design Thinking is the Next Competitive Advantage", Harvard Business Press, 2009.
3.	Hasso Plattner, Christoph Meinel and Larry Leifer (eds), "Design Thinking: Understand – Improve – Apply", Springer, 2011 4. http://ajjuliani.com/design-thinking-activities/
4.	Yousef Haik and Tamer M.Shahin, "Engineering Design Process", Cengage Learning, second Edition, 2011.
5.	5. https://venturewell.org/class-exercises

COURSE CODE	COURSE TITLE	L	T	P	J	C
22NCC201	NCC Credit Course Level 1* (ARMY WING)	1	0	0	0	1
		Syllabus version			v. 1.0	

UNIT-1	NCC GENERAL	3 HOURS

NCC 1 Aims, Objectives & Organization of NCC
NCC 2 Incentives
NCC 3 Duties of NCC Cadet
NCC 4 NCC Camps: Types & Conduct

UNIT-2	NATIONAL INTEGRATION AND AWARENESS	3 HOURS

NI 1 National Integration: Importance & Necessity
NI 2 Factors Affecting National Integration
NI 3 Unity in Diversity & Role of NCC in Nation Building
NI 4 Threats to National Security

UNIT-3	PERSONALITY DEVELOPMENT	3 HOURS

PD 1 Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving
PD 2 Communication Skills
PD 3 Group Discussion: Stress & Emotions

UNIT-4	LEADERSHIP	2 HOURS

L 1 Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour Code
L 2 Case Studies: Shivaji, Jhasi Ki Rani

UNIT-5	SOCIAL SERVICE AND COMMUNITY DEVELOPMENT	4 HOURS

SS 1 Basics, Rural Development Programmes, NGOs, Contribution o Youth
SS 2 Protection of Children and Women Safety
SS 3 Road / Rail Travel Safety
SS 4 New Initiatives
SS 5 Cyber and Mobile Security Awareness

TOTAL LECTURE HOURS	15 HOURS

COURSE CODE	COURSE TITLE	L	T	P	J	C
22NCC202	NCC Credit Course Level 1* (NAVAL WING)	1	0	0	0	1
		Syllabus version			v. 1.0	

UNIT-1	NCC GENERAL	3 HOURS

NCC 1 Aims, Objectives & Organization of NCC
NCC 2 Incentives
NCC 3 Duties of NCC Cadet
NCC 4 NCC Camps: Types & Conduct

UNIT-2	NATIONAL INTEGRATION AND AWARENESS	3 HOURS
NI 1 National Integration: Importance & Necessity NI 2 Factors Affecting National Integration NI 3 Unity in Diversity & Role of NCC in Nation Building NI 4 Threats to National Security		
UNIT-3	**PERSONALITY DEVELOPMENT**	**3 HOURS**
PD 1 Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving PD 2 Communication Skills PD 3 Group Discussion: Stress & Emotions		
UNIT-4	**LEADERSHIP**	**2 HOURS**
L 1 Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour Code L 2 Case Studies: Shivaji, Jhasi Ki Rani		
UNIT-5	**SOCIAL SERVICE AND COMMUNITY DEVELOPMENT**	**4 HOURS**
SS 1 Basics, Rural Development Programmes, NGOs, Contribution o Youth SS 2 Protection of Children and Women Safety SS 3 Road / Rail Travel Safety SS 4 New Initiatives SS 5 Cyber and Mobile Security Awareness		
	TOTAL LECTURE HOURS	**15 HOURS**

COURSE CODE	COURSE TITLE	L	T	P	J	C
22NCC203	NCC Credit Course Level 1* (AIR FORCE WING)	1	0	0	0	1
		Syllabus version			v. 1.0	

UNIT-1	NCC GENERAL	3 HOURS
NCC 1 Aims, Objectives & Organization of NCC NCC 2 Incentives NCC 3 Duties of NCC Cadet NCC 4 NCC Camps: Types & Conduct		
UNIT-2	**NATIONAL INTEGRATION AND AWARENESS**	**3 HOURS**
NI 1 National Integration: Importance & Necessity NI 2 Factors Affecting National Integration NI 3 Unity in Diversity & Role of NCC in Nation Building NI 4 Threats to National Security		
UNIT-3	**PERSONALITY DEVELOPMENT**	**3 HOURS**
PD 1 Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving PD 2 Communication Skills PD 3 Group Discussion: Stress & Emotions		

UNIT-4	LEADERSHIP	2 HOURS
L 1 Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour Code L 2 Case Studies: Shivaji, Jhasi Ki Rani		
UNIT-5	**SOCIAL SERVICE AND COMMUNITY DEVELOPMENT**	**4 HOURS**
SS 1 Basics, Rural Development Programmes, NGOs, Contribution o Youth SS 2 Protection of Children and Women Safety SS 3 Road / Rail Travel Safety SS 4 New Initiatives SS 5 Cyber and Mobile Security Awareness		
	TOTAL LECTURE HOURS	**15 HOURS**

Course Code	Course Title	L	T	P	J	C
22ESP201	ENGINEERING PRODUCT LABORATORY	0	0	3	0	1.5
		Syllabus version			v. 2.0	

COURSE OBJECTIVES: The main learning objective of this course is to provide hands on training to the students in:

1. Drawing pipe line plan; laying and connecting various pipe fittings used in common household plumbing work; Sawing; planning; making joints in wood materials used in common household wood work.
2. Wiring various electrical joints in common household electrical wire work.
3. Welding various joints in steel plates using arc welding work; Machining various simple processes like turning, drilling, tapping in parts; Assembling simple mechanical assembly of common household equipments; Making a tray out of metal sheet using sheet metal work.
4. Soldering and testing simple electronic circuits; Assembling and testing simple electronic components on PCB

COURSE OUTCOME: At the end of the course, the student will be able to

1. Draw pipe line plan; lay and connect various pipe fittings used in common household plumbing work; Saw; plan; make joints in wood materials used in common household wood work.
2. Wire various electrical joints in common household electrical wire work.
3. Weld various joints in steel plates using arc welding work; Machine various simple processes like turning, drilling, tapping in parts; Assemble simple mechanical assembly of common household equipments; Make a tray out of metal sheet using sheet metal work.
4. Solder and test simple electronic circuits; Assemble and test simple electronic components on PCB.

LIST OF EXPERIMENTS:

GROUP – A (CIVIL & ELECTRICAL)

PART I CIVIL ENGINEERING PRACTICES PLUMBING WORK 15

a) Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows and other components which are commonly used in household.

b) Preparing plumbing line sketches.

c) Laying pipe connection to the suction side of a pump

d) Laying pipe connection to the delivery side of a pump.

e) Connecting pipes of different materials: Metal, plastic and flexible pipes used in household appliances.

PART II ELECTRICAL ENGINEERING PRACTICES 15

1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2. Fluorescent lamp wiring with introduction to CFL and LED types.
3. Stair case wiring
4. Residential house wiring using fuse, switch, indicator, lamp and energy meter.
5. Measurement of energy using single phase energy meter.

GROUP – B (MECHANICAL AND ELECTRONICS)

PART III MECHANICAL ENGINEERING PRACTICES 15

WELDING WORK:

Demonstrating welding of Butt Joints, Lap Joints, and Tee Joints using arc welding.

BASIC MACHINING WORK:

Demonstrating of a) (simple)Turning. b) (simple)Drilling. c) (simple)Tapping.

3D PRINITNG:

Demonstrating of working principle of 3D Printer machine.

FOUNDRY WORK:

a) Demonstrating basic foundry operations

SHEET METAL WORK:

b) Making of a square tray
c) Making of a cone

FITTING EXERCISE:

Make a model by using fitting exercise

PART IV ELECTRONIC ENGINEERING PRACTICES 15

1. Study of Electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CR.

2.Study of logic gates AND, OR, EOR and NOT.

3.Generation of Clock Signal.

4. Soldering practice – Components Devices and Circuits – Using general purpose PCB.

5. Measurement of ripple factor of HWR and FWR.

TOTAL LABORATORY HOURS:	**60 HOURS**

Course Code	Course Title	L	T	P	J	C
22ADP201	DATA STRUCTURES LABORATORY	0	0	3	0	1.5
Pre-requisite		Syllabus version			v. 1.0	
Course Objectives:						

1. To implement ADTs in Python
2. To design and implement linear data structures – lists, stacks, and queues
3. To implement sorting, searching and hashing algorithms
4. To solve problems using tree and graph structures

Course Outcome:

1. implement ADTs as Python classes
2. design, implement, and analyse linear data structures, such as lists, queues, and stacks, according to the needs of different applications
3. design, implement, and analyse efficient tree structures to meet requirements such as searching, indexing, and sorting
4. model problems as graph problems and implement efficient graph algorithms to solve them

LIST OF EXPERIMENTS:

1. Implement simple ADTs as Python classes
2. Implement recursive algorithms in Python
3. Implement List ADT using Python arrays
4. Linked list implementations of List
5. Implementation of Stack and Queue ADTs
6. Applications of List, Stack and Queue ADTs
7. Implementation of sorting and searching algorithms
8. Implementation of Hash tables
9. Tree representation and traversal algorithms
10. Implementation of Binary Search Trees
11. Implementation of Heaps
12. Graph representation and Traversal algorithms
13. Implementation of single source shortest path algorithm
14. Implementation of minimum spanning tree algorithms

Total Lecture hours:	60 hours

Course Code	Course Title	L	T	P	J	C
22BST301	**DISCRETE MATHEMATICS**	**3**	**2**	**0**	**0**	**4**
Pre-requisite		Syllabus version		v. 1.0		

COURSE OBJECTIVES:

1. To extend student's logical and mathematical maturity and ability to deal with abstraction.
2. To introduce most of the basic terminologies used in computer science courses and application of ideas to solve practical problems.
3. To understand the basic concepts of combinatorics and graph theory.
4. To familiarize the applications of algebraic structures.
5. To understand the concepts and significance of lattices and Boolean algebra which are widely used in computer science and engineering.

COURSE OUTCOME:

1. Have knowledge of the concepts needed to test the logic of a program.
2. Have an understanding in identifying structures on many levels.
3. Be aware of a class of functions which transform a finite set into another finite set which relates to input and output functions in computer science.
4. Be aware of the counting principles.
5. Be exposed to concepts and properties of algebraic structures

Unit-1	**LOGIC AND PROOFS**	**12 hours**

Propositional logic – Propositional equivalences - Predicates and quantifiers – Rules of inference - Introduction to proofs

Unit-2	**COMBINATORICS**	**12 hours**

Mathematical induction --The pigeonhole principle – Permutations and combinations – Recurrence relations – Solving linear recurrence relations – Inclusion and exclusion principle and its applications.

Unit-3	**GRAPHS**	**12 hours**

Graphs and graph models – Graph terminology and special types of graphs – Matrix representation of graphs and graph isomorphism – Connectivity – Euler and Hamilton paths.

Unit-4	**ALGEBRAIC STRUCTURES**	**12 hours**

Algebraic systems – Semi groups and monoids - Groups – Subgroups – Homomorphism's– Lagrange's theorem

Unit-5	**LATTICES AND BOOLEAN ALGEBRA**	**12 hours**

Partial ordering – Po-sets – Lattices as posets – Properties of lattices - Lattices as algebraic systems – Sub lattices – Direct product and homomorphism – Some special lattices – Boolean algebra

Total Lecture hours:	**60 hours**

TEXT BOOK(S)	
1.	Rosen. K.H., "Discrete Mathematics and its Applications", 7th Edition, Tata McGraw Hill Pub. Co. Ltd., New Delhi, Special Indian Edition, 2017.
2.	Tremblay. J.P. and Manohar. R, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill Pub. Co. Ltd, New Delhi, 30th Reprint, 2011.
REFERENCE BOOKS	
1.	Grimaldi. R.P. "Discrete and Combinatorial Mathematics: An Applied Introduction", 5thEdition, Pearson Education Asia, Delhi, 2013.
2.	Koshy. T. "Discrete Mathematics with Applications", Elsevier Publications, 2006.
3.	Lipschutz. S. and Mark Lipson., "Discrete Mathematics", Schaum's Outlines, Tata McGraw Hill Pub. Co. Ltd., New Delhi, 3rd Edition, 2010.

Course Code	Course Title	L	T	P	J	C
22ADT301	**SYSTEM SOFTWARE**	**3**	**0**	**0**	**0**	**3**
Pre-requisite		Syllabus version		v. 1.0		

Course Objectives:

1. To understand the relationship between system software and machine architecture.
2. To know the design and implementation of assemblers
3. To know the design and implementation of linkers and loaders.
4. To have an understanding of macro processors.
5. To have an understanding of system software tools.

1.

Course Outcome:

6. At the end of this course, the students will be able to:
7. Design various combinational digital circuits using logic gates
8. Design sequential circuits and analyze the design procedures
9. State the fundamentals of computer systems and analyze the execution of an instruction
10. Analyze different types of control design and identify hazards
11. Identify the characteristics of various memory systems and I/O communication

Unit-1	INTRODUCTION	9 hours

System software and machine architecture – The Simplified Instructional Computer (SIC) - Machine architecture - Data and instruction formats - addressing modes - instruction sets - I/O and programming.

Unit-2	ASSEMBLERS	9 hours

Basic assembler functions - A simple SIC assembler – Assembler algorithm and data structures - Machine dependent assembler features - Instruction formats and addressing modes – Program relocation - Machine independent assembler features - Literals – Symbol-defining statements – Expressions - One pass assemblers and Multi pass assemblers - MASM assembler.

Unit-3	LOADERS AND LINKERS	9 hours

Basic loader functions - Design of an Absolute Loader – A Simple Bootstrap Loader - Machine dependent loader features - Relocation – Program Linking – Algorithm and Data Structures for Linking Loader - Machine-independent loader features - Automatic Library Search – Loader Options - Loader design options - Linkage Editors – DynamicLinking – Bootstrap Loaders - MSDOS linker.

Unit-4	MACRO PROCESSORS	9 hours

Basic macro processor functions - Macro Definition and Expansion – Macro Processor Algorithm and data structures - Machine-independent macro processor features - Concatenation of Macro Parameters – Generation of Unique Labels – Conditional Macro Expansion – Keyword Macro Parameters-Macro within Macro.		
Unit-5	**SYSTEM SOFTWARE TOOLS**	**9 hours**
Text editors - Overview of the Editing Process - User Interface – Editor Structure. - Interactive debugging systems - Debugging functions and capabilities – Relationship with other parts of the system – User-Interface Criteria.		
	Total Lecture hours:	**45 hours**
Text Book(s)		
1	1. Leland L. Beck, “System Software – An Introduction to Systems Programming”, 3rd Edition, Pearson Education Asia, 2006.	
Reference Books		
1.	1. D. M. Dhamdhere, “Systems Programming and Operating Systems”, Second Revised Edition, Tata McGraw-Hill, 2000.	
2.	2. John J. Donovan “Systems Programming”, Tata McGraw-Hill Edition, 2000.	
3.	3. John R. Levine, Linkers & Loaders – Harcourt India Pvt. Ltd., Morgan Kaufmann Publishers, 2000	

Course Code	Course Title	L	T	P	J	C
22ADT302	**DESIGN AND ANALYSIS OF ALGORITHMS**	**3**	**0**	**0**	**0**	**3**
Pre-requisite		Syllabus version		v. 1.0		

Course Objectives:

1. To critically analyze the efficiency of alternative algorithmic solutions for the same problem
2. To illustrate brute force and divide and conquer design techniques.
3. To explain dynamic programming and greedy techniques for solving various problems.
4. To apply iterative improvement technique to solve optimization problems
5. To examine the limitations of algorithmic power and handling it in different problems.

Course Outcome:

1. At the end of this course, the students will be able to:
2. Analyze the efficiency of recursive and non-recursive algorithms mathematically
3. Analyze the efficiency of brute force, divide and conquer, decrease and conquer, Transform and conquer algorithmic techniques
4. Implement and analyze the problems using dynamic programming and greedy algorithmic techniques.
5. Solve the problems using iterative improvement techniques for optimization.
6. Compute the limitations of algorithmic power and solve the problems using backtracking and branch and bound techniques.

Unit-1	**INTRODUCTION**	**8 hours**

Notion of an Algorithm – Fundamentals of Algorithmic Problem Solving – Important Problem Types – Fundamentals of the Analysis of Algorithm Efficiency – Analysis Framework - Asymptotic Notations and their properties – Empirical analysis - Mathematical analysis of Recursive and Non-recursive algorithms – Visualization.

Unit-2	**BRUTE FORCE AND DIVIDE AND CONQUER**	**10 hours**

Brute Force – String Matching - Exhaustive Search - Traveling Salesman Problem - Knapsack Problem - Assignment problem. Divide and Conquer Methodology – Multiplication of Large Integers and Strassen's Matrix Multiplication – Closest-Pair and Convex - Hull Problems. Decrease and Conquer: - Topological Sorting – Transform and Conquer: Presorting – Heaps and Heap Sort.

Unit-3	**DYNAMIC TECHNIQUE**	**PROGRAMMING**	**AND**	**GREEDY**			**10 hours**

Dynamic programming – Principle of optimality - Coin changing problem – Warshall's and Floyd's algorithms – Optimal Binary Search Trees - Multi stage graph - Knapsack Problem and Memory functions. Greedy Technique – Dijkstra's algorithm - Huffman Trees and codes - 0/1 Knapsack problem.		
Unit-4	**ITERATIVE IMPROVEMENT**	**8 hours**
The Simplex Method-The Maximum-Flow Problem – Maximum Matching in Bipartite Graphs- The Stable Marriage Problem.		
Unit-5	**LIMITATIONS OF ALGORITHM POWER**	**9 hours**
Lower - Bound Arguments - P, NP, NP- Complete and NP Hard Problems. Backtracking – N-Queen problem - Hamiltonian Circuit Problem – Subset Sum Problem. Branch and Bound – LIFO Search and FIFO search - Assignment problem – Knapsack Problem – Traveling Salesman Problem -Approximation Algorithms for NP-Hard Problems – Traveling Salesman problem – Knapsack problem.		
	Total Lecture hours:	**45 hours**

Text Book(s)

1.	Anany Levitin, Introduction to the Design and Analysis of Algorithms, Third Edition, Pearson Education, 2012.

Reference Books

1.	Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, Computer Algorithms/ C++, Second Edition, Universities Press, 2019.
2.	Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, Introduction to Algorithms, Third Edition, PHI Learning Private Limited, 2012.
3.	S. Sridhar, Design and Analysis of Algorithms, Oxford university press, 2014.
4.	Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, Data Structures and Algorithms, Pearson Education, Reprint 2006.

Course Code	Course Title	L	T	P	J	C
22GET306	**ENTREPRENEURSHIP AND STARTUPS**	**2**	**0**	**0**	**0**	**2**
		Syllabus version			v. 1.0	

Course Objectives:

1. To provide practical, proven tools for transforming an idea into a product or service that createsvalue for others
2. To build a winning strategy, how to shape a unique value proposition, prepare a business plan
3. To impart practical knowledge on business opportunities
4. To inculcate the habit of becoming an entrepreneur
5. To know the financing, growth, and new venture & its problems

Course Outcome:

1. Transform ideas into real products, services, and processes by validating the idea, testing it, andturning it into a growing, profitable, and sustainable business.
2. Identify the major steps and requirements to estimate the potential of an innovative ideas the basis of an innovative project.
3. Reach creative solutions via an iteration of a virtually endless stream of world-changing ideasand strategies, integrating feedback and learning from failures along the way.
4. Apply the ten entrepreneurial tools in creating a business plan for a new innovative venture.
5. Apply methods and strategies learned from interviews with start-up entrepreneurs and innovators

Unit-1	**ENTREPRENEURIAL COMPETENCE**	9 hours

Introduction to Entrepreneurship & Entrepreneur Meaning and concept of Entrepreneurship, the history of Entrepreneurship development, Myths of Entrepreneurship, the role of Entrepreneurship in Economic Development, Agencies in Entrepreneurship Management, and the Future of Entrepreneurship. The Entrepreneur: Means the skills required to be an entrepreneur, the entrepreneurial decision process, Role models, Mentors and Support system.

Unit-2	**BUSINESS PLAN PREPARATION AND PROTOTYPING**	9 hours

Business Opportunity Identification and Preparing a Business Plan Business ideas, methods of generating ideas, and opportunity recognition, Idea Generation Process, Feasibility study, preparing a Business Plan: Meaning and significance of a business plan, components of a business plan. Experimentation and incubation, Participation in Innovation & Co-creation, and Prototyping

Unit-3	**ENTREPRENEURIAL ENVIRONMENT**	9 hours

Business Environment - Role of Family and Society - Entrepreneurship Development Training and Other Support Organisational Services - Central and StateGovernment Industrial Policies and Regulations

Unit-4	**LAUNCHING OF SMALL BUSINESS**	9 hours
Financing & Launching the New Venture Importance of new venture financing, types of ownership, venture capital, types of debt securities, determining ideal debt-equity mix, and financial institutions and banks. Launching the New Venture: Choosing the legal form of the new venture, protection of intellectual property, and formation of the new venture.		
Unit-5	**MANAGEMENT OF SMALL BUSINESS**	9 hours
Managing Growth & Rewards in New Venture Characteristics of high growth new ventures, strategies for growth, and building the new ventures. Managing Rewards: Exit Strategies for Entrepreneurs, Mergers and acquisitions, Succession and exit strategy, managing failures – bankruptcy - Business Sickness - Effective Management of Small Business - Case Studies.		
Total Lecture hours:		45 hours
Text Book(s)		
1.	Stephen Key, “One Simple Idea for Start-ups and Entrepreneurs: Live Your Dreams and Create Your Own Profitable Company”, 1st Edition, Tata Mc Graw hill Company, New Delhi, 2013.	
2.	Charles Bamford and Garry Bruton, “ENTREPRENEURSHIP: The Art, Science, and Process for Success”, 2nd Edition, Tata Mc Graw hill Company, New Delhi,2016.	
Reference Books		
1.	Philip Auerswald, “The Coming Prosperity: How Entrepreneurs Are Transforming the Global Economy”, Oxford University Press, 2012.	
2.	Janet Kiholm Smith; Richard L. Smith; Richard T. Bliss, “Entrepreneurial Finance: Strategy, Valuation, and Deal Structure, Stanford Economics and Finance”, 2011.	

Course Code	**Course Title**	**L**	**T**	**P**	**J**	**C**
22ADT303	**DATABASE MANAGEMENT SYSTEMS**	**3**	**0**	**0**	**0**	**3**
Pre-requisite		Syllabus version			v. 1.0	

Course Objectives:

1. To introduce database development life cycle and conceptual modelling
2. To learn SQL for data definition, manipulation and querying a database
3. To learn relational database design using conceptual mapping and normalization
4. To learn transaction concepts and serializability of schedules
5. To learn data model and querying in object-relational and No-SQL databases

Course Outcome:

After the completion of this course, students will be able to:

1. Understand the database development life cycle and apply conceptual modelling
2. Apply SQL and programming in SQL to create, manipulate and query the database
3. Apply the conceptual-to-relational mapping and normalization to design relational database
4. Determine the serializability of any non-serial schedule using concurrency techniques
5. Apply the data model and querying in Object-relational and No-SQL databases.

Unit-1	**CONCEPTUAL DATA MODELING**	8 hours

Database architecture – Database system development lifecycle – Requirements collection – Database design -- Entity-Relationship model – Enhanced-ER model

Unit-2	**RELATIONAL MODEL AND SQL**	10 hours

Relational model concepts -- Integrity constraints -- SQL Data manipulation – SQL Data definition – Views -- SQL programming.

Unit-3	**RELATIONAL DATABASE DESIGN AND NORMALIZATION**	10 hours

Functional dependencies – Update anomalies -Inference rules –Minimal cover – Properties of relational decomposition – Normalization (up to BCNF).

Unit-4	**TRANSACTION MANAGEMENT**	8 hours

Transaction concepts – ACID properties – Schedules – Serial , Non Serial and Conflict Serializability – Serializability – types of Serializability – Concurrency Control –Two-phase locking techniques.

Unit-5	**QUERY PROCESSING**	9 hours

File organization: – File organization – various kinds of indexes. Query Processing – Measures of query cost - Selection operation – Projection operation, - Join operation – set operation and aggregate operation – Relational Query Optimization – Transacting SQL queries – Estimating the cost – Equivalence Rules- Indexing and Hashing.

Total Lecture hours:	45 hours

Text Book(s)

1.	Abraham Silberschatz, Henry F Korth, S Sudharshan, “Database System Concepts", 6th Edition, Tata Mc Graw Hill, 2011.
2.	Ramez Elmasri, Shamkant B. Navathe, Fundamentals of Database Systems, 7th Edition, Pearson,

	2017.
Reference Books	
1.	Toby Teorey, Sam Lightstone, Tom Nadeau, H. V. Jagadish, “DATABASE MODELING AND DESIGN - Logical Design”, Fifth Edition, Morgan Kaufmann Publishers, 2011.
2.	Carlos Coronel, Steven Morris, and Peter Rob, Database Systems: Design, Implementation, And Management, Ninth Edition, Cengage learning, 2012
3.	Thomas M. Connolly, Carolyn E. Begg, Database Systems – A Practical Approach to Design, Implementation, and Management, Sixth Edition, Global Edition, Pearson Education, 2015.
4.	Hector Garcia-Molina, Jeffrey D Ullman, Jennifer Widom, "Database Systems:The Complete Book", 2nd edition, Pearson.
5.	Raghu Ramakrishnan, “Database Management Systems", 4th Edition, Tata Mc Graw Hill, 2010.

Course Code	Course Title	L	T	P	J	C
22ADT304	**SOFTWARE ENGINEERING**	**3**	**0**	**0**	**0**	**3**
Pre-requisite		Syllabus version			v. 1.0	

Course Objectives:

1. Understand the phases in a software project
2. Understand fundamental concepts of requirements engineering and Analysis Modelling.
3. Understand the major considerations for enterprise integration and deployment.
4. Learn various testing and maintenance measures

1.

Course Outcome:

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

1. Identify the key activities in managing a software project.
2. Compare different process models.
3. Concepts of requirements engineering and Analysis Modeling.
4. Apply systematic procedure for software design and deployment.
5. Compare and contrast the various testing and maintenance.

Unit-1	SOFTWARE PROCESS AND PROJECT MANAGEMENT	9 hours

Introduction to Software Engineering, Software Process, Perspective and Specialized Process Models – Software Project Management: Project Scheduling – Scheduling, Earned Value Analysis – Risk Management.

Unit-2	**REQUIREMENTS ANALYSIS AND SPECIFICATION**	**9 hours**
Software Requirements: Functional and Non-Functional, User requirements, System requirements, Software Requirements Document – Requirement Engineering Process: Feasibility Studies, Requirements elicitation and analysis, requirements validation, requirements management-Classical analysis: Data Dictionary.		
Unit-3	**SOFTWARE DESIGN**	**9 hours**
Design process – Design Concepts-Design Model– Design Heuristic – Architectural Design – Architectural styles, Architectural Design, - User Interface Design: Interface analysis, Interface Design –Component level Design: Designing Class based components, traditional Components.		
Unit-4	**TESTING AND IMPLEMENTATION**	**9 hours**
Software testing fundamentals-Internal and external views of Testing-white box testing- control structure testing-black box testing- Regression Testing – Unit Testing – Integration Testing – Validation Testing – System Testing And Debugging -Refactoring.		
Unit-5	**PROJECT MANAGEMENT**	**9 hours**
Estimation – FP Based, LOC Based, Make/Buy Decision,– Planning – Project Plan, Planning Process, RFP Risk Management – Identification, Projection, RMMM – Scheduling and Tracking –Relationship between people and effort, Task Set & Network, Scheduling, EVA – Process and Project Metrics.		
Total Lecture hours:		**45 hours**
Text Book(s)		
1.	1. Roger S. Pressman, “Software Engineering – A Practitioner‟s Approach”, Seventh Edition, Mc Graw-Hill International Edition, 2010.	
Reference Books		
1.	Ian Sommerville, “Software Engineering”, 9th Edition, PearsonEducation Asia, 2011.	
2.	Rajib Mall, “Fundamentals of Software Engineering”, Third Edition,PHI Learning PrivateLimited ,2009.	
3.	Pankaj Jalote, “Software Engineering, A Precise Approach”, WileyIndia, 2010.	
4.	Kelkar S.A., “Software Engineering”, Prentice Hall of India Pvt Ltd,2007.	
5.	Stephen R.Schach, “Software Engineering”, Tata McGraw-HillPublishing Company Limited,2007.	

Course Code	Course Title	L	T	P	J	C
22ADT305	ARTIFICIAL INTELLIGENCE	3	0	0	0	3
		Syllabus version			v. 1.0	

Course Objectives:

The main objectives of this course are to:

Learn the basic AI approaches

1. Develop problem solving agents
2. Perform logical and probabilistic reasoning
3. Intelligent agent frameworks
4. Solving Game playing and implementing CSP

Course Outcome:

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

1. Explain intelligent agent frameworks
2. Apply problem solving techniques
3. Apply game playing and CSP techniques
4. Perform logical reasoning
5. Perform probabilistic reasoning under uncertainty.

Unit-1	**INTELLIGENT AGENTS**	9 hours

Introduction to AI – Agents and Environments – concept of rationality – nature of environments –structure of agents. Problem solving agents – search algorithms – uninformed search strategies.

Unit-2	**PROBLEM SOLVING**	9 hours

Heuristic search strategies – heuristic functions. Local search and optimization problems – local search in continuous space – search with non-deterministic actions – search in partially observable environments – online search agents and unknown environments

Unit-3	**GAME PLAYING AND CSP**	9 hours

Game theory – optimal decisions in games – alpha-beta search – monte-carlo tree search – stochastic games – partially observable games. Constraint satisfaction problems – constraint propagation – backtracking search for CSP – local search for CSP – structure of CSP.

Unit-4	**LOGICAL REASONING**	9 hours

Knowledge-based agents – propositional logic – propositional theorem proving – propositional model checking – agents based on propositional logic. First-order logic – syntax and semantics – knowledge representation and engineering – inferences in first-order logic – forward chaining – backward chaining – resolution.

Unit-5	**PROBABILISTIC REASONING**	9 hours

Acting under uncertainty – Bayesian inference – naïve Bayes models. Probabilistic reasoning – Bayesian networks – exact inference in BN – approximate inference in BN – causal networks.	
Total Lecture hours:	45 hours
Text Book(s)	
1.	Stuart Russell and Peter Norvig, “Artificial Intelligence – A Modern Approach”,Fourth Edition, Pearson Education, 2021.
Reference Books	
1.	Dan W. Patterson, “Introduction to AI and ES”, Pearson Education,2007
2.	Kevin Night, Elaine Rich, and Nair B., “Artificial Intelligence”, McGraw Hill, 2008
3.	Patrick H. Winston, "Artificial Intelligence", Third Edition, Pearson Education, 2006
4.	Deepak Khemani, “Artificial Intelligence”, Tata McGraw Hill Education, 2013.
5.	http://nptel.ac.in/

Course Code	Course Title	L	T	P	J	C
22ADP301	**ARTIFICIAL INTELLIGENCE LABORATORY**	**0**	**0**	**3**	**0**	**1.5**
		Syllabus version			v. 1.0	

Course Objectives:

1. To design and implement search strategies.
2. To implement game playing techniques
3. To implement CSP techniques
4. To develop systems with logical reasoning
5. To develop systems with probabilistic reasoning

Course Outcome:

At the end of this course the students will be able to

1. Design and implement search strategies.
2. Implement game playing and CSP techniques
3. Develop logical reasoning systems
4. 4Develop probabilistic reasoning systems.

LIST OF EXPERIMENTS:

1. Implement basic search strategies– 8-Puzzle, 8 - Queens problem, Crypt arithmetic.
2. Implement A* and memory bounded A* algorithms
3. Implement Minimax algorithm for game playing (Alpha-Beta pruning)
4. Solve constraint satisfaction problems
5. Implement propositional model checking algorithms
6. Implement forward chaining, backward chaining, and resolution strategies
7. Build naïve Bayes models
8. Implement Bayesian networks and perform inferences
9. Mini-Project

Total hours:	**45 hours**

Course Code	Course Title	L	T	P	J	C
22ADP302	**DATABASE DESIGN AND MANAGEMENT LABORATORY**	**0**	**0**	**3**	**0**	**2**
		Syllabus version			v. 1.0	

Course Objectives:

1. To understand the database development life cycle
2. To learn database design using conceptual modelling, Normalization
3. To implement database using Data definition, Querying using SQL manipulation and SQL programming
4. To implement database applications using IDE/RAD tools
5. To learn querying Object-relational databases

Course Outcome:

After the completion of this course, students will be able to:

1. Understand the database development life cycle
2. Design relational database using conceptual-to-relational mapping, Normalization
3. Apply SQL for creation, manipulation and retrieval of data
4. Develop a database applications for real-time problems

LIST OF EXPERIMENTS:

1. Database Development Life cycle:
    a. Problem definition and Requirement analysis
    b. Scope and Constraints
2. Database design using Conceptual modeling (ER-EER) – top-down approach
   Mapping conceptual to relational database and validate using Normalization
3. Implement the database using SQL Data definition with constraints, Views
4. Query the database using SQL Manipulation
5. Querying/Managing the database using SQL Programming
    a. Stored Procedures/Functions
    b. Constraints and security using Triggers
6. Database design using Normalization – bottom-up approach
7. Develop database applications using IDE/RAD tools (Eg., NetBeans,VisualStudio)
8. Database design using EER-to-ODB mapping / UML class diagrams
9. Object features of SQL-UDTs and sub-types, Tables using UDTs, Inheritance, Method definition
10. Querying the Object-relational database using Objet Query language

Total Lecture hours:	**45 hours**

Course Code	Course Title	L	T	P	J	C
22EEP301	SOFT SKILLS	0	0	2	0	1
Pre-requisite		Syllabus version		v. 1.0		

Course Objectives:

1. Do self-introspection and develop right attitude
2. Understand the self-motivation and mange his abilities with time
3. Understand the inter personal skills
4. Know the leader's qualities and develop as a leader
5. Understand the conflict at work and make right decisions

Course Outcome:

1. Able to develop self-confidence through right attitude
2. Use self-motivation and to manage his abilities
3. Effectively use inter personal skills
4. Develop leadership qualities
5. Able to make right decisions and solving conflicts

Unit-1	**Self Analysis**	6 hours

Introduction, SWOT analysis, self-introspection, self confidence and self-esteem, Creativity -Out ofthe box thinking, Creative thinking and Lateral thinking, Factors influencing attitude, Influence of attitude on behaviour, Synergy between knowledge, skill and attitude,

Unit-2	**Growth Factors**	6 hours

Motivation, Motivational factors, Self-motivation, Intrinsic and extrinsic motivators, Goal setting, SMART goals, Short, long, life time goals, Time management, Value of time, Test your Time management skill, Prioritizing work, Time management matrix

Unit-3	**Interpersonal skills**	6 hours

Gratitude, Secret of happiness, Understanding the integration of leadership, networking and teamwork, situation analysis, Importance of teamwork, Teamwork activity, Stress Management-Causes of stress and its impact, how to manage and de-stress

Unit-4	**Leadership**	6 hours

Skills needed for a good leader, Types of leadership style, Assessment of leadership skills, Wheel of leadership, Personal, social and professional etiquette
Emotional intelligence, Emotional quotient and intelligence quotient, Emotion scale, Managing emotions

Unit-5	**Conflict resolution and Decision making**	6 hours

Conflicts in human relations, Self-assessment test for conflict management, Approaches to conflict resolution, Case study **Decision making-** Importance of decision making, Impact of decision in life, Process and practical way of decision making.

Total Lecture hours:	30 hours

Text Book(s)

1.	1. SOFT SKILLS, 2015, Career Development Centre, Green Pearl Publications.
Reference Books	
1.	Covey Sean, Seven Habits of Highly Effective Teens, New York, Fireside Publishers, 1998.
2.	Carnegie Dale, How to Win Friends and Influence People, New York: Simon & Schuster, 1998.
3.	Thomas A Harris, I am ok, You are ok, New York-Harper and Row, 1972.
4.	Daniel Coleman, Emotional Intelligence, Bantam Book, 2006.
5.	Carnegie Dale, How to stop worrying and start living, New York: Simon & Schuster, 1985.
6.	http://empower.srmuniv.ac.in (online LMS)

Course Code	Course Title	L	T	P	J	C
22BST402	**PROBABILITY AND STATISTICS**	**3**	**2**	**0**	**0**	**4**
Pre-requisite		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

1. This course aims at providing the required skill to apply the statistical tools in engineering problems.
2. To introduce the basic concepts of probability and random variables.
3. To introduce the basic concepts of two-dimensional random variables.
4. To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
5. To introduce the basic concepts of classifications of design of experiments which plays very important roles in the field of agriculture and statistical quality control.

COURSE OUTCOME:

1. Understand the fundamental knowledge of the concepts of probability and have knowledge of standard distributions which can describe real life phenomenon.
2. Understand the basic concepts of one- and two-dimensional random variables and apply in engineering applications.
3. Apply the concept of testing of hypothesis for small and large samples in real life problems.
4. Apply the basic concepts of classifications of design of experiments in the field of agriculture and statistical quality control.
5. Have the notion of sampling distributions and statistical techniques used in engineering and management problems.

Unit-1	**PROBABILITY AND RANDOM VARIABLES**	**12 hours**

Axioms of probability – Conditional probability – Baye's theorem - Discrete and continuous random variables – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions

Unit-2	**TWO- DIMENSIONAL RANDOM VARIABLES**	**12 hours**

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables		
Unit-3	**ESTIMATION THEORY**	**12 hours**
Unbiased estimators - Efficiency - Consistency - Sufficiency - Robustness - Method of moments - Method of maximum Likelihood - Interval estimation of Means - Differences between means, variations and ratio of two variances		
Unit-4	**NON- PARAMETRIC TESTS**	**12 hours**
Introduction - The Sign test - The Signed - Rank test - Rank - sum tests - The U test - The H test - Tests based on Runs - Test of randomness - The Kolmogorov Tests.		
Unit-5	**STATISTICAL QUALITY CONTROL**	**12 hours**
Control charts for measurements ($\bar{X}$ and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits - Acceptance sampling.		
	Total Lecture hours:	60 hours

TEXT BOOK(S)

1.	Johnson. R.A., Miller. I.R and Freund. J.E, " Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 9th Edition, 2016
2.	Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata Mc Graw Hill, 4th Edition, 2007
3.	John E. Freund, "Mathematical Statistics", Prentice Hall, 5th Edition, 1992.

REFERENCE BOOKS

1.	Gupta. S.C. and Kapoor. V. K., "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, New Delhi, 12th Edition, 2020.
2.	Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2014.
3.	Ross. S.M., "Introduction to Probability and Statistics for Engineers and Scientists", 5thEdition, Elsevier, 2014.
4.	Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum's Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill Edition, 4th Edition, 2012.
5.	Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia, 9th Edition, 2010.

Course Code	Course Title	L	T	P	J	C
22ADT401	**OPERATING SYSTEMS**	**3**	**0**	**2**	**0**	**4**
					v. 1.0	

Course Objectives:

1. To understand the basics and functions of operating systems.
2. To understand Processes and Threads
3. To analyze Scheduling algorithms and process synchronization.
4. To understand the concept of Deadlocks.
5. To analyze various memory management schemes.
6. To be familiar with I/O management and File systems.
7. To be familiar with the basics of virtual machines and Mobile OS like iOS and Android**.**

Course Outcome:

1. . Analyze various scheduling algorithms and process synchronization.
2. Explain deadlock, prevention and avoidance algorithms.
3. Compare and contrast various memory management schemes.
4. Explain the functionality of file systems I/O systems, and Virtualization
5. Compare iOS and Android Operating Systems.

Unit-1	INTRODUCTION	7 hours

Operating System Overview – Objectives and Functions - Evolution of Operating System; Operating System Structures – Operating System Services

User Operating System Interface - System Calls – System Programs :Types of OS - Interrupt handling Basic architectural concepts of an OS-Resource Manager view-process view - hierarchical view of an OS.

Unit-2	PROCESS MANAGEMENT	11 hours

Processes - Process Concept - Process Scheduling - Operations on Processes - Inter- process Communication; CPU Scheduling - Scheduling criteria - Scheduling algorithms: Threads -Multithread Models – Threading issues; Process Synchronization - The critical-section problem -Monitors; Deadlock - Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock.		
Unit-3	**MEMORY MANAGEMENT**	**10 hours**
Main Memory - Swapping - Contiguous Memory Allocation – Paging - Structure of the Page Table - Segmentation, Segmentation with paging; Virtual Memory - Demand Paging – Copy on Write - Page Replacement - Allocation of Frames – Thrashing.		
Unit-4	**STORAGE MANAGEMENT**	**10 hours**
Mass Storage system – Disk Structure - Disk Scheduling and Management; File-System Interface - File concept - Access methods - Directory Structure - Directory organization - File system mounting - File Sharing and Protection; File System Implementation - File System Structure - Directory implementation - Allocation Methods - Free Space Management; I/O Systems – I/O Hardware, Application I/O interface, Kernel I/O subsystem.		
Unit-5	**VIRTUAL MACHINES AND MOBILE OS**	**7 hours**
Virtual Machines – History, Benefits and Features, Building Blocks, Types of Virtual Machines and their Implementations, Virtualization and Operating-System Components; Mobile OS - iOS and Android.		
	Total Lecture hours:	**45 hours**
Text Book(s)		
1.	Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, “OperatingSystem Concepts”, 9th Edition, John Wiley and Sons Inc., 2018.	

Reference Books	
1.	Ramaz Elmasri, A. Gil Carrick, David Levine, “Operating Systems – A Spiral Approach”, Tata McGraw Hill Edition, 2010.
2.	William Stallings, "Operating Systems: Internals and Design Principles", 7th Edition, Prentice Hall, 2018.
3.	Achyut S.Godbole, Atul Kahate, “Operating Systems”, McGraw Hill Education, 2016.
List of Challenging Experiments (Indicative)	
1.	Installation of Operating system : Windows/ Linux
2.	Illustrate UNIX commands and Shell Programming
3.	Process Management using System Calls : Fork, Exec, Getpid, Exit, Wait, Close
4.	Write C programs to implement the various CPU Scheduling Algorithms
5.	Illustrate the inter process communication strategy
6.	Implement mutual exclusion by Semaphores
7.	Write a C program to avoid Deadlock using Banker's Algorithm
8.	Write a C program to Implement Deadlock Detection Algorithm
9.	Write C program to implement Threading
10.	Implement the paging Technique using C program
11.	Write C programs to implement the following Memory Allocation Methods
12.	First Fit b. Worst Fit
13.	Write C programs to implement the various Page Replacement Algorithms
14.	Write C programs to Implement the various File Organization Techniques
15.	Implement the following File Allocation Strategies using C programs
Total Laboratory Hours:	**30 hours**

Course Code	Course Title	L	T	P	J	C
22ADT402	**MACHINE LEARNING**	**3**	**0**	**0**	**0**	**3**
		Syllabus version		v. 1.0		

Course Objectives:

1. To understand the basic concepts of machine learning.
2. To understand and build supervised learning models.
3. To understand and build unsupervised learning models.
4. To evaluate the algorithms based on corresponding metrics identified

Course Outcome:

1. Explain the basic concepts of machine learning.
2. Construct supervised learning models.
3. Construct unsupervised learning algorithms.
4. Evaluate and compare different models

Unit-1	**INTRODUCTION TO MACHINE LEARNING**	8 hours

Review of Linear Algebra for machine learning; Introduction and motivation for machine learning; Examples of machine learning applications, Vapnik-Chervonenkis (VC) dimension, Probably Approximately Correct (PAC) learning, Hypothesis spaces, Inductive bias, Generalization, Bias variance trade-off.

Unit-2	**SUPERVISED LEARNING**	11 hours

Linear Regression Models: Least squares, single & multiple variables, Bayesian linear regression, gradient descent, Linear Classification Models: Discriminant function – Perceptron algorithm, Probabilistic discriminative model - Logistic regression, Probabilistic generative model – Naive Bayes, Maximum margin classifier – Support vector machine, Decision Tree, Random Forests

Unit-3	**ENSEMBLE TECHNIQUES AND UNSUPERVISED LEARNING**	9 hours

Combining multiple learners: Model combination schemes, Voting, Ensemble Learning - bagging, boosting, stacking, Unsupervised learning: K-means, Instance Based Learning: KNN, Gaussian mixture models and Expectation maximization

Unit-4	**NEURAL NETWORKS**	9 hours
Multilayer perceptron, activation functions, network training – gradient descent optimization – stochastic gradient descent, error backpropagation, from shallow networks to deep networks –Unit saturation (aka the vanishing gradient problem) – ReLU, hyper parameter tuning, batch normalization, regularization, dropout.		
Unit-5	**DESIGN AND ANALYSIS OF MACHINE LEARNING EXPERIMENTS**	8 hours
Guidelines for machine learning experiments, Cross Validation (CV) and resampling – K-fold CV, bootstrapping, measuring classifier performance, assessing a single classification algorithm and comparing two classification algorithms – t test, McNemar's test, K-fold CV paired t test .		
	Total Lecture hours:	45 hours

Text Book(s)	
1.	Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Fourth Edition,2020.
2.	Stephen Marsland, "Machine Learning: An Algorithmic Perspective, "SecondEdition", CRC Press, 2014.
Reference Books	
1.	Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer,2006.
2.	Tom Mitchell, "Machine Learning", McGraw Hill, 3rd Edition, 1997.
3.	Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar, "Foundations of Machine Learning", Second Edition, MIT Press, 2012, 2018
4.	Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press,2016
5.	Sebastain Raschka, Vahid Mirjalili , "Python Machine Learning", Packt publishing,3rd Edition, 2019.

Course Code	Course Title	L	T	P	J	C
22ADT403	**FUNDAMENTALS OF DATA SCIENCE AND ANALYTICS**	**3**	**0**	**0**	**0**	**3**
		Syllabus version		v. 1.0		

Course Objectives:

1. To understand the techniques and processes of data science
2. To apply descriptive data analytics
3. To visualize data for various applications
4. To understand inferential data analytics
5. To analysis and build predictive models from data

Course Outcome:

1. Explain the data analytics pipeline
2. Describe and visualize data
3. Perform statistical inferences from data
4. Analyze the variance in the data
5. Build models for predictive analytics

Unit-1	**INTRODUCTION TO DATA SCIENCE**	8 hours

Need for data science – benefits and uses – facets of data – data science process – setting the research goal – retrieving data – cleansing, integrating, and transforming data – exploratory data analysis – build the models – presenting and building applications.

Unit-2	**DESCRIPTIVE ANALYTICS**	10 hours

Frequency distributions – Outliers –interpreting distributions – graphs – averages - describing variability – interquartile range – variability for qualitative and ranked data - Normal distributions – z scores –correlation – scatter plots – regression – regression line – least squares regression line – standard error of estimate – interpretation of r^2 – multiple regression equations – regression toward the mean.

Unit-3	**INFERENTIAL STATISTICS**	9 hours

Populations – samples – random sampling – Sampling distribution- standard error of the mean - Hypothesis testing – z-test – z-test procedure –decision rule – calculations – decisions – interpretations - one-tailed and two-tailed tests – Estimation – point estimate – confidence interval – level of confidence – effect of sample size.		
Unit-4	**ANALYSIS OF VARIANCE**	9 hours
t-test for one sample – sampling distribution of t – t-test procedure – t-test for two independent samples – p-value – statistical significance – t-test for two related samples. F-test – ANOVA – Two factor experiments – three f-tests – two-factor ANOVA – Introduction to chi-square tests.		
Unit-5	**PREDICTIVE ANALYTICS**	9 hours
Linear least squares – implementation – goodness of fit – testing a linear model – weighted resampling. Regression using Stats Models – multiple regression – nonlinear relationships – logistic regression – estimating parameters – Time series analysis – moving averages – missing values – serial correlation – autocorrelation. Introduction to survival analysis.		
	Total Lecture hours:	45 hours

Text Book(s)	
1.	David Cielen, Arno D. B. Meysman, and Mohamed Ali, “Introducing Data Science”, Manning Publications, 2016. (first two chapters for Unit I).
2.	Robert S. Witte and John S. Witte, “Statistics”, Eleventh Edition, Wiley Publications, 2017
3.	Jake VanderPlas, “Python Data Science Handbook”, O’Reilly, 2016.
Reference Books	
1.	Allen B. Downey, “Think Stats: Exploratory Data Analysis in Python”, Green Tea Press, 2014.
2.	Sanjeev J. Wagh, Manisha S. Bhende, Anuradha D. Thakare, “Fundamentals ofData Science”, CRC Press, 2022.
3.	Chirag Shah, “A Hands-On Introduction to Data Science”, Cambridge UniversityPress, 2020.
4.	Vineet Raina, Srinath Krishnamurthy, “Building an Effective Data Science Practice: A Framework to Bootstrap and Manage a Successful Data Science Practice”,

Course Code	Course Title	L	T	P	J	C
22EST401	**ENVIRONMENTAL SCIENCES AND SUSTAINABILITY**	**2**	**0**	**0**	**0**	**2**
		Syllabus version			v. 1.0	

Course Objectives:

1. To study the nature and facts about environment.
2. To finding and implementing scientific, technological, economic and political solutions to environmental problems.
3. To study the interrelationship between living organism and environment.
4. To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
5. To study the dynamic processes and understand the features of the earth's interior and surface.
6. To study the integrated themes and biodiversity, natural resources, pollution control and waste management

Course Outcome:

. 1. Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.

. 2. Public awareness of environmental is at infant stage.

. 3.Ignorance and incomplete knowledge has lead to misconceptions

. 4.Development and improvement in std. of living has lead to serious environmental disasters

Unit-1	**ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY**	6 hours

Definition, scope and importance of environment – need for public awareness. Eco-system and Energy flow– ecological succession. Types of biodiversity: genetic, species and ecosystem diversity– values of biodiversity, India as a mega-diversity nation

hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts
endangered and endemic species of India – conservation of biodiversity: In-situ and ex- situ.

Unit-2	**ENVIRONMENTAL POLLUTION**	6 hours

Causes, Effects and Preventive measures of Water, Soil, Air and Noise Pollutions. Solid, Hazardous and E-Waste management. Case studies on Occupational Health and Safety Management system (OHASMS). Environmental protection, Environmental protection acts .		
Unit-3	NATURAL RESOURCES	6 hours
Energy management and conservation, New Energy Sources: Need of new sources. Different types new energy sources. Applications of- Hydrogen energy, Ocean energy resources, Tidal energy conversion. Concept, origin and power plants of geothermal energy.		
Unit-4	SOCIAL ISSUES AND THE ENVIRONMENT	6 hours
Development, GDP, Sustainability- concept, needs and challenges-economic, social and aspects of sustainability-from unsustainability to sustainability-millennium development goals, and protocols- Sustainable Development Goals-targets, indicators and intervention areas Climate change- Global, Regional and local environmental issues and possible solutions-case studies. Concept of Carbon Credit, Carbon Footprint. Environmental management in industry-A case study		
Unit-5	HUMAN POPULATION AND THE ENVIRONMENT	6 hours
Population growth, variation among nations – population explosion – family welfare Programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and humanhealth – Case studies.		
	Total Lecture hours:	30 hours
Text Book(s)		
1.	Anubha Kaushik and C. P. Kaushik's "Perspectives in Environmental Studies", 6th Edition, NewAge International Publishers ,2018.	
2.	Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2016.	
3.	Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.	

Reference Books							
1.	Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.						
2.	Erach Bharucha "Textbook Orient Blackswan Pvt. Ltd. 2013.	of	Environmental	Studies	for	Undergraduate	Courses"

Course Code	Course Title	L	T	P	J	C
22ADP401	**MACHINE LEARNING LABORATORY**	**0**	**0**	**4**	**0**	**2**
		Syllabus version			v. 1.0	

Course Objectives:

1. To understand the data sets and apply suitable algorithms for selecting the appropriate features for analysis.
2. To learn to implement supervised machine learning algorithms on standard datasets and evaluate the performance.
3. To experiment the unsupervised machine learning algorithms on standard datasets and evaluate the performance.
4. To build the graph based learning models for standard data sets.
5. To compare the performance of different ML algorithms and select the suitable one based on the application

Course Outcome:

1. Apply suitable algorithms for selecting the appropriate features for analysis.
2. Implement supervised machine learning algorithms on standard datasets and evaluate the performance.
3. Apply unsupervised machine learning algorithms on standard datasets and evaluate the performance.
4. Build the graph based learning models for standard data sets.
5. Assess and compare the performance of different ML algorithms and select the suitable one based on applications.

LIST OF EXPERIMENTS:

1. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
2. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
3. Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.
4. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file and compute the accuracy with a few test data sets.
5. Implement naïve Bayesian Classifier model to classify a set of documents and measure the accuracy, precision, and recall.

6. Write a program to construct a Bayesian network to diagnose CORONA infection using standard WHO Data Set.
7. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using the k-Means algorithm. Compare the results ofthese two algorithms.
8. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions.

Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select an appropriate data set for your experiment and draw graphs.

Total Lecture hours:	60hours

Course Code	**Course Title**	**L**	**T**	**P**	**J**	**C**
22EEP401	**QUANTITATIVE ANALYSIS AND LOGICAL REASONING -1**	**0**	**0**	**2**	**0**	**1**
		Syllabus version			v. 1.0	

Course Objectives:

1. This module would train the students on the quick ways to solve quantitative aptitude problems

and questions applying logical reasoning, within a short time span given during the placement

drives.

Course Outcome:

1. Mock interviews
2. Quantitative aptitude
3. Logical Reasoning

LIST OF EXPERIMENTS:

1. Mock interviews on one-on-one basis
2. Quantitative aptitude
3. Partnership
4. Simple Interest, Compound Interest
5. Profit and Loss
6. Problems on Clock, Calendar and Cubes
7. Permutation and Combination
8. Allegation and mixtures
9. Logical Reasoning
10. Letter and Symbol series
11. Number series
12. Analyzing arguments
13. Making judgments

PYTHON TRAINING MODULE

The Python Training module will make the reader accustomed to python language. This material will help the reader in understanding the basics of the python language, Python libraries and the use of python for the analytics.

DELIVERY METHOD

25 % Self-paced Learning

75 % Instructor led training

VERSION

2019

LEARNING OBJECTIVES

- Explain what Python is
- Advantages and disadvantages of Python
- Getting started with Python and its different versions
- Explain variables, strings and functions
- Use of mathematical operators and functions
- Explain different statements like if, for etc.
- Explain the python libraries
- Explain Details of the Pandas library
    - Series and Data Frames
    - Grouping and aggregating
    - Merging and joining
- Define error handling in Python
- Define RE objects
- Define pattern matching and Parsing of data
- Define regression with Use case study
- Define exploratory data analysis
- Define correlation matrix
- Define visualization using matplotlib
- Define churn analysis with Use case
- Define advance Machine Learning Algorithms
- Define Support vector machine
- Define Random forest

PREREQUISITES SKILLS

- Computer Science fundamentals
- Basic knowledge of applied math, algorithms, and data modelling
- Basic knowledge of statistics

DURATION

40 Hours

SKILL LEVEL

Basic – Intermediate

HARDWARE REQUIREMENTS

Processor	2 GHz or Higher
GB RAM	8 GB
GB Disk Free	80 GB
Network Requirements	Yes

Notes

The following unit and exercise durations are estimates and might not reflect every class experience. The estimates do not include the duration of optional exercises or sections. Students in this course use an IBM Cloud Lite account to perform the exercises. This account will never expire; therefore, students can continue working on the optional exercises after the class

COURSE AGENDA

UNIT I. Introduction to PYTHON

Duration: 6 Hrs.

Overview	This unit explains what is Python, its advantages and disadvantages, howto run python scripts, how to use variables, string operator and functions.
Learning Objectives	After completing this unit, you should be able to: • Explain what Python is • How to install and get start with python • How to use basic variables and stings in python • Work with Mathematical operators in python

UNIT II. Deep dive into PYTHON

Duration: 8 Hrs.

Overview	This unit consist more in depth working of Python like inputting the data,working with Boolean and other statements.
Learning Objectives	After completing this unit, you should be able to: • How to input data in Python • Use Boolean with python • Use If and elif statement in python • Use while loop in python • Work with lists • Use For statement

UNIT III. Python Libraries

Duration: 8 Hrs.

Overview	This unit explains the use of pandas library for data analysis
Learning Objectives	After completing this unit, you should be able to: • Install Pandas • Work with series and data frames • Work on grouping, aggregating and applying different functionson data • Merge and Join the data

UNIT IV. Error Handling

Duration: 4 hrs.

Overview	This unit explains how to deal with different type of errors that one canencounter while working with Python.
Learning Objectives	After completing this unit, you should be able to: • Deal with Syntax errors • Deal with the exceptions

UNIT V. Other Topics

Duration: 4 hrs.

Overview	This unit explains how to deal with miscellaneous things in python
Learning Objectives	After completing this unit, you should be able to: • Work with regular expression • Work with Pattern matching • Parse data

UNIT VI. Regression (Use case study)

Duration: 3 hrs.

Overview	This unit explains regression analysis with the help of a use case.
Learning Objectives	After completing this unit, you should be able to: • Define regression analysis • Work with regression analysis

UNIT VII. Other Regression related topics

Duration: 4 hrs.

Overview	This unit explains different topics which are important from the point ofview of data analytics.
Learning Objectives	After completing this unit, you should be able to: • Define exploratory analysis • Define correlation matrix • Perform visualization using matplotlib • Implement linear regression

UNIT VIII. Advance

Duration: 3 hrs.

Overview	This unit explains some advance data analytics techniques.
Learning Objectives	After completing this unit, you should be able to: • Apply advanced Machine learning algorithms • Work on Support vector machines • Define Random forest

RDBMS TRAINING MODULE

The RDBMS Training module will get the reader accustomed with RDBMS concepts. This material will helpthe reader in understanding the basics of RDBMS, what are Entities and Relationships, Overview on Normalization, Database Design and Performance Tuning, JDBC and Advanced concept in RDBMS like Database Security and Database backup and Restore.

DELIVERY METHOD

100% Instructor led training

VERSION

2020

LEARNING OBJECTIVES

- Understanding Database Concepts
  - Introduction
  - Tables
  - Primary Keys
  - Foreign Keys
  - Installation of SQLite
  - Installation of Docker based MySQL and DB2 database

- Understanding Database Storage
  - Introduction
  - Database normalization
  - Indexes and how they are used in databases
  - Configure non-clustered indexes
  - Configure clustered indexes

- Entities and Relationships
  - Introduction
  - Entities and Their Attributes
  - Domains
  - Basic Data Relationships
  - Documenting Relationships
  - Dealing with Many-to-Many Relationships
  - Relationships and Business Rules
  - Data Modeling Versus Data Flow
  - Schemas

- The Relational Data Model
  - Introduction
  - Understanding Relations
  - Primary Keys
  - Representing Data Relationships
  - Views
  - The Data Dictionary

- Normalization
  - Introduction
  - Translating an ER Diagram into Relations
  - Normal Forms
  - First Normal Form
  - Second Normal Form
  - Third Normal Form
  - Boyce–Codd Normal Form
  - Fourth Normal Form
  - Fifth Normal Form
  - Sixth Normal Form

- Database Design and Performance Tuning
  - Introduction
  - Indexing
  - Clustering
  - Partitioning

- Creating Database Objects
  - Understand data definition language (DDL)
  - Choose appropriate data types

- Manipulating Data
  - Introduction
  - Understand data manipulation language (DML)

- JDBC As the Fundamental Java API
  - Introduction
  - JDBC basics

- JPA as the JAVA ORM API
  - Introduction
  - From JDBC to JPA

- Database Security
  - Introduction
  - Sources of External Security Threats
  - Sources of Internal Threats
  - External Remedies
  - Internal Solutions

- Understanding Database Backup and Restore
  - Introduction
  - Understand different types of backups
  - Define a backup and recovery strategy

- Introduction of MySQL
  - Create Tables
  - Drop Tables
  - Insert Query
  - Select Query
  - Where Query
  - Update Query
  - Delete Query

- Like Clause
- MySQL Joins

PREREQUISITES SKILLS

- Computer Science fundamentals
- Basic hands-on experience in Unix Operating system
- Basic understanding of Database concepts
- Basic knowledge on Containerization & Virtualization concepts

DURATION

36 Hours

SKILL LEVEL

Basic – Intermediate

HARDWARE REQUIREMENTS

Processor	2 GHz or Higher
GB RAM	8 GB
GB Disk Free	20 GB
Network Requirements	Yes

NOTES

The following unit and exercise durations are estimates and might not reflect every class experience. The estimates do not include the duration of optional exercises or sections.

COURSE AGENDA

CHAPTER I. Understanding Database Concepts

Duration: 1 Hr.

Overview	This chapter provides an overview on database concepts, provides details on database tables, primary keys and foreign keys. Also, it givesdetailed steps on installation of SQLite and Dockerized MySQL and DB2 databases.
Learning Objectives	After completing this unit, you should be able to: • Explain the database concepts like tables and different keys. • Install SQLite, MySQL and DB2.

CHAPTER II. Understanding Database Storage

Duration: 2 Hrs.

Overview	In this chapter, you will get an overview on Database normalization, Indexes and how they are used along with configuring clustered aswell as non-clustered indexes in databases.
Learning Objectives	After completing this unit, you should be able to: • Explain database normalization, clustered as well as non-clustered indexes. • Create Indexes in database.

CHAPTER III. Entities and Relationships

Duration: 2 Hrs.

Overview	This chapter provide an overview on entities and relationships in RDBMS and explains concepts like Domains, Relationship and Business rules, Data Modelling and Schemas etc.
Learning Objectives	After completing this unit, you should be able to: • Understand concepts like entities, attributes, data modelling and relationship in RDBMS.

CHAPTER IV. The Relational Data Model

Duration: 2 hrs.

Overview	This chapter provides an over view on Database relations, primarykeys and how to represent the data relationships in RDBMS. This chapter also explains about views and Data dictionary in RDBMS.
Learning Objectives	After completing this unit, you should be able to: • Understand the Relational Data Model in RDBMS • Understand concepts like database views and data dictionary.

CHAPTER V. Normalization

Duration: 3 hrs.

Overview	This chapter provides an overview on the Database Normalization and all the database normal forms (from first till sixth) and Boyce-Codd Normal form.
Learning Objectives	After completing this unit, you should be able to: • Understand the Database Normalization and all the database normal forms.

CHAPTER VI. Database Design and Performance Tuning

Duration: 2 hrs.

Overview	This chapter provides an over view on the performance and tuning of a database.
Learning Objectives	After completing this unit, you should be • Understand the tuning of database

CHAPTER VII. Creating Database Objects

Duration: 4 hrs.

Overview	This chapter provides an over view of Data definition language and its operation.
Learning Objectives	After completing this unit, you should be able to: • Understand how DDLs used to create or modify the Schema, tables index etc.

CHAPTER VIII. Manipulating Data

Duration: 4 hrs.

Overview	This chapter provides an overview of Data manipulation language and its operation.
Learning Objectives	After completing this unit, you should be able to: • Understand how DMLs used to store, manipulate, retrieve data from tables.

CHAPTER IX. JDBC As the Fundamental Java API

Duration: 3 hrs.

Overview	This chapter provides an overview on JDBC Basics.
Learning Objectives	After completing this unit, you should be able to: • Understand on how to create Database and to connect through Java API, and CRUD operations using Java API

CHAPTER X. JPA as the JAVA ORM API

Duration: 4 hrs.

Overview	This chapter provides an overview of JPA
Learning Objectives	After completing this unit, you should be able to: • Understand on how to adopt JPA from JDBC and CRUD operation using JPA

CHAPTER XI. Database Security

Duration: 3 hrs.

Overview	This chapter provides an overview of Database Security on External Security threats, Internal threats.
Learning Objectives	After completing this unit, you should be able to: • Understand on external security threats, internal threats and the social remedies.

CHAPTER XII. Understanding Database Backup and Restore

Duration: 3 hrs.

Overview	Thischapterprovidesan overview of Data Backup and Restore
Learning Objectives	After completing this unit, you should be able to: • Understand on different backups, how to take a Database backup, restore point.

CHAPTER XIII. Introduction to MySQL

Duration: 3 hrs.

Overview	Thischapterprovidesan overview of basics of MySQL, basic queries
Learning Objectives where,	After completing this unit, you should be able to: Understand how to insert, delete, select, update, drop, create queries in MySQL Database.

DATA VISUALIZATION TRAINING MODULE

The Data Visualization Training module will give the reader a thorough introduction to Data Science, Statistics, R, IBM Watson Studio and python using real life examples. This course does not require a prior quantitative or mathematics background. The course introduces the basic concepts such as the mean, median etc. Then it eventually covers all aspects of an analytics (or) data science career from analyzing and preparing raw data to visualizing your findings. It covers both the theoretical aspects of statistical concepts and the practical implementation using R, IBM Watson Studio and python

DELIVERY METHOD

100 % Instructor led training

VERSION

2019

LEARNING OBJECTIVES

- Introduction to Statistics
  - Introduction to Statistics
  - Difference between inferential statistics and descriptive statistics
- Inferential Statistics
  - Drawing Inferences from Data
  - Random Variables
  - Normal Probability Distribution
  - Sampling
  - Sample Statistics and Sampling Distributions
- R overview and Installation
  - Overview and About R
  - R and R studio Installation
- Descriptive Data analysis using R
  - Description of basic functions used to describe data in R
- Data manipulation with R
  - Introduction to dplyr (filter, select, arrange, mutate, summarize)
  - Introduction to data.table
  - Introduction to reshape2 package
  - Introduction to tidyr package
  - Introduction to Lubridate package
- Data visualization with R
  - Working with Base R Graphics (Scatter Plot, Bar Plot, and Histogram)
  - Working with ggplot2
- Data visualization in Watson Studio
  - Adding data to data refinery
  - Visualization of Data on Watson Studio
- Introduction to Python
  - Python and Anaconda Installation
  - Introduction to Jupyter Notebook
  - Python scripting basics

- Numpy and Pandas
  - Numpy overview - Creating and Accessing Numpy Arrays
  - Introduction to pandas
  - Pandas read and write csv
  - Descriptive statistics using pandas
  - Pandas working with text data and datetime columns
  - Pandas Indexing and selecting data
  - Pandas - groupby
  - Merge / Join datasets
- Introduction to Data Visualization Tools in Python
  - Introduction to Matplotlib
  - Read a CSV and Generate a line plot with matplotlib
- Basic plots using matplotib
  - Area Plots
  - Bar Charts
  - Histograms
- Specialized Visualization Tools using Matplotlib
  - Pie Charts
  - Box Plots
  - Scatter Plots
  - Bubble Plots
- Advanced Visualization Tools using Matplotlib
  - Waffle Charts
  - Word Clouds
- Introduction to Seaborn
  - Seaborn functionalities and usage with Hands-on
- Spatial Visualizations and Analysis in Python with Folium
  - Introduction to Folium
  - Case Study (Analyze New York City Taxi Trip Ride Data Set to Identify best locations for taxistops)

PREREQUISITES SKILLS

Basic knowledge of Python

DURATION

32 Hours

SKILL LEVEL

Advanced

Notes

The following unit and exercise durations are estimates and might not reflect every class experience. The estimates do not include the duration of optional exercises or sections. Students in this course use an IBM Cloud account to perform the exercises.

COURSE AGENDA

UNIT I. Introduction to Statistics

Duration: 1 Hr.

Overview	This chapter introduces you to Statistics.
Learning Objectives	After completing this unit, you should be able to: • Understand the different methods of data collections • Difference between descriptive and inferential statistics • Understanding on Descriptive Statistics: Mean, Median, Mode

UNIT II. Inferential Statistics

Duration: 3.5 Hrs.

Overview	In this chapter, you will be introduced to Inferential Statistics.
Learning Objectives	After completing this unit, you should be able to: • Understand the importance of making inference from Data • Understand Inferential Statistics: Random Variables, ProbabilityDistributions, Normal Distribution, Sampling and Sampling Distribution

UNIT III. R overview and Installation

Duration: 45 Minutes.

Overview	In this unit, we will discuss overview on R and then install R and R studio
Learning Objectives	After completing this unit, you should be able to: • Understand R basics • Install R and R studio

UNIT IV. Descriptive Data analysis using R

Duration: 1 hr.

Overview	In this unit, you learn the basic functions, mathematical functions, graphical functions, statistical functions, summary function used to describe data in R. We will use R to calculate summary statistics, including mean, standard deviation, range, and percentile
Learning Objectives	After completing this unit, you should be able to: • Understand the different used to describe data including basic functions, mathematical, graphical and statistical functions. • We will use R to calculate summary statistics, including mean, standard deviation, range, and percentile

UNIT V. Data manipulation with R

Duration: 2.5 hrs.

Overview	In this chapter, you learn data manipulation with R to improve data accuracy and precision. We will see the usage of inbuilt R function, CRAN packages, and use ML algorithms
Learning Objectives	After completing this unit, you should be able to: • Different Ways to Manipulate / Treat Data: • List of available Packages and its usages with hands on

UNIT VI. Data visualization with R

Duration: 1 Hr.

Overview	This chapter introduces you to data visualization with R. We will learn the basic visualization like Histogram and then advanced visualization like HeatMap and its usage in detail
Learning Objectives	After completing this unit, you should be able to: • Visualize data with R • Good understanding of various basic visualization like Histogram, Bar / Line Chart, Box plot, Scatter plot

UNIT VII. Data visualization in Watson Studio

Duration: 6 Hrs.

Overview	In this chapter, you will be introduced to IBM Watson Studio for data visualization. Visualizing information in graphical ways can give you insights into your data. By enabling you to look at and explore data from different perspectives, visualizations can help you identify patterns, connections, and relationships within that data as well as understand large amounts of information very quickly.
Learning Objectives	After completing this unit, you should be able to: • Visualize data using IBM Watson Studio • Manage Data Refinery flows

UNIT VIII. Introduction to Python

Duration: 4.25 hrs.

Overview	In this unit, we will install Python and Anaconda. We will learn usage of Jupyter notebook and then do scripting using Python
Learning Objectives	After completing this unit, you should be able to: • Install Python and Anaconda. • Understanding on Jupyter notebook and Python

UNIT IX. Numpy and Pandas

Duration: 3 hrs.

Overview	In this unit, you learn the Pandas and Numpy for fast numeric array computations. We will learn the common functionalities of NumPy and Pandas with existing toolboxes in R. the added flexibility have resulted in wide acceptance of python in the scientific community lately.
Learning Objectives	After completing this unit, you should be able to: • use Numpy functions for scientific studies • use Pandas for data manipulation and analysis

UNIT X. Introduction to Data Visualization Tools in Python

Duration: 30 minutes.

Overview	In this chapter, you learn the basics of Matplotlib which is a 2d plotting library which produces publication quality figures in a variety of hardcopy formats and interactive environments. Matplotlib can be used in Python scripts, Python and IPython shell, Jupyter Notebook, web application servers and GUI toolkits.
Learning Objectives	After completing this unit, you should be able to: • Data visualization and some of the best practices to keep in mindwhen creating plots and visuals. • The history and the architecture of Matplotlib. • Basic plotting with Matplotlib. • The dataset on immigration to Canada, which will be used extensivelythroughout the course. • Generating line plots using Matplotlib.

UNIT XI. Basic plots using matplotib

Duration: 45 Minutes.

Overview	This chapter introduces you to basic plots using Matplotlib.
Learning Objectives	After completing this unit, you should be able to: • Plot 2d graph and plots using Matplotlib • Area plots, and how to create them with Matplotlib. • Histograms, and how to create them with Matplotlib. • Bar charts, and how to create them with Matplotlib.

UNIT XII. Specialized Visualization Tools using Matplotlib

Duration: 1.0 Hr.

Overview	In this chapter, you will be introduced to Specialized Visualization Toolsusing Matplotlib
Learning Objectives	After completing this unit, you should be able to: • Pie charts, and how to create them with Matplotlib. • Box plots, and how to create them with Matplotlib. • Scatter plots and bubble plots, and how to create them withMatplotlib.

UNIT XIII. Advanced Visualization Tools using Matplotlib

Duration: 30 Minutes.

Overview	In this unit, we will discuss overview on R and then install R and R studio
Learning Objectives	After completing this unit, you should be able to: • Understand the R basics • Install of R and R studio

UNIT XIV. Introduction to Seaborn

Duration: 2 hrs.

Overview	In this unit, we will introduce you to seaborn. We will see how to use it to generate attractive plots.
Learning Objectives	After completing this unit, you should be able to: • Seaborn, and how to use it to generate attractive regression plots.

UNIT XV. Spatial Visualizations and Analysis in Python with Folium

Duration: 4.25 hrs.

Overview	In this chapter, you learn Folium to visualize geospatial data, create maps with markers and Chropleth maps with Folium
Learning Objectives	After completing this unit, you should be able to: • Folium, a data visualization library in Python. • Creating maps of different regions of the world and how tosuperimpose markers on top of a map. • Creating Choropleth maps with Folium.