SRI MANAKULA VINAYAGAR

ENGINEERING COLLEGE

(An Autonomous Institution)

Puducherry

B.TECH.

COMPUTER SCIENCE AND BUSINESS SYSTEMS

ACADEMIC REGULATIONS 2023

(R-2023)

CURRICULUM AND SYLLABI

COLLEGE VISION AND MISSION

Vision

To be globally recognized for excellence in quality education, innovation and research for the transformation of lives to serve the society

Mission

M1 :	**Quality Education**	**:**	To provide comprehensive academic system that amalgamates the cutting-edge technologies with best practices
M2 :	**Research and Innovation**	**:**	To foster value-based research and innovation in collaboration with industries and institutions globally for creating intellectuals with new avenues
M3:	**Employability and Entrepreneurship**	**:**	To inculcate the employability and entrepreneurial skills through value and skill-based training
M4 :	**Ethical Values**	**:**	To instill deep sense of human values by blending societal righteousness with academic professionalism for the growth of society

DEPARTMENT VISION AND MISSION

Vision

To envision the technology and business trends in this domain and to create technically competent professionals for meeting out the needs globally

Mission

M1: To foster knowledge sharing through contemporary curriculum and creative teaching learning process

M2: To impart strong computer and business skills to shine and sustain in the agile IT industry

M3: To promote technocrats with rich expertise in innovation and research

M4: To instill moral values and ethical responsibilities by empowering graduates to be socially responsible

PROGRAM OUTCOMES (Pos)

PO1: Engineering knowledge:

Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem analysis:

Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/development of solutions:

Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct investigations of complex problems:

Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions.

PO5: **Modern tool usage:**

Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: The engineer and society:

Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Environment and sustainability:

Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of and need for sustainable development.

PO8: Ethics:

Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and team work:

Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication:

Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11:Project management and finance:

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

PO12: Life-long learning:

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

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO1: To apply computer science and business concepts to solve the real world problems

PEO2: To develop professional skills in contemporary areas of computer science and business systems to obtain employability and pursue higher education

PEO3: To reconcile business demands with state-of-the art technologies by providing innovative solutions and insightful decisions

PEO4: To ensure ample growth with social and ethical responsibilities

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO1: Ability to gain deep knowledge in Computer Science with equal appreciation in humanities, management, sciences and human values.

PSO2: Ability to demonstrate the technical and business skills and provide solutions for the societal needs

PSO3: Ability to engage lifelong learning and bestow innovative contributions to enhance research in the field of computer science and business system

STRUCTURE FOR UNDERGRADUATE ENGINEERING PROGRAMME

Sl. No.	Course Category	Breakdown of Credits
1.	Humanities, Social Sciences and Management Courses (HS)	27
2.	Basic Science Courses (BS)	30
3.	Engineering Science Courses (ES)	18
4.	Professional Core Courses (PC)	58
5.	Professional Elective Courses (PE)	16
6.	Open Elective Courses (OE)	9
7.	Professional Activity Courses (PA)	13
8.	Mandatory non-Credit Course (MC)	-
9.	Ability Enhancement Courses (AEC)	-
	Total	**171**

SCHEME OF CREDIT DISTRIBUTION – SUMMARY

Sl. No.	Course Category	Credits per Semester								Total Credits
		I	II	III	IV	V	VI	VII	VIII	
1	Humanities, Social Sciences and Management Courses (HS)	5	5	-	5	4	2	2	4	27
2	Basic Science Courses (BS)	11	9	5	5	-	-	-	-	30
3	Engineering Science Courses (ES)	6	8	-	4	-	-	-	-	18
4	Professional Core Courses (PC)	-	4	18	8	6	13	9	-	58
5	Professional Elective Courses (PE)	-	-	-	2	3	2	3	6	16
6	Open Elective Courses (OE)	-	-	-	-	3	3	3	-	9
7	Professional Activity Courses (PA)	-	-	-	-	1	1	3	8	13
8	Mandatory non-Credit Course (MC)*	-	-	-	-	-	-	-	-	-
9	Ability Enhancement Courses (AEC)*	-	-	-	-	-	-	-	-	-
Total		**22**	**26**	**23**	**26**	**18**	**21**	**21**	**18**	**171**

**** AEC and MC are not included for CGPA calculation***

HONOURS DEGREE PROGRAMME:

The student is permitted to opt for earning an *honours degree* in the same discipline of engineering in addition to the degree in his/her own discipline. To earn an honours degree the student is required to earn an additional 18 - 20 credits (over and above the total 170 credits prescribed in the curriculum) starting from fourth semester onwards by completing 5 additional courses offered in respective semesters. A student is eligible to exercise this option if he/she has passed all the courses offered upto third semester in the first attempt itself and has earned a CGPA / GPA* (*for lateral entry) of not less than 8.0. The prescribed courses offered for Honours degree are given in **Annexure V**.

SEMESTER-I										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23MAT101	Discrete Mathematics	BS	3	1	0	4	25	75	100
2	U23MAT102	Introductory Topics in Statistics and Probability	BS	3	1	0	4	25	75	100
3	U23BSTC01	Physical science for Engineers	BS	3	0	0	3	25	75	100
4	U23CBT101	Fundamentals of Computer Science	ES	3	0	0	3	25	75	100
5	U23HSTC01	Universal Human Values-II	HS	2	0	0	2	25	75	100
Theory Cum Practical										
6	U23ENB101	Business Communication & Value Science - I	HS	2	0	2	3	50	50	100
Practical										
7	U23CBP101	Fundamentals of Computer Science Laboratory	ES	0	0	2	1	50	50	100
8	U23ESPC02	Design Thinking and IDEA Lab	ES	0	0	2	1	50	50	100
9	U23ESPC03	Engineering Graphics using AutoCAD	ES	0	0	2	1	50	50	100
Ability Enhancement Course										
10	U23CBC1XX	Certification Course-I **	AEC	0	0	4	-	100	-	100
Mandatory Course										
11	U23CBM101	Induction Programme	MC	2 Weeks			-	-	-	-
							22	**425**	**575**	**1000**

SEMESTER-II										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23MAT203	Statistical Methods and Modelling	BS	3	1	0	4	25	75	100
2	U23MAT204	Linear Algebra	BS	3	1	0	4	25	75	100
3	U23HST201	Fundamentals of Economics	HS	2	0	0	2	25	75	100
4	U23ESTC03	Basics of Electrical and Electronics Engineering	ES	3	0	0	3	25	75	100
5	U23ADTC01	Programming in Python	ES	3	0	0	3	25	75	100
6	U23CBT202	Data Structures & Algorithms	PC	3	0	0	3	25	75	100
Theory Cum Practical										
7	U23ENB202	Business Communication & Value Science – II	HS	2	0	2	3	50	50	100
Practical										
8	U23MAP201	Statistical Methods and Modelling Laboratory	BS	0	0	2	1	50	50	100
9	U23ESPC01	Basics of Electrical and Electronics Engineering Laboratory	ES	0	0	2	1	50	50	100
10	U23ADPC01	Programming in Python Laboratory	ES	0	0	2	1	50	50	100
11	U23CBP202	Data Structures & Algorithms Laboratory	PC	0	0	2	1	50	50	100
Ability Enhancement Course										
12	U23CBC2XX	Certification Course - II**	AEC	0	0	4	-	100	-	100
Mandatory Course										
13	U23CBM202	Sports Yoga and NSS	MC	0	0	2	-	100	-	100
							26	**600**	**700**	**1300**

***** Certification Courses are to be selected from the list given in Annexure II***

SEMESTER-III										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23MAT305	Computational Statistics	BS	3	1	0	4	25	75	100
2	U23CBT303	Computer Organization and Architecture	PC	3	0	0	3	25	75	100
3	U23CBT304	Object Oriented Programming in C++	PC	3	0	0	3	25	75	100
4	U23CBT305	Principles of Operating Systems	PC	3	0	0	3	25	75	100
5	U23CBT306	Database System Concepts	PC	3	0	0	3	25	75	100
Theory Cum Practical										
6	U23CBB301	Formal Languages and Automata Theory	PC	2	0	2	3	50	50	100
Practical										
7	U23MAP302	Computational Statistics Laboratory	BS	0	0	2	1	50	50	100
8	U23CBP303	Object Oriented Programming in C++ Laboratory	PC	0	0	2	1	50	50	100
9	U23CBP304	Principles of Operating Systems Laboratory	PC	0	0	2	1	50	50	100
10	U23CBP305	Database System Concepts Laboratory	PC	0	0	2	1	50	50	100
Ability Enhancement Course										
11	U23CBC3XX	Certification Course - III**	AEC	0	0	4	-	100	-	100
12	U23CBS301	Skill Enhancement Course 1- R Programming*`	AEC	0	0	2	-	100	-	100
Mandatory Course										
13	U23CBM303	Introduction To Climate Change	MC	2	0	0	-	100	-	100
							23	**675**	**625**	**1300**

SEMESTER-IV										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23MAT406	Operations Research	BS	3	1	0	4	25	75	100
2	U23HST402	Introduction to Innovation, IP Management and Entrepreneurship	HS	3	0	0	3	25	75	100
3	U23ITTC02	Programming in Java	ES	3	0	0	3	25	75	100
4	U23CBT407	Algorithm Design and Applications	PC	3	0	0	3	25	75	100
5	U23CBT408	Software Engineering and Applications	PC	3	0	0	3	25	75	100
6	U23CBE4XX	Professional Elective I#	PE	2	0	0	2	25	75	100
Theory Cum Practical										
7	U23ENB403	Business Communication & Value Science – III	HS	2	0	2	2	50	50	100
Practical										
8	U23MAP403	Operations Research Laboratory	BS	0	0	2	1	50	50	100
9	U23ITPC02	Programming in Java Laboratory	ES	0	0	2	1	50	50	100
10	U23CBP406	Algorithm Design and Applications Laboratory	PC	0	0	2	1	50	50	100
11	U23CBP407	Software Engineering and Applications Laboratory	PC	0	0	2	1	50	50	100
Ability Enhancement Course										
12	U23CBC4XX	Certification Course - IV**	AEC	0	0	4	-	100	-	100
13	U23CBS402	Skill Enhancement Course 2- Presentation Tools using ICT*	AEC	0	0	2	-	100	-	100
Mandatory Course										
14	U23CBM404	Right To Information Law and Good Governance	MC	2	0	0	-	100	-	100
							24	**700**	**700**	**1400**

#Professional Electives are to be selected from the list given in Annexure I
***** Certification Courses are to be selected from the list given in Annexure II***
**** Skill Enhancement Courses (1 and 2) are to be selected from the list given in Annexure III***

SEMESTER-V										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23HST503	Fundamentals of Management Science	HS	2	0	0	2	25	75	100
2	U23CBT509	Cloud, Microservices and Application	PC	3	0	0	3	25	75	100
3	U23CBT510	Machine Learning	PC	2	0	0	2	25	75	100
4	U23HSTC02	Research Methodology	HS	2	0	0	2	25	75	100
5	U23CBE5XX	Professional Elective II#	PE	2	0	0	2	25	75	100
6	U23CBOCXX	Open Elective I$	OE	3	0	0	3	25	75	100
Practical										
7	U23ENP501	Business Communication & Value Science – IV	HS	0	0	2	0	100	-	100
8	U23CBP508	Cloud, Microservices and Application Laboratory	PC	0	0	2	1	50	50	100
9	U23CBEP5X	Professional Elective II# Laboratory	PE	0	0	2	1	50	50	100
10	U23CBW501	Micro Project	PA	0	0	2	1	100	-	100
Ability Enhancement Course										
11	U23CBC5XX	Certification Course-V**	AEC	0	0	4	-	100	-	100
Mandatory Course										
12	U23CBM505	Essence of Indian Traditional Knowledge	MC	2	0	0	-	100	-	100
							17	**650**	**550**	**1200**

SEMESTER-VI										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23HST604	Financial and Cost Accounting	HS	2	0	0	2	25	75	100
2	U23CBT611	Computer Networks Architectures and Protocols	PC	3	0	0	3	25	75	100
3	U23CBT612	Natural Language Processing	PC	3	0	0	3	25	75	100
4	U23CBT613	Information Security	PC	2	0	0	2	25	75	100
5	U23CBE6XX	Professional Elective III#	PE	2	0	0	2	25	75	100
6	U23CBOCXX	Open Elective II$	OE	3	0	0	3	25	75	100
Theory Cum Practical										
7	U23CBB602	Data Visualization	PC	2	0	2	3	50	50	100
Practical										
8	U23CBP609	Computer Networks Architectures and Protocols Laboratory	PC	0	0	2	1	50	50	100
9	U23CBP610	Information Security Laboratory	PC	0	0	2	1	50	50	100
10	U23CBW602	Mini Project	PA	0	0	2	1	50	50	100
Ability Enhancement Course										
11	U23CBC6XX	Certification Course - VI**	AEC	0	0	4	-	100	-	100
Mandatory Course										
12	U23CBM606	Gender Equality	MC	2	0	0	-	100	-	100
							21	**550**	**650**	**1200**

#Professional Electives are to be selected from the list given in Annexure I
$ Open Electives are to be selected from the list given in Annexure IV
***** Certification Courses are to be selected from the list given in Annexure II***

SEMESTER-VII										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23HST705	Financial Management	HS	2	0	0	2	25	75	100
2	U23CBT614	Artificial Intelligence and Applications	PC	3	0	0	3	25	75	100
3	U23CBT615	Information Retrieval	PC	2	0	0	2	25	75	100
4	U23CBT616	Foundation and Full Stack Web Development	PC	2	0	0	2	25	75	100
5	U23CBE7XX	Professional Elective IV#	PE	2	0	0	2	25	75	100
6	U23CBOCXX	Open Elective III$	OE	3	0	0	3	25	75	100
Practical										
7	U23CBP711	Artificial Intelligence and Applications Laboratory	PC	0	0	2	1	50	50	100
8	U23CBP712	Foundation and Full Stack Web Development Laboratory	PC	0	0	2	1	50	50	100
9	U23CBEP7X	Professional Elective IV# Laboratory	PE	0	0	2	1	50	50	100
Project Work										
10	U23CBW703	Project Phase I	PA	0	0	4	2	50	50	100
11	U23CBW704	Internship/ Industrial	PA	0	0	2	1	100	-	100
							20	**450**	**650**	**1100**

SEMESTER-VIII										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23HST806	IT Project Management	HS	3	0	0	3	25	75	100
2	U23CBE8XX	Professional Elective V#	PE	2	0	0	2	25	75	100
3	U23CBE8XX	Professional Elective VI#	PE	3	0	0	3	25	75	100
Practical										
4	U23HSP801	IT Project Management Laboratory	HS	0	0	2	1	50	50	100
5	U23CBEP8X	Professional Elective VI# Laboratory	PE	0	0	2	1	50	50	100
Project Work										
6	U23CBW805	Project Phase II	PA	0	0	16	8	50	100	150
							18	**225**	**485**	**650**

#Professional Electives are to be selected from the list given in Annexure I
$ Open Electives are to be selected from the list given in Annexure IV

ANNEXURE I

PROFESSIONAL ELECTIVE COURSES (18 CREDITS)

Professional Elective – I (Offered in Semester IV)		
Sl. No.	**Course Code**	**Course Title**
1	U23CBE401	Business Strategies
2	U23CBE402	Design thinking and its applications
3	U23CBE403	Compiler Design
4	U23CBE404	Business Process
5	U23CBE405	Software Design with UML
Professional Elective – II (Offered in Semester V)		
Sl. No.	**Course Code**	**Course Title**
1	**U23CBEC01**	**Business Intelligence and Applications (CSBS-CCE, AIDS, IT)**
2	U23CBE506	Robotics and Embedded Systems
3	U23CBE507	Modern Web Applications
4	U23CBE508	Data Mining and Analytics
5	U23CBE509	E- Commerce and E- Payment Systems
Professional Elective – III (Offered in Semester VI)		
Sl. No.	**Course Code**	**Course Title**
1	U23CBE610	Human Resource Management
2	U23CBE611	Cognitive Science & Analytics
3	U23CBE612	Cryptology
4	U23CBE613	SAP Intelligent Robotic Process Automation
5	U23CBE614	Digital Marketing
Professional Elective – IV (Offered in Semester VII)		
Sl. No.	**Course Code**	**Course Title**
1	U23CBE715	Quantum Computation & Quantum Information
2	U23CBE716	Advanced Social, Text and Media Analytics
3	U23CBE717	Usability Design of Software Applications
4	U23CBE718	Introduction to IoT
5	U23CBEC02	**Virtual Reality (CSBS-AIDS)**
Professional Elective – V (Offered in Semester VIII)		
Sl. No.	**Course Code**	**Course Title**
1	U23CBE819	Behavioral Economics
2	U23CBE820	Computational Finance & Modeling
3	U23CBE821	Psychology
4	U23CBE822	Marketing Research & Marketing Management
5	U23CBE823	Smart Systems
Professional Elective – VI (Offered in Semester VIII)		
Sl. No.	**Course Code**	**Course Title**
1	U23CBE824	Enterprise Systems
2	U23CBE825	Services Science and Service Operational Management
3	U23CBE826	Image Processing and Pattern Recognition
4	U23CBE827	Block chain and Applications
5	**U23CBEC03**	**Augmented Reality (CSBS-AIDS)**

PROFESSIONAL ELECTIVE PRACTICAL COURSES (3 CREDITS)

Professional Elective – II (Offered in Semester V)		
Sl. No.	**Course Code**	**Course Title**
1	U23CBEP51	Business Intelligence and Applications Laboratory
2	U23CBEP52	Robotics and Embedded Systems Laboratory
3	U23CBEP53	Modern Web Applications Laboratory
4	U23CBEP54	Data Mining and Analytics Laboratory
5	U23CBEP55	E- Commerce and E- Payment Systems Laboratory
Professional Elective – IV (Offered in Semester VII)		
Sl. No.	**Course Code**	**Course Title**
1	U23CBEP71	Quantum Computation & Quantum Information Laboratory
2	U23CBEP72	Advanced Social, Text and Media Analytics Laboratory
3	U23CBEP73	Usability Design of Software Applications Laboratory
4	U23CBEP74	Introduction to IoT Laboratory
5	U23CBEP75	Virtual Reality Laboratory
Professional Elective –VI (Offered in Semester VIII)		
Sl. No.	**Course Code**	**Course Title**
1	U23CBEP81	Enterprise Systems Laboratory
2	U23CBEP82	Services Science & Service Operational Management Laboratory
3	U23CBEP83	Image Processing and Pattern Recognition Laboratory
4	U23CBEP84	Block chain and Applications Laboratory
5	U23CBEP85	Augmented Reality Laboratory

Annexure – II

ABILITY ENHANCEMENT COURSES – (A). CERTIFICATION COURSES

S. No	Course Code	Course Title	Certified By
1	U23CBCX01	Adobe Photoshop	Adobe
2	U23CBCX02	Adobe Animate	Adobe
3	U23CBCX03	Adobe Dreamweaver	Adobe
4	U23CBCX04	Adobe After Effects	Adobe
5	U23CBCX05	Adobe Illustrator	Adobe
6	U23CBCX06	Adobe InDesign	Adobe
7	U23CBCX07	Autodesk AutoCAD -ACU	Autodesk
8	U23CBCX08	Autodesk Inventor - ACU	Autodesk
9	U23CBCX09	Autodesk Revit - ACU	Autodesk
10	U23CBCX10	Autodesk Fusion 360 - ACU	Autodesk
11	U23CBCX11	Autodesk 3ds Max - ACU	Autodesk
12	U23CBCX12	Autodesk Maya - ACU	Autodesk
13	U23CBCX13	Cloud Security Foundations	AWS
14	U23CBCX14	Cloud Computing Architecture	AWS
15	U23CBCX15	Cloud Foundation	AWS
16	U23CBCX16	Cloud Practitioner	AWS
17	U23CBCX17	Cloud Solution Architect	AWS
18	U23CBCX18	Data Engineering	AWS
19	U23CBCX19	Machine Learning Foundation	AWS
20	U23CBCX20	Robotic Process Automation / Medical Robotics	Blue Prism
21	U23CBCX21	Advance Programming Using C	CISCO
22	U23CBCX22	Advance Programming Using C ++	CISCO
23	U23CBCX23	C Programming	CISCO
24	U23CBCX24	C++ Programming	CISCO
25	U23CBCX25	CCNP Enterprise: Advanced Routing	CISCO
26	U23CBCX26	CCNP Enterprise: Core Networking	CISCO
27	U23CBCX27	Cisco Certified Network Associate - Level 2	CISCO
28	U23CBCX28	Cisco Certified Network Associate- Level 1	CISCO
29	U23CBCX29	Cisco Certified Network Associate- Level 3	CISCO
30	U23CBCX30	Fundamentals Of Internet of Things	CISCO
31	U23CBCX31	Internet Of Things / Solar and Smart Energy System with IoT	CISCO
32	U23CBCX32	Java Script Programming	CISCO
33	U23CBCX33	NGD Linux Essentials	CISCO
34	U23CBCX34	NGD Linux I	CISCO
35	U23CBCX35	NGD Linux II	CISCO
36	U23CBCX36	Advance Java Programming	Ethnotech
37	U23CBCX37	Android Programming / Android Medical App Development	Ethnotech
38	U23CBCX38	Angular JS	Ethnotech
39	U23CBCX39	Catia	Ethnotech
40	U23CBCX40	Communication Skills for Business	Ethnotech
41	U23CBCX41	Coral Draw	Ethnotech
42	U23CBCX42	Data Science Using R	Ethnotech
43	U23CBCX43	Digital Marketing	Ethnotech
44	U23CBCX44	Embedded System Using C	Ethnotech
45	U23CBCX45	Embedded System with IOT / Arduino	Ethnotech

46	U23CBCX46	English For IT	Ethnotech
47	U23CBCX47	Plaxis	Ethnotech
48	U23CBCX48	Sketch Up	Ethnotech
49	U23CBCX49	Financial Planning, Banking and Investment Management	Ethnotech
50	U23CBCX50	Foundation Of Stock Market Investing	Ethnotech
51	U23CBCX51	Machine Learning / Machine Learning for Medical Diagnosis	Ethnotech
52	U23CBCX52	IOT Using Python	Ethnotech
53	U23CBCX53	Creo (Modelling & Simulation)	Ethnotech
54	U23CBCX54	Soft Skills, Verbal, Aptitude	Ethnotech
55	U23CBCX55	Software Testing	Ethnotech
56	U23CBCX56	MX-Road	Ethnotech
57	U23CBCX57	CLO 3D	Ethnotech
58	U23CBCX58	Solid works	Ethnotech
59	U23CBCX59	Staad Pro	Ethnotech
60	U23CBCX60	Total Station	Ethnotech
61	U23CBCX61	Hydraulic Automation	Festo
62	U23CBCX62	Industrial Automation	Festo
63	U23CBCX63	Pneumatics Automation	Festo
64	U23CBCX64	Agile Methodologies	IBM
65	U23CBCX65	Block Chain	IBM
66	U23CBCX66	Devops	IBM
67	U23CBCX67	Artificial Intelligence	ITS
68	U23CBCX68	Cloud Computing	ITS
69	U23CBCX69	Computational Thinking	ITS
70	U23CBCX70	Cyber Security	ITS
71	U23CBCX71	Data Analytics	ITS
72	U23CBCX72	Databases	ITS
73	U23CBCX73	Java Programming	ITS
74	U23CBCX74	Networking	ITS
75	U23CBCX75	Python Programming	ITS
76	U23CBCX76	Web Application Development (HTML, CSS, JS)	ITS
77	U23CBCX77	Network Security	ITS & Palo alto
78	U23CBCX78	MATLAB	MathWorks
79	U23CBCX79	Azure Fundamentals	Microsoft
80	U23CBCX80	Azure AI (AI-900)	Microsoft
81	U23CBCX81	Azure Data (DP -900)	Microsoft
82	U23CBCX82	Microsoft 365 Fundamentals (SS-900)	Microsoft
83	U23CBCX83	Microsoft Security, Compliance and Identity (SC-900)	Microsoft
84	U23CBCX84	Microsoft Power Platform (PI-900)	Microsoft
85	U23CBCX85	Microsoft Dynamics Fundamentals 365 – CRM	Microsoft
86	U23CBCX86	Microsoft Excel	Microsoft
87	U23CBCX87	Microsoft Excel Expert	Microsoft
88	U23CBCX88	Securities Market Foundation	NISM
89	U23CBCX89	Derivatives Equinity	NISM
90	U23CBCX90	Research Analyst	NISM
91	U23CBCX91	Portfolio Management Services	NISM
92	U23CBCX92	Cyber Security	Palo alto
93	U23CBCX93	Cloud Security	Palo alto
94	U23CBCX94	PMI – Ready	PMI
95	U23CBCX95	Tally – GST & TDS	Tally
96	U23CBCX96	Advance Tally	Tally

97	U23CBCX97	Associate Artist	Unity
98	U23CBCX98	Certified Unity Programming	Unity
99	U23CBCX99	VR Development	Unity

ANNEXURE-III

ABILITY ENHANCEMENT COURSES-(B) SKILL ENHANCEMENT COURSES

Sl. No.	Course Code	Course Title
1.	U23CBS301	Skill Enhancement Course 1: R Programming
2.	U23CBS402	Skill Enhancement Course 2: Presentation Tools using ICT

ANNEXURE IV

OPEN ELECTIVE COURSES (9 CREDITS)

S. No	Course Code	Course Title	Offering Department	Permitted Departments
Open Elective – I / II (Offered in Semester V/VI)				
1	U23CBOC01	Business Applications of Game Theory	CSBS	EEE, ECE, MECH, CIVIL, ICE, Mechatronics, BME, CCE
2	U23CBOC02	Cryptology and Analysis	CSBS	EEE, MECH, CIVIL, ICE, Mechatronics, BME
Open Elective – III (Offered in Semester VII)				
1	U23CBOC03	Engineering Economics	CSBS	EEE, ECE, CSE, IT, MECH, CIVIL, ICE, Mechatronics, BME, AIDS, CCE, FT
2	U23CBOC04	Conversational AI	CSBS	EEE, ECE, MECH, CIVIL, ICE, Mechatronics, BME

Annexure – V

Honours Programme - Computer Science and Business Intelligence

COURSE DETAILS											
Sl. No.	**Semester**	**Course Code**	**Course Title**	**Category**	**Periods**			**Credits**	**Max. Marks**		
					L	**T**	**P**		**CAM**	**ESM**	**Total**
Theory											
1	IV	U23CBH401	Business Analytics and Data Mining	PC	3	1	0	4	25	75	100
2	V	U23CBH502	Digital Technology	PC	3	1	0	4	25	75	100
3	VI	U23CBH603	Neural Network for Data Analysis	PC	3	1	0	4	25	75	100
4	VII	U23CBH704	Enterprise Blockchain Frameworks	PC	3	1	0	4	25	75	100
5	VIII	U23CBH805	Macroeconomic Environment of Business	PC	3	1	0	4	25	75	100
	Total							**20**	**125**	**375**	**500**
Equivalent NPTEL courses[##]											
1	IV To VIII	U23CBHN01	E-Business					**3**	**12 Weeks Course**		
2			Business Development from start to scale					**3**			
3			Deep Learning for computer vision					**3**			
4			Blockchain and its Applications					**3**			
5			Organizational Behavior					**3**			

[##] The student shall be given an option to earn 3 credits through one equivalent 12 weeks NPTEL course instead of any one course listed for honours degree programme that should be completed before the commencement of eighth semester. The equivalent courses are subject to change based on its availability as per NPTEL course list.

Department	**Mathematics**	Programme: **B.Tech.**						
Semester	**I**	Course Category: **BS**			*End Semester Exam Type: **TE**			
Course Code	**U23MAT101**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Discrete Mathematics**	**3**	**1**	**0**	**4**	**25**	**75**	**100**

Course Objectives	**1)**	To understand the concepts and significance of Boolean algebra.
	2)	To know the fundamental concepts of Group theory.
	3)	To understand the basic concepts of combinatorics and graph theory.
	4)	To learn the basic of graph theory.
	5)	To extend student's ability to deal with logics and connectives.

Course Outcome	**On completion of the course, the students will be able to**		BT Mapping (Highest Level)
	CO1	Understand the basic concepts of Boolean algebra.	**K2**
	CO2	Recall the basic concepts of sets, groups, ring and field.	**K2**
	CO3	Understand and apply the basic concepts of mathematical induction.	**K3**
	CO4	Determine the different types of graphs.	**K3**
	CO5	Gain knowledge of the concepts needed to test the logic of a program.	**K2**

UNIT-I	**Boolean Algebra**	**(9 Hrs)**
Introduction of Boolean algebra, truth table, basic logic gate, basic postulates of Boolean algebra, principle of duality, canonical form, Karnaugh map.		**CO1**

UNIT-II	**Abstract Algebra**	**(9 Hrs)**
Set: Definition, simple problems, Relation: types, simple problems, Group: monoid, semigroup, group, Abelian group, simple problems Ring: Definition, simple problems Field: Definition, simple problems.		**CO2**

UNIT-III	**Combinatorics**	**(9Hrs)**
Basic counting, balls and bins problems, generating functions, recurrence relations. Proof techniques, principle of mathematical induction, pigeonhole principle.		**CO3**

UNIT- IV	**Graph Theory**	**(9Hrs)**
Graphs and digraphs, complement, isomorphism, connectedness and reachability, adjacency matrix, Eulerian paths and circuits in graphs and digraphs, Hamiltonian paths and circuits in graphs and tournaments, trees; Planar graphs, Euler's formula, dual of a planer graph, independence number and clique number, chromatic number, statement of Four-color theorem.		**CO4**

UNIT- V	**Logic**	**(9Hrs)**
Propositional calculus - propositions and connectives, syntax; Semantics – truth assignments and truth tables, validity and satisfiability tautology; Adequate set of connectives; Equivalence and normal forms; Compactness and resolution; Formal reducibility - natura deduction system and axiom system; Soundness and completeness.		**CO5**

Lecture Periods: 60	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 60**

Text Books

1. I. N. Herstein, John Wiley and Sons, "Topics in Algebra".
2. M. Morris Mano," Digital Logic & Computer Design", Pearson. January 2014
3. C. L. LiuMcGraw Hill, "Elements of Discrete Mathematics", (Second Edition) New Delhi.
4. J. A. Bondy and U. S. R. Murty, "Graph Theory with Applications", Macmillan Press, London.
5. L. Zhongwan, "Mathematical Logic for Computer Science", World Scientific, Singapore

Reference Books

1. Gilbert Strang, "Introduction to linear algebra".5th Edition,2016
2. R. A. Brualdi, "Introductory Combinatorics", 5th Edition,North-Holland, New York,2016.
3. N. Deo, Prentice Hall, Englewood Cliffs, "Graph Theory with Applications to Engineering and Computer Science" Dover Publications Inc.; 1stEdition,2016.
4. E. Mendelsohn, Van-Nostrand, "Introduction to Mathematical Logic", (Second Edition), London.

Web References

1. https://youtu.be/0Dx7r0PFyUM
2. https://youtu.be/rs5S0Ehp3s8
3. https://youtu.be/aUjq6o0PmjY

4. https://youtu.be/fZqfkJ-cb28
5. https://youtu.be/oaOm2pnKkyY

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	-	-	-	-	-	-	-	-	2	1	1
2	2	1	-	-	-	-	-	-	-	-	-	-	2	1	1
3	3	2	1	1	-	-	-	-	-	-	-	1	2	1	-
4	3	2	1	1	-	-	-	-	-	-	-	1	2	-	1
5	2	1	-	-	-	-	-	-	-	-	-	1	2	1	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Mathematics**	Programme: **B.Tech.**						
Semester	**I**	Course Category: BS				*End Semester Exam Type: **TE**		
Course Code	**U23MAT102**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**INTRODUCTORY TOPICS IN STATISTICS AND PROBABILITY**	**3**	**1**	**0**	**4**	**25**	**75**	**100**

Course Objectives		
	1)	To learn the concepts of evaluation using statistical analysis
	2)	To Know the central tendency like mean, median, mode etc.
	3)	To study the basic probability concepts
	4)	To introduce knowledge of standard discrete distributions.
	5)	To acquire knowledge on probability continuous distributions

Course Outcome	**On completion of the course, the students will be able to**		BT Mapping (Highest Level)
	CO1	Understand the types of data and graphical representation in statistics.	**K2**
	CO2	Apply the concepts of central tendency.	**K2**
	CO3	Recall the concepts of basic probability.	**K2**
	CO4	Apply the basic rules of discrete random variables.	**K3**
	CO5	Apply the fundamentals of probability theory and random processes.	**K3**

UNIT-I	**Introduction To Statistics**	**(9Hrs)**
Definition of Statistics. Basic objectives. Applications in various branches of science with examples. Collection of Data: Internal and external data, Primary and secondary Data. Population and sample, Representative sample		**CO1**

UNIT-II	**Descriptive Statistics**	**(9Hrs)**
Classification and tabulation of univariate data, graphical representation, Frequency curves. Descriptive measures - central tendency and dispersion. Bivariate data. Summarization, marginal and conditional frequency distribution.		**CO2**

UNIT-III	**Basics Of Probability**	**(9Hrs)**
Concept of experiments, sample space, event. Definition of Combinatorial Probability. Conditional Probability, Bayes Theorem. .		**CO3**

UNIT- IV	**Discrete Probability Distributions**	**(9Hrs)**
Discrete Distributions: Probability mass function – Probability density function- Distribution functions, Binomial, Geometric, Negative Binomial, Poisson.		**CO4**

UNIT- V	**Continuous Probability Distributions**	**(9Hrs)**
Continuous Distributions: Uniform, Exponential, Gamma, Weibull and Normal distributions and their properties – Functions of a random variable.		**CO5**

Lecture Periods: 60	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 60**

Text Books

1. S.M. Ross, “Introduction of Probability Models”, Academic Press, N.Y.
2. A. Goon, M. Gupta and B. Dasgupta, “Fundamentals of Statistics”, vol. I & II, World Press.
3. Bali N.P. and Dr. Manish Goyal, “Engineering Mathematics”, Lakshmi Publications Pvt. Ltd., New Delhi, 9th Edition, 2015
4. T. Veerarajan,” Probability and Statistics, Random Process and Queuing Theory”, McGraw Hill Education, 2018.
5. **P. Sivaramakrishna Das, C. Vijayakumari**, “Probability and Queuing Theory”, Pearson Education, 6th Edition, 2019.
6. G. Balaji, “Probability and Queuing Theory”, Balaji Publication, Revised Edition 2017.

Reference Books

1. S.M. Ross, “A first course in Probability”, Prentice Hall.
2. I.R. Miller, J.E. Freund and R., “Johnson, Probability and Statistics for Engineers”,(Fourth Edition), PHI.
3. A.M. Mood, F.A. Graybilland D.C. Boes, “Introduction to the Theory of Statistics”, McGraw Hill Education.
4. Erwin Kreyszig, “Advanced Engineering Mathematics”, John Wiley & Sons, New Delhi, 10th Edition, 2019.
5. Ravish R. Singh and Mukul Bhatt, “Engineering Mathematics”, Tata McGraw Hill, 1st Edition, New Delhi, 2016.
6. Ramana B.V.,” Higher Engineering Mathematics”, Tata Mc Graw Hill, New Delhi 2018

Web References

1. https://youtu.be/BceFKnWh68Y
2. https://youtu.be/fjDh4WPTGq4
3. https://youtu.be/Hw8KHNgRaOE

4. https://youtu.be/2CP3m3EgL1Q
5. https://youtu.be/wo__Vag3yls
6. https://swayam.gov.in/nd1_noc20_ma17/preview

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	-	-	-	-	-	-	-	1	2	1	1
2	2	1	-	-	-	-	-	-	-	-	-	1	2	-	1
3	2	1	-	-	-	-	-	-	-	-	-	1	2	1	1
4	3	2	1	1	-	-	-	-	-	-	-	1	2	1	-
5	3	2	1	1	-	-	-	-	-	-	-	1	2	1	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Physics / Chemistry**	Programme: **B.Tech.**						
Semester	**I**	Course Category: **BS**				End Semester Exam Type: **TE**		
Course Code	**U23BSTC01**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**PHYSICAL SCIENCE FOR ENGINEERS**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

(Common to all Branches)

Prerequisite: Physics of 12th standard or equivalent / Chemistry of 12th standard or equivalent.

Course Outcomes		On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1	Understand the basic of properties of magnetic, dielectric and superconductors.	**K2**
	CO2	Identify the wave nature of the particles, physical significance of wave functions	**K3**
	CO3	Understand the basic principles of laser and fiber optics communication	**K2**
	CO4	Understand and familiar with the water treatment.	**K2**
	CO5	Understand the electrode potential for its feasibility in electrochemical reaction and uses of various batteries.	**K2**
	CO6	Understand the specific operating condition under which corrosion occurs and suggest a method to control corrosion.	**K2**

SECTION A - PHYSICS

UNIT-I	**Magnetic, Dielectric and Superconducting Materials**	**Periods: 8**

Introduction to magnetic materials, Ferromagnetism- Domain theory-Types of energy-Hysteresis-Hard and Soft magnetic materials-ferrites-Dielectric materials-Types of polarization – Langevin-Debye equation-Frequency effects on polarization-Dielectric breakdown- Ferroelectric materials-Superconducting materials and their properties. **CO1**

UNIT-II	**Quantum Mechanics**	**Periods: 7**

Matter Waves - de Broglie Wavelength - Uncertainty Principle –Physical Significance of wave functions - Schrodinger wave Equation - Time Dependent - Time Independent - Application to Particle in a One Dimensional Box - Tunnel Diode. **CO2**

UNIT-III	**Laser and Fiber Optics**	**Periods: 7**

Lasers - Principles of Laser - Spontaneous and Stimulated Emissions - Einstein's Coefficients - Population Inversion and Laser Action –components of laser - Types of Lasers - NdYAG, CO_2 laser, GaAs Laser Fiber Optics - Principle and Propagation of light in optical fiber - Numerical aperture and acceptance angle - Types of optical fibers (material, refractive index, mode) **CO3**

SECTION B – CHEMISTRY

UNIT-IV	**Water And Its Treatment**	**Periods: 8**

Water: Sources and impurities, Water quality parameters: Definition and significance of-color, odour, turbidity, pH, hardness, alkalinity, TDS, COD and BOD. Desalination of brackish water: Reverse osmosis-disadvantages of using hard water in boiler - Treatment of boiler feed water: Internal treatment (phosphate, colloidal, sodium aluminate and Calgon conditioning) and External treatment–Ion exchange demineralization and zeolite process. **CO4**

UNIT-V	**Electrochemical Cells and Storage Devices**	**Periods: 8**

Galvanic cells, single electrode potential, standard electrode potential, electrochemical series. EMF of a cell and its measurement. Nernst equation. Electrolyte concentration cell. Reference electrodes-hydrogen, calomel and Ag/AgCl. Batteries and fuel cells: Types of batteries- alkaline battery-lead storage battery- nickel-cadmium battery- fuel cell H_2 -O_2 fuel cell-applications. **CO5**

UNIT-VI	**Corrosion**	**Periods: 7**

Corrosion –Introduction - factors – types – chemical, electrochemical corrosion (galvanic, differential aeration), corrosion control – material selection and design aspects – electrochemical protection – sacrificial anode method and impressed current cathodic method. Uses of inhibitors, metallic coating – anodic coating, cathodic coating. Metal cladding, Electroplating of Copper and electroless plating of nickel. **CO6**

Lecture Periods: 45	**Tutorial Periods:-**	**Practical Periods:-**	**Total Periods: 45**

Text Books

1. V Rajendran, “Engineering Physics”, 2nd Edition, TMH, New Delhi 2011.
2. S.S Dara – “A text book of Engineering Chemistry” - 15th Edition, 2021. S.Chand Publications.
3. C.Jain, Monica Jain, —”Engineering Chemistryll” 17th Ed. Dhanpat Rai Pub. Co., New Delhi, (2015).

Reference Books

1. R.Murugeshan, “Modern Physics”, S. Chand &Co, New Delhi 2006.
2. William D Callister Jr., “Material Science and Engineering”, 6th Edition, John Wiley and sons, 2009.
3. Jain & Jain “Engineering chemistry”, 23rd Edition, DhanpatRai Publishing Company. 2022
4. Mars Fontana “Corrosion Engineering”, July 2017
5. JinaRedlin, “Handbook of Electrochemistry”, March 28, 2005

Web References

1. https://www.sciencedaily.com/terms/materials_science.htm.

2. https://www.acs.org/content/acs/en/careers/college-to-career/chemistry-careers/materials science.html.
3. https://study.com/academy/lesson/semiconductors-superconductors-definition-properties.html
4. https://mechanicalc.com/reference/engineering-materials
5. http://ndl.ethernet.edu.et/bitstream/123456789/89589/1/%5BPerez_N.%5D_Electrochemistry_and_corrosion%28BookZZ.org%29.pdf

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	2	-	-	-	-	-	-	-	-	-	-	-
2	3	2	3	2	-	-	-	-	-	-	-	-	-	-	-
3	3	2	3	2	-	-	-	-	-	-	-	-	-	-	-
4	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-
5	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-
6	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Computer Science and Business Systems**	Program: **B.Tech.**						
Semester	**I**	Course Category: ES				*End Semester Exam Type: **TE**		
Course Code	**U23CBT101**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**FUNDAMENTALS OF COMPUTER SCIENCE**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

Course Objectives	**1)**	To understand the basic concepts of problem solving concepts.
	2)	To gain Knowledge about the syntax and semantics about programming language.
	3)	To learn the techniques of Pointers, Arrays and Functions in C.
	4)	To be exposed to user defined data types to handle the files.
	5)	To develop program using pre-processor directives and files.

Course Outcome	**On completion of the course, the students will be able to**		BT Mapping (Highest Level)
	CO1	Recognize the basics of programming concepts.	**K1**
	CO2	Choose appropriate controls and functions to solve the problems.	**K1**
	CO3	Develop and Manage memory with Pointers and Arrays.	**K3**
	CO4	Explore the various Input and Output functions.	**K2**
	CO5	Create and Manipulate the Files accessing and storage.	**K3**

UNIT-I	**Introduction**	**(9Hrs)**
Algorithm and Flowchart for problem solving with Sequential Logic Structure- Decisions and Loops. Introduction to imperative language; syntax and constructs of a specific language (ANSI C)- Variable Names-Data Type and Sizes (Little Endian Big Endian)- Constants- Declarations- Arithmetic Operators- Relational Operators-Logical Operators-Type Conversion- Increment Decrement Operator-Bitwise Operators- Assignment Operators and Expressions- Precedence and Order of Evaluation- proper variable naming and Hungarian Notation.		**CO1**

UNIT-II	**Control Flow and Functions**	**(9Hrs)**
Statements and Blocks- If-Else-If, Switch, Loops – while, do, for, break and continue, goto labels, structured and un- structured programming. Basics of functions- parameter passing and returning type- C main return as integer,-External- Auto- Local- Static- Register Variables- Scope Rules- Block structure- Initialization- Recursion- Pre-processor- Standard Library Functions and return types.		**CO2**

UNIT-III	**Pointers, Arrays and Structures**	**(9Hrs)**
Pointers and address- Pointers and Function Arguments- Pointers and Arrays- Address Arithmetic- character Pointers and Functions- Pointer Arrays- Pointer to Pointer- Multi-dimensional array and Row/column major formats- Initialization of Pointer Arrays- Command line arguments- Pointer to functions- complicated declarations and how they are evaluated. Basic Structures- Structures and Functions- Array of structures- Pointer of structures- Self-referral structures- Table look up-typedef,-unions- Bit-fields.		**CO3**

UNIT- IV	**Input and Output**	**(9Hrs)**
Standard I/O, Formatted Output – printf, Formated Input – scanf- Variable length argument list- file access including FILE structure- fopen, stdin, sdtout and stderr,-Error Handling including exit- perror and error.h- Line I/O- related miscellaneous functions.		**CO4**

UNIT- V	**Unix System Interface**	**(9Hrs)**
File Descriptor- Low level I/O – read and write- open,-create- close and unlink- Random access – lseek- Discussions on Listing Directory- Storage allocator. Programming Method: Debugging, Macro, User Defined Header, User Defined Library Function, makefile utility.		**CO5**

Text Books

7. B. W. Kernighan and D. M. Ritchi , “The C Programming Language”, Second Edition, PHI.
8. B. Gottfried, Schaum ,”Programming in C”, Second Edition, Outline Series, 2017
9. E Balagurusamy ,”Programming in ANSI C”, Fourth Edition, , TMH, 2007.

Reference Books

7. Herbert Schildt ,”C: The Complete Reference”, Fourth Edition , McGraw Hill, 2017.
8. Yashavant Kanetkar “Let Us C” , BPB Publications 14th Edition,2019
9. Pradip dey and Manas Ghosh ,”Computer fundamentals and Programming in C” ,Oxford University Press,2013

Web References

1. https://codeforwin.org/
2. https://www.geeksforgeeks.org/c-programming-language/
3. http://learn-c.org/
4. https://www.cprogramming.com/
5. https://www.linuxtopia.org/online_books/programming_books/gnu_c_programming_tutorial/ index.html

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	-	-	-	-	-	-	-	-	-	-	-	1	-	-
2	1	-	-	-	-	-	-	-	-	-	-	-	1	-	-
3	3	2	1	-	-	-	-	-	-	-	-	-	3	1	-
4	2	1	-	-	-	-	-	-	-	-	-	-	2	-	-
5	3	2	1	-	-	-	-	-	-	-	-	-	3	1	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Computer Science and Business Systems**	Programme: **B. Tech.**						
Semester	**I**	Course Category: **HS**			End Semester Exam Type: **TE**			
Course Code	**U23HSTC01**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**UNIVERSAL HUMAN VALUES - II**	**2**	**0**	**0**	**2**	**25**	**75**	**100**
	(Common to all Branch)							

Prerequisite	UHV - I	
Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Evaluate the significance of value inputs in formal education and start applying them in their life and profession	**K2**
	CO2 Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.	**K2**
	CO3 Analyze the value of harmonious relationship based on trust and respect in their life and profession	**K2**
	CO4 Examine the role of a human being in ensuring harmony in society and nature.	**K2**
	CO5 Apply the understanding of ethical conduct to formulate the strategy for ethical life and profession.	**K2**

UNIT - I	**Introduction To Value Education**	**Periods: 06**
Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education) - Understanding Value Education - Self-exploration as the Process for Value Education - Basic Human Aspirations - Happiness and Prosperity - Current Scenario- Method to Fulfil the Basic Human Aspirations		**CO1**
UNIT - II	**Harmony In The Human Being**	**Periods: 06**
Understanding Human being as the Co-existence of the Self and the Body-Distinguishing between the Needs of the Self and the Body-The Body as an Instrument of the Self-Understanding Harmony in the Self-Harmony of the Self with the Body-Programme to ensure self-regulation and Health		**CO2**
UNIT - III	**Harmony In The Family And Society**	**Periods: 06**
Harmony in the Family - Basic Unit of Human Interaction- 'trust' - Foundational Value in Relationship - 'Respect' - as the Right Evaluation - Other Feelings, Justice in Human-to-Human Relationship - Understanding Harmony in the Society-Vision for the Universal Human Order.		**CO3**
UNIT - IV	**Harmony In The Nature / Existence**	**Periods: 06**
Understanding Harmony in the Nature-Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature - Realizing Existence as Co-existence at All Levels - Holistic Perception of Harmony in Existence		**CO4**
UNIT - V	**Implications Of The Holistic Understanding - A Look At Professional Ethics**	**Periods: 06**
Natural Acceptance of Human Values - Definitiveness of (Ethical) Human Conduct - Basis for Humanistic Education, Humanistic Constitution and Universal Human Order-Competence in Professional Ethics-Holistic Technologies, Production Systems and Management Models-Typical Case Studies-Strategies for Transition towards Value - based Life and Profession		**CO5**

Lecture Periods: 30	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 30**

Text Book

1. R. R. Gaur, R. Asthana, G. P. Bagaria, "A Foundation Course in Human Values and Professional Ethics", Excel Books, 2nd Revised Edition, New Delhi, 2019.

Reference Books

1. A Nagraj, Jeevan Vidya Prakashan, Amarkantak, "Jeevan Vidya: EkParichaya", 2013.
2. A.N. Tripathi, "Human Values", New Age International Publishers, New Delhi, 3rd Edition, 2019.
3. Annie Leonard, "The Story of Stuff", Free Press, Reprint Edition, 2011.
4. Mohandas Karam chand Gandhi, "The Story of My Experiments with Truth – Mahatma Gandhi Autobiography", Finger print Publisher, 2009.
5. E. F Schumacher, "Small is Beautiful", Vintage Publisher, 1993.
6. Cecile Andrews, "Slow is Beautiful", New Society Publishers, 2006.
7. J C Kumarappa, "Economy of Permanence", Sarva Seva Sangh Prakashan, 2017.
8. Pandit Sunderlal, "Bharat Mein Angreji Raj", Prabhat Prakashan Publisher, 2021.
9. Dharampal, "Rediscovering India", Stosius Inc/Advent Books Division Publisher, 1983.
10. Mohandas K. Gandhi, "Hind Swaraj or Indian Home Rule", Gyan Publishing House, 2023.
11. Maulana Abdul Kalam Azad, "India Wins Freedom", Orient BlackSwan Publisher, 1st Edition, 1988.

12. Life of Vivekananda, **"**Romain Rolland (English)", Advaita Ashrama Publisher, India, 4th Edition, 2010.
13. Mahatma Gandhi, "Romain Rolland (English)", Srishti Publishers & Distributors, 2020.

Web References

1. https://www.uhv.org.in/uhv-ii
2. http://www.storyofstuff.com
3. https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw
4. https://fdp-si.aicte-india.org/8dayUHV_download.php
5. https://www.youtube.com/watch?v=8ovkLRYXIjE

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	-	-	-	-	-	2	3	2	2	-	-	3	-	-	-
2	-	-	-	-	-	2	3	2	2	-	-	3	-	-	-
3	-	-	-	-	-	3	3	2	2	-	-	3	-	-	-
4	-	-	-	-	-	2	3	2	2	-	-	3	-	-	-
5	-	-	-	-	-	2	3	2	2	-	-	3	-	-	-

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**English**			Programme: **B.Tech**				
Semester	**I**			Course Category: HS			*End Semester Exam Type: **TE**	
Course Code	**U23ENB101**			Periods/Week			Credit	Maximum Marks		
				L	T	P	C	CAM	ESE	TM
Course Name	**Business Communication & Value Science -I**			**2**	**0**	**2**	**3**	**50**	**50**	**100**
Prerequisite	Basics of English Language									
Course Outcome	**On completion of the course, the students will be able to**							BT Mapping (Highest Level)		
	CO1	Apply the knowledge of grammar in oral and written communication						**K3**		
	CO2	Understand the basic tenets of communication						**K2**		
	CO3	Build strong technical communication skills to meet out the organizational anticipation						**K3**		
	CO4	Identify own strengths and opportunities						**K2**		
	CO5	Develop the multivariate skills requisites for life						**K3**		

UNIT-I	**Grammar**	**Periods:10**	
Essential Grammar: Parts of Speech – Tenses - Applications of tenses on Functional Grammar -Sentence formation -(General and Technical) - Common Errors-Voices -Sentence Sequence			**CO1**
UNIT-II	**Fundamentals in Communication**	**Periods:10**	
Types of communication: Verbal and Non – verbal – Role-play -Importance of Questioning - Listening Skills: Importance - Difference between listening and hearing - Types of listening - Expressing self – connecting with emotions - visualization and experience - Skit based on communication skills - Evaluation on Listening skills			**CO2**
UNIT-III	**Organizational Communication**	**Periods:10**	
Email writing: Formal and informal -Verbal communication: Pronunciation - clarity - brevity of speech- Vocabulary Enrichment: General Service List (GSL), Academic word list (AWL) technical terms, phrases, idioms, significant abbreviations, formal business vocabulary - GD - Written Communication -Narrative writing – creating CV –Life skill - Stress management and teamwork			**CO3**
UNIT- IV	**People Skills and Self-introspection**	**Periods:15**	
List of Exercises **Listening** Listen to recording and answer questions, Record conversation between a celebrity and an interviewer- Self-awareness – identity, body awareness - stress management. **Speaking** • Presentation on favourite cricket captain-skills and values they demonstrate • Interviewing a maid- watchman – sweeper- cabdriver- beggar- narrate values **Reading** • Over viewing business communication **Writing** • Newspaper Report – football- hockey			**CO4**
UNIT-V	**Incorporating Life Skills with Values**	**Periods:15**	
List of Exercises **Listening** Life Skills: Movie based learning – identifying skills and values - Critical life skills - Multiple Intelligences Values: Leadership, Teamwork, Managing Stress, Motivation, and Creativity **Speaking** Work with an NGO and makes a presentation, Table Topics speech **Reading** , Reading Newspapers - Magazine - Journal **Writing** Accident report - current political scenario **Project:** Create a podcast on a topic			**CO5**

LecturePeriods:30	**Tutorial Periods:-**	**Practical Periods:30**	**TotalPeriods:60**

Text Books

1. Wren & Martin, “High School English Grammar and Composition”, S Chandh &Co. Ltd, 2015.

2. Comfort, Jeremy,etal., “Speaking Effectively: Developing Speaking Skills for Business English”, Cambridge University Press,Cambridge, Reprint 2011.
3. Boove, Courtland L, “Business Communication Today”, Pearson Education, New Delhi,2002.

Reference Books

1. English vocabulary in use – Alan Mc’carthy and O’dell
2. APAART: Speak Well 1 (English language and communication)
3. APAART: Speak Well 2 (Soft Skills)
4. Business Communication – Dr.SarojHiremath
5. Wren, Percival Christopher, and Wren Martin. “High School English Grammar and Composition”. S Chand, 2005

Web References

1. Train your mind to perform under pressure- Simon sinek
   https://curiosity.com/videos/simon-sinek-on-training-your-mind-to-perform-under-pressure-capture-your-flag/
2. Brilliant way one CEO rallied his team in the middle of layoffs
   https://www.inc.com/video/simon-sinek-explains-why-you-should-put-people-before-numbers.html
3. Will Smith's Top Ten rules for success
   https://www.youtube.com/watch?v=bBsT9omTeh0
4. https://www.coursera.org/learn/learning-how-to-learn
5. https://www.coursera.org/specializations/effective-business-communication

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	-	-	-	-	-	-	1	-	3	-	1	1	-	-
2	1	-	-	-	-	-	-	-	-	3	-	1	-	-	-
3	1	-	-	-	-	-	-	1	-	3	-	1	1	-	-
4	1	-	-	-	-	-	-	1	-	3	-	1	1	-	-
5	1	-	-	-	-	-	-	1	-	3	-	1	1	-	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)									End Semester Examination (ESE) Marks (Practical – Internal Evaluation)	End Semester Examination (ESE) Marks (Theory)	Total Marks
	Continuous Assessment (Theory)					Continuous Assessment (Practical)						
	CAT 1	CAT 2	Model	Attendance	Total	Conduction of Practical	Report	Viva	Total			
Marks	5	5	5	5	20*	15	10	5	30*	30	75**	-
*To be weighted for 10 Marks					10	*To be weighted for 10 Marks			10		*To be weighted for 50 Marks	100

Department	**Computer Science and Business Systems**	Programme: **B.Tech.**						
Semester	**I**	Course Category: **ES**			*End Semester Exam Type: **LE**			
Course Code	**U23CBP101**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**FUNDAMENTALS OF COMPUTER SCIENCE LABORATORY**	**0**	**0**	**2**	**1**	**50**	**50**	**100**

Course Objectives	• To understand the basic concepts of problem solving concepts.		
	• To gain Knowledge about the syntax and semantics about programming language.		
	• To learn the techniques of Pointers, Arrays and Functions in C.		
	• To be exposed to user defined data types to handle the files.		
	• To develop program using pre-processor directives and files.		
Course Outcome	**On completion of the course, the students will be able to**		BT Mapping (Highest Level)
	CO1	Develop Algorithm and Flowcharts.	**K3**
	CO2	Develop program using tricky codes and parameter passing	**K3**
	CO3	**Analyze problems and implement those using functions**	**K3**
	CO4	Design applications using Files concepts	**K3**
	CO5	Analyze and discover searching programs	**K3**

List of Experiments:

1. Algorithm and flowcharts of small problems like GCD
2. Develop a Small but tricky codes
3. Develop a program with Proper parameter passing
4. Write a C program using Command line Arguments
5. Write a Program to understand about Variable parameter
6. Develop a program to illustrate the use of Pointer to functions
7. Write a program to explain the concept of User defined header
8. Write a program to analyze the importance of Make file utility
9. Develop a program to elucidate Multi file program and user defined libraries
10. Develop a program with Interesting substring matching / searching programs
11. Write programs with Parsing related assignments

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 3 0**	**Total Periods: 30**

Text Books

1. B. W. Kernighan and D. M. Ritchi , “The C Programming Language”, Second Edition, PHI.
2. B. Gottfried, Schaum ,”Programming in C”, Second Edition, Outline Series, 2017
3. E Balagurusamy ,”Programming in ANSI C”, Fourth Edition, , TMH, 2007

Reference Books

1. Herbert Schildt ,”C: The Complete Reference”, Fourth Edition , McGraw Hill, 2017.
2. Yashavant Kanetkar “Let Us C” , BPB Publications 14th Edition,2019
3. Pradip dey and Manas Ghosh ,”Computer fundamentals and Programming in C” ,Oxford University Press,2013

Web References

1. https://codeforwin.org/
2. https://www.geeksforgeeks.org/c-programming-language/
3. http://learn-c.org/
4. https://www.cprogramming.com/
5. http://cse02-iiith.vlabs.ac.in

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	3	-	-	-	-	-	-	-	3	1	-
2	3	2	1	1	3	-	-	-	-	-	-	-	3	1	-
3	3	2	1	1	3	-	-	-	-	-	-	-	3	1	-
4	3	2	1	1	3	-	-	-	-	-	-	-	3	1	-
5	3	2	1	1	3	-	-	-	-	-	-	-	3	1	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Department	**Mechanical Engineering**	Programme : **B.Tech.**						
Semester	**I**	Course Category: **ES**			End Semester Exam Type: **LE**			
Course Code	**U23ESPC02**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**DESIGN THINKING AND IDEA LAB**	**0**	**0**	**2**	**1**	**50**	**50**	**100**
(Common to ALL Branches)								
Prerequisite	Basic Knowledge of Science							

Course Outcomes	**On completion of the course, the students will be able to**		BT Mapping (Highest Level)
	CO1	Demonstrate a comprehensive understanding of the tools and inventory associated with the IDEA Lab.	**K2**
	CO2	Develop proficiency in ideation techniques to generate creative and innovative solutions for various design challenges and problems	**K3**
	CO3	Acquire practical knowledge of mechanical and electronic fabrication processes, including hands-on experience with machinery, tools, and techniques used in the manufacturing and assembly of physical components.	**K3**
	CO4	Cultivate the skills necessary for developing innovative and desirable products, including the ability to integrate user needs, market trends, and technological advancements into the design process.	**K4**
	CO5	Apply iterative design methodologies to refine and improve solutions based on feedback, user testing, and evaluation of functional, aesthetic, and usability aspects	**K4**

Design process: Traditional design, Design thinking, Existing sample design projects, Study on designs around us, Compositions/structure of a design, Innovative design: Breaking of patterns, Reframe existing design problems, Principles of creativity Empathy: Customer Needs, Insight-leaving from the lives of others/standing on the shoes of others, Observation

Design team-Team formation, Conceptualization: Visual thinking, Drawing/sketching, New concept thinking, Patents and Intellectual Property, Concept Generation Methodologies, Concept Selection, Concept Testing, Opportunity identification Prototyping: Principles of prototyping, Prototyping technologies, Prototype using simple things, Wooden model, Clay model, 3D printing; Experimenting/testing.

Sustainable product design, Ergonomics, Semantics, Entrepreneurship/business ideas, Product Data Specification, Establishing target specifications, Setting the final specifications. Design projects for teams.

List of Lab Activities and Experiments

1. Schematic and PCB layout design of a suitable circuit, fabrication and testing of the circuit.
2. Machining of 3D geometry on soft material such as softwood or modelling wax.
3. 3D scanning of computer mouse geometry surface. 3D printing of scanned geometry using FDM or SLA printer.
4. 2D profile cutting of press fit box/casing in acrylic (3 or 6 mm thickness)/cardboard, MDF (2 mm) board using laser cutter & engraver.
5. 2D profile cutting on plywood /MDF (6-12 mm) for press fit designs.
6. Familiarity and use of welding equipment.
7. Familiarity and use of normal and wood lathe.
8. Embedded programming using Arduino and/or Raspberry Pi.
9. Design and implementation of a capstone project involving embedded hardware, software and machined or 3D printed enclosure.
10. Discussion and implementation of a mini project.
11. Documentation of the mini project (Report and video).

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 30**	**Total Periods: 30**

Text Books

1. Tim Brown, Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation, HarperCollins Publishers Ltd
2. Workshop / Manufacturing Practices (with Lab Manual), Khanna Book Publishing.

Reference Books

1. Ulrich and Eppinger, Product Design and Development, 3rd Edition, McGraw Hill, 2004
2. The Big Book of Maker Skills: Tools & Techniques for Building Great Tech Projects. Chris Hackett. Weldon Owen; 2018.
3. The Total Inventors Manual (Popular Science): Transform Your Idea into a Top-Selling Product. Sean Michael Ragan, Weldon Owen; 2017.
4. The Art of Electronics. 3rd edition. Paul Horowitz and Winfield Hill. Cambridge University Press.
5. Practical Electronics for Inventors. 4th edition. Paul Sherz and Simon Monk. McGraw Hill.
6. Make Your Own PCBs with EAGLE: From Schematic Designs to Finished Boards. Simon Monk and Duncan Amos. McGraw Hill Education.
7. Programming Arduino: Getting Started with Sketches. 2nd edition. Simon Monk. McGraw Hill.
8. Venuvinod, PK., MA. W., Rapid Prototyping – Laser Based and Other Technologies, Kluwer
9. Chapman W.A.J, "Workshop Technology", Volume I, II, III, CBS Publishers and Distributors, 5th Edition,2002.

Web References

1. https://onlinecourses.nptel.ac.in/noc23_mg72

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	2	2	2	-	-	2	-	3	2	-	-	-
2	3	3	3	2	2	2	-	-	2	-	3	2	-	-	-
3	3	3	3	2	3	2	-	-	2	-	3	2	-	-	-
4	3	3	3	2	3	2	-	-	2	-	3	2	-	-	-
5	3	3	3	2	3	2	-	-	2	-	3	2	-	-	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Department	**Mechanical Engineering**	Programme: **B.Tech.**						
Semester	**I**	Course Category: **ES**			End Semester Exam Type: **LE**			
Course Code	**U23ESPC03**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**ENGINEERING GRAPHICS USING AUTOCAD**	**0**	**0**	**2**	**1**	**50**	**50**	**100**

(Common to all Branches)

Prerequisite	Nil	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Familiarize with the fundamentals and standards of engineering graphics.	**K3**
	CO2 Perform drawing of basic geometrical constructions and multiple views of objects.	**K2**
	CO3 Visualize the isometric and perspective sections of simple solids.	**K3**
	CO4 Connect side view associate on front view.	**K4**
	CO5 Correlate sectional views and lateral surface developments of various solids.	**K4**

List of Experiments

1. Study of capabilities of software for Drafting and Modeling – Coordinate systems (absolute, relative, polar, etc.) – Creation of simple figures like polygon and general multi-line figures.
2. Drawing a Title Block with necessary text and projection symbol.
3. Drawing 2D sketch by applying modify tools like fillet, mirror, array, etc.,
4. Drawing front view and top view of simple solids like prism, pyramid, cylinder, cone, etc., and Dimensioning.
5. Drawing front view, top view and side view of objects from the given pictorial views (eg. Simple stool, V-block, Mixie Base).
6. Drawing a plan of residential building (Two bed rooms, kitchen, hall, etc.)
7. Drawing sectional views of prism, pyramid, cylinder, cone, etc,
8. Drawing lateral surface development of prism, pyramid, cylinder, cone, etc,
9. Drawing isometric projection of simple objects.
10. Creating 3D model of simple object and obtaining 2D multi-view drawings.
11. Note: Plotting of drawings must be made for each exercise and attached to the records written by Students.

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 30**	**Total Periods: 30**

Reference Books

1. James D. Bethune, Engineering Graphics with AutoCAD A Spectrum book 1st Edition, Macromedia Press, Pearson, 2020.
2. NS Parthasarathy and Vela Murali, Engineering Drawing, Oxford university press, 2015.
3. M.B Shah, Engineering Graphics, ITL Education Solutions Limited, Pearson **Education** Publication, 2011.
4. Bhatt N.D and Panchal V.M, Engineering Drawing: Plane and Solid Geometry, Charotar Publishing House, 2017.
5. Jeyapoovan T, Engineering Drawing and Graphics Using AutoCAD, Vikas Publishing House Pvt Ltd., 7th Edition, New Delhi, 2016.
6. C M Agrawal, Basant Agrawal, Engineering Graphics, McGraw Hill, 2012.
7. Dhananjay A. Jolhe, Engineering Drawing: With An Introduction To CAD McGraw Hill, 2016.
8. James Leach, AutoCAD 2017 Instructor, SDC Publications, 2016.

Web References

1. http://vlabs.iitb.ac.in/vlabs-dev/labs/mit_bootcamp/egraphics_lab/labs/index.php
2. http://www.nptelvideos.in/2012/12/computer-aided-design.html
3. https://mech.iitm.ac.in/meiitm/course/cad-in-manufacturing/
4. https://autocadtutorials.com
5. https://dwgmodels.com

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	1	-	-	3	-	-	-	3	-	-	2	3	3	3
2	3	1	-	-	3	-	-	-	3	-	-	3	3	3	3
3	3	1	-	-	3	-	-	-	3	-	-	3	3	3	3
4	3	1	-	-	3	-	-	-	3	-	-	2	3	3	3
5	3	1	-	-	3	-	-	-	3	-	-	3	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Department	**Computer Science and Business Systems**	Programme: **B.Tech.**						
Semester	**I**	Course Category: **MC**			End Semester Exam Type: -			
Course Code	**U23CBM101**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Induction Programme**	-	-	-	Non-Credit	-	-	-
Prerequisite	**-**							

Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
CO1	Develop holistic attitude and harmony in the individual, family, and Society	**K2**
CO2	Acquire grammar skills and capable to write and speak English confidently	**K2**
CO3	Understand the basic concepts in Mathematics and Programming	**K2**
CO4	Know about the art and culture, language and literature of this vast secular nation	**K2**
CO5	Identify the inherent talent and develop it professionally	**K3**

UNIT-I	**Universal Human Values**	**Periods: 12**
Welcome and Introductions - Getting to know each other, Aspirations and Concerns - Individual Academic and Career, Expectations of Family, Peers, Society, Nation, Fixing one's Goals, Self-Management - Self-confidence, Peer Pressure, Time Management, Anger, Stress Personality Development, Self-improvement, Health - Health issues, Healthy diet, Healthy lifestyle, Hostel life, Relationships - Home sickness, Gratitude towards Parents, Teachers and others Ragging and interaction, Competition and Cooperation, Peer Pressure, Society - Participation in Society, Natural Environment - Participation in Nature, Sum Up - Role of Education, Need for a Holistic Perspective, Self-evaluation and Closure - Sharing and feedback.		**CO1**

UNIT-II	**Proficiency in English**	**Periods: 12**
Communication skills - Prognostic test on Grammar - Synonyms, Antonyms, Tenses, Sentence Completion, Idioms and Phrases, One- word Substitution, Homophones, Homonyms, Use of Prepositions, Subject-verb Agreement - Writing - Paragraph writing, Letter writing, Essay writing, Story Development.		**CO2**

UNIT-III	**Bridge Course in Mathematics and C Programming**	**Periods: 12**
Mathematics: Fundamentals of differential and integral calculus: Theory and Practice, Limit of function - Fundamental results on limits - Continuity of a function - Concept of differentiation - Concept of derivative - Slope of a curve -Differentiation Techniques - Derivatives of elementary functions from first principle - Derivatives of inverse functions - Logarithmic differentiation - Method of substitution - Differentiation of parametric functions -Differentiation of implicit functions - Higher order derivatives. Integrals of functions containing linear functions -Method of integration (Decomposition method, method of substitution, integration by parts) - Definite integrals. Simple definite integrals - Properties of Definite integrals - Reduction formulae - Area and volume - Length of curve - surface area of a solid. **C Programming:** Features of C and its basic Structure - Keywords - constants - variables - operators - Data types - Formatted input and output statements - Control and Looping statement - Arrays - Functions - Strings - writing simple C programs.		**CO3**

UNIT-IV	**Literary Activities**	**Periods: 12**
Team building activities - Quiz - Oral Exercises - Group discussion, Debate, Extempore, Role play, *சிறப்பு சொற்பொழிவு - தமிழர் மரபு மற்றும் தமிழர் தொழில்நுட்பம்.*		**CO4**

UNIT-V	**Creative Arts**	**Periods: 12**
Introduction to painting and renowned artworks - Documentary and Short films - Music - Vocal, Instrumental - Dance - Classical, Cinematic - Mimicry - Mime.		**CO5**

Lecture Periods: 60	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 60**

Reference Books

1. R.R Gaur, R. Asthana, G.P. Bagaria," A Foundation Course in Human Values and Professional Ethics", Excel Books, New Delhi, 2nd Revised Edition, 2019.
2. Kumar Mohan R, "English Grammar for all (Functional and Applied Grammar)", Unicare Academy, 2022.
3. Seely, John," Oxford A-Z of Grammar and Punctuation, Oxford Publication, 2013.
4. B.V. Ramana," Higher Engineering Mathematics", Tata McGraw – Hill, New Delhi, 6th Edition, 2018.
5. Dr. A. Singaravelu, "Engineering Mathematics - I", Meenakshi publications, Tamil Nadu, 2019.
6. E. Balagurusamy, "PROGRAMMING IN ANSI C", Mc Graw Hill, 8th Edition, 2019.
7. Dr.K.K.Pillay,"Social Life of Tamils", A joint publication of TNTB & ESC and RMRL

8. R.Balakrishnan, “Journey of Civilization”,Roja muthiah research publishers, 1st Edition 2019
9. தமிழக வரலாறு - மக்களும் பண்பாடும், பிள்ளை, கே. கே. , சென்னை : உலகத் தமிழாராய்ச்சி நிறுவனம் , 2002.
10. கணினித்தமிழ் - முனைவர் இல.சுந்தரம், விகடன் பிரசுரம்.
11. கீழடி - வைகை நதிக்கரையில் சங்க கால நகர நாகரிகம், தமிழக தொல்லியல் துறை

Web References

1. http://www.newsociety.com/Books/S/Slow-isBeautiful
2. https://www.aplustopper.com/formal-letter/
3. https://www.javatpoint.com/c-programming-language-tutorial
4. http://www.math.cum.edu/~wn0g/2ch6a.pdf
5. https://education.nsw.gov.au/teaching-and-learning/curriculum/creative-arts

Evaluation methods

Assessment	Continuous Assessment Marks (CAM)			Total Marks
	Attendance	**MCQ Test**	**Presentation / Activity / Assignment**	
Marks	10	30	60	100

Department	**Computer Science and Business Systems**	Programme: **B.Tech.**						
Semester	**I**	Course Category: **AEC**			*End Semester Exam Type: **-**			
Course Code	**U23CBC1XX**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**CERTIFICATION COURSE-I**	**0**	**0**	**4**	**-**	**100**	**-**	**100**

Students shall choose an International certification course offered by the reputed organizations like Google, Microsoft, IBM, Texas Instruments, Bentley, Autodesk, Eplan and CISCO, etc. The duration of the course is 40-50 hours specified in the curriculum, which will be offered through Centre of Excellence.

Pass /Fail will be determined on the basis of participation, attendance, performance and completion of the course. If a candidate Fails, he/she has to repeat the course in the subsequent years. Pass in this course is mandatory for the award of degree.

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 5 0**	**Total Periods: 50**

Evaluation methods

Assessment	**Continuous Assessment Marks (CAM)**		**Total Marks**
	Attendance	**MCQ Test**	
Marks	10	90	100

Department	**Mathematics**	Programme: **B.Tech.**						
Semester	**II**	Course Category: BS				*End Semester Exam Type: **TE**		
Course Code	**U23MAT203**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**STATISTICAL METHODS AND MODELLING**	**3**	**1**	**0**	**4**	**25**	**75**	**100**

Course Objectives	**1)**	To learn basic concepts of a few statistical and give procedures for solving numerically different kinds of problems occurring in engineering and technology.
	2)	It is framed to address the issues and the principles of estimation theory.
	3)	To learn the concept of testing of hypothesis using statistical analysis.
	4)	Identify the direction and strength of a linear correlation between two factors.
	5)	Analyze the data on agriculture field experiments using various types of designs they learned

Course Outcome	**On completion of the course, the students will be able to**		BT Mapping (Highest Level)
	CO1	Understand the basic concepts of Statistics	**K2**
	CO2	Consistency, efficiency and unbiased ness of estimators, method of maximum likelihood estimation and Central Limit Theorem.	**K3**
	CO3	Apply the concept of testing of hypothesis for small and large samples in real life problems.	**K2**
	CO4	Concept of linear regression, correlation, and its applications.	**K3**
	CO5	List the guidelines for designing experiments and recognize the key historical figures in Design of Experiments.	**K3**

UNIT-I	**Measures of Dispersion**	**(9Hrs)**
Standard Deviation – Mean Deviation – Quartile Deviation – Range –Measures of Skewness and Pearson's coefficient of skewness– Moments about the arbitrary origin and moments based on measures of skewness and kurtosis.		**CO1**

UNIT-II	**Estimation Theory**	**(9Hrs)**
Estimators: Unbiasedness, Consistency, Efficiency and sufficiency – Maximum likelihood estimation – Method of moments.		**CO2**

UNIT-III	**Testing of Hypothesis**	**(9Hrs)**
Sampling distributions – Small and large samples –Tests based on Normal, t, Chi square, and F distributions for testing of means, variance and proportions — Contingency table (test for independent) Goodness of fit.		**CO3**

UNIT- IV	**Correlation and Regression**	**(9Hrs)**
Correlation –Rank correlation– Regression –Multiple and partial correlation – Method of least squares – Plane of regression – Coefficient of multiple correlation – Coefficient of partial correlation.		**CO4**

UNIT- V	**Design of Experiments**	**(9Hrs)**
Analysis of variance – One way and two-way classifications – Completely randomized design – Randomized block design – Latin square design - 2^2 Factorial design.		**CO5**

Text Books

1. Richard A. Johnson, Irwin Miller and John E. Freund, "Probability and Statistics for Engineers", Pearson Education, Asia, 9th Edition, 2018.
2. Murray R. Spegel, Larry J. Stephens, "Schaum's Outlines- Statistics" Mc. Graw Hill Education, 6th Edition ,2017.
3. Gupta. S. C., and Kapoor, V.K., "Fundamentals of Mathematical Statistics", Sultan Chand and Sons, 11th Edition, 2002.
4. Mood, A.M., Graybill, A.M. and Boes, D.C. (1974): "Introduction to theory of Statistics", McGraw Hill.
5. Johnson, R.A. and Wichern, D. W. "Applied Multivariate Statistical Analysis", Pearson Education, Asia, 6th Edition, 2007.

Reference Books

1. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, New Delhi,10th Edition, 2019.
2. Grewal. B.S. and Grewal. J.S., "Numerical Methods in Engineering and Science ", 10th Edition, Khanna Publishers, New Delhi, 2015.
3. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.
4. Dr. G. Balaji "Statistics and Numerical methods" Balaji publication, 11th Edition, 2017.

Web References

1. 1. ://nptel.ac.in/courses/110/105/110105087/
2. https https://nptel.ac.in/courses/111/105/111105077/
3. https://www.coursera.org/learn/basic-statistics
4. https://www.youtube.com/watch?v=k3lUo0XYG3E

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	-	-	-	-	-	-	-	-	1	1	-
2	3	2	1	1	-	-	-	-	-	-	-	-	2	1	1
3	2	1	-	-	-	-	-	-	-	-	-	-	1	-	-
4	3	2	1	1	-	-	-	-	-	-	-	-	2	1	1
5	3	2	1	1	-	-	-	-	-	-	-	-	2	-	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Mathematics**			Programme: **B.Tech.**				
Semester	**II**			Course Category: BS			*End Semester Exam Type: **TE**	
Course Code	**U23MAT204**			Periods / Week			Credit	Maximum Marks
				L	T	P	C	CAM	ESE	TM
Course Name	**LINEAR ALGEBRA**			**3**	**1**	**0**	**4**	**25**	**75**	**100**
FCourse Objectives	**1)**	To familiarize the concept of Linear algebra.								
	2)	To know determinant of a matrix and the solution of simultaneous linear equations.								
	3)	To learn linear dependence and linear independence in vector space.								
	4)	Understand the characteristics of matrices.								
	5)	To acquaint with the concepts of differential and integral calculus								
Course Outcome	**On completion of the course, the students will be able to**							BT Mapping (Highest Level)		
	CO1	Analyze the concepts of Linear Algebra.						**K2**		
	CO2	Solve systems of linear equations.						**K3**		
	CO3	Recognize and use basic properties of subspaces and vector spaces, Identify the dimension of a vector space.						**K2**		
	CO4	Find Eigen values and eigen vectors, diagonalization of a matrix, Symmetric matrices, Positive definite and similar matrices.						**K3**		
	CO5	Evaluate double integral and triple integral.						**K2**		
UNIT-I	**Matrices**						**(9Hrs)**			
Introduction to Matrices and Determinants; Solution of Linear Equations; Cramer's rule; Inverse of a Matrix.								**CO1**		
UNIT-II	**Vectors**						**(9Hrs)**			
Vectors and linear combinations; Rank of a matrix; Gaussian elimination; LU Decomposition; Solving Systems of Linear Equations using the tools of Matrices.								**CO2**		
UNIT-III	**Vector Space**						**(9Hrs)**			
Vector space, Subspace, Dimension, Geometric interpretations, Linearly independent. Basis, Orthogonality.								**CO3**		
UNIT- IV	**Eigen Values and Eigen Vectors**						**(9Hrs)**			
Eigenvalues and Eigenvectors; Positive definite matrices; Linear transformations; Hermitian and unitary matrices.								**CO4**		
UNIT- V	**Calculus**						**(9Hrs)**			
Basic concepts of Differential and integral calculus, application of double and triple integral.								**CO5**		

Text Books

1. B. S. Grewal, Khanna Publishers, "Higher Engineering Mathematics", Khanna Publication, Delhi 4th Edition,2015
2. Gregory Hartman, "Fundamentals of Matrix Algebra", Virginia Military Institute, APEX Calculus. Copyright Year: 2011
3. G. Balaji, "Linear Algebra and Partial Differential Equations: Balaji Publisher,3rd Edition 2017

Reference Books

1. Peter V. O'Neil, "Advanced Engineering Mathematics", (Seventh Edition), Cengage Learning,7th Edition 2011.
2. Michael. D. Greenberg, "Advanced Engineering Mathematics", Pearson, 2nd Edition 2013.
3. Gilbert Strang, "Introduction to linear algebra", (Fifth Edition), Wellesley-Cambridge Press,2016
4. P. N. Wartikar & J. N. Wartikar, "Applied Mathematics" (Vol. I & II), Pune Vidyarthi GrihaPrakashan, 2010.
5. M. D. Greenberg," Advanced Engineering Mathematics", Pearson Education, (Second Edition).

Web References

1. https://machinelearningmastery.com/introduction-matrices-machine-learning/
2. https://nptel.ac.in/courses/108/104/108104112/
3. https://nptel.ac.in/courses/111108098/
4. https://youtu.be/wo - Vag3yls

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	-	-	-	-	-	-	-	-	1	-	-
2	3	2	1	1	-	-	-	-	-	-	-	-	2	-	-
3	2	1	-	-	-	-	-	-	-	-	-	-	1	-	1
4	3	2	1	1	-	-	-	-	-	-	-	-	2	2	1
5	2	1	-	-	-	-	-	-	-	-	-	-	2	1	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Master of Business Administration**	Program: **B.Tech.**						
Semester	**II**	Course Category: HS				*End Semester Exam Type: **TE**		
Course Code	**U23HST201**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**FUNDAMENTALS OF ECONOMICS**	**2**	**0**	**0**	**2**	**25**	**75**	**100**

Course Objectives	**1)**	To develop an understanding of the framework that economists use to analyse choices made by individuals in response to incentives and consider how these choices can also serve the social interest.
	2)	To Measure how changes in price and income affect the behaviour of buyers and sellers
	3)	To analyze how buyers and sellers interact in a free and competitive market to determine prices and quantities of goods
	4)	To evaluate macro-economic performance using indicators that include output measures and unemployment
	5)	To understand the strengths and weakness of fiscal and monetary policy to determine an appropriate stabilization policy for a given macroeconomic situation

Course Outcome	**On completion of the course, the students will be able to**		BT Mapping (Highest Level)
	CO1	Infer how competitive markets organize the allocation of scarce resources and the distribution of goods and services.	**K1**
	CO2	Relate the basic economic theory and principles to current microeconomic issues and evaluate related public policy.	**K2**
	CO3	Analyze the various types of markets and compare their efficiency.	**K2**
	CO4	Determine the major economic indicators used to assess the state of the macro economy.	**K3**
	CO5	Choose an appropriate fiscal and monetary policy for a given state of the economy.	**K1**

UNIT-I	**Demand and Supply**	**(9Hrs)**
Principles of Demand and Supply- Supply Curves of Firms - Elasticity of Supply; Demand Curves of Households- Elasticity of Demand; Equilibrium and Comparative Statics (Shift of a Curve and Movement along the Curve).		**CO1**

UNIT-II	**Welfare Analysis and Consumer Behaviour**	**(9Hrs)**
Consumers' and Producers' Surplus - Price Ceilings and Price Floors; Consumer Behaviour- Axioms of Choice - Budget Constraints and Indifference Curves; Consumer's Equilibrium- Effects of a Price Change, Income and Substitution Effects -Derivation of a Demand Curve; Applications- Tax and Subsidies -Intertemporal Consumption - Suppliers' Income Effect.		**CO2**

UNIT-III	**Production Concept and Cost Concept**	**(9Hrs)**
Theory of Production - Production Function and Iso-quants - Cost Minimization; Cost Curves- Total, Average and Marginal Costs - Long Run and Short Run Costs; Equilibrium of a Firm Under Perfect Competition; Monopoly and Monopolistic Competition.		**CO3**

UNIT- IV	**Macroeconomic Measures of Performance**	**(9Hrs)**
National Income and its Components- GNP, NNP, GDP, NDP; Consumption Function; Investment; Simple Keynesian Model of Income Determination and the Keynesian Multiplier; Government Sector- Taxes and Subsidies; External Sector- Exports and Imports.		**CO4**

UNIT- V	**Stabilization Policy**	**(9Hrs)**
Money- Definitions; Demand for Money-Transactionary and Speculative Demand; Supply of Money- Bank's Credit Creation Multiplier; Integrating Money and Commodity Markets- IS, LM Model; Business Cycles and Stabilization- Monetary and Fiscal Policy - Central Bank and the Government; The Classical Paradigm- Price and Wage Rigidities - Voluntary and Involuntary Unemployment.		**CO5**

Text Books

1. Pindyck, Robert S., and Daniel L. Rubinfeld, "Microeconomics", Pearson, Eigth Edition, 2012.
2. Dornbusch, Fischer and Startz, "Macroeconomics", Tata McGraw Hill, Twelfth Edition, 2018.
3. Paul Anthony Samuelson, William D. Nordhaus, "Economics", Tata McGraw Hill, Nineteenth Edition, 2010

Reference Books

1. Hal R, Varian, "Intermediate Microeconomics: A Modern Approach", W.W. Norton & Company, Eighth Edition, 2010.
2. N. Gregory Mankiw, Principles of Macroeconomics, Cengage, Eighth Edition, 2015.
3. Case, Karl E., and Ray C. Fair, "Principles of microeconomics", Pearson Education, Thirteenth Edition, 2020.
4. Koutsoyiannis, Anna. Modern microeconomics. Springer, Second Edition, 1975.
5. McConnell, Campbell R., Stanley L. Brue, and Sean Masaki Flynn, "Economics: Principles, problems, and policies", Boston McGraw-Hill/Irwin, 21st Edition, 2018.
6. Froyen, Richard T., and Stephen J. Perez, "Macroeconomics: Theories and policies", Macmillan, 1990.
7. Goodwin, Neva, et al, "Macroeconomics in context", ME Sharpe, Third Edition, 2013.

Web References

1. http://economics.mit.edu/
2. http://hbswk.hbs.edu/
3. http://www.cbsnews.com/moneywatch/

4. http://mruniversity.com/
5. http://www.economist.com/
6. http://www.bloomberg.com/
7. http://www.moneyweek.com/

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	-	-	-	-	-	1	-	-	-	-	-	1	1	-
2	1	-	-	-	-	-	1	-	-	-	-	-	1	-	-
3	1	-	-	-	-	-	1	-	-	-	-	-	1	1	-
4	1	-	-	-	-	-	1	-	-	-	-	-	1	-	-
5	1	-	-	-	-	-	1	-	-	-	-	-	-	-	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**EEE and ECE**	Programme: **B.Tech.**						
Semester	**II**	Course Category: **ES**				End Semester Exam Type: **TE**		
Course Code	**U23ESTC03**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Basics of Electrical and Electronics Engineering**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

(Common to CSE, IT, MECH, CIVIL, MCTR, CCE, AI&DS, FT and CSBS Branches)

Prerequisite	**Mathematics and Physics**	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Apply the basic concepts and various laws in DC circuits.	**K3**
	CO2 Analyze the AC circuits and develop resonance conditions for transmitter and receiver circuits.	**K3**
	CO3 Gain the knowledge of power system components, importance of electrical safety measures and real time applications of transformer and motor.	**K2**
	CO4 Understand the operator of semiconductor diode and its applications.	**K2**
	CO5 Explain the characteristics and operation of BJT and FET.	**K2**
	CO6 Relate and Explain Different Communication Systems.	**K2**

Section A – Electrical Engineering

UNIT - I	**DC Circuits**	**Periods: 8**
Concept of Potential Difference, Current, Resistance, Inductance and Capacitance, Work, Power, Energy, Current and Voltage sources - ideal and practical sources - concept of dependent and independent sources, Ohm's law, Kirchhoff's law, Series parallel combination of R, L, C components, Voltage Divider and Current Divider Rules, Mesh and Nodal analysis, Star/Delta transformation, Network Theorems - Superposition, Thevenin, Norton and Maximum Power Transfer.		**CO1**
UNIT - II	**AC Circuits**	**Periods: 8**
AC waveform definitions - form factor, peak factor, R-L, R-C, RLC series circuit, R-L-C parallel circuit, phasor representation in polar and rectangular form, concept of impedance, admittance, active, reactive, apparent and complex power, power factor, Resonance in series and parallel circuits, band-width and quality factor, Three Phase balanced AC Circuits (Y-Δ and Y-Y) - Power Measurement – Two Wattmeter method.		**CO2**
UNIT - III	**Electrical Safety and Electrical Machines**	**Periods: 7**
Layout of electrical power system and its functions, Wiring Accessories, Types of domestic wiring, Necessity of earthing, insulators and cables, Safety devices - fuse, relay and circuit breaker - Sensors and its types. Faraday's Law of electromagnetic induction, Fleming's Right and Left hand rule - DC Generator and DC Motor - construction, principle, load test and performance characteristics - Auto transformer, Single phase transformer- construction, principle, load test - Single phase capacitor start and run induction motor – Load test.		**CO3**

Section B – Electronics Engineering

UNIT - IV	**Semiconductor Diodes And Applications**	**Periods: 7**
Introduction semiconductor materials – Doping - Intrinsic and Extrinsic Semiconductor – PN junction diode, structure, characteristics - diffusion and depletion capacitance - Rectifier, Half wave and Full wave rectifier - zener diode characteristics - zener diode as regulator – Light Emitting Diode (LED) - Solar Cell.		**CO4**
UNIT - V	**Transistors**	**Periods: 7**
Bipolar Junction Transistor - construction – operation - Common Base, Common Emitter, Common collector Configuration – characteristics – Biasing - numerical application. Junction Field Effect Transistor (JFET), Metal oxide semiconductor Field Effect Transistor, EMOSFET-DMOSFET operation characteristics - Numerical application.		**CO5**
UNIT - VI	**Communication Systems**	**Periods: 8**
Need for Modulation – Block diagram of analog communication System - AM, FM, PM Definitions and Waveforms – Comparison of digital and analog communication system- Block diagram of digital communication system – Electromagnetic Spectrum. Wired and wireless Channel – Block diagram of communication systems – satellite communication – Cellular Mobile Communication – Fibre Optical Communication System.		**CO6**

Lecture Periods: 45	**Tutorial Periods:-**	**Practical Periods:-**	**Total Periods: 45**

Text Books

1. R. K. Rajput, "Basic Electrical and Electronics Engineering", University Science Press, 2nd Edition, 2017.
2. Dr. R. Saravanakumar, Dr.V. Jegathesan, Dr. K. Vinoth Kumar, Dr. K. Kowsalya, "Basic Electrical and Electronics Engineering", Wiley Publisher, 2nd Edition, 2022.
3. R. Muthusubramaniam, S. Salivahanan and K. A. Mureleedharan, "Basic Electrical Electronics and Computer Engineering", Tata McGraw Hill, 2018.

Reference Books

1. A. Sudhakar and S. P. Shyam Mohan, "Circuits and Networks: Analysis and Synthesis", Tata McGraw Hill Publishing Company Ltd., New Delhi, 4th Edition, 2017.
2. D. P. Kothari and I. J. Nagrath, "Electric Machines", Tata McGraw Hill, New Delhi, 5th Edition, 2017.

3. B. L. Theraja, A. K. Theraja, “A Textbook of Electrical Technology – Volume - II”, S Chand & Co. Ltd., New Delhi, 23rd Edition, 2009.
4. David. A. Bell, “Electronic Devices and Circuits”, PHI Learning Private Ltd, India, 4th Edition, 2020
5. Wayne Tomasi, “Electronic Communication Systems- Fundamentals Theory Advanced”, Pearson Education, 6th Edition, 2018.

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1. https://nptel.ac.in/courses/108/108/108108076/
2. https://www.electrical4u.com/
3. https://nptel.ac.in/courses/108/102/108102146/
4. https://onlinecourses.nptel.ac.in/noc21_ee55/
5. https://nptel.ac.in/courses/117/102/117102059

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	-	2	-	-	-	-	-	-	1	3	2	-
2	3	3	3	-	2	-	-	-	-	-	-	1	3	2	-
3	3	3	3	-	2	-	-	-	-	-	-	1	3	2	-
4	3	3	3	-	2	-	-	-	-	-	-	1	3	2	-
5	3	3	3	-	2	-	-	-	-	-	-	1	3	2	-
6	3	3	3	-	2	-	-	-	-	-	-	1	3	2	-

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Artificial Intelligence and Data Science**	Programme: **B.Tech**					
Semester	**II**	Course Category: **ES**			End Semester Exam Type: **TE**		
Course Code	**U23ADTC01**	Periods / Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	**Programming In Python**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
	(Common to All Branches)							
Prerequisite	NIL							

Course Outcome		On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1	Interpret the basic concepts of Python programs.	**K2**
	CO2	Articulate the concepts of Sets, Dictionaries and Object-Oriented concepts.	**K2**
	CO3	Experiment with Numpy package.	**K3**
	CO4	Apply and analyze Data Manipulation with Pandas.	**K3**
	CO5	Illustrate programming concept for Visualization with Matplotlib.	**K3**

UNIT-I	**Introduction To Python**	**Periods: 09**
Structure of Python Program – Underlying mechanism of Module Execution – Branching and Looping – Problem Solving Using Branches and Loops – Functions – Lambda Functions – Lists and Mutability – Problem Solving Using Lists and Functions.		**CO1**

UNIT-II	**Sequence Datatypes and Object-Oriented Programming**	**Periods: 09**
Sequences – Mapping and Sets – Dictionaries. Classes: Classes and Instances – Inheritance – Exception Handling – Introduction to Regular Expressions using “re” module.		**CO2**

UNIT-III	**Using Numpy**	**Periods: 09**
Basics of NumPy – Computation on NumPy – Aggregations – Computation on Arrays – Comparisons – Masks and Boolean Arrays – Fancy Indexing – Sorting Arrays – Structured Data: NumPy’s Structured Array.		**CO3**

UNIT-IV	**Data Manipulation with Pandas**	**Periods: 09**
Introduction to Pandas Objects – Data indexing and Selection – Operating on Data in Pandas – Handling Missing Data – Hierarchical Indexing – Combining Data Sets. Aggregation and Grouping – Pivot Tables –Vectorized String Operations – Working with Time Series – High Performance Pandas – eval() and query().		**CO4**

UNIT-V	**Visualization with Matplotlib**	**Periods: 09**
Basic functions of Matplotlib – Simple Line Plot – Scatter Plot – Density and Contour Plots – Histograms – Binnings and Density – Customizing Plot Legends – Colour Bars – Three-Dimensional Plotting in Matplotlib.		**CO5**

Lecture Periods: 45	**Tutorial Periods:**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Jake VanderPlas, “Python Data Science Handbook - Essential Tools for Working with Data”, O’Reily Media Inc, 2016.
2. Zhang.Y, “An Introduction to Python and Computer Programming”, Springer Publications, 2016.
3. Wesley J Chun, “Core Python Programming”, Pearson Education, 2nd Edition, 2006.

Reference Books

1. John Paul Mueller, Luca Massaron, “Python for Data Science for Dummies”, 2nd Edition, John Wiley& Sons, 2019.
2. Jesus Rogel-Salazar, “Data Science and Analytics with Python”, CRC Press Taylor and Francis Group, 2017.
3. Brian Draper, “Python Programming A Complete Guide for Beginners to Master and Become an Expert in Python Programming Language”, CreateSpace Independent Publishing Platform, 2016.
4. Mark Lutz, Laura Lewin, Frank Willison, “Programming Python”, O'Reilly Media, 3rd Edition, 2006.
5. Gowrishankar S, Veena A, “Introduction to Python Programming”, CRC Press, 2018.

Web References

1. https://nptel.ac.in/courses/106/106/106106212/
2. https://www.geeksforgeeks.org/data-analysis-visualization-python/
3. https://www.coursera.org/learn/python-data-analysis
4. https://www.python.org/
5. https://www.programiz.com/python-programming

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	3	-	-	-	-	-	-	-	3	-	3
2	2	2	1	3	-	-	-	-	-	-	-	2	2	2	3
2	3	2	2	3	-	-	-	-	-	-	-	2	3	2	3
3	3	3	2	3	-	-	-	-	-	-	-	3	3	3	3
2	3	3	2	3	-	-	-	-	-	-	-	2	3	3	3
3	3	3	2	3	-	-	-	-	-	-	-	3	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Computer Science and Business Systems**	Programme: **B.Tech.**						
Semester	**II**	Course Category: PC				*End Semester Exam Type: **TE**		
Course Code	**U23CBT202**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**DATA STRUCTURES & ALGORITHMS**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

Course Objectives	**1)**	To understand performance analysis of an algorithm
	2)	To learn linear data structures
	3)	To learn non-linear data structures
	4)	To understand sorting, searching and hashing algorithms
	5)	To learn file organization and accessing methods

Course Outcome	**On completion of the course, the students will be able to**		BT Mapping (Highest Level)
	CO1	Understand the usage and analysis of algorithms in computing.	**K1**
	CO2	Implement and apply linear data structures to solve various problems	**K3**
	CO3	Represent and apply non-linear data structures to solve real time problems	**K2**
	CO4	Develop and analyse algorithms for sorting and searching data organized in linear and non-Linear data structures.	**K3**
	CO5	Understand various file organization and accessing methods	**K2**

UNIT-I	**Concepts of Algorithm and Data Organisation**	**(9Hrs)**
Algorithm specification – Recursion - Performance analysis - Asymptotic Notation - The Big-O - Omega and Theta notation - Programming Style - Refinement of Coding - Time-Space Trade Off – Testing - Data Abstraction		**CO1**

UNIT-II	**Linear Data Structure**	**(9Hrs)**
Array - Stack - Queue - Linked-list and its types - Various Representations - Operations & Applications of Linear Data Structures.		**CO2**

UNIT-III	**Non-Linear Data Structure**	**(9Hrs)**
Trees - Binary Tree - Threaded Binary Tree - Binary Search Tree – B-Tree - B+ Tree - AVL Tree - Splay Tree. Graphs: Basic Terminologies - Directed – Undirected - Various Representations - Operations - Graph search and traversal algorithms - complexity analysis - Applications of Non-Linear Data Structures.		**CO3**

UNIT- IV	**Searching And Sorting On Various Data Structures**	**(9Hrs)**
Sequential Search - Binary Search - Comparison Trees - Breadth First Search - Depth First Search Insertion Sort - Selection Sort - Shell Sort - Divide and Conquer Sort - Merge Sort - Quick Sort- Heapsort - Introduction to Hashing		**CO4**

UNIT- V	**File Concepts**	**(9Hrs)**
File Organisation – Sequential – Direct - Indexed Sequential - Hashed and various types of accessing schemes.		**CO5**

Text Books

1. E. Horowitz, S. Sahni, S. A-Freed, “Fundamentals of Data Structures”, Universities Press, Second Edition, 2008.
2. A. V. Aho, J. E. Hopperoft, J. D. Ullman, “Data Structures and Algorithms”, Pearson, First Edition, 2003.
3. Gregory L. Heilman, Data Structures, Algorithms and Object Oriented Programming, Tata Mcgraw-Hill, New Delhi, 2002.
4. Jean-Paul Tremblay and Paul G. Sorenson, An Introduction to Data Structures with Applications, Second Edition, Tata McGraw-Hill, New Delhi, 1991.
5. Alfred V. Aho, John E. Hopcroft and Jeffry D. Ullman, Data Structures & Algorithms, Pearson Education, New Delhi, 2006

Reference Books

1. Donald E. Knuth, “The Art of Computer Programming: Volume 1: Fundamental Algorithms”, Third Edition, Dorling Kindersley Pvt Ltd, Third Edition, 1997.
2. Thomas, H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, “Introduction to Algorithms”, The MIT Press,Third Edition,2009 .
3. Pat Morin, “Open Data Structures: An Introduction (Open Paths to Enriched Learning)”, UBC Press, Thirty First Edition, 2013.

Web References

1. https://www.tutorialspoint.com/data_structures_algorithms/index.htm
2. https://nptel.ac.in/courses/106/102/106102064/
3. https://www.geeksforgeeks.org/data-structures/
4. https://www.javatpoint.com/data-structure-tutorial

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	-	-	-	-	-	-	-	-	-	-	-	1	-	-
2	3	2	1	-	-	-	-	-	-	-	-	-	2	1	-
3	2	1	-	-	-	-	-	-	-	-	-	-	2	1	-
4	3	2	1	-	-	-	-	-	-	-	-	-	3	2	-
5	2	1	-	-	-	-	-	-	-	-	-	-	1	1	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**English**	Programme: **B.Tech.**						
Semester	**II**	Course Category: **HS**			*End Semester Exam Type:**TE**			
Course Code	**U23ENB202**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**BUSINESS COMMUNICATION & VALUE SCIENCE - II**	**2**	**0**	**2**	**3**	**50**	**50**	**100**
(Common to ALL Branches except CSBS)								

Prerequisite	Basics of Communication Skills	
Course Outcome	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand tools of structured written communication	**K2**
	CO2 Apply the mechanics of creative writing with precision and clarity	**K3**
	CO3 Acquire the skill to work in team and professionally groom the overall personality	**K3**
	CO4 Develop the art of reviewing and giving feedback	**K3**
	CO5 Understands varied effective communication skills and express the ideas with clarity and focus	**K2**

UNIT-I	**Societal Needs and Expertise Writing**	**Periods:10**	
Individual identification of social issues - Theory to introduce the participant - Class discussion: Good and Bad Writing - Common errors, punctuation rules, and use of technical words. Refer Catherine Morris and Joanie McMahon's writing techniques-. The personal take away acquired from GD,			**CO1**

UNIT-II	**Innovative Designing Skills**	**Periods:10**	
Each group will form an NGO. Create Vision, Mission, Value statement, tagline and Design a logo. Introduction to basic presentation skills & ORAI app. Skimming and Scanning.			**CO2**

UNIT-III	**Interpersonal Skills**	**Periods:10**	
Ad campaign- Brain storming, , Intro of Dr. Meredith Belbin and his research on team work, Belbin's 8 Team Roles and Lindgren's Big 5 personality traits. Team Falcon Practical to identify individual personality traits with Belbin's 8 team player styles. Design a skit, and Enact the play on interpersonal skills			**CO3**

UNIT-IV	**Reviewing**	**Periods:15**	
List of Exercises **Listening:** Awareness related to "Join Hands Movement', A short film on diversity **Speaking:** Debriefing of the Practical.- Film: "The fish and I'' by Babak Habibifar" (1.37mins), **Reading:** Research on a book, incident or film based on the topic of your respective NGO and give feedback. **Writing:** Groups to create a story – 10 minutes of a person's life affected by the social issue groups are working on			**CO4**

UNIT-V	**Diversified Communication Skills**	**Periods:15**	
List of Exercises **Listening:** Teams to video record interviews of people from diverse groups. Share the recordings in FB - - **Speaking:** Debate - Discussion on TCS values **Reading:** Diversity & Inclusion - Different forms of Diversity in society **Writing:** Write a review in a blog on the topics they are covering in their research			**CO5**

LecturePeriods:30	**Tutorial Periods: -**	**Practical Periods:30**	**Total Periods:60**

Text Books

1. Dr.Kalam , Abdul .A.P.J & Mahapragya ,Acharya.."The Family and the Nation"; 2015;:
2. Kumar, Sanjay, Pushpalatha," Communication Skills". Oxford University Press, 2018.
3. Raman, Meenakshi&Sangeetha Sharma," Communication Skills", New Delhi: OUP,2018.

Reference Books

1. Peter H. Diamandis,Steven Kotler, "Abundance: The Future is Better Than You Think", : Free Press, 21 Feb, 2012
2. Sinek,simon, " Start With Why: How Great Leaders Inspire Everyone to Take Action" Penguin, 6 October 2011
3. Grussendorf, Marion, "E nglish for Presentations". Oxford University Press, Oxford, 2007.
4. Seely John, "The Oxford Guide to Writing and Speaking", Oxford University Press, 2006.
5. Dr.Kalam , Abdul .A.P.J, " Guiding Souls : Dialogues on the purpose of life" , 2005

Web References

1. https://www.indeed.com/career-advice/finding-a-job/how-to-write-an-application-letter
2. https://owlcation.com/humanities/Four-Types-of-Writing
3. https://targetstudy.com/languages/english/paragraph-writing.html
4. https://www.businessnewsdaily.com/8262-email-etiquette-tips.html
5. https://www.youtube.com/watch?v=UOceysteIjo

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	-	-	-	-	-	-	-	-	3	-	1	-	-	-
2	1	-	-	-	-	-	-	-	-	3	-	1	-	-	-
3	1	-	-	-	-	-	-	-	-	3	-	1	-	-	-
4	1	-	-	-	-	-	-	-	-	3	-	1	-	-	-
5	1	-	-	-	-	-	-	-	-	3	-	1	-	-	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)									End Semester Examination (ESE) Marks (Practical – Internal Evaluation)	End Semester Examination (ESE) Marks (Theory)	Total Marks
	Continuous Assessment (Theory)					Continuous Assessment (Practical)						
	CAT 1	CAT 2	Model	Attendance	Total	Conduction of Practical	Report	Viva	Total			
Marks	5	5	5	5	20*	15	10	5	30*	30	75**	-
*To be weighted for 10 Marks					10	*To be weighted for 10 Marks			10		*To be weighted for 50 Marks	100

Department	**Computer Science and Business Systems**		Programme: **B.Tech.**					
Semester	**II**		Course Category: **BS**			*End Semester Exam Type: **LE**		
Course Code	**U23MAP201**		Periods / Week			Credit	Maximum Marks	
			L	T	P	C	CAM	ESE	TM
Course Name	**STATISTICAL METHODS AND MODELLING LABORATORY**		**0**	**0**	**2**	**1**	**50**	**50**	**100**
Course Outcome	**On completion of the course, the students will be able to**							BT Mapping (Highest Level)	
	CO1	Gain knowledge in the concepts of statistical methods and models.						**K2**	
	CO2	Trained for data collection on various fields of survey enabling them to classify them statistically.						**K3**	
	CO3	Familiarized in various statistical software.						**K3**	
	CO4	Find the correlation between two variables.						**K2**	
	CO5	Compute regression lines.						**K3**	

List of Experiments

1. Descriptive Statistics
2. Test for Single mean
3. Test for difference of mean
4. Standard Deviation
5. Sampling distributions
6. ANOVA One-way Classification
7. Two-way ANOVA
8. Chi-Square Test
9. Correlation and Regression (Simple and Multiple)
10. Maximum likelihood estimation

Lecture Periods:	**Tutorial Periods:**	**Practical Periods: 30**	**Total Periods: 30**

Web references

1. https://www.mathworks.com/help/matlab/ref/std.html
2. https://www.mathworks.com/help/stats/mle.html
3. https://wwhw.mathworks.com/help/stats/two-way-anova.html
4. https://youtu.be/ullVTCmQdpI
5. www.youtube.com/watch?v=ullVTCmQdpI

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	**Program Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
1	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-
2	2	2	1	1	-	-	-	-	-	-	-	-	-	-	-
3	3	2	1	1	-	-	-	-	-	-	-	-	-	-	-
4	2	1	-	-	-	-	-	-	-	-	-	-	1	-	-
5	2	2	1	1	-	-	-	-	-	-	-	-	1	1	-
1	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Department	**EEE and ECE**	Programme: **B.Tech.**						
Semester	**II**	Course Category: **ES**			End Semester Exam Type: **LE**			
Course Code	**U23ESPC01**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Basics of Electrical and Electronics Engineering Laboratory**	**0**	**0**	**2**	**1**	**50**	**50**	**100**

(Common to CSE, IT, MECH, CIVIL, MCTR, CCE, AI&DS, FT, CSBS Branches)

Prerequisite	Mathematics and Physics	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Build the different wiring for domestic and commercial applications.	**K3**
	CO2 Design and analyze the domestic power distribution.	**K3**
	CO3 Estimate the performance of transformer and motors by conducting load test.	**K3**
	CO4 Describe characteristics of semiconductor diode and utilize it for different applications	**K5**
	CO5 Relate the characteristics of various transistor	**K2**
	CO6 Understand Rectifiers and Regulators	**K2**

List of Experiments

Section– A Electrical Experiments

Demonstration on Power Sources, Ammeter, Voltmeter, Wattmeter and Energy meter are Pre-requisite for conducting this Electrical Engineering Lab.

1. Electrical safety precautions and study of tools, accessories, electrical joints and electrical symbols.
2. Domestic Wiring Practice
   - Staircase wiring
   - Doctor's room wiring
   - Godown wiring
   - Wiring of Ceiling fan, LED lamps and Iron Box.
3. Design of Domestic power distribution.
4. Measurement of 3-phase power using two wattmeter method
5. Load test on DC shunt motor.
6. Load test on single phase transformer.
7. Load test on single phase Induction Motor.

Section – B Electronics Experiments

1. Study of Electronic components and equipment: Resistor, Capacitor
2. Measurement of AC signal parameter (Peak-Peak, rms period, frequency) using CRO.
3. VI Characteristics of PN junction diode, Zener diode
4. Input and output characteristics of Common Emitter configuration of BJT
5. Characteristics of JFET
6. Measurement of Ripple factor of HWR, FWR
7. Voltage Regulator using Zener Diode

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 30**	**Total Periods: 30**

Reference Books

1. S. Gowri, T. Jeyapoovan Nadar, "Engineering Practices Lab Manual", Vikas Publishing House Private Limited, New Delhi, 5th Edition, 2014.
2. A. Sudhakar and S. P. Shyam Mohan, "Circuits and Networks: Analysis and Synthesis", Tata McGraw Hill Publishing Company Ltd., New Delhi, 5th Edition, 2017.
3. D. P. Kothari and I.J. Nagrath, "Electric Machines", Tata McGraw Hill, New Delhi, 5th Edition, 2017.
4. Edward Hughes, John Hiley, Keith Brown, Ian McKenzie Smith, "Electrical and Electronics Technology", Pearson Education Limited, New Delhi, 12th Edition, 2016.
5. S.K. Sahdev, "Fundamentals of Electrical Engineering and Electronics", Dhanpat Rai and Co, 2017.

Web References

1. http://eie.sliet.ac.in/laboratories/basic-electrical-engineering-lab/

2. https://www.electronics-tutorials.ws/accircuits/series-circuit.html
3. https://www.allaboutcircuits.com/textbook/experiments/
4. https://www.electronicshub.org/measurements-of-ac-current/
5. http://www.electronics-tutorials.ws

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	3	-	-	1	-	-	3	-	-	1	3	2	-
2	3	2	3	-	-	1	-	-	3	-	-	1	3	2	-
3	3	2	3	-	-	1	-	-	3	-	-	1	3	2	-
4	3	2	3	-	-	1	-	-	3	-	-	1	3	2	-
5	3	2	3	-	-	1	-	-	3	-	-	1	3	2	-
6	3	2	3	-	-	1	-	-	3	-	-	1	3	2	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in Practical classes			Model Practical Examination	Attendance		
	Conduction of Practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Department	**Artificial Intelligence and Data Science**	Programme: **B.Tech**						
Semester	**II**	Course Category: **ES**				End Semester Exam Type: **LE**		
Course Code	**U23ADPC01**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Programming in Python Laboratory**	**0**	**0**	**2**	**1**	**50**	**50**	**100**
	(Common to All Branches)							
Prerequisite	NIL							

Course Outcome		On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1	Describe common Python functionality and features used for data science.	**K2**
	CO2	Query Data Frame structures for cleaning and processing.	**K2**
	CO3	Configure your programming environment	**K3**
	CO4	Experiment the concept using data visualization.	**K3**
	CO5	Analyze real time datasets,	**K3**

List of Exercises

1. Build a python program to implement Fibonacci series.
2. Build a python program to get a range of numbers from user and to separate even numbers and odd numbers respectively.
3. Build a function in Python to check duplicate letters. It must accept a string, i.e., a sentence. The function should return True if the sentence has any word with duplicate letters, else return False.
4. Build a program to perform arithmetic operations using lambda function.
5. Build a Python program that takes a list of numbers as input and returns a new list containing only the even numbers from the input list.
6. Build a python program to create a class called Car with attributes Company, model, and year. Implement a method that returns the age of the car in years.
7. Build a python program to create a base class called Shape that has a method called area which returns the area of the shape (set it to 0 for now). Then, create two derived classes Rectangle and Circle that inherit from the Shape class to calculate the area of derived classes.
8. Build a python program to implement aggregation using Numpy.
9. Build a python program to perform Indexing and Sorting.
10. Build a python program to perform Handling of missing data.
11. Build a python program to perform usage of Pivot table using Titanic datasets
12. Build a python program to perform use of eval () and query ()
13. Build a python program to perform Scatter Plot
14. Build a python program to perform 3D plotting
15. Implement an application to process a real time data.

Lecture Periods:	**Tutorial Periods:**	**Practical Periods: 30**	**Total Periods: 30**

Reference Books

1. Chirag Shah, “A Hands-On Introduction to Data Science”, Cambridge University Press, 2020.
2. Siddhartha Chatterjee, Michal Krystyanczuk, “Python Social Media Analytics”, Packt Publishing, 2017.
3. Jake VanderPlas, “Python Data Science Handbook - Essential Tools for Working with Data”, O’Reily Media Inc, 2016.
4. Zhang.Y, “An Introduction to Python and Computer Programming”, Springer Publications, 2016.
5. Wesley J Chun, “Core Python Programming”, Pearson Education, 2nd Edition, 2006.

Web References

1. https://nptel.ac.in/courses/106/106/106106212/
2. https://www.geeksforgeeks.org/data-analysis-visualization-python/
3. https://www.coursera.org/learn/python-data-analysis
4. https://www.python.org/
5. https://www.programiz.com/python-programming

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	2	2	1	3	-	-	-	-	-	-	-	2	2	2
2	2	3	2	2	3	-	-	-	-	-	-	-	2	3	2
3	3	3	3	2	3	-	-	-	-	-	-	-	3	3	3
4	3	3	3	3	3	-	-	-	-	-	-	-	3	3	3
5	3	3	3	3	3	-	-	-	-	-	-	-	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Department	**Computer Science and Business Systems**		Programme: **B.Tech.**					
Semester	**II**		Course Category: **PC**			*End Semester Exam Type: **LE**		
Course Code	**U23CBP202**		Periods / Week			Credit	Maximum Marks	
			L	T	P	C	CAM	ESE	TM
Course Name	**DATA STRUCTURES AND ALGORITHMS LABORATORY**		**0**	**0**	**2**	**1**	**50**	**50**	**100**
Course Outcome	**On completion of the course, the students will be able to**							BT Mapping (Highest Level)	
	CO1	Solve the given problem by identifying the appropriate Data Structure.						**K3**	
	CO2	Implement and apply trees to improve accessing of data						**K3**	
	CO3	Apply graph to solve various real time problems						**K3**	
	CO4	Analyze the algorithm's / program's efficiency in terms of time and space complexity.						**K3**	
	CO5	Use linear data structures while solving simple and complex problems						**K3**	

List of Experiments

1. Towers of Hanoi using user defined stacks.
2. Reading, writing, and addition of polynomials.
3. Line editors with line count, word count showing on the screen.
4. Trees with all operations.
5. All graph algorithms.
6. Saving / retrieving non-linear data structure in/from a file

Lecture Periods:	**Tutorial Periods:**	**Practical Periods: 30**	**Total Periods: 30**

1. E. Horowitz, S. Sahni, S. A-Freed ,"Fundamentals of Data Structures", Universities Press.
2. Jean-Paul Tremblay and Paul G. Sorenson, An Introduction to Data Structures with Applications, Second Edition, Tata McGraw-Hill, New Delhi, 1991.
3. Alfred V. Aho, John E. Hopcroft and Jeffry D. Ullman, Data Structures & Algorithms, Pearson Education, New Delhi, 2006

Web references

6. Donald E. Knuth,"The Art of Computer Programming: Volume 1: Fundamental Algorithms", Pearson,Third Edition, 2005.
7. Thomas, H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", The MIT Press,Third Edition,2009 .
8. Pat Morin, "Open Data Structures: An Introduction (Open Paths to Enriched Learning)", UBC Press, Thirty First Edition, 2013.

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	3	-	-	-	-	-	-	-	3	1	-
2	3	2	1	1	3	-	-	-	-	-	-	-	3	1	-
3	3	2	1	1	3	-	-	-	-	-	-	-	3	1	-
4	3	2	1	1	3	-	-	-	-	-	-	-	3	1	-
5	3	2	1	1	3	-	-	-	-	-	-	-	3	1	-

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Department	**Computer Science and Business Systems**	Programme: **B.Tech.**						
Semester	**II**	Course Category: **MC**			End Semester Exam Type: -			
Course Code	**U23CBM202**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Sports Yoga and NSS**	0	0	2	Non-Credit	100	-	100
Prerequisite	**-**							

Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Practice Physical activities and Hatha Yoga focusing on yoga for strength, flexibility and relaxation.	**K2**
	CO2 Understand basic skills associated with yoga and physical activities including strength and flexibility, balance and coordination.	**K2**
	CO3 Develop understanding of psychological problems associated with age and lifestyle.	**K2**
	CO4 Recognize the importance of national service in community development.	**K2**
	CO5 Convert existing skills into socially relevant life skills.	**K2**

UNIT-I	**Introduction To Physical Education**	**Periods: 06**
Definition, Aims and Objectives of Physical Education - Changing trends in Physical Education **Physical Fitness, Wellness and Lifestyle:** Importance of Physical Fitness and Wellness - Components of Physical fitness - Components of Health related fitness - Components of wellness - Preventing Health Threats through Lifestyle Change - Concept of Positive Lifestyle.		**CO1**

UNIT-II	**Yoga and Lifestyle**	**Periods: 06**
Importance of Yoga - Elements of Yoga - Introduction - Asanas, Pranayama, Meditation and Yogic Kriyas - Yoga for concentration and related Asanas (Sukhasana, Tadasana, Padmasana and Shashankasana) - Relaxation Techniques for improving concentration - Yog-nidra. Asanas as preventive measures – Hypertension – Obesity - Back Pain-Diabetes - Asthema.		**CO2**

UNIT-III	**Training And Planning In Sports**	**Periods: 06**
Training - Warming up and limbering down-Skill, Technique and Style - Objectives of Planning – Tournament - Knock-Out, League/Round Robin and Combination. **Psychology and Sports** - Important of Psychology in Physical Education and Sports - Differentiate Between Growth and Development - Adolescent problems and their Management - Emotion: Concept, Type and Controlling of emotions - Concepts and Types of Aggressions in Sports - Psychological benefits of exercise - Anxiety and Fear and its effects on Sports Performance - Motivation, its type and techniques - Understanding Stress and Coping strategies		**CO3**

UNIT-IV	**Introduction To National Service Scheme**	**Periods: 06**
Orientation of NSS volunteers: History, motto, symbol, awards, structure and activities of NSS - Days of National and International Importance - Sensitizing about the thrust areas and awareness activities - Importance of tree plantation and voluntary blood donation - The role of SHGs and NGOs in community development – CSR - Life skills and youth development-extension activities in HEIs - various clubs and schemes like RRC, ELC, YRC, UBA, SBA, etc.,		**CO4**

UNIT-V	**Community Issues and The Use Of Technology**	**Periods: 06**
Common Problems of rural India - Technology development and its suitability – Sustainability - Value addition to agricultural products - Service learning and youth volunteering – Shramdaan - Campus cleaning - Field visit to nearby communities - village survey - Initiatives to clean and green environment - preservation of water bodies in adopted villages.		**CO5**

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 30**	**Total Periods: 30**

Reference Books

1. Brar Ajmer Singh, Gill Jagtar Singh, Bains Jagdish, “Modern Textbook of Physical Education Health and Sports- I”, Kalyani Publishers , 6th Edition, 2014
2. B.K.S. Iyengar, “Light on Yoga: The Definitive Guide to Yoga Practice”,Thorsons Publishers, Thorsons Classics edition, 2015
3. Joseph, Siby K, Mahodaya, “Bharat Essays on Conflict Resolution”, Institute of Gandhian Studies Publishers, 2007
4. Barman Prateeti , Goswami, “Document on Peace Education”, Triveni Akansha Publishing House, New Delhi, 2009
5. Prof R.B.S. Verma, “Field Work Practicum in Social Work-Emerging Concerns”, Rapid Publisher, Lucknow, 2020
6. Sibereisen, K , Richard M, “Lerner Approaches to Positive Youth Development”, Sage Publications, New Delhi, 2007
7. Hoshiar Singh, “Administration of Rural Development in India”,Sterling Publisher, the University of Michigan, 2009

Web References

1. http://www.thebetterindia.com/140/national-service-scheme-nss
2. http://en.wikipedia.org/wiki/national-service-scheme 19=http://nss.nic.in/adminstruct
3. http://nss.nic. in
4. http://socialworknss.org/about.html
5. Young Journal on Youth published by SAGE: http://you.sagepub.com

Evaluation methods

Assessment	Continuous Assessment Marks (CAM)			Total Marks
	Attendance	**MCQ Test**	**Presentation / Activity / Assignment**	
Marks	10	30	60	100

Department	**Computer Science and Business Systems**	Programme: **B.Tech.**						
Semester	**II**	Course Category: **AEC**			*End Semester Exam Type: **-**			
Course Code	**U23CBC2XX**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**CERTIFICATION COURSE-II**	**0**	**0**	**4**	**-**	**100**	**-**	**100**

Students shall choose an International certification course offered by the reputed organizations like Google, Microsoft, IBM, Texas Instruments, Bentley, Autodesk, Eplan and CISCO, etc. The duration of the course is 40-50 hours specified in the curriculum, which will be offered through Centre of Excellence.

Pass /Fail will be determined on the basis of participation, attendance, performance and completion of the course. If a candidate Fails, he/she has to repeat the course in the subsequent years. Pass in this course is mandatory for the award of degree.

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 5 0**	**Total Periods: 50**

Evaluation methods

Assessment	**Continuous Assessment Marks (CAM)**		**Total Marks**
	Attendance	**MCQ Test**	
Marks	10	90	100

Department	**CSBS**			Programme: **B.Tech.**				
Semester	**III**			Course Category: BS			*End Semester Exam Type: **TE**	
Course Code	**U23MAT305**			Periods / Week			Credit	Maximum Marks		
				L	T	P	C	CAM	ESE	TM
Course Name	**COMPUTATIONAL STATISTICS**			**3**	**1**	**0**	**4**	**25**	**75**	**100**
Course Objectives	**1)**	To know the multivariate normal distribution and its relation.								
	2)	To solve the multiple linear regression model and autocorrelation.								
	3)	To gain knowledge in multivariate regression								
	4)	To learn the discriminant and principal components								
	5)	To learn the factor and cluster analysis								
Course Outcome	**On completion of the course, the students will be able to**							BT Mapping (Highest Level)		
	CO1	Classify the Solution of multivariate normal distribution.						**K2**		
	CO2	Know the multiple linear regression model and autocorrelation.						**K2**		
	CO3	Know the multivariate regression.						**K3**		
	CO4	Analysis the discriminant and principal components.						**K3**		
	CO5	Analysis the factor and cluster analysis.						**K2**		
UNIT-I	**MULTIVARIATE NORMAL DISTRIBUTION**						**(9Hrs)**			
Multivariate Normal Distribution Functions, Conditional Distribution and its relation to regression model, Estimation of parameters.										**CO1**
UNIT-II	**MULTIPLE LINEAR REGRESSION MODEL**						**(9Hrs)**			
Standard multiple regression models with emphasis on detection of collinearity, outliers, non-normality and autocorrelation, Validation of model assumptions.										**CO2**
UNIT-III	**MULTIVARIATE REGRESSION**						**(9Hrs)**			
Assumptions of Multivariate Regression Models, Parameter estimation, Multivariate Analysis of variance and covariance										**CO3**
UNIT- IV	**DISCRIMINANT & PRINCIPAL COMPONENT ANALYSIS**						**(9Hrs)**			
Statistical background, linear discriminant function analysis, Estimating linear discriminant functions and their properties. Principal components, Algorithm for conducting principal component analysis, deciding on how many principal components to retain, H-plot.										**CO4**
UNIT- V	**FACTORS & CLUSTER ANALYSIS**						**(9Hrs)**			
Factor analysis model, Extracting common factors, determining number of factors, Transformation of factor analysis solutions, Factor scores. Introduction, Types of clustering, Correlations and distances, clustering by partitioning methods, hierarchical clustering, overlapping clustering, K-Means Clustering-Profiling and Interpreting Clusters.										**CO5**

Text Books

1. T.W. Anderson, “An Introduction to Multivariate Statistical Analysis”, 2 nd edition, 2003
2. J.D. Jobson ,” Applied Multivariate Data Analysis”, Vol I & II, 2 nd edition ,1991.
3. Magnus Lie Hetland ,”Beginning Python: From Novice to Professional”, 9th. Edition, 2005.

Reference Books

1. D.A. Belsey, E. Kuh and R.E. Welsch, “Regression Diagnostics, Identifying Influential Data and Sources of Collinearety”, New York, 1980.
2. D.C. Montgomery and E.A. Peck, “Introduction to Linear Regression Analysis”,5 th edition , 2012.
3. D.F. Morrison, “Multivariate Statistical Analysis”, 2013.

Web References

1. http://www.ams.sunysb.edu/~zhu/ams571/normals_quadratics_regressions.pdf
2. https://www.slideshare.net/jtneill/multiple-linear-regression
3. http://home.iitk.ac.in/~shalab/regression/Chapter3-Regression-MultipleLinearRegressionModel.pdf
4. https://www.slideshare.net/jewelmrefran/cluster-analysis-15529464

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	2	2	2	1	-	-	-	-	-	-	-	2	1	2
2	2	2	2	2	1	-	-	-	-	-	-	-	2	1	2
3	3	2	3	2	1	-	-	-	-	-	-	-	2	1	2
4	3	2	3	3	2	-	-	-	-	-	-	-	2	2	3
5	2	2	3	3	2	-	-	-	-	-	-	-	2	2	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**CSBS**			Programme: **B.Tech.**				
Semester	**III**			Course Category: PC			*End Semester Exam Type: **TE**	
Course Code	**U23CBT303**			Periods / Week			Credit	Maximum Marks
				L	T	P	C	CAM	ESE	TM
Course Name	**COMPUTER ORGANIZATION AND ARCHITECTURE**			**3**	**0**	**0**	**3**	**25**	**75**	**100**
Course Objectives	**1)**	To understand the basic structure and operation of a digital computer								
	2)	To learn the fundamentals of organizational and architectural aspects of control unit								
	3)	To obtain knowledge on pipelining concepts and parallel processing								
	4)	To acquire knowledge about processor and memory design of a digital computer								
	5)	To have a broad understanding of various system interfaces and Input output devices								
Course Outcome	**On completion of the course, the students will be able to**									BT Mapping (Highest Level)
	CO1	Identify and explain the basic structure of a computer and instruction sets with addressing modes								**K2**
	CO2	Apply fixed and floating-point arithmetic operations								**K2**
	CO3	Illustrate the concepts of CPU design pipelining and parallel processors								**K2**
	CO4	Choose the appropriate memory mapping procedure to enhance the performance of the system								**K2**
	CO5	Describe and identify the standard I/O interfaces and peripheral devices								**K2**
UNIT-I	**COMPUTER ORGANIZATION AND DESIGN**						**(9Hrs)**			
Functional blocks of a computer, Instruction set architecture of a CPU: Registers -instruction execution cycle- RTL interpretation of instruction- addressing modes- instruction set. Outlining instruction sets of some common CPUs										**CO1**
UNIT-II	**DATA REPRESENTATION AND COMPUTER ARITHMETIC**						**(9Hrs)**			
Data representation: Signed number -fixed and floating point number -character representation Computer arithmetic: Integer addition and subtraction, ripple carry adder, carry look-ahead adder, multiplication – shift-and-add- Booth multiplier- carry save multiplier-Division restoring and non-restoring techniques, floating point arithmetic, IEEE 754 format,										**CO2**
UNIT-III	**PROCESSOR AND CONTROL UNIT**						**(9Hrs)**			
Introduction to x86 architecture, CPU control unit design: Hardwired and micro-programmed design approaches - consideration design of a simple hypothetical CPU, Basic concepts of pipelining- throughput and speedup -pipeline hazards, Parallel Processors: Introduction to parallel processors- Concurrent access to memory - cache coherency, introduction to multicore processor, multiprocessor and cluster multiprocessor										**CO3**
UNIT- IV	**MEMORY ORGANIZATION**						**(9Hrs)**			
Semiconductor memory technologies- Memory interleaving, concept of hierarchical memory organization: auxiliary memory types and CD operations – Associate memory – Virtual memory -cache memory -cache size vs. block size- mapping functions- replacement algorithms- write policies										**CO4**
UNIT- V	**PERIPHERAL DEVICES AND THEIR CHARACTERISTICS**						**(9Hrs)**			
Input-output subsystems- I/O device interface- I/O transfers – program controlled- interrupt driven and DMA - privileged and non-privileged instructions -software interrupts and exceptions - Programs and processes – role of interrupts in process state transitions- I/O device interfaces – SCII, USB **Content Beyond Syllabus** Recent Intel processor architectures										**CO5**

Text Books

1. Morris Mano, "Computer System Architecture ", Prentice Hall of India, Third Edition, 2008
2. David A. Patterson and John L. Henessey, “Computer Organisation and Design”, Fifth edition, Morgan Kauffman / Elseveir, 2014
3. Carl Hamacher, Zvonko G. Vranesic, Safwat G. Zaky, Computer Organization, 5th edition, McGraw-Hill, 2014

Reference Books

1. John P.Hayes, Computer Architecture and Organisation, McGraw Hill, 2012.
2. William Stallings, Computer Organization and Architecture, 7th edition, Prentice-Hall of India Pvt. Ltd., 2016.
3. .Vincent P. Heuring, Harry F. Jordan, “Computer System Architecture”, 2nd Edition, Pearson Education, 2005.

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5. http://www.inetdaemon.com/tutorials/computers/hardware/cpu/
6. https://inst.eecs.berkeley.edu/~cs152/sp18/
7. http://users.ece.cmu.edu/~jhoe/doku/doku.php?id=18-447_introduction_to_computer_architecture

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	1	1	-	-	-	-	-	-	-	3	2	-
2	3	3	2	1	2	-	-	-	-	-	-	-	3	2	1
3	3	2	2	2	2	-	-	-	-	-	-	-	3	2	2
4	3	2	2	2	-	-	-	-	-	-	-	-	3	1	-
5	3	2	2	2	-	-	-	-	-	-	-	-	3	1	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**CSBS**	Programme: **B.Tech.**						
Semester	**III**	Course Category: PC				*End Semester Exam Type: **TE**		
Course Code	**U23CBT304**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**OBJECT ORIENTED PROGRAMMING IN C++**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

Course Objectives		
	1)	To introduce the concepts of Basic Object Oriented concepts and Programming Basics.
	2)	To understand in depth about the Classes and Objects.
	3)	To study the Operator overloading and Inheritance concepts.
	4)	To understand the Generic Programming and File I/O.
	5)	To apply object-oriented concepts to solve real time computing problems

Course Outcome	***After completion of the course, the students will be able to***	BT Mapping (Highest Level)
	CO1 Describe the programming elements of C++.	**K1**
	CO2 Explain the concepts Object oriented approach for finding Solutions	**K2**
	CO3 Solve various real-world problems using inheritance and polymorphism concept	**K3**
	CO4 Manipulate programs using concepts of Templates, files and streams in C++.	**K3**
	CO5 Exemplify simple applications using Object Oriented Design and Modeling.	**K3**

UNIT-I	**INTRODUCTION TO C++**	**(9Hrs)**
Procedural programming, An Overview of C, **Difference between C and C++:** Single line comments, Local variable declaration within function scope, function declaration, function overloading, stronger type checking, Reference variable, parameter passing – value vs reference, passing pointer by value or reference, Operator new and delete, the typecasting operator, Inline Functions in contrast to macro, default arguments		**CO1**
UNIT-II	**FUNDAMENTALS OF OBJECT ORIENTED PROGRAMMING**	**(9Hrs)**
Necessity for OOP, Data Hiding, Data Abstraction, Encapsulation, Procedural Abstraction, Class and Object. **More extensions to C in C++ to provide OOP Facilities:** Scope of Class and Scope Resolution Operator, Member Function of a Class, private, protected and public Access Specifier, this Keyword, Constructors and Destructors, friend class, error handling (exception)		**CO2**
UNIT-III	**ESSENTIALS OF OBJECT ORIENTED PROGRAMMING**	**(9Hrs)**
Operator overloading, Inheritance – Single and Multiple, Class Hierarchy, Pointers to Objects, Assignment of an Object to another Object, Polymorphism through dynamic binding, Virtual Functions, Overloading, overriding and hiding, Error Handling		**CO3**
UNIT- IV	**GENERIC PROGRAMMING AND I/O**	**(9Hrs)**
Generic Programming: Template concept, class template, function template, template specialization Input and Output: Streams, Files, Library functions, formatted output		**CO4**
UNIT- V	**OBJECT ORIENTED DESIGN AND MODELLING**	**(9Hrs)**
UML concept, Use case for requirement capturing, Class diagram, Activity diagram and Sequence Diagram for design, Corresponding C++ code from design		**CO5**

Text Books

4. BjarneStroustrup, “The C++ Programming Language “, Fourth Edition, Addison Wesley, 2013.
5. Debasish Jana,” C++ and Object-Oriented Programming Paradigm”, Third Edition, PHI Learning Pvt. Ltd, 2014.
6. E Balagurusamy,Object-Oriented Programming with C++, 7th Edition,2017

Reference Books

4. Bjarne Stroustrup, “A Tour of C++ “, Addison-Wesley Professional; 2nd Edition, 2018.
5. Scott Meyers “Effective Modern C++”, Shroff/O'Reilly; First Edition, 2014.
6. Stanley Lippman, Josée Lajoie , Barbara Moo , “C++ Primer”, 5th Edition, 2012.
7. Bjarne Stroustrup, "The Design and Evolution of C++", Addison-Wesley , 2005.
8. Alexanderscu “Modern C++ Design” Pearson; 1st Edition, 2004.

Web References

8. https://www.tutorialspoint.com/cplusplus/index.htm
9. http://www.cplusplus.com/doc/tutorial/
10. https://www.w3schools.com/cpp/

11. https://www.javatpoint.com/cpp-tutorial
12. https://www.geeksforgeeks.org/cpp-tutorial/

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	-	-	-	3	-	-	-	-	-	-	-	3	2	1
2	2	1	-	-	3	-	-	-	-	-	-	-	3	2	1
3	3	2	1	1	3	-	-	-	-	-	-	-	3	2	1
4	3	2	1	1	3	-	-	-	-	-	-	-	3	2	1
5	3	2	1	1	3	-	-	-	-	-	-	-	3	2	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**CSBS**			Programme: **B.Tech.**				
Semester	**III**			Course Category: PC			*End Semester Exam Type: **TE**	
Course Code	**U23CBT305**			Periods / Week			Credit	Maximum Marks		
				L	T	P	C	CAM	ESE	TM
Course Name	**PRINCIPLES OF OPERATING SYSTEMS**			**3**	**0**	**0**	**3**	**25**	**75**	**100**
Course Objectives	**1)**	To grasp a fundamental understanding of operating systems and processes								
	2)	To learn the concepts of CPU scheduling and Inter Process Communication								
	3)	To learn the concepts of Dead lock and Concurrent Programming								
	4)	To understand memory management concepts in OS								
	5)	Understand the concepts of I/O, file and disk management								
	6)	To learn the features of UNIX operating systems								
Course Outcome	***After completion of the course, the students will be able to***							BT Mapping (Highest Level)		
	CO1	Define the concepts of operating systems operations, processes and threads						**K2**		
	CO2	Apply the concepts of CPU scheduling and Inter Process						**K3**		
	CO3	Describe the concepts of Dead lock and Concurrent Programming.						**K2**		
	CO4	Simulate the principles of memory management						**K3**		
	CO5	Identify appropriate I/O, file system and disk organizations for a variety of computing scenario						**K2**		
UNIT-I	**INTRODUCTION AND PROCESS MANAGEMENT**						**(9Hrs)**			
Introduction: Concept of Operating Systems - Generations of OS- Types of OS-OS Services-Interrupt handling and System Calls- Basic architectural concepts of an OS - Concept of Virtual Machine- Resource Manager view-process view and hierarchical view of an OS. Processes: Definition-Process Relationship- Different states of Process- Process State transitions- Process Control Block (PCB) - Context switching. Thread: Definition- Various states- Benefits of threads- Types of threads-Concept of multithreads.										**CO1**
UNIT-II	**CPU SCHEDULING AND INTER PROCESS COMMUNICATION**						**(9Hrs)**			
Process Scheduling: Foundation and Scheduling objectives - Types of Schedulers- Scheduling criteria. Scheduling algorithms: Pre-emptive and non-pre-emptive- FCFS- SJF- RR-Multiprocessor scheduling- Real Time scheduling. Inter-process Communication: Concurrent processes, precedence graphs, Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Semaphores, Strict Alternation, Peterson's Solution, The Producer / Consumer Problem, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem, Barber's shop problem.										**CO2**
UNIT-III	**DEAD LOCK AND I/O**						**(9Hrs)**			
Deadlocks: Definition - Necessary and sufficient conditions for Deadlock - Deadlock Prevention, Deadlock Avoidance: Banker's algorithm - Deadlock detection and Recovery. Concurrent Programming: Critical region, conditional critical region, monitors, concurrent languages, communicating sequential process (CSP)										**CO3**
UNIT- IV	**MEMORY MANAGEMENT**						**(9Hrs)**			
Memory Management: Basic concept - Logical and Physical address maps - Memory allocation: Contiguous Memory allocation – Fixed and variable partition– Internal and External fragmentation and Compaction. Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference- Page allocation- Partitioning, Paging- Page fault-Working Set-Segmentation- Demand paging- Page Replacement algorithms: Optimal, FIFO – SC –NRU-LRU.										**CO4**
UNIT- V	**I/O ANDFILE MANAGEMENT**						**(9Hrs)**			
I/O Hardware: I/O devices- Device controllers-Direct Memory Access- Principles of I/O File Management: Concept of File- Access methods- File types- File operation- Directory structure-File System structure-Allocation methods -Free-space management - directory implementation- efficiency and performance. Disk Management: Disk structure- Disk scheduling – FCFS- SSTF- SCAN- C-SCAN- Disk reliability, Disk formatting, Boot-block, Bad blocks. Case study: UNIX OS file system										**CO5**

Text Books

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, “Operating System Concepts”, John Wiley & Sons (Asia) Pvt. Ltd, Ninth Edition,2017.
2. Gary Nutt, “Operating Systems- A Modern Perspective”, Pearson Education Pvt. Ltd, Second Edition, 2013.
3. Andrew S. Tanenbaum, “Modern Operating Systems”, 3rd edition Prentice Hall of India Pvt. Ltd,2015.

Reference Books

1. William Stallings, “Operating System”, Prentice Hall of India, 6th Edition, 2009
2. Charles Patrick Crowley, “Operating System: A Design-oriented Approach”Tata McGraw - Hill Edition 1998 21st reprint,2009 .
3. Maurice J. Bach , “Design of the Unix Operating Systems”Prentice-Hall2 nd edition ,1986
4. Daniel Pierre Bovet, Marco Cesati , “Understanding the Linux Kernel”O'Reilly Media, Incorporated publications,2 nd edition ,2005

Web References

1. https://nptel.ac.in/courses/106108101/
2. http://www.tcyonline.com/tests/operating-system-concepts
3. http://www.galvin.info/history-of-operating-system-concepts-textbook
4. http://www.ittestpapers.com/operating-system-concepts

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	3	-	-	-	-	-	-	-	3	-	-
2	3	2	1	1	3	-	-	-	-	-	-	-	2	2	-
3	2	1	-	-	3	-	-	-	-	-	-	-	2	2	1
4	3	2	1	1	3	-	-	-	-	-	-	-	2	2	1
5	2	1	-	-	3	-	-	-	-	-	-	-	2	2	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**CSBS**		Programme: **B.Tech.**					
Semester	**III**		Course Category: PC			*End Semester Exam Type: **TE**		
Course Code	**U23CBT306**		Periods / Week			Credit	Maximum Marks	
			L	T	P	C	CAM	ESE	TM
Course Name	**DATABASE SYSTEM CONCEPTS**		**3**	**0**	**0**	**3**	**25**	**75**	**100**
Course Objectives	**1)**	To understand the various data models, conceptualize E-R diagram and depict using relational model							
	2)	To gain knowledge about database languages and frame query using Relational Algebra and SQL							
	3)	To understand and design an efficient database schema using the various normal forms							
	4)	To impart knowledge on data storage and transaction processing, concurrency control techniques and recovery procedures							
	5)	To explore knowledge on database security							
Course Outcome	***After completion of the course, the students will be able to***								BT Mapping (Highest Level)
	CO1	Explain the concepts of Database Management System							**K2**
	CO2	Manipulate and build database queries using Structured and Relational Query Language							**K3**
	CO3	Use data normalization principles to develop a normalized database for a given application.							**K3**
	CO4	Illustrate various transactions and recovery techniques							**K2**
	CO5	Describe the concepts of Database Security							**K2**

UNIT-I	**INTRODUCTION**	**(9Hrs)**	
Introduction: Introduction to Database. Hierarchical, Network and Relational Models. **Database system architecture:** Data Abstraction, Data Independence, Data Definition Language (DDL), Data Manipulation Language (DML).			**CO1**
UNIT-II	**DATA MODELS AND DATABASE LANGUAGES**	**(9Hrs)**	
Data models: Entity-relationship model, network model, relational and object oriented data models, integrity constraints, data manipulation operations. **Relational query languages:** Relational algebra, Tuple and domain relational calculus, SQL3, DDL and DML constructs, Open source and Commercial DBMS - MYSQL, ORACLE, DB2, SQL server			**CO2**
UNIT-III	**RELATIONAL-DATABASE DESIGN**	**(9Hrs)**	
Relational database design: Domain and data dependency, Armstrong's axioms, Functional Dependencies, Normal forms, Dependency preservation, Lossless design. **Query processing and optimization**: Evaluation of relational algebra expressions, Query equivalence, Join strategies, Query optimization algorithms.			**CO3**
UNIT- IV	**DATA STORAGE AND TRANSACTIONS**	**(9Hrs)**	
Storage strategies: Indices, B-trees, Hashing. **Transaction processing:** Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp based schedulers, Multi-version and optimistic Concurrency Control schemes, Database recovery.			**CO4**
UNIT- V	**DATABASE SECURITY**	**(9Hrs)**	
Database Security: Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQL injection. **Content beyond Syllabus** **Advanced topics:** Object oriented and object relational databases, Logical databases, Web databases, Distributed databases, Data warehousing and data mining.			**CO5**

Text Books

1. Silberschatz, Korth, Sudarshan, Database System Concepts, 7thEdition – McGraw-Hill Higher Education, International Edition, 2020.
2. Ramez Elmasri, and Shamkant B. Navathe, Fundamentals of Database Systems (7th edition), ,Publisher: Pearson,2017.
3. Raghu Ramakrishnan, —Database Management Systems, Fourth Edition, McGraw-Hill College

Publications, 2015.

Reference Books

1. J. D. Ullman ,Principles of Database and Knowledge – Base Systems, Vol 1,2016
2. R. Elmasri and S. Navathe ,Fundamentals of Database Systems,2015
3. Serge Abiteboul, Richard Hull and Victor Vianu, Foundations of Databases: The Logical Level,1994

Web References

1. http://www.database.com/
2. http://cassandra.apache.org/
3. https://www.mongodb.com/

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	3	-	-	-	-	-	-	-	3	-	-
2	3	2	1	1	3	-	-	-	-	-	-	-	3	2	-
3	3	2	1	1	3	-	-	-	-	-	-	-	3	2	1
4	2	1	-	-	3	-	-	-	-	-	-	-	3	1	1
5	2	1	-	-	3	-	-	-	-	-	-	-	3	1	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**CSBS**			Programme: **B.Tech.**				
Semester	**III**			Course Category: **PC**		*End Semester Exam Type:**TE**		
Course Code	U23CBB301			Periods/Week			Credit	Maximum Marks
				L	T	P	C	CAM	ESM	TM
Course Name	**FORMAL LANGUAGES AND AUTOMATA THEORY**			**2**	**-**	**2**	**3**	**50**	**50**	**100**
Prerequisite	Discrete Mathematics & Basic Computer Science Concepts									
Course objectives	**1.**	To know about the fundamental concepts of finite automata and its minimization								
	2.	To construct the regular expressions and context free grammars for various languages								
	3.	To construct the Push down stack machine and context sensitive language								
	4.	To construct basic Turing machine for its recursive languages and functions								
	5.	To solve various undecidability, P, NP and NP completeness problems								
Course Outcome	**On completion of the course, the students will be able to**								BT Mapping (Highest Level)	
	CO1	Illustrate the concepts of finite automata and reduce the states in finite automata.							**K2**	
	CO2	Design regular expressions and context free grammars for various languages.							**K2**	
	CO3	Familiarize the concepts of Push down stack machine and context sensitive language							**K3**	
	CO4	Construct Turing machine for its recursive languages and functions							**K3**	
	CO5	Determine and classify the various undecidability, P, NP and NP completeness problems							**K2**	

UNIT-I	**FINITE AUTOMATA**	**Periods:10**	
Introduction: Alphabet, languages and grammars, productions and derivation, Chomsky hierarchy of languages. **Regular languages and finite automata:**, Deterministic finite automata (DFA), nondeterministic finite automata (NFA), equivalence with DFA and NFA, Myhill-Nerode theorem and its uses, minimization of finite automata			**CO1**
UNIT-II	**REGULAR AND CONTEXT-FREE LANGUAGES**	**Periods:10**	
Regular expressions and languages, regular grammars and equivalence with finite automata, properties of regular languages, Kleene's theorem, pumping lemma for regular languages, **Context-free languages:** Context-free grammars (CFG) and languages (CFL), parse trees, ambiguity in CFG, Chomsky and Greibach normal forms, pumping lemma for context-free languages, closure properties of CFLs			**CO2**
UNIT-III	**PUSHDOWN AUTOMATA AND CONTEXT-SENSITIVE LANGUAGES**	**Periods:10**	
Pushdown Automata: Pushdown automata (PDA), Deterministic pushdown automata, Nondeterministic pushdown automata and equivalence with CFG, **Context-sensitive languages:** Context-sensitive grammars (CSG) and languages, linear bounded automata and equivalence with CSG.			**CO3**
UNIT-IV	**Finite and Turing Machines**	**Periods:15**	
List of Exercises: 1. Conversion from Regular Expression to DFA 2. Conversion from CFG to PDA 3. Construction of Turing Machine 4. Variants of Turing Machine 5. Deterministic, Nondeterministic - Turing Machine 6. TMs as enumerators			**CO4**
UNIT-V	**UNDECIDABILITY AND COMPLEXITY**	**Periods:15**	
List of Exercises: 1. Rice's theorem 2. Example for undecidable problems 3. Calculation of Time complexity of Deterministic Turing machines 4. Calculation of Time complexity of Nondeterministic Turing machines 5. NP- completeness Problem			**CO5**

LecturePeriods:30	**Tutorial Periods: -**	**Practical Periods:30**	**Total Periods:60**

Text Books

1. John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman, "Introduction to Automata Theory, Languages, and Computation",Third Edition, Pearson Education, 2013.
2. Peter Linz, "An introduction to Formal Languages and Automata", Sixth Edition, Jones & Bartlett, 2016
3. K.V.N Sunitha and N.Kalyani , "Formal Languages and Automata Theory", Pearson Education India, 2015

Reference Books

1. Harry R. Lewis and Christos H. Papadimitriou,"Elements of the Theory of Computation", Second Edition, Prentice Hall of India,2003.
2. Dexter C. Kozen, "Automata and Computability", Springer-Verlag, Berlin, 1997.
3. Michael Sipser, "Introduction to the Theory of Computation , "Third Edition, Cengage Learning, 2013.
4. John C. Martin, "Introduction to Languages and the Theory of Computation ", Fourth Edition, McGraw-Hill, 2011.
5. M. R. Garey and D. S. Johnson, "Computers and Intractability: A Guide to the Theory of NP Completeness ", A Series of Books in the Mathematical Sciences, W. H. Freeman and Company, 1979.

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	3	-	-	-	-	-	-	-	2	2	2	1
2	3	3	2	3	-	-	-	-	2	-	-	2	2	2	1
3	3	3	2	3	-	-	-	-	2	-	-	2	3	2	1
4	3	3	2	3	2	-	-	-	2	-	-	2	3	2	1
5	3	3	2	3	2	-	-	-	2	-	-	2	3	2	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)									End Semester Examination (ESE) Marks (Practical – Internal Evaluation)	End Semester Examination (ESE) Marks (Theory)	Total Marks
	Continuous Assessment (Theory)					Continuous Assessment (Practical)						
	CAT 1	CAT 2	Model	Attendance	Total	Conduction of Practical	Report	Viva	Total			
Marks	5	5	5	5	20*	15	10	5	30*	30	75**	-
*To be weighted for 10 Marks					10	*To be weighted for 10 Marks			10		*To be weighted for 50 Marks	100

Department	**CSBS**	Programme: **B.Tech.**						
Semester	**III**	Course Category: **BS**			*End Semester Exam Type: **LE**			
Course Code	**U23MAP302**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**COMPUTATIONAL STATISTICS LABORATORY**	**0**	**0**	**2**	**1**	**50**	**50**	**100**

Course Objectives	**1.** To study the concepts of linear regression models	
	2. To develop a sound understanding of correlation	
	3. To analyze the concept of autocorrelation	
	4. To apply principles of multivariate data	
	5. To understand the concept of clustering.	
Course Outcome	***After completion of the course, the students will be able to***	BT Mapping (Highest Level)
	CO1 Remember the basic concepts of linear regression.	**K3**
	CO2 Interpret the results of correlation coefficient	**K3**
	CO3 Develop a sound understanding of auto correlation.	**K3**
	CO4 Analyze the concept of multivariate data	**K3**
	CO5 Know the application of clustering.	**K3**

List of Experiments

1. Program on Regression lines
2. Program on correlation coefficient
3. Program on Autocorrelation
4. Program on Multivariate analysis
5. Program on Factor scores
6. Program on multivariate data
7. Implement k-means, logistic and time series algorithm using Scikit-learn
8. Draw statistical graphics using seaborn
9. Working with hierarchical clustering
10. Working with overlapping clustering

Lecture Periods:	**Tutorial Periods:**	**Practical Periods: 30**	**Total Periods: 30**

Text Books

1. T.W. Anderson, “An Introduction to Multivariate Statistical Analysis”, 2 nd edition, 2003
2. J.D. Jobson ,” Applied Multivariate Data Analysis”, Vol I & II, 2 nd edition ,1991.
3. Magnus Lie Hetland ,”Beginning Python: From Novice to Professional”, 9th. Edition, 2005.

Reference Books

1. D.A. Belsey, E. Kuh and R.E. Welsch, “Regression Diagnostics, Identifying Influential Data and Sources of Collinearety”, New York, 1980.
2. D.C. Montgomery and E.A. Peck, “Introduction to Linear Regression Analysis”,5 th edition , 2012.
3. D.F. Morrison, “Multivariate Statistical Analysis”, 2013.

Web references

1. https://www.edx.org/course/statistical-modeling-and-regression-analysis
2. https://www.cin.ufpe.br/~embat/Python%20for%20Data%20Analysis.pdf
3. https://www.kdnuggets.com/2016/07/statistical-data-analysis-python.html
4. https://people.duke.edu/~ccc14/sta-663/

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	-	-	-	-	-	-	-	-	2	1	
2	3	2	1	1	-	-	-	-	-	-	-	-	2	1	1
3	3	2	1	1	-	-	-	-	-	-	-	-	2	1	1
4	3	2	1	1	-	-	-	-	-	-	-	-	2	1	1
5	3	2	1	1	-	-	-	-	-	-	-	-	2	1	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Department	**CSBS**			Programme: **B.Tech.**				
Semester	**III**			Course Category: **PC**		*End Semester Exam Type: **LE**		
Course Code	**U23CBP303**			Periods / Week			Credit	Maximum Marks
				L	T	P	C	CAM	ESE	TM
Course Name	**OBJECT ORIENTED PROGRAMMING IN C++ LABORATORY**			**0**	**0**	**2**	**1**	**50**	**50**	**100**

Course Objectives	**1**	To introduce the concepts of Basic Object Oriented concepts and Programming Basics.
	2	To gain insight into the Functions and Array usages using C++.
	3	To understand in depth about the Classes and Objects.
	4	To study the Operator overloading and Inheritance concepts.
	5	To acquaint the Files and Exception Handling concepts.

Course Outcome	***After completion of the course, the students will be able to***		BT Mapping (Highest Level)
	CO1	Implement the Object Oriented concepts in simple applications.	**K3**
	CO2	Employ the Functions and Arrays in simple programs.	**K3**
	CO3	Demonstrate simple programs with Classes and Objects.	**K3**
	CO4	Illustrate Operator overloading and Inheritance concepts.	**K3**
	CO5	Experiment Files and Exception Handling concepts.	**K3**

List of Experiments

1. Programs on concept of classes and objects
2. Programs using friend functions
3. Programs using static polymorphism
4. Programs using constructors
5. Programs using inheritance
6. Programs on dynamic polymorphism
7. Programs on exception handling
8. Programs on generic programming using template function & template class
9. Programs on file handling

Lecture Periods:	**Tutorial Periods:**	**Practical Periods: 30**	**Total Periods: 30**

Reference Books

1. Yashavant Kanetkar, “Let Us C++ “, BPB Publications, 2020.
2. Bjarne Stroustrup, “The C++ Programming Language”, Pearson Education, 3rd Edition, 2009
3. Debasish Jana, “C++ and Object-Oriented Programming Paradigm”, PHI Learning, 2nd Edition,2005
4. Bjarne Stroustrup, “Programming: Principles and Practice Using C++”, Addison Wesley, 2009
5. Bjarne Stroustrup, “The Design and Evolution of C++”, Pearson Education, 2009

Web references

1. https://www.studytonight.com/cpp/cpp-and-oops-concepts.php
2. https://www.tutorialspoint.com/What-are-basic-Object-oriented-programming-concepts
3. https://www.cplusplus.com/doc/tutorial/
4. https://www.w3schools.com/cpp/
5. https://www.javatpoint.com/cpp-tutorial
6. https://www.geeksforgeeks.org/cpp-tutorial/

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	3	-	-	-	-	-	-	-	2	-	-
2	3	2	1	1	3	-	-	-	-	-	-	-	2	1	1
3	3	2	1	1	3	-	-	-	-	-	-	-	3	2	-
4	3	2	1	1	3	-	-	-	-	-	-	-	3	2	1
5	3	2	1	1	3	-	-	-	-	-	-	-	3	2	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Department	**CSBS**	Programme: **B.Tech.**						
Semester	**III**	Course Category: **PC**			*End Semester Exam Type: **LE**			
Course Code	**U23CBP304**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**PRINCIPLES OF OPERATING SYSTEMS LABORATORY**	**0**	**0**	**2**	**1**	**50**	**50**	**100**

Course Objectives	**1**	To learn about the UNIX commands &shell programs and UNIX system calls
	2	To simulate scheduling algorithms concepts
	3	To simulate process synchronization and deadlock,
	4	To learn about the various memory allocation and page replacement algorithms.
	5	To learn about the file allocation and organization techniques.

Course Outcome	***After completion of the course, the students will be able to***		BT Mapping (Highest Level)
	CO1	Demonstrate the fundamental of UNIX commands &shell programs and UNIX system calls.	**K3**
	CO2	Apply the scheduling algorithms for the given problem.	**K3**
	CO3	Apply the process synchronous concept using semaphore and apply an algorithm to avoid dead lock.	**K3**
	CO4	Apply the various methods in memory allocation and page replacement algorithm.	**K3**
	CO5	Demonstrate the various operations of file system.	**K3**

List of Experiments

1. UNIX Commands
2. Programs using Shell Programming
3. Implementation of UNIX System Calls
4. Simulation and Analysis of Non pre-emptive and Pre-Emptive CPU Scheduling Algorithms
5. Simulation of Producer – Consumer Problem using Semaphores
6. Implementation of Dining Philosopher's Problem to demonstrate Process Synchronization
7. Simulation of Banker's Algorithm for Deadlock Avoidance
8. Analysis and Simulation of Memory Allocation and Management Techniques
9. Implementation of Page Replacement Techniques
10. Simulation of Disk Scheduling Algorithms
11. Implementation of File organization Techniques

Lecture Periods:	**Tutorial Periods:**	**Practical Periods: 30**	**Total Periods: 30**

Reference Books

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", John Wiley & Sons (Asia) Pvt. Ltd, Ninth Edition,2017.
2. Gary Nutt, "Operating Systems- A Modern Perspective", Pearson Education Pvt. Ltd, Second Edition, 2013.
3. Andrew S. Tanenbaum, "Modern Operating Systems", 3rd edition Prentice Hall of India Pvt. Ltd,2015.
4. Charles Patrick Crowley, "Operating System: A Design-oriented Approach"Tata McGraw - Hill Edition 1998 21st reprint, 2009 .

Web references

1. https://www.geeksforgeeks.org/operating-systems/
2. http://www.inf.ed.ac.uk/teaching/courses/os/prac/
3. http://www.scribd.com/doc/7137624/OS-Practical-File/
4. http://www.cl.cam.ac.uk/freshers/raspberrypi/tutorials/os/introduction.html/

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	3	-	-	-	-	-	-	-	3	-	-
2	3	2	1	1	3	-	-	-	-	-	-	-	2	2	-
3	3	2	1	1	3	-	-	-	-	-	-	-	2	2	1
4	3	2	1	1	3	-	-	-	-	-	-	-	2	2	1
5	3	2	1	1	3	-	-	-	-	-	-	-	2	2	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Department	**CSBS**	Programme: **B.Tech.**						
Semester	**III**	Course Category: **PC**			*End Semester Exam Type: **LE**			
Course Code	**U23CBP305**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**DATABASE SYSTEM CONCEPTS LABORATORY**	**0**	**0**	**2**	**1**	**50**	**50**	**100**

Course Objectives	**1**	To understand data definitions and data manipulation commands
	2	To understand data selection and data projection commands
	3	To learn the use of nested and join queries
	4	To understand functions, procedures and procedural extensions of databases
	5	To understand design and implementation of typical database applications.

Course Outcome	***After completion of the course, the students will be able to***		BT Mapping (Highest Level)
	CO1	Implement relational database systems using SQL statements	**K3**
	CO2	Use typical data definitions and manipulation commands in various applications.	**K3**
	CO3	Demonstrate applications using Nested and Join Queries.	**K3**
	CO4	Execute various PL/SQL Queries.	**K3**
	CO5	Build commercial relational database applications.	**K3**

List of Experiments

Structured Query Language:

1. Conceptual Database design using E-R DIAGRAM
2. Implementation of SQL commands DDL, DML, DCL and TCL
3. Queries to demonstrate implementation of Integrity Constraints
4. Practice of Inbuilt functions
5. Implementation of Join and Nested Queries AND Set operators
6. Implementation of virtual tables using Views

PL/SQL

7. Practice of Procedural extensions (Procedure, Function, Cursors, Triggers)

Application Development

8. Mini Project (Application Development using DB)
9. Mini Project (Application Development using NoSQL)

Lecture Periods:	**Tutorial Periods:**	**Practical Periods: 30**	**Total Periods: 30**

Reference Books

1. Oracle developer handbook
2. SQL/PL/SQL for Oracle by P.S. Deshpande IIT Madras, Dream Tech Press
3. Alan Beaulieu, Mastering SQL Fundamentals, Second Edition, O"Reilly,2009
4. Silberschatz, Korth, Sudarshan, Database System Concepts, 7thEdition – McGraw-Hill Higher Education, International Edition, 2019

Web references

1. www.oracle-developer.net
2. www.oracle.com/DBA

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	3	-	-	-	-	-	-	-	3	2	1
2	3	2	1	1	3	-	-	-	-	-	-	-	3	2	1
3	3	2	1	1	3	-	-	-	-	-	-	-	3	2	1
4	3	2	1	1	3	-	-	-	-	-	-	-	3	3	1
5	3	2	1	1	3	-	-	-	-	-	-	-	3	3	2

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Department	**CSBS**	Programme: **B.Tech.**						
Semester	**III**	Course Category: **AEC**			*End Semester Exam Type: **-**			
Course Code	**U23CBC3XX**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**CERTIFICATION COURSE-III**	**0**	**0**	**4**	**-**	**100**	**-**	**100**

Students shall choose an International certification course offered by the reputed organizations like Google, Microsoft, IBM, Texas Instruments, Bentley, Autodesk, Eplan and CISCO, etc. The duration of the course is 40-50 hours specified in the curriculum, which will be offered through Centre of Excellence.

Pass /Fail will be determined on the basis of participation, attendance, performance and completion of the course. If a candidate Fails, he/she has to repeat the course in the subsequent years. Pass in this course is mandatory for the award of degree.

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 50**	**Total Periods: 50**

Evaluation methods

Assessment	**Continuous Assessment Marks (CAM)**		**Total Marks**
	Attendance	**MCQ Test**	
Marks	10	90	100

Department	**CSBS**	Programme: **B.Tech.**						
Semester	**III**	Course Category: **AEC**			*End Semester Exam Type: **LE**			
Course Code	**U23CBS301**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Skill Enhancement Course 1 – R Programming**	**0**	**0**	**2**	**-**	**-**	**100**	**100**

List of Experiments

Course Content:

- **Introduction**
  R and features, Evolution of R?,Big data Hadoop and R
- **Data Types**
  R & R Studio Installation, Scalar, Vectors, Matrix, List, Data frames, Factors, Handling date in R, Conversion of data types, Operators in R
- **Importing Data**
  CSV files, Database data (Oracle 11g), XML files, JSON files, Reading & Writing PDF file, Reading & Writing JPEG files, Saving Data in R,
- **Manipulating Data**
  Cbind, Rbind, Sorting, Aggregating, dplyr
- **Conditional Statements and Functions**
  If …else, For loop, While loop, Repeat loop, Apply ()
- **Statistical Concepts**
  Descriptive Statistics, Inferential Statistics, Central Tendency (Mean,Mode,Median), Hypothesis Testing, Probability, tTest, ,Chi Square test, Correlation
- **Predictive Modelling**
  Linear Regression, Normal distribution, Density
- **Data Visualisation in R using GGPlot**
  Box Plot, Histograms, Scatter Plotter, Line chart, Bar Chart, Heat maps, Misc. functions and Data Visualization using Plotly

Lecture Periods:	**Tutorial Periods:**	**Practical Periods: 30**	**Total Periods: 30**

Web references

5. https://www.w3schools.com/r/
6. https://www.geeksforgeeks.org/r-tutorial/
7. https://www.tutorialspoint.com/r/index.htm

* TE – Theory Exam, LE – Lab Exam

Evaluation Method

Table 9.15 Assessment method for skill Enhancement courses

Assessment	Continuous Assessment Marks (CAM)			Total Marks
	Attendance	Report	Presentation/Demo/Skill Test	
Marks	10	40	50	100

Department	**CSBS**	Programme: **B.Tech.**						
Semester	**III**	Course Category: MC				*End Semester Exam Type: **TE**		
Course Code	**U23CBM303**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**INTRODUCTION TO CLIMATE CHANGE**	**2**	**0**	**0**	**-**	**100**	**-**	**100**

UNIT-I	**ATMOSPHERE AND ITS COMPONENTS**	**(8Hrs)**	
Importance of Atmosphere-Physical Chemical Characteristics of Atmosphere- Vertical structure of the atmosphere-Composition of the atmosphere-Atmospheric stability-Temperature profile of the atmosphere-Lapse rates-Temperature inversion-effects of inversion on pollution dispersion.			**CO1**
UNIT-II	**GLOBAL CLIMATE**	**(8Hrs)**	
Account of past climate - Environmental indicators and instrumental records - Human Footprints on global warming- Predicting future climates- Temperature regime - Extreme climate events.			**CO2**
UNIT-III	**IMPACTS OF CLIMATE CHANGE**	**(8Hrs)**	
Causes of Climate change: Change of Temperature in the environment-Melting of ice Pole-sea level rise-Impacts of Climate Change on various sectors — Agriculture, Forestry and Ecosystem — Water Resources — Human Health — Industry, Settlement and Society — Methods and Scenarios — Projected Impacts for Different Regions— Uncertainties in the Projected Impacts of Climate Change — Risk of Irreversible Changes.			**CO3**
UNIT- IV	**OBSERVED CHANGES AND ITS CAUSES**	**(8Hrs)**	
Climate change and Carbon credits- Initiatives in India-Kyoto Protocol-Intergovernmental Panel on Climate change- Climate Sensitivity and Feedbacks —The Montreal Protocol — UNFCCC — IPCC Evidences of Changes in Climate and Environment — on a Global Scale and in India.			**CO4**
UNIT- V	**CLIMATE CHANGE AND MITIGATION MEASURES**	**(8Hrs)**	
Clean Development Mechanism —Carbon Trading- examples of future Clean Technology — Biodiesel — Natural Compost — Eco-Friendly Plastic —i Alternate Energy — Hydrogen — Bio-fuels —Mitigation Efforts in India and Adaptation funding. Key Mitigation Technologies and Practices—Carbon sequestration — Carbon capture and storage (CCS) — International and Regional cooperation- Remedial measures.			**CO5**

Text Books

1. Joan Fitzgerald "Greenovation: Urban Leadership on Climate Change, Oxford University Press 2020.
2. J. David Neelin" Climate change and climate modelling" Cambridge University press (2011).
3. Robin Moilveen "Fundamentals of weather and climate" Oxford University Press (2nd Edition) (2010),
4. Andrew Dessler and Edward A. Parson "The Science and Politics of Global Climate Change" 2009
5. Dash Sushil Kumar, "Climate Change — An Indian Perspective", Cambridge University Press India Pvt. Ltd, 2007.

Reference Books

1. Bill McKibben(2012), The Global Warming Reader: A Century of Writing About Climate Change, Penguin.
2. JasonSmerdon(2009) Climate Change: The Science of Global Warming and Our Energy Future, Columbia University
3. Adaptation (2006) and mitigation of climate change-Scientific Technical Analysis. Cambridge University Press, Cambridge.
4. J.M. Wallace and P.V. Hobbs (2006) Atmospheric Science, Elsevier / Academic Press.
5. Jan C. van Dam,(2003) Impacts of "Climate Change and Climate Variability on Hydrological Regimes", Cambridge University Press,.

Web References

1. https://n tel.ac.in/courses/105102089/
2. https://www.warmheartworldwide
3. https://nptel.ac.in/content/storage.

* TE – Theory Exam, LE – Lab Exam

Evaluation methods

Assessment	**Continuous Assessment Marks (CAM)**			**Total Marks**
	Attendance	**MCQ Test**	**Presentation / Activity / Assignment**	
Marks	10	30	60	100

Department	**CSBS**	Programme: **B.Tech.**						
Semester	**IV**	Course Category: BS			*End Semester Exam Type: **TE**			
Course Code	**U23MAT406**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**OPERATIONS RESEARCH**	**3**	**1**	**0**	**4**	**25**	**75**	**100**

Course Objectives	**1)**	To learn about the Linear programming problem
	2)	To know the types of solution of LPP
	3)	To understand Transportation and Assignment Problem
	4)	To learn the Project scheduling techniques
	5)	To study the behavior of the functions of inventory and its disadvantages

Course Outcome	**On completion of the course, the students will be able to**		BT Mapping (Highest Level)
	CO1	Frame the Linear programming problem	**K2**
	CO2	Solve the Linear Programming problem	**K3**
	CO3	Know the solution of Transportation and Assignment problem.	**K2**
	CO4	Understand the Applications of PERT- CPM	**K2**
	CO5	Understand the types of Inventory control	**K2**

UNIT-I	**INTRODUCTION TO OPERATION RESEARCH (OR)**	**(9Hrs)**	
Origin of OR and its definition. Concept of optimizing performance measure, Types of OR problems, Deterministic vs. Stochastic optimization, Phases of OR problem approach – problem formulation, building mathematical model, deriving solutions, validating model, controlling and implementing solution. Linear programming – Examples from industrial cases, formulation & definitions, Matrix form.Implicit assumptions of LPP. Convex set, Convex polyhedron, Extreme points, Basic feasible solutions. Some basic concepts and results of linear algebra – Vectors, Matrices, Linear Independence / Dependence of vectors, Rank, Basis, System of linear eqns., Hyperplane,			**CO1**
UNIT-II	**LINEAR PROGRAMMING**	**(9Hrs)**	
Geometric method: 2-variable case, Special cases – infeasibility, unboundedness, redundancy & degeneracy, Sensitivity analysis. Simplex Algorithm – slack, surplus & artificial variables, computational details, big-M method, identification and resolution of special cases through simplex iterations. Duality – formulation, results, fundamental theorem of duality, dual-simplex and primal-dual algorithms			**CO2**
UNIT-III	**TRANSPORTATION AND ASSIGNMENT PROBLEMS**	**(9Hrs)**	
TP - Examples, Definitions – decision variables, supply & demand constraints, formulation, Balanced & unbalanced situations, Solution methods – NWCR, minimum cost and VAM, test for optimality (MODI method), degeneracy and its resolution. AP - Examples, Definitions – decision variables, constraints, formulation, Balanced & unbalanced situations, Solution method – Hungarian, test for optimality (MODI method), degeneracy & its resolution.			**CO3**
UNIT- IV	**PROJECT SCHEDULING**	**(9Hrs)**	
Project definition, Project scheduling techniques – Gantt chart, PERT & CPM, Determination of critical paths, Estimation of Project time and its variance in PERT using statistical principles, Concept of project crashing/time-cost trade-off.			**CO4**
UNIT- V	**INVENTORY CONTROL**	**(9Hrs)**	
Functions of inventory and its disadvantages, ABC analysis, Concept of inventory costs, Basics of inventory policy (order, lead time, types), Fixed order-quantity models – EOQ, POQ & Quantity discount models. EOQ models for discrete units, sensitivity analysis and Robustness, Special cases of EOQ models for safety stock with known / unknown stock out situations, models under prescribed policy, Probabilistic situations			**CO5**

Text Books

1. H.A. Taha., Operations Research: An Introduction. Pearson,10th edition,2017

2. F.S. Hiller and G.J. Lieberman, Introduction to Operations Research. Third edition 2015.
3. K.G. Murthy, Linear Programming. Wiley, Third edition 2019.

Reference Books

1. G. Hadley, .Linear Programming,2002
2. H.M. Wagner, Principles of OR with Application to Managerial Decisions,1980
3. Thomas L Saaty, Elements of Queuing Theory with Applications, 2000
4. A.RaviRavindran, Operations Research and Management Science, Hand Book: Management Guide to PERT/CPM. CRC Press; 1st edition, 2016
5. J.W. Prichard and R.H Modern Inventory Management,1965

Web References

1. https://www.ifors.org/what-is-
2. https://www.springer.com/journal/12351
3. https://www.britannica.com/topic/operations-research

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	3	-	-	-	-	-	-	-	1	-	-
2	3	2	1	1	3	-	-	-	-	-	-	-	1	-	1
3	2	1	-	-	3	-	-	-	-	-	-	-	1	-	1
4	2	1	-	-	3	-	-	-	-	-	-	-	1	-	2
5	2	1	-	-	3	-	-	-	-	-	-	-	1	-	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**CSBS**		Programme: **B.Tech.**					
Semester	**IV**		Course Category: HS			*End Semester Exam Type: **TE**		
Course Code	**U23HST402**		Periods / Week			Credit	Maximum Marks	
			L	T	P	C	CAM	ESE	TM
Course Name	**INTRODUCTION TO INNOVATION, IP MANAGEMENT AND ENTREPRENEURSHIP**		**3**	**0**	**0**	**3**	**25**	**75**	**100**
Course Objectives	**1)**	To acquaint the students with the knowledge base of Entrepreneurship							
	2)	To learn about Innovation and Creativity							
	3)	To learn to manage various types of Intellectual Property Rights IPR to protect competitive advantage							
	4)	To know about the Building an Innovative Organization							
	5)	To enable students to investigate, understand and internalize the process of founding a start-up.							
Course Outcome	**On completion of the course, the students will be able to**							BT Mapping (Highest Level)	
	CO1	Examine different types' entry strategies of entrepreneurship						**K3**	
	CO2	Demonstrate about Innovation and Creativity						**K2**	
	CO3	Elaborate on various types of Intellectual Property Rights						**K3**	
	CO4	Analyze various entrepreneurial opportunities.						**K3**	
	CO5	Evaluate the process of founding a start-up						**K3**	
UNIT-I	**INNOVATION**					**(9Hrs)**			
Innovation: Definition and meaning; Innovation as a core business process, Sources of innovation, Types of Innovation, Challenges in Innovation, Knowledge push vs. need pull innovations. Innovation Vs. Creativity.									**CO1**
UNIT-II	**BUILDING AN INNOVATIVE ORGANIZATION**					**(9Hrs)**			
Creating new products and services, Exploiting open innovation and collaboration, Use of innovation for starting a new venture									**CO2**
UNIT-III	**INTELLECTUAL PROPERTY RIGHTS (IPR)**					**(9Hrs)**			
Introduction and the economics behind development of IPR: Business Perspective; IPR in India – Genesis and Development; International Context; Concept of IP Management, Use in marketing; Types of Intellectual Property: Patent- Procedure, Licensing and Assignment, Infringement and Penalty, Trademark- Use in marketing, example of trademarks- Domain name, Geographical Indications, Copyright, Industrial Designs.									**CO3**
UNIT- IV	**ENTREPRENEURSHIP**					**(9Hrs)**			
Opportunity recognition and entry strategies, Entrepreneurship as a Style of Management, Types of Entrepreneurship, Maintaining Competitive Advantage- Use of IPR to protect Innovation.									**CO4**
UNIT- V	**ENTREPRENEURSHIP- FINANCIAL PLANNING**					**(9Hrs)**			
Financial Projections and Valuation, Stages of financing, Debt, Venture Capital and other forms of Financing.									**CO5**

Text Books

1. Joe Tidd, John Bessant. Managing Innovation: Integrating Technological, Market and Organizational Change,Sixth Edition, John Wiley & Sons Limited, 2018
2. Robert D. Hisrich, Michael P. Peters, Dean A. Shepherd: Entrepreneurship, Tata McGraw Hill,2007
3. Lee Swanson, Entrepreneurship and Innovation Toolkit, Open press,2017

Reference Books

1. Arya Kumar: Creating and Leading an Entrepreneurial Organization, Pearson, 2012
2. Vasant Desai: The Dynamics of Entrepreneurial Development and Management,Himalaya Publishing House,2011
3. Gabe Burton: Entrepreneurship and Small Business Management, Library Press, 2017

Web References

1. www.ediindia.org
2. www.enterweb.org/entrship.htm
3. https://www.theweekendleader.com/more-articles.html

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	3	-	-	-	-	-	-	-	1	3	2
2	3	1	-	-	3	-	-	-	-	-	-	-	1	2	1
3	3	2	1	1	3	-	-	-	-	-	-	-	1	3	2
4	3	2	1	1	3	-	-	-	-	-	-	-	1	3	2
5	3	2	1	1	3	-	-	-	-	-	-	-	1	2	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**IT**	Programme: **B.Tech.**						
Semester	**IV**	Course Category Code: **PC**			*End Semester Exam Type: **TE**			
Course Code	**U23ITTC02**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Programming in Java**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

(Common to All Branches)

Prerequisite	Basic knowledge of Object-Oriented Programming Principles	
Course Outcome	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Articulate the concept of Java fundamentals, OOPs and Strings	**K2**
	CO2 Demonstrate the principles of inheritance, packages and interfaces with real time applications	**K2**
	CO3 Create real time applications using exception handling and thread programming.	**K3**
	CO4 Build distributed applications using Collections and IO streams	**K3**
	CO5 Design and build simple GUI programs using AWT, Swings and build database applications	**K3**

Unit- I	**Introduction**	**Periods: 09**

Introduction: Java: History – Features – JVM - JRE – JDK – Java Compilation and Execution – Data Types - Variables, Types, Expressions, Assignment Statements, Input/Output Statements: Scanner/System class, Type Casting (Primitives to Primitives), Conditional and Iterative Control Structures - Arrays

OOPs with Java: Introduction to OOPs Concepts - Class – Objects – Methods - Access Modifiers – Creating Class and Objects, Object Life-Cycle - Garbage Collection-Constructors - this – static – Array of Objects – Nested Classes.

String: String Class– Built-in Methods – StringBuilder – String Buffer

CO1

Unit- II	**Inheritance, Interfaces and Packages**	**Periods: 09**

Inheritance: Types of Inheritance – is-a Relationship, has-a Relationship – super keyword – final keyword – Polymorphism - Method overloading and Method overriding – Abstract Class

Interfaces: Define – Extend – Implement – Access - Interfaces vs Abstract classes, Type Conversions (Primitives to Objects vice-versa): Autoboxing and Auto unboxing

Packages: Define – Create – Access – Import

CO2

Unit- III	**Exception Handling and Multithreading**	**Periods: 09**

Exception Handling: Exception Hierarchy – Checked and Unchecked Exceptions – try, catch, throws, throw and finally – User Defined Exceptions.

Multithreading: Thread – Life cycle – Defining and Running – Implementation Types – Thread Priorities – Thread Synchronization - Inter-Thread Communication

CO3

Unit- IV	**Collections and I/O Streams**	**Periods: 09**

Collections: List: Array List and LinkedList. Set: HashSet and Tree Set. Map: HashMap – Stack – Queue. Lambda Expressions.

I/O Streams: Streams – Byte Streams and Character Streams – FileInputStream and FileOutputStream – FileReader and FileWriter. Object Serialization : ObjectInputStream and ObjectOutputStream

CO4

Unit- V	**GUI and JDBC**	**Periods: 09**

AWT: Components – Controls – Event Handling

SWING: Swing Components – Layout Management.

JDBC: JDBC Architecture – JDBC Driver Types – Implementation of JDBC.

CO5

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

Text Books

1. Allen B. Downey and Chris Mayeld, “Think Java - How to Think Like a Computer Scientist”, 2nd Edition, Green Tea Press, 2020
2. Herbert Schildt, “Java: The Complete Reference”, TMH Publishing Company Ltd, 11th Edition, 2018.
3. H.M.Dietel and P.J.Dietel, “Java How to Program”, 11th Edition, Pearson Education/PHI, 2017
4. Cay S. Horstmann, Gary Cornell, “Core Java Volume - I Fundamentals”, 9th Edition, Prentice Hall, 2013.

Reference Books

1. Sagayaraj, Denis, Karthik, Gajalakshmi, “JAVA Programming for core and advanced learners”, Universities Press Private Limited, 2018.
2. Poaul Deitel, Harvey Deitel, “Java SE 8 for programmers”, 3rd Edition, Pearson, 2015.
3. P.J. Dietel and H.M Dietel, “Java for Programmers”, Pearson Education, 9th Edition, 2011.
4. Steven Holzner, “Java 2 Black book”, Dreamtech Press, 2011.

Web References

1. https://www.javatpoint.com/java-tutorial
2. https://docs.oracle.com/en/java/
3. https://www.studytonight.com/java/
4. https://onlinecourses.nptel.ac.in/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	1	1	-	1	-	-	-	-	-	-	2	3	2	1
2	3	3	3	-	3	-	-	-	-	-	-	2	3	2	1
3	3	3	3	1	3	-	-	-	-	-	-	2	3	2	1
4	3	3	3	1	3	-	-	-	-	-	-	2	3	2	1
5	3	3	3	1	3	-	-	-	-	-	-	2	3	2	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

*Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**CSBS**		Programme: **B.Tech.**					
Semester	**IV**		Course Category: PC			*End Semester Exam Type: **TE**		
Course Code	**U23CBT407**		Periods / Week			Credit	Maximum Marks	
			L	T	P	C	CAM	ESE	TM
Course Name	**ALGORITHM DESIGN AND APPLICATIONS**		**3**	**0**	**0**	**3**	**25**	**75**	**100**
Course Objectives	**1)**	Learn and understand the algorithm analysis techniques and complexity notations							
	2)	Become familiar with the different algorithm design techniques for effective problem solving in computing.							
	3)	Learn to apply the design techniques in solving various kinds of problems in an efficient way.							
	4)	Become familiar with various Computability classes of problem.							
	5)	Understand the Randomized algorithmsand Approximation algorithms to deal optimization problems in polynomial time							
Course Outcome	**On completion of the course, the students will be able to**								BT Mapping (Highest Level)
	CO1	Analyze the best, worst and average behavior of an algorithm based on time and space							**K2**
	CO2	Understand various algorithm design strategies to synthesize algorithms for solving various problems.							**K2**
	CO3	Choose and apply appropriate algorithm design strategies to design algorithms based on the nature of problems							**K3**
	CO4	Apply Backtracking and Branch and Bound techniques to develop algorithms to solve various problems							**K3**
	CO5	Understand various computability classes of problem							**K2**
UNIT-I	**ALGORITHM ANALYSIS**					**(9Hrs)**			
Introduction: Characteristics of Algorithm. Analysis of Algorithm: Asymptotic analysis of Complexity Bounds – Best, Average and Worst-Case behavior; Performance Measurements of Algorithm, Time and Space Trade-Offs, Analysis of Recursive Algorithms through Recurrence Relations: Substitution Method, Recursion Tree Method and Masters' Theorem.									**CO1**
UNIT-II	**ALGORITHMI STRATEGIES I**					**(9Hrs)**			
Brute-Force, Heuristics, Greedy, Divide and Conquer, Dynamic Programming									**CO2**
UNIT-III	**ALGORITHMIC STRATEGIES II**					**(9Hrs)**			
Branch and Bound and Backtracking methodologies; Illustrations of these techniques for Problem-Solving , n-Queens Problem , Graph Coloring , Knapsack, Travelling Salesman Problem.									**CO3**
UNIT- IV	**GRAPH AND TREE ALGORITHMS**					**(9Hrs)**			
Traversal algorithms: Depth First Search (DFS) and Breadth First Search (BFS); Shortest path algorithms, Transitive closure, Minimum Spanning Tree, Topological sorting, Network Flow Algorithm.									**CO4**
UNIT- V	**TRACTABLE AND INTRACTABLE PROBLEMS**					**(9Hrs)**			
Computability of Algorithms, Computability classes – P, NP, NP-complete and NP-hard.Cook's theorem, Standard NP-complete problems and Reduction techniques. Advanced Topics: Approximation algorithms, Randomized algorithms, Class of problems beyond NP – P SPACE, Introduction to Quantum Algorithm.									**CO5**

Text Books

1. E. Horowitz and S. Sahni., "Fundamental of Computer Algorithms", Second Edition, Computer Science Press, 2008.
2. A. Aho, J. Hopcroft and J. Ullman, "The Design and Analysis of Computer Algorithms", Fourth edition, Pearson India 2009.
3. T. H. Cormen, C. E. Leiserson and R. L. Rivest, "Introduction to Algorithms", Third Edition, MIT Press, 2009.

Reference Books

1. S. Baase, "Computer Algorithms: Introduction to Design and Analysis", Third Edition, Pearson, 2000.
2. D. E. Knuth ,"The Art of Computer Programming, Vol. 1, Vol. 2 and Vol. 3", Third Edition, Mathematical Science Publishers,1997.
3. Michael A. Nielsen and Isaac L. Chuang ,Quantum Computation and Quantum Information: 10th Anniversary Edition.Cambridge University Press, 2010

Web References

1. https://www.tutorialspoint.com/design_and_analysis_of_algorithms/index.htm
2. https://www.javatpoint.com/daa-tutorial
3. https://www.guru99.com/design-analysis-algorithms-tutorial.html
4. https://nptel.ac.in/courses/106/106/106106131/
5. https://online.stanford.edu/courses/soe-ycsalgorithms1-algorithms-design-and-analysis-part-1

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	-	-	-	-	-	-	-	-	2	1	1
2	2	1	-	-	-	-	-	-	-	-	-	-	2	1	1
3	3	2	1	1	-	-	-	-	-	-	-	1	2	1	-
4	3	2	1	1	-	-	-	-	-	-	-	1	2	-	1
5	2	1	-	-	-	-	-	-	-	-	-	1	2	1	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**CSBS**	Programme: **B.Tech.**						
Semester	**IV**	Course Category: PC			*End Semester Exam Type: **TE**			
Course Code	**U23CBT408**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**SOFTWARE ENGINEERING AND APPLICATIONS**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

Course Objectives	**1)**	To know the various software engineering approaches
	2)	To learn about the software project management.
	3)	To understand the software quality and reliability.
	4)	To explore software requirements analysis, design and construction.
	5)	To acquire the knowledge of software testing concepts.

Course Outcome	**On completion of the course, the students will be able to**		BT Mapping (Highest Level)
	CO1	Know the various software engineering approaches	**K2**
	CO2	Learn about the software project management	**K2**
	CO3	Analyze and understand the software quality and reliability	**K3**
	CO4	Explore software requirements analysis, design and construction	**K3**
	CO5	Acquire the knowledge of software testing concepts	**K2**

UNIT-I	**INTRODUCTION**	**(9Hrs)**	
Programming in the small vs. programming in the large; software project failures and importance of software quality and timely availability; engineering approach to software development; role of software engineering towards successful execution of large software projects; emergence of software engineering as a discipline.			**CO1**
UNIT-II	**SOFTWARE PROJECT MANAGEMENT**	**(9Hrs)**	
Basic concepts of life cycle models – different models and milestones; software project planning – identification of activities and resources; concepts of feasibility study; techniques for estimation of schedule and effort; software cost estimation models and concepts of software engineering economics; techniques of software project control and reporting; introduction to measurement of software size; introduction to the concepts of risk and its mitigation; configuration management			**CO2**
UNIT-III	**SOFTWARE QUALITY AND RELIABILITY**	**(9Hrs)**	
Internal and external qualities; process and product quality; principles to achieve software quality; introduction to different software quality models like McCall, Boehm, FURPS / FURPS+, Dromey, ISO – 9126; Introduction to Capability Maturity Models (CMM and CMMI); introduction to software reliability, reliability models and estimation.			**CO3**
UNIT- IV	**SOFTWARE REQUIREMENTS ANALYSIS, DESIGN AND CONSTRUCTION**	**(9Hrs)**	
Introduction to Software Requirements Specifications (SRS) and requirement elicitation techniques; techniques for requirement modeling – decision tables, event tables, state transition tables, Petri nets; requirements documentation through use cases; introduction to UML, introduction to software metrics and metrics based control methods; measures of code and design quality.			**CO4**
UNIT- V	**SOFTWARE TESTING**	**(9Hrs)**	
Introduction to faults and failures; basic testing concepts; concepts of verification and validation; black box and white box tests; white box test coverage – code coverage, condition coverage, branch coverage; basic concepts of black-box tests – equivalence classes, boundary value tests, usage of state tables; testing use cases; transactionbased testing; testing for non-functional requirements – volume, performance and efficiency; concepts of inspection.			**CO5**

Text Books

1. Ian Sommerville, “Software Engineering “, Ninth edition, Pearson Education, 2010.
2. Roger S. Pressman,” Software Engineering – A Practitioner’s Approach”, Seventh edition, 2010
3. Carlo Ghezzi, Jazayeri Mehdi, Mandrioli Dino,” Fundamentals of Software Engineering”, second edition,2002

Reference Books

1. Michael Jackson,” Software Requirements and Specification: A Lexicon of Practice, Principles and Prejudices”,first edition, ACM Press, 1995
2. Ivar Jacobson, Grady Booch, James Rumbaugh,“The Unified Development Process”, Addison-Wesley, 1999

3. Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides, “Design Patterns: Elements of Object-Oriented Reusable Software”, First edition, 1994
4. Norman E Fenton, Shari Lawrence Pfleeger,” Software Metrics: A Rigorous and Practical Approach”, Second edition, International Thomson Computer Press, 1997
5. Shari Lawrence Pfleeger and Joanne M. Atlee, “Software Engineering: Theory and Practice“, fourth edition, Pearson, 2009
6. Bertrand Meyer, second edition,” Object-Oriented Software Construction”, Prentice-hall International Series, 1997
7. Ivar Jacobson, “Object Oriented Software Engineering: A Use Case Driven Approach“, First edition, ACM Press, 1992
8. Bertrand Meyer, “Touch of Class: Learning to Program Well with Objects and Contracts “, First edition, Springer-Verlag Berlin Heidelberg,2013
9. Martin Fowler, “UML Distilled: A Brief Guide to the Standard Object Modeling Language “, Third edition,Addison Wesley, 2003

Web References

1. http://www.nptelvideos.in/2012/11/software-engineering.html
2. https://www.projectengineer.net/the-earned-value-formulas/
3. https://www.smartdraw.com/downloads/
4. https://www.visual-paradigm.com/support/documents/vpuserguide.jsp

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	1	-	-	-	-	-	-	-	-	-	2	1	1
2	2	1	1	1	1	-	-	-	-	-	-	-	2	1	1
3	3	2	2	2	2	-	-	-	-	-	-	-	2	2	2
4	3	2	2	2	2	-	-	-	-	-	-	-	2	2	2
5	2	1	2	2	2	-	-	-	-	-	-	-	2	2	2

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**English**			Programme: **B.Tech.**				
Semester	**IV**			CourseCategoryCode:**HS**		*End Semester Exam Type: **TE**		
Course Code	**U23ENB403**			Periods/Week			Credit	Maximum Marks
				L	T	P	C	CAM / ESE / TM
Course Name	**BUSINESS COMMUNICATION & VALUE SCIENCE - III**			**2**	**-**	**2**	**2**	**50 / 50 / 100**
Prerequisite	Basics of Communication Skills							
Course objectives	**1.**	To develop technical writing skills						
	2.	To Introduce students to Self-analysis techniques like SWOT & TOWS						
	3.	To enrich students to the key concepts of Pluralism and cultural spaces						
	4.	To imbibe self-motivation and foresee future prospects						
	5.	To inculcate the importance of science in nation building						
Course Outcome	**On completion of the course, the students will be able to**							BT Mapping (Highest Level)
	CO1	Understand, apply & analyze the tools of technical writing						**K2**
	CO2	Apply basic principles of SWOT & life positions						**K3**
	CO3	Identify & respect pluralism in cultural spaces						**K1**
	CO4	Inherent the skill of self- introspection and envision the future						**K2**
	CO5	Learn to apply the role of science in nation building						**K3**

UNIT- I	**TECHNICAL WRITING SKILLS**	**Periods:10**

Technical writing: Introduction and application of Technical writing - Identify the best practices on technical writing - Technical writing in profession -Theory with YouTube and Dr Bimal Ray's videos on cryptology. Technical writing in real-life scenarios-Scenario-based Assessment on technical writing - Sell Analytics and Insight to the local tea seller - Explain the concept of Cloud to your 87 year old grandmother-Introduce the concept of friendly robots to a class 3 kid. **CO1**

UNIT-II	**ANALYSIS OF LIFE POSITION**	**Periods:10**

Personal analysis: SWOT analysis - SWOT and Life Positions –Analysis of others' lives – Analysis of one's own life. - TOWS Analysis: How to turn threat into opportunity – VUCA - Volatility, uncertainty, complexity and ambiguity - Application of analysis in real life scenarios – TED talk on bio mimicry – Group activity - Presentation on strengths identified to survive in the VUCA World **CO2**

UNIT-III	**PLURALISM IN CULTURAL SPACES**	**Periods:10**

Identifying Pluralism in cultural spaces - uniqueness and differences - Global, Glocal and Translocational culture benefits, differences and implications of multi-culture – Gender awareness – Roles and relations of different genders- Group activity – Exploring cultures and traditions of different states – Performing Indian dance forms–cultural misunderstanding–-Gender awareness campaign: College, Workplace, Family, Friend **CO3**

UNIT-IV	**SELF DRIVEN HUMAN VALUES AND FUTURISM SKILLS**	**Periods:15**

List of Exercises

Listening: Videos of motivation based on TED talk and followed by discussion. YouTube videos on Maslow's Theory

Speaking: Gender awareness: Differentiate between the roles and relations of different gender with four different themes: College-Workplace-Family-Friends. Debate on Global, Glocal and Translocational impacts

Reading: Development of Information Technology

Writing: Groups to create the college of future with the future teachers, teaching methods, types of students, etc. How will offices/workplaces change in future? Design your college in the year 2090 **CO4**

UNIT-V	**ROLE OF SCIENCE IN NATION BUILDING**	**Periods:15**

List of Exercises

Listening: Videos on Pre & Post Independent scientific inventions and inventors Role of science in nation building

Speaking: Quiz on Scientists and inventions. Explaining DNA, Rings of Saturn, structure of heart to visually impaired person. Group discussion on implications of cross cultural communication

Reading: Explore the inventions and role of eminent scientists and mathematicians

Writing: SWOT analysis of a well-known individual's life **CO5**

LecturePeriods:30	**TutorialPeriods: -**	**PracticalPeriods:30**	**TotalPeriods:60**

TextBooks

1. Dr.Kalam , Abdul .A.P.J &Mahapragya,Acharya.."The Family and the Nation";2015;:
2. Kumar, Sanjay, Pushpalatha," Communication Skills". Oxford University Press, 2018.
3. Singh, Purnima ," Multiculturalism: The Essence of Indian Culture" Vitasta Publishing Pvt. Ltd.India

ReferenceBooks

1. Self-Analysis by Ron Hubbard, Bridge Pubns; 2007th edition
2. Managing a Diverse Workforce: Learning Activities, Gary N. Powell, 3rd Edition, Sage Publication,2010
3. Unity in Diversity: The Indian Experience in Nation-building, M.S. Gore, Rawat Publication,2015
4. Carrie Hutchinson, "Cross Cultural Communication A Guide for International Students" Createspace Independent Pub 1 December 2013.
5. Gupta N L, Natthūlāla Gupta, "Human Values in Education", Concept Publishing Company, 2000

Web References

1. https://freelance-writing.lovetoknow.com/kinds-technical-writing
2. https://clickhelp.com/clickhelp-technical-writing-blog/11-skills-of-a-good-technical-writer/
3. https://www.hult.edu/blog/benefits-challenges-cultural-diversity-workplace/
4. https://www.investopedia.com/terms/c/cross-culture.asp
5. https://link.springer.com/article/10.1007/s11569-018-0327-8

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	-	-	-	-	-	-	2	-	3	-	1	-	-	-
2	1	-	-	-	-	-	-	2	-	3	-	1	-	-	-
3	1	-	-	-	-	-	-	2	-	3	-	1	-	1	1
4	1	-	-	-	-	-	-	2	-	3	-	1	-	1	1
5	1	-	-	-	-	-	-	2	-	3	-	1	-	1	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)									End Semester Examination (ESE) Marks (Practical – Internal Evaluation)	End Semester Examination (ESE) Marks (Theory)	Total Marks
	Continuous Assessment (Theory)					Continuous Assessment (Practical)						
	CAT 1	CAT 2	Model	Attendance	Total	Conduction of Practical	Report	Viva	Total			
Marks	5	5	5	5	20*	15	10	5	30*	30	75**	-
*To be weighted for 10 Marks					10	*To be weighted for 10 Marks			10		*To be weighted for 50 Marks	100

Department	**CSBS**	Programme: **B.Tech.**						
Semester	**IV**	Course Category: **BS**			*End Semester Exam Type: **LE**			
Course Code	**U23MAP403**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**OPERATIONS RESEARCH LABORATORY**	**0**	**0**	**2**	**1**	**50**	**50**	**100**

Course Objectives	To learn about the Queuing models		
	To know the Random number generator		
	To understand Poisson's Process.		
	To learn little's law.		
	To study the Application in Scheduling		
Course Outcome	After completion of the course the students will be able to		BT Mapping (Highest Level)
	CO1	Find waiting cost	**K3**
	CO2	Solve M/M/1 model.	**K3**
	CO3	Solve M/M/m model.	**K3**
	CO4	Understand the Applications in Scheduling.	**K2**
	CO5	Understand the types of Inventory control	**K3**

List of Experiments

1. Formulation of linear programming problems.
2. Solution of linear programming problem using graphical method with:
   - i. Multiple constraints
   - ii. Unbounded solution
   - iii. Infeasible solution
   - iv. Alternative or multiple solution
3. Solution of linear programming problem with simplex method.
4. Problem solving using Big M method.
5. Problem solving using two phase method.
6. Solution on primal problem as well as dual problem.
7. Solution based on dual simplex method.
8. Solution of transportation problem.
9. Solution of assignment problem.
10. Simulation: Random number generation.
11. Performance measures for M/M/1 queuing model.
12. ABC analysis.

Lecture Periods:	**Tutorial Periods:**	**Practical Periods: 30**	**Total Periods: 30**

Reference Books

1. H.A. Taha., Operations Research: An Introduction. Pearson,10th edition,2017
2. F.S. Hiller and G.J. Lieberman, Introduction to Operations Research. Third edition 2015.
3. K.G. Murthy, Linear Programming. Wiley, Third edition 2019.Reference Books
4. G. Hadley, .Linear Programming, 2002
5. H.M. Wagner, Principles of OR with Application to Managerial Decisions,1980
6. Thomas L Saaty, Elements of Queuing Theory with Applications, 2000
7. A.RaviRavindran, Operations Research and Management Science, Hand Book: Management Guide to PERT/CPM. CRC Press; 1st edition, 2016

Web references

1. https://www.ifors.org/what-is-
2. https://www.springer.com/journal/12351
3. https://www.britannica.com/topic/operations-research

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	3	-	-	-	-	-	-	-	1	-	-
2	3	2	1	1	3	-	-	-	-	-	-	-	1	-	1
3	3	2	1	1	3	-	-	-	-	-	-	-	1	-	1
4	3	2	1	1	3	-	-	-	-	-	-	-	1	-	2
5	3	2	1	1	3	-	-	-	-	-	-	-	1	-	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Department	**Information Technology**	Programme: **B.Tech**						
Semester	**IV**	Course Category Code: **ES**			*End Semester Exam Type: **LE**			
Course Code	**U23ITPC02**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**PROGRAMMING IN JAVA LABORATORY**	**0**	**0**	**2**	**1**	**50**	**50**	**100**
(Common to All Branches)								
Prerequisite	Basic concepts of Object-Oriented Programming Principles							

Course Outcome	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Apply and practice logical formulations to solve simple problems leading to specific applications.	**K3**
	CO2 Demonstrate the use of inheritance, interface and package in relevant applications	**K3**
	CO3 Implement robust application programs in Java using exception handling and multithreading	**K3**
	CO4 Build java distributed applications using Collections and IO streams.	**K3**
	CO5 Implement Graphical User Interface based application programs by utilizing event handling features and Swing in Java.	**K3**

List of Exercises

1. Develop simple programs using java
2. Develop a java program that implements class and object.
3. Write a java program to find the frequency of a given character in a string
4. Write a java program to demonstrate inheritance and interfaces.
5. Develop a java program that implements the Packages.
6. Create java applications using Exception Handling for error handling.
7. Develop a simple real life application program to illustrate the use of Multi-Threads.
8. Implement simple applications using Collections.
9. Develop application using the concept of I/O Streams
10. Write a Java Program to demonstrate AWT and Swing Components
11. Develop a simple application and use JDBC to connect to a back-end database.

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 30**	**Total Periods: 30**

Reference Books

1. Allen B. Downey and Chris Mayeld, “Think Java - How to Think Like a Computer Scientist”, 2nd Edition, Green Tea Press, 2020
2. Sagayaraj, Denis, Karthik, Gajalakshmi, “JAVA Programming for core and advanced learners”, Universities Press Private Limited, 2018
3. Cay.S.Horstmann and Gary Cornell, “Core Java 2”, Vol 2, Advanced Features, Pearson Education, 7th Edition, 2010

Web References

1. http://www.ibm.com/developerworks/java/
2. http://docs.oracle.com/javase/tutorial/rmi/.
3. IBM’s tutorials on Swings, AWT controls and JDBC.
4. https://www.edureka.co/blog.
5. https://www.geeksforgeeks.org.

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	3	-	-	-	-	-	-	-	3	2	1
2	3	2	1	1	3	-	-	-	-	-	-	-	3	2	1
3	3	2	1	1	3	-	-	-	-	-	-	-	3	2	1
4	3	2	1	1	3	-	-	-	-	-	-	-	3	2	1
5	3	2	1	1	3	-	-	-	-	-	-	-	3	2	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Department	**CSBS**	Programme: **B.Tech.**						
Semester	**IV**	Course Category: **PC**			*End Semester Exam Type: **LE**			
Course Code	**U23CBP406**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**ALGORITHM DESIGN AND APPLICATIONS LABORATORY**	**0**	**0**	**2**	**1**	**50**	**50**	**100**

Course Objectives	To apply linear data structures		
	To apply non-linear data structures		
	To understand the different operations on trees		
	To implement graph traversal algorithms		
	To access non-linear data structure from a file		
Course Outcome	After completion of the course, the students will be able to		BT Mapping (Highest Level)
	CO1	Use linear data structures while solving simple and complex problems	**K3**
	CO2	Implement and apply trees to improve accessing of data	**K3**
	CO3	Apply graph to solve various real time problems	**K3**

List of Experiments

1. Design and implement algorithms using Brute Force Technique.
2. Design and implement algorithms using Divide and Conquer Technique.
3. Design and implement algorithms using Greedy Technique.
4. Design and implement algorithms using Dynamic Programming.
5. Design and implement algorithms using Backtracking.
6. Design and implement algorithms using Branch and Bound.
7. Design and implement algorithms using Graph concept.
8. Design and implement algorithms using Tree concept.

Lecture Periods:	**Tutorial Periods:**	**Practical Periods: 30**	**Total Periods: 30**

Text Books

1. E. Horowitz and S. Sahni., “Fundamental of Computer Algorithms”, Second Edition, Computer Science Press, 2008.
2. A. Aho, J. Hopcroft and J. Ullman, “The Design and Analysis of Computer Algorithms”, Fourth edition, Pearson India, 2009.
3. T. H. Cormen, C. E. Leiserson and R. L. Rivest, “Introduction to Algorithms”, Third Edition, MIT Press, 2009.

Reference Books

1. S. Baase, “Computer Algorithms: Introduction to Design and Analysis”, Third Edition, Pearson, 2000.
2. D. E. Knuth ,”The Art of Computer Programming, Vol. 1, Vol. 2 and Vol. 3”, Third Edition, Mathematical Science Publishers,1997.
3. Michael A. Nielsen and Isaac L. Chuang ,Quantum Computation and Quantum Information: 10th Anniversary Edition.Cambridge University Press, 2010

Web references

1. https://www.tutorialspoint.com/data_structures_algorithms/dsa_quick_guide.htm
2. https://www.programiz.com/dsa
3. http://cse01-iiith.vlabs.ac.in/

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	3	-	-	-	-	-	-	-	3	1	-
2	3	2	1	1	3	-	-	-	-	-	-	-	3	1	-
3	3	2	1	1	3	-	-	-	-	-	-	-	3	1	-
4	3	2	1	1	3	-	-	-	-	-	-	-	3	1	-
5	3	2	1	1	3	-	-	-	-	-	-	-	3	1	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Department	**CSBS**	Programme: **B.Tech.**						
Semester	**IV**	Course Category: **PC**			*End Semester Exam Type: **LE**			
Course Code	**U23CBP407**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**SOFTWARE ENGINEERING AND APPLICATIONS LABORATORY**	**0**	**0**	**2**	**1**	**50**	**50**	**100**

Course Objectives	To learn the development of requirements specification.		
	To learn the function oriented design using SA/SD.		
	To introduce the object-oriented design using UML, test case design		
	To study about the implementation using C++ and testing.		
	To understand the use of appropriate CASE tools and other tools such as configuration management tools, program analysis tools in the software life cycle.		
Course Outcome	After completion of the course, the students will be able to		BT Mapping (Highest Level)
	CO1	Learn the development of requirements specification	**K3**
	CO2	Learn the function oriented design using SA/SD	**K3**
	CO3	Know the object-oriented design using UML, test case design.	**K3**
	CO4	Implement using C++ and testing.	**K2**
	CO5	use appropriate CASE tools and other tools such as configuration management tools, program analysis tools in the software life cycle	**K3**

List of Experiments

- Development of requirements specification,
- Function oriented design using SA/SD,
- Object-oriented design using UML,
- Test case design,
- Implementation of the designed software using C++ language.
- Perform Testing using any tool or different strategies
- Use of appropriate CASE tools and other tools such as configuration management tools
- program analysis tools in the software life cycle

Lecture Periods:	**Tutorial Periods:**	**Practical Periods: 30**	**Total Periods: 30**

Reference Books

1. Roger S. Pressman," Software Engineering – A Practitioner's Approach", Seventh edition, 2010
2. Carlo Ghezzi, Jazayeri Mehdi, Mandrioli Dino," Fundamentals of Software Engineering", second edition,2002
3. Michael Jackson," Software Requirements and Specification: A Lexicon of Practice, Principles and Prejudices",first edition, ACM Press, 1995
4. Ivar Jacobson, Grady Booch, James Rumbaugh,"The Unified Development Process", Addison-Wesley, 1999
5. Ivar Jacobson, "Object Oriented Software Engineering: A Use Case Driven Approach", First edition, ACM Press, 1992
6. Bertrand Meyer, "Touch of Class: Learning to Program Well with Objects and Contracts ", First edition, Springer-Verlag Berlin Heidelberg,2013
7. Martin Fowler, "UML Distilled: A Brief Guide to the Standard Object Modeling Language ", Third edition,Addison Wesley, 2003

Web references

1. http://vlabs.iitkgp.ernet.in/se/

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	3	-	-	-	-	-	-	-	2	1	-
2	3	2	1	1	3	-	-	-	-	-	-	-	2	1	-
3	3	2	1	1	3	-	-	-	-	-	-	-	2	2	1
4	3	2	1	1	3	-	-	-	-	-	-	-	2	2	1
5	3	2	1	1	3	-	-	-	-	-	-	-	2	2	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Department	**CSBS**	Programme: **B.Tech.**						
Semester	**IV**	Course Category: **AEC**			*End Semester Exam Type: **-**			
Course Code	**U23CBC4XX**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**CERTIFICATION COURSE-IV**	**0**	**0**	**4**	**-**	**100**	**-**	**100**

Students shall choose an International certification course offered by the reputed organizations like Google, Microsoft, IBM, Texas Instruments, Bentley, Autodesk, Eplan and CISCO, etc. The duration of the course is 40-50 hours specified in the curriculum, which will be offered through Centre of Excellence.

Pass /Fail will be determined on the basis of participation, attendance, performance and completion of the course. If a candidate Fails, he/she has to repeat the course in the subsequent years. Pass in this course is mandatory for the award of degree.

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 50**	**Total Periods: 50**

Evaluation methods

Assessment	**Continuous Assessment Marks (CAM)**		**Total Marks**
	Attendance	**MCQ Test**	
Marks	10	90	100

Department	**CSBS**	Programme: **B.Tech.**						
Semester	**IV**	Course Category: **AEC**			*End Semester Exam Type: **LE**			
Course Code	**U23CBS402**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Skill Enhancement Course 2 – Presentation Tools using ICT**	**0**	**0**	**2**	**-**	**-**	**100**	**100**

List of Experiments

Course Content:

- **Introduction**
  R and features, Evolution of R?,Big data Hadoop and R
- **Data Types**
  R & R Studio Installation, Scalar, Vectors, Matrix, List, Data frames, Factors, Handling date in R, Conversion of data types, Operators in R
- **Importing Data**
  CSV files, Database data (Oracle 11g), XML files, JSON files, Reading & Writing PDF file, Reading & Writing JPEG files, Saving Data in R,
- **Manipulating Data**
  Cbind, Rbind, Sorting, Aggregating, dplyr
- **Conditional Statements and Functions**
  If …else, For loop, While loop, Repeat loop, Apply ()
- **Statistical Concepts**
  Descriptive Statistics, Inferential Statistics, Central Tendency (Mean, Mode, Median), Hypothesis Testing, Probability, tTest, ,Chi Square test, Correlation
- **Predictive Modelling**
  Linear Regression, Normal distribution, Density
- **Data Visualisation in R using GG Plot**
  Box Plot, Histograms, Scatter Plotter, Line chart, Bar Chart, Heat maps, Misc. functions and Data Visualization using Plotly

Lecture Periods:	**Tutorial Periods:**	**Practical Periods: 30**	**Total Periods: 30**

Web references

1. https://www.w3schools.com/r/
2. https://www.geeksforgeeks.org/r-tutorial/
3. https://www.tutorialspoint.com/r/index.htm

* TE – Theory Exam, LE – Lab Exam

Evaluation Method

Table 9.15 Assessment method for skill Enhancement courses

Assessment	Continuous Assessment Marks (CAM)			Total Marks
	Attendance	Report	Presentation/Demo/Skill Test	
Marks	10	40	50	100

Department	**CSBS**	Programme: **B.Tech.**						
Semester	**IV**	Course Category: MC				*End Semester Exam Type: **TE**		
Course Code	**U23CBM404**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**RIGHT TO INFORMATION LAW AND GOOD GOVERNANCE**	**2**	**0**	**0**	**-**	**-**	**100**	**100**
UNIT-I	**Introduction**				**(9Hrs)**			
Conceptual background — Right to know — Open Government — Transparency in governance and accountability — Right to information under the Indian Constitution - Article 19 (l)(a) and Article 21 of the Constitution — Role of NGOs and movement for right to information — Right to Information Act, 2005 — Scope and objectives.								**CO1**
UNIT-II	**Obligation of Public Authorities**				**(9Hrs)**			
Obligations of public authorities: Section 4 Designation of Public Information Officers: Section 5 Disposal of request: Section 7 Exemption from disclosure of information: Section 8 Grounds for rejection to access in certain cases: Section 9 Severability: Section 10 Third party information: Section 11								**CO2**
UNIT-III	**Central and State Information Commission**				**(9Hrs)**			
Constitution of Central and State Information Commissions Terms of office and conditions of service Removal of Chief Information Commissioner or Information Commissioner. Powers and functions of Information Commissions.								**CO3**
UNIT- IV	**Judiciary and Right to Information Act**				**(9Hrs)**			
Protection of right to access the information — Role of the Supreme Court and High Courts — Recent attempts of dilution of the right to information Law								**CO4**
UNIT- V	**Right to Information Act, 2005 and its relevance to other laws**				**(9Hrs)**			
Public Records Act, 1993 Whistle Blowers Protection Act, 2014 Official Secrets Act, 1923								**CO5**

Evaluation Method

Table 9.17 Assessment method for Mandatory courses

Assessment	Continuous Assessment Marks (CAM)			Total Marks
	Attendance	MCQ Test	Presentation / Activity / Assignment	
Marks	10	30	60	100

Professional Elective I

Department	**CSBS**	Programme: **B.Tech.**						
Semester	**IV**	Course Category: PE			*End Semester Exam Type: **TE**			
Course Code	**U23CBE401**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**BUSINESS STRATEGIES**	**2**	**0**	**0**	**2**	**25**	**75**	**100**

Course Objectives	**1)**	To learn the fundamental concepts of strategic management to analyze business situations and apply these concepts to solve business problems
	2)	To understand the fundamental principles of and interrelationships among business functions such as: R&D, production, marketing, finance, HR and information technology
	3)	To understand the inter-relationships of business to individuals, other organizations, government and society
	4)	To analyze complex, unstructured qualitative and quantitative problems, using appropriate tools
	5)	To analyse alternatives to choose appropriate strategies

Course Outcome	**On completion of the course, the students will be able to**		BT Mapping (Highest Level)
	CO1	Summarize the Key dimensions of strategic management – Analysis, Evaluation, Choice and Implementation	**K1**
	CO2	Analyse and apply information from a variety of Environmental sources	**K2**
	CO3	Improve structure, design, culture and working environment to effective strategic Management	**K2**
	CO4	Compare alternative strategies for business development in differing operating contexts	**K3**
	CO5	Evaluate to implement chosen strategies and identify the areas requiring change	**K3**

UNIT-I	**INTRODUCTION TO STRATEGIC MANAGEMENT**	**(9Hrs)**	
Importance of Strategic Management- need, dimensions -Vision and Objectives- Schools of thought in Strategic Management- Strategy Content, Process, and Practice- Fit Concept and Configuration Perspective in Strategic Management			**CO1**
UNIT-II	**ENVIRONMENT ANALYSIS**	**(9Hrs)**	
Environmental Scanning and approaches- Core Competence as the Root of Competitive Advantage-Sources of Sustained Competitive Advantage-Business Processes and Capabilities-based Approach to Strategy			**CO2**
UNIT-III	**PORTFOLIO EXTERNAL ENVIRONMENTS OF FIRM-COMPETITIVE STRATEGY**	**(9Hrs)**	
SWOT Analysis -Five Forces of Industry Attractiveness that Shape Strategy-The concept of Strategic Groups, and Industry Life Cycle-Generic Strategies-Generic Strategies and the Value Chain			**CO3**
UNIT- IV	**CORPORATE STRATEGY, AND GROWTH STRATEGIES**	**(9Hrs)**	
The Motive for Diversification-Related and Unrelated Diversification-Business Portfolio Analysis-Expansion, Integration and Diversification-Strategic Alliances, Joint Ventures, and Mergers & Acquisitions-– Strategic Alliances			**CO4**
UNIT- V	**STRATEGY IMPLEMENTATION: STRUCTURE AND SYSTEMS**	**(9Hrs)**	
The 7S Framework-Strategic Control - Challenges of Change and Corporate Governance- Recent Trends in Strategic Management- Recent Trends in business strategy			**CO5**

Text Books

1. Robert M. Grant (2012). *Contemporary Strategic Management*, Blackwell, 7th Edition
2. Thomas L. Wheelan,J. David Hunger, Alan N. Hoffman & Charles E. Bamford . Concepts in Strategic Management and Business Policy: Globalization, Innovation and Sustainability.5th Edition. Pearson; 2017
3. Charles W. L. Hill & Gareth R. Jones. Strategic Management. 9th edition. Cengage India, 2012.

Reference Books

1. M.E. Porter, Competitive Strategy, 1980.M.E. Porte
2. Competitive Advantage, 1985 Richard Rumelt (2011). Good Strategy Bad Strategy: The Difference and Why It Matters
3. Fred R. David & David. Strategic Management. Student edition. Pearson College Div, 2014
4. J.-C. Spender. Business Strategy: Managing Uncertainty, Opportunity, and Enterprise. Reprint edition. Oxford University Press, 2015

5. Niraj Dawar. Shifting Your Strategy from Products to Customers. 1st Edition. Harvard Business Review Press, 2013
6. Azhar Kazmi. Strategic Management and Business Policy. 3rd edition. McGraw Hill Education, 2010.

Web References

1. www.thenewstribune.com
2. www.brandweek.com
3. Journal of Management and Strategy
4. www.foxnews.com
5. Strategic Management Journal
6. https://nptel.ac.in/courses/110/108/110108047/www.obweb.org

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	-	-	-	2	1	-	-	3	2	1	1
2	3	2	1	1	-	-	-	2	1	-	-	3	2	1	1
3	2	1	-	-	-	-	-	2	1	3	-	3	2	1	-
4	3	2	1	1	-	-	-	2	1	3	-	3	2	-	1
5	3	2	1	1	-	-	-	2	1	3	-	3	2	1	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	CSBS			Programme: **B.Tech.**				
Semester	IV			Course Category: PE			*End Semester Exam Type: **TE**	
Course Code	U23CBE402			Periods / Week			Credit	Maximum Marks
				L	T	P	C	CAM	ESE	TM
Course Name	**DESIGN THINKING AND ITS APPLICATIONS**			**2**	**0**	**0**	**2**	**25**	**75**	**100**
Course Objectives	**1)**	To make the students familiar with the concepts of Design Thinking and its importance								
	2)	To understand phases of Design Thinking process								
	3)	To know about the steps in Design Thinking process.								
	4)	To understand and appreciate doodling & story telling								
	5)	To know how to value proposition statements during presenting ideas								
Course Outcome	**On completion of the course, the students will be able to**									BT Mapping (Highest Level)
	CO1	Understand the phases of Design Thinking process								**K1**
	CO2	List the steps required to complete each phase in Design Thinking process								**K1**
	CO3	Apply each phase in the Design Thinking process								**K3**
	CO4	Apply doodling and storytelling in presenting ideas and prototypes								**K3**
	CO5	Create value proposition statements in presenting the ideas								**K3**

UNIT-I	**INTRODUCTION TO DESIGN THINKING**	**(9Hrs)**	
Introduction to design thinking - Meaning and Importance of design thinking for business - Design thinking process – Five Step Stanford Model – Classroom activity – Case study			**CO1**
UNIT-II	**EMPATHIZE PHASE**	**(9Hrs)**	
Steps involved - Touch the target Activity - Moccasin Walk Activity - Immersion activity - Case study			**CO2**
UNIT-III	**DEFINE PHASE**	**(9Hrs)**	
Creation of personas - Problem statement defining, creation - Problem statement definition – Activities - Case Study			**CO3**
UNIT- IV	**IDEATION PHASE**	**(9Hrs)**	
Ideation process - Ideation games - Ideate to find solutions - Doodling - Storytelling in design thinking - Case Study.			**CO4**
UNIT- V	**PROTOTYPE AND TESTING**	**(9Hrs)**	
Importance of prototype - Stages - Importance - Guidelines - Prototyping the idea - Group Activity - Value proposition statement - Testing in design thinking - Testing the Prototype - Documentation - Design thinking in functional work – Delivering customer satisfaction through Agile and Design Thinking - Case Study			**CO5**

Text Books

4. Eyal, N. (2014). Hooked: How to build habit-forming products. Penguin.
5. Judkins, R. (2015). The art of creative thinking. Hachette UK.
6. Senor, D., & Singer, S. (2011). Start-up nation: The story of Israel's economic miracle. Random House Digital, Inc.

Reference Books

1. Sinek, S. (2009). Start with why: How great leaders inspire everyone to take action. Penguin.
2. Brown, T., & Katz, B. (2019). Change by design: How design thinking transforms organizations and inspires innovation (Vol. 20091). New York, NY: HarperBusiness.
3. Lee, D. (2018). Design thinking in the classroom: Easy-to-use teaching tools to foster creativity, encourage innovation, and unleash potential in every student. Simon and Schuster.
4. Shrutin N Shetty (2018). Design the Future: Simplifying Design Thinking to Help You. Notion Press.com

Web References

1. https://www.interaction-design.org/literature/article/5-stages-in-the-design-thinking-process (Interaction Design Foundation)

2. https://voltagecontrol.com/blog/8-great-design-thinking-examples/ (Good examples of design thinking)
3. https://careerfoundry.com/en/blog/ux-design/design-thinking-examples/ (Good examples of design thinking)
4. https://justcreative.com/design-thinking-101/ (Design thinking 101: Principles, Tools & Examples to transform your creative process)
5. https://youtu.be/7oPZg_FR-ys (Understanding Design thinking WF NEN)
6. https://youtu.be/ir3E-TEUk48 (Design Thinking and Innovation at Apple Wei Li)
7. https://youtu.be/vSuK2C89yjA (Stanford Webinar- Design Thinking = Method, Not Magic)
8. https://youtu.be/pmjyZPibH14 (Stanford Design Thinking Virtual Crash Course)
9. https://youtu.be/5MFZTOK3e7s (So Many Uses- activity to spark creativity and design)

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	-	-	-	-	-	-	-	-	2	-	-
2	2	1	-	-	-	-	-	-	-	-	-	-	2	-	-
3	3	2	1	1	-	-	-	-	-	-	-	-	2	-	-
4	3	2	1	1	-	-	-	-	-	-	-	-	2	-	-
5	3	2	1	1	-	-	-	-	-	-	-	-	2	-	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**CSBS**			Programme: **B.Tech.**				
Semester	**IV**			Course Category: PE			*End Semester Exam Type: **TE**	
Course Code	**U23CBE403**			Periods / Week			Credit	Maximum Marks
				L	T	P	C	CAM / ESE / TM
Course Name	**Compiler Design**			**2**	**0**	**0**	**2**	**25 / 75 / 100**
Course Objectives	**1)**	Understand various phases of compiler design						
	2)	Learn to understand the relation between regular expression and finite automata						
	3)	Learn to apply various paring techniques to construct syntactical analyzer						
	4)	To demonstrate intermediate code using technique of syntax directed translation						
	5)	To Illustrate the various optimization techniques for designing various optimizing compilers						
	6)	Understand compilation process of Object Oriented features and non-imperative programming languages						
Course Outcome	**On completion of the course, the students will be able to**							BT Mapping (Highest Level)
	CO1	Understand and explain different phases of compilation process						**K2**
	CO2	Implement a lexical analyzer from a specification of a language's lexical rules						**K3**
	CO3	Understand context-free grammar and top down and bottom up parsing techniques						**K2**
	CO4	Implement syntactical analyzer using various parsing techniques						**K3**
	CO5	Design syntax directed translation schemes for a given context free grammar						**K3**
	CO6	Apply optimization techniques to intermediate code and generate machine code for high level language program						**K3**
	CO7	Understand the structures and support required for compiling advanced language features						**K2**
UNIT-I	**INTRODUCTION**						**(9Hrs)**	
Phases of compilation and overview. Lexical Analysis (scanner): Regular languages, finite automata, regular expressions, relating regular expressions and finite automata, scanner generator (lex, flex).								**CO1**
UNIT-II	**SYNTAX ANALYSIS**						**(9Hrs)**	
Context-free languages and grammars, push-down automata, LL(1) grammars and top-down parsing, operator grammars, LR(O), SLR(1), LR(1), LALR(1) grammars and bottom-up parsing, ambiguity and LR parsing, LALR(1) parser generator (yacc, bison)								**CO2**
UNIT-III	**SEMANTIC ANALYSIS AND SYMBOL TABLE**						**(9Hrs)**	
Attribute grammars, syntax directed definition, evaluation and flow of attribute in a syntax tree Basic structure, symbol attributes and management. Run-time environment: Procedure activation, parameter passing, value return, memory allocation, scope								**CO3**
UNIT- IV	**INTERMEDIATE CODE GENERATION AND CODE IMPROVEMENT**						**(9Hrs)**	
Translation of different language features, different types of intermediate forms. Control-flow, data-flow dependence etc.; local optimization, global optimization, loop optimization, peep-hole optimization etc.								**CO4**
UNIT- V	**ARCHITECTURE DEPENDENT CODE IMPROVEMENT**						**(9Hrs)**	
Instruction scheduling (for pipeline), loop optimization (for cache memory) etc. Register allocation and target code generation. **Advanced topics:** Type systems, data abstraction, compilation of Object Oriented features and nonimperative programming languages								**CO5**

Text Books

1. Alfred V Aho, Monica S. Lam, Ravi Sethi and Jeffrey D Ullman, “Compilers – Principles, Techniques and Tools”, Second Edition, Pearson Education, 2007.
2. Kenneth C. Louden (1997), Compiler Construction– Principles and Practice, 1st edition, PWS Publishing.
3. K. L. P Mishra, N. Chandrashekaran (2003), Theory of computer science- Automata Languagesand computation, 2nd

edition, Prentice Hall of India, New Delhi, India.

Reference Books

1. Randy Allen, Ken Kennedy, “Optimizing Compilers for Modern Architectures: A Dependence-based Approach”, First Edition, Morgan Kaufmann Publishers, 2002..
2. Steven S. Muchnick, “Advanced Compiler Design and Implementation”, First Edition, Morgan Kaufmann publishers, 2003.
3. D. Grune, H.E. Bal, C.J.H. Jacobs, K.G. Langendoen, “Modern Compiler Design”, Wiley, 2008
4. Allen I. Holub, “Compiler Design in C”, Prentice Hall of India, 2003.

Web References

1. https://www.tutorialspoint.com/compiler_design/
2. https://www.javatpoint.com/compiler-tutorial
3. https://www.geeksforgeeks.org/introduction-of-compiler-design/
4. https://nptel.ac.in/courses/106/105/106105190/
5. https://www.guru99.com/compiler-design-tutorial.html

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* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	-	-	-	-	-	-	-	-	2	1	1
2	2	1	-	-	-	-	-	-	-	-	-	-	2	1	1
3	3	2	1	1	-	-	-	-	-	-	-	1	2	1	-
4	3	2	1	1	-	-	-	-	-	-	-	1	2	-	1
5	2	1	-	-	-	-	-	-	-	-	-	1	2	1	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**CSBS**			Programme: **B.Tech.**				
Semester	**IV**			Course Category: **PE**			*End Semester Exam Type: **TE**	
Course Code	**U23CBE404**			Periods / Week			Credit	Maximum Marks
				L	T	P	C	CAM / ESE / TM
Course Name	**BUSINESS PROCESS**			**2**	**0**	**0**	**2**	**25 / 75 / 100**
Course Objectives	**1)**	To introduce the fundamental concepts of Business Process						
	2)	To learn about Business process management modeling						
	3)	To understand about the how to manage the business process using metrics and dashboards						
	4)	To comprehend about the process innovation features						
	5)	To understand the usage of the Business Process in the current industry scenario						
Course Outcome	**On completion of the course, the students will be able to**							BT Mapping (Highest Level)
	CO1	Understand the concepts of business process.						**K2**
	CO2	Comprehend Business process management and model a business process.						**K2**
	CO3	Analyze the semantics of business process models.						**K3**
	CO4	Illustrate the features of Process innovation.						**K3**
	CO5	Simulate a Process model following the lifecycle of Business Process Management.						**K2**
UNIT-I	**INTRODUCTION TO BUSINESS PROCESS**						**(9Hrs)**	
Introduction – Definition of Business Process- the need and the importance of Business Process – Examples of Business Process - Business Process Excellence								**CO1**
UNIT-II	**BUSINESS PROCESS MANAGEMENT (BPM)**						**(9Hrs)**	
Business process management -Process architecture, process modelling , People Centric and System Centric Process – Preparing a process for execution, Execution Process, Stimulating Processes, Rules Vs Processes								**CO2**
UNIT-III	**METRICS AND EVENT IN BUSINESS PROCESS MODELING**						**(9Hrs)**	
Managing Processes: Metrics & Dashboards -Managing the Runtime, Designing a BPM Dashboard Process Mining – Events in Business Process Modeling – Semantics of Events.								**CO3**
UNIT- IV	**PROCESS INNOVATION**						**(9Hrs)**	
Process Innovation- Process Improvement, Process Invocation, Advanced Process Improvement, Business Process Specification.								**CO4**
UNIT- V	**BPM SCENARIOS**						**(9Hrs)**	
BPM Maturity & Governance - Case Study: Designing Technology Support for a Process- Oriented Organization – Business Process Management Maturity – Process Governance– Business Process Management – Life Cycle of Business Process Management –Tools of BPM								**CO5**

Text Books

1.Dirk Draheim–Business Process Technology: A unified view on Business Processes, Workflows and Enterprise Solutions. Springer 2010.

2.Harmon, Paul: Business Process Change. A Guide for Business Managers and BPM and Six Sigma Professionals. 2nd Edition, Morgan Kaufmann, San Francisco, ISBN-10: 0123741521 ISBN-13: 978-0123741523.

Reference Books

1.M.Weske, Business Process Management : Concepts, Languages, Architectures Springer , 2012

2.Martyn A Ould, Business Process Management: A Rigorous Approach,British Computer Society, 2004.

3.Becker, J., v. Uthmann, C., zur Muehlen, M., and Rosemann, M. "Identifying the Workflow Potential of Business Processes," 32nd Hawaii International Conference on System Sciences (HICSS 1999), IEEE, Wailea (HI), 1999.

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1. https://www.process.st/bpmn-tutorial/
2. https://www.visual-paradigm.com/tutorials/business-process-modeling-tutorial/

3. https://creately.com/blog/diagrams/business-process-modeling-tutorial/
4. https://www.heflo.com/blog/process-modeling/business-process-modeling-tutorial/
5. https://www.processmaker.com/blog/bpmn-2-0-tutorial-and-examples/
6. https://sparxsystems.com/downloads/whitepapers/businessProcessModelTutorial.pdf

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	-	-	-	-	-	-	-	-	2	1	1
2	2	1	-	-	-	-	-	-	-	-	-	-	2	1	1
3	3	2	1	1	-	-	-	-	-	-	-	1	2	1	-
4	3	2	1	1	-	-	-	-	-	-	-	1	2	-	1
5	2	1	-	-	-	-	-	-	-	-	-	1	2	1	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**CSBS**			Programme: **B.Tech.**				
Semester	**V**			Course Category: PE			*End Semester Exam Type: **TE**	
Course Code	**U20CBT509**			Periods / Week			Credit	Maximum Marks
				L	T	P	C	CAM	ESE	TM
Course Name	**SOFTWARE DESIGN WITH UML**			**2**	**0**	**0**	**2**	**25**	**75**	**100**
Course Objectives	**1)**	To Understand the object-oriented software development process								
	2)	To Design suitable pattern to develop software models								
	3)	To Analyze requirements to create requirements design mode								
	4)	To Apply business modeling and modeling languages to design software								
	5)	To Develop correct and robust software deployment models								
Course Outcome	**On completion of the course, the students will be able to**									BT Mapping (Highest Level)
	CO1	Decide a suitable software model for a project								**K1**
	CO2	Describe how to model object-oriented languages								**K2**
	CO3	Design a project business model								**K2**
	CO4	Elicit requirements and design a user interface model								**K3**
	CO5	Create a deployment model								**K3**

UNIT-I	**INTRODUCTION**	**(9Hrs)**
Software development process: The Waterfall Model vs. The Spiral Model - The Software Crisis,description of the real world using the Objects Model. - Classes, inheritance and multiple configurations. - Quality software characteristics - Description of the Object-Oriented Analysis process vs. the Structure Analysis Model.		**CO1**
UNIT-II	**UML LANGUAGE AND DESIGN PATTERNS**	**(9Hrs)**
Standards - Elements of the language. - General description of various models -The process of Object-Oriented Software development. - Description of Design Patterns - Technological Description of Distributed Systems.		**CO2**
UNIT-III	**BUSINESS MODEL DIAGRAMS**	**(9Hrs)**
Requirements Analysis Using Case Modeling - Analysis of system requirements - Actor definitions. - Writing a case goal - Use Case Diagrams. - Use Case Relationships. Dynamic Model: State Diagram / Activity Diagram- Description of the State Diagram - Events Handling - Description of the Activity Diagram - Exercise in State Machine - Case studies to implement in design lab		**CO3**
UNIT- IV	**LOGICAL VIEW DESIGN DIAGRAMS**	**(9Hrs)**
Transfer from Analysis to Design in the Characterization Stage: Interaction Diagrams - Description of goal - Defining UML Method, Operation, Object Interface, Class - Sequence Diagram - Finding objects from Flow of Events - Describing the process of finding objects using a Sequence Diagram - Describing the process of finding objects using a Collaboration Diagram – Mapping use case to sequence diagram **The Static Structure Diagrams. -**The Class Diagram Model - Attributes descriptions - Operations descriptions - Connections descriptions in the Static Model - Association, Generalization, Aggregation, Dependency, Interfacing, Multiplicity- Case studies to implement in design lab		**CO4**
UNIT- V	**TECHNICAL STACK DIAGRAMS**	**(9Hrs)**
Package Diagram Model - Description of the model. - White box, black box - connections between packagers - Interfaces - Create Package Diagram - Drill Down - Component Diagram Model - Physical Aspect – Logical Aspect - Connections and Dependencies - User face - Initial DB design in a UML environment. **Deployment Model** - Processors - Connections - Components - Tasks - Threads- Signals and Events. – Mapping class diagram to create skeleton code to implement - Case studies to implement in design lab.		**CO5**

Text Books

1. Bernd Bruegge and Allen H. Dutoit, Object-Oriented Software Engineering: using UML, Patterns, and Java,Third Edition, Pearson, 2010.
2. Erich Gamma, Richard Helm, Ralph Johnson, and John M. Vlissides, Design Patterns: Elements of Reusable Object-Oriented Software, Addison Wesley, 1994.

3. Grady Booch, Robert Maksimchuk, Michael Engle, Bobbi Young Ph.D. (Author), Jim Conallen Kelli Houston,Object-Oriented Analysis and Design with Applications,Addison-Wesley,2007

Reference Books

1. Craig Larman, "Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development", 3rd Edition, Pearson Education, 2005.
2. Simon Bennett, Steve Mc Robb and Ray Farmer, "Object Oriented Systems Analysis and Design Using UML", Fourth Edition, Mc-Graw Hill Education, 2010
3. Martin Fowler, "UML Distilled: A Brief Guide to the Standard Object Modeling Language", Third edition, Addison Wesley, 2003

Web References

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2.https://www.tutorialspoint.com/software_engineering/software_design_basics.htm
3.https://www.javatpoint.com/software-engineering-software-design
4.https://onlinecourses.nptel.ac.in/noc20_cs84/preview

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	-	-	-	2	1	-	-	3	2	1	1
2	3	2	1	1	-	-	-	2	1	-	-	3	2	1	1
3	2	1	-	-	-	-	-	2	1	3	-	3	2	1	-
4	3	2	1	1	-	-	-	2	1	3	-	3	2	-	1
5	3	2	1	1	-	-	-	2	1	3	-	3	2	1	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Honours Programme

Department	**CSBS**	Programme: **B.Tech.**						
Semester	**IV**	Course Category: PC			*End Semester Exam Type: **TE**			
Course Code	U23CBH401	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**BUSINESS ANALYTICS AND DATA MINING**	**3**	**1**	**0**	**4**	**25**	**75**	**100**

Course Objectives	**1)**	Gain a comprehensive understanding of the role of business analytics and data mining in organizational decision-making.
	2)	Develop a strong foundation in the data mining process, including data preparation, exploration, transformation, and modeling.
	3)	Critically evaluate and interpret the results of data mining models, considering their strengths, limitations, and potential biases.
	4)	Apply business analytics and data mining methodologies to solve real-world business problems across diverse industry sectors.
	5)	Data preparation and exploration methods to clean, organize, and visualize data for effective analysis.

Course Outcome	**On completion of the course, the students will be able to**		BT Mapping (Highest Level)
	CO1	Key concepts and terminology used in data mining, including notation and basic data mining processes	**K2**
	CO2	Identify and handle common data quality problems	**K3**
	CO3	Understand the fundamental principles of supervised learning and its applications in various domains	**K3**
	CO4	Evaluate the effectiveness of different unsupervised learning models	**K3**
	CO5	Characterize time series data, identifying its componentsand analyzing its stationarity properties.	**K2**

UNIT-I	**General Overview of data Mining and its Components**	**(9Hrs)**	
Data Mining definitions, applications, origins, growth, terminology and notation. Data Mining Process: core ideas, overview of classification, prediction, association rules, predictive analytics, data reduction, data exploration, data visualization, supervised and unsupervised learning, and steps in data mining.			**CO1**
UNIT-II	**Data Exploration, Preparation and Performance Evaluation**	**(9Hrs)**	
Data Visualization: basic charts, multidimensional visualization, and specialized visualizations. Dimension Reduction: Data summaries, correlation analysis, and principal component analysis. Judging classification performance: naive rule, class separation, classification matrix, accuracy measures, cutoff, unequal importance of classes, and asymmetric misclassification. Evaluating predictive performance: average, prediction accuracy measures.			**CO2**
UNIT-III	**Supervised Learning Methods**	**(9Hrs)**	
Multiple Linear Regression, Logistic Regression: modeling, evaluation, and analysis. k-Nearest Neighbors (k-NN), Classification and Regression Trees: modeling, evaluation, and analysis. Neural Nets: concept and structure, fitting a network to data.			**CO3**
UNIT- IV	**Unsupervised Learning**	**(9Hrs)**	
Association Rules: A priori algorithm, support and confidence. Cluster Analysis: distance measures, hierarchical clustering, and nonhierarchical clustering			**CO4**
UNIT- V	**Forecasting Time Series**	**(9Hrs)**	
Handling Time Series: time series components, data partitioning. Regression-Based Forecasting: model with trend, model with seasonality, model with trend and seasonality. Smoothing Methods: moving average, simple exponential smoothing			**CO5**

Text Books

1. Galit Shmueli, Nitin Patel, and Peter Bruce, Data Mining for Business Intelligence: Concepts, Techniques, and Applications in Microsoft Office Excel with XLMiner, Second Edition,2015
2. Ian H. Witten, Eibe Frank, and Mark A. Hall, Data Mining: Practical Machine Learning Tools and Techniques, Third Edition,2011
3. Anand Rajaraman, and Jeffrey David Ullman, Mining of Massive Datasets, First Edition,2011

Reference Books

1. Jiawei Han, Micheiine Kamber, and Jian Pie, Data Mining: Concepts and Techniques, Third Revised Edition, 2011
2. Foster Provost, and Tom Fawcett, Data Science for Business: What you need to know about data mining and data-analytic thinking. First Edition, 2013

Web References

1. https://www.wgu.edu/blog/data-mining-business-analytics2005.html
2. https://onlinecourses.nptel.ac.in/noc20_mg24/preview
3. https://www.snowflake.com/trending/data-mining-for-business-analytics/
4. https://www.isid.ac.in/~sqc/badmor.html

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3	3	3	3	1	3	-	-	-	-	-	-	2	3	2	1
4	3	3	3	1	3	-	-	-	-	-	-	2	3	2	1
5	3	3	3	1	3	-	-	-	-	-	-	2	3	2	1

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