

Haldia Institute of Technology

ICARE Complex, Hatiberia, Haldia, Dist-Purba Medinipur, Pin-721657, WB.

(An Autonomous Institution under Maulana Abul Kalam Azad University of Technology)

NAAC Accredited Grade 'A' Institute,

NBA Accredited Department

Approved by: All India Council for Technical Education (AICTE)



Curriculum for B. Tech. in Computer Science and Engineering

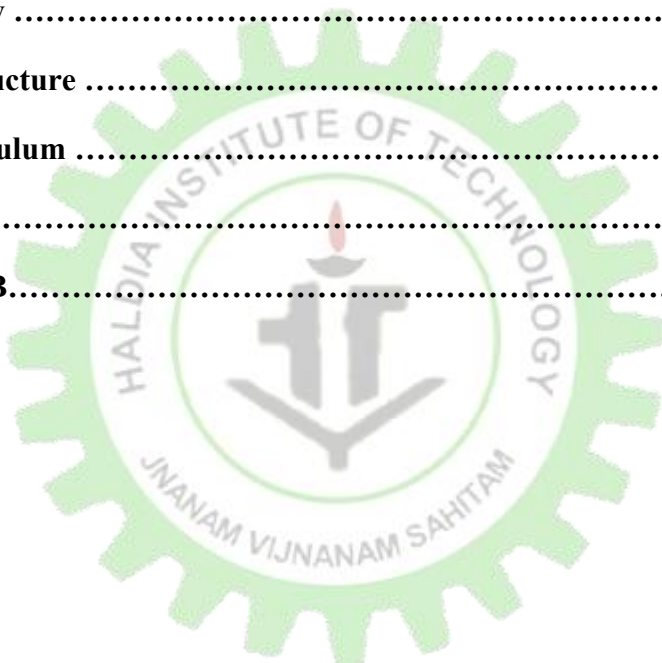
[NEP-2020 IMPLEMENTED]

(Applicable from the Academic Session 2026-2030)

Haldia Institute of Technology, West Bengal
(An Autonomous Institution under Maulana Abul Kalam Azad University of Technology.)
Curriculum for B. Tech courses in Computer Science and Engineering
(Applicable from the Academic Session 2026-2030)

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Institutional Vision & Mission

VISION

To achieve Centre of Excellence in the field of Science, Technology and Management Education for creating dynamic human resources of global standards with capabilities of accepting new challenges.

MISSION

- To impart quality and value-based education to raise satisfaction level of all stakeholders.
- To create competent, creative professionals, and great entrepreneurs who can work as individual or in group in multi-cultural global environments.
- To prepare citizens who would grow to be competent enough to contribute significantly with personal integrity and civic responsibility for the betterment of mankind throughout their careers and profession.

Department of Computer Science and Engineering

VISION

To be a centre of excellence in Computer Science and Engineering by nurturing innovation, multidisciplinary learning, research, and ethical values, producing globally competent professionals capable of addressing technological and societal challenges through sustainable solutions.

MISSION

- To provide a strong foundation in Computer Science and Engineering through outcome-based, learner-centric education, integrating experiential learning and modern computing practices to cultivate analytical thinking, innovation, and problem-solving abilities.
- To nurture technically proficient and ethically responsible professionals by providing exposure to emerging technologies, industry-oriented learning, effective communication, teamwork, leadership, and entrepreneurial skills for successful careers and lifelong learning.
- To encourage multidisciplinary research, innovation, and collaborative learning to develop sustainable, secure, and socially responsible computing solutions that address contemporary regional, national, and global challenges.

Departmental of Computer Science and Engineering

PROGRAMME EDUCATIONAL OBJECTIVES (PEO):

- PEO-1:** To provide students with a strong foundation in applied science and Computer Science & Engineering fundamentals necessary to analyse the requirements of the software, understand the technical specifications, design and create innovative computing products and solutions for real life problems.
- PEO-2:** To provide exposure to emerging technologies, adequate training and opportunities to work as teams on multidisciplinary projects with effective communication skills and leadership qualities.
- PEO-3:** To prepare the students for a successful professional career as engineer, scientist, teacher, technocrat, administrator or an entrepreneur and work with values & social concern bridging the digital divide and meeting the requirements of Indian and multinational companies.

Departmental of Computer Science and Engineering

PROGRAM OUTCOME (POs):

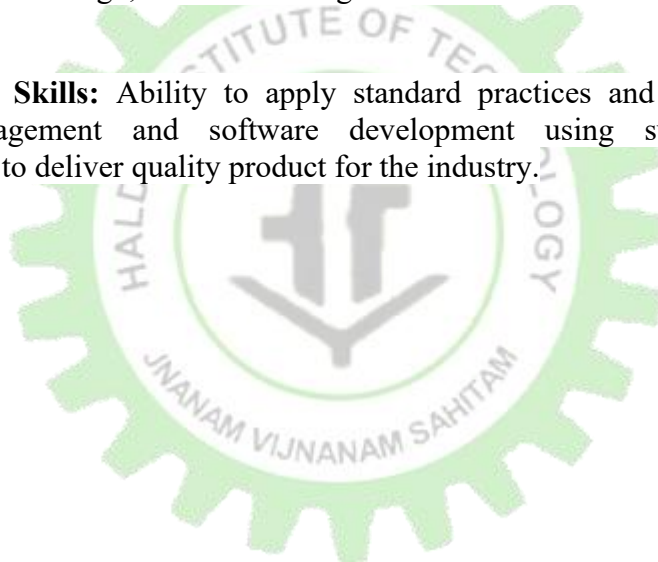
Engineering Graduates will be able to:

- PO-1: Engineering Knowledge:** Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in **WK1 to WK4** respectively to develop to the solution of complex engineering problems.
- PO-2: Problem Analysis:** Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (**WK1 to WK4**)
- PO-3: Design/development of solutions:** Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (**WK5**).
- PO-4: Conduct investigations of complex problems:** Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (**WK8**).
- PO-5: Engineering Tool Usage:** Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems (**WK2 and WK6**).
- PO-6: The engineer and the World:** Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment (**WK1, WK5, and WK7**).
- PO-7: Ethics:** Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws (**WK9**).
- PO-8: Individual and Collaborative Team work:** Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.
- PO-9: Communication:** Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences.
- PO-10: Project Management and Finance:** Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.
- PO-11: Life-Long Learning:** Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change (**WK8**).

Departmental of Computer Science and Engineering

PROGRAM SPECIFIC OUTCOMES (PSOs):

- PSO-1: Demonstration of Basic Knowledge:** Ability to understand the principles & working of computer systems; demonstrate, analyse, apply management principles, mathematical foundations in the development of computational solutions.
- PSO-2: Problem Solving Skills:** Ability to design and develop computer programs and computer based systems of moderate complexity in the areas pertaining to database, networking, web-design, artificial intelligence and information security.
- PSO-3: Professional Skills:** Ability to apply standard practices and methods in software project management and software development using suitable programming environments to deliver quality product for the industry.



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Credit Summary for B. Tech. Programme in CSE with effect from 2026-2030

Category/ Type of Course		Course Code	AICTE recommended Credit
Lecture		L	
Tutorial		T	
Practical		P	
Classroom Instruction		CI	
Laboratory Instruction		LI	
Term Work		TW	
Self-Learning		SL	
BSC/ESC	Basic Science Courses	BSC	29*
	Engineering Courses	ESC	27*
Program Course	Program Core Course	PCC	58*
	Program Elective Course	PEC	9*
Multidisciplinary Course	Open or General Course (OE/GE)	OEC	9*
Skill Courses	Vocational and Skill Enhancement Course	VSEC	12*
Multidisciplinary Holistic development-humanities, Social Science and Management + Liberal Learning	Ability Enhancement course(AEC)	HSSM	
	Indian Knowledge System (IKS)		
	Value Education/value Addition/ Professional Ethics/Life skills Courses (VEC/EVLSC)/ Value Added Course (VAC)**		
	Entrepreneurship/ Economics		
	Co-curricular Activities		
Employment Enhancement Courses	Project	EEC	16*
	Summer Internship/ Internship		
	Seminar		
Mandatory Courses [Non-Credited]		AU	Non credit
Total Credit (Semester/ Program)		162	
Honours Course			20

Definition of Credit (as per National Credit Framework 2024): Total notional learning hours = 1200 Hours/ Year, 1 Credit = 30 notional learning hours

- A student will be eligible to get **B Tech degree with Honours** if he/she completes an additional 20 credit points/16 credit points (for lateral entry students). These could be acquired through MOOCs. For details kindly refer to APPENDIX – A
- A student will be eligible to get B.Tech degree certificate, if he/she acquires 100 MAR points in 4 years of their study, Lateral entry students must acquire 75 MAR points in their 3 years of study. For details kindly refer to APPENDIX – B.

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SCHEME OF INSTRUCTION & SYLLABI
Scheme of Instructions: First Year B. Tech in CSE
Semester-I (w.e.f. 2026-27)

Sr. No.	Course Category	Course Code	Course Title	Teaching & Learning Scheme (in hrs. per semester)						EXAM SCHEME		
				CI		LI	TW+ SL	Total	Total Credits	CA	ESE	TOTAL
				L	T	P						
1	BS	BS-M101	Engineering Mathematics-I	42	14	0	64	120	4	30	70	100
2	BS	BS-CH102 D	Engineering Chemistry	42	0	0	48	90	3	30	70	100
3	BS	BS-CH 192 D	Engineering Chemistry Lab	0	0	42	03	45	1.5	40	60	100
4	ES	ES-EE 103 B	Basic Electro. & Elec. Engg	42	0	0	48	90	3	30	70	100
5	ES	ES-CS 103	Programming for Problem Solving	42	14	0	64	120	4	30	70	100
6	ES	ES-EE 193 B	Basic Electro. & Elec. Engg Lab	0	0	42	03	45	1.5	40	60	100
7	ES	ES-CS 193	Programming Lab	0	0	42	03	45	1.5	40	60	100
8	VSEC	VSEC-181	Soft Skills for Professional Development - I	0	0	28	02	30	1	-	-	100
			Total	168	28	154	235	585	19.5	240	460	800

	Program Course		Programme Course		Multidisciplinary Course	Skill Course	Multidisciplinary Holistic development- humanities, Social Science and Management + Liberal Learning					Employment Enhancement Courses			
Course Category	Basic Science (BS)	Engineering Science (ES)	Programme Core (PC)	Programme Elective (PE)	Open Elective (OE/MDM)	Vocational and Skill Enhancement Course (VSEC)	Ability enhance Course	Indian Knowledge System	Value Education	Co-curricular	Entrepreneurship/Economics/Management	Res. math.	Mini project	Project	Internship
Semester Credits=19.5	8.5	10.0	-	-	-	1.0	-	-	-	-	-	-			
Cumulative Sum=19.5	8.5	10.0	-	-	-	1.0	-					-			

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Scheme of Instructions: First Year B. Tech in CSE

Semester-II (w.e.f.2026-27)

Sr. No.	Course Category	Course Code	Course Title	Teaching & Learning Scheme (in hrs. per Semester)						EXAMSCHEME		
				CI		LI	TW + SL	Total	Total Credits	CA	ESE	TOTAL
				L	T	P						
1	BS	BS-M 201 D	Engineering Mathematics-II	42	14	0	64	120	4	30	70	100
2	BS	BS-PH 202D	Engineering Physics	42	0	0	48	90	3	30	70	100
3	BS	BS-PH 292D	Engineering Physics Lab	0	0	42	03	45	1.5	40	60	100
4	ES	ES-BT 204	Biology for Engineers	28	0	0	32	60	2	30	70	100
5	ES	ES-CSE-201	Artificial Intelligence	42	0	0	48	90	3	30	70	100
6	ES	ES-CSE 291	IT Workshop-I (Programming with Python)	0	0	42	03	45	1.5	40	60	100
7	ES	ES-ME 292	Engineering Drawing	0	0	42	03	45	1.5	40	60	100
8	HSSM	HM-AEC 205	English Language and Technical Communication	28	0	0	32	60	2	30	70	100
9	HSSM	HM-IKS 206	Values, Ethics and Indian Knowledge System	28	0	0	32	60	2	30	70	100
10	HSSM	HM-AEC 295	Language Lab	0	0	28	02	30	1	40	60	100
11	HSSM	AU-281	NCC/NSS/CSP/Yoga	0	0	14	14	28	0	0	0	100
			Total	210	14	168	281	673	21.5	340	660	1100

	Program Course		Programme Course		Multidisciplinary Course	Skill Course	Multidisciplinary Holistic development- humanities, Social Science and Management + Liberal Learning					Employment Enhancement Courses			
Course Category	Basic Science (BS)	Engineering Science (ES)	Programme Core (PC)	Programme Elective (PE)	Open Elective (OE/MDM)	Vocational and Skill Enhancement Course (VSEC)	Ability enhance Course	Indian Knowledge System	Value Education	Co-curricular	Entrepreneurship/Economics/Management	Res. math.	Mini project	Project	Internship
Semester Credits=21.5	8.5	8.0	-	-	-	-	3.0	2.0	-	0	-	-	-	-	-
Cumulative Sum=41	17.0	18.0	-	-	-	1.0	5.0					-			

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Scheme of Instructions: Second Year B. Tech in CSE
Semester–III (w.e.f.2026-27)

Sr. No.	Course Category	Course Code	Course Title	Teaching & Learning Scheme (in hrs per Semester)						EXAMSCHEME		
				CI		LI	TW + SL	Total	Total Credits	CA	ESE	TOTAL
				L	T	P						
1	BSC	BS-CSE 301	Probability and Statistics	42	0	0	48	90	3	30	70	100
2	ESC	ES-CSE 301	Digital Logic Design	42	0	0	48	90	3	30	70	100
3	PCC	PC-CSE 301	Data Structure & Algorithms	42	0	0	48	90	3	30	70	100
4	PCC	PC-CSE 302	Database Management System	42	0	0	48	90	3	30	70	100
5	PCC	PC-CSE 303	Formal Language & Automata Theory	42	0	0	48	90	3	30	70	100
6	PCC	PC-CSE 304	Introduction to Cyber Security & Block Chain Technology	42	0	0	48	90	3	30	70	100
7	HSSM	AU-CSE 301	Environmental Sciences	14	0	0	14	28	0	0	0	100
8	ESC	ES-CSE 391	Digital Logic Design Lab	0	0	56	4	60	2	40	60	100
9	PCC	PC-CSE 391	Data Structure & Algorithms Lab	0	0	56	4	60	2	40	60	100
10	PCC	PC-CSE 392	Database Management System Lab	0	0	56	4	60	2	40	60	0
			Total	266	0	168	314	748	24	300	600	900

	Program Course		Programme Course		Multidisciplinary Course	Skill Course	Multidisciplinary Holistic development- humanities, Social Science and Management + Liberal Learning					Employment Enhancement Courses			
Course Category	Basic Science (BS)	Engineering Science (ES)	Programme Core (PC)	Programme Elective (PE)	Open Elective (OE/MDM)	Vocational and Skill Enhancement Course (VSEC)	Ability enhance Course	Indian Knowledge System	Value Education	Co-curricular	Entrepreneurship/Economics/Management	Res. math.	Mini project	Project	Internship
Semester Credits = 24	3.0	5.0	16.0	-	-	-	0	-	-	-	-	-	-	-	-
Cumulative Sum = 65	20.0	23.0	16.0	-	-	1.0	5.0					-			

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Scheme of Instructions: Second Year B. Tech in CSE

Semester–IV (w.e.f.2026-27)

Sr. No.	Course Category	Course Code	Course Title	Teaching & Learning Scheme (in hrs per Semester)						EXAMSCHEME		
				CI		LI	TW + SL	Total	Total Credits	CA	ESE	TOTAL
				L	T	P						
1	PCC	PC-CSE 401	Computer Organization & Architecture	42	0	0	48	90	3	30	70	100
2	PCC	PC-CSE 402	Object Oriented Programming	42	0	0	48	90	3	30	70	100
3	PCC	PC-CSE 403	Machine Learning	42	0	0	48	90	3	30	70	100
4	PCC	PC-CSE 404	Discrete Mathematics	42	14	0	64	120	4	30	70	100
5	PCC	PC-CSE 406	Ethical Issues in AI	28	0	0	32	60	2	30	70	100
6	HSSM	HM-CSE 401	Project Management and Entrepreneurship	42	0	0	48	90	3	30	70	100
7	PCC	PC-CSE 491	Computer Organization & Architecture Lab	0	0	56	4	60	2	40	60	100
8	PCC	PC-CSE 492	Object Oriented Programming Lab	0	0	56	4	60	2	40	60	100
9	PCC	PC-CSE 493	Machine Learning Lab	0	0	56	4	60	2	40	60	100
10	VSEC	VSEC 481	Soft Skills for Professional Development II	0	0	28	02	30	1	-	-	100
			Total	238	14	196	302	750	25	300	600	1000

	Program Course		Programme Course		Multidisciplinary Course	Skill Course	Multidisciplinary Holistic development- humanities, Social Science and Management + Liberal Learning					Employment Enhancement Courses			
Course Category	Basic Science (BS)	Engineering Science (ES)	Programme Core (PC)	Programme Elective (PE)	Open Elective (OE/MDM)	Vocational and Skill Enhancement Course (VSEC)	Ability enhance Course	Indian Knowledge System	Value Education	Co-curricular	Entrepreneurship/Economics/Management	Res. math.	Mini project	Project	Internship
Semester Credits = 25	-	-	21.0	-	-	1.0	-	-	-	3.0	-	-	-	-	
Cumulative Sum = 90	20.0	23.0	37.0	-	-	2.0	8.0					-			

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Scheme of Instructions: Third Year B. Tech in CSE

Semester-V (w.e.f. 2026-27)

Sr. No.	Course Category	Course Code	Course Title	Teaching & Learning Scheme (in hrs. per Semester)						EXAMSCHEME		
				CI		LI	TW + SL	Total	Total Credits	CA	ESE	TOTAL
				L	T	P						
1	ESC	ES-CSE 501	Compiler Design	42	0	0	48	90	3	30	70	100
2	PCC	PC-CSE 501	Operating Systems	42	0	0	48	90	3	30	70	100
3	PCC	PC-CSE 502	Design & Analysis of Algorithms	42	0	0	48	90	3	30	70	100
4	PEC	PE-CSE 501 A/B/C/D	Data Mining /Human Computer Interaction/Computer Graphics/ Image Processing	42	0	0	48	90	3	30	70	100
5	OEC	OE-CSE 501 A/B/C	Operations Research/ Multimedia Systems/ Introduction to Philosophical Thoughts	42	0	0	48	90	3	30	70	100
6	HSSM	VAC-CSE 501	Python for Data Analytics	42	0	0	48	90	3	30	70	100
7	PCC	PC-CSE 591	Operating Systems Lab	0	0	56	4	60	2	40	60	100
8	PCC	PC-CSE 592	Design & Analysis of Algorithms Lab	0	0	56	4	60	2	40	60	100
9	PCC	PC-CSE 593	IT Workshop-II (Web Programming)	0	0	56	4	60	2	40	60	100
			Total	252	0	168	300	720	24	300	600	900

	Program Course		Programme Course		Multidisciplinary Course	Skill Course	Multidisciplinary Holistic development- humanities, Social Science and Management + Liberal Learning					Employment Enhancement Courses			
Course Category	Basic Science (BS)	Engineering Science (ES)	Programme Core (PC)	Programme Elective (PE)	Open Elective (OE/MDM)	Vocational and Skill Enhancement Course (VSEC)	Ability enhance Course	Indian Knowledge System	Value Education	Co-curricular	Entrepreneurship/Economics/Management	Res. math.	Mini project	Project	Internship
Semester Credits = 24	-	3.0	12.0	3.0	3.0	-	-	-	3	-	-	-	-	-	-
Cumulative Sum = 114	20.0	26.0	49.0	3.0	3.0	2.0	11.0					0			

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Scheme of Instructions: Third Year B. Tech in CSE

Semester–VI (w.e.f. 2026-27)

Sr. No.	Course Category	Course Code	Course Title	Teaching & Learning Scheme (in hrs. per Semester)						EXAMSCHEME		
				CI		LI	TW + SL	Total	Total Credits	CA	ESE	TOTAL
				L	T	P						
1	PCC	PC-CSE 601	Cloud Computing	42	0	0	48	90	3	30	70	100
2	PCC	PC-CSE 602	Computer Networks	42	0	0	48	90	3	30	70	100
3	ESC	ES-CSE 601	Software Engineering	42	0	0	48	90	3	30	70	100
4	PEC	PE-CSE 601 A/B/C/D	Advanced Algorithms/Quantum Computing/Neural Networks and Deep Learning/Soft Computing	42	0	0	48	90	3	30	70	100
5	OEC	OE-CSE 601A/B/C	Numerical Methods/ Human Resource Development and Organizational Behavior/ Soft Skill & Interpersonal Communication	42	0	0	48	90	3	30	70	100
6	HSSM	VAC-CSE 601	Aptitude and Professional Skills for Industry readiness	42	0	0	48	90	3	30	70	100
7	PCC	PC-CSE 691	Cloud computing Lab	0	0	56	4	60	2	40	60	100
8	PCC	PC-CSE 692	Computer Networks Lab	0	0	56	4	60	2	40	60	100
9	ESC	ES-CSE 691	Software Engineering Lab	0	0	56	4	60	2	40	60	100
			Total	252	0	168	300	720	24	300	600	900

	Program Course		Programme Course		Multidisciplinary Course	Skill Course	Multidisciplinary Holistic development- humanities, Social Science and Management + Liberal Learning					Employment Enhancement Courses			
Course Category	Basic Science (BS)	Engineering Science (ES)	Programme Core (PC)	Programme Elective (PE)	Open Elective (OE/MDM)	Vocational and Skill Enhancement Course (VSEC)	Ability enhance Course	Indian Knowledge System	Value Education	Co-curricular	Entrepreneurship/Economics/Management	Res. math.	Mini project	Project	Internship
Semester Credits = 24	-	5.0	10.0	3.0	3.0	-	-	-	3	-	-	-	-	-	
Cumulative Sum = 138	20.0	31.0	59.0	6.0	6.0	2.0	14.0					0			

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Scheme of Instructions: Fourth Year B. Tech in CSE

Semester–VII (w.e.f. 2026-27)

Sr. No.	Course Category	Course Code	Course Title	Teaching & Learning Scheme (in hrs. per Semester)						EXAMSCHEME		
				CI		LI	TW + SL	Total	Total Credits	CA	ESE	TOTAL
				L	T	P						
1	PEC	PE-CSE 702 A/B/C/D	Pattern Recognition/Cryptography & Network Security/Speech and Natural Language Processing/Internet of Things	42	0	0	48	90	3	30	70	100
2	EEC	EE-CSE 771	Industry Internship	0	0	0	90	90	3	0	0	100
3	EEC	EE- CSE 781	Project-I	0	30	120	120	270	6	0	0	100
			Total	42	30	120	408	450	12	30	70	300

	Program Course		Programme Course		Multidisciplinary Course	Skill Course	Multidisciplinary Holistic development- humanities, Social Science and Management + Liberal Learning					Employment Enhancement Courses			
Course Category	Basic Science (BS)	Engineering Science (ES)	Programme Core (PC)	Programme Elective (PE)	Open Elective (OE/MDM)	Vocational and Skill Enhancement Course (VSEC)	Ability enhance Course	Indian Knowledge System	Value Education	Co-curricular	Entrepreneurship/Economics/Management	Res. math.	Mini project	Project	Internship
Semester Credits = 12	-	-	-	3.0	-	-	-	-	-	-	-	-	-	6	3
Cumulative Sum = 150	20.0	31.0	59.0	9.0	6.0	2.0	14.0					9			

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SCHEME OF INSTRUCTION & SYLLABI

Scheme of Instructions: Fourth Year B. Tech in CSE

Semester–VIII (w.e.f. 2026-27)

Sr. No.	Course Category	Course Code	Course Title	Teaching & Learning Scheme (in hrs. per Semester)						EXAMSCHEME		
				CI		LI	TW + SL	Total	Total Credits	CA	ESE	TOTAL
				L	T	P						
1	OEC	OE-CSE 801 A/B/C/D/E	Big Data Analysis/Cyber Law and Ethics/ Mobile Computing/Ad-hoc and Sensor Network/ Research Methodology	42	0	0	48	90	3	30	70	100
2	EEC	EE-CSE 871	Industry Internship	0	0	0	90	90	3	0	0	100
3	EEC	EE- CSE 881	Project-II	0	30	120	120	270	6	0	0	100
			Total	42	30	120	258	450	12	30	70	300

	Program Course		Programme Course		Multidisciplinary Course	Skill Course	Multidisciplinary Holistic development- humanities, Social Science and Management + Liberal Learning					Employment Enhancement Courses			
Course Category	Basic Science (BS)	Engineering Science (ES)	Programme Core (PC)	Programme Elective (PE)	Open Elective (OE/MDM)	Vocational and Skill Enhancement Course (VSEC)	Ability enhance Course	Indian Knowledge System	Value Education	Co-curricular	Entrepreneurship/Economics/Management	Res. math.	Mini project	Project	Internship
Semester Credits = 12	-	-	-	-	3.0	-	-	-	-	-	-	-	-	6	3
Cumulative Sum = 162	20.0	31.0	59.0	9.0	9.0	2.0	14.0					18			

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PROGRESSIVE TOTAL CREDITS:

Category/ Type of Course			Semester wise Credit								Course wise Total credit
			I	II	III	IV	V	VI	VII	VII	
BSC/ESC	Basic Science Courses	BSC	8.5	8.5	3	-	-	-	-	-	20
	Engineering Science Courses	ESC	10	8	5	-	3	5	-	-	31
Program Course	Program Core Course	PCC	-	-	16	21	12	10	-	-	59
	Program Elective Course	PEC	-	-	-	-	3	3	3		09
Multidisciplinary Course	Open or General Course (OE/GE)	OEC	-	-	-	-	3	3	-	3	09
Skill Courses	Vocational and Skill Enhancement Course	VSEC	1		-	1	-	-	-	-	2
Multidisciplinary Holistic development- humanities, Social Science and Management + Liberal Learning	Ability Enhancement course (AEC)	HSSM		3	-	-	-	-	-	-	14
	Indian Knowledge System (IKS)			2	-	-	-	-	-		
	Value Education/value Addition/ Professional Ethics/Life skills Courses (VEC/EVLSC)		-	-	-	-	3	3	-	-	
	Entrepreneurship/ Economics		-	-	-	3	-	-	-	-	
Employment Enhancement Course	Project	EEC	-	-	-	-	-	-	6	6	18
	Internship		-	-	-	-	-	-	3	3	
	Seminar		-	-	-	-	-	-	-	-	
Mandatory Course [Non-Credited]		AU	-	-	0	-	-	-	-	-	
Total Credit (Semester/ Program)			41		49		48		24		162

Curriculum for B. Tech Courses in Computer Science and Engineering
(Applicable for Academic Year 2026-2030)



(First Year - First Semester)

Course Code: BS-M101	Category: Basic Science Courses
Course Title: Engineering Mathematics-I	Semester: 1 st
L-T-P: 3-1-0	Credit: 4
Pre-Requisites: 10+2 Level Mathematics.	Branch: All Engineering Branch Total Lecture: 56L
Course Outcomes: Upon successful completion of this course, the student will be able to:	
CO1: Apply elementary row operations, rank methods, and the Cayley–Hamilton theorem to determine the consistency of systems of linear equations, and compute eigenvalues and eigenvectors for matrix diagonalization in engineering applications.	
CO2: Apply mean value theorems and Leibnitz’s theorem for successive differentiation, and determine the convergence of improper integrals using Beta and Gamma functions	
CO3: Compute partial derivatives, Jacobians, and total differentials for functions of several variables, and employ the Lagrange Multiplier method to find extrema and saddle points in constrained optimization problems.	
CO4: Calculate the gradient, divergence, and curl of vector fields and apply fundamental theorems—namely Green’s, Gauss Divergence, and Stokes’ theorems—to evaluate line, surface, and volume integrals.	
Module 1: Introduction to Linear Algebra (14 L)	
Introduction to Matrix Algebra, Elementary row and column operations over a matrix; Rank of a matrix; Rank and nullity; System of linear equations and its consistency; Cayley-Hamilton theorem; Eigenvalues and Eigenvectors; Diagonalization of matrices.	
Module 2: Differential & Integral Calculus of Single Variable (14 L)	
Leibnitz’s Theorem on Successive Derivatives; Mean value theorem (Rolle’s, Lagrange’s, Cauchy’s, Taylor’s and Maclaurin’s theorems with remainders); Improper integrals; Beta and Gamma functions and their properties; Convergence of improper integrals.	
Module 3: Calculus of functions with several variables (15 L)	
Introduction to functions of several variables; Limit and continuity, Partial derivatives, Homogeneous functions and Euler’s theorem, Chain rules, Differentiation of implicit functions, Total differentials and their applications, Jacobians. Maxima, Minima and Saddle points of functions; Lagrange Multiplier method and their applications; Concept of line integrals, Double and triple integrals.	

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Module 4: Vector Calculus (13 L)

Introduction to Vector Algebra, Vector function of a scalar variable, Differentiation of a vector function, Scalar and vector point functions, Gradient of a scalar point function, divergence and curl of a vector point function, Directional derivative. Green's theorem, Gauss Divergence Theorem and Stoke's theorem (Applications Only).

Course Articulation Matrix:

Mapping of COs with POs and PSOs (Course Articulation Matrix):														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	1	1	2	-	-	-	-	-	1	3	3	1
CO2	3	2	1	1	1	-	-	-	-	-	1	3	2	1
CO3	3	3	2	1	2	-	-	-	-	-	1	3	2	2
CO4	3	3	1	2	2	-	-	-	-	-	1	3	2	1
AVG.	3.00	2.75	1.25	1.25	1.75	-	-	-	-	-	1.00	3.00	2.25	1.25

Learning Resources:

1. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley India.
2. B.S. Grewal, Higher Engineering Mathematics. S. Chand &Co..
3. John Bird, Higher Engineering Mathematics. Elsevier.
4. S. S. Sastry, Engineering Mathematics (PHI, 4PthP Edition, 2008).
5. H.K. Dass, Advanced Engineering Mathematics, . S. Chand &Co..
6. Seymour Lipschutz, Marc Lars Lipson, Linear Algebra, McGraw-Hill Companies, Inc.
7. Robert Wrede, Murray R. Spiegel, Advanced Calculus, McGraw-Hill Companies, Inc.
8. Murray R. Spiegel, Vector Analysis, McGraw-Hill Companies, Inc.

Course Code: BS-CH 102 D	Category: Basic Science Course
Course Title: Engineering Chemistry	Semester: 1 st
L-T-P: 3-0-0	Credit: 3
Pre-Requisites: Basic knowledge in higher secondary chemistry.	Branch : CSE / IT / DS / CS / AIML Total Lecture: 42L
Course Outcomes: Upon successful completion of this course, students will be able to	
CO1: Remember and apply quantum mechanical principles, LCAO, and crystal field theory to explain the bonding, spectroscopic, and physicochemical properties of molecules and transition metal complexes, and Correlate band theory with the size-dependent optical, electrical, and magnetic properties of nanomaterials.	
CO2: Understand and analyze the synthesis, properties, and applications of nanomaterials, hybrid photovoltaics, and optoelectronic materials, and Interpret spectroscopic signatures from IR, Raman, NMR, fluorescence, and absorbance studies to characterize molecular structure and bonding.	
CO3: Demonstrate the structure–property relationships of conducting (PANI), biodegradable (PLA), OLED (PVK), and LCD (PI) materials by correlating polymer	

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synthesis, stereochemistry, and tacticity with their functional and device performance.
CO4: Employ molecular mechanics, DFT, and geometry optimisation techniques to predict thermodynamic parameters and physicochemical properties and Propose material and drug molecules design strategies using cheminformatics tools for engineering and device applications.
Module 1: Electronic Foundations & application (10 L) A. Wavefunction, Eigenvalues & Eigenfunctions; B. Classifications of Spectroscopy; UV-Vis, Emission spectroscopy; IR spectroscopy
Module 2: Engineering Materials (10 L) Band theory (only in context of nanomaterials) & Semiconductor (p/n-type); Synthesis, Properties & Applications of Nanomaterials (ZnO, CdS, TiO ₂ , Au/Ag, Fullerene/Graphene); Hybrid Photovoltaic Materials (TiO ₂ /Fullerene); Optoelectronic Materials (GaAs)
Module 3: Molecular Geometry & Soft Materials (12 L) Stereochemistry (R/S, E/Z); Drug molecules [use and synthesis (Aspirin, Paracetamol, Codeine, Morphine, Heroin)], Polymer (Synthesis & Tacticity); Conducting (PANI) and Biodegradable (PLA) Polymers; OLED (PVK) and LCD Materials (PI)
Module 4: Computational Engineering & Molecular Modelling (10 L) Basics of Molecular Mechanics & DFT; Different Techniques of Geometry Optimization; Thermodynamic Parameters Calculations; Prediction of Physico-Chemical Properties; Cheminformatics.

Course Articulation Matrix:

Mapping of COs with POs and PSOs (Course Articulation Matrix):														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	2	1	1	1	-	-	-	2	3	3	-
CO2	3	3	2	3	1	2	1	-	-	-	2	3	3	2
CO3	3	3	2	2	2	1	1	-	-	-	2	-	2	3
CO4	3	2	1	2	1	1	1	1	1	1	2	1	3	3
AVG.	3.00	2.50	1.50	2.25	1.25	1.25	1.00	1.00	1.00	1.00	2.00	2.33	2.75	2.67

Learning Resources

1. P.C.Rakshit, Physical Chemistry Sarat Book House.
2. S. Pahari, Physical Chemistry New Central Book Agency.
3. P. W. Atkins, & Paula, J. de Atkins', Physical Chemistry, Oxford University Press.
4. J. D. Lee, Concise Inorganic Chemistry, 5th Ed., Wiley India Pvt. Ltd.
5. F.A. Cotton, G. Wilkinson, and P.L. Gaus, Basic Inorganic Chemistry 3rd Ed.; Wiley India.
6. J. E. Huheey, E. A. Keiter, & R. L. Keiter, Inorganic Chemistry, Principles of Structure and Reactivity 4th Ed., Harper Collins 1993, Pearson, 2006.
7. J. Clayden, N. Greeves, S. Warren, Organic Chemistry, Second edition, Oxford University Press.
8. S. Sen Gupta, Reaction Mechanisms in Organic Chemistry, Oxford University Press.
9. L. Finar, Organic Chemistry (Volume 1) Pearson Education.
10. R. N. Morrison, & R. N. Boyd, Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).

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11. D. Nasipuri, Stereochemistry of Organic Compounds, Wiley Eastern Limited.
12. E. L. Eliel, & S. H. Wilen, Stereochemistry of Organic Compounds, Wiley: London, 1994.
13. Sharma, Industrial Chemistry (including Chemical Engineering), GOEL Publishing House.
14. D. L. Pavia, G. M. Lampman, G. S. Kriz, J. R. Vyvyan Introduction to Spectroscopy, Brooks/Cole Cengage Learning, 2009.
15. C. P. Poole Jr.; F. J. Owens, Introduction to Nanotechnology, Wiley-Interscience, 2003.
16. C. J. Cramer, Essentials of Computational Chemistry, Wiley-Interscience, 2004.

Paper Name: Engineering Chemistry Laboratory	Category: Basic Science Course
Paper Code: BS-CH-192D	Semester: First / Second
L-T-P: 0-0-3	Credit: 1.5
Pre-Requisites: Basic knowledge in higher secondary chemistry.	Branch :All Total Lecture: 42L

Name of the Experiments (Any eight experiments will be performed based on theory syllabus of the respective branches)

1. Standardization of NaOH solution with standard Oxalic acid solution.
2. Standardization of KMnO₄ solution by standard Oxalic acid solution
3. Conductometric and pH- metric titration for determination of strength of a given HCl solution against a standard NaOH solution.
4. Determination of the partition coefficient of a substance between two immiscible liquids.
5. Determination of chloride ion in a given water sample by Argentometric method (using chromate indicator solution)
6. Determination of dissolved oxygen present in a given water sample.
7. Complexometric titration for determination of calcium and magnesium hardness of water.
8. Determination of concentration of Organic molecules using UV-Vis. spectroscopy.
9. Study of conformational analysis and reactivity using Molecular Optimization technique.
10. Principle of Thin Layer Chromatography using ortho nitrophenol and para nitrophenol; paracetamol, aspirin, ibuprofen; benzoic acid, benzaldehyde, aniline; glycine, alanine, leucine etc.
11. Preparation of materials- phthalimide, aspirin, soap, phenyl, melamine formaldehyde etc.
12. Estimation of Fe²⁺ in Mohr's salt using permanganometry.
13. Determination of Biochemical Oxygen Demand (BOD) of Water Sample by Dilution Method
14. Determination of Chemical Oxygen Demand (COD) of Water Sample by Dichromate Reflux Method

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Course Outcomes (COs)

CO1: Explain the underlying principles, theoretical concepts, and safety protocols of various laboratory techniques, including volumetric titrations, instrumental methods, preparation of materials and computational molecular optimization.

CO2: Illustrate standard laboratory procedures, calibration and handling of analytical instruments, precise preparation of standard solutions, execution of analytical titrations and the synthesis/separation of organic compounds.

CO3: Articulate experimental data quantitatively and qualitatively, performing accurate chemical calculations, interpreting graphical plots and utilizing computational data to evaluate molecular properties.

CO4: Analyse structured laboratory reports that document experimental observations, errors and calculations systematically, while upholding professional ethics, safety consciousness, and environmental responsibility in chemical waste management.

Course Articulation Matrix:

Mapping of COs with POs and PSOs (Course Articulation Matrix):														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	2	3	3	2	2	3	1	3	3	3	-
CO2	2	2	3	3	2	3	3	3	3	-	3	3	3	2
CO3	2	2	2	2	3	3	2	3	2	-	3	3	2	3
CO4	3	2	3	2	3	3	3	3	3	2	3	-	3	3
AVG.	2.5	2.25	2.75	2.25	2.75	3.00	2.50	2.75	2.75	1.50	3.00	3.00	2.75	2.67

Learning Resources

1. A. I. Vogel, Elementary Practical Organic Chemistry, Part 2: Qualitative Organic Analysis, CBS Publishers and Distributors.
2. A. K. Nad, B. Mahapatra, A. Ghoshal, An Advanced Course in Practical Chemistry, New Central Book Agency; 3rd edition.
3. University Hand Book of Undergraduate Chemistry Experiments, edited by Mukherjee, G. N. University of Calcutta, 2003.
4. Furniss, B.S., Hannaford, A.J., Smith, P.W.G., Tatchell, A.R. Practical Organic Chemistry, 5th Ed., Pearson (2012).
5. H. T. Clarke, A Handbook of Organic Analysis (Qualitative and Quantitative), Fourth Edition, CBS Publishers and Distributors (2007).
6. Practical Workbook Chemistry (Honours), UGBS, Chemistry, University of Calcutta, 2015.

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Paper Name: Basic Electronics and Electrical Engineering	Semester: First / Second
Category: Engineering Science Courses	L-T-P: 3-0-0
Paper Code: ES-EE 103 B	Credit: 3
	Branch: CSE, IT, DS, CS, AIML, ECE Total Lecture: 42 L

COURSE CONTENTS

- **Module 1: Fundamentals of Semiconductor Diodes and their Applications (10L)**

Structure of p-n junction diode; Concept of hole current & electron current, Idea of Drift current & Diffusion current; Current-Voltage characteristics of a p-n junction diode in forward and reverse bias condition, Introduction to Shockley equation; Breakdown mechanism: Avalanche and Zener breakdown; Special diodes: Zener diode and its application as voltage regulator (Line regulation and Load regulation); Diode applications: Half-Wave rectification, Full-Wave rectification (Center tapped, Bridge rectifier).

- **Module 2: Fundamentals of DC Electrical Circuits (10L)**

Introduction to basic circuit elements: resistor, inductor, capacitor, voltage and current sources; Kirchhoff's Current Law (KCL) and Kirchhoff's Voltage Law (KVL), Analysis of electrical circuits using Mesh and Nodal methods, Star-Delta transformation; Network theorems: Superposition theorem, Thevenin's theorem, and Norton's theorem.

- **Module 3: Basic Operating Principle of Bipolar Junction Transistor and Field Effect Transistor (13L)**

Introduction to BJT structure and symbols; Common Base (CB) configuration of BJT: Input and Output characteristics, Concept of current gain (α), early effect, early voltage, thermal runaway; Common Emitter (CE) configuration of BJT: Input and Output characteristics, Different regions of transistor operation, Concept of current gain (β); Introduction to Common Collector (CC) configuration: Concept of current gain (γ); Relation between α , β and γ ; Concept of Load line and Q-point while considering BJT characteristics in CE mode, Transistor biasing: Fixed Bias, Self-Bias (Voltage Divider Bias); Introduction to FET and Comparison with BJT; Drain and Transfer characteristics of JFET, Concept of pinch-off voltage, cut-off voltage, transconductance; Introduction to MOSFET: Structure and symbol; Basic working principle of Enhancement and depletion type MOSFET.

- **Module 4: Introduction to Digital Electronics and Operational Amplifier (9L)**

Introduction to Number System, and Logic Gates; Op-Amp Fundamentals: Circuit symbol and brief description of individual terminals; Ideal vs. Practical Op-Amp Characteristics; Concept of Common-mode Rejection Ratio (CMRR), Slew Rate, virtual ground;

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Applications of Op-Amps: Inverting and Non-Inverting Amplifiers, Adder or Summing Amplifier, Subtractor, Integrator and Differentiator Circuits.

Course Outcomes (COs)

CO1: Understand the concepts of p-n junction diodes and its applications.

CO2: Analyze electrical circuits by identifying fundamental components and principles for effective problem-solving.

CO3: Study the fundamentals of various transistors technology for the designing of amplification circuits.

CO4: Apply the fundamental concepts of digital logic and op-amp for the designing of various mathematical operational circuits.

Recommended Textbooks:

1. “Electronic Devices and Circuit Theory” [Author: Robert L. Boylestad & Louis Nashelsky, Publisher: Pearson Education]
2. “Electronics Fundamentals And Applications” [Author: D. Chattopadhyay, P. C. Rakshit, Publisher: New Age International Publishers]
3. “Electronic Devices” [Author: Thomas L. Floyd, Publisher: Prentice Hall]
4. “Fundamentals of Electric Circuit Theory” [Author: D. Chattopadhyaya, Publisher: S. Chand & Company Ltd]
5. “A Textbook of Electrical Technology” - Volume I and 4 [Author: B.L. Theraja A.K. Theraja, Publisher: S. Chand & Company Ltd].

Course Articulation Matrix:

Mapping of COs with POs and PSOs (Course Articulation Matrix):														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	-	-	-	-	-	-	1	3	3	2
CO2	3	3	2	2	1	-	-	-	-	-	1	3	3	2
CO3	3	2	2	1	1	-	-	-	-	-	1	3	2	3
CO4	3	3	3	2	2	-	-	-	-	1	1	-	3	3
AVG.	3.00	2.50	2.00	1.50	1.33	-	-	-	-	1.00	1.00	3.00	2.75	2.50

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Paper Name: Programming for Problem Solving	Category: Engineering Science Course
Paper Code: ES-CS-103	Semester: First / Second
L-T-P: 3-1-0	Credit: 4
	Branch: All Engineering Branch Total Lecture: 56 L

COURSE CONTENTS

Module 1 [14L]

Unit 1: Introduction to Programming (6L)

Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.) Overview of Number system and its conversion: Binary, Octal & HEX

Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode with examples.

From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code

Unit 2: Arithmetic expressions and precedence (2 L)

Unit 3: Conditional Branching and Loops (6 L)

Writing and evaluation of conditionals and consequent branching; Iteration and loops

Module 2 [14L]

Unit 1: Arrays (6 L)

Arrays (1-D, 2-D), Character arrays and Strings

Unit 2: Basic Algorithms (8 L)

Searching algorithm (Linear & Binary search), Basic Sorting Algorithms (Bubble, Selection), notion of order of complexity through example programs (no formal definition required)

Module 3 [14L]

Unit 1: Function (7 L)

Functions (including using built in libraries), Parameter passing in functions, call by value, passing arrays to functions: idea of call by reference.

Unit 2: Recursion (7 L)

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Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Tower of Hanoi problem.

Module 4 [14 L]

Unit 1: Structure & Union (4L)

Basic concepts of Structures & Union; Array of Structures, Structure-Union comparison with implementation.

Unit 2: Pointers (6L)

Concept of pointers, Pointer arithmetic, array of pointers, passing pointer to function, function returning pointer, Array-pointer relationship-basic idea.

Unit 3: File handling (4L)

Basic idea about read, write, append in file operation. Sample files creating and reading a file.

Course Outcomes (COs)

CO1: Understand and remember the basic concepts of C programming.

CO2: Apply control structures such as loops and conditionals to develop and solve problems.

CO3: Apply concept of array, strings, pointers for efficient data storage and manipulation.

CO4: Design complex data structures and manage file operations.

Learning Resources:

1. R. S. Salaria, Computer Concepts and Programming in C, Khanna Publishers.
2. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill.
3. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill.
4. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India.

Course Articulation Matrix:

Mapping of COs with POs and PSOs (Course Articulation Matrix):														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	-	-	-	2	-	2	3	3	3
CO2	2	2	1	3	3	-	1	-	-	-	-	1	2	1
CO3	2	2	2	2	2	1	2	3	3	2	3	2	1	3
CO4	3	2	2	3	3	-	-	-	-	1	-	2	2	2
AVG.	2.50	2.25	2.00	2.50	2.50	1.00	1.50	3.00	2.50	1.50	2.50	2.00	2.00	2.25

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Paper Name: Basic Electronics and Electrical Engineering Laboratory	Semester: First
Category: Engineering Science Courses	L-T-P: 0-0-3
Paper Code: ES-EE 193 B	Credit: 1.5
	Branch: CSE, IT, DS, CS, AIML, ECE Total Lecture: 42 L

Name of the Experiments

1. Familiarization with Basic Electronic Components

Objective: To study the characteristics and applications of basic electronic components such as resistors, diodes, transistors and electrical devices including DC power supplies, multimeters, trainer kits.

2. Study of P-N Junction Diode Characteristics

Objective: To study and plot the forward and reverse bias characteristics of a P-N junction diode.

3. Study of Zener Diode Characteristics

Objective: To study and plot the forward and reverse bias characteristics of a Zener diode.

4. Construction and Testing of Rectifier Circuits

Objective: To design and analyze the performance of half-wave and bridge rectifiers circuits.

5. Verification of Kirchhoff's Voltage Law (KVL) and Kirchhoff's Current Law (KCL)

Objective: To experimentally verify Kirchhoff's Voltage Law (KVL) and Kirchhoff's Current Law (KCL) using resistive DC circuits.

6. Verification of Superposition Theorem

Objective: To experimentally verify the Superposition Theorem in linear DC networks.

7. Verification of Thevenin's and Norton's Theorems

Objective: To determine and verify the Thevenin's and Norton's equivalent circuits experimentally.

8. Study of BJT Characteristics in CE Configurations

Objective: To analyze input and output characteristics of a BJT in common emitter (CE) configuration.

9. Study of BJT Characteristics in CB Configurations

Objective: To analyze input and output characteristics of a BJT in common base (CB) configuration.

10. Study of V-I characteristics of Junction Field Effect Transistors

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Objective: To analyze the drain and transfer characteristics of a JFET.

11. Operational Amplifier Applications – I

Objective: To design and test inverting and non-inverting amplifier circuits using Op-Amps.

12. Operational Amplifier Applications – II

Objective: To design and test adder and subtractor circuits using Op-Amps.

Course Outcomes (COs)

CO1: Analyze the behavior of P-N junction diodes and Zener diodes and their applications.

CO2: Understand the characteristics of basic electronic components, DC circuits, and network theorems for effective analysis and verification.

CO3: Study the operating principles and characteristics of BJT and JFET transistors in different configurations for circuit analysis.

CO4: Apply the fundamentals of the operational amplifier to design and test various linear operational and arithmetic circuits.

Recommended Textbooks

1. “**Electronic Devices and Circuit Theory**” [Author: Robert L. Boylestad & Louis Nashelsky, Publisher: Pearson Education]
2. “**Electronics Fundamentals And Applications**” [Author: D. Chattopadhyay, P. C. Rakshit, Publisher: New Age International Publishers]
3. “**Electronic Devices**” [Author: Thomas L. Floyd, Publisher: Prentice Hall]
4. “**Fundamentals of Electric Circuit Theory**” [Author: D. Chattopadhyaya, Publisher: S. Chand & Company Ltd]
5. “**A Textbook of Electrical Technology**” - Volume I and 4 [Author: B.L. Theraja A.K. Theraja, Publisher: S. Chand & Company Ltd]

Course Articulation Matrix:

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	2	1	-	-	-	-	-	1	3	3	2
CO2	3	3	1	2	1	-	-	-	-	1	1	3	3	2
CO3	3	2	2	2	1	-	-	-	-	-	1	3	2	3
CO4	3	3	3	2	2	-	-	-	1	1	1	-	3	3
AVG.	3.00	2.5	1.75	2.00	1.25	-	-	-	1.00	1.00	1.00	3.00	2.75	2.50

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Paper Name: Programming for Problem Solving Laboratory	Category: Engineering Science Course
Paper Code: ES-CS-193	Semester: First / Second
L-T-P: 0-0-3	Credit:1.5
	Branch: All Engineering Branch Total Lecture: 42 L

The laboratory should be preceded or followed by a tutorial to explain the approach or algorithm to be implemented for the problem given

Tutorial 1: Problem solving using computers, Variable types and type conversions

Lab1: Familiarization with programming environment; Simple computational problems using arithmetic expressions

Tutorial 2: Branching and logical expressions:

Lab 2: Problems involving if-then-else structures

Tutorial 3: Loops, while and for loops:

Lab 3: Iterative problems e.g., sum of series

Tutorial 4: 1D Arrays: searching, sorting:

Lab 4: 1D Array manipulation

Tutorial 5: 2D arrays and Strings

Lab 5: Matrix problems, String operations

Tutorial 6: Functions, call by value:

Lab 6: Simple functions

Tutorial 7: Recursion, structure of recursive calls

Lab 7: Recursive functions

Tutorial 8: Numerical methods (Root finding, numerical differentiation, numerical integration):

Lab 8: Programming for solving Numerical methods problems

Tutorial 9: Pointers, structures and dynamic memory allocation

Lab 9: Pointers and structures

Tutorial 10: File handling:

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Lab 10: File operations

Course Outcomes (COs)

CO1: Demonstrate the ability to write. Compile and execute basic C program.

CO2: Develop algorithms and solve problems using control structures.

CO3: Implement programs that utilize array, string, pointers for storage, memory access and manipulation.

CO4: Use structures and unions to create, manipulate complex data type and perform file operational for reading and writing data.

Course Articulation Matrix:

Mapping of COs with POs and PSOs (Course Articulation Matrix):														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	3	2	2	-	-	-	2	-	2	3	3	3
CO2	3	3	3	-	3	3	3	-	1	2	-		2	1
CO3	2	3	2	2	-	2	1	3	2	3	3	2	1	3
CO4	1	2	2	3	3	-	-	-	-	1	-	2	2	-
AVG.	2.25	2.50	2.51	2.33	2.67	2.50	2.00	3.00	1.50	1.67	2.510	2.33	2.00	2.33

Course Code: VSEC-181	Category: Vocational and Skill Enhancement Course
Course Title: Soft Skills for Professional Development - I	Semester: 1 st
L-T-P:0-0-2	Credit: 1
Pre-Requisites: Basic knowledge in English fundamentals, computer skills, current awareness, and participation skills.	Branch: All Engineering Branch Total Lecture: 28 L
Course Outcomes: Upon completion of the course, the student will be able to	
CO1: Apply English language skills for competitive and professional communication.	
CO2: Demonstrate teamwork, group discussion skills, and design thinking techniques.	
CO3: Analyze arguments and present ideas through debates and PowerPoint presentations	
CO4: Develop career readiness through resume writing, interviews, and wellness practices.	
Course Contents:	
Module 1: Communication & Competitive English Foundations (6 L) Diagnostic test (grammar, vocabulary, comprehension); Vocabulary drills (synonyms, antonyms, idioms); Error detection exercises; Reading Comprehension Practice; General Awareness.	
Module 2: Design Thinking, Group Discussion & Team Communication (8 L) Introduction to Design Thinking; Empathy Mapping & Problem Identification; Creative Problem-Solving Activities; GD simulations (fishbowl method); Initiation, entry, and summarization drills; Themed GDs (current, abstract, case-based); Role-based discussions.	

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Module 3: Debate & PowerPoint Presentation (6 L)

Types of Debates: Argument building (claim–evidence–reasoning), Structured debates (for/against); Rapid rebuttal rounds; PowerPoint Presentation.

Module 4: Professional Writing & Career Readiness (8 L)

Job Application Letter; Resume review and improvement; Voice Assessment; HR question practice; Mock interviews; Stress interview simulation; Mental Wellness.

Assessment Scheme: English Language Proficiency: 20 | Design Thinking: 20 | GD: 20 | Debate/PowerPoint Presentation: 20 | Interview: 20 | Total: 100

Course Articulation Matrix:

Mapping of Cos with Pos and PSOs (Course Articulation Matrix):														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	1	-	-	-	-	-	-	3	-	2	3	3	-
CO2	1	2	2	1	-	1	1	3	3	1	2	3	3	2
CO3	1	3	1	1	1	1	1	2	3	-	2	-	2	3
CO4	1	1	-	-	-	1	2	2	3	2	3	2	3	3
AVG.	1.00	1.75	1.50	1.00	1.00	1.00	1.33	2.33	3.00	1.50	2.25	2.67	2.75	2.67

Learning Resources

1. Debashis Bandyopadhyay and Malathy Krishnan, *Connect: A Course in Communicative English*, Cambridge University Press, 2018.
2. Sanjay Kumar and Pushp Lata, *Communication Skills*, Oxford University Press, 2015.
3. Nira Konar, *Communication Skills for Professionals*, Prentice Hall of India, 2nd edition, 2011.
4. Wren and Martin, *Modern English Grammar & Composition*, S Chand Publishing, 2025.
5. S. Prasad & K.P. Thakur, *Common Errors in English*, Bharati Bhawan Publishers, 2021.
6. Susmit Maity & Arpita Mazumdar, *Crack Campus Placements*, SelfyPage Developers Pvt. Ltd., 2024.

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(First Year – Second Semester)

Course Code: BS-M 201 D	Category: Basic Science Courses
Course Title: Engineering Mathematics-II	Semester: 2 nd
L-T-P: 3-1-0	Credit: 4
Pre-Requisites: 10+2 Level Mathematics.	Branch: CSE, IT, AIML, CS, DS Total Lecture: 56L
Course Outcomes: Upon successful completion of this course, the student will be able to:	
CO1: Apply analytical methods to solve and analyze first-order and higher-order ordinary differential equations, including nonlinear, Bernoulli, second-order linear, variation of parameters, and Cauchy–Euler equations for modeling physical systems.	
CO2: Demonstrate understanding of complex variables by verifying Cauchy–Riemann equations, identifying analytic functions, expanding functions using Taylor and Laurent series, classifying singularities, and applying Cauchy’s Residue Theorem to evaluate contour integrals	
CO3: Apply graph theory concepts to represent and analyze networks using adjacency and incidence matrices, distinguish different graph types, and implement Dijkstra’s algorithm to solve shortest-path problems in weighted graphs.	
CO4: Analyze vector spaces in $\mathbb{R}^n$ with respect to basis, dimension, and linear independence, and apply the Gram–Schmidt process to construct orthonormal bases in inner product spaces.	
Course Contents:	
Module 1: Ordinary Differential Equations (ODE) (14 L) Linear and non-linear differential equations, Bernoulli’s equation. General solution of ODE of first order and higher degree (Solvable for x, solvable for y, solvable for p and Clairaut’s equation). Solutions of Second order Linear ODE with constant Coefficients, Method of variation of parameters, Cauchy-Euler equations. Simultaneous linear differential equations.	
Module 2: Calculus of Complex Variables (16 L) Complex functions, Analytic functions, Cauchy-Riemann Equations (statement only). Sufficient conditions for a function to be analytic. Harmonic and Conjugate Harmonic functions, Milne Thomson method. Concept of simple curve, closed curve, smooth curve & contour. Cauchy’s theorem (statement only). Cauchy’s integral formula, Zeroes and Singularities, Taylor’s series and Laurent’s series. Residue, Cauchy’s Residue theorem (statement only) and its applications.	

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Module 3: Basics of Graph Theory (14 L)

Graph, Digraph, Weighted graph, Connected and disconnected graph, Complement of a graph, Regular graph, Complete graph, Bipartite graph, Subgraph, Walks, Paths, Circuits, Euler graph, Hamiltonian Graph. Graph isomorphism, Matrix representation of a Graph, Adjacency and incidence matrices of a graph. Shortest path and Dijkstra's algorithm.

Module 4: Vector space (12 L)

Definition of Vector Space, subspaces, linear independence, basis, and dimension. Inner Product Space, Orthogonal, Orthonormal Sets and Bases, Gram-Schmidt process.

Course Articulation Matrix:

Mapping of Cos with Pos and PSOs (Course Articulation Matrix):														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	-	-	-	-	-	1	2	3	3
CO2	3	3	1	2	2	-	-	-	-	-	1	3	2	-
CO3	3	3	3	2	3	-	-	-	1	-	1	-	-	1
CO4	3	3	2	1	2	-	-	-	-	-	1	2	3	2
AVG.	3.00	3.00	2.00	1.75	2.25	-	-	-	1.00	-	1.00	2.33	2.67	2.00

Learning Resources:

1. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley India.
2. B.S. Grewal, Higher Engineering Mathematics. S. Chand & Co.
3. John Bird, Higher Engineering Mathematics. Elsevier.
4. S. S. Sastry, Engineering Mathematics (PHI, 4PthP Edition, 2008).
5. H.K. Dass, Advanced Engineering Mathematics, S. Chand & Co.
6. S. Ponnusamy, Herb Silverman, Complex Variables with Applications, Birkhäuser Boston.
7. V. K. Balakrishnan, Graph Theory, Schaum's Outline, TMH.
8. Daniel A. Murray, Introductory Course in Differential Equations, Longmans & Green.
9. N. Deo, Graph Theory, Prentice-Hall of India.
10. Seymour Lipschutz, Marc Lars Lipson, Linear Algebra, McGraw-Hill Companies, Inc.

Course Code: BS-PH 202 D	Category: Basic Science
Course Title: Engineering Physics	Semester: 2nd
L-T-P: 3-0-0	Credit: 3
Pre-Requisites: 10+2 Physics	Br2.33anch CSE, IT, AIML, CS, DS Total Lecture: 42L
Course Outcomes: Upon successful completion of this course, the student will be able to	
CO1: Analyze the principles of Electromagnetic theory and Fiber Optics to evaluate data for transmission mechanisms in modern networking.	
CO2: Apply the concepts of Physical Optics and Laser technology to explain the working principle of optical storage, high-speed switching, and photonic devices.	
CO3: Formulate principles of quantum mechanics to analyze radiation and to solve problems of particle in infinite potential well with the concept of wave function so that they evaluate the	

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physical limitations of semiconductor scaling and the operational foundations of quantum computing.
CO4: Evaluate the statistical distribution of different type of subatomic particles using Statistical Mechanics to understand the particle distribution.
Course Contents:
Module-1 Electromagnetic Waves and Propagation [12L] Concept of Gradient of a Scalar function, Divergence and Curl of Vector field, Vector Integration, Line, surface and volume integration, Divergence and Stoke's Theorem, Maxwell's equations of Electromagnetism and Interpretation. Electromagnetic (EM) wave formation in free space and medium, Poynting Theorem, Propagation of EM wave through optical fiber, Types of optical fibers, accepted angle, Numerical aperture, V-parameter, wave attenuation and dispersion, applications.
Module-2 Physical Optics and Light Devices [12L] Interference- Superposition of waves, Division of wave front and division of amplitude, Interference in parallel and wedge-shaped film, Thin film Interference, Newton's rings, determination of wave length and thickness. Diffraction- Fresnel and Fraunhofer diffraction , Single Slit, Double Slit, Optical grating (Qualitative discussion only) Polarization- Introduction, States of Polarization, Brewster's law, Malus Law, Phase Retardation Plate. Lasers- Characteristics of Laser, Spontaneous and Stimulated Emission, Population Inversion, Classification of Laser, construction and working, Einstein's coefficients, Example of Gas Laser (He-Ne), Solid state laser (Ruby) and LED and p-n junction semiconductor lasers, Applications of Laser in communication.
Module-3 Quantum Mechanics [12L] Concept of Quantum Mechanics, Matter wave/ de Broglie wave, Group velocity, Phase velocity, Matter wave function, Postulates of Quantum Mechanics, Quantum Mechanical operator and their types, Eigen function and Eigen value, Expectation value, Schrödinger's time dependent and time independent wave equation, Application of Schrödinger's Equation- Particle in 1D box, Particle in 3D box, Concept of degeneracy, Quantum Tunnelling (Concept only), Various application of Quantum Idea.
Module- 4 Statistical Mechanics [6L] Phase Space, Macro states and Microstates, Density of States, Statistical Ensemble and Thermodynamic Probability, Classical Statistical systems (Maxwell - Boltzman statistics) and quantum statistical systems (Fermi-Dirac and Bose-Einstein Statistics) and their applications.

Course Articulation Matrix:

Mapping of Cos with Pos and PSOs (Course Articulation Matrix):														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	1	2	1	1	1	1	1	1	1	-	3	-
CO2	3	3	1	2	1	1	1	1	1	1	1	2	2	3
CO3	3	3	1	2	1	1	1	1	1	1	1	1	3	2
CO4	3	3	1	2	1	1	1	1	1	1	1	-	1	2
AVG.	3.00	3.00	1.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.50	2.25	2.33

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Learning Resources:

1. Vector Analysis – M.R.Spiegel.
2. Principles of Physics, 10ed, David Halliday, Robert Resnick Jearl Walker , Wiley.
3. Optics –A.K.Ghatak McGraw Hill Education India Private Limited.
4. Modern Physics for Scientists and Engineers, J. R. Taylor, C.D. Zafiratos and M. A.Dubson, 2nd Ed. Pearson (2007).
5. Modern Quantum Mechanics, J. J. Sakurai, Cambridge University Press.
6. Classical Theory of Electricity and Magnetism, A. K. Roychowdhury.
7. Statistical Mechanics, Reif, Pathria.

Paper Name: Engineering Physics Laboratory	Category: Basic Science Course
Paper Code: BS-PH-292 D	Semester: Second
L-T-P: 0-0-3	Credit: 1.5
Pre-Requisites: Basic knowledge in higher secondary chemistry.	Branch: All Total Lecture: 42 P

Course Outcomes (Cos)

CO 1: Describe and understand the working formulas, uses of instruments, and apparatus used in diverse experiments.

CO 2: Apply theoretical concepts to effectively execute experiments and record experimental data.

CO 3: Analyze experimentally collected data, validate it through calculations, graphical representation, and error estimation, while adhering to necessary precautions.

CO 4: Integrate acquired knowledge and apply it across various engineering disciplines.

List of Experiments

Students will perform their laboratory experiment as per corresponding theory syllabus

1. Determination of wavelength of the given laser source by diffraction method
2. Determination of wavelength of a monochromatic light by Newton's ring
3. Determination of Planck constant using photocell.
4. Determination of numerical aperture, angle of acceptance and bending energy losses of an optical fiber.

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5. Determination of Dielectric Constant of different dielectric materials (air, paper, glass, plastics)
6. Plot the B-H curve of different magnetic materials and also determine the Coercivity and Retentivity for Ferromagnetic material
7. Determination of specific charge (e/m) of electron by J.J. Thompson's method
8. Determination of Band gap of semiconductor. (2 probe, 4 probe Method)
9. Study of Transient Response in LR, RC and LCR circuits using Exp EYES
10. Determination of resistance of ballistic galvanometer by half deflection method and study of variation of logarithmic decrement with series resistance.
11. Determination of unknown resistance using Carey Foster's bridge
12. To study current voltage characteristics, load response, areal characteristic and spectral response of a photovoltaic solar cell.

Course Articulation Matrix:

Mapping of Cos with Pos and PSOs (Course Articulation Matrix):														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	1	2	1	2	3	3	1	3	3	3	3
CO2	3	3	2	1	3	1	2	3	3	1	3	2	2	-
CO3	3	3	2	1	3	2	2	3	3	3	3	-	3	3
CO4	3	3	1	1	2	2	2	3	3	3	3	1	2	1
AVG.	3.00	3.00	1.75	1.00	2.50	1.50	2.00	3.00	3.00	2.00	3.00	2.00	2.50	2.33

Paper Name: Biology for Engineers	Category: Engineering Science
Paper Code: ES-BT 204	Semester: Second
L-T-P : 2 -0-0	Credit: 2.0
	Branch: All Engineering Branch Total Lecture: 28 L

COURSE CONTENTS

Introduction to Biological Sciences (6 L)

Introduction to Biology: Science and comparison with other disciplines. Differences between Science & Engineering and Biologist & Biological Engineer.

The concept of biomimicry and its modern-day applications. The interdisciplinary nature of biological sciences.

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Diversity of the living world, Taxonomy, Nomenclature, Taxonomic hierarchy, Biological classification.

Cell: Basic unit of life - Prokaryotes and Eukaryotes, Cell theory.

Biomolecules (8 L)

Introduction to Biomolecules: Sources, Structure, Characteristics and functions of the biomolecules (Carbohydrates, Proteins, Lipids and Nucleic acids).

Enzymology: Properties of enzymes, Enzyme structure, Classification and functions, Mechanism of enzyme reaction, Enzyme activity, Factors affecting enzyme activity.
Introduction to Metabolism in biological systems

Molecular aspects of life (8 L)

Molecular basis of Information Transfer: Central dogma, Replication, Transcription, Genetic code, Translation.

Immunity to Infection - Innate and Acquired immunity, Organs and cells of the immune system, Classification of antibodies. Microbes as Infectious Agents: Examples from human diseases.

Biology and its Industrial Applications (6 L)

Applications of Biology: Agriculture, Medicine, Industry, Environment, Bio-robotics, 3D bio-printing, Biosensors, Bioinformatics etc. New generation bio-fabricated products and future challenges.

Course Outcomes (Cos):

CO1: Remember and understand the biological concepts from an engineering perspective.

CO2: Understand the classification, structure and functions of various Biomolecules.

CO3: Perception of the various biomolecular aspects of life.

CO4: Apply and implement biological principles for the development of next generation technologies.

Course Articulation Matrix:

Mapping of Cos with Pos and PSOs (Course Articulation Matrix):														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	1	-	-	-	-	-	2	-	3
CO2	2	1	1	1	-	2	-	-	-	-	-	1	2	2
CO3	3	2	2	2	-	2	-	-	-	-	-	2	3	1
CO4	3	3	3	2	3	3	3	3	-	-	2	-	1	1
AVG.	2.50	1.75	2.00	1.67	3.00	2.00	3.00	3.00	-	-	2.00	1.67	2.00	1.75

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Learning Resources:

1. Gabi Nindl Waite, Lee Waite, Applied Cell and Molecular Biology for Engineers, McGraw-Hill Education, 2007.
2. Arthur T. Johnson, Biology for Engineers, Second Edition, CRC Press, 2019.
3. Campbell, J. B. Reece, L. Urry, M. L. Cain and S. A. Wasserman, —Biology: A global approach, Pearson Education Ltd, 2014.
4. G. S. Stent and R. Calendar, —Molecular Genetics, Freeman and company, 1978.

Web Reference:

NPTEL: https://onlinecourses.nptel.ac.in/noc19_ge31/preview

Course Code: ES-CSE 201	Category: Engineering Science
Course Title: Artificial Intelligence	Semester: 2 nd
L-T-P: 3-0-0	Credit: 3
Pre-Requisites: Discrete Mathematics, Understanding of Probability, Basic understanding of Programming language.	Branch CSE Total Lecture: 42L
Course Outcomes: Upon successful completion of this course, the student will be able to	
CO1: Explain the modern tools of Artificial Intelligence (AI) and knowledge representation models.	
CO2: Determine the domain-specific problems solving methods using AI based algorithms and techniques.	
CO3: Evaluate knowledge based representation and learning methods for broad areas of state-of-the-art technological growth	
CO4: Formulate the solution requirements of complex engineering problems in multidisciplinary application fields.	
Module-1 [10L]	
Introduction: Fundamentals of Artificial intelligence- Issues with AI, AI technique, Tic – Tac – Toe problem.	
Intelligent Agents: Agents & environment, nature of environment, structure of agents, goal based agents, utility based agents, learning agents.	
Problem Solving: Problems, Problem Space & search: Defining the problem as state space search, production system, problem characteristics, issues in the design of search programs.	
Module-2:[13L]	
Search techniques:	
Solving problems by searching: problem solving agents, searching for solutions; uniform search strategies: breadth first search, depth first search, depth limited search, bidirectional search, comparing uniform search strategies.	
Heuristic search strategies: Greedy best-first search, A* search, memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, simulated annealing search, local beam search, genetic algorithms; constraint satisfaction problems, local search for constraint satisfaction problems.	
Adversarial search: Games, optimal decisions & strategies in games, the minimax search procedure, alpha-beta pruning, additional refinements, iterative deepening.	

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Module-3:[5L] Knowledge & reasoning: Knowledge representation issues, representation & mapping, approaches to knowledge representation, issues in knowledge representation.
Module-4:[8L] Using predicate logic: Representing simple fact in logic, representing instant & ISA relationship, computable functions & predicates, resolution, natural deduction. Probabilistic reasoning: Representing knowledge in an uncertain domain, the semantics of Bayesian networks, Dempster-Shafer theory, Fuzzy sets & fuzzy logics.
Module -5:[6L] Natural Language processing: Introduction, Syntactic processing, semantic analysis, discourse & pragmatic processing. Learning: Forms of learning, inductive learning, learning decision trees, explanation based learning, learning using relevance information, neural net learning & genetic learning.

Course Articulation Matrix:

Mapping of Cos with Pos and PSOs (Course Articulation Matrix):														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	2	2	3	-	-	1	-	-	1	3	3	1
CO2	3	3	2	1	2	-	-	-	-	-	2	3	2	1
CO3	2	3	1	2	2	-	-	1	-	2	3	2	2	3
CO4	1	3	3	2	3	-	2	-	1	-	2	3	2	-
AVG.	2.00	2.75	2.00	1.75	2.50	-	2.00	1.00	1.00	2.00	3.00	2.75	2.25	1.67

Learning Resources:

1. Artificial Intelligence, Ritch & Knight, TMH.
2. Artificial Intelligence A Modern Approach, Stuart Russel Peter Norvig Pearson.
3. Introduction to Artificial Intelligence & Expert Systems, Patterson, PHI.
4. Poole, Computational Intelligence, OUP.
5. Logic & Prolog Programming, Saroj Kaushik, New Age International.
6. Expert Systems, Giarranto, VIKAS.
7. Stuart Russel, Peter Norvig, "AI – A Modern Approach", Second Edition, Pearson.

Paper Name: IT Workshop I (Programming with Python)	Category: Engineering Science
Paper Code: ES-CSE 291	Semester: Second
L-T-P : 0-0-3	Credit: 1.5
Pre Requisite: Knowledge of Programming Logic, Experience with a high-level language (C/C++,) is suggested.	Branch: CSE Total Lecture: 28 L

COURSE CONTENTS:

Programming with Python

Introduction

History, Features, Setting up path, working with Python, Basic Syntax, Variable and Data Types, Operator

Conditional Statements

If, If- else, Nested if-else, Looping, For, While, Nested loops. Break, Continue, Pass statement

String Manipulation

Accessing Strings, Basic Operations, String slices, Function and Methods

Lists, Tuple, Dictionaries

Introduction of lists, , Accessing list, Operations, Working with lists, Function and Methods

Introduction of tuples, Accessing tuples, Operations, Working, Functions and Methods

Introduction of dictionaries, Accessing values in dictionaries, working with dictionaries, Properties

Functions

Defining a function, calling a function, Types of functions, Function Arguments, Anonymous functions, Global and local variables

Modules

Importing module, Math module, Random module, Packages, Composition, Input-Output Printing on screen, Reading data from keyboard, Opening and closing file, Reading and Writing files, Functions

Exception Handling

Exception, Exception Handling, except clause, Try? Finally clause, User Defined Exceptions.

Course Outcomes (Cos):

CO1: Describe various data types in python and use them to solve basic python programs.

CO2: Solve Python programs using conditionals and loops.

CO3: Understand various built-in python functions and develop user-defined functions.

CO4: Write Python program using Python lists, tuples, dictionaries etc.

Course Articulation Matrix:

Mapping of Cos with Pos and PSOs (Course Articulation Matrix):														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	1	-	2	-	-	-	-	-	2	3	3	3
CO2	3	3	3	2	3	-	-	-	-	-	2	3	3	2
CO3	3	2	1	3	3	-	-	-	-	-	2	2	3	3
CO4	3	3	3	3	3	2	3	2	-	-	2	3	3	3
AVG.	2.75	2.25	2.00	2.67	2.75	2.00	3	2.00	-	-	2.00	2.75	3.00	2.75

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Learning Resources:

1. Reema Thareja– “Python Programming Using Problem Solving Approach” Oxford University Press”.
2. Paul Deitel and Harvey Deitel, “Python for Programmers”, Pearson Education, 1st Edition, 2021.
3. Allen B. Downey, “Think Python: How to Think like a Computer Scientist”, 2nd Edition, O’Reilly Publishers, 2016.
4. Karl Beecher, “Computational Thinking: A Beginner’s Guide to Problem Solving and Programming”, 1st Edition, BCS Learning & Development Limited, 2017.
5. Martin C. Brown, “Python: The Complete Reference”, 4th Edition, Mc-Graw Hill, 2018.
6. G Venkatesh and Madhavan Mukund, “Computational Thinkin.

Course Code: ES-ME 292	Category: Engineering Science Course
Course Title: Engineering Drawing	Semester: 2 nd
L-T-P: 0-0-3	Credit: 1.5
Pre-Requisites: Basic understanding of elementary geometry, Mathematical concepts related to lines and angles, and visualization of simple three-dimensional objects.	Branch: All Engineering Branch Total Lecture: 42L
Course Outcomes:	
CO1: Understand and apply different types of engineering scales including plain, diagonal, and vernier scales for accurate graphical representation.	
CO2: Construct geometrical curves and conic sections such as parabola, hyperbola, and ellipse using standard engineering drawing methods.	
CO3: Apply principles of orthographic projection and draw projections of points, lines, and plane surfaces in first-angle and third-angle projection systems.	
CO4: Draw and interpret projections of solids including cube, prism, pyramid, cylinder, cone, and frustums in different orientations.	
CO5: Develop isometric views and isometric projections of simple engineering solids and objects.	
CO6: Prepare sectional views, determine true shape of sections, and develop surfaces of engineering solids for practical engineering applications.	
Module 1: Scales [3L] Plain scales, Diagonal scales, Vernier scales	
Module 2: Geometrical Construction and Curves [3L] Conic Section: Parabola, Hyperbola, Ellipse	
Module 3: Projection of Points, Lines, Surfaces [9L] Orthographic Projection – First angle and third angle projection More no. Of problems should be practiced in first angle projection. Projection of lines inclined to the planes Projection of	

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surfaces Pentagon, Hexagon
Module 4: Projection of Solids [12L] Cube, Pyramid, Prism, Cylinder, Cone, Frustums
Module 5: Isometric View and Isometric Projection [6L] Prism, Pyramid, Cylinder, Cone and examples of simple solid objects / models.
Module 6: Sectional Views of Solids, True Shape of a Section [6L]
Module 7: Development of Surfaces [3L] Cube, Prism, Cylinder, Truncated Cone

Course Articulation Matrix:

Mapping of Cos with Pos and PSOs (Course Articulation Matrix):														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	-	2	-	-	1	-	2	-	2	2	2
CO2	3	3	2	1	2	-	-	1	-	2	-	2	2	2
CO3	3	3	2	2	2	1	-	1	1	3	-	3	3	2
CO4	3	3	3	2	2	1	-	1	1	3	1	3	3	2
AVG.	3.00	2.75	2.00	1.67	2.00	1.00	-	1.00	1.00	2.50	1.00	2.50	2.50	2.00

Learning Resources:

1. Pradeep Jain, Ankita Maheswari, A.P. Gautam, Engineering Graphics & Design, Khanna Publishing House.
2. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House.
3. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication.
4. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education.
5. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers
6. Corresponding set of CAD Software Theory and User Manuals.

Course Code: HM-AEC 205	Category: Humanities and Social Sciences, including Management
Course Title: English Language & Technical Communication	Semester: 2 nd
L-T-P: 2-0-0	Credit: 2
Pre-Requisites: Basic English grammar, vocabulary, reading, writing, and communication skills.	Branch : All Engineering Branch Total Lecture: 28L
Course Outcomes:	
CO1: Apply the principles, types, and flow of communication in diverse contexts.	

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CO2: Construct grammatically accurate sentences and transform sentence structures effectively.
CO3: Analyse texts and develop comprehension, vocabulary, and précis writing skills.
CO4: Draft professional letters and official correspondence using appropriate format and tone.
Module 1: Fundamentals of Communication (8 L) Definition of Communication, Process, Model (Brief Overview of Linear, Interactive & Transactional Model of Communication), 7 C's of Effective Communication; Types of Communication: Verbal and Non-verbal Communication (KOPPACT, Chromatics, Olfactics); Levels of Communication: Interpersonal, Intrapersonal, Mass Communication, Organisational Communication, External Communication, Extrapersonal Communication; Flow of Communication: Upward, Downward, Horizontal, Diagonal, Spiral, Grapevine and its Types; Barriers to Communication (Physical, Psychological, Physiological, Semantic, Organisational, Cultural Barriers) and methods to overcome them.
Module 2: Functional Grammar (6 L) Parts of Speech (functional approach); Tense and its uses; Common Grammatical Errors and Corrections (Subject-verb agreement, articles, prepositions); Transformation of Sentences: Active and Passive Voice, Direct and Indirect Speech, Degrees of Comparison; Phrases & Clauses; Simple, Compound and Complex Sentences (Transformation & Synthesis).
Module 3: Comprehension and Vocabulary Skill (6 L) Reading Comprehension (scientific, descriptive, analytical, report/data-based, narrative, case-study based); Synonym and Antonym; Phrasal verbs; One-word substitution (includes technical words); Precise Writing.
Module 4: Professional Writing Skills (8 L) Business Letters (Inquiry Letter, Order Letter, Complaint Letter, Adjustment Letter, Sales Letter); Cover letter & CV; Office Correspondence: Notice, Agenda, Minutes, Circular/Memo, Email; Essay Writing (analytical, descriptive, argumentative, expository).

Course Articulation Matrix:

Mapping of Cos with Pos and PSOs (Course Articulation Matrix):														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	2	3	2	3	1	2	-	3	2
CO2	1	1	1	1	1	1	3	1	2	1	2	3	2	-
CO3	1	2	1	1	1	2	3	2	2	1	3	2	-	2
CO4	1	1	1	1	1	2	3	3	3	2	2	-	1	3
AVG.	1.00	1.25	1.00	1.00	1.00	1.75	3.00	2.00	2.50	1.25	2.25	2.50	2.00	2.33

Learning Resources:

1. Debashis Bandyopadhyay and Malathy Krishnan, Connect: A Course in Communicative English, Cambridge University Press, 2018.
2. Sanjay Kumar and Pushp Lata, Communication Skills, Oxford University Press, 2015.
3. Nira Konar, Communication Skills for Professionals, Prentice Hall of India, 2nd edition, 2011.
4. Wren and Martin, Modern English Grammar & Composition, S Chand Publishing, 2025.
5. S. Prasad & K.P. Thakur, Common Errors in English, Bharati Bhawan Publishers, 2021.
6. R.C. Sharma and Krishna Mohon, Business Correspondence and Report Writing, Tata McGraw-Hill Publishing Company Ltd., 2017.
7. McCarthy, English Vocabulary in Use, Cambridge University Press, 2017.
8. E. Sureshkumar and P. Sreehari, Communicative English, Orient Blackswan, 2007.

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9. Jeremy Comfort, Speaking Effectively, Developing Speaking Skills for Business English, Cambridge University Press, 1994.
10. Michael Swan, Practical English Usage, OUP, 1995.
11. F.T. Wood, Remedial English Grammar, Macmillan, 2007.
12. Arora, V. N and Lakshmi Chandra. Improve your Writing. OUP, 2013.

Paper Title: Values, Ethics & Indian Knowledge System	Category: Humanities and Social Sciences, including Management (HSSM)
Paper Code: HM-IKS 206	Semester: 2nd
L-T-P: 2-0-0	Credit: 2
Pre-Requisites: Basic awareness of social, ethical, and cultural issues.	Total Lectures: 28 CSE
Course Outcomes: Upon the completion of the course, the student will be able to	
CO1: Explain the fundamental concepts of values, ethics, and moral reasoning.	
CO2: Apply ethical principles and professional values in workplace and organizational settings.	
CO3: Analyze ethical issues arising in engineering practice, research, and sustainable development.	
CO4: Evaluate the relevance of the Indian Knowledge System to holistic well-being and society.	
Module 1: Understanding Values & Ethics (8 L) Ethics, Ethical values, Moral values, Virtue theory, Civic virtue, Empathy, Trustworthiness, Harmony, Maslow's need hierarchy theory, Societal values, Aesthetic values, Value spectrum of a good life, Value education, Value system in contemporary society and gender inclusivity.	
Module 2: Professional Ethics (6 L) Ethical principles in Workplace, Ethical Leadership, Good corporate governance, Corporate social responsibility, Role of CSR in enhancing brand reputation	
Module 3: Engineering Ethics and Global Issues (6 L) Ethical duties and responsibilities of an engineer, Conflict between business deal and professional ideal, Whistle blowing, Environmental and Sustainability Ethics, Research Ethics, Bio-Ethics.	
Module 4: Indian Knowledge System (8 L) Introduction and Importance of Indian Knowledge System, Indian Knowledge System – Contribution to the world- Zero and Decimal System, Ayurveda medicine, Philosophical concepts of the four	

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Vedas, Yoga, etc. Psychological aspects of health and wellness, Knowledge Triangle.

Course Articulation Matrix:

Mapping of Cos with Pos and PSOs (Course Articulation Matrix):														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	1	-	-	-	2	3	2	2		1	1	3	3
CO2	-	2	1	-	-	3	3	3	3	2	2	2	1	3
CO3	-	3	1	1	1	3	3	2	2	1	2	-	2	2
CO4	-	1	-	-	-	3	2	1	1	-	3	3	2	2
AVG.	1.00	1.75	1.00	1.00	1.00	2.75	2.75	2.00	2.00	1.50	2.00	2.00	2.00	2.50

Learning Resources:

- 1.Mahadevan, B, et al. Introduction to Indian Knowledge System. 30 May 2022.
- 2.Bharat Boudhiks. 21 vols., VBUSS Publications, 2025.
- 3.Mishra, A., W. Biswas, and A. Giri. Ethics, Values and Indian Ethos. New Age Publishers, 2022.
- 4.Kapur, K., and A. K. Singh, editors. Indian Knowledge Systems. Vol. 1, Indian Institute of Advanced Study, 2005.
- 5.Shankaracharya, Sri Adi. Tatvabodh. Commentary by Swami Tejomayananda, Central Chinmaya Mission Trust, 1995.
- 6.Ramdhoni, Reshmi. Ancient Indian Culture and Civilisation. Star Publication, 2018.

Course Code: HM-AEC 295	Category: Humanities and Social Sciences, including Management
Course Title: Language Laboratory	Semester: 2 nd
L-T-P: 0-0-2	Credit: 1
Pre-Requisites: Basic English proficiency and readiness to participate in practical communication activities.	Branch: All Engineering Branch Total Lecture: 28P
Course Outcomes: Upon successful completion of this course, students will be able to	
CO1: Demonstrate effective listening and speaking skills in academic and social contexts.	
CO2: Interpret texts and short stories for meaningful comprehension.	
CO3: Apply basic writing skills in English communication.	
CO4: Evaluate individual communication skills through group discussion and debate activities.	
Course Contents:	
Module 1: Listening and Speaking Skills (8 P) Listening to conversations, short passages, news, and speeches, Listening for general and specific information, Basic speaking activities: self-introduction, daily conversation, Simple presentations, extempore, and conversational practice (face-to-face/telephonic), Introduction to pronunciation: sounds, stress, and intonation, Practice for clarity and neutral accent.	
Module 2: Reading Skills (6 P) Reading comprehension of technical and non-technical passages, identifying main ideas and	

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supporting details, Reading two short literary texts.
Module 3: Writing Skills (6 P) Technical Report Writing: Types and formats (Project Report, Progress Report, Lab Report, Survey Report, Incident/Accident Report), Essay writing, Dialogue/Creative writing, Statement of Purpose.
Module 4: Communication Practice and Soft Skills (8 P) Group Discussion: Strategies and Practice (structured/unstructured), Debates, Interpersonal Communication Skills, SWOT analysis (Self-assessment of Communication Skills).

Course Articulation Matrix:

Mapping of COs with POs and PSOs (Course Articulation Matrix):														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	1	-	-	-	1	1	2	3	1	2	2	3	1
CO2	1	2	1	1	-	2	2	-	2	-	2	2	3	1
CO3	1	1	1	-	1	1	1	2	3	1	2	1	2	2
CO4	1	2	1	1	-	2	2	3	3	1	2	2	1	3
AVG.	1.00	1.50	1.00	1.00	1.00	1.50	1.50	2.33	2.75	1.00	2.00	1.75	2.25	1.75

Learning Resources:

1. Balasubramanian, T. *A Textbook of English Phonetics for Indian Students*. Macmillan India, 1981.
2. Board of Editors. *Contemporary Communicative English for Technical Communication*. Pearson Longman, 2010.
3. Comfort, Jeremy. *Speaking Effectively: Developing Speaking Skills for Business English*. Cambridge University Press, 1994.
4. Hacker, Diane. *A Pocket Style Manual*. Bedford/St. Martin's, 2003.
5. Konar, Nira. *English Language Laboratories: A Comprehensive Manual*. PHI Learning, n.d.
6. Sudharani, D. *Manual for English Language Laboratory*. WB ed., Pearson Education, 2010.
7. Suresh Kumar, E., and P. Sreehari. *Communicative English*. Orient Blackswan, 2007.
8. Language Software: *Orell Talk MAX Version*
9. Wilson, Anil. *Figments of Imagination*. Inter University Press Private Limited, 2022.
10. Singh, Khuswant. *Best Indian Short Stories*. Harper Collins, 2024.
11. Thomas, J. A. *100 Indian Stories*. Aleph Books, 2025.

Curriculum for B. Tech Courses in Computer Science and Engineering
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(Second Year - Third Semester)

Course Title: Probability and Statistics

Code: BS-CSE 301

Contact: 3L

Theory: 3 hrs. /Week

Credit point: 3

Course Objective:

1.	Explain and apply the basic principles of probability and statistics.
2.	Understand and use various probability distributions.
3.	Perform hypothesis testing and construct confidence intervals.
4.	Analyse relationships between variables using regression and correlation.

Pre-Requisite:

1.	10+2 label Probability & Statistics.
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Unit	Content	Hrs.
1.	Probability Theory: Axiomatic definition of Probability, Conditional probability, Independent events, Bayes theorem (Proof not required). Probability Distributions: Discrete and continuous and their properties, Distribution functions and densities, Expectation and Variance, Binomial, Poisson, Uniform, Exponential, Normal distributions. Binomial and Poisson approximation to Normal distribution. t , and F-distribution (Definition only). Transformation of random variables. Central Limit Theorem, Law of large numbers (statement only) and their applications. Tchebychev inequalities (statement only) and its application.	14
2.	Bivariate Distributions: Two-dimensional random variable, Distribution function and its properties: Discrete and continuous, Marginal distribution, Conditional distribution, Mathematical expectation of bi-variate distribution, Conditional expectation, Correlation and regression - Rank correlation coefficient, Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves.	12
3.	Sampling and Estimation: Random sampling, Parameter, Statistic and its Sampling distribution. Standard error of statistic. Sampling distribution of sample mean and variance in random sampling from a normal distribution (statement only) and related problems. Estimation of parameters: Unbiased and consistent estimators. Point estimation. Interval estimation. Maximum likelihood estimation of parameters (Binomial, Poisson and Normal). Confidence intervals and related problems.	10
4.	Testing of Hypothesis: Simple and Composite hypothesis. Critical	6

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	region. Level of significance. Type I and Type II errors. One sample and two sample tests for means and proportions. χ^2 - test for goodness of fit.	
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Text books and Reference books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. Kapoor, V. K and Gupta, S.C.: Fundamental of Mathematical Statistics, Sultan Chand and Sons.
3. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.
4. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Ed., Wiley, 1968.
5. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
6. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000. (vii) Veerarajan T., Engineering Mathematics (for semester III), Tata McGraw-Hill, New Delhi, 2010.
7. Spiegel M R., Schiller J.J. and Srinivasan R.A.: Probability and Statistics (Schaum's Outline Series), TMH.

Course Outcome:	
On completion of the course students will be able to	
BS-CSE 301.1	Apply the fundamental concepts of probability theory, conditional probability, Bayes' theorem, and standard probability distributions to solve engineering and scientific problems involving random phenomena.
BS-CSE 301.2	Analyze discrete and continuous random variables, bivariate distributions, correlation, regression, curve fitting, and transformations of random variables using appropriate statistical techniques and probabilistic models.
BS-CSE 301.3	Evaluate sampling distributions, estimation techniques, confidence intervals, and maximum likelihood estimators for statistical inference and parameter estimation in practical applications.
BS-CSE 301.4	Perform statistical hypothesis testing using appropriate tests for means, proportions, goodness of fit, and interpret the results considering significance level, Type I and Type II errors for decision-making problems.

Mapping of COs with POs and PSOs (Course Articulation Matrix):														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	1	-	-	-	-	-	-	1	2	1	1
CO2	3	3	1	2	1	-	-	-	-	-	1	3	2	1
CO3	3	3	2	2	1	-	-	-	-	-	2	3	2	2
CO4	3	3	2	3	1	-	-	-	-	1	2	3	3	2
AVG.	3.00	2.75	1.67	2.00	1.00	-	-	-	-	1.00	1.50	2.75	2.00	1.50

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Course Title: Digital Logic Design

Code: ES-CSE 301

Contacts: 3L

Theory: 3 hrs. / Week

Credit Points: 3

Course Objective:

1.	Familiar with the digital signal, positive and negative logic, Boolean algebra, logic gates, logical variables, and number systems.
2.	To acquire the basic knowledge of digital logic levels and application of knowledge to understand digital electronics circuits.
3.	To prepare students to perform the analysis and design of various digital electronic circuits.

Pre-Requisite:

1.	Boolean algebra.
2.	Basic understanding of diode, transistor operation.

Unit	Content	Hrs.
1.	Binary Number System & Boolean Algebra: BCD, ASCII, EBCDIC, Gray codes and their conversions; Signed binary number representation with 1's and 2's complement methods, Binary arithmetic, Basic logic gates, Universality of NAND, NOR gates, AND-OR-Invert gates, Positive and Negative Logic; Boolean Algebra axioms and basic theorems; Standard and canonical representations of logic functions, Conversion between SOP and POS; Simplification of logic functions, Karnaugh Map, Don't Care Conditions.	12
2.	Combinational logic circuits: Adder and substructures, Multiplexers, de multiplexers, Encoders, decoders, code convertors, magnitude comparators, parity generators and checkers. Binary Adder: Serial and Parallel Adders. CPA, CLA, CSA.	11
3.	Sequential Circuits: Basic Flip-flop & Latch, Flip-flops -SR, JK, D, T and JK Master-slave Flip Flops, Registers (SISO, SIPO, PIPO, PISO), Ring counter, Johnson counter, Basic concept of Synchronous and Asynchronous counters, Design of Mod N Counter	9
4.	A/D and D/A conversion techniques: Basic concepts (D/A: R-2-R only, A/D: successive approximation) Logic families: TTL, ECL, MOS and CMOS – basic concepts.	10

Text books and Reference books:

1. Morris Mano, Digital Logic and computer Design, PHI, 2017.
2. R.P.Jain, Modern Digital Electronics, 4/e, McGraw Hill, 2008.
3. Leach & Malvino, Digital Principles & Application, 5/e, McGraw Hill.
4. Floyd & Jain, Digital Fundamentals, Pearson.
5. S. Salivahanan, S. Arivazhgan, Digital Circuits and Design, 5th edition, Oxford

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University Press, 2018.

6. A. Anand Kumar. Fundamentals of digital electronics, 4/e, PHI, 18 Jul 2016.

Course Outcomes:	
ES-CSE 301.1	Explain number systems, basic logic gates, Boolean algebra and define characteristics of logic families.
ES-CSE 301.2	Apply Boolean laws and K-map to simplify the Boolean Expression.
ES-CSE 301.3	Analyse and design various combinational and sequential Circuits.
ES-CSE 301.4	Understand various types of components-ADC and DAC, the different logic families involved in the digital system.

Mapping of COs with POs and PSOs (Course Articulation Matrix):														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	1	2	1	1	1	1	1	-	2	2	1	2
CO2	2	3	3	3	2	-	-	2	2	2	2	3	2	1
CO3	3	2	2	3	2	-	-	2	2	1	2	3	1	2
CO4	2	3	2	3	2	-	1	3	2	2	3	3	2	1
AVG.	2.25	2.25	2.00	2.75	1.75	1.00	1.00	2.00	1.75	1.67	2.25	2.75	1.50	1.50

Course Title: Data Structure & Algorithms

Code: PC-CSE 301

Contacts: 3L

Theory: 3 hrs. / Week

Credit Points: 3

Course Objective:	
1.	To Understand Abstract Data Types (ADTs).
2.	To Master Linear and Nonlinear Data Structures.
3.	To Apply Sorting and Searching Algorithms
4.	To Develop Practical Problem-Solving Skills.

Pre-Requisite:	
1	CS 201 (Basic Computation and Principles of C).
2	M101 & M201 (Mathematics), basics of set theory.

Unit	Content	Hrs.
1.	Introduction to Algorithms and Complexity, Basic Terminologies: Elementary data organizations, Recursion. Data Structure Operations: Insertion, deletion, traversal. Analysis of an Algorithm: Asymptotic notations (Big O, Omega, Theta). Time-Space Trade-Off: Understanding trade-offs in algorithm design. Searching Techniques: Linear Search, Binary Search and their complexity analysis.	8

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2.	ADT Stack and Its Operations: Algorithms and complexity analysis. Applications of Stacks: Expression conversion and evaluation. ADT Queue: Types of Queue - Simple Queue, Circular Queue, Priority Queue; operations and algorithms for each type.	8
3.	Singly Linked Lists: Representation in memory, algorithms for traversal, searching, insertion, and deletion. Linked Representation: Stacks and queues using linked lists. Doubly Linked Lists: Operations and algorithmic analysis. Circular Linked Lists: All operations, algorithms, and complexity analysis.	8
4.	Basic Tree Terminologies: Definitions and properties. Types of Trees: Binary Tree, Binary Search Tree, AVL Tree; tree operations and algorithms with complexity analysis. Applications of Binary Trees: Overview of applications in databases and decision making. Graph Terminologies: Basic definitions and representations. Graph Traversal Algorithms: BFS, DFS and their complexity analysis. Shortest Path Algorithms: Introduction to Dijkstra's algorithm.	10
5	Sorting Algorithms: Selection Sort, Bubble Sort, Quick Sort, Merge Sort. Performance and Comparison: Analysis of sorting methods. Hashing Techniques: Basics of hash tables	8

Text books and Reference books:

1. "Data Structures and Program Design In C", 2/E by 2. "Fundamentals of Data Structures of C" by Ellis Horowitz, Sartaj Sahni, Susan Anderson freed.
2. "Data Structures in C" by Aaron M. Tenenbaum.
3. "Data Structures" by S. Lipschutz.
4. "Data Structures Using C" by Reema Thareja.
5. "Data Structure Using C", 2/e by A.K. Rath, A. K. Jagadev.
6. "Introduction to Algorithms" by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein
7. "Data Structure through C" by Yaswant Kanetkar, BPB Publications

Course Outcomes:	
On completion of the course students will be able to	
PC-CSE 301.1	Demonstrate proficiency in foundational data structures and algorithms to solve computational problems effectively.
PC-CSE 301.2	Apply algorithmic thinking and asymptotic analysis to design and evaluate efficient algorithms for diverse computational tasks and data manipulation operations.
PC-CSE 301.3	Analyse algorithm performance using time-space complexity analysis and optimize algorithms for improved efficiency and scalability in various applications.
PC-CSE 301.4	Demonstrate the ability to apply various data structures and algorithms effectively to solve practical problems encountered in different applications and domains.

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Mapping of COs with POs and PSOs (Course Articulation Matrix):														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	1	1	1	1	1	2	3	3	2
CO2	3	3	2	2	3	1	1	2	1	1	2	3	3	2
CO3	3	3	3	3	3	1	1	2	2	1	3	3	3	2
CO4	3	3	3	2	3	2	1	3	2	2	3	3	3	3
AVG.	3.00	3.00	2.50	2.25	2.75	1.25	1.00	2.00	1.50	1.25	2.50	3.00	3.00	2.25

Course Title: Database Management System

Code: PC-CSE 302

Contacts: 3L

Practical: 3 hrs. / Week

Credit Points: 3

Course Objective:

1.	To learn data models, conceptualize and depict a database system using ER diagram.
2.	To understand the concept of Database Design in Normalization techniques.
3.	To understand the internal storage structures in a physical DB design.
4.	To know the fundamental concepts of transaction processing techniques.
5.	To know the manipulation of SQL Queries, relational algebra queries.

Pre-Requisite:

1.	Proper understanding of data structures and algorithms.
2.	Understanding of set theory.
3.	Basic programming knowledge.

Unit	Content	Hrs.
1.	Database system architecture: Introduction to DBMS, File based system versus Database System, 3 schema architecture, Data Abstraction, Data Independence, Administration roles, types of users.	6
2.	Data models: Relational model- definition and Properties, Key concepts, integrity constraints. Codd's Rules. ER Model to Relational model. (ER Diagram –Strong entity, weak entity, binary, ternary relationship, cardinality, participation, extended ER feature)	6
3.	Query languages: Relational algebra (operations, Codd's algebraic rules), Evaluation of relational algebra expressions, Querying by non procedural language (SQL)	6
4.	Relational database design: Single valued functional dependency, Armstrong's axioms, Normal forms (up to BCNF), Properties of decomposition. Multivalued Functional dependency, 4NF. (Overview), Join dependency and 5NF.	10
5.	Storage strategies: Storage structures (Sequential, indexed sequential) Types of single level index (Primary, secondary, clustering), multi-level index, Dynamic multilevel indices using B-trees and B+ tree (Creation, insertion, deletion)	7

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6.	Transaction processing: Concurrency control, ACID property, Serializability of scheduling (conflict and view), Locking (2PL) and timestamp-based schedulers, Database recovery techniques.	7
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Text books and Reference books:

1. “Database System Concepts”, 6th Edition by Abraham Silberschatz, Henry F. Korth, S. Sudarshan, McGraw-Hill.
2. “Principles of Database and Knowledge – Base Systems”, Vol 1 by J. D. Ullman, Computer Science Press.
3. Database Management Systems, R.P. Mahapatra, Khanna Publishing House, New Delhi (AICTE Recommended Textbook – 2018).
4. “Fundamentals of Database Systems”, 5th Edition by R. Elmasri and S. Navathe.
5. Pearson Education “Foundations of Databases”, Reprint by Serge Abiteboul, Richard Hull, Victor Vianu, Addison-Wesley.

Course Outcomes:	
On completion of the course students will be able to	
PC- CSE 302.1	Understanding Database system architecture and data models.
PC- CSE 302.2	Design the database with normalization techniques and construct queries using Relational Algebra, SQL etc.
PC- CSE 302.3	Develop efficient storage scheme of saving and retrieving Records and Files
PC- CSE 302.4	Understand transaction processing, concurrency control and recovery techniques

Mapping of COs with POs and PSOs (Course Articulation Matrix):														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	1	1	2	1	-	-	-	-	-	3	1	1
CO2	2	1	2	2	1	2	-	-	-	1	-	3	2	1
CO3	3	2	3	1	2	2	2	-	-	-	-	2	2	3
CO4	2	3	3	2	-	2	2	2	1	-	-	3	3	1
AVG.	2.25	1.75	2.25	1.5	1.67	1.75	2.00	2.00	1.00	1.00	-	2.75	2.00	1.50

Course Title: Formal Language & Automata Theory

Code: PC-CSE 303

Contacts: 3L

Theory: 3 hrs. /Week

Course Objective:	
1.	Be able to know different classes of grammars and formal languages.
2.	Be able to write grammar and construct finite automata for different languages.
3.	Be able to know properties of regular expression and construct pushdown automata for context free grammars.
4.	Be able to understand undesirability and decide on languages that are undesirable.

Pre-Requisite:

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1.	Basics of Set Theory, Graph Theory.
2.	Principle of Mathematical Induction, Proof by Contradiction.

Unit	Content	Hrs.
1.	Formal Languages and Grammars: Alphabet, strings, languages, grammars, productions and derivation, Chomsky hierarchy of grammars.	7
2.	Finite Automata: deterministic finite automata (DFA) and equivalence with regular expressions, nondeterministic finite automata (NFA), NFA with epsilon, NFA to DFA conversion, equivalence of NFA and DFA, state transition graph, transition table, Mealy and Moore machine, minimization of automata.	7
3.	Regular grammar and Languages: Regular expressions and languages, regular grammars and equivalence with finite automata, properties of regular languages, Arden's theorem, closure properties of regular set, pumping lemma for regular expression.	9
4.	Context-free grammar and pushdown automata: Context-free grammars (CFG) and languages (CFL), derivation, parse trees, ambiguity in CFG, left recursion, left factoring, normal forms, Closure Properties of CFG. Pushdown automata (PDA): Definition, acceptance of strings by PDA, DPDA and NPDA, construction of PDA from CFG.	9
5.	Turing Machines and Undecidability: The basic model for Turing machines (TM), Turing recognizable (recursively enumerable) and Turing-decidable (recursive) languages and their closure properties, variants of Turing machines, nondeterministic TMs and equivalence with deterministic TMs, unrestricted grammars and equivalence with Turing machines, TMs as enumerators. Undecidability: Church-Turing thesis, universal Turing machine, the universal and diagonalization languages, reduction between languages and Rice's theorem, undecidable problems about languages.	10

Text books:

1. John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman, Introduction to Automata Theory, Languages, and Computation, Pearson Education Asia.
2. Harry R. Lewis and Christos H. Papadimitriou, Elements of the Theory of Computation, Pearson Education Asia.
3. Dexter C. Kozen, Automata and Computability, Undergraduate Texts in Computer Science, Springer.

Reference books:

1. Shyamalendu Kandar, Introduction to Automata Theory, Formal Languages and Computation, PEARSON.
2. Dr. R. B. Patel, Theory of Computation, Khanna Publishing House.
3. K.L.P. Mishra (Author), N. Chandrashekar (Author), Theory of Computer Science: Automata, Languages and Computation, Prentice-Hall of India Pvt.Ltd.

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Course Outcomes:	
On completion of the course students will be able to	
PC-CSE 303.1	Understand the basics of formal language, grammar, and automata.
PC-CSE 303.2	Apply pumping lemma to disprove the language is regular language or context free language.
PC-CSE 303.3	Remember context free grammar to design pushdown automata.
PC-CSE 303.4	Analyze computational problems and understand decidability.

Mapping of COs with POs and PSOs (Course Articulation Matrix):														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	3	3	-	-	1	1	1	2	-	2	3	1	2
CO2	2	3	3	2	2	1	1	2	2	2	2	3	3	2
CO3	3	3	3	2	2	2	-	2	2	1	-	2	3	2
CO4	2	3	3	3	1	2	2	3	3	2	2	3	3	2
AVG.	2.00	3.00	3.00	2.33	1.67	1.50	1.33	2.00	2.25	1.67	2.00	2.75	2.50	2.00

Course Title: Introduction to Cyber Security & Block Chain Technology

Code: PC-CSE 304

Contacts: 3L

Theory: 3 hrs. /Week

Credit Points: 3

Course Objective:	
1.	To make familiar with security, threat, web security of information system.
2.	To develop an understanding the different types of cyber fraud, cybercrime and cyber law.
3.	To understand the current trends of Block chain.
4.	To understand the mechanisms of Bit coin, Ethereum, Hyper ledger

Pre-Requisite:	
1.	Data structures, Distributed systems, Computer Networks. Engineering Mathematics.
2.	Basic programming skills

Unit	Content	Hrs.
1.	Introduction to Cyber Security: Introduction, layers of security, Vulnerability, threat, Internet Governance – Challenges and Constraints, Computer Criminals, CIA Triad, Assets and Threat, motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, Spectrum of attacks, Taxonomy of various attacks, IP spoofing, Methods of defense, Security Models, risk management, Cyber Threats-Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, etc., Comprehensive Cyber Security Policy and law. Security attacks (active and passive): With respect to information security attacks, computer security attacks, network security attacks that means cyber security attacks.	12
2.	Cryptography: Introduction to Cryptography and related mathematics Modern Cryptography: Symmetric key (DES, Blowfish, AES etc.) &	10

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	Asymmetric key Cryptography (RSA, ElGamal, etc.) Key management and authentication: Hash function (MD5, SHA1), Digital signature, Signcryption -, Kerberos.	
3.	Block chain: Application of cryptography: Introduction, centralize and Decentralize system, Distributed Database, Comparison of Database Systems, Advantage over conventional distributed database, Distributed consensus algorithms, Block chain Technology Mechanisms & Networks, Objective of Block chain, Block chain Challenges, Transactions, Merkle Tree, private vs. public Block chain, Mining Mechanism, applications of Block chain.	10
4.	Crypto currency: an application of Block chain: Introduction, what is Bit coin, The Bit coin Network, The Bit coin Mining Process, Mining Developments, Bit coin Wallets, Decentralization and Hard Forks, Ethereum Virtual Machine (EVM), Double-Spend Problem, Block chain and Digital Currency, Transactional Blocks, Impact of Block chain Technology on Crypto currency.	10

Text books and Reference books:

1. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Sumit Belapure and Nina Godbole, Wiley India Pvt. Ltd.
2. Information Warfare and Security, Dorothy F. Denning, Addison Wesley.
3. Security in the Digital Age: Social Media Security Threats and Vulnerabilities, Henry A. Oliver, Create Space Independent Publishing Platform.
4. Data Privacy Principles and Practice, Natraj Venkataramanan and Ashwin Shriram, CRC Press.
5. Mastering Blockchain: Unlocking the Power of Cryptocurrencies, Smart Contracts, and Decentralized Application by Lorne Lantz, O'Reilly Media; 1st edition.
6. Blockchain Technology: Concepts and Applications, Kumar Saurabh , Ashutosh Saxena, Wiley.

Course Outcome:	
On completion of the course students will be able to	
PC-CSE 304.1	Understand the different types of cyber fraud, cybercrime and cyber law. Get familiar with security, threat, web security of information system.
PC-CSE 304.2	Understand cryptography basics, algorithms and mathematical background for cryptography. Analyse the important cryptographic algorithms.
PC-CSE 304.3	Understand the basics of Block chain technology along with its primitives. Analyse the Block chain techniques for use cases like Finance and Trade/Supply.
PC-CSE 304.4	Develop private Block chain environment and develop a smart contract on Ethereum. Identify and analyze the applications of Bit coin script.

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Mapping of COs with POs and PSOs (Course Articulation Matrix):														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	-	-	3	3	-	-	2	-	2	2	3	2
CO2	3	2	-	3	2	-	2	3	-	-	-	3	3	2
CO3	2	3	-	3	2	-	-	2	3	2	-	3	3	2
CO4	2	2	2	3	3	-	-	-	-	-	-	3	2	1
AVG.	2.50	2.50	2.00	3.00	2.50	3.00	2.00	2.50	2.50	2.00	2.00	2.75	2.75	1.75

Course Title: Environmental Sciences

Code: AU-CSE 301

Contacts: 1L

Theory: 1hr /Week

Course Objective:	
1.	To understand the natural environment and its relationship with human activities.
2.	To apply the fundamental knowledge of science and engineering to assess environmental and health risk.
3.	To solve problem related to Air, Water, Noise and Land pollution.
4.	To understand environmental laws and regulations to develop guidelines and procedures for health and safety issues.

Pre-Requisite:	
1.	N/A

Unit	Content	Hrs.
1.	Environment and ecosystem: Basic concepts of Environment; Biosphere; Society, Environment & their interrelationship; Nature and scope of Environmental Science and Engineering; Sustainable Development Ecosystem: Components of ecosystem; Ecosystem management; Structure and function different types of ecosystems; Food chain; Food web; Ecological Pyramid Biodiversity: Types, Importance, Endemic species, Biodiversity Hot-spot; Threats to biodiversity; Conservation of biodiversity	3
2.	Air & Water Quality Engineering: Air Pollution and Control: Atmospheric composition; Climate, Weather; Definition of pollutants and contaminants, Primary and secondary pollutants, sources and effects of pollutants; Greenhouse effect, Depletion of ozone layer, Acid rain, Control measures Water Pollution and Control: Hydrosphere, Hydrological cycle and Natural water; Sources and effects of water pollutants Water Treatment System: Physical Unit Processes; Chemical Unit Processes; Biological Unit Processes.	5
3.	Land & Noise Pollution: Solid Waste Management: Soil pollutants, waste generation, collection, disposal, recovery, and energy conversion methods. Noise Pollution: Sources, physiological and psychological effects, ambient standards, and engineering control measures.	2

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4.	Environmental Management: Environmental Impact Assessment, Environmental Audit, Environmental laws and protection act of India, Different international environmental treaty / Agreement / Protocol Action-Oriented Activities: Small-group waste management workshops, recycling campaigns, and cleanliness drives. Resource Conservation: Energy-saving initiatives and tree plantation drives. Community Advocacy: Slogan writing and poster-making campaigns for public environmental awareness.	4
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Textbooks:

1. Principles of Environmental Engineering, Gilbert Masters.
2. Introduction to Environmental Biotechnology, Milton Wainwright.
3. Environmental Biotechnology, Pradipta Kumar Mohapatra.
4. Environmental Science, S.C. Santra.
5. Ecology and Environment, PD Sharma PD, Rastogi Publications, Delhi.

Web Reference:

1. https://onlinecourses.nptel.ac.in/noc24_ge19/preview
2. https://onlinecourses.nptel.ac.in/noc23_hs155/preview
3. https://onlinecourses.nptel.ac.in/noc21_hs83/preview
4. https://onlinecourses.nptel.ac.in/noc20_ge16/preview

Course Outcomes:	
On completion of the course students will be able to	
AU-CSE 301.1	Understand the concept of environment and elaborate the organization of ecosystem, its components.
AU-CSE 301.2	Identify, understand and distinguish the different environmental pollution associated with environmental degradation.
AU-CSE 301.3	Design, formulate and develop different control mechanisms, devices to minimize the environmental pollution.
AU-CSE 301.4	Create and promote various environmental awareness programs in the society.

Mapping of COs with POs and PSOs (Course Articulation Matrix):														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	1	1	-	-	2	3	-	-	-	1	-	-	-
CO2	2	2	2	2	-	2	3	-	-	-	-	-	-	-
CO3	2	2	2	2	3	2	3	-	2	2	2	1	1	1
CO4	1	-	-	-	-	3	3	-	2	2	3	-	-	-
AVG.	1.50	1.67	1.67	2.00	3.00	2.25	3.00	-	2.00	2.00	2.00	1.00	1.00	1.00

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Course Title: Digital Logic Design Lab

Code: ES-CSE 391

Contacts: 4P

Practical: 4 hrs. /Week

Credit points: 2

Course Objective:	
1.	To learn Boolean Algebra and Understand the various logic gates.
2.	To design and implement various combinational circuit, synchronous sequential, asynchronous sequential circuits.
3.	To be familiar with basic combinational and sequential components used in the typical data path designs.

Pre-Requisite:	
1	Boolean Algebra.
2	Basic understanding of diode, transistor operation.

Laboratory Experiments:		Hrs
1	Implement various logic gates, half adder, full adder using universal logic gates.	8
2	Design a Full Adder using basic gates and verify its output, Design a Full Subtractor circuit using basic gates and verify its output.	8
3	Design code converter circuit. (BCD to Excess-3 and vice versa, Binary to Gray and vice versa)	8
4	Design 2 to 4 Decoder, 4 to 2 Encoder.	4
5	Design 4:1 Multiplexer, 1:4 Demux.	4
6	Design Magnitude comparator.	4
7	Design Flip-flops: SR, D, JK, T, Master slave JK Flipflops.	8
8	Design Shift Register.	4
9	Design Asynchronous Up/Down counter.	4
10	Design Synchronous Up/Down counter.	4

(Detailed instructions for Laboratory Manual to be followed for further guidance)

Text books and Reference books:

1. Morris Mano, Digital Logic and computer Design, PHI, 2017
2. R.P.Jain, Modern Digital Electronics, 4/e, McGraw Hill, 2008.
3. Leach & Malvino, Digital Principles & Application, 5/e, McGraw Hill
4. Floyd & Jain, Digital Fundamentals, Pearson.
5. S. Salivahanan, S. Arivazhgan, Digital Circuits and Design, 5th edition, Oxford University Press, 2018.
6. A. Anand Kumar. Fundamentals of digital electronics, 4/e, PHI, 18 Jul 2016.

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Course Outcome:	
On completion of the course students will be able to	
ES-CSE 391.1	Define different types of logic gates, identify their ICs and also verify their truth table.
ES-CSE 391.2	Interpret realization of Boolean expression in SOP and POS form and design it using logic gates.
ES-CSE 391.3	Apply Boolean simplification techniques to design a combinational hardware circuit.
ES-CSE 391.4	Design synchronous sequential circuits using basic flip-flops, counters.

Mapping of COs with POs and PSOs (Course Articulation Matrix):														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	2	1	2	1	1	2	1	1	1	2	2	1	2
CO2	2	2	2	2	2	-	-	2	2	2	2	3	2	1
CO3	2	2	2	2	2	-	-	2	2	2	2	3	1	2
CO4	2	2	3	3	2	-	-	2	2	2	2	3	2	1
AVG.	1.75	2.00	2.00	2.25	1.75	1.00	2.00	1.75	1.75	1.75	2.00	2.75	1.50	1.50

Course Title: Data Structure & Algorithm Lab

Code: PC-CSE 391

Contacts: 4P

Practical: 4 hrs. / Week

Credit Points: 2

Objectives:	
1.	Master in Implementation of Linear Data Structures/
2.	Apply Algorithmic Concepts to Solve Practical Problems/
3.	Explore and Implement Non-Linear Data Structures/
4.	Practice Application of Sorting and Searching Algorithms/

Pre-Requisite:	
1.	Assumed foundational knowledge in programming and basic data structures.

Laboratory Experiments:		Hrs.
Linear Data Structures		
1.	Implementation of Array Operations: Perform operations such as insertion, deletion, and traversal on arrays.	4
2.	Stacks and Queues: implement operations for stacks (push, pop) and queues (enqueue, dequeue). Implement Circular Queue operations: Adding and deleting elements.	12
3.	Expression Evaluation using Multiple Stacks and Queues	8
4.	Implementation of Linked Lists: Implement operations like insertion, deletion, and inversion on linked lists. Implement stacks and queues using linked lists.	8
5.	Polynomial Operations: Perform polynomial addition and multiplication.	4

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Non-Linear Data Structures		
6.	Recursive and Non-recursive Traversal of Trees: Implement recursive and non-recursive traversal algorithms for trees.	8
7.	Threaded Binary Tree Traversal: Implement threaded binary tree traversal algorithms.	4
8.	AVL Tree Implementation: Implement AVL tree operations for balanced binary search trees.	4
9.	Hash Tables Implementation: Implement hash tables and perform operations like searching, inserting, and deleting.	4

(Detailed instructions for Laboratory Manual to be followed for further guidance)

Text books and Reference books:

1. “Data Structures Using C” by Reema Thareja.
2. “Data Structures and Program Design In C”, 2/E by Robert L. Kruse, Bruce P. Leung.
3. “Data Structure Lab Experiment with C”, by Girish Rao Salanke, Medtech.

Course Outcomes:	
PC-CSE 391.1	Understand and analyze fundamental concepts of data structures, including algorithm efficiency and performance evaluation using asymptotic notations.
PC-CSE 391.2	Implement and apply various linear data structures, performing key operations and understanding their applications in computational problems.
PC-CSE 391.3	Develop and utilize non-linear data structures, including different traversal methods, and comprehend their practical applications in software development.
PC-CSE 391.4	Evaluate and implement advanced data structures, analyze key algorithms for efficiency, and appreciate their significance in solving complex computational challenges.

Mapping of COs with POs and PSOs (Course Articulation Matrix):														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	1	1	2	1	1	3	3	2	2
CO2	3	3	3	2	3	1	1	2	1	1	3	3	3	2
CO3	3	3	3	2	3	2	1	3	2	2	3	3	3	3
CO4	3	3	3	3	3	2	2	2	2	2	3	3	3	3
AVG.	3.00	3.00	2.75	2.25	2.75	1.50	1.25	2.25	1.50	1.50	3.00	3.00	2.75	2.50

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Course Title: Database Management System Lab

Code: PC-CSE 392

Contacts: 4P

Practical: 4hrs / Week

Credit Points: 2

Course Objective:	
1.	To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modelling, designing, and implementing a DBMS.
2.	To construct the SQL queries for a given specification in Open source and Commercial DBMS – ORACLE platform.
3.	To enable the students to practice the concepts learnt in the subject Database Management System by developing a database.

Pre-Requisite:	
1.	Proper understanding of data structures and algorithms.
2.	Understanding of set theory.
3.	Basic programming knowledge.

Laboratory Experiments:		Hrs.
Structured Query Language		
1.	Creating Database Creating a Database Creating a Table Specifying Relational Data Types Creating Constraints	12
2.	Table and Record Handling INSERT, DELETE, UPDATE, TRUNCATE commands DROP, ALTER commands COMMIT, ROLLBACK commands	8
3.	Retrieving Data from a Database The SELECT statement Using the WHERE clause ORDER BY, GROUP BY and HAVING Clause Using Logical Operators, Using IN, BETWEEN, LIKE, IS operators Using ANY, ALL, EXISTS operator Using Aggregate Functions Combining Tables Using JOINS Subqueries(independent and correlated)	12
4.	Database Management Creating Views Creating Column Aliases Creating Database Users Using GRANT and REVOKE	12
5.	Introduction to PL/SQL Basic programming constructs (decision making, iteration)	12

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	Practical implementation of Stored Procedure and function Cursor Trigger	
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(Detailed instructions for Laboratory Manual to be followed for further guidance)

Resources:

1. Sql, pl/sql the programming language of oracle by Bayross, Ivan
2. <https://livesql.oracle.com/>

Course Outcomes:	
On completion of the course students will be able to	
PC-CSE 392.1	Create a database schema, relation and implement referential integrity constraint.
PC-CSE 392.2	Implement and control the database using SQL queries for a given specification in ORACLE platform
PC-CSE 392.3	Applying administrative activities like working with views, creating users and granting or revoking privileges on database objects.
PC-CSE 392.4	Create database objects by using Procedural extension of SQL to develop a better control on database.

Mapping of COs with POs and PSOs (Course Articulation Matrix):														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	1	-	-	1	-	-	-	-	-	1	-	-
CO2	2	2	3	1	1	1	-	-	-	-	-	2	1	-
CO3	3	3	3	3	2	2	2	2	2	2	1	3	3	3
CO4	2	3	3	2	-	1	-	-	-	1	-	3	3	3
AVG.	2.25	2.25	2.50	2.00	1.50	1.25	2.00	2.00	2.00	1.50	1.00	2.25	2.33	3.00

Curriculum for B. Tech Courses in Computer Science and Engineering
(Applicable for Academic Year 2026-2030)



Second Year - Fourth Semester

Course Title: Computer Organization & Architecture

Course: PC-CSE 401

Contacts: 3L

Theory: 3 hrs. / Week

Credit Points: 3

Course Objective:

1.	To conceptualize the basics of organizational and architectural issues of a digital computer.
2.	To analyze performance issues in processor and memory design of a digital computer.
3.	To understand various data transfer techniques in digital computer.
4.	To analyze processor performance improvement using instruction level parallelism.

Pre-Requisite:

1.	Number systems.
2.	Basic programming skills.
3.	Basics of Digital Electronics.

Unit	Content	Hrs.
1.	Digital Computers: Introduction, Block diagram of Digital Computer, Definition of Computer Organization, Register Transfer Language and Micro operations: Register Transfer language, Register Transfer, Bus and memory transfers, Arithmetic Micro operations, logic micro operations, shift micro operations, Arithmetic logic shift unit.	10
2.	Data Representation: Data types, Complements, Fixed Point Representation, Floating Point Representation. Computer Arithmetic: Addition and subtraction, multiplication Algorithms, Floating – point Arithmetic operations. Decimal Arithmetic unit, Decimal Arithmetic operations.	10
3.	Central Processing Unit: General Register Organization, Instruction Formats, Addressing modes, Data Transfer and Manipulation, Program Control. Design of control unit. Input-Output Organization: Input-Output Interface, Asynchronous data transfer, Modes of Transfer. Memory Organization: Memory Hierarchy, Main Memory, Auxiliary memory, Associate Memory, Cache Memory.	11
4.	Reduced Instruction Set Computer: CISC Characteristics, RISC	11

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	Characteristics. Flynn's Classification of computers. Pipelining: Introduction, Definition, Space time diagram, Clock period. Performance measurement: Speed-up, Efficiency and Throughput, Example; Classification of pipelined processors. Design of arithmetic pipelines: Floating point adder pipeline, Multiplier pipeline. Issues in pipeline design: Pipeline hazards. Multiple issue processors: Super-pipelining, Super-scalar and VLIW. Vector processing: Introduction, Characteristics. SIMD array processor: Introduction, Classification. Multiprocessor: Introduction, Classification.	
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Text books and Reference books:

1. Computer System Architecture – M. Moris Mano, Third Edition, Pearson/PHI.
2. Computer Organization – Car Hamacher, Zvonks Vranesic, Safea Zaky, Vth Edition, McGraw Hill.
3. Computer Organization and Architecture – William Stallings Sixth Edition, Pearson/PHI.
4. Structured Computer Organization – Andrew S. Tanenbaum, 4th Edition, PHI / Pearson.
5. Computer Architecture and Organization, 3rd Edition by John P. Hayes, WCB/McGrawHill
6. Computer Architecture and Parallel Processing by Hwang and Briggs (Mc-Graw Hill).
7. Computer Organization and Architecture: Designing for Performance, 10th Edition by William Stallings, Pearson Education.

Course Outcomes:	
On completion of the course students will be able to	
PC-CSE 401.1	Understand the basics of instructions sets and their impact on processor design
PC-CSE 401.2	Demonstrate an understanding of the design of the functional units of a digital computer system.
PC-CSE 401.3	Evaluate cost performance and design trade-offs in designing and constructing a computer processor including memory.
PC-CSE 401.4	Design a pipeline for consistent execution of instructions with minimum hazards.

Mapping of COs with POs and PSOs (Course Articulation Matrix):														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	-	-	3	-	-	-	3	3	2	2	3	2
CO2	3	3	-	3	2	3	2	3	2	-	-	3	3	2
CO3	3	3	-	3	2	-	1	2	-	-		3	3	2
CO4	3	2	3	2	-	-	-	-	-	1	-	3	2	1
AVG.	3.00	2.75	3.00	2.67	2.33	3.00	1.50	2.50	2.50	2.00	2.00	2.75	2.75	1.75

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Course Title: Object Oriented Programming

Code: PC-CSE 402

Contacts: 3L

Practical: 3 hrs. / Week

Credit Points: 3

Course Objective:	
1.	Introduce the principles of object-oriented programming in a higher-level programming language.
2.	Analyze a problem statement to develop a mental model of objects necessary to create software architecture.
3.	Utilize object-oriented programming to frame software architectures, with care towards separation of concerns and abstraction.
4.	Gain skills in designing, and programming software for reuse of code.
5.	Establish development methods in object-oriented programming to qualify students for teaching the language in other settings.

Pre-Requisite:	
1.	Programming Fundamentals

Unit	Content	Hrs.
1.	OOP concepts and Overview of Java language: Class, object, Abstraction, encapsulation, Inheritance, Encapsulation Polymorphism, Difference between OOP and Procedural approach. Basics of Java programming, Data types, Variables, Operators, Control structures including selection, Looping, Java methods, Overloading, Math class, Arrays in java, Basic I/O operations using BufferedReader and Scanner class.	9
2.	Objects and Classes: Basics of objects and classes in java, Constructors, Finalizer, Visibility modifiers, Methods and objects, Inbuilt classes like String, Character, StringBuffer, StringBuilder, this reference.	9
3.	Inheritance, Polymorphism and Package: Inheritance in java, Super and sub class, Overriding, Object class, Polymorphism, Dynamic binding,, instanceof operator, Abstract class, Interface in java. Creation of package, detailed discussion on access specifiers. Defining packages, Member access, Importing packages. Creation of packages etc. UTIL package.	8
4.	Exception Handling and Multithreading: Exception Handling: Exception handling basics, different types of Exception classes, use of try & catch with throw, Errors in Java Program, Exceptions, throws Clause, throw Clause, Types of Exceptions, creation of user defined exception classes. Threads: Single Tasking, Multi-Tasking, thread life cycle, Uses of Threads, creating a Thread and Running it, terminating the Thread, Thread Class Methods, suspending & resuming threads, thread priorities, thread synchronization.	9
5.	Event and GUI programming: Event handling in java, Event types, Mouse and key events, GUI Basics, Panels, Frames, Layout Managers: Flow Layout,	7

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	Border Layout, Grid Layout, GUI components like Buttons, Check Boxes, Radio Buttons, Labels, Text Fields, Text Areas, Combo Boxes, Lists, Scroll Bars, Sliders, Windows, Menus, Dialog Box, Introduction to swing. Overview of Collections : ArrayList, LinkedList, Vector etc.	
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Text books and Reference books:

1. Rambaugh, James Michael, Blaha – "Object Oriented Modelling and Design" – Prentice Hall, India.
2. Ali Bahrami – "Object Oriented System Development" – Mc Graw Hill.
3. Patrick Naughton, Herbert Schildt – "The complete reference-Java2" – TMH.
4. R.K Das – "Core Java for Beginners" – VIKAS PUBLISHING.
5. Deitel and Deitel – "Java How to Program" – 6th Ed. – Pearson.
6. Ivor Horton's Beginning Java 2 SDK – Wrox.
7. E. Balagurusamy – " Programming With Java: A Primer" – 3rd Ed. – TM.H

Course Outcomes:	
On completion of the course students will be able to	
PC-CSE 402.1	Apply the concepts of classes and objects to solve simple problems.
PC-CSE 402.2	Analyze programs using inheritance, packages and interfaces.
PC-CSE 402.3	Evaluate the use of exception handling mechanisms and a multithreaded model to solve real-world problems.
PC-CSE 402.4	Design and develop GUI programs.

Mapping of COs with POs and PSOs (Course Articulation Matrix):														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	2	2	1	-	-	1	1	-	1	3	2	2
CO2	2	2	3	3	2	-	-	2	-	-	1	2	2	2
CO3	2	2	2	2	3	1	-	2	-	-	1	2	2	2
CO4	2	1	3	2	2	1	2	2	1	2	3	2	2	3
AVG.	2.00	1.75	2.50	2.25	2.00	1.00	2.00	1.75	1.00	2.00	1.50	2.25	2.00	2.25

Course Title: Machine Learning

Code: PC-CSE 403

Contacts: 3L

Practical: 3 hrs. / Week

Credit Points: 3

Course Objective:	
1.	To learn the concept of how to learn patterns and concepts from data without being explicitly programmed.
2.	To design and analyses various machine learning algorithms and techniques with a modern outlook focusing on recent advances.
3.	Explore supervised and unsupervised learning paradigms of machine learning.
4.	To explore Deep learning technique and various feature extraction strategies.

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Pre-Requisite:	
1.	Basic understanding of Linear algebra, Trigonometry, Statistics, calculus, probability
2.	Python Programming

Unit	Content	Hrs.
1.	Some performance metrics associated with ML, Supervised Learning (Regression/Classification) Basic methods: Distance-based methods, Nearest-Neighbor's, Decision Trees, Naive Bayes Linear models: Linear Regression, Logistic Regression Support Vector Machines, Nonlinearity and Kernel Methods	12
2.	Unsupervised Learning : Clustering: K-means/Kernel K-means / k-medoids Dimensionality Reduction: PCA and kernel PCA, Matrix Factorization and Matrix Completion	12
3.	Evaluating Machine Learning algorithms and Model Selection, Introduction to Statistical Learning Theory, Ensemble Methods (Boosting, Bagging, Random Forests)	8
4.	Time-Series Data, basics of Semi-supervised Learning, Reinforcement Learning, DL fundamentals: Introduction to neural network and feed forward network	10

References:

1. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning, Springer 2009 (freely available online).
2. Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 2007.
3. Dr. Rajiv Chopra, Machine Learning, Khanna Publishing House, 2018.
4. Tom M. Mitchell, Machine Learning, McGraw-Hill, 2017.
5. Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012.

Course Outcomes:	
On completion of the course students will be able to	
PC-CSE 403.1	To understand principles and concepts of various ML algorithms.
PC-CSE 403.2	To evaluate the ML algorithms using real life data.
PC-CSE 403.3	To analyse the ML algorithms according to different performance metrics.
PC-CSE 403.4	To understand Ensemble Methods, time series data, semi supervised learning, Reinforcement Learning, and essentials of NN architectures.

Mapping of COs with POs and PSOs (Course Articulation Matrix):														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	2	-	-	-	-	-	-	3	3	3	1
CO2	3	2	2	2	1	-	-	-	1	-	3	3	3	2
CO3	3	3	2	3	1	-	-	-	1	-	3	3	3	3
CO4	2	3	3	3	-	-	-	1	2	-	3	3	3	3
AVG.	2.75	2.75	2.25	2.5	1.00	-	-	1.00	1.33	-	3.00	3.00	3.00	2.25

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Course Title: Discrete Mathematics

Code: PC-CSE 404

Contacts: 3L+1T

Theory: 4 hrs. / Week

Credit points: 4

Course Objective:	
1.	Use mathematically correct terminology and notation.
2.	Construct correct direct and indirect proofs.
3.	To know Syntax, Semantics, Validity and Satisfiability, Graphs and Trees.
4.	Use counterexamples. Apply logical reasoning to solve a variety of problems.

Pre-Requisite:	
1.	Some concepts from basic math – algebra, geometry.

Unit	Content	Hrs.
1	Relations, Functions and Number Theory: Partial Ordering Relation, Hasse diagram, Functions, Domain and range of function Inverse and Composite Function, Bijective function, Inverse and Composite Function, Principles of Mathematical Induction, Well-ordering principle, Recursive definition, Division algorithm, Prime Numbers, Greatest Common Divisor: Euclidean Algorithm, Fundamental theorem of arithmetic, Least common multiple, Diophantine equation, Congruence, Properties of congruence, residue classes, Solution of linear congruence, Fermat's theorem, Wilson's theorem.	16
2	Counting Techniques: Permutation and combination, Principle of inclusion and exclusion, Pigeon-hole principle.	8
3	Propositional Logic: Syntax, Semantics, Validity and Satisfiability, Basic Connectives and Truth Tables, Logical Equivalence: The Laws of Logic, Logical Implication, Rules of Inference, The use of Quantifiers. Proof Techniques: Some Terminology, Proof Methods and Strategies, Forward Proof, Proof by Contradiction, Proof by Contraposition, Proof of Necessity and Sufficiency.	10
4	Algebraic Structures and Morphism: Algebraic Structures with one Binary Operation, Semi Groups, Monoids, Groups, Sub-group, Quotient Structures, Cyclic Groups, Coset, Normal Subgroups, Permutation Groups, and Quotient group. Morphism: Homomorphism and Isomorphism, Kernel and Image. Algebraic Structures with two Binary Operation, Rings, Integral Domain and Fields.	8
5	Graph Theory: Tree: Definition, types of tree (rooted, binary), properties of trees. Theorems of tree, Prim's and Kruskal's Algorithms to find MST. Weighted trees and prefix codes. Tree traversal algorithms: BFS & DFS. Graph coloring, Chromatic number, Chromatic polynomial, Decomposition theorem, Planarity of a graph, Clique, Clique number, Independent set, Independence number, Brooke's theorem, Dual and Planar graphs, detection of planarity, Theorems on planarity. Matching, Maximal and perfect matching, Matching number, SDR of Matching, Hall Marriage theorem.	14

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Text books and Reference books:

1. A text book of Discrete Mathematics, Guruprasad Samanta, New Age International.
2. Gary Haggard, John Schlipf and Sue Whitesides, Discrete Mathematics for Computer Science, CENGAGE Learning.
3. J.K. Sharma, Discrete Mathematics, Macmillan.
4. S. K. Chakraborty and B. K. Sarkar, Discrete Mathematics, OXFORD University Press.
5. Douglas B. West, Introduction to graph Theory, PHI.
6. C. L. Liu, Elements of Discrete Mathematics, 2nd Ed., Tata McGraw-Hill, 2000.
7. N. Deo, Graph Theory, Prentice Hall of India, 1974.
8. S. Lipschutz and M. L. Lipson, Schaum's Outline of Theory and Problems of Discrete Mathematics, 2nd Ed., Tata McGraw-Hill, 1999.
9. J. P. Tremblay and R. P. Manohar, Discrete Mathematics with Applications to Computer Science, Tata McGraw-Hill, 1997.
10. N. Chandrasekaran and M. Umavathi, Discrete Mathematics, PHI.

Course Outcomes:	
On completion of the course students will be able to	
PC-CSE 404.1	Apply concepts of relations, functions, number theory, mathematical induction, and counting techniques to solve discrete mathematical and combinatorial problems.
PC-CSE 404.2	Apply propositional logic, quantifiers, and proof techniques to analyze logical statements and construct valid mathematical arguments.
PC-CSE 404.3	Analyze algebraic structures, quotient structures, and morphisms including groups, rings, fields, homomorphisms, and isomorphisms.
PC-CSE 404.4	Apply graph theoretic concepts and algorithms to analyze trees, traversals, spanning trees, graph coloring, planarity, and matching problems.

Mapping of COs with POs and PSOs (Course Articulation Matrix):														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	1	-	-	-	-	-	-	2	3	2	1
CO2	3	3	1	2	-	-	-	1	-	2	2	3	2	1
CO3	3	3	2	2	-	-	-	-	-	-	2	2	3	2
CO4	3	3	2	3	2	-	-	-	-	1	2	2	3	2
AVG.	3.00	2.75	1.67	2.00	2.00	-	-	1.00	-	1.50	2.00	2.50	2.50	1.50

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Course Title: Ethical Issues in AI

Code: PC-CSE 406

Contacts: 2L

Practical: 2 hrs. / Week

Credit Points: 2

Course Objective:	
1.	Demonstrate an understanding of ethics and its application to AI.
2.	Analyze ethical dilemmas in AI using tools from normative ethics, metaethics, and moral epistemology.
3.	Learn how ethical principles can be integrated into the design of AI systems through practical frameworks and methodologies.
4.	Develop a capacity to critically evaluate fairness, transparency, and accountability in AI systems.

Pre-Requisite:	
1.	Knowledge about Artificial Intelligence.

Unit	Content	Hrs.
1.	Introduction to AI and Ethical Implications: Overview of AI, generative AI vs predictive AI, ethical concerns in AI development, societal impacts of AI, and ethical decision making frameworks in AI systems.	6
2.	Foundations of Generative AI: Understanding generative models like GANs, VAEs, and Diffusion models; Key concepts in unsupervised learning, ethical issues in synthetic data generation (e.g., deepfakes, authenticity). Predictive AI Models and Their Implications: Introduction to supervised learning, predictive analytics, algorithmic bias, fairness in predictive modelling, and consequences of biased predictions in decision-making.	8
3.	Ethics of Algorithmic Decision-Making: Ethics of predictive AI in areas like finance, criminal justice, and employment, analysing fairness, transparency, and the accountability of algorithmic decisions.	5
4.	AI in Autonomous Systems: Ethical challenges in self-driving cars, drones, and autonomous robots, the trolley problem, moral decision-making in AI systems, responsibility and accountability in autonomous systems.	4
5.	Future Directions and Governance of AI: Ethical implications of emerging AI technologies, the role of global governance in AI regulation, transparency, and the need for ethical AI standards, interdisciplinary collaboration in AI ethics.	5

Text books/ Reference Books:

1. Ethics of Artificial Intelligence edited by S. Matthew Liao. Oxford University Press.
2. The Oxford Handbook of Ethics of AI edited by Frank Pasquale, Sunit Das, Markus Dirk Dubber. Oxford University Press.
3. Patrick Lin, Keith Abney, George A Bekey, " Robot Ethics: The Ethical and Social Implications of Robotics", The MIT Press- January 2014.
4. Patrick Lin, Keith Abney, George A Bekey, " Robot Ethics: The Ethical and Social Implications of Robotics", The MIT Press- January 2014.

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Course Outcomes:	
On completion of the course students will be able to	
PC-CSE 406.1	Analyze ethical issues arising from AI systems and data-driven technologies.
PC-CSE 406.2	Evaluate the societal impact of AI and emerging intelligent systems.
PC-CSE 406.3	Identify and mitigate bias, privacy, and fairness concerns in AI applications.
PC-CSE 406.4	Apply ethical reasoning and governance frameworks to responsible AI development.

Mapping of COs with POs and PSOs (Course Articulation Matrix):														
	PO1	PO2	PO3	PO4	PO5	PO6	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	-	-	1	-	-	2	3	3	2
CO2	-	3	2	1	1	3	3	2	2	2	2	3	3	2
CO3	3	-	3	3	3	2	-	1	1	1	3	3	3	2
CO4	3	3	2	3	3	-	2	3	1	2	2	3	2	3
AVG.	3.00	3.00	2.50	2.50	2.25	2.50	2.50	1.75	1.33	1.67	2.25	3.00	2.75	2.25

Course Title: Project Management and Entrepreneurship

Code: HM-CSE 401

Contacts: 3L

Practical: 3 hrs. / Week

Credit Points: 3

Course Objective:	
1.	The course aims to bridge the gap between project management principles and entrepreneurial practices, enabling students to apply project management methodologies within the dynamic and innovative context of entrepreneurship.
2.	Another key objective is to foster the development of entrepreneurial skills, such as creativity, leadership, and adaptability, and cultivate an entrepreneurial mind-set characterized by resilience, risk-taking, and opportunity recognition.
3.	The course seeks to prepare students for launching and managing start-up ventures by equipping them with the knowledge, tools, and practical experience needed to identify viable business opportunities, develop comprehensive business plans, and execute entrepreneurial projects effectively.

Pre-Requisite:	
1.	N/A

Unit	Content	Hrs.
1.	Basic Concepts of Project Management: Definition and types of project, Project life cycle, Project constraints, Organizational structures for projects, Responsibilities of project manager, Project risk analysis, Project appraisal.	8
2.	Environmental and social aspects of project: Environmental considerations in project evaluation, Primary issues and secondary issues in Feasibility study, Social cost benefit analysis, Managing Project Risks, Contingency Planning, Project Audit Process and Closure.	8

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3.	Network analysis: Network modeling of a project, Activity on Arrow (AOA), Forward and backward pass computation, Critical paths, floats and slack, Project Scheduling Techniques, PERT, CPM Models, Time-Cost Trade-off in a project, Project Monitoring Techniques, Gantt chart, Line of Balance (LoB).	12
4.	Foundation of Entrepreneurship: Entrepreneurship and Intrapreneurship (comparisons), India's Start up Revolution, Rural and Social Entrepreneurship, Key attributes of an entrepreneur, women entrepreneurship, Myths and realities of entrepreneurship, Transition from college/ regular job to the world startups.	8
5.	Project Financing for entrepreneurs: Venture Capitalist, Role of Incubators and Angel Investors, Private Equity, Crowd sourcing, Overview of debt financing, Examples of project management softwares.	6

Text books and Reference books:

1. Project Management by Prasanna and Chandra, Tata McGraw Hill.
2. Elements of Project Management by Pete Spinner, Prentice Hall, USA.
3. A course in PERT and CPM by R. C. Gupta, Dhanpat Rai Publications (P) Ltd, Delhi.
4. Project Management for Engineering, Business and Technology: Nicholas, J.M., and Steyn, H.; PHI
5. Innovation and Entrepreneurship by Drucker, P.F.; Harper and Row
6. Business, Entrepreneurship and Management: Rao, V. S. P Vikas

Course Outcome:	
On completion of the course students will be able to	
HM-CSE 401.1	Students will demonstrate the ability to integrate project management principles, methodologies, and tools with entrepreneurial practices to effectively plan, execute, and manage projects within startup ventures.
HM-CSE 402.2	Students will be able to identify and evaluate business opportunities by applying project management techniques such as feasibility analysis, market research, and risk assessment, enabling them to make informed decisions regarding new venture creation.
HM-CSE 403.3	Students will develop an entrepreneurial mindset characterized by creativity, innovation, and adaptability, as well as leadership skills necessary to drive entrepreneurial initiatives, lead project teams and navigate uncertainties inherent in startup environments.
HM-CSE 404.4	Students will acquire the knowledge and skills needed to effectively execute and manage entrepreneurial projects, including project planning, resource allocation, time management and stakeholder communication, ensuring successful project delivery within budget and schedule constraints.

Mapping of COs with POs and PSOs (Course Articulation Matrix):														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	2	1	2	1	1	2	2	3	2	2	2	3
CO2	2	3	2	2	2	2	1	1	1	2	2	3	2	2
CO3	1	2	2	1	1	2	3	3	2	2	3	2	1	3
1CO4	1	2	2	1	2	1	1	3	3	3	2	2	2	3
AVG.	1.50	2.25	2.00	1.25	1.75	1.50	1.50	2.25	2.00	2.50	2.25	2.25	1.75	2.75

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Course Title: Computer Organization & Architecture Lab

Code: PC-CSE 491

Contacts: 4P

Practical: 4 hrs. / Week

Credit Points: 2

Course Objective:	
1.	To get exposure with hardware description Language.
2.	To implement adder circuits using basic gates.
3.	To understand the converter circuits using basic gates.
4.	To understand the various circuits for ALU, data path and control units.

Pre-Requisite:	
1.	Digital Design concepts- Boolean algebra, Logic Gates, Combinational and Sequential Circuits etc.
2.	Foundation of Computer system design

Laboratory Experiments:		Hrs.
1.	Implement the logic gates (AND, OR, XOR, NOT, NAND, NOR, XNOR) in VHDL using Data Flow Architecture.	4
2.	Implement the logic gates (AND, OR, XOR, NOT, NAND, NOR, XNOR) in VHDL using Behavioural Architecture.	4
3.	Design and implement the Half Adder circuit in VHDL using Data Flow and Behavioural Architecture.	4
4.	Design and implement Full Adder circuit in VHDL using Data Flow and Behavioural Architecture.	4
5.	Design and implement the Half Subtractor & Full Subtractor circuit in VHDL using Data Flow and Behavioural Architecture.	4
6.	a. Design and implement a Decoder (2X4) b. Encoder (4X2) c. 1 bit Comparator using Data flow and Behavioural Architecture.	4
7.	Design a MUX and DeMUX in VHDL using Data Flow Architecture	4
8.	Design and implement T, D and SR Flip Flop in VHDL using Behavioural architecture.	4
9.	Design and implement a shift registers (4 bits) using Data Flow architecture.	4
10.	Design and implement up & down counters(4 bits) using Data Flow architecture	4
11.	Design and implement an ALU (8 bit) using Data Flow architecture	4
12.	Design and implement a full adder using half adder using structural architecture	4
13.	Design and implement 4 bit parity generator using XOR Gate using structural architecture.	4
14.	Design and implement 8:1 MUX using 4:1 MUX using structural architecture	4

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(Detailed instructions for Laboratory Manual to be followed for further guidance)

Text books:

1. AMIR PALNITKAR, Verilog HDL: A Guide to Digital Design and Synthesis, Prentice Hall
2. Nazeih M.Botros, HDL Programming VHDL and Verilog, Dreamtech Press

Course Outcomes:	
On completion of the course students will be able to	
PC-CSE 491.1	Remember various computer organization and architecture concepts.
PC-CSE 491.2	Apply various arithmetic operations and processor design methods.
PC-CSE 491.3	Understand the combinational & sequential circuits using basic gates.
PC-CSE 491.4	Analyze the architecture and functionality of central processing unit and memory hierarchy.

Mapping of COs with POs and PSOs (Course Articulation Matrix):														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	-	-	3	3	3	2
CO2	3	3	3	3	3	-	-	-	-	-	-	3	3	2
CO3	3	3	3	3	-	-	3	3	-	-	-	3	2	3
CO4	3	3	3	3	-	-	3	3	-	-	-	3	3	2
AVG.	3.00	3.00	3.00	3.00	3.00	-	3.00	3.00	-	-	3.00	3.00	2.75	2.25

Course Title: Object Oriented Programming Lab

Code: PC-CSE 492

Contacts: 4P

Practical: 4hrs / Week

Credit Points: 2

Course Objective:	
1.	To build software development skills using java programming for real-world applications.
2.	To understand and apply the concepts of classes, packages, interfaces inheritance.
3.	Exception handling and file processing.

Pre-Requisite:

1.	Programming Fundamentals.
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Laboratory Experiments:		Hrs.
1.	Assignments on basic programming. Decision control, Loop Control, Array.	12
2.	Assignments on class, constructor, overloading, inheritance, overriding.	12
3.	Assignments on Strings.	8
4.	Assignments on developing abstract class interfaces- multiple inheritance, extending interfaces	8
5.	Assignments on creating and accessing packages	4
6.	Assignments on multithreaded programming, Exception handling programming.	4
7.	Assignments on AWT and Event handling programming, collections.	8

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	Note: Use Java for programming	
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(Detailed instructions for Laboratory Manual to be followed for further guidance)

1. Timothy Budd, Understanding object-oriented programming with Java, 2nd ed., Pearson, 2001.
2. Herbert Schildt, The complete reference Java 2, TMH, 8th ed., 2011.
3. Beginning Programming with Java for Dummies, 5ed by Barry A. Burd.

(Detailed instructions for Laboratory Manual to be followed for further guidance)

Course Outcomes:	
On completion of the course students will be able to	
PC-CSE 492.1	Understand java programs using object oriented programming concepts.
PC-CSE 492.2	Apply the knowledge of inheritance, interface to develop Java programs.
PC-CSE 492.3	Implement and evaluate simple applications using object oriented concepts such as package, exceptions.
PC-CSE 492.4	Create GUIs and event driven programming applications for real world problems.

Mapping of COs with POs and PSOs (Course Articulation Matrix):														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	3	2	2	1	-	-	1	1	-	2	2	3	2
CO2	2	3	3	2	2	-	-	1	1	-	2	3	2	2
CO3	2	3	3	2	3	1	-	1	2	1	2	2	3	2
CO4	3	3	3	2	3	2	1	2	2	2	3	3	3	3
AVG.	2.25	3.00	2.75	2.00	2.25	1.50	1.00	1.25	1.50	1.50	2.25	2.50	2.75	2.25

Course Title: Machine Learning Lab

Code: PC-CSE 493

Contacts: 4P

Practical: 4hrs / Week

Credit Points: 2

Course Objective:	
1.	To understand the basic theory underlying machine learning.
2.	To be able to formulate machine learning problems corresponding to different applications.
3.	To understand a range of machine learning algorithms along with their strengths and weaknesses.
4.	To be able to apply machine learning algorithms to solve problems of moderate complexity.
5.	To apply the algorithms to a real-world problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models.

Pre-Requisite:	
1.	Statistics, Probability, Linear algebra, calculus.
2.	Programming language(Python).

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Laboratory Experiments:		Hrs.
1.	Study some python libraries associated with ML	4
2.	Write a program in python to implement linear regression in real life dataset	4
3.	Write a program in python to implement logistic regression in real life dataset	4
4.	Write a program in python to implement k-nearest neighbour algorithm to classify a real-life dataset.	4
5.	Write a program in python to implement Naive based algorithm in real life dataset classification.	8
6.	Write a program in python to demonstrate the working of decision-tree algorithm. Use an appropriate dataset for building the decision trees and apply this knowledge to classify a new sample.	8
5.	Write a program to demonstrate the working of SVM algorithm. Use an appropriate dataset and apply this knowledge to classify the new sample.	4
6.	Write a program to implement random-forest algorithm to classify real life dataset.	4
7.	Write a program to implement k-means algorithm to classify real life dataset.	4
8.	Write a program to implement principal component analysis (PCA) in real life dataset.	4
9.	Write a program to implement random-forest algorithm to classify real life dataset.	4
10.	Write a program to implement ANN algorithm to classify real life dataset.	4

(Detailed instructions for Laboratory Manual to be followed for further guidance)

Text books and Reference books:

1. Manaranjan Pradhan and U Dinesh Kumar, machine Learning using Python, First edition, Wiley India Pvt. Ltd, 2019.
2. Andreas C.Mueller, Sarah Guido, Introduction to Machine Learning with Python guide for data scientists, O'REILLY Media, 2016.
3. Abhishek Vijayvargia, Machine Learning with Python, BPB Publications, 2018
4. Practical handbook of ML by S. Bhattacharya & S. Bhattacharya – G. K. Publication

Course Outcomes:	
On completion of the course students will be able to	
PC-CSE 493.1	Understand different machine learning techniques.
PC-CSE 493.2	Apply the knowledge of machine learning in various practical fields.
PC-CSE 493.3	Analyse the performances of different machine learning algorithms.
PC-CSE 493.4	Develop machine learning models to solve real life problems.

Mapping of COs with POs and PSOs (Course Articulation Matrix):														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	1	-	1	3	3	3
CO2	3	3	3	3	-	-	-	1	-	-	2	3	3	3
CO3	3	3	3	3	2	-	-	1	-	-	2	3	3	3
CO4	3	3	3	3	3	-	-	1	1	-	2	3	3	3
AVG.	3.00	3.00	3.00	3.00	2.50	-	-	1.00	1.00	-	1.75	3.00	3.00	3.00

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Course Title: Soft Skills for Professional Development – II

Code: VSEC-481

Contacts: 2

Practical: 2 hrs / Week

Credit Points: 1

Course Objective:	
1.	Strengthen presentation, interview, and group discussion skill.
2.	Prepare students for career advancement through personality development and professional networking skills.
3.	Encourage lifelong learning and continuous self-improvement for professional growth.

Pre-Requisite:	
1.	Basic English knowledge, computer skills, confidence, and readiness for group participation.

Unit	Content	Hrs.
1.	Advanced English Communication & Aptitude Skills: Vocabulary enhancement; Pronunciation and fluency practice; Listening skills; Paragraph writing; Verbal aptitude basics; Reading comprehension; Current affairs and general awareness.	6
2.	Design Thinking, Group Discussion & Team Communication : Design Thinking: Empathy mapping, Problem identification, Brainstorming; Team-building activities; Managing team roles and responsibilities; Conflict resolution; Negotiation skills; Situational GDs; Leading difficult group discussions; Reaching agreement in teams; Giving constructive feedback; Reviewing team performance.	8
3.	Debate, Public Speaking & Presentation Techniques: Public speaking basics; Debate formats; Argument building; Impromptu speaking; Persuasive speaking; PowerPoint slide design; Presentation delivery; Audience interaction.	6
4.	Professional Development & Interview Readiness: Professional email writing; Resume preparation; Personal branding; Interview etiquette; HR question practice; Verbal Communication Assessment; Mock interviews; Workplace ethics; Stress management.	8

Assessment Scheme: English Language Proficiency: 20 | Design Thinking: 20 | GD: 20 | Debate/PowerPoint Presentation: 20 | Interview: 20| Total: 100

Text books and Reference books:

1. Debashis Bandyopadhyay and Malathy Krishnan, Connect: A Course in

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Communicative English, Cambridge University Press, 2018.

2. Sanjay Kumar and Pushp Lata, Communication Skills, Oxford University Press, 2015.
3. Nira Konar, Communication Skills for Professionals, Prentice Hall of India, 2nd edition, 2011.
4. Wren and Martin, Modern English Grammar & Composition, S Chand Publishing, 2025.
5. S. Prasad & K.P.Thakur, Common Errors in English, Bharati Bhawan Publishers, 2021.
6. Susmit Maity & Arpita Mazumdar, Crack Campus Placements, SelfyPage Developers Pvt. Ltd., 2024.

Course Outcomes:	
On completion of the course students will be able to	
VSEC 481.1	Apply effective English communication and aptitude skills in academic and professional contexts.
VSEC 481.2	Analyze problems and demonstrate teamwork using design thinking and group discussion techniques..
VSEC 481.3	Demonstrate persuasive speaking, debate, and presentation skills for effective communication.
VSEC 481.4	Develop professional readiness through resume writing, interview performance, and workplace communication skills.

Mapping of COs with POs and PSOs (Course Articulation Matrix):														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	1	-	-	-	-	-	-	3	-	2	3	3	-
CO2	1	2	2	1	-	1	1	3	3	1	2	3	3	-
CO3	1	3	1	1	1	1	1	2	3	-	2	-	2	3
CO4	1	1	-	-	-	1	2	2	3	2	3	-	3	3
AVG.	1.00	1.75	1.50	1.00	1.00	1.00	1.33	2.33	3.00	1.50	2.25	3.00	2.75	3.00

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Third Year - Fifth Semester

Course Title: Compiler Design

Code: ES-CSE 501

Contact: 3L

Theory: 3 hrs. / Week

Credit Points: 3

Course Objective:	
1.	To understand and list the different stages in the process of compilation.
2.	Identify different methods of lexical analysis.
3.	Design top-down and bottom-up parsers.
4.	Identify synthesized and inherited attributes.
5.	Develop syntax directed translation schemes.
6.	Develop algorithms to generate code for a target machine.

Pre-Requisite:	
1.	Knowledge of automata theory, context free Languages.
2.	Computer organization.
3.	Data structures and simple graph algorithms, logic or algebra.

Unit	Content	Hrs.
1.	Introduction to Compiling: Compilers, Analysis of the source program, The phases of the compiler, Cousins of the compiler. The role of the lexical analyser, Tokens, Patterns, 6 Lexemes, Input buffering, Specifications of a token, Recognition of a tokens, Finite automata, From a regular expression to an NFA, From a regular expression to NFA, From a regular expression to DFA, Design of a lexical analyser generator (Lex).	8
2.	Syntax Analysis: The role of a parser, Context free grammars, Writing a grammar, Top down Parsing, Non recursive Predictive parsing (LL), Bottom up parsing, Handles, Viable prefixes, Operator precedence parsing, LR parsers (SLR, LALR), Parser generators (YACC). Error Recovery strategies for different parsing techniques.	12
3.	Syntax directed translation and Type checking: Syntax director definitions, Construction of syntax trees, Bottom-up evaluation of S attributed definitions, L attributed definitions, Bottom-up evaluation of inherited attributes. Type systems, Specification of a simple type checker, Equivalence of type expressions, Type conversions.	7
4	Run time environments: Source language issues (Activation trees, Control stack, scope of declaration, Binding of names), Storage organization (Subdivision of run-time memory, Activation records), Storage allocation strategies, Parameter passing (call by value, call by reference, copy restore, call by name), Symbol tables, dynamic storage allocation techniques.	7
5	Intermediate code generation, code optimization and code generation: Intermediate languages, Graphical representation, Three-address code. Implementation of three address statements (Quadruples, Triples,	8

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	Indirect triples): Introduction, Basic blocks & flowgraphs, Transformation of basic blocks, DAG representation of basic blocks, The principle sources of optimization, Loops in flow graph, Peephole optimization, Issues in the design of code generator, Register allocation & assignment.	
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Text books and Reference Books:

1. Alfred V. Aho, Jeffrey D Ullman, "Compilers: Principles, Techniques and Tools", Pearson Education Asia, 2012.
2. Allen I. Holub, "Compiler Design in C", Prentice Hall of India, 2003.
3. C. N. Fischer, R. J. LeBlanc, "Crafting a compiler with C", Benjamin Cummings, 2003.
4. Henk Alblas, Albert Nymeyer, "Practice and Principles of Compiler Building with C", PHI, 2001.
5. Kenneth C. Loudon, "Compiler Construction: Principles and Practice", Thompson Learning, 2003.
6. Jean Paul Tremblay, Paul G Serenson, "The Theory and Practice of Compiler Writing", BS Publications, 2005.
7. Dhamdhare, D. M., "Compiler Construction Principles and Practice", Second Edition, Macmillan India Ltd., New Delhi, 2008.
8. V. Raghavan, Principles of Compiler Design, Tata McGraw Hill Education Publishers, 2010.

Course Outcomes:	
On completion of the course students will be able to	
ES-CSE 501.1	Remember the fundamentals of Automata Theory and explain various phases of a compiler.
ES-CSE 501.2	Analyse the different parsing techniques.
ES-CSE 501.3	Learn to create intermediate code generation and understand run time environment.
ES-CSE 501.4	Learn the use of applying code optimization and code generation.

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	-	-	-	-	-	-	-	-	-	2	2	-	-
CO2	2	3		2	2	-	-	-	-	-	-	2	2	-
CO3	2	-	2	-	2	-	-	-	-	-	-	1	2	-
CO4	2	2	2	-	-	-	-	-	-	-	-	1	2	-
AVG.	2.00	2.50	2.00	2.00	2.00	-	-	-	-	-	2.00	1.50	2.00	-

Course Title: Operating Systems

Code: PC-CSE 501

Contacts: 3L

Theory: 3 hrs. / Week

Credit Points: 3

Course Objective:

- | | |
|----|--|
| 1. | To learn the mechanisms of OS to handle processes and threads and their communication. |
|----|--|

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2.	To learn the mechanisms involved in memory management in contemporary OS.
3.	To gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols.
4.	To know the components and management aspects of concurrency management.

Pre-Requisite:

1.	Computer Organization & Architecture
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Unit	Content	Hrs.
1.	Introduction: Generations Concept of Operating systems, Systems, Types of 3 Operating Systems, OS Services, System Calls, Structure of an OS, Concept of Virtual Machine. Computer system structures.	5
2.	Processes: Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching. Thread: Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads. Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and Non pre-emptive, FCFS, SJF, RR; Multiprocessor scheduling: Real Time scheduling: RM and EDF.	12
3.	Inter-process Communication: Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution, The Producer Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dining Philosopher Problematic.	6
4.	Deadlocks: Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.	5
5.	Memory Management: Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation– Fixed and variable partition– Internal and External fragmentation and Compaction; Paging: Principle of operation –Page allocation Hardware support for paging, Protection and sharing, Disadvantages of paging. Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault , Working Set , Dirty page/Dirty bit – Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used(LRU).	8
6.	File Management: Concept of File, Access methods, Allocation methods (contiguous, linked and indexed), Free-space management (bit vector, linked list, grouping). Disk Management: Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks.	6

Text books and Reference books:

1. Operating System Concepts Essentials, 9th Edition by AviSilberschatz, Peter Galvin, Greg Gagne, Wiley Asia Student Edition.

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2. Operating Systems: Internals and Design Principles, 5th Edition, William Stallings, Prentice Hall of India.
3. Operating System Concepts, Ekta Walia, Khanna Publishing House (AICTE Recommended Textbook – 2018).
4. Operating System: A Design-oriented Approach, 1st Edition by Charles Crowley, Irwin Publishing.
5. Operating Systems: A Modern Perspective, 2nd Edition by Gary J. Nutt, Addison Wesley.
6. Design of the Unix Operating Systems, 8th Edition by Maurice Bach, Prentice-Hall of India.
7. Understanding the Linux Kernel, 3rd Edition, Daniel P. Bovet, Marco Cesati, O'Reilly and Associates.

Course Outcomes:	
On completion of the course students will be able to	
PC-CSE 501.1	Understand basic concepts of operating system and process management.
PC-CSE 501.2	Analyse various scheduling algorithms and process synchronization.
PC-CSE 501.3	Evaluate various deadlock prevention and avoidance algorithms.
PC-CSE 501.4	Design various memory, file and disk management schemes.

Mapping of COs with POs and PSOs (Course Articulation Matrix):														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	1	2	1	1	1	1	1	-	2	2	1	2
CO2	3	3	3	3	2	-	-	2	2	2	2	3	3	3
CO3	2	2	2	3	2	-	-	2	2	1	2	2	2	3
CO4	2	3	2	3	2	-	1	3	2	2	3	2	3	3
AVG.	2.25	2.25	2.00	2.75	1.75	1.00	1.00	2.00	1.75	1.67	2.25	2.25	2.25	2.75

Course Title: Design and Analysis of Algorithms

Code: PC-CSE 502

Contacts: 3L

Theory: 3 hrs. / Week

Credit Points: 3

Course Objective:	
1.	The aim of this module is to learn how to develop efficient algorithms for simple computational tasks and reasoning about the correctness of them.
2.	Through the complexity measures, different range of behaviours of algorithms and the notion of tractable and intractable problems will be understood.
Pre-Requisite:	
1.	To know data-structure and basic programming ability.

Unit	Content	Hrs.
1.	Introduction: Characteristics of algorithm. Analysis of algorithm: Asymptotic analysis of complexity bounds – best, average and worst-case behaviour; Performance measurements of Algorithm, Time and space trade-offs, Analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method and Masters' theorem.	8

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2.	Divide and Conquer and Greedy Approach: Basic method, use, Examples – Binary Search, Merge Sort, Quick Sort and their complexity, Strassen's matrix manipulation algorithm, Basic method, use, Examples – Knapsack problem, Job sequencing with deadlines, Minimum cost spanning tree by Prim's and Kruskal's algorithm.	8
3	Dynamic Programming and Backtracking Basic method, use, Examples – Matrix Chain Manipulation, All pair shortest paths, single source shortest path. Basic method, use, Examples – 8 queen's problem, Graph coloring problem.	8
4.	Graph traversal algorithm: Breadth First Search (BFS) and Depth First Search (DFS): Classification of edges - tree, forward, back and cross edges – complexity and comparison, topological sorting. Network Flow: Ford Fulkerson algorithm, Max-Flow Min-Cut theorem (Statement and Illustration).	10
5.	Notion of NP-completeness: P class, NP class, NP hard class, NP complete class – their interrelationship, Satisfiability problem, Cook's theorem (Statement only), vertex cover problem and independent set problem. Approximation Algorithms: approximation scheme, polynomial time approximation schemes, vertex cover problem, travelling salesman problem.	8

Text books and Reference books:

1. Introduction to Algorithms, 4TH Edition, Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, MIT Press/McGraw-Hill.
2. Fundamentals of Algorithms – E. Horowitz et al.
3. Algorithm Design, 1ST Edition, Jon Kleinberg and ÉvaTardos, Pearson.
4. Algorithm Design: Foundations, Analysis, and Internet Examples, Second Edition, Michael T Goodrich and Roberto Tamassia, Wiley.
5. Algorithms -- A Creative Approach, 3RD Edition, UdiManber, Addison-Wesley, Reading, MA

Course Outcomes:	
On completion of the course students will be able to	
PC-CSE 502.1	Analyzing the basic relation and the performance of an algorithm in terms of time complexity.
PC-CSE 502.2	Apply the algorithmic design paradigm (Divide and Conquer, Greedy method, dynamic programming and back tracking).
PC-CSE 502.3	Design algorithm for Graph and Network Flow.
PC-CSE 502.4	Understand NP class of Problem and propose Approximation Algorithm for the same.

Mapping of COs with POs and PSOs (Course Articulation Matrix):														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	3	3	-	-	-	-	2	-	2	2	3	3
CO2	3	2	2	3	2	-	-	-	2	-	2	2	3	3
CO3	3	3	3	3	2	-	-	-	2	-	2	3	3	3

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CO4	3	2	3	2	2	-	-	1	2	-	2	3	3	3
AVG.	3.00	2.25	2.75	2.75	2.00	-	-	1.00	2.00	-	2.00	2.50	3.00	3.00

Course Title: Data Mining

Code: PE-CSE 501A

Contacts: 3L

Theory: 3 hrs. / Week

Credit Points: 3

Course Objective:

1.	To introduce students to the field of data mining (also known as knowledge discovery from data, or KDD for short).
2.	To study fundamental data mining concepts and techniques for discovering interesting patterns from data in various applications.
3.	To study techniques for developing effective, efficient, and scalable data mining tools.

Pre-Requisite:

1.	Basic database concepts such as schema, ER model, Structured Query language
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Unit	Content	Hrs.
1.	Introduction to Data Mining: Related technologies - Machine Learning, DBMS, OLAP, Statistics, Data Mining Goals, Stages of the Data Mining Process, Data Mining Techniques, Knowledge Representation Methods, Applications.	6
2.	Data Warehouse and OLAP: Data Warehouse and DBMS, Multidimensional data model, OLAP operations Example: loan data set.	6
3.	Data pre-processing: Data cleaning, Data transformation, Data reduction, Discretization and generating concept hierarchies.	6
4.	Data mining knowledge representation: Task relevant data, Background knowledge, Interestingness measures, Representing input data and output knowledge, Visualization techniques.	5
5.	Data Mining Algorithms: Association rules : Basic idea: item sets , Generating item sets and rules efficiently, Correlation analysis, Example: mining weather data	9
6.	Data mining algorithms: Classification : Basic learning/mining tasks, Decision trees, Statistical (Bayesian) classification, Bayesian networks, Instance-based methods (nearest neighbor), Data mining algorithms Clustering: Basic issues in clustering, First conceptual clustering system: Cluster/2, Partitioning methods: k-means, expectation maximization (EM), hierarchical methods: distance-based agglomerative and divisible clustering.	10

Text books and Reference books:

1. Data Warehousing Fundamentals for IT Professionals, Second Edition by PaulrajPonniah, Wiley India.
2. Data Warehousing, Data Mining, & OLAP – Second Edition by Alex Berson and Stephen J. Smith, Tata McGraw Hill Education.
3. Data warehouse Toolkit by Ralph Kimball, Wiley India.

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4. Data Mining & Warehousing by Ikvinderpal Singh, Khanna Publishing House.
5. Jiawei Han and M Kamber, Data Mining Concepts and Techniques, Second Edition, Elsevier Publication, 2011.
6. Vipin Kumar, Introduction to Data Mining - Pang-Ning Tan, Michael Steinbach, Addison Wesley, 2006.

.Course Outcomes:	
After completion of course, students would be:	
PE-CSE 501A.1	Understand the types of the data to be mined and present a general classification of tasks and primitives to integrate a data mining system
PE-CSE 501A.2	Apply preprocessing methods for any given raw data.
PE-CSE 501A.3	Analyse interesting patterns from large amounts of data
PE-CSE 501A.4	Evaluate the accuracy of supervised and unsupervised models and algorithms.

Mapping of COs with POs and PSOs (Course Articulation Matrix):														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	2	-	-	-	-	-	-	2	3	3	2
CO2	3	2	2	2	-	-	2	-	-	-	-	2	2	-
CO3	3	2	2	-	2	-	1	1	-	-	-	1	1	-
CO4	-	-	2	2	-	-	-	1	-	-	-	-	1	-
AVG.	3.00	2.33	2.00	2.00	2.00	-	1.50	1.00	-	-	2.00	2.00	1.75	2.00

Course Title: Human Computer Interaction

Code: PE-CSE 501B

Contact: 3L

Theory: 3 hrs. / Week

Credit Points: 3

Course Objective:	
1.	Learn the foundations of Human Computer Interaction.
2.	Be familiar with the design technologies for individuals and persons with disabilities.
3.	Be aware of mobile Human Computer interaction.
4.	Learn the guidelines for user interface.
Pre-Requisite:	
1.	The course catalog lists "knowledge of C programming language/UNIX." In reality, the prerequisite is programming skill in some practical programming language such as Java, C#, HTML, or Processing.
2.	The course focuses on human-computer interaction and interface design and assumes that students will have the skills required to program prototypes of computer interfaces.
3.	Students without programming experience who wish to take this course should speak with the instructor before the second class.

Unit	Content	Hrs.
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1.	Human: I/O channels – Memory – Reasoning and problem solving; The computer: Devices – Memory – processing and networks; Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity-Paradigms.	8
2.	Interactive Design basics – process – scenarios – navigation – screen design – Iteration and prototyping. HCI in software process – software life cycle – usability engineering – Prototyping in practice – design rationale. Design rules – principles, standards, guidelines, rules. Evaluation Techniques – Universal Design.	8
3.	Cognitive models –Socio-Organizational issues and stake holder requirements –Communication and collaboration models-Hypertext, Multimedia and WWW.	8
4.	Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools.	8
5.	Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow. Case Studies.	7
6.	Recent Trends: Speech Recognition and Translation, Multimodal System.	3

Text books:

1. Theodor Richardson, Charles N Thies, Secure Software Design, Jones & Bartlett
2. Kenneth R. van Wyk, Mark G. Graff, Dan S. Peters, Diana L. Burley, Enterprise Software Security, Addison Wesley.
3. A Dix, Janet Finlay, G D Abowd, R Beale, Human-Computer Interaction, 3rd Edition, Pearson Publishers, 2008.
4. Shneiderman, Plaisant, Cohen and Jacobs, Designing the User Interface: Strategies for Effective Human Computer Interaction, 5th Edition, Pearson Publishers, 2010.

Reference books:

1. Brian Fling, —Mobile Design and Development, First Edition, O'Reilly Media Inc., 2009 (UNIT – IV)
2. Bill Scott and Theresa Neil, —Designing Web Interfaces, First Edition, O'Reilly, 2009. (UNIT-V).

Course Outcomes:	
On completion of the course students will be able to	
PE-CSE 501B.1	Understand the design and development processes and life cycle of Human Computer Interaction.
PE-CSE 501B.2	Apply the interface design standards/guidelines for cross cultural and disabled users.
PE-CSE 501B.3	Analyze the interface design standards/guidelines for cross cultural and disabled users.
PE-CSE 501B.4	Design and Develop Human Computer Interaction in proper architectural structures.

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Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	2	1	1	3	2	3	2	2	2	3	2	3
CO2	3	2	1	3	2	2	3	3	3	3	3	3	1	-
CO3	2	2	3	2	2	1	1	3	3	3	1	2	-	1
CO4	3	2	2	2	-	2	1	3	2	3	2	-	3	1
AVG.	2.50	1.75	2.00	2.00	1.67	2.00	1.75	3.00	2.50	2.75	2.00	2.67	2.00	1.67

Course Title: Computer Graphics

Code: PE-CSE 501C

Contacts: 3L

Theory: 3 hrs. / Week

Credit Points: 3

Objective:

1.	The main objective of the course is to introduce students with fundamental concepts and theory of computer graphics.
2.	It presents the important drawing algorithm, polygon fitting, clipping and 2D transformation curves and an introduction to 3D transformation.
3.	To make the students know about various curve and surface representation methods
4.	To make the students understand about various hidden surface removal algorithms, and lighting and shading models.

Pre-Requisite:

1.	Knowledge of data structures and algorithm is preferable.
2.	Knowledge of Linear Algebra.

Unit	Content	Hrs.
1.	Introduction to computer graphics & graphics systems: Overview of computer graphics, representing pictures, preparing, presenting & interacting with pictures for presentations; Visualization & image processing; RGB colour model, direct coding, lookup table; storage tube graphics display, Raster scan display, 3D viewing devices, Plotters, printers, digitizers, Light pens etc.; Active & Passive graphics devices; Computer graphics software.	8
2.	Scan conversion: Points & lines, Line drawing algorithms; DDA algorithm, Bresenham's line algorithm, Circle generation algorithm; Ellipse generating algorithm; scan line polygon, fill algorithm, boundary fill algorithm, flood fill algorithm.	10
3.	2D transformation & viewing: Basic transformations: translation, rotation, scaling; Matrix representations & homogeneous coordinates, transformations between coordinate systems; reflection shear; Transformation of points, lines, parallel lines, intersecting lines. Viewing pipeline, Window to view port co-ordinate transformation, clipping	10

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	operations, point clipping, line clipping, clipping circles, polygons & ellipse.	
4.	Cohen and Sutherland line clipping, Sutherland-Hodgeman Polygon clipping, Cyrus-beck clipping method 3D transformation & viewing: 3D transformations: translation, rotation, scaling & other transformations. Rotation about an arbitrary axis in space, reflection through an arbitrary plane; general parallel projection transformation; clipping, view port clipping, 3D viewing.	8

5.	Curves: Curve representation, surfaces, designs, Bezier curves, B-spline curves, end conditions for periodic B-spline curves, rational B-spline curves. Hidden surfaces: Depth comparison, Z-buffer algorithm, Back face detection, BSP tree method, the Painter's algorithm, scan-line algorithm; Hidden line elimination, wire frame methods, fractal - geometry. Colour & shading models: Light & colour model; interpolative shading model; Texture. Introduction to Ray-tracing: Human vision and colour, Lighting, Reflection and transmission models.	6
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Text book and Reference books:

1. Hearn, Baker – “Computer Graphics (C version 2nd Ed.)” – Pearson education.
2. Z. Xiang, R. Plastock – “Schaum's outlines Computer Graphics (2nd Ed.)” – TMH.
3. D. F. Rogers, J. A. Adams – “Mathematical Elements for Computer Graphics (2nd Ed.)” – TMH.
4. Foley, J. D., Dam, A.V, Feiner, S. K., & Hughes, J. F. (1995). Computer Graphics: Principles and Practice in C. 2nd edition. Addison-Wesley Professional.
5. Bhattacharya, S. (2018). Computer Graphics. Oxford University Press.
6. Marschner, S., & Shirley, P. (2017) Fundamentals of Computer Graphics. 4th Edition. CRC Press.

Course Outcomes:	
On completion of the course students will be able to	
PE-CSE 501C.1	Understanding computer graphics system, display devices and various application areas of graphics.
PE-CSE 501C.2	Applying scan conversion algorithms for line, circle and ellipse with examples.
PE-CSE 501C.3	Analyzing and illustrating 2D and 3D transformation operations such as translation, rotation, scaling, etc.
PE-CSE 501C.4	Evaluating any kind of 3D objects using viewing, clipping and projection techniques.

Mapping of COs with POs and PSOs (Course Articulation Matrix):														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	-	-	-	-	-	-	1	-	2	-	1	-
CO2	3	2	2	3	1	-	1	2	-	1	2	1	2	-

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CO3	3	3	3	2	2	2	-	2	-	-	3	2	1	2
CO4	3	3	3	3	2	-	2	3	-	1	2	2	2	-
AVG.	3.00	2.25	2.67	2.67	1.67	2.00	1.50	2.33	1.00	1.00	2.25	1.67	1.50	2.00

Course Title: Image Processing

Code: PE-CSE 501D

Contact: 3L

Theory: 3 hrs. / Week

Credit Points: 3

Course Objective:

1.	To introduce the concepts of image processing and basic analytical methods to be used in image processing.
2.	To familiarize students with image enhancement techniques.
3.	To understand image restoration techniques.
4.	To introduce segmentation and morphological processing techniques.

Pre-Requisite:

1.	Concepts of Digital Signal Processing
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Unit	Content	Hrs.
1.	Introduction: Background, Digital Image Representation, Fundamental steps in Image Processing, Elements of Digital Image Processing - Image Acquisition, Storage, Processing, Communication, Display. A Simple Image Model, Geometric Model- Basic Transformation (Translation, Scaling, Rotation), Sampling & Quantization - Uniform & Non uniform.	6
2.	Mathematical Preliminaries: Neighbour of pixels, Connectivity, Relations, Equivalence & Transitive Closure; Distance Measures, Arithmetic/Logic Operations, Fourier Transformation, Properties of The Two-Dimensional Fourier Transform, Discrete Fourier Transform, Discrete Cosine & Sine Transform.	10
3.	Image Enhancement: Spatial Domain Method, Frequency Domain Method, Contrast Enhancement -Linear & Nonlinear Stretching, Histogram Processing; Smoothing - Image Averaging, Mean Filter, Low-pass Filtering; Image Sharpening. High pass Filtering, High- boost Filtering, Derivative Filtering, Homomorphic Filtering; Enhancement in the frequency domain - Low pass filtering, High pass filtering.	10
4.	Image Restoration: Degradation Model, Discrete Formulation, Algebraic Approach to Restoration - Unconstrained & Constrained; Constrained Least Square Restoration, Restoration by Homomorphic Filtering, Geometric Transformation - Spatial Transformation, Gray Level Interpolation.	6

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5.	Morphological image processing and Image Segmentation: Basics, Erosion, Dilation, Opening, Closing, Hit-or-Miss Transform, Basic Morphological Algorithms – Boundary extraction and Region Filling. Point Detection, Line Detection, Edge detection, Combined detection, Edge Linking & Boundary Detection - Local Processing, Global Processing; Thresholding - Foundation, Simple Global Thresholding, Optimal Thresholding; Region Oriented Segmentation - Basic Formulation, Region Growing by Pixel Aggregation, Region Splitting & Merging.	10
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Text book and Reference books:

1. Rafael C. Gonzalez, Richard E. Woods – “Digital Image Processing (3rd Ed. 2007)” – Pearson.
2. S Jayaraman, S Esakkirajan, T Veerakumar – “Digital Image Processing (2nd Ed.)” – TMH.
3. S. Sridhar – “Digital Image Processing (2nd Ed.)” – TMH.
4. B. Chanda, D. Dutta Majumder – “Digital Image Processing and Analysis (2nd Ed.)” – PHI.
5. Anil K. Jain – “Fundamentals of Digital Image Processing” - PHI.
6. S. Annadurai, R. Shanmugalakshmi – “Fundamentals of Digital Image Processing, 2016” - Pearson.

Course Outcomes:	
On completion of the course students will be able to	
PE-CSE 501D.1	Understand the fundamental concepts of image processing.
PE-CSE 501D.2	Analyze the images in the spatial and frequency domain.
PE-CSE 501D.3	Evaluate the techniques for image enhancement and image restoration.
PE-CSE 501D.4	Understand the image morphological processing and segmentation techniques.

Mapping of COs with POs and PSOs (Course Articulation Matrix):														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	-	-	-	1	-	1	-	-	-	1	1	-	-
CO2	3	2	2	2	3	-	-	1	3	2	3	3	2	3
CO3	2	3	2	2	3	-	1	1	-	-	2	2	2	2
CO4	1	2	3	-	1	-	-	-	-	-	2	2	2	2
AVG.	2.00	2.33	2.33	2.00	2.00	-	1.00	1.00	3.00	2.00	2.00	2.00	2.00	2.33

Course Title: Operations Research

Code: OE-CSE 501A

Contact: 3L

Theory: 3 hrs. / Week

Credit Points: 3

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Course Objective:	
1.	To comprehend and use operations research methods to analyse and solve your operational challenges in real life.
2.	To formulate and apply the techniques of Linear Programming and the extended topics to solve certain optimization problems

Pre-Requisite:	
1.	Engineering Mathematics, System of linear Equations, Probability, Fundamental Calculus.

Unit	Content	Hrs.
1.	Linear Programming Problem: Formulation of Linear Programming Problems, Definitions: Feasible Solution, Basic and non-basic Variables, Basic Feasible Solution, Degenerate and Non-degenerate Solution, Convex set and explanation with examples. Solution of LPP by Graphical Method; Simplex Method; Charnes' Big-M Method; Duality Theory.	12
2.	Transportation and Assignment Problem: Basic concept of Transportation problem, Different solution methods, Optimality test. Problem formulation of Assignment problem, Solution methods, Travelling Salesman Problem.	10
3.	Game Theory and Network Analysis: Introduction of Game theory; 2-Person Zero-sum Game; Saddle Point; Mini-Max and Maxi-Min Theorems (statement only) and problems; Games without Saddle Point; Graphical Method; Principle of Dominance. Maximal Flow Problem: Ford-Fulkerson; PERT & CPM.	10
4.	Inventory Control and Queuing Theory: Introduction to EOQ Models of Deterministic and Probabilistic; Safety Stock; Buffer Stock. Introduction of Queuing theory; Basic Definitions and Notations; Axiomatic Derivation of the Arrival & Departure (Poisson Queue). Poisson Queue Models: (M/M/1): (∞ / FIFO) and (M/M/1: N / FIFO) and problems.	10

Text book and Reference books:

1. H. A. Taha, "Operations Research", Pearson.
2. P. M. Karak – "Linear Programming and Theory of Games", ABS Publishing House.
3. Ghosh and Chakraborty, "Linear Programming and Theory of Games", Central Book Agency,
4. Ravindran, Philips and Solberg - "Operations Research", WILEY INDIA.

Course Outcome:	
On completion of the course students will be able to	
OE-CSE 501A.1	Apply graphical, simplex, Big-M, and duality methods to formulate and solve Linear Programming Problems and analyze feasible and optimal solutions.
OE-CSE	Formulate and solve Transportation and Assignment Problems using

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501A.2	appropriate optimization techniques and evaluate optimality conditions.
OE-CSE 501A.3	Analyze decision-making and network optimization problems using concepts of Game Theory, Maximal Flow, PERT, and CPM techniques.
OE-CSE 501A.4	Apply inventory control models and queuing theory concepts to solve deterministic, probabilistic, and Poisson queue-based operational problems.

Mapping of COs with POs and PSOs (Course Articulation Matrix):														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	2	1	-	-	-	-	2	1	3	2	1
CO2	3	3	3	2	1	-	-	1	-	2	1	3	2	2
CO3	3	3	2	2	1	-	-	2	-	2	2	2	3	2
CO4	3	3	2	3	1	-	-	-	-	3	2	2	2	3
AVG.	3.00	3.00	2.25	2.25	1.00	-	-	1.50		2.25	1.50	2.50	2.25	2.00

Course Title: Multimedia Systems

Code: OE-CSE 501B

Contacts: 3L

Theory: 3 hrs. / Week

Course Objective:	
1.	To understand various components of the multimedia systems.
2.	To introduce how multimedia can be used in various application areas.
3.	To provide a solid foundation to the students so that they can identify the proper applications of multimedia, evaluate the appropriate multimedia systems and develop effective multimedia applications.

Pre-Requisite:	
1.	Knowledge in Data Structure, Computer Network and Operating System.

Unit	Content	Hrs.
1.	Introduction: Multimedia today, Impact of Multimedia, Multimedia Systems, Components and Its Applications.	4
2.	Text and Audio, Image and Video: Text: Types of Text, Ways to Present Text, Aspects of Text Design, Character, Character Set, Codes, Unicode, Encryption; Audio: Basic Sound Concepts, Types of Sound, Digitizing Sound, Computer Representation of Sound (Sampling Rate, Sampling Size, Quantization), Audio Formats, Audio tools, MIDI Image: Formats, Image Color Scheme, Image Enhancement; Video: Analogue and Digital Video, Recording Formats and Standards (JPEG, MPEG, H.261) Transmission of Video Signals, Video Capture, and Computer based Animation.	10
3.	Synchronization, Storage models and Access Techniques: Temporal relationships, synchronization accuracy specification factors, quality of service, Magnetic media, optical media, file systems (traditional, multimedia) Multimedia devices – Output devices, CD-ROM, DVD, Scanner, and CCD.	10

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4.	Image and Video Database, Document Architecture and Content Management: Image representation, segmentation, similarity based retrieval, image retrieval by color, shape and texture; indexing- kd trees, R-trees, quad trees; Case studies- QBIC, Virage. Video Content, querying, video segmentation, indexing, Content Design and Development, General Design Principles Hypertext: Concept, Open Document Architecture (ODA), Multimedia and Hypermedia Coding Expert Group (MHEG), Standard Generalized Markup Language (SGML), Document Type Definition (DTD), Hypertext Markup Language (HTML) in Web Publishing. Case study of Applications.	12
5.	Multimedia Applications: Interactive television, Video-on-demand, Video Conferencing, Educational Applications, Industrial Applications, Multimedia archives and digital libraries, media editors.	6

Text books and Reference books:

1. Ralf Steinmetz and Klara Nahrstedt, Multimedia: Computing, Communications & Applications, Pearson Ed.
2. Nalin K. Sharda, Multimedia Information System, PHI.
3. Fred Halsall, Multimedia Communications, Pearson Ed.
4. Koegel Buford, Multimedia Systems, Pearson Ed.
5. Fred Hoffstetter, Multimedia Literacy, McGraw Hill.
6. Ralf Steinmetz and Klara Nahrstedt, Multimedia Fundamentals: Vol. 1- Media Coding and Content Processing, PHI.
7. J. Jeffcoate, Multimedia in Practice: Technology and Application, PHI.
8. V.K. Jain, Multimedia and Animation, Khanna Publishing House, New Delhi (AICTE Recommended Textbook – 2018)

Course Outcome:	
On completion of the course students will be able to	
OE-CSE 501B.1	Analysing the range of concepts, techniques and tools for creating and editing the interactive multimedia applications
OE-CSE 501B.2	To understand the hardware and software needed to create projects using creativity and organization to create them.
OE-CSE 501B.3	To apply the concepts of Synchronization, Storage models and Access Techniques.
OE-CSE 501B.4	To evaluate the approaches for Image and Video Database, Document Architecture, Content Management to develop a complete project.

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	3	3	1	1	1	1	1	2	2	1	2
CO2	2	2	3	2	2	2	-	2	1	2	3	-	2	1
CO3	2	1	3	3	2	2	-	2	-	2	3	2	3	2

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CO4	3	2	2	3	2	-	2	1	2	3	2	3	1	2
AVG.	2.50	1.75	2.50	2.75	2.25	1.67	1.50	1.50	1.33	2.00	2.50	2.33	1.75	1.75

Course Title: Introduction to Philosophical Thoughts

Code: OE-CSE 501C

Contact: 3L

Theory: 3 hrs. / Week

Credit Points: 3

Course Objective:

1.	To inspire the student to confront the philosophical problems implicit in the experience of self, others and the universe, together with the question of their relations to ultimate transcendence (God and immortality).
2.	To develop in the student habits of clear, critical thinking within the framework of both an adequate philosophical methodology and accepted norms of scholarship.
3.	To introduce the student to reading critically the great philosophers, past and present
4.	Finally, to help the student to formulate for himself or herself a philosophy of life or world-view consistent with the objectives of liberal education at a Catholic university.

Pre-Requisite:

1.	Multiple Measures Placement in GE-level writing, completion of 113A or 114A, or completion of the lower division writing requirement.
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Unit	Content	Hrs.
1.	Nature of Indian Philosophy: Plurality as well as common concerns. 2. Basic concepts of the Vedic and Upanisadic views: Atman, Jagrata, Svapna, Susupti, Turiya, Brahman, Karma, Rta, Rna.	10
2.	Carvaka school: its epistemology, metaphysics and ethics. Mukti.	10
3.	Jainism: Concepts of sat, dravya, guna, paryaya, jiva, ajiva, anekantavada, syadvada, and nayavada; pramanas, ahimsa, bondage and liberation.	10
4.	Buddhism: theory of pramanas, theory of dependent origination, the four noble truths; doctrine of momentariness; theory of no soul. The interpretation of these theories in schools of Buddhism: Vaibhasika, Sautrantrika, Yogacara, Madhyamika.	6
5.	Nyaya: theory of Pramanas; the individual self and its liberation; the idea of God and proofs for His existence.	6

Text book and Reference books:

1. M. Hiriyanna: Outlines of Indian Philosophy.
2. C. D. Sharma: A Critical Survey of Indian Philosophy.
3. S. N. Das Gupta: A History of Indian Philosophy Vol – I to V.
4. S. Radhakrishnan: Indian Philosophy Vol – I & II.
5. T. R. V. Murti: Central Philosophy of Buddhism.
6. J. N. Mahanty: Reason and Tradition of Indian Thought.
7. R. D. Ranade: A Constructive Survey of Upanisadic Philosophy.
8. P. T. Raju: Structural Depths of Indian Thought.
9. K. C. Bhattacharya: Studies in Philosophy Vol – 1.

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10. Datta and Chatterjee: Introduction of Indian Philosophy.

Course Outcome:	
On completion of the course students will be able to	
OE-CSE 501C.1	Understand and explain philosophically important theories and concepts that have historically been used to organize and explain human experience.
OE-CSE 501C.2	Apply philosophical methods and principles to analyse real-world issues and dilemmas.
OE-CSE 501C.3	Analyse the arguments presented in philosophical texts and contemporary philosophical discourse.
OE-CSE 501C.4	Evaluate the strengths and weaknesses of various philosophical theories and positions.

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	1	3	1	1	2	3	1	2	-	3	2	2	2
CO2	-	-	2	2	-	1	3	2	1	-	3	2	1	2
CO3	-	-	2	1	-	2	3	1	2	-	3	1	2	2
CO4	-	-	2	-	-	2	3	1	2	-	3	2	2	2
AVG.	1.00	1.00	2.25	1.33	1.00	1.75	3.00	1.25	1.75	-	3.00	1.75	1.75	2.00

Course Title: Python for Data Analytics

Code: VAC-CSE 501

Contact: 3L

Theory: 3 hrs. /Week

Credit point: 3

Course Objective:

1.	To understand the fundamentals of data analytics and its role in data-driven decision-making.
2.	To gain proficiency in using Python libraries for data handling, analysis, and visualization.
3.	To apply statistical and machine learning techniques for data interpretation. To develop problem-solving skills using real-world datasets.
4.	To develop problem-solving skills using real-world datasets.

Pre-Requisite:

1.	Basic knowledge of programming concepts such as variables, loops, conditionals, and functions.			
2.	Fundamental understanding of mathematics and statistics, including topics like mean, median, standard deviation, and probability.			
3.	Familiarity with data structures such as lists, arrays, and dictionaries.			
4.	Basic computer and data handling skills, including working with files, spreadsheets, and simple datasets.			
Unit	Content			Hrs.
1.	Introduction to Data Analytics: Introduction to Data Science & Data			8

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	Analytics, Types of Data: Structured, Semi-Structured, and unstructured. Data Life Cycle: Collection, Cleaning, Analysis, Visualization, Interpretation. Python for Data Analytics: Environment Setup (Anaconda, Jupyter Notebook). Introduction to Python Libraries: NumPy, Pandas, Matplotlib, Seaborn.	
2.	Data Handling and Preprocessing: Data Types, Variables, Lists, Dictionaries, Tuples in Python. Reading and Writing Data from Files (CSV, Excel, JSON). Using Pandas for Data Frames: Importing, Cleaning, Merging, Grouping, Sorting, Handling Missing Values, Outliers, and Duplicates. Data Transformation: Normalization, Standardization, Encoding, Exploratory Data Analysis (EDA) Techniques.	8
3.	Statistical Analysis and Data Visualization: Introduction to Descriptive Statistics (Mean, Median, Mode, Variance, Standard Deviation). Correlation and Covariance. Probability Distributions (Normal, Binomial, Poisson). Hypothesis Testing: t-Test, Chi-Square, ANOVA. Data Visualization using Matplotlib and Seaborn. Line Plot, Bar Plot, Histogram, Pie Chart. Box Plot, Heatmap, Pair Plot.	8
4.	Data Analytics Techniques (Applied Python): Introduction to Predictive Analytics. Regression Analysis: Linear & Multiple Regression. Classification Techniques: Logistic Regression, Decision Trees. Clustering: K-Means, Hierarchical Clustering. Dimensionality Reduction (PCA). Model Evaluation Metrics: Accuracy, Precision, Recall, F1-Score, Confusion Matrix.	9
5.	Case Studies & Project Work: Real-life Dataset Analysis using Python. Example Domains: Social Media Data Analysis, Healthcare / Finance Analytics, E-commerce Customer Behavior, COVID-19 Data Analysis. Model Deployment Overview (Optional): Flask / Streamlit Introduction. Mini Project & Report Preparation.	9

Laboratory / Practical Work

Each lab session will focus on hands-on Python programming for analytics using Jupyter Notebook or Google Colab.

1. Introduction to Python & Libraries (NumPy, Pandas).
2. Importing and Cleaning Data using Pandas.
3. Handling Missing and Categorical Data.
4. Data Visualization using Matplotlib and Seaborn.
5. Descriptive Statistics and Correlation Analysis.
6. Linear Regression Model Implementation.
7. Classification using Logistic Regression / Decision Tree

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- .8. Clustering using K-Means.
9. Exploratory Data Analysis (EDA) on Real Dataset.
10. Mini Project – Full Data Analytics Pipeline.

Text books and Reference books:

7. Wes McKinney, Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython, 2nd Edition, O'Reilly Media, 2017.
8. Reema Thareja, Python Programming: Using Problem Solving Approach, Oxford University Press, 2017.
9. Allen B. Downey, Think Stats: Exploratory Data Analysis in Python, 2nd Edition, O'Reilly Media, 2014.

Course Outcome:	
On completion of the course students will be able to	
VAC-CSE 501.1	Understand the fundamental concepts of Python programming and its role in data analytics.
VAC-CSE 501.2	Apply Python libraries such as NumPy and Pandas for efficient data manipulation, cleaning, and preprocessing.
VAC-CSE 501.3	Perform data visualization using tools such as Matplotlib and Seaborn to identify patterns and insights.
VAC-CSE 501.4	Implement basic statistical and analytical techniques using Python for data-driven decision making and Develop end-to-end data analysis projects using real-world datasets, integrating data acquisition, processing, and visualization.

Mapping of COs with POs and PSOs (Course Articulation Matrix):														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	-	-	-	-	-	2	3	3	2
CO2	3	2	2	2	3	-	-	1	-	-	2	3	3	3
CO3	3	2	3	2	3	-	-	1	1	-	3	3	3	3
CO4	3	3	3	3	3	-	-	1	1	-	3	3	3	3
AVG.	3.00	2.50	2.50	2.25	2.75	-	-	1.00	1.00	-	2.50	3.00	3.00	2.75

Course Title: Operating Systems Lab

Code: PC-CSE 591

Contacts: 4P

Practical: 4 hrs. / Week

Course Objective:	
1.	To install windows operating systems.
2.	To understand the basics of Unix command and shell programming.
3.	To implement various CPU scheduling algorithms.
4.	To implement Deadlock Avoidance and Deadlock Detection Algorithms
5.	To implement Page Replacement Algorithms
6.	To implement various memory allocation methods.

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Pre-Requisite:

1. Basic programming knowledge.

Unit	Content	Hrs.
1.	Managing Unix/Linux Operating System: Creating a bash shell script, making a script executable, shell syntax (variables, conditions, control structures, functions, and commands). Partitions, Swap space, Device files, Raw and Block files, Formatting disks, Making file systems, Superblock, Inodes, File system checker, Mounting file systems, Logical Volumes, Password file management, Password security, Groups and the group file, Shells, restricted shells, user-management commands, homes and permissions, default files, profiles, locking accounts, setting passwords, Switching user, Switching group, Removing users & user groups.	5
2.	Process: Starting new process, implement child, parent and grandparent process, waiting for a process, zombie process, orphan process.	2
3.	Signal: Signal handling, sending signals, signal interface, signal sets.	2
4.	CPU scheduling algorithms: Implement various cpu scheduling algorithm using C programming language.	2
5.	Threads: programming with pthread functions (viz. pthread_create, pthread_join, pthread_exit, pthread_attr_init, pthread_cancel)	1
6.	Inter-process communication: Pipes (use functions pipe, popen, pclose), named pipes (FIFOs, accessing FIFO), message passing & shared memory (IPC).	1

(Detailed instructions for Laboratory Manual to be followed for further guidance)

Text book and Reference books:

1. Richard Stevens, Stephen Rago, Advanced Programming in the UNIX Environment, Pearson Education, 2/e.
2. UNIX: Concepts and Applications | 4th Edition by Sumitabha Das.
3. The C Odyssey: UNIX: v. 3 by Vijay Mukhi.

Course Outcomes:

On completion of the course students will be able to

PC-CSE 591.1	Understand elementary UNIX system commands used for UNIX operating system.
PC-CSE 591.2	Apply the knowledge of shell program to solve various complex problems.
PC-CSE 591.3	Evaluate process creation concepts, different CPU scheduling algorithms and user threads.
PC-CSE 591.4	Design different IPC techniques and synchronization problems.

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	2	1	2	1	1	2	1	1	1	2	2	2	2

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CO2	2	2	2	2	2	-	-	2	2	2	2	3	2	3
CO3	2	2	2	2	2	-	-	2	2	2	2	2	2	3
CO4	2	2	3	3	2	-	-	2	2	2	2	2	2	3
AVG.	1.75	2.00	2.00	2.25	1.75	1.00	2.00	1.75	1.75	1.75	2.00	2.25	2.00	2.75

Course Title: Design and Analysis of Algorithms Lab

Code: PC-CSE 592

Contacts: 4P

Practical: 4 hrs. / Week

Credit Points: 2

Course Objective:

1.	Ability to develop C programs for computing and real-life applications using basic elements like control statements, arrays, functions, pointers and strings, and data structures like stacks, queues and linked lists.
2.	Ability to Implement searching and sorting algorithms.

Pre-Requisite:

1.	Programming fundamentals (preferably in C/C++).
2.	Basic algorithm design techniques.

Laboratory Experiments:		Hrs.
Divide and Conquer:		
1.	Implement Binary Search using Divide and Conquer approach Implement Merge Sort using Divide and Conquer approach.	8
2.	Implement Quick Sort using Divide and Conquer approach Find Maximum and Minimum element from an array of integer using Divide and Conquer approach.	8
Dynamic Programming:		
3.	Find the minimum number of scalar multiplication needed for chain of matrix	8
4.	Implement all pair of Shortest path for a graph (Floyed- Warshall Algorithm) Implement Traveling Salesman Problem	8
5.	Implement Single Source shortest Path for a graph (Dijkstra , Bellman Ford Algorithm	8
Backtracking:		
6.	Implement 8 Queen problem	4
7.	Graph Coloring Problem	4
Greedy method:		
8.	Knapsack Problem	
9.	Minimum Cost Spanning Tree by Prim's Algorithm Minimum Cost Spanning Tree by Kruskal's Algorithm	4
Graph Traversal Algorithm:		
10.	Implement Breadth First Search (BFS) Implement Depth First Search (DFS)	4

(Detailed instructions for Laboratory Manual to be followed for further guidance)

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Course Outcomes:	
On completion of the course students will be able to	
PC-CSE 592.1	Analyze different types of applications of Divide & Conquer techniques
PC-CSE 592.2	Understanding the implementation of Dynamic Programming techniques
PC-CSE 592.3	Apply backtracking and Greedy method for different types of algorithm
PC-CSE 592.4	Evaluate and Implement the Graph Traversal Algorithms

Mapping of COs with POs and PSOs (Course Articulation Matrix):														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	3	3	-	-	-	-	2	-	2	2	3	3
CO2	3	2	2	3	2	-	-	-	2	-	2	2	3	3
CO3	3	3	3	3	2	-	-	-	2	-	2	3	3	3
CO4	3	2	3	2	2	-	-	1	2	-	2	3	3	3
AVG.	3.00	2.25	2.75	2.75	2.00	-	-	1.00	2.00	-	2.00	2.50	3.00	3.00

Course Title: IT Workshop-II (Web Programming)

IT Workshop-II (Web Programming)

Code: PCC-CSE 593

Contacts: 4P

Practical: 4 hrs. / Week

Credit Points: 2

Course Objective:	
1.	To introduce scripting language concepts for developing client-side applications.
2.	Comprehend the basics of the internet and web terminologies.
3.	Familiar with client server architecture and able to develop web applications.
4.	Students will gain the skills to develop project-based experience .

Pre-Requisite:	
1.	Basic Object Oriented Programming Concepts are required.
2.	How the internet works, including concepts like IP addresses, DNS, and how web browsers interact with servers.
3.	Knowing how HTTP requests and responses work.

Unit	Content	Hrs.
1.	DHTML (HTML , CSS , Java Script): HTML: Introduction, Editors, Elements, Attributes, Heading, Paragraph. Formatting, Link, Head, Table, List, Block, LayoutForm, Iframe, Colors, Colormame, Colorvalue. Image Maps: map, area, attributes of image area. CSS: Panels , Borders , Padding , Margins , Display, Buttons , Notes , Quotes , Alerts , Images , Tags , Icons. Java Script : Statements, Syntax, Comments , Operators, Data Types , Functions , Objects , Events, Strings , Arrays , Math, Errors , Scope , Classes , Modules.	4
2.	AngularJS: Directives, Models, Data Binding, Controllers, Scopes, Filters, DOM Manipulation, Events, Forms, Form Validation, REST APIs, HTTP GET and POST Methods.	2
3.	Node.js:	2

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	Modules, HTTP Module, File System (FS) Module, URL Module, NPM, Events, File Upload, Sending Emails.	
4.	MongoDB : Introduction to MongoDB and Environment Setup ,NoSQL Databases ,Features and Architecture of MongoDB. MongoDB : Query API , Create DB , Collection , Insert ,Find , Update , Delete,Query Operators , Update Operators , Aggregations , Indexing/Search , Validation,Data API , Drivers , Node.js Driver , Charts.	2
5.	React: Introduction to React and Environment Setup , ES6, JSX Intro, JSX Expressions , JSX Attributes, JSX If Statements . React: Components, Class, Props , Props Destructuring, Props Children, Events , Conditionals , Lists , Forms , Forms Submit , Textarea , Select , Multiple Inputs ,Checkbox , Radio, Portals, Suspense. CSS Styling , CSS Modules , CSS-in-JS , Router , Transitions, Forward Ref , HOC ,Sass , Hooks , useState , useEffect , useContext,useRef , useReducer , useCallback , useMemo , Custom Hooks.	3
6.	Extensible Markup Language: Introduction, Tree, Syntax, Elements, Attributes, Validation, Viewing. XHTML in brief.	1

Text book and Reference books:

1. Web Technology: A Developer's Perspective, N.P. Gopalan and J. Akilandeswari, PHI Learning, Delhi, 2013. (Chapters 1-5, 7, 8, 9).
2. Internetworking Technologies, An Engineering Perspective, Rahul Banerjee, PHI Learning, Delhi, 2011.
3. Full Stack Web Development with JavaScript, Anthony Accomazzo, Ari Lerner, Nate Murray, Packt Publishing, 2018.
4. MERN Stack Development with React, Node.js, Express, and MongoDB ,Vasan Subramanian, Apress ,2019.

Course Outcome:	
On completion of the course students will be able to	
PCC-CSE 593.1	Understand and develop a dynamic webpage by the use of java script and DHTML
PCC-CSE 593.2	Develop full-stack web applications by building dynamic client-side interfaces using AngularJS and scalable server-side applications using Node.js with RESTful API and database integration.
PCC-CSE 593.3	Analyse and manage NoSQL databases using MongoDB by performing CRUD operations, schema design, indexing, aggregation, and database integration with applications.
PCC-CSE 593.4	Create an interactive and responsive single-page web applications using React by creating reusable components, managing state, and implementing client-side routing.

Mapping of COs with POs and PSOs (Course Articulation Matrix):															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	2	1	1	1	-	1	-	2	2	2	1
CO2	2	2	3	2	1	-	-	2	2	-	2	-	1	1	1

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CO3	1	3	2	3	2	2	2	-	3	-	1	1	2	3	2
CO4	1	1	2	2	2	1	-	2	-	2	3	2	1	1	1
AVG.	1.50	2.00	2.25	2.25	1.75	1.00	0.75	1.00	1.25	0.75	1.50	1.25	1.50	1.75	1.25



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Third Year - Sixth Semester

Course Title: Cloud Computing

Code: PC-CSE 601

Contact: 3L

Theory: 3 hrs. / Week

Credit Points: 3

Course Objective:

1.	To understand the concepts of Cloud Computing and virtualization.
2.	To learn Resource and sharing through virtualization ensuring security.
3.	To learn cloud technologies.
4.	To develop cloud environment to utilize resources fully.

Pre-Requisite:

1.	Distributed computing, Computer Networks.
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Unit	Content	Hrs.
1.	Distributed Computing and Enabling Technologies, Cloud Fundamentals: Cloud Definition, Evolution, Architecture, Applications, deployment models, service models. Virtualization: Issues with virtualization, virtualization technologies and architectures, internals of virtual machine monitors/hypervisors, virtualization of data centres and issues with Multi-tenancy.	10
2.	Resource Management and Load Balancing: Distributed Management of Virtual Infrastructures, Server consolidation, Dynamic provisioning and resource management, Resource Optimization, Resource dynamic reconfiguration, Scheduling Techniques for Advance Reservation, Capacity Management to meet SLA Requirements, and Load Balancing, various load balancing techniques.	10
3.	Cloud technologies and Advancements: Hadoop, MapReduce, Virtual Box, Google App Engine, Programming Environment for Google App Engine, Open Stack Federation in the Cloud, Four Levels of Federation, Federated Services and Applications, Future of Federation	8
4.	Cloud Security: Infrastructure Security, Network level security, Host level security, Application level security, Data privacy and security Issues. Access Control and Authentication in cloud computing.	6
5	Implementation: Study of Cloud computing Systems like Amazon EC2 and S3, Google App Engine, and Microsoft Azure, Build Private/Hybrid	4

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	Cloud using open source tools, Deployment of Web Services from Inside and Outside Cloud Architecture. MapReduce and its extensions to Cloud Computing, HDFS, and GFS.	
6.	Green Computing: Introduction to Green Computing, concept, objectives, benefits, and environmental impact of IT. Energy Efficient Computing, green hardware, power management, energy efficient software, and virtualization. Green Data Centers, server consolidation, cooling techniques, and energy optimization. E Waste Management, reuse, recycling, refurbishment, disposal methods, and environmental regulations. Green IT Standards, ISO 14001, Energy Star, EPEAT, and sustainable IT practices. Applications and Future Trends, Green Cloud Computing, AI for sustainability, smart cities, renewable energy integration, and case studies.	4

Text books and Reference books:

1. Cloud Computing Bible by Barrie Sosinsky, Wiley India Pvt. Ltd, 2013.
2. Mastering Cloud Computing by Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, McGraw Hill Education (India) Private Limited, 2013.
3. Cloud computing: A practical approach, Anthony T. Velte, Tata Mcgraw-Hill.
4. Cloud Computing, Miller, Pearson.
5. Building applications in cloud: Concept, Patterns and Projects, Moyer, Pearson.
6. Cloud Computing – Second Edition by Dr. Kumar Saurabh, Wiley India
7. San Murugesan and G. R. Gangadharan (Eds.), Green IT: An Overview of Green Technologies, Business Practices and Environmental Impact, Wiley India Pvt. Ltd., 2012
8. Bud E. Smith, Green Computing: Tools and Techniques for Saving Energy, Money, and Resources, CRC Press, 2014.

Course Outcome:	
On completion of the course students will be able	
PC-CSE 601.1	To understand the evolution of cloud architecture, virtualization through early computing concepts, resource provisioning and load distribution techniques in cloud.
PC-CSE 601.2	To analyse technologies behind cloud deployment considering security issues.
PC-CSE 601.3	To apply the cloud deployment knowledge and tools for creating cloud environment.
PC-CSE 601.4	Explain the principles of green computing, including energy-efficient hardware, sustainable data centers, e-waste management, and environmentally responsible computing practices.

Mapping of COs with POs and PSOs (Course Articulation Matrix):														
	PO1	PO2	PO3	PO4	PO5	PO6	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	-	-	2	2	-	2	1	1	3	3	2
CO2	3	2	2	1	-	-	2	-	2	-	1	3	3	2
CO3	3	3	2	2	3	2	2	1	2	2	3	3	3	3
CO4	3	3	3	3	3	3	2	3	2	2	3	3	3	3
AVG.	3.00	2.25	2.00	2.00	3.00	2.33	2.00	2.00	2.00	1.67	2.00	3.00	3.00	2.50

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Course Title: Computer Networks

Code: PC-CSE 602

Contact: 3L

Theory: 3 hrs. / Week

Credit Points: 3

Course Objective:	
1.	To understand the concept of layering in networks.
2.	To know the functions of protocols of each layer of OSI and TCP/IP protocol suite.
3.	To visualize the end-to-end flow and error control mechanisms.
4.	To familiarize the functions and protocols of different layers

Pre-Requisite:	
1.	Basic mathematics.
2.	Basic understanding of computer algorithms.

Unit	Content	Hrs.
1.	Introduction: History and development of computer networks, networks topologies. Layering and protocols, Different types of transmission media.	6
2.	Physical Layer: , errors in transmission: attenuation, noise. Repeaters. Encoding (NRZ, NRZI, Manchester, 4B/5B, etc.), LAN: Design, specifications of popular technologies, switching. Design of LAN of a campus or a building, FDM & TDM.	8
3.	Data Link Layer: Error detection (Parity, CRC) & correction (Hamming distance), Sliding Window, Stop and Wait protocols. Go back – N ARQ, Selective Repeat ARQ. Medium Access Control Sub Layer: MAC Layer: Aloha, CSMA, CSMA/CD, CSMA/CA protocols. Examples: Ethernet, including Gigabit Ethernet and WiFi (802.11), Token Ring, Bluetooth and WiMax.	10
4.	Network Layer: Internet Protocol, IPv6, ARP, DHCP, ICMP, Routing algorithms: Distance vector, Link state, Metrics, Inter-domain routing. Subnetting, Classless addressing, Network Address Translation (NAT).	6
5.	Transport Layer: UDP, TCP Connection establishment and termination, sliding window revisited, flow and congestion control, timers, retransmission, TCP extensions, etc.	6
6.	Application Layer: Examples: DNS, SMTP, IMAP, HTTP etc.; Basics of Firewalls and Cryptography.	6

Text books and Reference books:

1. Behrouz A. Forouzan, Data Communications and Networking with TCP/IP Protocol Suite, Sixth Edition TMH, 2022.
2. William Stallings, Data and Computer Communications, Tenth Edition, Pearson Education, 2013.
3. Andrew S. Tanenbaum, David J. Wetherall, “Computer Networks”, Fifth Edition, Prentice Hall, 2011.

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4. Ying-Dar Lin, Ren-Hung Hwang, Fred Baker, "Computer Networks: An Open Source Approach", McGraw Hill, 2012.
5. James F. Kurose, Keith W. Ross, Computer Networking, A Top-Down Approach Featuring the Internet, Eighth Edition, Pearson Education, 2021.
6. Nader F. Mir, Computer and Communication Networks, Second Edition, Prentice Hall, 2014

Course Outcomes:	
On completion of the course students will be able to	
PC-CSE 602.1	Understand the layered communication architectures and its functions in computer networks.
PC-CSE 602.2	Apply the basics of how data flows from one station to another through physical medium.
PC-CSE 602.3	Analyze Flow and Error Control mechanisms and protocols for LAN technologies.
PC-CSE 602.4	Evaluate the protocols for various functions in the network.

Mapping of COs with POs and PSOs (Course Articulation Matrix):														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	2	1	2	-	-	-	-	-	2	3	2	-
CO2	3	3	2	1	2	-	-	-	-	-	2	3	3	-
CO3	3	3	3	1	2	-	-	-	-	-	2	3	3	-
CO4	3	3	3	1	3	1	1	3	-	-	2	3	3	3
AVG.	2.75	2.75	2.50	1.00	2.25	1.00	1.00	3.00	-	-	2.00	3.00	2.75	3.00

Course Title: Software Engineering

Code: ES-CSE 601

Contact: 3L

Theory: 3 hrs. / Week

Credit Points: 3

Course Objective:	
1.	This course introduces the concepts and methods required for the construction of large software intensive systems. It aims to develop a broad understanding of the discipline of software engineering.
2.	It seeks to complement this with a detailed knowledge of techniques for the analysis and design of complex software intensive systems. It aims to set these techniques in an appropriate engineering and management context.

Pre-Requisite:	
1.	C Programming, Java or C++ programming.

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Unit	Content	Hrs.
1.	The role of software, Overview of System Analysis & Design, SDLC, Waterfall Model, Iterative Model, Incremental Model, Evolutionary Model, Spiral Model, Agile Methodology, Case Study on SDLC models, Feasibility Analysis, Requirement Specification, Standard SRS Document.	10
2.	System Design – Context diagram and DFD, Problem Partitioning, Top Down And Bottom Up design; Decision tree, Decision table, Functional vs. Object- Oriented design approach.	6
3.	Static and dynamic models, UML diagrams: Class diagram, interaction diagram: collaboration diagram, sequence diagram, state chart diagram, activity diagram and implementation diagram.	6
4.	Coding & Documentation – Structured Programming, OO Programming, Information Hiding, Reuse, System Documentation. Testing – Testing Objectives, Unit Testing, Integration Testing, System Testing, Types of System Testing , Software Testing Strategies: Test Drivers and Test Stubs, Structural Testing and Functional Testing, Test case Specification, Reliability Assessment, Validation & Verification Metrics, Monitoring & Control.	10
5.	Software Project Management – Project Scheduling, Staffing, Cost Benefit Analysis, COCOMO model, Software Configuration Management, Quality Assurance, Project Monitoring, Risk Management, Project Maintenance, Preparation of Risk mitigation plan.	8

Text books and Reference books:

1. Pressman, Software Engineering: A practitioner's approach– (TMH)
2. Pankaj Jalote, Software Engineering- (Wiley-India)
3. Rajib Mall, Software Engineering- (PHI)
4. N.S. Gill, Software Engineering – (Khanna Publishing House)
5. Agarwal and Agarwal, Software Engineering – (PHI)
6. Sommerville, Software Engineering – Pearson
7. Martin L. Shooman, Software Engineering – TMH

Course Outcomes:	
On completion of the course students will be able to	
ES -CSE 601.1	Understanding the principles of software engineering and analyzing various software development life cycle process.
ES -CSE 601.2	Creating various components of software using professional software design concepts.
ES -CSE 601.3	Understanding software testing and maintenance approaches following standard coding and testing guidelines.
ES -CSE 601.4	Evaluating software matrices and applying project management techniques to maximize the productivity.

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Mapping of COs with POs and PSOs (Course Articulation Matrix):														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	-	2	2	3	3	3	3	3	3	3	3
CO2	3	3	3	2	3	-	1	2	3	3	2	3	2	2
CO3	3	3	2	2	3	-	1	3	2	2	2	3	2	2
CO4	3	3	3	3	3	2	3	3	3	3	3	3	3	3
AVG.	3.00	2.75	2.50	2.33	2.75	2.00	2.00	2.75	2.75	2.75	2.50	3.00	2.50	2.50

Course Title: Advanced Algorithms

Code: PE-CSE 601A

Contact: 3L

Theory: 3 hrs. / Week

Credit Points: 3

Course Objective:	
1.	Introduce students to the advanced methods of designing and analysing algorithms.
2.	The student should be able to choose appropriate algorithms and use it for a specific problem.
3.	To familiarize students with basic paradigms and data structures used to solve advanced algorithmic problems.
4.	Students should be able to understand different classes of problems concerning their computation difficulties.
5.	To introduce the students to recent developments in the area of algorithmic design.

Pre-Requisite:	
1.	Algorithm Design and Analysis.

Unit	Content	Hrs.
1.	Sorting: Review of various sorting algorithms, topological sorting. Graph: Definitions and Elementary Algorithms: Shortest path by BFS, shortest path in edge-weighted case (Dijkstra's), depth-first search and computation of strongly connected components, emphasis on correctness proof of the algorithm and time/space analysis, example of amortized analysis.	8
2.	Matroids: Introduction to greedy paradigm, algorithm to compute a maximum weight maximal independent set. Application to MST. Graph Matching: Algorithm to compute maximum matching. Characterization of maximum matching by augmenting paths, Edmond's Blossom algorithm to compute augmenting path.	8
3.	Flow-Networks: Maxflow-mincut theorem, Ford Fulkerson Method to compute maximum flow, Edmond-Karp maximum-flow algorithm. Matrix Computations: Strassen's algorithm and introduction to divide and conquer paradigm, inverse of a triangular matrix, relation between the time complexities of basic matrix operations, LUP-decomposition.	8

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4.	Modulo Representation of integers/polynomials: Chinese Remainder Theorem, Conversion between base-representation and modulo-representation. Extension to polynomials. Application: Interpolation problem. Discrete Fourier Transform (DFT): In complex field, DFT in modulo ring. Fast Fourier Transform algorithm. Schonhage-Strassen Integer Multiplication algorithm	10
5.	Linear Programming: Geometry of the feasibility region and Simplex algorithm. NP-completeness: Examples, proof of NP-hardness and NP-completeness. One or more of the following topics based on time and interest Approximation algorithms, Randomized Algorithms, Interior Point Method, Advanced Number Theoretic Algorithm	8

Text books and Reference books:

1. "Introduction to Algorithms" by Cormen, Leiserson, Rivest, Stein.
2. "The Design and Analysis of Computer Algorithms" by Aho, Hopcroft, Ullman.
3. "Algorithm Design" by Kleinberg and Tardos.
4. Design & Analysis of Algorithms, Gajendra Sharma, Khanna Publishing House, New Delhi.

Course Outcomes:	
On completion of the course students will be able to	
PE-CSE 601A.1	Understand the complexity/performance of different algorithms.
PE-CSE 601A.2	Applying the appropriate data structure for solving a particular set of problems.
PE-CSE 601A.3	Analyze the different problems in various classes according to their complexity.
PE-CSE 601A.4	Capable to Evaluate recent activities in the field of the advanced data structure

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	-	-	1	1	-	2	3	3	1
CO2	3	3	3	3	2	-	-	1	-	-	-	3	2	1
CO3	3	3	3	3	2	1	-	1	-	-	-	2	2	1
CO4	3	3	3	3	-	-	-	1	1	2	2	-	1	3
AVG.	3.00	3.00	3.00	2.75	2.00	1.00	-	1.00	1.00	2.00	2.00	2.67	2.00	1.50

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Course Title: Quantum Computing

Code: PE-CSE 601B

Contacts: 3L

Theory: 3 hrs. / Week

Credit Points: 3

Course Objective:	
1.	To introduce the fundamentals of quantum computing.
2.	To learn about the operators involved in Quantum computing and their applications.
3.	To comprehend the applications of quantum computing to information theory.

Pre-Requisite:	
1.	Linear Algebra, Theory of Computation.

Unit	Content	Hrs.
1.	Introduction to quantum computing: Qubit & Quantum States: The Qubit, Vector Spaces. Linear Combination Of Vectors, Uniqueness of a spanning set, basis & dimensions, inner Products, orthonormality, gram-schmidt orthogonalization, bra-ket formalism, the Cauchy-Schwarz and triangle Inequalities.	6
2.	Matrices & Operators: Observables, The Pauli Operators, Outer Products, The Closure Relation, Representation of operators using matrices, outer products & matrix representation, matrix representation of operators in two dimensional spaces, Pauli Matrix, Hermitian unitary and normal operator, Eigen values & Eigen Vectors, Spectral Decomposition, Trace of an operator, important properties of Trace, Expectation Value of Operator, Projection Operator, Positive Operators.	10
3.	Commutator Algebra, Heisenberg uncertainty principle, polar decomposition & singular values, Postulates of Quantum Mechanics.	8
4.	Tensor Products: Representing Composite States in Quantum Mechanics, Computing inner products, Tensor products of column vectors, operators and tensor products of Matrices. Density Operator: Density Operator of Pure & Mix state, Key Properties, Characterizing Mixed State, Practical Trace & Reduce Density Operator, Density Operator & Bloch Vector.	10
5.	Quantum Measurement Theory: Distinguishing Quantum states & Measures, Projective Measurements, and Measurement on Composite systems, Generalized Measurements, Positive Operator- Valued Measures. Recent trends in Quantum Computing Research, Quantum Computing Applications of Genetic Programming.	8

Text books:

1. Nielsen, M., & Chuang, I. In Quantum Computation and Quantum Information: 10th Anniversary Edition, Cambridge: Cambridge University Press.
2. John Gribbin, Computing with Quantum Cats: From Colossus to Qubits, Prometheus Books.
3. Dr. Chuck Easttom, Quantum Computing Fundamentals, Pearson.

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Reference books:

1. Quantum Computing without Magic by Zdzislaw Meglicki.
2. Quantum Computing Explained By DAVID Mc MAHON.
3. Quantum Computer Science by Marco Lanzagorta, Jeffrey Uhlmann.
4. An Introduction to Quantum Computing Phillip Kaye, Raymond Laflamme, Michele Mosca.

Course Outcome:	
On completion of the course students will be able to	
PE-CSE 601B.1	Understand basics of quantum computing and of Qubit.
PE-CSE 601B.2	Apply operators of quantum computing in different applications.
PE-CSE 601B.3	Remember the notions of Tensor Products and Density Operators.
PE-CSE 601B.4	Evaluate the Quantum Measurements Theories.

Mapping of COs with POs and PSOs (Course Articulation Matrix):														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	2	2	2	2	-	2	3	2	3
CO2	3	3	3	3	3	2	3	3	3	3	3	3	3	3
CO3	3	3	3	2	-	1	-	2	-	2	-	2	3	3
CO4	3	3	3	3	2	2	2	2	1	2	2	3	3	3
AVG.	3.00	3.00	3.00	2.5	2.33	1.75	2.33	2.25	2.00	2.33	2.33	2.75	2.75	3.00

Course Title: Neural Networks and Deep Learning

Code: PE-CSE 601C

Contacts: 3L

Theory: 3 hrs. / Week

Credit Points: 3

Course Objective:	
1.	Understanding Human learning aspects.
2.	Acquaintance with primitives in the learning process by computer.
3.	Understanding the nature of problems solved with Deep Learning.

Pre-Requisite:	
1.	Statistics, Linear Algebra, Probability.

Unit	Content	Hrs.
1.	Introduction: Various paradigms of learning problems, Perspectives and Issues in deep learning framework, review of fundamental learning techniques.	3
2.	Feed forward neural network: Artificial Neural Network, activation function, multi-layer neural network, cardinality, operations, and properties of fuzzy relations.	8
3.	Training Neural Network: Risk minimization, loss function, backpropagation, regularization, model selection, and optimization.	8
4.	Conditional Random Fields: Linear chain, partition function, Markov network, Belief propagation, Training CRFs, Hidden Markov Model,	9

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	Entropy.	
5.	Deep Learning: Deep Feed Forward network, regularizations, training deep models, dropouts, Convolutional Neural Network, Recurrent Neural Network, Deep Belief Network.	8
6.	Deep Learning research: Object recognition, sparse coding, computer vision, natural language.	6

Text book and Reference books:

1. Goodfellow I, Bengio Y. and Courville, A., Deep Learning, MIT Press, 2016.
2. Bishop, C., M., Pattern Recognition and Machine Learning, Springer, 2006.
3. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009.
4. Golub, G., H., and Van Loan, C., F., Matrix Computations, JHU Press, 2013.
5. Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw-Hill Education, 2004.
6. Dr. Rajiv Chopra, Deep Learning, Khanna Publishing House, New Delhi (AICTE Recommended Textbook – 2018)

Course Outcome:	
On completion of the course students will be able to	
PE-CSE 601C.1	Understand basic concepts of artificial neural networks in deep learning and functioning of the most common types of deep neural networks.
PE-CSE 601C.2	To analyze model performance and results.
PE-CSE 601C.3	To evaluate how to solve practical problems via artificial neural networks and deep learning techniques.
PE-CSE 601C.4	To create Artificial Neural Networks and Deep Neural Networks in solving complex real-world problems.

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	1	-	-	-	-	2	2	2	2
CO2	3	3	2	3	3	2	2	2	2	-	2	2	3	3
CO3	3	3	3	3	3	1	2	2	2	1	3	3	3	3
CO4	3	3	3	3	3	2	-	3	3	2	3	3	3	3
AVG.	3.00	3.00	2.50	2.75	2.75	1.50	2.00	2.33	2.33	1.50	2.50	2.50	2.75	2.75

Course Title: Soft Computing

Code: PE-CSE 601 D

Contacts: 3L

Theory: 3 hrs. / Week

Credit Points: 3

Course Objective:	
1.	Motivation and historical background of Soft Computing.
2.	Application of Fuzzy logic.
3.	Biologically inspired algorithm such as neural networks, genetic algorithms, ant colony optimization, and bee colony optimization.
4.	Hybrid systems of neural network, genetic algorithms and fuzzy systems.

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Pre-Requisite:	
1.	Basic Mathematics (linear algebra, probability, and statistics).
2.	Basic concepts of Artificial Intelligence and Machine Learning (desirable).

Unit	Content	Hrs.
1.	Introduction: Introduction to soft computing; introduction to fuzzy sets and fuzzy logic systems; introduction to biological and artificial neural network; introduction to Genetic Algorithm	8
2.	Fuzzy sets and Fuzzy logic systems: Classical Sets and Fuzzy Sets and Fuzzy relations: Operations on Classical sets, properties of classical sets, Fuzzy set operations, properties of fuzzy sets, cardinality, operations, and properties of fuzzy relations. Membership functions: Features of membership functions, standard forms and boundaries, different fuzzification methods. Fuzzy to Crisp conversions: Lambda Cuts for fuzzy sets, fuzzy Relations, Defuzzification methods. Classical Logic and Fuzzy Logic: Classical predicate logic, Fuzzy Logic, Approximate reasoning and Fuzzy Implication Fuzzy Rule based Systems: Linguistic Hedges, Fuzzy Rule based system – Aggregation of fuzzy Rules, Fuzzy Inference System- Mamdani Fuzzy Models – Sugeno Fuzzy Models. Applications of Fuzzy Logic: How Fuzzy Logic is applied in Home Appliances, General Fuzzy Logic controllers, Basic Medical Diagnostic systems and Weather forecasting.	10
3.	Introduction to Neural Networks: Advent of Modern Neuroscience, Classical AI and Neural Networks, Biological Neurons and Artificial neural network; model of artificial neuron. Learning Methods: Hebbian, competitive, Boltzman etc., Neural Network models: Perceptron, Adaline and Madaline networks; single layer network; Backpropagation and multi-layer networks. Competitive learning networks: Kohonen self-organizing networks, Hebbian learning; Hopfield Networks. Neuro-Fuzzy modelling: Applications of Neural Networks: Pattern Recognition and classification	10
4.	Genetic Algorithms: Simple GA, crossover and mutation, Multi-objective Genetic Algorithm (MOGA). Applications of Genetic Algorithm: genetic algorithms in search and optimization, GA based clustering Algorithm, Image processing and pattern Recognition	10
5.	PSO: Other Soft Computing techniques: Simulated Annealing, Tabu search, Ant colony optimization (ACO), Particle Swarm Optimization (PSO).	4

Text books and Reference books:

1. Fuzzy logic with engineering applications, Timothy J. Ross, John Wiley and Sons.
2. S. Rajasekaran and G.A.V.Pai, “Neural Networks, Fuzzy Logic and Genetic Algorithms”, PHI
3. Principles of Soft Computing, S N Sivanandam, S. Sumathi, John Wiley & Sons

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4. Genetic Algorithms in search, Optimization & Machine Learning by David E. Goldberg.
5. Neuro-Fuzzy and Soft computing, Jang, Sun, Mizutani, PHI.
6. Neural Networks: A Classroom Approach, 1/e by Kumar Satish, TMH.
7. Genetic Algorithms in search, Optimization & Machine Learning by David E. Goldberg, Pearson/PHI

Course Outcome:	
On completion of the course students will be able to	
PE-CSE 601 D.1	Learn soft computing techniques and their applications.
PE-CSE 601 D.2	Analyse various neural network architectures.
PE-CSE 601 D.3	Define the fuzzy systems.
PE-CSE 601 D.4	Understand the genetic algorithm concepts and their applications.

Mapping of COs with POs and PSOs (Course Articulation Matrix):														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	2	1	2	1	1	2	1	1	1	2	2	2	2
CO2	2	2	2	2	2	-	-	2	2	2	2	3	2	3
CO3	2	2	2	2	2	-	-	2	2	2	2	2	2	3
CO4	2	2	3	3	2	-	-	2	2	2	2	2	2	3
AVG.	1.75	2.00	2.00	2.25	1.75	1.00	2.00	1.75	1.75	1.75	2.00	2.25	2.00	2.75

Course Title: Numerical Methods

Code: OE-CSE 601A

Contact: 3L

Theory: 3 hrs. / Week

Credit Points: 3

Course Objective:	
1.	To understand and analyse errors.
2.	To apply interpolation techniques.
3.	To perform numerical integration.
4.	To solve systems of linear equations
5.	To solve algebraic and differential equations numerically

Pre-Requisite:	
1.	Basic knowledge of differentiation, integration, matrix, and ordinary differential equation.

Unit	Content	Hrs.
1.	Error and interpolation: Truncation and rounding errors, Fixed and floating point arithmetic, Propagation of errors, Different operators and their relations, Newton forward, Newton's backward, Lagrange's and Newton's divided difference Interpolation formula.	12
2.	Numerical integration: Trapezoidal rule, Simpson's 1/3 rule, Expression for corresponding error terms, Weddle's rule.	8
3.	Numerical solution of Algebraic equation: Bisection method, Regula-Falsi method, Newton-Raphson method.	10

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4.	Numerical solution of a System of Linear equations: Gauss elimination method, Matrix inversion method, LU Factorization method, Gauss-Seidel iterative method.	4
5.	Numerical solution of Ordinary differential equation: Euler's method, Runge-Kutta methods, Predictor Corrector methods and Finite Difference method.	8

Text book and Reference books:

1. R.S. Salaria: Computer Oriented Numerical Methods, Khanna Publishing House.
2. Sahajahan Ali Mollah: Numerical Analysis and Computational Procedures.
3. Dutta & Jana: Introductory Numerical Analysis.
4. J.B. Scarborough: Numerical Mathematical Analysis.
5. Jain, Iyengar & Jain: Numerical Methods (Problems and Solution).
6. Balagurusamy: Numerical Methods, Scitech.
7. Baburam: Numerical Methods, Pearson Education.
8. N. Dutta: Computer Programming & Numerical Analysis, Universities Press.

Course Outcomes:	
After completion of the course, the students will be able to	
OE-CSE 601A.1	Apply the concepts of truncation and rounding errors, interpolation techniques, and numerical integration methods to approximate mathematical functions and evaluate definite integrals accurately.
OE-CSE 601A.2	Analyze and solve algebraic and transcendental equations using numerical methods such as Bisection, Regula-Falsi, and Newton-Raphson methods.
OE-CSE 601A.3	Solve systems of linear algebraic equations using direct and iterative numerical techniques including Gauss elimination, LU factorization, matrix inversion, and Gauss-Seidel methods.
OE-CSE 601A.4	Apply numerical techniques such as Euler's method, Runge-Kutta methods, Predictor-Corrector methods, and Finite Difference methods for solving ordinary differential equations.

Mapping of COs with POs and PSOs (Course Articulation Matrix):														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	2	1	-	-	-	-	-	1	3	2	1
CO2	3	3	-	2	1	-	-	-	-	-	1	3	2	1
CO3	3	3	1	2	2	-	-	-	-	-	1	2	3	2
CO4	3	3	2	3	2	-	-	-	-	-	1	2	3	2
AVG.	3.00	2.75	1.5	2.25	1.50	-	-	-	-	-	1.00	2.50	2.50	1.50

Course Title: Human Resource Development and Organizational Behaviour

Code: OE-CSE 601B

Contact: 3L

Theory: 3 hrs. / Week

Credit Points: 3

Course Objective:	
1.	To aid students in understanding human behavior in organizations.
2.	To provide students with a comprehensive exposure to organizational behaviour theories, research and workplace issues.

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3.	To recognize and discuss the different perspectives of working culture in organizations.
4.	To provide an overview of the theories and practices of management in organizational contexts.

Pre-Requisite:

1.	Basic understanding of management principles.
2.	Basic communication and teamwork skills.

Unit.	Content	Hrs.
1.	Organizational Behaviour: Introduction: Importance, Challenges for OB, Organizational Culture.	2
2.	Personality and Attitudes, Perception: Personality Determinants and Traits, Development of Personality, Types of Attitudes Importance, Factors influencing Perception, Link between Perception and Decision Making.	8
3.	Motivation: Theories of Motivation - Maslow's Hierarchy of Needs Theory, McGregor's Theory X & Y, Herzberg's Motivation-Hygiene Theory, Alderfer's ERG Theory, McClelland's Theory of Needs, Vroom's Expectancy Theory.	8
4.	Group Behaviour: Characteristics of Group, Stages of Group Development, Group Decision Making.	8
5.	Communication: Communication Process, Direction of Communication, Barriers to Effective Communication.	6
6.	Leadership: Importance, Theories of Leadership Styles.	4
7.	Conflict Management: Functional and Dysfunctional Conflict, Conflict Process, Negotiation Process.	4

Text books and Reference books:

1. Organizational Behaviour – Robbins, S.P., Judge, T.A. & Vohra, N., Pearson.
2. A textbook of Organizational Behaviour – Prasad, L.M. Sultan Chand & Sons.
3. Management and Organizational Behaviour – Mullins, L.J. & Christy, G., Pearson.
4. Organizational Behaviour – McShane, S.L., Glinow, M.A.V. & Rai, H., McGraw Hill.
5. Organizational Behavior – Luthans, F. McGraw Hill.

Course Outcomes:

On completion of the course students will be able to	
OE-CSE 601B.1	Analyzing and appreciating the role of individual factors upon decision making in organizations and understanding the effect of motivation in achieving organizational excellence.
OE-CSE 601B.2	Appraising guidelines for applying proper leadership styles on different contexts and analyzing the importance of various types of organization communication as a part of managerial skill development.
OE-CSE 601B.3	Providing conflict resolution strategies for smooth functioning at group level as well as organizational level.
OE-CSE 601B.4	Discussing the effect of organizational culture in developing satisfied and self-motivated internal stakeholders.

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Mapping of COs with POs and PSOs (Course Articulation Matrix):														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	-	-	-	1	-	2	3	3	2	1	3	1	3	3
CO2	-	1	-	-	-	1	3	3	3	1	3	2	3	3
CO3	1	-	-	-	-	1	2	3	2	1	1	1	2	3
CO4	-	-	-	1	-	1	3	3	2	2	1	1	3	3
AVG.	1.00	1.00	-	1.00	-	1.25	2.75	3.00	2.25	1.25	2.00	1.25	2.75	3.00

Course Title: Soft Skill & Interpersonal Communication

Code: OE-CSE 601C

Contact: 3L

Theory: 3 hrs. / Week

Credit Points: 3

Course Objective:

1.	To improve the communication skills to enrich personality development, Computing skills of the students.
2.	To enhance the employability of the students. The courses will help to bridge the gap between the skill requirements of the employer or industry and the competency of the students.

Pre-Requisite:

1.	Basic knowledge in communication and a good understanding of English.
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Unit	Content	Hrs.
1.	Foundations of Soft Skills and Interpersonal Communication: Meaning, significance and development of soft skills; principles of effective interpersonal communication; barriers to communication and strategies to overcome them; active listening and its types; non-verbal communication—forms and elements; corporate communication styles—assertion, persuasion and negotiation; emotional intelligence in communication.	10
2.	Self-Development and Motivation: SWOT analysis for self-awareness; positive thinking and management of negative thoughts; goal setting—short-term, long-term and SMART goals; motivation—meaning, Maslow's Hierarchy of Needs, Herzberg's, Two-factor Theory, Vroom's Expectancy theory; intrinsic and extrinsic motivation; building self-confidence, self-esteem and adaptability.	10
3.	Professional Communication and Employability Skills: Professional writing—emails, letters, notice, agenda, minutes, memo; public speaking—methods and strategies; group discussion—planning, participation, disagreement and summarising; interview skills—preparation, performance	12

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	and follow-up; presentation skills—content development, audience analysis and managing nervousness; resume and cover-letter writing; personal branding and professional networking.	
4.	Workplace Etiquette and Teamwork: Workplace etiquette—email, telephone, digital and cross-cultural etiquette; time management and punctuality; team formation, team roles, and effective teamwork; leadership—meaning, styles, and qualities; workplace conflict management and negotiation; stress management and work-life balance.	10

Text books and Reference books:

1. Bhatnagar, Nitin. Effective Communication and Soft Skills. Pearson Education India, 2011.
2. Dhanavel, S. P. English and Soft Skills. Orient Blackswan, 2010.
3. Ghosh, B. N., editor. Managing Soft Skills for Personality Development. McGraw Hill India, 2012.
4. Kumar, Kulbhushan. Effective Business Communication. Khanna Publishing House, 2021.

Course Outcomes:	
After completion of course, students would be able to:	
OE-CSE 601C.1	Apply effective interpersonal and corporate communication skills.
OE-CSE 601C.2	Analyse self-development needs and set SMART goals.
OE-CSE 601C.3	Demonstrate professional communication and employability skills.
OE-CSE 601C.4	Implement workplace etiquette, teamwork, leadership and conflict-management strategies.

Mapping of Cos with Pos and PSOs (Course Articulation Matrix):														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	1	-	-	1	2	1	2	3	1	2	2	1	1
CO2	-	2	1	1	-	1	-	1	1	2	3	3	3	2
CO3	1	-	-	-	2	2	1	2	3	2	2	3	3	1
CO4	-	2	2	1	-	2	3	3	3	3	2	3	3	3
AVG.	1.00	1.67	1.50	1.00	1.50	1.75	1.67	2.00	2.50	2.00	2.25	2.75	2.50	1.75

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Course Title: Aptitude and Professional Skills for Industry readiness

Code: VAC-CSE 601

Contact: 3L

Theory: 3 hrs. /Week

Credit point: 3

Course Objective:

1	Develop Quantitative and Logical Aptitude: Strengthen students' abilities in numerical reasoning, data interpretation, and problem-solving to enhance analytical thinking.
2	Enhance Verbal and Communication Skills: Improve proficiency in verbal aptitude, vocabulary, grammar, and effective communication for professional and academic settings.
3	Build Professional and Interpersonal Competence: Cultivate soft skills such as teamwork, leadership, adaptability, time management, and workplace etiquette essential for career success.
4	Prepare for Industry and Campus Recruitment: Familiarize students with placement test patterns, interview techniques, and group discussions to boost employability and confidence.
5	Encourage a Growth Mindset and Professional Ethics: Promote self-awareness, continuous learning, and ethical behavior in professional life.

Pre-Requisite:

1.	Basic Mathematical Knowledge.
2.	Analytical and Logical Thinking Skills.
3.	English Language Proficiency.

Unit	Content	Hrs.
1.	Quantitative Aptitude: Arithmetic: Number System, LCM & HCF, Divisibility Rules, Simplification & Approximation, Ratio & Proportion Percentage, Profit, Loss & Discount, Simple Interest & Compound Interest, Averages Mixtures & Alligations, Time, Speed & Distance, Time & Work, Pipes & Cisterns Boats & Streams, Problems on Ages Partnership. Algebra: Linear Equations, Quadratic Equations, Inequalities, Sequences & Progressions (AP, GP, HP). Geometry & Mensuration: Lines, Angles & Triangles, Circles & Polygons, Coordinate Geometry (basic level), Areas, Volumes & Perimeters. Modern Mathematics: Permutations & Combinations, Probability, Set Theory, Statistics, Mean, median, mode, Standard deviation, variance.	10
2.	Logical Reasoning / Analytical Ability: Verbal Reasoning: Logical Deduction, Statement-Assumption, Statement-Conclusion, Cause & Effect, Arguments & Inferences. Non-Verbal Reasoning: Series & Pattern Completion, Analogy Classification, Mirror & Water Images, Paper Folding & Cutting, Embedded Figures, Figure Matrix.	12
3.	Verbal Ability / English Language: Vocabulary: Synonyms & Antonyms, One Word Substitution, Idioms & Phrases, Spelling Correction. Grammar: Spotting Errors, Sentence Correction, Fill in the Blanks (with grammar	10

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	rules), Active & Passive Voice, Direct & Indirect Speech. Reading Comprehension: Passage-based questions, Theme identification Inference-based questions, Paragraph completion, Critical reasoning. Sentence Completion/Rearrangement: Sentence Completion, Para Jumbles (Rearranging sentences to form a paragraph).	
4.	Data Interpretation (DI): Graphical Data: Bar graphs, Line charts, Pie charts, Mixed graphs. Tabular Data: Data tables, Caselets, Missing data interpretation. Advanced DI: Probability-based DI, Venn diagrams, Scatter plots, Radar charts.	10

Text books and Reference books:

1. R.S. Aggarwal, Quantitative Aptitude for Competitive Examinations, S. Chand Publications, Latest Edition.
2. R.S. Aggarwal, A Modern Approach to Verbal and Non-Verbal Reasoning, S. Chand Publications, Latest Edition.
3. Arun Sharma, How to Prepare for Quantitative Aptitude for the CAT, McGraw Hill Education, Latest Edition.

Course Outcome:	
On completion of the course students will be able to	
VAC-CSE 601.1	Apply basic mathematical concepts to solve quantitative aptitude problems involving arithmetic, algebra, geometry, and data interpretation relevant to placement examinations.
VAC-CSE 601.2	Analyze and solve logical reasoning and analytical problems using systematic and critical thinking approaches.
VAC-CSE 601.3	Demonstrate proficiency in verbal ability including grammar, vocabulary, comprehension, and sentence correction as required in competitive exams and interviews.
VAC-CSE 601.4	Develop effective problem-solving speed and accuracy through practice and application of shortcut methods and logical techniques.

Mapping of Cos with Pos and PSOs (Course Articulation Matrix):														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	3	1	-	-	2	2	-	2	2	1	1
CO2	2	2	1	2	-	-	-	2	2	-	3	3	3	2
CO3	1	2	1	2	-	-	-	3	2	-	2	3	3	1
CO4	2	1	1	1	-	-	-	2	1	-	2	3	3	3
AVG.	2.00	1.75	1.25	2.00	1.00	-	-	2.25	1.75	-	2.25	2.75	2.50	1.75

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Course Title: Cloud Computing Lab

Code: PC CSE 691

Contacts: 4P

Practical: 4 hrs. / Week

Credit Points: 2

Course Objective:	
1.	Understand the fundamentals of cloud computing, including key concepts, architectures, deployment models, and service models.
2.	Gain hands-on experience with virtualization technologies and manage virtual environments effectively.
3.	Deploy and manage cloud-based applications using various platforms, including Google App Engine and OpenStack.
4.	Implement and simulate cloud resource management and big data processing using CloudSim and Hadoop.

Pre-Requisite:	
1.	Distributed computing, Computer Networks, knowledge of programming languages.

Unit	Content	Hrs.
1.	Introduction to Virtualization and Development Environment Install VirtualBox/VMware Workstation: Set up VirtualBox or VMware Workstation on Windows, Install different flavours of Linux (e.g., Ubuntu) or Windows OS as virtual machines. Install and Use a C Compiler: Install a C compiler (e.g., GCC) in the virtual machine, Compile and execute simple C programs.	16
2.	Cloud Application Deployment Google App Engine (GAE) Setup: Install Google Cloud SDK and set up Google App Engine, Create and deploy a basic "Hello World" application using Python or Java. Using GAE Launcher: Use the GAE Launcher to deploy and manage web applications.	12
3.	Cloud Simulation and Resource Management CloudSim Simulation: Install and configure CloudSim for cloud resource simulation, Create and run a simulation scenario, including implementing and testing a custom scheduling algorithm. File Transfer Between VMs: Find and apply procedures for transferring files between virtual machines, Demonstrate file transfer using tools like SCP or shared folders.	16
4.	OpenStack and Big Data Processing Using TryStack for OpenStack: Access TryStack (online OpenStack demo) and launch virtual machines. Perform basic VM management tasks such as starting, stopping, and configuring VMs. Hadoop Single Node Cluster: Install and configure a single-node Hadoop cluster. Run basic MapReduce jobs (e.g., WordCount) and analyze results.	12

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List of Experiments:

1. Install VirtualBox/VMware Workstation with Linux or Windows OS
 - Objective: Set up and configure virtual machines.
 - Tasks: Install VirtualBox/VMware, create virtual machines, and configure networking.
2. Install a C Compiler in the Virtual Machine and Execute Simple Programs
 - Objective: Set up a development environment in a VM.
 - Tasks: Install GCC/MinGW, write, compile, and run simple C programs.
3. Install Google App Engine and Create a Hello World App Using Python/Java
 - Objective: Deploy a basic application on Google App Engine.
 - Tasks: Install Google Cloud SDK, set up a GAE project, and deploy a simple application.
4. Use GAE Launcher to Launch and Manage Web Applications
 - Objective: Manage web applications using GAE Launcher.
 - Tasks: Deploy, test, and debug applications on GAE.
5. Simulate a Cloud Scenario Using CloudSim
 - Objective: Understand cloud resource management and scheduling.
 - Tasks: Install CloudSim, create simulation scenarios, and test custom scheduling algorithms.
6. Find Procedure to Transfer Files Between Virtual Machines
 - Objective: Learn file transfer techniques.
 - Tasks: Transfer files between VMs using SCP or shared folders.
7. Find Procedure to Launch Virtual Machines Using TryStack (OpenStack Demo)
 - Objective: Use OpenStack for VM management.
 - Tasks: Access TryStack, launch VMs, and perform basic management tasks.
8. Install Hadoop Single Node Cluster and Run Simple Applications Like WordCount
 - Objective: Set up Hadoop and execute MapReduce jobs.
 - Tasks: Install Hadoop, configure a single-node cluster, and run basic MapReduce jobs.
9. Host a Website Using GitHub Pages, Netlify, or Render
 - Objective: Deploy and manage a website on a cloud platform.
 - Tasks: Create and host a static website using GitHub Pages, Netlify, or Render; configure domain and deployment settings.
10. Explore AWS Cloud Services ***
 - Objective: Gain familiarity with AWS cloud services.
 - Tasks: Create an AWS account, explore AWS Management Console, and perform basic tasks such as launching EC2 instances and using S3 for storage.

(Detailed instructions for Laboratory Manual to be followed for further guidance)

Course Outcome:	
On completion of the course students will be able	
PC-CSE 691.1	Demonstrate a comprehensive understanding of cloud computing fundamentals, including cloud architecture, deployment, and service models.
PC-CSE 691.2	Set up and manage virtual machines using virtualization tools like

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	VirtualBox and VMware, and effectively manage development environments within these VMs.
PC-CSE 691.3	Deploy and manage web applications using cloud platforms such as Google App Engine and OpenStack, and handle file transfers and networking within virtual environments.
PC-CSE 691.4	Gain practical insights into cloud resource management and data processing.

Mapping of COs with POs and PSOs (Course Articulation Matrix):														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	1	3	1	1	3	1	2	1	3	2	2
CO2	3	2	3	2	3	1	1	2	2	2	2	3	3	3
CO3	3	2	2	3	3	1	1	2	1	2	1	3	2	2
CO4	3	2	3	1	3	1	1	2	1	2	1	3	3	2
AVG.	3.00	2.00	2.50	1.75	3.00	1.00	1.00	2.25	1.25	2.00	1.25	3.00	2.50	2.25

Course Title: Computer Networks Lab

Code: PC-CSE 692

Contacts: 4P

Practical: 4 hrs. / Week

Credit Points: 2

Course Objective:	
1.	To understand the working principle of communication system and various communication protocols.
2.	To analyze the various routing algorithms.
3.	To know the concept of data transfer between nodes.

Pre-Requisite:	
1.	Basic knowledge of C programming.
2.	Basic understanding of computer algorithms.

Laboratory Experiments:		Hrs.
1.	Familiarization with - Networking cables (CAT5, UTP) - Connectors (RJ45, T-connector) - Hubs, Switches Understanding IP address, subnet etc.	8
2.	Implement Interprocess communication using Message Queue.	4
3.	Design TCP client and server applications using socket programming.	8
4.	Design UDP client and server applications using socket programming.	4
5.	Implement the flow control protocols i.e., Stop and wait, Go back-N, selective repeat ARQ protocols.	8
6.	Configuration and logging to a CISCO Router and introduction to the basic user Interfaces. Introduction to the basic router configuration and basic commands (using CISCO Packet Tracer).	8

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7.	Configuration of IP addressing for a given scenario for a given set of topologies (using CISCO Packet Tracer).	8
8.	Implement cryptographic algorithms RSA and DES for performing encryption and decryption.	8

(Detailed instructions for Laboratory Manual to be followed for further guidance)

Text books and Reference books:

1. Unix Network Programming, Volume 1: The Sockets Networking API, 3rd Edition (2003), by W. Richard Stevens et al.
2. UNIX Network Programming, W. Richard Stevens, Bill Fenner, Andrew M. Rudoff, Third Edition, Pearson Education, 2015.
3. UNIX Systems Programming using C++, T Chan, First Edition, Pearson, 2015.
4. W. Richard Stevens, TCP/IP Illustrated, Volume 1: The Protocols, Addison-Wesley, 1994.
5. CCNA Command Quick Reference (Cisco Networking Academy Program) By Scott D. Empson Published Apr 7, 2005 by Cisco Press. Cryptography and Network.
6. Security – by Atul Kahate – TMH.
7. William Stallings, Cryptography and Network Security: Principles and Practice, PHI 3rd Edition, 2006.
8. Behrouz A. Foruzan, Cryptography and Network Security, Tata McGraw Hill 2007.

Course Outcomes:	
On completion of the course students will be able to	
PC-CSE 692.1	Understand the use of various networking components as well as transmission media and cables for establishing a network.
PC-CSE 692.2	Apply any topology using network devices.
PC-CSE 692.3	Analyze performance of various communication protocols.
PC-CSE 692.4	Evaluate various routing algorithms.

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	-	-	2	2	-	2	2	2	-
CO2	2	3	2	2	2	-	-	2	-	-	2	2	2	-
CO3	2	2	3	2	3	-	-	2	-	-	2	2	3	3
CO4	2	2	-	2	-	-	-	-	-	-	2	-	-	-
AVG.	2.25	2.50	2.33	2.00	2.33	-	-	2.00	2.00	-	2.00	2.00	2.33	3.00

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Course Title: Software Engineering Lab

Code: ES-CSE 691

Contacts: 4P

Practical: 4 hrs. / Week

Credit Points: 2

Course Objective:	
1.	To develop a broad understanding of the discipline of software engineering and SDLC models.
2.	To provide detailed knowledge of the system analysis, design concepts, testing and maintenance approaches.
3.	To identify project scope and objectives and aim to develop the prototype of the real life problems.

Pre-Requisite:	
1.	Programming knowledge.

Laboratory Experiments:		Hrs.
1.	Problem Analysis and Project Planning: Thorough study of the problem – Identify Project scope, Objectives and Infrastructure.	12
2.	Software Requirement Analysis: Describe the individual Phases/modules of the project and Identify deliverables. Identify functional and non-functional requirements.	8
3.	Data Modelling: Use work products, DFD models (level-0 and level-1), data dictionary.	8
4.	Software Designing: Develop use case diagrams and activity diagrams, build class Diagrams, sequence diagrams and add interface to class diagrams.	12
5.	Software Testing: Develop test cases and test suits for various testing techniques.	8
6.	Prototype model: Develop the prototype of the small and real life problems.	8

(Detailed instructions for Laboratory Manual to be followed for further guidance)

Text books and Reference books:

1. Pressman, Software Engineering: A practitioner's approach– (TMH)
2. Pankaj Jalote, Software Engineering- (Wiley-India)
3. Rajib Mall, Software Engineering- (PHI)

Course Outcomes:	
On completion of the course students will be able to	
ES-CSE 691.1	Analyzing customer requirements and creating standard SRS document.
ES-CSE 691.2	Creating various design diagrams using modern tools.
ES-CSE 691.3	Applying testing guidelines to design different test cases and test suites.
ES-CSE 691.4	Evaluating the prototype of the small and real life problems.

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Mapping of COs with POs and PSOs (Course Articulation Matrix):														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	3	2	2	3	2	3	3	3	3	2	2
CO2	3	3	2	2	3	-	1	2	3	3	2	3	3	2
CO3	3	3	3	2	3	-	1	3	2	2	2	3	2	2
CO4	3	2	2	-	2	2	3	3	3	3	3	3	3	3
AVG.	3.00	2.75	2.25	2.33	2.50	2.00	2.00	2.50	2.75	2.75	2.50	3.00	2.50	2.25



Curriculum for B. Tech Courses in Computer Science and Engineering
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Curriculum Structure
Fourth Year - Seventh Semester

Course Title: Pattern Recognition

Code: PE-CSE 702A

Contact: 3L

Theory: 3 hrs. / Week

Credit Points: 3

Course Objective:

1.	Study the fundamental algorithms for pattern recognition.
2.	To instigate the various classification techniques.
3.	To originate the various structural pattern recognition and feature extraction techniques.

Pre-Requisite:

1.	Statistics and Probability Theory.
2.	Differential Equations, ordinary and partial.
3.	Analytical Geometry and Linear Algebra.
4.	Differential and Integral Calculus.

Unit	Content	Hrs.
1.	Introduction: Fundamental concepts and blocks of a typical pattern recognition system. Decision functions- role and types, pattern and weight space, properties and implementation of decision functions.	6
2.	Feature identification, selection and extraction: Distance measures, clustering transformation and feature ordering, clustering in feature selection, feature selection through maximization and approximations.	10
3.	Pattern classification by distance functions: Clusters and cluster seeking algorithms. Pattern classification by likelihood functions. Baye's classifier and performance measures.	9
4.	Artificial Neural Network model: Neural network-based pattern associators, Feed forward networks and training by back-propagation- ART networks.	9
5.	Applications of Statistical and Neural network – based pattern classifiers in speech recognition, image recognition and target recognition.	3
6.	Miscellaneous Topics: Hidden Markov Models (HMMs), Support Vector Machines (SVMs).	5

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Text books and Reference books:

1. J.I. Tou & R.C. Gonzalez, Pattern Recognition Principles, Addison-Wesley.
2. R. Schalkoff, Pattern Recognition - Statistical, Structural and Neural Approaches, John Wiley, 1992.
3. R. O. Duda, P. E. Hart and D. G. Stork: Pattern Classification, John Wiley, 2001.
4. S. Theodoridis and K. Koutroumbas, Pattern Recognition, 4th Ed., Academic Press, 2009.
5. C. M. Bishop, Pattern Recognition and Machine Learning, Springer, 2006.
6. Friedman and Kandel, Introduction to Pattern Recognition: Statistical, Structural, Neural and Fuzzy Logic Approaches, World Scientific, 1999.

Course Outcomes:	
On completion of the course students will be able to	
PE-CSE 702A.1	Understand the various techniques involved in pattern recognition.
PE-CSE 702A.2	Apply the various pattern recognition techniques into supervised and unsupervised learning applications.
PE-CSE 702A.3	Analyse artificial neural network based pattern recognition tasks.
PE-CSE 702A.4	Evaluate the applications of pattern recognition in various applications.

Mapping of COs with POs and PSOs (Course Articulation Matrix):														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	-	2	-	-	-	-	-	-	1	2	-
CO2	2	3	-	-	2	-	-	-	-	-	-	2	2	-
CO3	2	-	3	-	2	-	-	-	-	-	-	1	2	-
CO4	-	3	-	2	2	-	-	-	-	-	-	1	2	-
AVG.	2.33	3.00	2.50	2.00	2.00	-	-	-	-	-	-	1.25	2.00	-

Course Title: Cryptography and Network Security

Code: PE-CSE 702B

Contact: 3L

Theory: 3 hrs. / Week

Credit Points: 3

Course Objective:	
1.	To understand basics of Cryptography and Network Security.
2.	To be able to secure a message over insecure channel by various means.
3.	To learn about how to maintain the Confidentiality, Integrity and Availability of a data.
4.	To understand various protocols for network security to protect against the threats in the networks.

Pre-Requisite:	
1.	Computer Network and Telecommunication.

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Unit	Content	Hrs.
1.	Attacks on Computers & Computer Security: Introduction, Need for Security, Security approaches, Principles of Security, Types of attack. Cryptography: Concepts & Techniques Introduction, Plaintext & Cipher text, Substitution Techniques, Transposition Techniques, Encryption & Decryption, and Symmetric & Asymmetric key Cryptography, Key Range & Key Size.	12
2.	Symmetric Key Algorithm: Introduction, Algorithm types & Modes, Overview of Symmetric Key Cryptography, DES (Data Encryption Standard) algorithm. Asymmetric Key Algorithm: Digital Signature and RSA - Introduction, Overview of Asymmetric key Cryptography, RSA algorithm, Symmetric & Asymmetric key Cryptography together, Digital Signature, Basic concepts of Message Digest and Hash Function (Algorithms on Message Digest and Hash function not required).	12
3.	Internet Security Protocols, User Authentication: Basic Concepts, SSL protocol, Authentication Basics, Password, Authentication Token, and Certificate based Authentication, Biometric Authentication.	10
4.	Electronic Mail Security: Basics of mail security, Pretty Good Privacy, S/MIME. Firewall - Introduction, Types of firewall, Firewall Configurations, DMZ Network.	8

Text books:

1. "Cryptography and Network Security", William Stallings, 2nd Edition, Pearson Education Asia.
2. "Cryptography and Network Security" by V.K. Jain, Khanna Publishing House.
3. "Network Security private communication in a public world", C. Kaufman, R. Perlman and M. Speciner, Pearson.
4. Cryptography & Network Security: AtulKahate, TMH.

Reference Books:

1. W. Mao, "Modern Cryptography – Theory and Practice", Pearson Education.
2. Charles P. Pfleeger, Shari Lawrence Pfleeger – Security in computing – Prentice Hall of India.

Course Outcome:

On completion of the course students will be able to

PE-CSE 702B.1	Understand the basic concepts of data and system level security.
PE-CSE 702B.2	Illustrate various Public key and private key cryptographic techniques
PE-CSE 702B.3	Evaluate the authentication and hash algorithms.
PE-CSE 702B.4	Summarize the intrusion detection and its solutions to overcome the attacks.

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	-	-	3	-	-	-	-	-	2	2	3	2
CO2	3	3	-	3	2	-	-	-	-	2	-	3	3	2
CO3	3	3	-	3	2	-	-	-	-	-	-	3	3	2
CO4	3	2	3	2	-	-	-	-	-	-	-	3	2	1
AVG.	3.00	2.75	3.00	2.67	2.33	-	-	-	-	2.00	2.00	2.75	2.75	1.75

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Course Title: Speech and Natural Language Processing

Code: PE-CSE 702C

Contacts: 3L

Theory: 3 hrs. / Week

Credit Points: 3

Course Objective:	
1.	To understand the algorithms available for the processing of linguistic information and computational properties of natural languages.
2.	To conceive basic knowledge on various morphological, syntactic and semantic NLP tasks.
3.	To familiarize various NLP software libraries and data sets publicly available.
4.	To develop systems for various NLP problems with moderate complexity.
5.	To learn various strategies for NLP system evaluation and error analysis.

Pre-Requisite:	
1.	Concepts of Automata Theory.

Unit	Content	Hrs.
1.	NLP – introduction and applications, NLP phases, Difficulty of NLP including ambiguity; Spelling error and Noisy Channel Model; Concepts of Parts-of-speech and Formal Grammar of English .	8
2.	Language Modelling with N-gram, Simple N-gram models, Smoothing (basic techniques), Evaluating language models; Neural Network basics, Training; Neural Language Model, Case study: application of neural language model in NLP system development	9
3.	Parts-of-speech Tagging: basic concepts; Tagset; Early approaches: Rule based and TBL; POS tagging using HMM, Introduction to POS Tagging using Neural Model.	9
4.	Basic concepts: top down and bottom up parsing, treebank; Syntactic parsing: CKY parsing; Statistical Parsing basics: Probabilistic Context Free Grammar (PCFG); Probabilistic CKY Parsing of PCFGs.	8
5.	Vector Semantics; Words and Vector; Measuring Similarity; Semantics with dense vectors; SVD and Latent Semantic Analysis; Embeddings from prediction: Skip-gram and CBOW; Concept of Word Sense; Introduction to WordNet	8

Text books and Reference books:

1. Speech and Language Processing, Jurafsky and Martin, Pearson Education.
2. Foundation of Statistical Natural Language Processing, Manning and Schutze, MIT Press.
3. Multilingual Natural Language Processing Applications from Theory to Practice: Bikel, Pearson.
4. Jurafsky Dan and Martin James H. "Speech and Language Processing" ,3rd Edition, 2018.

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5. Jurafsky D. and Martin J. H., "Speech and language processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition", 2nd Edition, Upper Saddle River, NJ: Prentice-Hall, 2008.
6. Goldberg Yoav "A Primer on Neural Network Models for Natural Language Processing".

Course Outcome:	
On completion of the course students will be able to	
PE-CSE 702C.1	Understand the fundamental concepts and techniques of natural language processing (NLP).
PE-CSE 702C.2	Applying the different approaches to discourse, generation, dialogue and summarization within NLP.
PE-CSE 702C.3	Evaluating current methods for statistical approaches to machine translation.
PE-CSE 702C.4	Creating the computational properties of natural languages and the commonly used algorithms for processing linguistic information.

Mapping of COs with POs and PSOs (Course Articulation Matrix):														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	1	-	-	-	1	1	-	-	-	1	1	1	-
CO2	2	2	1	2	1	-	-	1	2	-	1	1	3	2
CO3	2	2	2	2	2	1	1	2	-	1	2	2	1	1
CO4	2	1	2	2	2	2	-	-	3	2	2	1	1	1
AVG.	1.75	1.50	1.67	2.00	1.67	1.33	1.00	1.50	2.50	1.50	1.50	1.25	1.50	1.33

Course Title: Internet of Things

Code: PE-CSE 702D

Contacts: 3L

Theory: 3 hrs. / Week

Credit Points: 3

Course Objective:	
1.	Able to understand the basic concept of IoT & IoT enabled technologies.
2.	Able to realize the revolution of Internet in various Things (Devices), Cloud & Sensor Networks.
3.	Able to understand building blocks of Internet of Things and characteristics.
4.	Able to develop mini project with IoT enabled devices and technologies with data handling techniques.

Pre-Requisite:	
1.	Computer network, Wireless Networks, SQL.

Unit	Content	Hrs.
1.	INTRODUCTION TO IOT: Introduction to IoT, History of IoT, About Things in IoT, Characteristics of IoT, Architectures of IoT, Physical design of IoT, Logical design of IoT, Communication models & APIs, IoT & M2M Machine to Machine, Difference between IoT and	6

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	M2M, Software define Network, Challenges in IoT(Design ,Development, Security), Enabling Technologies in IoT (Wireless Sensor Networks, Cloud Computing, Embedded Systems)	
2.	SENSORS: Definition, Types of Sensors (Light sensor, temperature sensor, voltage sensor, Temperature and Humidity Sensor DHT11, Motion Detection Sensors, Wireless Bluetooth Sensors, USB Sensors, Embedded Sensors, Distance Measurement with ultrasound Sensor), Types of Actuators. IoT DEVELOPMENT BOARDS: Arduino IDE and Board Types, RaspberriPi Development Kit, RFID Principles and components, WORKING PROGRAMMING: Python program with Raspberry PI with focus on interfacing external gadgets, controlling output, reading input from pins	10
3.	CONNECTIVITY AND COMMUNICATION PROTOCOLS: IEEE 802.15.4, Zigbee, HART, NFC, Z-Wave, BLE, BACnet, Modbus. IP Based Protocols for IoT IPv6, 6LowPAN, RPL, REST, AMPQ, CoAP, MQTT. Edge connectivity and protocols	11
4.	DATA HANDLING & ANALYTICS: Introduction, Bigdata, Types of data, Characteristics of Big data, Data handling Technologies, IoT data analytics overview, IoT data analytics challenges. Machine Learning: Machine Learning overview, Predictive analytics. Big data analytics tools and technology: Massively parallel processing databases, NoSQL databases, HADOOP.	9
5.	APPLICATION OF IoT: Home Automation, Smart Cities, Energy, Retail Management, Agriculture, Health and Lifestyle, Industrial IoT, Legal challenges, IoT design Ethics, IoT in Environmental Protection.	6

Text Books

1. Internet of Things – A Hands-on Approach, Arshdeep Bahga and Vijay Madiseti, Universities Press, 2015, ISBN: 9788173719547
2. Getting Started with Raspberry Pi, Matt Richardson and Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759
3. Hakima Chaouchi, — “The Internet of Things Connecting Objects to the Web” ISBN : 978-1- 84821-140-7, Wiley Publications
4. Olivier Hersent, David Boswarthick, and Omar Elloumi, — “The Internet of Things: Key Applications and Protocols”, WileyPublications
5. Vijay Madiseti and ArshdeepBahga, — “Internet of Things (A Hands-on-Approach)”, 1st Edition, VPT, 2014. 4. J. Biron and J. Follett, "Foundational Elements of an IoT Solution", O'Reilly Media, 2016.
6. Keysight Technologies, “The Internet of Things: Enabling Technologies and Solutions for Design and Test”, Application Note, 2016.

Course Outcomes:	
On completion of the course the student should be able to	
PE-CSE 702D.1	To understand the fundamental concept of IOT and IoT enabled technologies with respect to sensors.
PE-CSE 702D.2	To learn development boards with various components and high-level programming.

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PE-CSE 702D.3	To analyze various protocols and data handling techniques in IoT.
PE-CSE 702D.4	To apply knowledge in various smart projects for society betterment maintaining values & ethics.

Mapping of COs with POs and PSOs (Course Articulation Matrix):														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	-	2	2	1	-	1	1	3	3	1	1
CO2	3	2	3	1	3	2	2	2	1	1	3	3	2	2
CO3	3	2	3	3	3	2	-	2	2	2	3	3	3	3
CO4	3	3	3	3	3	3	3	2	2	3	3	3	3	3
AVG.	3.00	2.25	2.50	2.33	2.75	2.25	2.00	2.00	1.50	1.75	3.00	3.00	2.25	2.25

Course Title: Industry Internship

Code: EE-CSE 771

Contact:

Credit Points: 3

Industry Internship
OBJECTIVES Internships are educational and career development opportunities, providing practical experience in a field or discipline. They are structured, short-term, supervised placements often focused around particular tasks or projects with defined timescales. An internship may be compensated, non-compensated or some time may be paid. The internship has to be meaningful and mutually beneficial to the intern and the organization. It is important that the objectives and the activities of the internship program are clearly defined and understood. Following are the intended objectives of internship training: • Will expose Technical students to the industrial environment, which cannot be simulated in the classroom and hence creating competent professionals for the industry. • Provide possible opportunities to learn understand and sharpen the real time technical / managerial skills required at the job. • Exposure to the current technological developments relevant to the subject area of training. • Experience gained from the 'Industrial Internship' in classroom will be used in classroom discussions. • Create conditions conducive to quest for knowledge and its applicability on the job. • Learn to apply the Technical knowledge in real industrial situations. • Gain experience in writing Technical reports/projects. • Expose students to the engineer's responsibilities and ethics. • Familiarize with various materials, processes, products and their applications along with relevant aspects of quality control. • Promote academic, professional and/or personal development. • Expose the students to future employers. • Understand the social, economic and administrative considerations that influence the working environment of industrial organizations

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- Understand the psychology of the workers and their habits, attitudes and approach to problem solving.

INTERNSHIP GUIDELINES:

The T&P cell will arrange internship for students in industries/organization after second, fourth and six/seventh semester(s) or as per AICTE/ affiliating University guidelines. The general procedure for arranging internship is given below:

- **Step 1:** Request Letter/ Email from the office of Training & Placement cell of the college should go to industry to allot various slots of 4-6 weeks during summer vacation as internship periods for the students. Students request letter/profile/ interest areas may be submitted to industries for their willingness for providing the training. (Sample attached)
- **Step 2:** Industry will confirm the training slots and the number of seats allocated for internships via Confirmation Letter/ Email. In case the students arrange the training themselves the confirmation letter will be submitted by the students in the office of Training & Placement through concerned department. Based on the number of slots agreed to by the Industry, TPO will allocate the students to the Industry. In addition, the internship slots may be conveyed through Telephonic or Written Communication (by Fax, Email, etc.) by the TPO or other members of the T&P cell / Faculty members who are particularly looking after the Final/Summer Internship of the students.
- **Step 3:** Students on joining Training at the concerned Industry / Organization, submit the Joining Report/ Letters / Email.
- **Step 4:** Students undergo industrial training at the concerned Industry / Organization. In-between Faculty Member(s) evaluate(s) the performance of students once/twice by visiting the Industry/Organization and Evaluation Report of the students is submitted in department office/TPO with the consent of Industry persons/ Trainers. (Sample Attached)
- **Step 5:** Students will submit training report after completion of internship.
- **Step 6:** Training Certificate to be obtained from industry.
- **Step 7:** List of students who have completed their internship successfully will be issued by Training and Placement Cell.

Course Outcomes:

On completion of the course students will be able to

EE-CSE 771.1	To construct the company profile by compiling the brief history, management structure, products / services offered, key achievements and market performance as well as to assess its Strengths, Weaknesses, Opportunities and Threats (SWOT), and demonstrate awareness of documentation, and professional reporting requirements toward promoting academic, professional and/or personal development for his / her organization of internship.
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EE-CSE 771.2	To determine the technological/managerial challenges along with social and economic considerations for his / her internship organization, and evaluate industrial practices to develop industry readiness .
EE-CSE 771.3	To test the theoretical learning in practical situations by accomplishing the tasks assigned during the internship period and to analyze the functioning of internship organization to recommend changes for organizational betterment as well as to enhance professional competence, employability, preparedness for higher studies and research .
EE-CSE 771.4	To apply various soft skills such as time management, positive attitude and communication skills along with prompt technical knowledge during performance of the tasks assigned in internship organization compliance with organizational requirements , and readiness for industrial careers and lifelong learning.

Mapping of COs with POs and PSOs (Course Articulation Matrix):														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	-	-	2	-	2	-	-
CO2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	3	3	3	-	2	2	3	3	3	3	3	3
CO4	-	-	2	-	2	2	-	-	-	-	-	-	-	2
AVG.	3.00	3.00	2.50	3.00	2.50	2.00	2.00	2.00	3.00	2.50	3.00	2.50	3.00	2.50

Course Title: Project-I

Code: EE- CSE 781

Contact: 12P

Credit Points: 6

Project Work I

Objective :The objective of Project Work I is to enable the student to take up investigative study in the broad field of Computer Science & Engineering, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an individual basis or two/three students in a group, under the guidance of a Supervisor. This is expected to provide a good initiation for the student(s) in R&D work. The assignment to normally include:

1. Survey and study of published literature/existing application on the assigned topic.
2. Working out a preliminary approach to the problem relating to the assigned topic.
3. Conducting preliminary Analysis/Modelling/Simulation/Experiment/Design/ Feasibility.
4. Preparing a written report on the study conducted for presentation to the department.
5. Final Seminar, Presentation before a departmental faculty panel.
6. The evaluation of the Project Work I will be done as per the procedure suggested by the department.

Course Outcome:

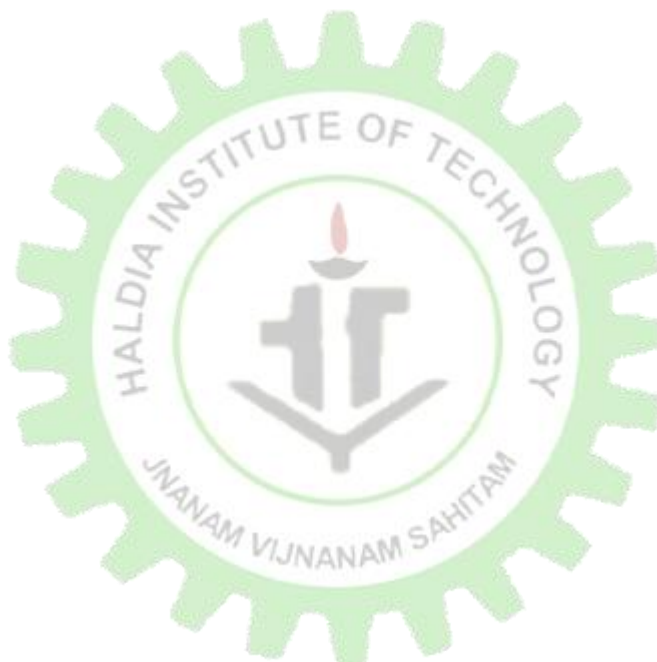
On completion of the course students will be able to

EE-CSE 781.1	Understanding the literature; Identify and classify the requirements for the solution of complex engineering problems.
EE-CSE	Applying proper solution, architecture, module level designs, algorithms by

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781.2	proper analysis and interpretation.
EE-CSE 781.3	Evaluating project metrics like size, effort and cost, reliability and quality, etc and plan project development schedule.
EE-CSE 781.4	Creating technical documentation, presentation, and discussions as a group to share knowledge to justify the work.

Mapping of COs with POs and PSOs (Course Articulation Matrix):														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	-	-	2	-	-	-	3	-	-
CO2	3	3	2	2	-	-	-	3	1	-	-	3	2	2
CO3	-	-	2	2	1	-	-	3	2	1	1	2	3	-
CO4	-	-	-	1	-	-	-	3	-	-	-	-	-	2
AVG.	3.00	3.00	2.00	1.67	1.00	-	-	2.75	1.50	1.00	1.00	2.67	2.50	2.00



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Fourth Year - Eighth Semester

Course Title: Big Data Analysis

Code: OE-CSE 801A

Contacts: 3L

Theory: 3 hrs. / Week

Credit Points: 3

Course Objective:

1.	Understand big data for business intelligence. Learn business case studies for big data analytics. Understand no sql big data management. Perform map-reduce analytics using Hadoop and related tools.
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Pre-Requisite:

1.	Programming language to solve real world learning problems and extract knowledge from real datasets.
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Unit	Content	Hrs.
1.	Introduction to Big Data Analytics: Importance and challenges of Big Data. Big Data Ecosystem, Components and architecture, Key players and technologies in Big Data, 3 Vs and more, Big data analytics, Big data applications. Big Data vs. Traditional Data, Differences in processing and analysis, Hadoop & Hadoop EcoSystem, MapReduce, credit risk management, big data and algorithmic trading	8
2.	Data Acquisition and Storage: Structured, semi-structured, and unstructured data and Data generation and collection methods. Distributed file systems (e.g., HDFS), NoSQL databases (e.g., MongoDB, Cassandra), and Cloud storage options, ETL (Extract, Transform, Load) processes, Data pipelines and workflow automation, Insuring data integrity and accuracy, Data privacy and security considerations Hive Architecture, Comparison with Traditional Database, Map Reduce Scripts, HBase concepts, Advanced Usage, Schema Design & Indexing - PIG, Zookeeper	8

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3.	Data Processing Frameworks: Hadoop MapReduce paradigm, Map and Reduce tasks, Job, Task trackers, Algorithms using map reduce, Examples of Map Reduce (Word count problem, Matrix-Vector Multiplication), YARN, Hadoop Cluster Setup & Hadoop Configuration, Hadoop Architecture, HDFS, HDFS Administration: Monitoring & Maintenance, Pig, pig data model, Spark: RDD's in Spark, Data Frames & Spark SQL, Spark Streaming, , MongoDB, NoSQL	10
4.	Machine Learning for Big Data: Machine Learning Algorithms, Machine Learning Tools and Libraries, Training and evaluating models on large datasets, Scalability and performance optimization Real-Time Data Processing: Importance and applications of real-time analytics, Apache Kafka, Apache Flink, and Apache Storm, Designing and implementing real-time data workflows, Industry examples and best practices Big Data	8
5.	Industry Applications & Capstone: Making data comprehensible and actionable, Visualization Tools and Techniques, Building user-friendly and interactive data dashboards, Intersection of data science and big data analytics, Integrating AI techniques with big data analytics, Processing and analyzing IoT-generated data, Retail, Finance, Healthcare, Manufacturing, IoT, Smart Cities, Cybersecurity, ESG analytics, end-to-end capstone project.	8

Text books and References:

1. Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "Big Data, Big Analytics: Emerging.
2. V.K. Jain, Big Data and Hadoop, Khanna Publishing House, New Delhi (2017).
3. V.K. Jain, Data Analysis, Khanna Publishing House, New Delhi (2019).
4. Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
5. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2012.
6. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012.
7. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.
8. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
9. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.
10. Eben Hewitt, "Cassandra: The Definitive Guide", O'Reilley, 2010.
11. Alan Gates, "Programming Pig", O'Reilley, 2011.

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Course Outcomes:	
After completion of course, students would be:	
OE-CSE 801A.1	To understand the Big Data Platform and its Use cases.
OE-CSE 801A.2	To analyse the overview of Apache Hadoop.
OE-CSE 801A.3	To remember HDFS Concepts and it's Interfacing with HDFS and big data management.
OE-CSE 801A.4	To evaluate and learn business case studies for big data analytics and map - reduce analytics using Hadoop and related tools

Mapping of COs with POs and PSOs (Course Articulation Matrix):														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	3	2	2	1	3	2	3	1	3	2	1	1
CO2	3	3	3	2	3	1	1	3	2	2	2	3	2	3
CO3	2	2	2	3	3	-	-	3	1	3	3	2	1	2
CO4	2	3	3	3	3	1	1	3	1	2	1	3	3	3
AVG.	2.25	2.25	2.75	2.50	2.75	1.00	1.67	2.75	1.75	2.00	2.25	2.50	1.75	2.25

Course Title: Cyber Law and Ethics

Code: OE-CSE 801B

Contacts: 3L

Theory: 3 hrs. / Week

Credit Points: 3

Course Objective:	
1.	To introduce the cyber world and cyber law in general.
2.	To explain about the various facets of cyber crimes.
3.	To enhance the understanding of problems arising out of online transactions and provoke them to find solutions.
4.	To clarify the Intellectual Property issues in the cyber space and the growth and development of the law in this regard.

Pre-Requisite:

1.	Fundamental understanding of cybersecurity concepts and digital systems.
2.	Awareness of ethical issues related to technology and information usage.

Unit	Content	Hrs.
1.	Introduction of Cybercrime: What is cybercrime? Types of Cybercrime, Forgery, Hacking, Software Piracy, Computer Network intrusion. Case Studies: Real-world examples of significant cybercrimes. History of Cybercrime: Evolution and notable milestones. Category Cybercrime: of how criminals plan attacks, passive attack, Active attacks, cyberstalking.	10
2.	Cybercrime Mobile & Wireless devices: Security challenges posted by mobile devices, cryptographic security for mobile devices, Attacks on mobile/cellphones, Theft, Virus, Hacking. Bluetooth; Different viruses on laptop	10

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3.	Tools and Methods used in Cybercrime: Proxy servers, pan word checking, Random checking, Trojan Horses and Backdoors; DOS & DDOS attacks; SQL injection: buffer over flow, Advanced Persistent Threats (APTs), Ransomware.	9
4.	Phishing & Identity Theft: Phishing methods, ID Theft; Online identity method, Social Media Exploits, Email Security.	6
5.	Cybercrime & Cybersecurity: Legal aspects, Indian laws, IT act, Public key certificate, Incident Response and Management, Cyber Forensics, Ethical Hacking (Principles, methodologies, and certifications).	7

Text books and Reference books:

1. Cyber security by Nina Gobole&SunitBelapune; Pub: Wiley India.
2. Information Security & Cyber laws by Gupta & Gupta, Khanna Publishing House.
3. Cybersecurity and Cyberwar: What Everyone Needs to Know by P.W. Singer and Allan Friedman.
4. Computer Forensics and Cyber Crime: An Introduction by Marjie T. Britz
5. Cybercrime and Digital Forensics: An Introduction by Thomas J. Holt, Adam M. Bossler, and Kathryn C. Seigfried-Spellar.
6. Introduction to Cyber-Warfare: A Multidisciplinary Approach by Paulo Shakarian, Jana Shakarian, and Andrew Ruef
7. Ransomware: Defending Against Digital Extortion by Allan Liska and Timothy Gallo.
8. Practical Malware Analysis: The Hands-On Guide to Dissecting Malicious Software by Michael Sikorski and Andrew Honig.
9. Hacking Exposed: Network Security Secrets and Solutions by Stuart McClure, Joel Scambray, and George Kurtz.

Course Outcomes:	
After completion of course, students would be:	
OE-CSE 801B.1	Understand and Apply Foundational Concepts in Cyber Law and Ethics
OE-CSE 801B.2	Analyze and Evaluate Legal and Ethical Issues in Information Technology
OE-CSE 801B.3	Apply Web Security Principles and Forensic Tools.
OE-CSE 801B.4	Create Comprehensive Security Plans and Solutions.

Mapping of COs with POs and PSOs (Course Articulation Matrix):														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	1	3	-	-	-	-	-	2	3	2	1
CO2	-	-	-	-	-	3	3	-	1	-	-	2	1	-
CO3	3	3	3	3	3	-	-	-	1	-	2	3	3	2
CO4	3	3	3	3	3	1	3	2	3	3	3	3	3	3
AVG.	3.00	2.67	3.00	2.33	3.00	2.00	3.00	2.00	1.67	3.00	2.33	2.75	2.25	2.00

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Course Title: Mobile Computing

Code: OE-CSE 801C

Contacts: 3L

Theory: 3 hrs. / Week

Credit Points: 3

Course Objective:	
1.	To describe and analyse the network infrastructure requirements to support mobile devices and users.
2.	To illustrate the concepts, techniques, protocols and architecture employed in wireless local area networks, cellular networks, and perform basic requirements analysis.
3.	To apply techniques and current network technologies to the consideration of next generation technologies.

Pre-Requisite:	
1.	Understanding of computer networks.

Unit	Content	Hrs.
1.	Wireless Networks and Mobile Systems: Cellular Mobile Wireless Networks: Systems and Design Fundamentals, Propagation Models.	7
2.	Evolution of Modern Mobile Wireless Communication System: First Generation Wireless Networks, Second Generation (2G) Wireless Cellular Networks, Major 2G standards, 2.5G Wireless Networks, Third Generation 3G Wireless Networks, Wireless Local Area Networks (WLANs), Cellular –WLAN Integration, All IP Network: Vision for 4G.	7
3.	Wireless Energy Management: Measurement of energy consumption, WiFi Power Save Mode (PSM), Constant Awake Mode (CAM), Different Sleep States, WiFi Energy management.	7
4.	Localization: User location and tracking system, Cell tower localization, Spot localization, Logical location, Ambience fingerprinting, War-driving, Localization without war-driving, Indoor localization, Crowd sourcing for localization.	7
5.	Context Sensing: Context-Aware system, Automatic Image Tagging, Safety critical applications (case study: determining driver phone use), Energy-efficient Context Sensing, Contextual Ads and Mobile Apps.	7
6.	Mobility: Overview of Mobility models, Automatic Transit Tracking, Mapping, Arrival Time Prediction, Augmenting Mobile 3G with WiFi, Vehicular WiFi Hotspots, Code Offload, Privacy and Security: Authentication on Mobile Phones, Activity based Password, Finger Taps usage as Fingerprints, Location Privacy.	7

Text books and Reference books:

1. "Pervasive Computing", Burkhardt, Pearson.
2. "Mobile Communication", J. Schiller, Pearson.
3. "Wireless and Mobile Networks Architectures", Yi-Bing Lin & Imrich Chlamtac, John Wiley & Sons, 2001.

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4. "Mobile and Personal Communication systems and services", Raj Pandya, Prentice Hall of India, 2001.
5. "Guide to Designing and Implementing wireless LANs", Mark Ciampa, Thomson learning, Vikas Publishing House, 2001.
6. Smart Phone and Next Generation Mobile Computing (Morgan Kaufmann Series in Networking), Pei Zheng, Lionel Ni.

Course Outcomes:	
After completion of course, students would be:	
OE-CSE 801C.1	Understand basic terminologies of mobile computing, fundamental concepts of mobile programming environment
OE-CSE 801C.2	Apply the components and functioning of mobile networking to develop mobile applications
OE-CSE 801C.3	Analyse the functioning of WLAN for local as well as remote applications.
OE-CSE 801C.4	Evaluate the performance of mobile applications using the concepts of mobility management.

Mapping of COs with POs and PSOs (Course Articulation Matrix):														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	-	-	-	-	-	3	3	2	1
CO2	3	3	2	2	2	-	-	-	-	-	3	3	2	1
CO3	3	1	2	2	2	-	-	-	-	-	3	2	2	1
CO4	2	2	2	2	3	1	-	-	1	1	3	2	3	2
AVG.	2.75	2.25	2.25	2.00	2.25	1.00	-	-	1.00	1.00	3.00	2.50	2.25	1.25

Research Methodology

Code: OE-CSE-801D

Contacts: 3L

Credit Points: 3

Course Objective:	
1.	To Understand the fundamental concepts, types, and processes of research, along with problem formulation and literature review techniques.
2.	To Apply appropriate data collection, analysis methods, research ethics, and intellectual property guidelines in scholarly work.
3.	To Analyze and prepare well-structured research reports, ensuring accuracy, reproducibility, and professional presentation.

Pre-Requisite:	
1.	Probability and Statistics

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Unit	Content	Hrs.
1	Research formulation and design: Motivation and objectives – Research methods vs. Methodology. Types of research– Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical, concept of applied and basic research process, criteria of good research. Defining and formulating the research problem, selecting the problem, necessity of defining the problem, importance of literature review in defining a problem, literature review-primary and secondary sources, reviews, monograph, patents, research databases, web as a source, searching the web, critical literature review, identifying gap areas from literature and research database, development of working hypothesis	10
2	Data collection and analysis: Accepts of method validation, observation and collection of data, methods of data collection, sampling methods, data processing and analysis strategies and tools, data analysis with statically package (Sigma STAT, SPSS for student t-test, ANOVA, etc.), hypothesis testing	10
3	Research ethics, IPR and scholarly publishing: Ethics-ethical issues, ethical committees (human & animal); IPR-intellectual property rights and patent law, commercialization, copy right, royalty, trade related aspects of intellectual property rights (TRIPS); scholarly publishing- IMRAD concept and design of research paper, citation and acknowledgement, plagiarism, reproducibility and accountability.	10
4	Interpretation and report writing: Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Project Report, Layout of the Project/Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Project/Research Report, Precautions for Writing Research Reports, Conclusions.	12

Text book and Reference books:

1. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. An introduction to Research Methodology, RBSA Publishers.
2. Kothari, C.R., 1990. Research Methodology: Methods and Techniques. New Age International.
3. Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, Ess Publications. 2 volumes.
4. Trochim, W.M.K., 2005. Research Methods: the concise knowledge base, Atomic Dog Publishing.
5. Wadehra, B.L. 2000. Law relating to patents, trade-marks, copyright designs and geographical indications. Universal Law Publishing.
6. Anthony, M., Graziano, A.M. and Raulin, M.L., 2009. Research Methods: A Process

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of Inquiry, Allyn and Bacon.

7. Carlos, C.M., 2000. Intellectual property rights, the WTO and developing countries: the TRIPS agreement and policy options. Zed Books, New York. Coley, S.M. and Scheinberg, C. A., 1990,—Proposal Writing||, Sage Publications.
8. Day, R.A., 1992. How to Write and Publish a Scientific Paper, Cambridge University Press.
9. Fink, A., 2009. Conducting Research Literature Reviews: From the Internet to Paper. Sage Publications
10. Leedy, P.D. and Ormrod, J.E., 2004. Practical Research: Planning and Design, Prentice Hall.
11. Satarkar, S.V., 2000. Intellectual property rights and Copyright. Ess Publications.

Courses Outcomes:	
On completion of the course student will be able to	
OE-CSE 801D.1	Explain the fundamental concepts of research methodology, research designs, problem formulation, literature review, and hypothesis development for conducting systematic research.
OE-CSE 801D.2	Apply appropriate methods of data collection, sampling techniques, statistical tools, and hypothesis testing for analyzing research data
OE-CSE 801D.3	Analyze research ethics, intellectual property rights (IPR), scholarly publishing practices, and issues related to plagiarism, reproducibility, and accountability in research.
OE-CSE 801D.4	Develop a well-structured research report by interpreting research findings and presenting them effectively using standard scientific writing and reporting practices

Mapping of COs with POs and PSOs (Course Articulation Matrix):														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	3	1	2	1	-	-	-	1	-	2	2	1	-
CO2	2	3	1	3	2	-	-	-	1	-	2	2	2	1
CO3	1	2	-	1	-	2	3	-	2	-	2	1	-	2
CO4	1	2	1	2	1	-	2	2	3	1	2	1	-	2
AVG.	1.50	2.50	1.00	2.00	1.33	2.00	2.50	2.00	1.00	1.00	2.00	1.50	1.50	1.66

Course Title: Ad-hoc and Sensor Network

Code: OE-CSE 801E

Contact: 3L

Theory: 3 hrs. / Week

Credit Points: 3

Course Objective:	
1.	Provide an overview about sensor networks and emerging technologies.
2.	To study about the node and network architecture of sensor nodes and its execution environment.
3.	To understand the concepts of communication, MAC, routing protocols and also study

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	about the naming and addressing in WSN.
4.	To learn about topology control and clustering in networks with timing synchronization for localization services with sensor tasking and control.
5.	To study about sensor node hardware and software platforms and understand the simulation and programming techniques.
6.	These networks aim to facilitate seamless communication among distributed nodes in various application scenarios while addressing challenges such as limited resources, energy constraints, and dynamic environments.

Pre-Requisite:

1.	Computer networking concepts.
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Unit	Content	Hrs.
1.	Introduction and Overview: Overview of wireless networks, types, infrastructure-based and infrastructure-less, introduction to MANETs (Mobile Ad-hoc Networks), characteristics, reactive and proactive routing protocols with examples, introduction to sensor networks, commonalities and differences with MANETs, constraints and challenges, advantages, applications, enabling technologies for WSNs.	6
2.	Architectures Single-node architecture: Hardware components, design constraints, energy consumption of sensor nodes, operating systems and execution environments, examples of sensor nodes, sensor network scenarios, types of sources and sinks – single hop vs. multi hop networks, multiple sources and sinks – mobility, optimization goals and figures of merit, gateway concepts, design principle.	10
3.	Communication Protocols: Physical layer and transceiver design considerations, MAC protocols for wireless sensor networks, low duty cycle protocols and wakeup concepts - S-MAC , the mediation device protocol, wakeup radio concepts, address and name management, assignment of MAC addresses, routing protocols classification, gossiping, flooding, energy efficient routing, unicast protocols, multipath routing, data-centric routing, data aggregation, SPIN, LEACH, Directed Diffusion, geographic routing.	10
4.	Infrastructure Establishment: Topology control, flat network topologies, hierarchical networks by clustering, time synchronization, properties, protocols based on sender-receiver and receiver-receiver synchronization, LTS, TPSN, RBS, HRTS, localization and positioning, properties and approaches, single-hop localization, positioning in multi-hop environment, range based localization algorithms – location services, sensor tasking and control	8
5.	Sensor Network Platforms and Tools: Sensor node hardware, Berkeley motes, programming challenges, node level software platforms, node-level simulators, state-centric programming, Tiny OS, nesC components, NS2 simulator, TOSSIM.	8

Text books:

1. Carlos Corderio Dharma P. Aggarwal, “Ad Hoc and sensor networks”, world scientific publication/

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Cambridge university press, March 2006

2. Holger Karl & Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley, 2005.
3. Feng Zhao & Leonidas J. Guibas, "Wireless Sensor Networks- An Information Processing Approach", Elsevier, 2007.
4. KazemSohraby, Daniel Minoli, &TaiebZnati, "Wireless Sensor Networks- Technology, Protocols, and Applications", John Wiley, 2007.
5. Anna Hac, "Wireless Sensor Network Designs", John Wiley, 2003.
6. Thomas Haenselmann, "Sensor Networks", available online for free, 2008.

Course Outcome:	
On completion of the course students will be able to	
OE-CSE 801E.1	Understanding the overview of the physical, networking and architectural issues of mobile ad-hoc networks.
OE-CSE 801E.2	Apply routing algorithms such as AODV (Ad-hoc On-Demand Distance Vector) and DSR (Dynamic Source Routing) to route data in ad-hoc networks.
OE-CSE 801E.3	Analyse the performance of different routing protocols under varying network conditions and traffic loads.
OE-CSE 801E.4	Evaluate the energy efficiency and reliability of communication protocols in ad-hoc and sensor networks.

Mapping of COs with POs and PSOs (Course Articulation Matrix):														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	-	-	-	-	-	3	2	-	-
CO2	2	3	-	3	-	-	-	-	-	-	3	2	3	2
CO3	2	1	-	2	2	-	-	-	-	-	3	2	3	1
CO4	2	-	-	-	-	1	-	-	-	-	2	2	1	-
AVG.	2.25	2.33	-	2.50	2.00	1.00	-	-	-	-	2.75	2.00	2.33	1.50

Course Title: Industry Internship

Code: EE-CSE 871

Contact:

Credit Points: 3

Industry Internship
OBJECTIVES Internships are educational and career development opportunities, providing practical experience in a field or discipline. They are structured, short-term, supervised placements often focused around particular tasks or projects with defined timescales. An internship may be compensated, non-compensated or some time may be paid. The internship has to be meaningful and mutually beneficial to the intern and the organization. It is important that the objectives and the activities of the internship program are clearly defined and understood. Following are the intended objectives of internship training:

- Will expose Technical students to the industrial environment, which cannot be simulated in the classroom and hence creating competent professionals for the industry.
- Provide possible opportunities to learn, understand and sharpen the real time technical / managerial skills required at the job.
- Exposure to the current technological developments relevant to the subject area of training.
- Experience gained from the 'Industrial Internship' in classroom will be used in classroom discussions.
- Create conditions conducive to quest for knowledge and its applicability on the job.
- Learn to apply the Technical knowledge in real industrial situations.
- Gain experience in writing Technical reports/projects.
- Expose students to the engineer's responsibilities and ethics.
- Familiarize with various materials, processes, products and their applications along with relevant aspects of quality control.
- Promote academic, professional and/or personal development.
- Expose the students to future employers.
- Understand the social, economic and administrative considerations that influence the working environment of industrial organizations
- Understand the psychology of the workers and their habits, attitudes and approach to problem solving.

INTERNSHIP GUIDELINES:

The T&P cell will arrange internship for students in industries/organization after second, fourth and six/seventh semester(s) or as per AICTE/ affiliating University guidelines. The general procedure for arranging internship is given below:

- **Step 1:** Request Letter/ Email from the office of Training & Placement cell of the college should go to industry to allot various slots of 4-6 weeks during summer vacation as internship periods for the students. Students request letter/profile/ interest areas may be submitted to industries for their willingness for providing the training. (Sample attached)
- **Step 2:** Industry will confirm the training slots and the number of seats allocated for internships via Confirmation Letter/ Email. In case the students arrange the training themselves the confirmation letter will be submitted by the students in the office of Training & Placement through concerned department. Based on the number of slots agreed to by the Industry, TPO will allocate the students to the Industry. In addition, the internship slots may be conveyed through Telephonic or Written Communication (by Fax, Email, etc.) by the TPO or other members of the T&P cell / Faculty members who are particularly looking after the Final/Summer Internship of the students.
- **Step 3:** Students on joining Training at the concerned Industry / Organization, submit the Joining Report/ Letters / Email.
- **Step 4:** Students undergo industrial training at the concerned Industry / Organization.

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In-between Faculty Member(s) evaluate(s) the performance of students once/twice by visiting the Industry/Organization and Evaluation Report of the students is submitted in department office/TPO with the consent of Industry persons/ Trainers. (Sample Attached)

- **Step 5:** Students will submit training report after completion of internship.
- **Step 6:** Training Certificate to be obtained from industry.
- **Step 7:** List of students who have completed their internship successfully will be issued by Training and Placement Cell.

Course Outcomes:

On completion of the course students will be able to

EE-CSE 871.1	To construct the company profile by compiling the brief history, management structure, products / services offered, key achievements and market performance as well as to assess its Strengths, Weaknesses, Opportunities and Threats (SWOT), and demonstrate awareness of documentation, and professional reporting requirements toward promoting academic, professional and/or personal development for his / her organization of internship.
EE-CSE 871.2	To determine the technological/managerial challenges along with social and economic considerations for his / her internship organization, and evaluate industrial practices to develop industry readiness .
EE-CSE 871.3	To test the theoretical learning in practical situations by accomplishing the tasks assigned during the internship period and to analyze the functioning of internship organization to recommend changes for organizational betterment as well as to enhance professional competence, employability , preparedness for higher studies and research .
EE-CSE 871.4	To apply various soft skills such as time management, positive attitude and communication skills along with prompt technical knowledge during performance of the tasks assigned in internship organization compliance with organizational requirements , and readiness for industrial careers and lifelong learning .

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	-	-	2	-	2	-	-
CO2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	3	3	3	-	2	2	3	3	3	3	3	3
CO4	-	-	2	-	2	2	-	-	-	-	-	-	-	2
AVG.	3.00	3.00	2.50	3.00	2.50	2.00	2.00	2.00	3.00	2.50	3.00	2.50	3.00	2.50

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Course Title: Project-II

Code: EE-CSE 881

Contact: 12P

Credit Points: 6

Project Work II & Dissertation

Objective :The objective of Project Work II & Dissertation is to enable the student to extend further the investigative study taken up under guidance, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership. The assignment to normally include:

1. In depth study of the topic assigned in the light of the Report prepared under EC P1;
2. Review and finalization of the Approach to the Problem relating to the assigned topic;
3. Preparing an Action Plan for conducting the investigation, including team work;
4. Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed;
5. Final development of product/process, testing, results, conclusions and future directions;
6. Preparing a paper for Conference presentation/Publication in Journals, if possible;
7. Preparing a Dissertation in the standard format for being evaluated by the Department.
8. Final Seminar Presentation before a Departmental Committee.

Course Outcomes:

After completion of course, students would be:

EE-CSE 881.1	Applying the system design of project-I in to executable code(s) using modern programming languages to Build the system.
EE-CSE 881.2	Analysing the developed system tested & validate by following standards testing techniques.
EE-CSE 881.3	Evaluating project metrics like size, effort and cost, reliability and quality, etc and plan project development schedule.
EE-CSE 881.4	To determine all the system development phases towards the completion of the Project and analyse/compare the result(s); evaluate and maximize system performances which contribute to lifelong learning.

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	1	3	1	2	-	-	3	1	-	-	1	1	1
CO2	3	1	3	1	3	-	2	3	-	1	-	1	3	2
CO3	3	-	3	1	-	-	-	3	3	1	1	-	-	3
CO4	3	-	3	1	2	2	3	3	3	1	1	-	2	3
AVG.	2.50	1.00	3.00	1.00	2.33	2.00	2.50	3.00	2.33	1.00	1.00	1.00	2.00	2.25

APPENDIX – A

GUIDELINES OF MASSIVE OPEN ONLINE COURSES (MOOCS) SCHEME

MOOCs for B.Tech. Honours Degree

For the award of a **B.Tech. Honours Degree**, a regular **4-year B.Tech. Student** must earn an additional **20 credits** through MOOCs (Massive Open Online Courses) offered by any recognized and established MOOC platform, over and above the prescribed credits required for the B.Tech. Degree.

Similarly, **B.Tech. Lateral entry students** are required to earn an additional **16 MOOC credits**, in addition to the prescribed credits for the B.Tech. Degree. Credit will be distributed over four year as:

1 st year	4-8 credits
2 nd year	4-8 credits
3 rd year	4-8 credits
4 th year	4 credits

A student of first year has to cover courses from at least three skills:

1. Computer Programming with Python / R
2. Soft skills
3. Values and Ethics

Students of all streams are to be equipped with Programming skill in the language that is in high demand worldwide in the first year itself so that they can apply this skill in the subsequent semesters in their different areas including their core area of study.

Soft skill is very essential for grooming of the student and student must be exposed to it in the very beginning of the 4 year long program.

Ethics is something that one should practice. Students are to be made aware of the ethics right in the beginning of the 4 year long program so that they can practice at least some of the ethical norms as applicable to Institutional environment and society, and be prepared to practice ethics in their working life.

All of the MOOCs courses are to be taken any MOOCs platform as per following scheme of credit points. There would not be any concept of fixed basket anymore. However, during choosing courses in the online platform students would essentially avoid the courses taught / offered through the curriculum in the offline / class room mode.

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For NPTEL / Swayam platform: Credit points as specified in the platform

Courses of 4 weeks to 7 weeks: 1 credit point

Courses of 8 weeks to 11 weeks: 2 credit point

Courses of 12 weeks to 15 weeks: 3 credit point

Courses of 16 weeks or more: 4 credit point

Where duration of MOOCs courses are available in hours

For every 8 hours of course: 1 credit point (< 8 hours = No credit)

16 hours = 2 credits (> 8 - < 16 hours = 1 credit)

24 hours = 3 credits (> 16 - < 24 hours = 2 credits)

32 hours = 4 credits [Max.] (> 24 - < 32 hours = 3 credits)

However, for the courses with duration less than 8 hours, multiple courses could be taken together (preferably in the same area) to consider 1 credit point. But where duration is available in week, count of hours will not be applicable.

The above structure is indicative only. And BoS / DC concerned may propose credit points of the courses offered through MOOCs platform based on the content and level (beginner / intermediate / advanced) of the courses.

Evaluation of the MOOCs courses:

Evaluation of the MOOCs courses would be done by the organization by whom it is being offered. In extraordinary circumstances, the modality of evaluation through certified personnel, online or offline will be decided by the appropriate authority.

Uploading of MOOCs Data:

Every UG Department has to upload the details of MOOCs data in respect of each student time to time in Institute's examinations portal and / or hard / soft copy as per instruction of the Controller of Examinations of the Institute.

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APPENDIX – B

GUIDELINES OF MANDATORY ADDITIONAL REQUIREMENT (MAR) FOR EARNING B. TECH DEGREE

The additional requirement of MAR points applies to - every student, who is admitted to the 4 years B.Tech program under Autonomy, as per following

Level of Entry in B. Tech Course	Total duration for earning Points	Minimum Points
1 st Year from the academic year 2026-27 onwards	1 st to 4 th Year	100
2 nd Year from the academic year 2027-28 onwards (Lateral Entry)	2 nd to 4 th Year	75

Mandatory Additional Requirement is compulsory for acquiring B.Tech./B.Tech. (Honours) degree for all the students under autonomy.

Total hundred (100) points are required in different fields mentioned in the MAR table in syllabus to achieve B.Tech./B.Tech. (Honours) degree in the four years of study. For lateral entry students the total MAR points will be 75.

These 100 (75 for 3 years B.Tech/Lateral Entry) points are equally divided in four/three (for lateral entry) years of study, i.e., students have to acquire minimum 25 points in each and every year. If any candidate is failed to achieve the minimum MAR points, it will be treated as backlog and he/she should clear it in the immediate next year. For final year students, no degree will be conferred if he/she has unable to achieve total 100/75 (for 3 years B.Tech/ Lateral Entry) points from MAR.

Certification and awarding on the activities of MAR for outstanding activities/special achievements in these areas would be considered.

Students may achieve more than maximum admissible points and total MAR points would be reflected in the final certificate.

These points must be earned on the basis of active participation in co-curricular and extracurricular activities spanning through all the semesters of study. Every student may choose, as per his/her liking, activities in order to achieve the mandatory points (as per Table- I, depending on his/her entry level), before becoming eligible for award of the Degree. These activities can be spread over the years, as per convenience of the student.

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Notes:

- Every student shall participate in the co-curricular and extra-curricular activities and produce documentary proof to the designated Faculty Members appointed by the Head of Department / Principal / Director in the respective college. Thereby the student should earn the required Points before *her* she appears for his/ her Final Examinations.
- A student's result of his/her Final Examinations will be withheld until he/she completes the minimum Activity Points by the end of his/her B.Tech Program.
- In every semester, every student is required to prepare a file containing documentary • proofs of activities, done by him / her. This file will be duly verified and Activity Points will be assigned by the teachers as appointed above, at the end of every semester. • The college will form a 3 members committee and finalize the Activity Points for each • student before entering them into the Online Point Entry System of the Institute
- Every student has to earn at least 100 / 75 (for lateral) activity points. The points students have earned will be reflected in the student's mark sheet.
- Activity points earned by Lateral Entry students will be multiplied by 1.33.

Table I provides a List of Activity Heads and Sub-Activity Heads along with their capping of the Activity Points that can be earned by the students during the entire B.Tech duration.

Sl. No.	Name of the Activity	Points	Maximum Points Allowed
1.	MOOCS (SWAYAM/NPTEL/Spoken Tutorial) (per course)	2 weeks: 5 4 weeks: 10 8 weeks: 16 12 weeks: 20	40
2.	Tech Fest/Teachers Day/Freshers Welcome		
	Organizer	5	10
	Participants	3	6
3.	Rural Reporting	5	10
4.	Tree Plantation (per tree)	1	10
5.	Participation in Relief Camps	20	40
6.	Participation in Debate/Group Discussion/ Tech quiz/Seminar/Workshop	10	20
7.	Publication of Wall magazine in institutional level (magazine/article/internet)	10	20

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8.	Publication in News Paper, Magazine & Blogs	10	20
9.	Research Publication (per publication)	15	30
10.	Innovative Projects (other than course curriculum)	30	60
11.	Blood donation	8	16
	Blood donation camp Organization	10	20
12.	Participation in Sports/Games		
	College level	5	10
	University Level	10	20
	District Level	12	24
	State Level	15	30
	National/International Level	20	20
13.	Cultural Programme (Dance, Drama, Elocution, Music, etc.)	10	20
14.	Member of Professional Society	10	20
15.	Student Chapter	10	20
16.	Relevant Industry Visit & Report	10	20
17.	Photography activities in different Club (Photography club, Cine Club, Gitisansad)	5	10
18.	Participation in Yoga Camp (Certificate to be submitted)	5	10
19.	Self-Entrepreneurship Programme	20	20
20.	Adventure Sports with Certification	10	20
21.	Training to under privileged/Physically challenged	15	30
22.	Community Service & Allied Activities	10	20
