Department of Computer Science &Engineering

Curriculum
For
Computer Science &Technology

1st Semester to 8th Semester

(Effective from 2021-22 Admission Batch)

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

CURRICULUM							
1st Year 1st Semester: 1st Semester							
Sl. NO	**Category**	**Course Code**	**Course Title**	**Hours per week**			**Credits**
				T	P	Total	
A. THEORY							
1	Basic Science course	PH101	Physics-I	0	0	3	3
2	Basic Science course	M101	Mathematics –I	0	0	4	4
3	Humanities and Social Sciences including Management courses	HSMC 101	Professional Communication	0	0	2	2
B. PRACTICAL							
4	Basic Science course	PH191	Physics-I Lab	0	3	3	1.5
5	Engineering Science Courses	ME 191	Workshop & Manufacturing Practices Lab	0	3	3	1.5
6	PROJECT	PR191	Theme based Project I	0	1	1	0.5
7	PROJECT	PR192	Skill Development I: Soft Skill	0	1	1	0.5
C. MANDATORY ACTIVITIES / COURSES							
8	Mandatory Course	MC181	Induction Program	0	0	0	2Units
	TOTAL CREDIT						13

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

CURRICULUM							
1ST Year 2nd Semester: 2nd Semester							
Sl.NO.	Category	Course Code	Course Title	Hours per week			Credits
				T	P	Total	
A. THEORY							
1	Basic Science courses	CH201	Chemistry-I	0	0	3	3
2	Basic Science courses	M201	Mathematics –II	0	0	4	4
3	Engineering Science Courses	EE201	Basic Electrical Engineering	0	0	3	3
4	Engineering Science Courses	CS201	Programming for Problem Solving	0	0	3	3
B. PRACTICAL							
5	Basic Science course	CH291	Chemistry-I Lab	0	3	3	1.5
6	Humanities and Social Sciences including Management courses	HSMC 291	Professional Communication LAB	0	2	2	1
7	Engineering Science Courses	EE291	Basic Electrical Engineering Lab	0	3	3	1.5
8	Engineering Science Courses	ME292	Engineering Graphics & Design Lab	0	3	3	1.5
9	Engineering Science Courses	CS291	Programming for Problem Solving Lab	0	3	3	1.5
10	PROJECT	PR291	Theme based Project II	0	1	1	0.5
11	PROJECT	PR292	Skill Development II: Life Skill	0	0	1	0.5

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

C. MANDATORY ACTIVITIES / COURSES							
12	Mandatory Course	MC281	NSS/Physical Activities / Meditation & Yoga / Photography	0	3	3	3 Units
TOTAL CREDIT							21

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

CURRICULUM								
2nd Year 1st Semester: 3rd Semester								
Sl.NO.	Category	Course Code	Course Title	Hours per week				Credits
				L	**T**	**P**	**Total**	
A. THEORY								
1	Basic Science course	M(CSE)301	Discrete Mathematics	3	0	0	3	3
2	Engineering Science Courses	ESC301	Analog Electronics	3	0	0	3	3
3	Engineering Science Courses	ESC302	Digital Electronics	3	0	0	3	3
4	Program Core Course	CT301	Programming in Python	3	0	0	3	3
5	Program Core Course	CS302	Data Structures	3	0	0	3	3
6	Humanities and Social Sciences including Management courses	HSMC303	Universal Human Values 2: Understanding Harmony	3	0	0	3	3
B. PRACTICAL								
7	Engineering Science Courses	M (CS)391	Numerical Methods Lab	1	0	3	3	2.5
8	Engineering Science Courses	ESC391	Digital and Analog Electronics Lab	0	0	3	3	1.5
9	Program Core Course	CT391	Programming in PythonLab	0	0	3	3	1.5
10	Program Core Course	CS392	Data Structures Lab	0	0	3	3	1.5

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

11	PROJECT	PR391	Theme based Project III	0	0	1	1	0.5
12	PROJECT	PR392	Skill Development III: Technical Seminar Presentation	1	0	0	1	0.5
C. MANDATORY ACTIVITIES / COURSES								
15	MC	MC301	Environmental Science	0	0	3	3	3 Units
TOTAL CREDIT WITHOUT MOOCS COURSES								26
D.MOOCS COURSES**								
16	MOOCS COURSES	HM301	MOOCS COURSE-I					

*MOOCS COURSES for MAJOR/MINOR Degree are Programme specific and to be taken from the specific curriculum of MAJOR/MINOR.

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

CURRICULUM							
2nd Year 2nd Semester: 4th Semester							
Sl. No.	Category	Course Code	Course Title	Hours per week			Credits
				T	**P**	**Total**	
A. THEORY							
1	Program Core Course	CS401	Computer Organization and Architecture	0	0	3	3
2	Program Core Course	CS402	Design and Analysis of Algorithms	0	0	3	3
3	Program Core Course	CS403	Operating Systems	0	0	3	3
4	Program Core Course	CS404	Formal Language and Automata Theory	0	0	3	3
5	Humanities and Social Sciences including Management courses	HSMC 402	Gender Culture and Development	0	0	2	2
6	Basic Science course	M401	Probability and Statistics	0	0	3	3
B. PRACTICAL							
6	Program Core Course	CS491	Computer Organization and Architecture Lab	0	3	3	1.5
7	Program Core Course	CS492	Design and Analysis of Algorithms Lab	0	3	3	1.5
8	Program Core Course	CS493	Operating Systems Lab	0	3	3	1.5
9	Engineering Science Courses	ESC(CT)491	IT Workshop Lab (C++/python)	0	3	3	1.5
10	PROJECT	PR491	Theme based Project IV	0	1	1	0.5
11	PROJECT	PR492	Skill Development	0	0	1	0.5

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

			IV: Soft Skill &Aptitude- I				
C. MANDATORY ACTIVITIES / COURSES							
15	MC	MC481	Learning an Art Form [vocal or instrumental, dance, painting, clay modelling, etc.] OR Environmental Protection Initiatives	0	0	3	3 Units
TOTAL CREDIT WITHOUT MOOCS COURSES							24
D.MOOCS COURSES							
16	MOOCS COURSES	HM401	MOOCS COURSE-II				

*MOOCS COURSES for MAJOR/MINOR Degree are Programme specific and to be taken from the specific curriculum of MAJOR/MINOR.

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

CURRICULUM								
3rd Year 1st Semester: 5th Semester								
Sl. NO	Category	Course Code	Course Title	Hours per week				Credits
				L	T	P	Total	
A. THEORY								
1	Humanities and Social Sciences including Management courses	HSMC 505	Principles of Management	2	0	0	2	2
2	Program Core Course	CS501	Compiler Design	3	0	0	3	3
3	Program Core Course	CS502	Database Management Systems	3	0	0	3	3
4	Program Core Course	CS503	Object Oriented Programming using Java	3	0	0	3	3
5	Professional Elective courses	CT501	Microprocessors and Microcontrollers	3	0	0	3	3
		CS501S	Advanced Computer Architecture	3	0	0	3	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

		CT501D	Artificial Intelligence	3	0	0	3	3
		CT501A	Computer Graphics	3	0	0	3	3
B. PRACTICAL								
6	Program Core Course	CS591	Compiler Design Lab	0	0	3	3	1.5
7	Program Core Course	CS592	Database Management Systems Lab	0	0	3	3	1.5
8	Program Core Course	CS593	Object Oriented Programming using Java Lab	0	0	3	3	1.5
9	Professional Elective courses	CT591T	Microprocessors and Microcontrollers Lab	0	0	3	3	1.5
		CS591S	Advanced Computer Architecture Lab	0	0	3	3	1.5
		CT591D	Artificial Intelligence Lab	0	0	3	3	1.5
		CT591A	Computer Graphics Lab	0	0	3	3	1.5
10	PROJECT	PR591	Minor Project I	0	0	3	2	1

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

11	PROJECT	PR592	Skill Development V: Soft Skill & Aptitude-II	1	0	0	1	0.5
C. MANDATORY ACTIVITIES / COURSES								
12	MC	MC501	Constitution of India	2	0	0	3	
	TOTAL CREDIT TOTAL CREDIT WITHOUT MOOCS COURSES							21.5
D. MOOCS COURSES**								
13	MOOCS COURSES	HM501	MOOCS COURSE-III					

*MOOCS COURSES for MAJOR/MINOR Degree are Programme specific and to be taken from the specific curriculum of MAJOR/MINOR.

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

CURRICULUM								
3rd Year 2nd Semester: 6th Semester								
Sl. NO	**Category**	**Course Code**	**Course Title**	**Hours per week**				**Credits**
				L	T	P	Total	
A. THEORY								
1	Humanities and Social Sciences including Management courses	HSMC 604	Economics for Engineers	2	0	0	2	2
2	Program Core Course	CS601	Computer Networks	3	0	0	3	3
3	Program Core Course	CS602	Software Engineering	3	0	0	3	3
4	Professional Elective courses	CT601T	Advanced Algorithms	3	0	0	3	3
		CS601S	Advanced Operating Systems	3	0	0	3	3
		CS601D	Machine Learning	3	0	0	3	3
		CS601A	Web and Internet Technology	3	0	0	3	3
5	Professional Elective courses	CS602T	Parallel and Distributed Algorithms	3	0	0	3	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

		CS602S	Embedded Systems	3	0	0	3	3
		CS602D	Soft Computing	3	0	0	3	3
		CS602A	Human Computer Interaction	3	0	0	3	3
6	Open Elective courses	CS601A	Introduction to Internet of Things	3	0	0	3	3
		CS601B	Bio-informatics	3	0	0	3	3
		CS601C	Robotics	3	0	0	3	3
B. PRACTICAL								
7	Program Core Course	CS691	Computer Networks Lab	0	0	3	3	1.5
8	Program Core Course	CS692	Software Engineering Lab	0	0	3	3	1.5
9	Professional Elective courses	CT691T	Advanced Algorithms Lab	0	0	3	3	1.5
		CS691S	Advanced Operating Systems Lab	0	0	3	3	1.5
		CS691D	Machine Learning Lab	0	0	3	3	1.5

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

		CS691A	Web and Internet Technology Lab	0	0	3	3	1.5
10	PROJECT	PR691	Minor Project II	0	0	3	2	1
11	PROJECT	PR692	Skill Development VI: Soft Skill & Aptitude-III	1	0	0	1	0.5
C. MANDATORY ACTIVITIES / COURSES								
12	MC	MC601	Intellectual Property Right	2	0	0	2	
	TOTAL CREDIT TOTAL CREDIT WITHOUT MOOCS COURSES							23
D. MOOCS COURSES**								
13	MOOCS COURSES	HM601	MOOCS COURSE-IV					

*MOOCS COURSES for MAJOR/MINOR Degree are Programme specific and to be taken from the specific curriculum of MAJOR/MINOR.

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

CURRICULUM								
4th Year 1st Semester: 7th Semester								
Sl. NO	Category	Course Code	Course Title	Hours per week				Credits
				L	T	P	Total	
A. THEORY								
1	Professional Elective courses	CS701T	Information Theory and Coding	3	0	0	3	3
		CS701S	Ad-Hoc and Sensor Networks	3	0	0	3	3
		CS701D	Data Mining and Data Warehousing	3	0	0	3	3
		CS701A	Cloud Computing	3	0	0	3	3
2	Professional Elective courses	CS702T	Quantum Computing	3	0	0	3	3
		CS702S	Mobile Computing	3	0	0	3	3
		CS702D	Natural Language Processing	3	0	0	3	3
		CS702A	Cryptography and Network Security	3	0	0	3	3
3	Open Elective courses	CS701A	High Performance Computing	3	0	0	3	3
		CT701B	VLSI	3	0	0	3	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

		CS701C	Optimization Techniques	3	0	0	3	3
4	Open Elective courses	CS702A	Cyber Law and Ethics	3	0	0	3	3
		CS702B	Soft Skills and Interpersonal Communication	3	0	0	3	3
		CS702C	Foreign Language	3	0	0	3	3
B. PRACTICAL								
5	Professional Elective courses	CS791T	Information Theory and Coding Lab	0	0	3	3	1.5
		CS791S	Ad-Hoc and Sensor Networks Lab	0	0	3	3	1.5
		CS791D	Data Mining and Data Warehousing Lab	0	0	3	3	1.5
		CS791A	Cloud Computing Lab	0	0	3	3	1.5
6	Open Elective courses	CS791A	High Performance Computing Lab	0	0	3	3	1.5
		CT791B	VLSI Lab	0	0	3	3	1.5
		CS791C	Optimization Techniques Lab	0	0	3	3	1.5
7	PROJECT	PR791	Major Project-I	0	0	0	4	2

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

8	PROJECT	PR792*	Industrial Training / Internship	0	0	0	0	1
9	PROJECT	PR793	Skill Development VII: Seminar & Group Discussion	1	0	0	1	0.5
C. MANDATORY ACTIVITIES / COURSES								
10	MC	MC781	Entrepreneurship & Innovation Skill	2	0	0	2	
	TOTAL CREDIT TOTAL CREDIT WITHOUT MOOCS COURSES							18.5
D. MOOCS COURSES**								
11	MOOCS COURSES	HM701	MOOCS COURSE-V					

*MOOCS COURSES for MAJOR/MINOR Degree are Programme specific and to be taken from the specific curriculum of MAJOR/MINOR.

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

CURRICULUM								
4th Year 2nd Semester: 8th Semester								
Sl. NO	Category	Course Code	Course Title	Hours per week				Credits
				L	T	P	Total	
A. THEORY								
1	Professional Elective courses	CS801T	Advance Graph Algorithms	3	0	0	3	3
		CS801S	Real Time Systems	3	0	0	3	3
		CS801D	Data Analytics	3	0	0	3	3
		CT801A	Image Processing	3	0	0	3	3
2	Open Elective courses	CS801A	Human Resource Development and organizational behaviour	3	0	0	3	3
		CS801A	Block Chain	3	0	0	3	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

		CS801C	Simulation and Modelling	3	0	0	3	3
3	Open Elective courses	CS802A	Values and Ethics in Profession	3	0	0	3	3
		CS802B	History of Science	3	0	0	3	3
		CS802C	Economic Policies in India	3	0	0	3	3
B. PRACTICAL								
7	PROJECT	PR891	Major Project-II	0	0	0	12	6
8	PROJECT	PR892	Grand Viva	0	0	0	0	1
C. MANDATORY ACTIVITIES / COURSES								
12	MC	MC801	Essence of Indian Knowledge Tradition	0	0	3	3	3 Units
	TOTAL CREDIT							16

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

Program Specific Outcomes (PSOs) of CST

Program Specific Outcome:

PSO1	The ability to understand, illustrate, discuss, explain the fundamental design and working principle of any existing or new computing technology with a focus on acquiring the knowledge of cutting-edge technical skills in the field of Computer Science.
PSO2	The ability to identify and formulate an engineering problem within the scope of Computer Science & Technology domain with a special focus on the probable technical challenges while proposing any software application-based or research-based technical solution with adequate justification
PSO3	The ability to design, implement and analyse a solution proposal with proper documentation and tools by demonstrating adequate software engineering management skill along with the necessary technical skill for driving the intellect towards technological innovation boosted with research as well as entrepreneurial aptitude for producing globally competent engineering professionals capable of making meaningful contributions in the field of computer science and technology with a special focus on its technological aspects.

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS

Semester – I

Course Code	**PH 101**
Course Name	**PHYSICS –I**
Contact	**3:0:0**
Total Contact Hours	**36**
Credit	**3**

Prerequisites: Knowledge of Physics up to 12th standard.

Course Outcome:

After attending the course students' should be able to

CO1: describe various types of mechanical resonance and its electrical equivalence

CO2: explain basic principles of Laser, Optical fibres and Polarization of light

CO3: apply superposition principle to explain interference and diffraction

CO4: analyze different crystallographic structures according to their co-ordination number and packing factors

CO5: justify the need of a quantum mechanics as remedy to overcome limitations imposed by classical physics

MODULE NUMBER	COURSE CONTENT
1(5L)	**Waves &Oscillations(5L):-** Simple Harmonic Motion (Recap), superposition of waves, damped harmonic motion-over damped, critically damped and under damped motion, energy decay, logarithmic decrement, force vibration and resonance (amplitude, velocity resonance), sharpness of resonance, quality factor, related numerical problems.

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

2(12L)	**Classical Optics:** **2.01- Interference of light(4L):**Huygens's principle, conditions of sustained interference, classification of interference, Newton's ring (qualitative descriptions of working principles and procedures-no deduction required). Engineering applications, related numerical problems. **2.02-Diffraction of light(4L):** Fresnel and Fraunhofer class, Fraunhoffer diffraction of a single slit, double slit, multiple slits, intensity distributions, missing order, Rayleigh criterion (no deduction) and resolving power of grating and microscope (no deduction),related numerical problems. **2.03-Polarization(4L):** Definition, Plane of polarization, Plane of vibration, Malus Law, Fundamental concepts of plane, circular & elliptical polarizations (only qualitative idea) with examples, Brewster's law, Double refraction: Ordinary & Extra ordinary rays, positive and negative crystal, Nicol's prism, Numerical problems.
3(8L)	**Quantum Mechanics-I** **3.01 Quantum Theory(4L)**: Inadequacy of classical physics-concept of quantization of energy, particle concept of electromagnetic wave (example: photoelectric and Compton Effect; no derivation required, origin of modified and unmodified lines), wave particle duality; phase velocity and group velocity; de Broglie hypothesis; Davisson and Germer experiment. **3.02 Quantum Mechanics 1(4L):** Concept of wave function, physical significance of wave function, probability interpretation; normalization of wave functions; uncertainty principle, relevant numerical problems. Introduction of Schrödinger wave equation (only statement).
4(3L)	**Solid State Physics-I:** **4.01 Crystal Structure(3L):** Structure of solids, amorphous and crystalline solids (definition and examples), lattice, basis, unit cell, Fundamental types of lattices – Bravais lattice, simple cubic, fcc and bcc lattices, Miller indices and miller planes, co-ordination number and atomic packing factor, Bragg's equation, applications, numerical problems.
5(8L)	**Modern Optics-I:** **5.01- Laser(5L):** Concepts of various emission and absorption processes, Einstein A andB coefficients and equations, working principle of laser, metastable state, population inversion, condition necessary for active laser action, optical resonator,

	illustrations of Ruby laser, He-Ne laser, Semiconductor laser, applications of laser, related numerical problems. **5.02-Fibre optics(3L)**-Principle and propagation of light in optical fibers (Step index, Graded index, single and multiple modes) - Numerical aperture and Acceptance angle, Basic concept of losses in optical fiber, related numerical problems
Recommended Text Books for Physics I (PH 101):	
1	**Waves & Oscillations:** 1. Sound-N. K. Bajaj (TMH) 2. Advanced Acoustics-D. P. Roy Chowdhury (Chayan Publisher) 3. Principles of Acoustics-B.Ghosh (Sridhar Publisher) 4. A text book of sound-M. Ghosh (S. Chand publishers) 5. A text book of Light- K.G. Mazumder&B.Ghoshs, (Book & Allied Publisher) 6. Physics of Oscillations and Waves- R.P. Singh 7. College Physics Vol. II - A.B. Gupta 8. Vibration, Waves and Acoustics- Chattopadhyay and Rakshit
2	**Classical & Modern Optics:** 1. A text book of Light- K.G. Mazumder&B.Ghoshs (Book & Allied Publisher) 2. A text book of Light-Brijlal&Subhramanium, (S. Chand publishers) 3. Modern Optics-A. B. Gupta (Book& Allied Publisher) 4. Optics-Ajay Ghatak (TMH) 5. Optics-Hecht 6. Optics-R. Kar, Books Applied Publishers 7. PhysicalOpticsMöler 8. Optics -F.A. Jenkins and H.E White
3	**Quantum Mechanics-I** 1. Introduction to Quantum Mechanics-S. N. Ghoshal (Calcutta Book House) 2. Quantum Mechanics-Bagde and Singh (S. Chand Publishers) 3. Perspective of Quantum Mechanics-S. P. Kuilla (New Central Book Agency) 4. Quantum Mechanics-Binayak Datta Roy (S. Chand Publishers) 5. Quantum Mechanics-Bransden (Pearson Education Ltd.) 6. Perspective of Modern Physics-A. Beiser (TMH) 7. Quantum mechanics -A.K. Ghatak and S Lokenathan 8. Modern Physics -E.E. Anderson 9. Physics Volume 2 -Haliday, Resnick & Krane, Published by Wiley India

4	**Solid State Physics-I:** 1. Solid state physics-Puri &Babbar(S. Chand publishers) 2. Materials Science & Engineering-KakaniKakani 3. Solid state physics- S. O. Pillai 4. Introduction to solid state physics-Kittel (TMH) 5. Solid State Physics and Electronics-A. B. Gupta and Nurul Islam (Book & Allied Publisher) 6. Problem in Solid state physics -S.O. Pillai (a. b.)

Text Books:

1. Refresher courses in physics (Vol. 1, Vol. 2 & Vol. 3)-C. L. Arora (S. Chand Publishers)
2. Basic Engineering Physics-Amal Chakraborty (Chaya PrakashaniPvt. Ltd.)
3. Perspective & Concept of Modern Physics -Arthur Baiser
4. Principles of engineering physics – Md. N Khan and S Panigrahi.
5. Basic Engineering Physics-Sujoy Bhattacharya, Saumen Pal (MG)
6. Engineering Physics (Vol. 1, Vol. 2)-S.P. Kuila(S. Chand Publishers)
7. Engineering Physics-A. S.

Project Domains:

1. Study of Superposition of waves: Lissajous figures.
2. Electrical analogue of mechanical vibrations: application to electrical circuit (LC and LCR circuits), Electrical and mechanical impedance, quality factor, complex representation and phasor diagram.
3. Study of N-slit diffractions
4. Optical Fiber& its applications: Study of losses, estimation of numerical aperture in practical problems.
5. Photonic nature of electromagnetic waves
6. Optical Rotation

**Total marks of the questions set from each module should be in proportion to the number of lectures allotted.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	2
CO2	3	-	-	-	-	-	-	-	-	-	-	2
CO3	3	2	-	-	-	-	-	-	-	-	-	2
CO4	2	3	-	-	-	-	-	-	-	-	-	2
CO5	2	3	-	-	-	-	-	-	-	-	-	2

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS

Semester – I

Course Code	**M101**
Course Name	**Mathematics-I**
Contact	**3:1:0**
Total Contact Hours	**48**
Credit	**4**

Prerequisites:

The students to whom this course will be offered must have the concept of (10+2) standard matrix algebra, calculus, and vector algebra.

Course Outcome:

On successful completion of the learning sessions of the course, the learner will be able to

CO1: Recall the properties and formula related to matrix algebra, differential calculus, multivariable calculus, vector calculus and infinite series.

CO2: Determine the solutions of the problems related to matrix algebra, differential calculus, multivariable calculus, vector calculus and infinite series.

CO3: Apply the appropriate mathematical tools of matrix algebra, differential calculus, multivariable calculus, vector calculus and infinite series for the solutions of the problems.

CO4: Analyze different engineering problems linked with matrix algebra, differential calculus, multivariable calculus, vector calculus.

MODULE NUMBER	COURSE CONTENT
1(11L)	**Matrix Algebra:** Echelon form and Normal (Canonical) form of a matrix; Inverse and rank of a matrix; Consistency and inconsistency of system of linear equations, Solution of system of linear equations; Eigenvalues and eigenvectors; Diagonalization of matrices; Cayley-Hamilton theorem.

2(10L)	**: Differential Calculus and Infinite Series:** Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; Concept of sequence and series, Tests for convergence of infinite series: Comparison test, D'Alembert's ratio test, Raabe's test, Cauchy's root test, Leibnitz's Test, Power series; Taylor's series, Series for exponential, trigonometric and logarithm functions.
3(13L)	**Multivariable Calculus (Differentiation):** Function of several variables, Concept of limit, continuity and differentiability; Partial derivatives, Total derivative and its application; Chain rules, Derivatives of implicit functions Euler's theorem on homogeneous function, Jacobian. Maxima and minima of functions of two variables, Method of Lagrange multipliers.
4(6L)	**Multivariable Calculus (Integration):** Line Integral, Double Integral, Triple Integral,Change of order in multiple integrals, Change of variables in multiple integrals.
5(8L)	**Vector Calculus:** Gradient, Directional derivatives, Divergence, Curl, vector line integrals, vector surface integrals, vector volume integrals, Green's theorem, Gauss divergence theorem and Stokes' theorem.

Reference Books:

1. Thomas, G.B. and Finney, R.L., Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. Apostol, M., Calculus, Volumes 1 and 2 (2nd Edition), Wiley Eastern, 1980.
3. Kumaresan, S., Linear Algebra - A Geometric approach, Prentice Hall of India, 2000.
4. Poole, D., Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
5. Bronson, R., Schaum's Outline of Matrix Operations. 1988.

6. Piskunov, N., Differential and Integral Calculus, Vol. I & Vol. II, Mir Publishers, 196

Text Books:

1. Kreyszig, E., Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. Ramana, B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
3. Veerarajan, T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
4. Grewal, B.S., Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
5. Bali, N.P. and Goyal, M., A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
6. Samanta Guruprasad, A text book of Engineering Mathematics-I, New age International Publishers

Project Domains:

1. Study on eigenvalues and eigenvectors.
2. Study on convergence of infinite series.
3. Application of partial derivatives.
4. Application of vector calculus
5. Application of integral calculus.

CO-PO Mapping:

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	2
CO2	3	2	-	-	-	-	-	-	-	-	-	2
CO3	3	2	2	-	-	-	-	-	-	-	-	2
CO4	2	3	2	2	-	-	-	-	-	-	-	2

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS

Semester – I

Course Code	**HSMC101**
Course Name	**Professional Communication**
Contact	**2:0:0**
Total Contact Hours	**24**
Credit	**2**

Prerequisites:
Basic (10+2) level of knowledge of English grammar, vocabulary reading and writinskills.

Course Outcome:
After attending the course students' should be able to

CO1: apply the modalities and nuances of communication in a workplace context.

CO2: analyze communication across cultures and societies.

CO3: apply the basic formats, templates of business and official communication.

CO4: employ formal communication modes in meetings and reports.

CO5: justify importance of culturally neutral language in interpersonal and business communication.

MODULE NUMBER	COURSE CONTENT
1(4L)	**Verbal and Non-verbal communication :** 1.1: Definition, Relevance and Effective Usage 1.2: Components of Verbal Communication: Written and Oral Communication 1.3: Components of Non-verbal Communication: Kinesics, Proxemics, Chronemics, HapticsParalanguage 1.4: Barriers to Effective Communication
2(6L)	**Social Communication Essentials and Cross-Cultural Communication:** 2.1: Communication in Society and the Workplace 2.2: Greetings, Courtesies and Socially Useful Language 2.3: Cultural Contexts: High Context and Low Context Cultures

	2.4: Understanding Cultural Nuances and Stereotyping 2.5: Achieving Culturally Neutral Communication in Speech and Writin
3(4L)	**Meetings:** 3.1: Meetings: Nature and Types 3.2: Conducting Meetings: Organization and Procedures 3.3: Meeting Coordination: Roles of Chairpersons and Members 3.4: Notice and Agenda for a Meeting 3.5: Preparing the Minutes of a Meeting (MOM)
4(4L)	**Report Writing:** 4.1: Nature and Function of Reports 4.2: Types of Reports 4.3: Researching for a Business Report 4.4: Format, Language and Style 4.5: Report Documentation
5(6L)	**Employment Communication :** 5.1: Writing Business Letters- (Enquiry, Order, Sales, Complaint, Adjustment, Job Application, Offer) 5.2: Preparing a CV or Resume 5.3: Creating a Digital/Online Profile – LinkedIn (Résumé/Video Profile) 5.4: Writing E-mails: types, convention, and etiquette 5.5: Memo, Notices and Circulars 5.6: Writing Technicalities—Paragraphing, Sentence Structure and Punctuation

Text Books and Reference Books:

1. Meenakshi Raman and Sangeetha Sharma. *Technical Communication*. 3rd edition. New Delhi: Oxford University Press, 2015.
2. Mark Ibbotson. *Cambridge English for Engineering*. Cambridge: Cambridge University Press, 2008.
3. Mark Ibbotson. *Professional English in Use: Engineering*. Cambridge: Cambridge UP, 2009.
4. Lesikar et al. *Business Communication: Connecting in a Digital World*. New Delhi: Tata

McGraw-Hill, 2014.
5. John Seeley. *Writing Reports*. Oxford: Oxford University Press, 2002.
6. Judith Leigh. *CVs and JobApplications*. Oxford: Oxford University Press, 2002.
7. Judith Leigh. *Organizing and Participating in Meetings*. Oxford: Oxford University Press, 2002.
8. Michael Swan. *Practical English Usage*. Oxford: OUP, 1980.
9. Pickett, Laster and Staples. *Technical English: Writing, Reading & Speaking.* 8th ed. London: Longman, 2001.

Links:

1. Purdue University's Online Writing Lab (OWL)-https://owl.purdue.edu/
2. Business English Pod-https://www.businessenglishpod.com/

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	-	-	-	-	2	-	-	3	-	2
CO2	2	3	2	-	-	2	2	2	-	3	-	3
CO3	1	3	-	-	-	3	3	3	-	3	-	3
CO4	-	-	-	-	-	3	3	3	-	3	-	3
CO5	-	-	-	-	-	-	3	3	-	3	-	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS

Semester – I

Course Code	**PH 191**
Course Name	**Physics I Lab**
Contact	**0:0:3**
Credit	**1.5**

Prerequisites:
Knowledge of Physics up to 12th standard.

Course Outcome:
After attending the course students' will be able to

CO1: demonstrate experiments allied to their theoretical concepts

CO2 : conduct experiments using LASER, Optical fiber, Torsional pendulum, Spectrometer

CO3: participates an individual, and as a member or leader in groups in laboratory sessions actively

CO4: analyze experimental data from graphical representations , and to communicate effectively them in Laboratory reports including innovative experiments

General idea about Measurements and Errors (One Mandatory):
i) Error estimation using Slide calipers/ Screw-gauge/travelling microscope for one experiment.
ii) Proportional error calculation using Carrey Foster Bridge

Any 6 to be performed from the following experiments:

Experiments on Waves & Oscillations:
1. Study of Torsional oscillation of Torsional pendulum & determination of time using various load of the oscillator.
2. Determination of elastic moduli of different materials (Young's modulus /Rigidity modulus)
3. Determination of Q factor using LCR Circuit.
4. Calibration of an oscillator using Lissajous Figure.

Experiments on Classical Optics:
5. Determination of wavelength of light by Newton's ring method.
6. Determination of wavelength of light by Laser diffraction method.
7. To determine the angle of optical rotation of a polar solution using polarimeter

Experiments on Quantum Physics-I:
8. Determination of Planck's constant using photoelectric cell.
9. Verification of Bohr's atomic orbital theory through Frank-Hertz experiment.
10. Determination of Stefan's Constant

Probable experiments beyond the syllabus:
1. Determination of wavelength of light by Fresnel's bi-prism method (beyond the syllabus).
3. Study of dispersive power of material of a prism.
4. Study of viscosity using Poiseuille's capillary flow method/using Stoke's law.
5. Measurement of nodal and antipodal points along transmission wire and measurement of wavelength.
6. Any other experiment related to the theory**.**

Text Books:
1. Practical Physics by Chatterjee &Rakshit (Book & Allied Publisher)
2. Practical Physics by K.G. Mazumder (New Central Publishing)
3. Practical Physics by R. K. Kar (Book & Allied Publisher)

Recommended Text Books for Physics I Lab (PH 291):

Waves & Oscillations:
1. Vibration, Waves and Acoustics- Chattopadhyay and Rakshit

Classical & Modern Optics:
1. A text book of Light- K.G. Mazumder&B.Ghoshs (Book & Allied Publisher)

Quantum Mechanics-I
1. Introduction to Quantum Mechanics-S. N. Ghoshal (Calcutta Book House)

Solid State Physics-I:
1. Solid State Physics and Electronics-A. B. Gupta and Nurul Islam (Book & Allied Publisher)

In addition it is **recommended that each student should carry out at least one experiment beyond the syllabus/one experiment as Innovative experiment

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	2
CO2	2	2	-	3	-	-	-	-	-	-	-	2
CO3	2	2	-	-	-	-	-	-	3	-	-	2
CO4	2	2	-	-	-	-	-	-	-	3	-	2

SYLLABUS

Semester – I

Course Code	**ME 191**
Course Name	**Workshop/Manufacturing Practices**
Contact	**0:0:3**
Credit	**1.5**

Prerequisites:

Higher Secondary with Mathematics, Physics and Chemistry.

Course Outcome:

After completion of this course students will be able to

CO1: Identify and operate various hand tools related to variety of manufacturing operations

CO2: Safely fabricate simple components with their own hands.

CO3: Get practical knowledge of the dimensional accuracies and tolerances applicable for different manufacturing processes.

CO4: Produce small devices of their interest in project or research purpose.

MODULE NUMBER	COURSE CONTENT
	(i) Workshop Practice:
1(6P)	**Machine shop:** Typical jobs that may be made in this practice module: i. To make a pin from a mild steel rod in a lathe. ii. To make rectangular and vee slot in a block of cast iron or mild steel in a shaping and / or milling machine.
2(6P)	**Fitting shop:** Typical jobs that may be made in this practice module: i. To make a Gauge from MS plate.
3(6P)	**Carpentry:** Typical jobs that may be made in this practice module:

	i. To make wooden joints and/or a pattern or like.
4(3P)	**Welding shop (Arc welding 3P + gas welding 3P):** : Typical jobs that may be made in this practice module: i. ARC WELDING (3P): To join two thick (approx 5mm) MS plates by manual metalarcwelding. ii. GAS WELDING (3P): To join two thin mild steel plates or sheets by gas welding.
5(3P)	**Electrical & Electronics:** House wiring, soft Solderingproblems
6(3P)	**Smithy:** Typical jobs that may be made in this practice module: i. A simple job of making a square rod from a round bar or similar. *For further study (Optional)*
7(3P)	**Casting:** Typical jobs that may be made in this practice module: i. One/ two green sand moulds to prepare, and a casting be demonstrated.
8(3P)	**Plastic moulding& Glass Cutting :** Typical jobs that may be made in this practice module: i. For plastic moulding, making at least one simple plastic component should be made. ii. At least one sample shape on glass should be made using laser cutting machine. Examinations could involve the actual fabrication of simple components, utilizing one or more of the techniques covered above.
(i) Theoretical discussion & videos(3P): 1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods 2. Fitting operations & power tools 3. Carpentry 4. Welding (arc welding & gas welding), brazing 5. Electrical & Electronics 6. Metal casting 7. CNC machining, Additive manufacturing	

8. Plastic moulding& Glass Cutting

Text Books:

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., “Elements of Workshop Technology”, Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
2. Rao P.N., “Manufacturing Technology”, Vol. I and Vol. II, Tata McGrawHill House, 2017

Reference Books:

1. Gowri P., Hariharan and A. Suresh Babu, Manufacturing Technology – I, Pearson Education, 2008.
2. Roy A. Lindberg, “Processes and Materials of Manufacture”, 4th edition, Prentice Hall India, 1998.
3. Kalpakjian S. and Steven S. Schmid, Manufacturing Engineering and Technology, 4th edition, Pearson Education India Edition, 2002.
4. Manufacturing Science by A. Ghosh and A.K. Mallick, Wiley Eastern.
5. Principles of Metal Cutting/Principles of Machine Tools by G.C. Sen and A. Bhattacharya, New Central Book Agency, Kolkata

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	-	2	3	2	-	2	2	2	3
CO2	2	2	3	2	2	2	2	-	3	2	2	3
CO3	3	2	2	2	2	2	2	2	2	2	2	3
CO4	2	2	3	2	3	3	2	-	3	3	3	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – II	
Course Code	**CH 201**
Course Name	**Chemistry**
Contact	**3:0:0**
Total Contact Hours	**36**
Credit	**3**

Prerequisites:
A basic knowledge in 10+2 science with chemistry

Course Outcome:
After completion of this course students will be able to

CO1: Describe the fundamental properties of atoms & molecules, atomic structure and the periodicity of elements in the periodic table

CO2: Apply fundamental concepts of thermodynamics in different engineering applications.

CO3: Apply the knowledge of water quality parameters, corrosion control & polymers to different industries.

CO4: Determine the structure of organic molecules using different spectroscopic techniques.

CO5: Evaluate theoretical and practical aspects relating to the transfer of the production of chemical products from laboratories to the industrial scale, in accordance with environmental considerations.

MODULE NUMBER	COURSE CONTENT
(i) Workshop Practice:	
1(9L)	Inorganic Chemistry: (i) **Atomic structure (5L):** Bohr's theory to hydrogen-like atoms and ions; spectrum of hydrogen atom. Quantum numbers, Introduction to the concept of atomic orbitals, diagrams of s, p and d orbitals,

	Pauli's exclusion principle, Hund's rule, exchange energy, Aufbau principle and its limitation, introduction to Schrodinger equation. **(ii)** Periodic properties (4L): Modern Periodic table, group trends and periodic trends in physical properties: electron affinity, electronegativity, polarizability, oxidation states, effective nuclear charges, penetration of orbitals, variations of s, p and d orbital energies of atoms.
2(8L)	**Physical Chemistry:** i) Use of free energy in chemical equilibria(6L): Thermodynamic functions: internal energy, enthalpy, entropy and free energy. 2^{nd} Law of Thermodynamics, Estimations of entropy and free energies, Free energy and emf, Cell potentials, the Nernst equation and applications. **ii) Real Gases (2L):** Reason for deviation of real gases from ideal behavior, Equations of state of real gases,Vander Waals' equation, pressure & volume correction, validity, critical state of gas.
3(8L)	**Organic Chemistry:** *(i) Stereochemistry(4L):* Representations of 3 dimensional structures, Chirality, optical activity, isomerism, structural isomerism, stereoisomers, enantiomers, diastereomers, configurations (D,L& cis trans), racemisation. *(ii) Organic reactions (4L):* Concepts of inductive effect, resonance, hyperconjugation, introduction to reactions involving substitution, addition, elimination, oxidation (Baeyer villiger oxidation), reduction (Clemmensen reduction, Wolff-Kishner reduction).
4(8L)	**Industrial Chemistry:** *(i) Water (2L):* Hardness, alkalinity, numerical *(ii) Corrosion.(2L):*

	Types of corrosion: wet & dry, preventive measures *(iii) Polymers(3L):* Classification of polymers, conducting polymers, biodegradable polymers *(iv) Synthesis of a commonly used drug molecule(1L):* Paracetamol, Aspirin
5(3L)	**Spectroscopic techniques in Chemistry:** Electromagnetic radiation, Principles of spectroscopy, spectrophotometer, infrared spectroscopy, fingerprint region, functional group region, UV-VIS spectroscopy, ^{1}H Nuclear magnetic resonance spectroscopy, chemical shift.

Text Books:

1. A Text Book of Organic Chemistry, Arun Bahl& Arun Bahl
2. General & Inorganic Chemistry, P.K. Dutt
3. General & Inorganic Chemistry, Vol I, R.P. Sarkar
4. Physical Chemistry, P.C. Rakshit

Reference Books:

1. Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane
2. Fundamentals of Molecular Spectroscopy, by C. N.Banwell
3. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S.Krishnan
4. Physical Chemistry, by P. W.Atkins
5. Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Editionhttp://bcs.whfreeman.com/vollhardtschore5e/default.asp

Project Domain:

1. Application of Thermodynamics
2. Application of polymers in daily life
3. Nanomaterials and its applications
4. Determination of water quality parameters
5. Electronic storage devices
6. Managing E –wastes
7. Application of chemistry in core engineering
8. Application of spectroscopy in medical field
9. Applications of green chemistry
10. Merits of commercial organic products
11. Bioplastics
12. Any other related topics

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

CO-PO Mapping

CO	PO1	PO2	PO 3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	-	-	-	-	2	2	2	2
CO2	3	3	3	3	-	-	-	-	2	2	2	3
CO3	3	3	2	2	-	2	2	-	2	-	3	3
CO4	3	2	3	2	-	-	2	-	2	2	3	3
CO5	3	3	3	3	2	2	2	-	2	-	2	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS

Semester – II

Course Code	**M 201**
Course Name	**Mathematics-II**
Contact	**3:1:0**
Total Contact Hours	**48**
Credit	**4**

Prerequisites:
The students to whom this course will be offered must have the concept of (10+2) calculus.

Course Outcome:
On successful completion of the learning sessions of the course, the learner will be able to

CO1: Recall the properties and formula related to ordinary differential equations, improper integral, Laplace transform and numerical techniques.

CO2: Determine the solutions of the problems related to ordinary differential equations, improper integral, Laplace transform and numerical techniques.

CO3: Apply appropriate mathematical tools of ordinary differential equations, improper integral, Laplace transform and numerical techniques for the solutions of the problems.

CO4: Analyze engineering problems by using differential equation, Laplace Transform and Numerical Methods.

MODULE NUMBER	COURSE CONTENT
1(10L)	**First Order Ordinary Differential Equations (ODE):** Solution of first order and first degree ODE: Exact ODE, Rules for finding Integrating factors, Linear ODE, Bernoulli's equation, Solution of first order and higher degree ODE: solvable for p, solvable for y solvable for x and Clairaut's equation.
2(10L)	**Second Order Ordinary Differential Equations (ODE):** Solution of second order ODE with constant coefficients: C.F. & P.I., Method of variation of parameters, Cauchy-Euler equations, Solution of simultaneous linear ODEs.

3(14L)	**Laplace Transform (LT):** Improper integrals; Beta and Gamma functions and their properties. Definition and existence of LT, LT of elementary functions, First and second shifting properties, Change of scale property, LT of $t\,f\,(t)$, LT of $\frac{f\,(t)}{t}$, LT of derivatives of $f(t)$, LT of integral of $f(t)$, Evaluation of improper integrals using LT, LT of periodic and step functions, Inverse LT: Definition and its properties, Convolution theorem (statement only) and its application to the evaluation of inverse LT, Solution of linear ODE with constant coefficients (initial value problem) using LT.
4(14L)	**Numerical Methods** Introduction to error analysis, Calculus of finite difference. **Interpolation:** Newton forward and backward interpolation, Lagrange's interpolation, Newton's divided difference interpolation formula. Numerical integration: Trapezoidal rule, Simpson's 1/3 rule, Weddle's rule. Numerical solution of ordinary differential equation: Euler method, Modified Euler method, Fourth order Runge-Kutta method.

Text Books:

1. Kreyszig, E., Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. Ramana, B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
3. Veerarajan, T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
4. Grewal, B.S., Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
5. Bali, N.P. and Goyal, M., A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
6. Samanta Guruprasad, A text book of Engineering Mathematics-II, New age International Publishers
7. Mollah, S. A, Numerical Analysis and Computational Procedures, Books and Allied (P) Ltd.

Reference Books:

1. Thomas, G.B. and Finney, R.L., Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. Boyce, W. E. and DiPrima, R. C., Elementary Differential Equations and Boundary Value Problems, 9th Edn., Wiley India, 2009.
3. Ross, S. L., Differential Equations, 3rd Ed., Wiley India, 1984.
4. Piskunov, N., Differential and Integral Calculus, Vol. I & Vol. II, Mir Publishers, 1969.
5. Coddington, E. A., An Introduction to Ordinary Differential Equations, Prentice Hall, India, 1995.
6. Dey, Sukhendu, Gupta Sisir, Numerical Methods, MsGraw Hill Education(India) Private Limited.
7. Jain, M. K., Iyengar, S. R. K., Jain, R. K., Numerical Methods, New age International

Publishers

Project Domain:

1. Mathematical modelling using ODE.
2. Application of ODE.
3. Application of Laplace Transform in different engineering branches.
4. Application of Numerical Methods in different engineering branches

CO-PO Mapping:

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	3	2	-	-	-	-	-	-	-	-	-	2
CO2	3	2	-	-	-	-	-	-	-	-	-	2
CO3	3	2	2	-	-	-	-	-	-	-	-	2
CO4	2	3	2	2	-	-	-	-	-	-	-	2

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – II	
Course Code	**EE201**
Course Name	**Basic Electrical Engineering**
Contact	**3:0:0**
Total Contact Hours	**36**
Credit	**3**

Prerequisites:
Basic 12th standard Physics and Mathematics, Concept of components of electric circuit.

Course Outcome:
After attending the course students would be able to -
CO1: understand and analyze basic electric circuits
CO2: study the working principles of electrical machines.
CO3: introduce the components of low voltage electrical installations
CO4: study the fundamentals of electrical Power systems and Control Systems

MODULE NUMBER	COURSE CONTENT
1(8L)	**DC Circuits:** Definition of electric circuit, linear circuit, non-linear circuit, bilateral circuit, unilateral circuit, Dependent source, node, branch, active and passive elements, Kirchhoff ‘s laws, Source equivalence and conversion, Network Theorems - Superposition Theorem, Thevenin‘s Theorem, Norton Theorem, Maximum Power Transfer Theorem, Star-Delta Conversions.
2(8L)	**AC Fundamentals:** Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three phase balanced circuits, voltage and current relations in star and delta connections.

3(10L)	**Electrical Machines:** **Transformer:** Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation, and efficiency. Auto-transformer and three-phase transformer connections. **Rotating Machines - DC Machines:** Brief idea on constructional features, classifications, working principle of both motor and generator. Simple problems on Voltage equation. Three-Phase Induction Motor: Basic concept of three phase circuit and production of rotating magnetic field. Working principle of three-phase induction motor and torque-speed characteristics (concept only).
4(3L)	**Electrical Installations:** Earthing of Electrical Equipment, ideas of basic components- MCB, MCCB, ELCB, SFU, Megger. Types of Wires and Cables, Earthing.
5(5L)	**Fundamentals of Power Systems:** Generation of power: Block schematic representation of Thermal and nuclear power plants. Renewable energy sources: solar, wind, tidal and geothermal (Block diagram and working only- No Problems). Power transmission: Typical electrical power transmission scheme-need for high voltage transmission-(Derivation is not needed, No Problems). Power Distribution: substation equipments, primary and secondary transmission and distribution systems- feeder, service mains.
6(2L)	**Introduction to Control Systems** Concept control systems, Objectives of control system, Types of control systems, Real examples of control systems.

Text Books:

1. P. Kothari & I. J. Nagrath, Basic Electrical Engineering, TMH.
2. V. Mittle& Arvind Mittal, Basic Electrical Engineering, TMH.
3. Ashfaq Hussain, Basic Electrical Engineering, S. Chand Publication.
4. Chakrabarti, Nath& Chanda, Basic Electrical Engineering, TMH.
5. C.L. Wadhwa, Basic Electrical Engineering, Pearson Education.

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

Reference Books:

1. E. Hughes, ―Electrical and Electronics Technology‖, Pearson, 2010.
2. V. D. Toro, ―Electrical Engineering Fundamentals‖, Prentice Hall India, 1989.

CO-PO Mapping:

COs	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2
CO1	1	2	2	-	-	-	-	-	-	-	-	1
CO2	2	2	2	-	-	-	-	-	-	-	-	1
CO3	-	2	2	-	-	-	-	-	-	-	-	2
CO4	-	2	-	-	-	-	-	-	-	-	-	1

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – II	
Course Code	**CS 201**
Course Name	**Programming for Problem Solving**
Contact	**3:0:0**
Total Contact Hours	**36**
Credit	**3**
Prerequisites: Number system, Boolean Algebra	

Course Outcome:
On successful completion of the learning sessions of the course, the learner will be able to

CO1: Understand the fundamental concept of Computer and mathematical knowledge and **apply** them in **designing** and **analyzing** solution to engineering problem.

CO2:Understandthe basic concept of C programming and **use** of data types/operators/input/output function for **developing and implementing** complete program leading to solution of mathematical and engineering problem.

CO3:Use conditional branching, iteration, recursion and **formulate** algorithms and programs in **solving** mathematical/scientific/engineering problem and also **analyze** the same leading to lifelong learning.

CO4: Understand the concept of arrays, pointers, file and dynamic memory allocation and **apply** it for problem solving and also **create** new data types using structure, union and enum.

CO5: Understand how to decompose a problem into functions and **assemble** into a complete program by means of modular programming possibly as a team.

MODULE NUMBER	COURSE CONTENT
1(9L)	**Fundamentals of Computer:** History of Computer, Generation of Computer, Classification of Computers, Basic structure of Computer System, Primary & Secondary Memory, Processing Unit, Input & Output devices. Number System: basic of Binary, Octal, Decimal and Hexadecimal number systems; Representation and interchanging of number in different number systems.

	Introduction to complements system, Representation of signed and unsigned numbers in singed magnitude singed 1's complement system and signed 2's complement system. Arithmetic – Addition and Subtraction (using 1's complement and 2's complement). Representation of Characters-ASCII Code Basics of Compiler, Interpreter and Assembler Problem solving – Basic concept of Algorithm. Representation of algorithm using flow chart and pseudo code. Some basic examples.
2(5L)	**Introduction to C Programming :** Overview of Procedural vs Structural language; History of C Programming Language. Variable and Data Types: The C character set identifiers and keywords, data type & sizes, variable names, declaration, statements. Operators & Expressions: Arithmetic operators, relational operators, logical operators, increment and decrement operators, bitwise operators, assignment operators, conditional operators, special operators - type conversion, C expressions, precedence and associativity. Input and Output: Standard input and output, formatted output - printf, formatted input scanf
3(5L)	**Branch and Loop:** Branching: Concept of Statement and Blocks in C, Simple if, if - else, nested if-else and if-else ladder. Switch Case: break and continue; switch-case, concept of goto and labelsLoops - while, for, do while
4(4L)	**Program Structures:** Function: Basics of Functions, function types, function prototypes, formal and actual parameter, function calling, functions returning values, functions not returning values. Recursion and Recursive Function. Storage Class in C: Storage Class-auto, external, static and register storage class, scope rules and life time of variables C preprocessor: Preprocessing directive and macro, parameterized macro
5(7P)	**Array and Pointer:** Arrays: One dimensional arrays, Two-dimensional arrays, Passing an array to a function Pointers: Pointers, Pointer and Array, Pointer and functions. Strings: Character array and string, array of strings, Passing a string to a function,

	String related functions, Pointer and String. Dynamic memory allocation: Malloc, calloc, realloc and free with example.
6(5L)	**Structures, Unions and Enum:** Basic of structures, arrays of structures, structures and pointers, bit fields. Basics of union and enum, difference between structure and union.
7(5L)	**File in C:** Files handling- opening and closing a file in different mode, formatted and unformatted files, Command line arguments, fopen, fclose, fgetc, fputc, fprintf, fscanf function.

Text Books:

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
2. Kanetkar Y. - Let us C, BPB Publication, 15th Edition.

Reference Books:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India
2. K R Venugopal & S R Prasad – MASTERING C, TMH, 2nd Edition

CO–POMapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	-	-	-	-	-	-	-	3	3	3
CO2	2	2	3	2	-	-	-	-	-	-	-	-	3	2	3
CO3	2	3	2	2	-	-	-	-	-	-	-	3	3	3	1
CO4	3	2	2	2	3	-	-	-	-	-	-	-	3	3	1
CO5	2	2	2	2	-	-	-	-	3	2	-	-	3	2	1

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – II	
Course Code	**CH 291**
Course Name	**Chemistry Lab**
Contact	**0:0:3**
Credit	**1.5**

Prerequisites:
A basic knowledge in 10+2 science with chemistry.

Course Outcome:
After attending this course, students would be
CO1: able to operate different types of instruments for estimation of small quantities chemicals used in industries and scientific and technical fields.
CO2: able to analyze and determine the composition of liquid and solid samples working as an individual and also as a team member.
CO3: able to analyze different parameters of water considering environmental issues.
CO4: able to synthesize drug and polymer materials.
CO5: Capable to design innovative experiments applying the fundamentals of chemistry.

Course Content:

1. Determination of surface tension and viscosity
2. Thin layer chromatography
3. Determination of hardness of water
4. Determination of chloride content of water
5. Determination of the rate constant of a reaction
6. Determination of cell constant and conductometric tritration
7. pH metric titrations
8. Synthesis of a polymer/drug
9. Saponification/acid value of an oil
10. Chemical analysis of a salt

Chemical oscillations- Iodine clock reaction

11. Determination of the partition coefficient of a substance between two immiscible liquids
12. Adsorption of acetic acid by charcoal
13. Estimation of iron in Mohr's salt solution by permanganometry (Redox Titration)
14. Innovative experiments (any one)

- Synthesis of silver nano-particles
- Green synthesi

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	3	2	-	2	3	-	-	-	-	2
CO2	2	2	2	2	-	2	-	-	-	2	-	2
CO3	-	-	-	-	-	-	-	-	3	3	2	2
CO4	2	2	2	2	-	-	2	-	-	-	-	2
CO5	3	3	3	3	2	2	2	2	-	-	2	2

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – II	
Course Code	**HSMC 291**
Course Name	**Professional Communication Lab**
Contact	**0:0:2**
Credit	**1**

Prerequisites:
Basic knowledge of LSRW skills.

Course Outcome:
After attending the course students' would be

CO1: Able to explain advanced skills of Technical Communication in English through Language Laboratory.

CO2: Able to apply listening, speaking, reading and writing skills in societal and professional life.

CO3: Able to demonstrate the skills necessary to be a competent Interpersonal communicator.

CO4: Able to analyze communication behaviours.

CO5: Able to adapt to multifarious socio-economical and professional arenas with the help Ofeffective communication and interpersonal skills.

MODULE NUMBER	COURSE CONTENT
1	**Introduction to the Language Lab:** a. The Need for a Language Laboratory b. Tasks in the Lab c. Writing a Laboratory Note Book
2	**Active Listening:** a. What is Active Listening? b. Listening Sub-Skills—Predicting, Clarifying, Inferencing, Evaluating, Note-taking c. Academic Listening vs Business Listening d. Listening in Business Telephony e. Study of Contextualized Examples based on Lab Recording

3	**Speaking:** a. Speaking—Accuracy and Fluency Parameters b. Pronunciation Guide—Basics of Sound Scripting, Stress and Intonation c. Fluency-focussed activities—JAM, Conversational Role Plays, Speaking using Picture/Audio Visual inputs d. Accuracy-focussed activities—Identifying Minimal Pairs, Sound Mazes, Open and Closed Pair Drilling, Student Recordings (using software) e. Group Discussion: Principles and Practice f. Business Meetings and Sales Talks
4	**Lab Project Work:** a. Making a brief Advertisement video (1-2 minutes) b. Making a brief Business Documentary film (5-7 minutes) c. Client interaction video (5-7 minutes) d. Making a short video CV (1-2 minutes)

Reference Books:

1. IIT Mumbai, Preparatory Course in English syllabus
2. IIT Mumbai, Introduction to Linguistics syllabus
3. Sasikumar et al. A Course in Listening and Speaking. New Delhi: Foundation Books, 2005.
4. Tony Lynch, Study Listening. Cambridge: Cambridge UP, 2004

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	-	-	2	-	-	3	-	2
CO2	2	3	2	-	-	2	2	2	-	3	-	3
CO3	2	3	-	-	-	3	3	3	-	3	-	3
CO4	-	-	-	-	-	3	3	3	-	3	-	3
CO5	-	-	-	-	-	-	3	3	-	3	-	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS

Semester – II

Course Code	**EE291**
Course Name	**Basic Electrical Engineering Laboratory**
Contact	**0:0:3**
Credit	**1.5**

Prerequisites:
Basic Physics and applied physics, Basic Mathematics, Basic concept of Electric Circuit.

Course Outcome:
After completion of this course students will be able to

CO1: Identify and use common electrical components.

CO2: To develop electrical networks by physical connection of various components and analyze the circuit behavior.

CO3: Apply and analyze the basic characteristics of transformers and electrical machines.

List of Experiments:

1. Basic safety precautions – earthing, introduction to measuring instruments – Voltmeter, Ammeter, Multimeter, Wattmeter, Real life Resistor, Capacitor, Inductor.
2. Verification of Thevenin's and Norton's Theorem.
3. Verification of Superposition and Maximum Power Transfer Theorem.
4. Characteristics of Fluorescent, Tungsten and Carbon filament lamps.
5. Study of R-L-C series circuit.
6. Three-phase Power measurement with two wattmeter methods.
7. Demonstration of cut-out sections of machines: DC Machine (commutator-brush arrangement), Induction Machine (squirrel cage rotor).
8. Measurement of primary and secondary voltage and current of single-phase transformer – Open Circuit and Short Circuit Test.
9. Starting, Reversing and speed control of DC shunt motor.
10. Torque-Speed characteristics of DC Machine.
11. Torque-Speed characteristics of Three-phase Induction Motor.
12. Test on single-phase Energy Meter.
13. Innovative experiments

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	2	-	-	-	-	-	-	1	-	-	1
CO2	-	2	2	2	-	-	-	-	2	-	-	1
CO3	-	2	-	2	-	-	-	-	2	-	-	1

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS

Semester – II

Course Code	**ME 292**
Course Name	**Engineering Graphics & Design**
Contact	**0:0:3**
Credit	**1.5**

Prerequisites:
Basic knowledge of geometry

Course Outcome:
After completion of the course students will be able to

CO1: get introduced with Engineering Graphics and visual aspects of design.

CO2: know and use common drafting tools with the knowledge of drafting standards.

CO3: be able to apply computer aided drafting techniques to represent line, surface or solid models in different Engineering viewpoints.

CO4: be able to produce part models; carry out assembly operation and show working procedure of a designed project work using animation.

List of Drawing:

Traditional Engineering Graphics:

Principles of Engineering Graphics; Orthographic Projection; Descriptive Geometry; Drawing Principles; Isometric Projection; Surface Development; Perspective; Reading a Drawing; Sectional Views; Dimensioning & Tolerances; True Length, Angle; intersection, Shortest Distance.

MODULE NUMBER	COURSE CONTENT
1	**Introduction to Engineering Drawing:** Principles of Engineering Graphics and their significance, Usage of Drawing instruments, lettering, Conic sections including Rectangular Hyperbola (General method only); Cycloid, Epicycloid and Involute; Scales – Plain, Diagonal and Vernier Scales.

2	**Orthographic & Isometric Projections:** Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes on inclined Planes - Auxiliary Planes; Projection of Solids inclined to both the Planes- Auxiliary Views; Isometric Scale, Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa.
3	**Sections and Sectional Views of Right Angular Solids:** Drawing sectional views of solids for Prism, Cylinder, Pyramid, Cone and project the true shape of the sectioned surface, Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw sectional orthographic views of objects from industry and dwellings (foundation to slab only). **Computer Graphics**: Engineering Graphics Software; -Spatial Transformations; Orthographic Projections; Model Viewing; Co-ordinate Systems; Multi-view Projection; Exploded Assembly; Model Viewing; Animation; Spatial Manipulation; Surface Modelling; Solid Modelling.
4	**Overview of Computer Graphics:** Demonstration of CAD software [The Menu System, Toolbars (Standard, Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), Zooming methods, Select and erase objects].
5	**CAD Drawing, Customization, Annotations, layering:** Set up of drawing page including scale settings, ISO and ANSI standards for dimensioning and tolerancing; Using various methods to draw straight lines, circles, applying dimensions and annotations to drawings; Setting up and use of Layers, changing line lengths (extend/lengthen); Drawing sectional views of solids; Drawing annotation, CAD modelling of parts and assemblies with animation, Parametric and nonparametric solid, surface and wireframe modelling, Part editing and printing documents.
6	**Demonstration of a simple team design project :** Illustrating Geometry and topology of engineered components: creation of engineering

	models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; Meshed topologies for engineering analysis and tool-path generation for component manufacture, use of solid-modeling software for creating associative models at the component and assembly levels.

Text Books:

1. Bhatt N.D., Panchal V.M. & Ingle P.R, (2014), Engineering Drawing, Charotar Publishing House.

2. K. Venugopal, Engineering Drawing + AutoCAD, New Age International publishers.

Reference Books:

1. Pradeep Jain, Ankita Maheswari, A.P. Gautam, Engineering Graphics & Design, Khanna Publishing House

2. **Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication.**

3. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education

4. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers.

CO-PO Mapping:

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	2	3	2	2	2	2	-	2	2	2	2
CO2	2	2	3	2	2	2	2	2	2	2	2	2
CO3	2	2	3	2	3	2	2	-	2	2	2	3
CO4	2	2	3	3	3	3	2	2	3	3	2	2

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS

Semester – II

Course Code	**CS 291**
Course Name	**Programming for Problem Solving Lab**
Contact	**3:0:0**
Credit	**1.5**

Prerequisites:
Number system, Boolean Algebra

Objective of the course:

The objective of the course is to make the students able to –

1. Understand and propose appropriate command or function in running system or developing program.
2. Identify and propose appropriate data type, arithmetic operators, input/output functions and also conditional statements in designing effective programs.
3. Design and develop effective programs using iterative statements as well as recursive functions using modular programming approach.
4. Explain and organize data in arrays, strings and structures and manipulate them through programs and also define pointers of different types and use them in defining self-referential structures and also to construct and use files for reading and writing.
5. Prepare laboratory reports on interpretation of experimental results and analyze it for validating the same.

Course Outcome:

After completion of this course students will be able to

CO1:Understand, propose and **apply** appropriate command or function in running system or **developing** program for engineering and mathematical problems depending on the platform used even in changed environment leading to their lifelong learning.

CO2:Identify and **apply** appropriate data type, arithmetic operators, input/output functions and also conditional statements in **designing** effectiveprogramsto**solve** complex engineering problem using modern tools.

CO3:Design and **develop** effective programs after **analyzing** engineering and mathematical problems using iterative statements as well as recursive functions using modular programming approach possibly as a team maintaining proper ethics of collaboration.

CO4: Explain and **organize** data in arrays, strings and structures and manipulate them through programs and also **define** pointers of different types and **use** them in defining self-referential structures and also to **construct** and **use** files for reading and writing to and from leading to solution of engineering and mathematical problem.

CO5: Prepare laboratory reports on interpretation of experimental results and **analyze** it for validating the same maintaining proper ethics of collaboration.

MODULE NUMBER	COURSE CONTENT
1	Familiarization withsomebasiccommandsofDOSandLinux.FilehandlingandDirectorystructures,filepermissions,creatingandeditingsimpleCprogram in different editor and IDE,compilationandexecutionofCprogram. Introduction to Codeblock.
2	Problem based on a) Basic data types b) Different arithmetic operators. c) printf( ) and scanf( ) functions.
3	Problem based on conditional statements using a) if-else statements b) different relational operators c) different logical operators
4	Problem based on a) **for**loop b) **while**loop c) **do-while**loop
5	Problem based on a) Howtowriteamenudrivenprogramusing**switch-case**statement b) Howtowritea function and passing values to a function c) Howtowritea**recursivefunction.**
6	Problem based on a) Howtouse**array(both I-Dand2-D).** b) Howtopassan**array**toa**function.**
7	Problem based onmanipulationofstrings in different way.
8	Problem based on a) Howto handle compound variables in C b) How to handle file in C c) How to use command line argument in C

Textbook:

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.

ReferenceBooks:

1. "Design Analysis and Algorithms" by Hari Mohan Pandey.

CO–POMapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	2	-	-	-	-	-	-	-	3	3	3	-
CO2	3	3	2	3	3	-	-	-	-	-	-	-	3	3	3
CO3	2	3	3	3	-	-	-	3	3	-	-	-	-	-	3
CO4	2	2	2	2	-	-	-	-	-	-	-	-	3	-	-
CO5	-	-	-	-	-	-	-	3	-	3	-	-	3	-	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS

Semester – III

Course Code	**M(CSE)301**
Course Name	**Discrete Mathematics**
Contact	**3:0:0**
Total Contact Hours	**36**
Credit	**3**

Prerequisites:
Higher Secondary Level Mathematics.

Objective of the course

1. Comprehend the fundamental concepts of Set Theory, Mathematical Logic for inferencing and various Proof Techniques, Theory of Numbers, Algebraic Structures. Graph Theory.
2. Formulate problems based on Combinatorial Structures, Algebraic Structures, Graph Theory, Recurrence Relation etc.
3. Use the concepts of Discrete Mathematics to solve problems based on Combinatorial Structures, Algebraic Structures, Graph Theory, Recurrence Relation etc.
4. Provide proof sof theorems using well known Proof Techniques and Mathematical Logic Frameworks to justify a claim.
5. Propose solutions to the complex problems of Discrete Mathematics and Analyze their effectiveness in solving the relevant problems

Course Outcome:
After completion of this course students will be able to

CO1:Understand the fundamental concepts of Set Theory to **Explain or Illustrate**and**Identify** problems wherestudents can **Apply** the concept appropriately to **Solve** them.

CO2:Understand the fundamental concepts of Mathematical Logic and Proof Techniques so that they can **Prove** theorems using Proof Techniques and Mathematical Logic Frameworks to justify a claim.

CO3 Explain or Illustrate the fundamental Theory of Numbers and **Identify** problems where students can **Use** the concept appropriately to **Solve** them.

CO4:Explain or Illustrate the fundamental principles of Algebraic Structures and **Identify** problems where studentscan **apply** the concept appropriately to **Solve** them.

CO5:Develop ideas to **Propose** solutions to the problems of Graph Theory and **Identify** problems where students can

Apply the concept appropriately and **Analyze**the effectiveness as well as limitations of solutions making the students aware of its utilitarian importance for further explorations leading towards lifelong learning.

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

MODULE NUMBER	COURSE CONTENT
1(8L)	**Set Theory:** Set: Operations and Properties of set, Finite Set, Power Set, Cardinality of finite set, Cartesian Product, Relation: Types of Relations, Properties of Binary Relation, Equivalence Relation, Partial Ordering Relation and Poset, Lattice. Combinatorics and Counting: Sum and product rule, Permutation and Combination Principle of Inclusion Exclusion. Pigeon Hole Principle. Generating Functions and Recurrence Relations: Recursively defined relation and functions, Discrete Numeric Function, Growth of Functions, Problems on Recurrence Relations and their solutions using different methods.
2(8L)	**Mathematical Logic and Proof Techniques:** Propositional Logic: Basics of Boolean Logic, Idea of Propositional Logic, well-formed formula, Truth tables, Tautology, Satisfiability, Contradiction, Algebra of proposition, Inference theory of Propositional Logic. Predicate Logic: Idea of First Order Predicate Logic and Quantifiers, well-formed formula of predicate, Inference theory of Predicate Logic. Proof Techniques: Some Terminology, Proof Methods and Strategies, Forward Proof, Proof by Contradiction, Proof by Contraposition, Proof of Necessity and Sufficiency.
3(4L)	**Theory of Numbers:** Well-Ordering Principle, Divisibility theory and properties of Divisibility, Fundamental theorem of Arithmetic, Prime and Composite Numbers. Greatest Common Divisor and Euclidean Algorithm, Congruence, Residue Classes.
4(8L)	**Algebraic Structures:** Concepts of Groups, Subgroups and Order, Cyclic Groups, Cosets, Normal Subgroups, Permutation and Symmetric groups, Group Homomorphisms. Elementary properties of Rings and related problems. Elementary properties of Fields and related problems. Elementary properties of Vector Space and related problems.
5(8L)	**Graph Theory:** Graph Terminologies and their properties: Degree, Connectivity, Path, Cycle, Sub-Graph, Isomorphism, Eulerian and Hamiltonian Walks, Matrix representation of graphs, Shortest

	Path in Graph. Graph Colouring and Matching: Colouring Vertices and Chromatic Number, Colouring Edges and Total Colouring, Independence and Chromatic Partitioning, Cliques, Perfect Graphs, Bounds on Chromatic Numbers, Chromatic Polynomials, Matching. Tree: Rooted Trees, Binary Search Tree and Tree Sorting, Spanning Tree, Weighted Trees and prefix codes.

Textbook:

1. 1 Kenneth H. Rosen, Discrete Mathematics and its Applications, Tata McGraw – Hill.
2. Susanna S. Epp, Discrete Mathematics with Applications,4th edition, Wadsworth Publishing Co. Inc..

ReferenceBooks:

3. C L Liu and D P Mohapatra, Elements of Discrete Mathematics A Computer Oriented Approach, 3rd Edition by, Tata McGraw – Hill.
4. J.P. Tremblay and R. Manohar, Discrete Mathematical Structure and It's Application to Computer Science", TMG Edition, TataMcgraw-Hill
5. Seymour Lipschutz, Marc Lipson, Discrete Mathematics (Schaum's Outlines Series), Tata McGraw - Hill.

CO–PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	2	2	3	2	-	-	-	-	-	-	-	-	2	-	2
CO4	2	2	2	3	-	-	-	-	-	-	-	-	2	-	2
CO5	2	2	3	3	-	-	-	-	-	-	-	2	2	2	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS

Semester – III

Course Code	**ESC301**
Course Name	**Analog Electronics**
Contact	**3:0:0**
Total Contact Hours	**36**
Credit	**3**

Prerequisites:
Concept of basic electronics devices, basic law of circuit analysis.

Objective of the course

1.To provide a strong foundation on linear circuits

2. To familiarize students with applications of various IC's

3. Having a broad coverage in field that is relevant for engineers to design Linear circuits using OP-AMPS

4. Familiarize the conversion of data from Analog to Digital and Digital to Analog

Course Outcome:
After completion of this course students will be able to

CO1:Understand the characteristics of ICs, diodes, transistors, FET and **apply** them in **designing** solution to engineering problems

CO2:Understand the working principles of RC coupled amplifier, feedback amplifier, voltage gain and current gain in these circuits, handling frequencies and bandwidth related problems and **demonstrate** the solutions leading to mathematical and engineering problems.

CO3Analyzethe functioning of OP-AMP, feedback amplifiers, oscillator circuits and **design** different circuits leading to lifelong learning.

CO4:Understand, **implement** and **evaluate** the performance of different types of analog amplifiers and multi-vibrator circuits.

CO5:Understand different types of power amplifiers, power supply including ADC and DAC circuits and **compare**their performances and **solve** related problems possibly as a team.

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

MODULE NUMBER	COURSE CONTENT
1(4L)	**Small signal amplifiers:** Introduction to Analog Integrated Circuits, BJT Modelling-hybrid model of transistors; Emitter follower circuits, High frequency model of transistors. FET Small signal analysis - Source follower
2(9L)	**Transistor Amplifiers:** RC coupled amplifier, functions of all components, equivalent circuit, derivation of voltage gain, current gain, input impedance and output impedance, frequency response characteristics, lower and upper half frequencies, bandwidth, and concept of wide band amplifier. **Feedback Amplifiers & Oscillators:** Feedback concept, Voltage series-shunt, current series-shunt feedback Configurations, Berkhausen criterion, Colpitts, Hartley's, Phase shift, Wien brige and crystal oscillators.
3(14L)	**Operational Amplifier:** Introduction to Integrated Circuits, Differential Amplifier, Constant current source (current mirror etc.), level shifter, CMRR, Open & Closed loop circuits, importance of feedback loop (positive & negative), Block Diagram of OPAMP, Ideal OPAMP. **Applications of Operational Amplifiers:** analog adder, subtractor, integrator, differentiator, comparator, Schmitt Trigger. Instrumentation Amplifier, Log & Anti-log amplifiers, Analog multiplier, Precision Rectifier, voltage to current and current to voltage converter, free running Multivibrator, zero crossing detector **Multivibrator** – Monostable, Bistable, Astable multivibrators ; Monostable and astable operation using 555 timer.
4(9L)	**Large signal Amplifiers:** Introduction to power amplifiers (Class A, B, AB) **Power Supply**: Analysis for DC voltage and ripple voltage with C, L-C and C-L-C filters in Rectifier Circuit - Regulated DC power supplies- Line regulation, output resistance and temperature coefficient, Series and Shunt Voltage Regulation – percentage regulation, Fixed output voltage IC regulator 78xx and 79xx series , Adjustable output voltage regulator, LM 337 series power supply ICs, Concept of **Switched** Mode Power Supply.

Textbook:

1. Millman Halkias – Integrated Electronics, McGraw Hill
2. Schilling & Belove—Electronic Circuit: Discrete & Integrated, 3/e, McGraw Hill
3. Ramakant A. Gayakwad —Op- Amps and linear Integrated Circuits, Pub: PHI
4. Boylested&Nashelsky- Electronic Devices and Circuit Theory- Pearson/PHI
5. "Operational Amplifiers and Linear Integrated Circuits" by Robert F. Coughlin, Frederick F. Driscoll

ReferenceBooks:

1. Rashid-Microelectronic Circuits- Analysis and Design- Thomson (Cenege Learning)
2. Linear Integrated Circuits – D. Roy Choudhury &Shail B. Jain
3. Analog Integrated Circuits – J. B. Gupta..

CO-PO & PSO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	-	-	-	-	-	-	-	2	3	2
CO2	3	3	3	3	3	-	-	-	-	-	-	-	2	3	2
CO3	3	3	3	3	3	-	-	-	-	-	-	3	2	3	2
CO4	3	3	3	3	3	-	-	-	-	-	-	-	2	3	2
CO5	3	3	3	3	3	-	-	-	3	-	2	-	2	3	2
CO	3	3	3	3	3	-	-	-	3	-	2	3	2	3	2

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS

Semester – III

Course Code	**ESC302**
Course Name	**Digital Electronics**
Contact	**3:0:0**
Total Contact Hours	**36**
Credit	**3**

Prerequisites:
Basic concepts of Logic gates, Truth Tables, Concept of basic components of a digital computer.

Objective of the course
. Objective of Digital electronics is to acquire the basic knowledge of different logic gates and to prepare students to Perform. the analysis and design of various digital electronic circuits

Course Outcome:
After completion of this course students will be able to

CO1:Understandboolean algebra, number system and **execute** and **solve** the problem related to number system conversion, minimization techniques and their application in digital design which **leads** to the solution of engineering problems

CO2:Understandthe working principles of the logic gates, combinational circuits as well as different components of a digital computer and **demonstrate** the solutions leading to mathematical and engineering problems.

CO3Analyze and **design** different sequential circuits like flip flops, registers and counters leading to lifelong learning

CO4:Understand, implement and **evaluate** the performance of different types of digital circuits.

CO5:Understand different logic families like TTL, ECL, MOS and CMOS, A/D and D/A conversion Programmable logic Array, programmable Array logic, Sequential Programmable Devices and **compare** their performances and **solve** related problems possibly as a team.

MODULE NUMBER	COURSE CONTENT
1(8L)	Binary Number System [1L], BCD, ASCII, EBDIC, Gray codes and their conversions [1L], Introduction and laws of boolean algebra [1L], boolean functions, minterm and maxterm,

	prime implicants, representation in SOP and POS forms [2L], minimization of logic expressions by Karnaugh map and algebraic method [3L].
2(8L)	**Combinational circuits:** Adder and Subtractor (half-full adder & subtractor) [2L], Serial & Parallel Adder, Carry look ahead adder and Parity Generator[2L], Encoder, Decoder, Multiplexer [2L], Demultiplexer, Comparator, Code Converters [2L.
3(12L)	**Sequential Circuits:** Flip-Flops, SR, JK, Master slave JK, D, T and, characteristic Tables, Excitation tables. [5L] Basic concept of Synchronous and Asynchronous counters, Up/Down Counters, Ring counter, Johnson counter, Design of Modulo-N Counter, Counter applications [5L] Registers (SISO, SIPO, PIPO, PISO) [2L]
4(8L)	A/D and D/A conversion techniques – Basic concepts (D/A :R-2-R only [2L] , A/D: successive approximation [2L]), Logic families- TTL, ECL, MOS and CMOS - basic concepts [2L], Programmable logic Array, programmable Array logic, Sequential Programmable Devices [2L]

Textbook:

1. 1. Salivahanan S - Digital Circuits and Design, Oxford
2. Morries Mano - Digital Logic Design- PHI

ReferenceBooks:

1. R. P. Jain - Modern Digital Electronics, 2/e, Mc Graw Hill
2. Thomas L. Floyd - Digital Fundamentals: A Systems Approach, Pearson

CO-PO & PSO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	-	-	-	-	-	-	-	2	3	2
CO2	3	3	3	3	3	-	-	-	-	-	-	-	2	3	2
CO3	3	3	3	3	3	-	-	-	-	-	-	3	2	3	2
CO4	3	3	3	3	3	-	-	-	-	-	-	-	2	3	2
CO5	3	3	3	3	3	-	-	-	3	-	2	-	2	3	2

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

CO	3	3	3	3	3	-	-	-	3	-	2	3	2	3	2

SYLLABUS

Semester – III

Course Code	**CT301**
Course Name	**Programming in Python**
Contact	**3:0:0**
Total Contact Hours	**36**
Credit	**3**

Prerequisites:
Basics of computer, Boolean Algebra.

Objective of the course:

- .Describe the core syntax and semantics of Python programming language.
- Discover the need for working with the strings and functions.
- Illustrate the process of structuring the data using lists, dictionaries, tuples and sets.
- Indicate the use of regular expressions and built-in functions to navigate the file system.

Course Outcome:
After completion of this course students will be able to

CO1:Interpret the fundamental Python syntax and semantics and be fluent in the **use** of Python control flow statements.

CO2: Develop proficiency in the handling of strings and functions.

CO3 Identify the methods to **design** and **modify** Python programs by **applying** the data structures like lists, dictionaries, tuples and sets.

CO4: Articulate the concepts of Dictionaries while **analyzing** different case studies.

CO5:Identify the commonly used operations **collaborating** file systems and regular expressions.

MODULE NUMBER	COURSE CONTENT
1(7)	**Parts of Python Programming Language:** **Parts of Python Programming Language,** Identifiers, Keywords, Statements and Expressions, Variables, Operators, Precedence and Associativity, Data Types, Indentation, Comments, Reading Input, Print Output, Type Conversions, The type() Function and Is

	Operator, Dynamic and Strongly Typed Language, **Control Flow Statements,** The if Decision Control Flow Statement, The if…else Decision Control Flow Statement, The if…elif…else Decision Control Statement, Nested if Statement, The while Loop, The for Loop, The continue and break Statements, Catching Exceptions Using try and except Statement.
2(3)	**Functions:** Built-In Functions, Commonly Used Modules, Function Definition and Calling the Function, The return Statement and void Function, Scope and Lifetime of Variables, Default Parameters, Keyword Arguments, *args and **kwargs, Command Line Arguments.
3(9)	**Strings:** Creating and Storing Strings, Basic String Operations, Accessing Characters in String by Index Number, String Slicing and Joining, String Methods, Formatting Strings, **Lists,** Creating Lists, Basic List Operations, Indexing and Slicing in Lists, Built-In Functions Used on Lists, List Methods, The del Statement.
4(8)	**Self-Study:** **Dictionaries**, Creating Dictionary, Accessing and Modifying key; value Pairs in Dictionaries, Built-In Functions Used on Dictionaries, Dictionary Methods, The del Statement, **Tuples and Sets,** Creating Tuples, Basic Tuple Operations, Indexing and Slicing in Tuples, Built-In Functions Used on Tuples, Relation between Tuples and Lists, Relation between Tuples and Dictionaries, Tuple Methods, Using zip() Function, Sets, Set Methods, Traversing of Sets, Frozenset.
5(8)	**Files:** Types of Files, Creating and Reading Text Data, File Methods to Read and Write Data, Reading and Writing Binary Files, The Pickle Module, Reading and Writing CSV Files, Python OS and os.path Modules, **Regular Expression Operations,** Using Special Characters, Regular Expression Methods, Named Groups in Python Regular Expressions, Regular Expression with glob Module.

Textbook:

1. Gowrishankar S, Veena A, “Introduction to Python Programming”, 1st Edition, CRC Press/Taylor & Francis, 2018.

ReferenceBooks:

1. Jake VanderPlas, “Python Data Science Handbook: Essential Tools for Working with Data”, 1st Edition, O'Reilly Media, 2016.
2. AurelienGeron, “Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools, and

Techniques to Build Intelligent Systems”, 2nd Edition, O’Reilly Media, 2019.
3. Wesley J Chun, “Core Python Applications Programming”, 3rd Edition, Pearson Education India, 2015.
4. Miguel Grinberg, “Flask Web Development: Developing Web Applications with Python”, 2nd Edition, O'Reilly Media, 2018.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	1	3	-	-	-	-	-	-	-	2	3	3
CO2	3	3	2	1	3	-	-	-	-	-	-	-	3	3	3
CO3	2	2	2	1	3	-	-	-	-	-	-	-	3	3	3
CO4	3	3	2	2	3	-	-	-	-	-	-	-	2	2	3
CO5	2	2	2	2	3	-	-	-	-	-	-	-	3	2	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – III	
Course Code	**CS302**
Course Name	**Data Structures**
Contact	**3:0:0**
Total Contact Hours	**36**
Credit	**3**

Prerequisites:

1. Familiarity with the fundamentals of C or other programming language
2. A solid background in mathematics, including probability, set theory.

Objective of the course:

.The objective of the course is to make the students able to -

1. Understand the concept of data structure and create new data structure and also analyzing the efficiency of the same.
2. Identify and differentiate different types of data structures and implement the appropriate data structure and analyze the same.
3. Understand and implement stack, queue and dequeue by selecting appropriate methods.
4. Understand and implement different non-linear data structures by selecting appropriate methods.
5. Understand different factors of sorting and searching algorithm and select the appropriate algorithm and also implement and analyze the algorithm.

Course Outcome:

After completion of this course students will be able to

CO1:Understand the concept of data structure and **create** new data structure to **propose** efficient solution by writing appropriate algorithm and program for engineering and mathematical problem after **analyzing** the efficiency of the same.

CO2:Identify and **differentiate** different types of data structures and **implement** the appropriate data structure after **analyzing** complex engineering problem leading to their lifelong learning.

CO3Understand and **implement** stack, queue and dequeue by **selecting** appropriate methods and **use** it for **solving** real life and engineering problem **choosing** appropriate modern tools.

CO4:Understand and **implement** different non-linear data structures by **selecting** appropriate methods and **apply** it for **solving** complex engineering problem and also **argue** and **judge** maintaining the professional ethics tovalidate the same.

CO5:Understand different factors of sorting and searching algorithm and **select** the appropriate algorithm for **solving** complex engineering problem and also **implement** and **analyze** the algorithm.

MODULE NUMBER	COURSE CONTENT
1(4L)	**Introduction:** Concepts of data and information; Concept of Abstract Data Type, Data Structure and Data Type. Classification of Data Structures- Primitive and Non-Primitive Data Structure, Linear and Non-Linear Data Structure. Need of Data Structures. (1L) Concept of algorithms and programs, Different methods of representing algorithm; Algorithm analysis, time and space analysis of algorithms – Asymptotic notations like Big Oh (O), Big Omega(Ω) and Theta(Θ) notation(definition and significance). (3L).
2(9L)	**Non-Restricted Linear Data Structure]:** List or Linear List: Definition and Example, List as ADT. Representation of Linear List- Sequential Representation and Linked Representation. Array: Introduction to sequential representation, Linearization of multidimensional array. Application of array- representation of polynomial using array, Representation of Sparse matrix using array. Linked List: Introduction to linked representation, Implementation of different types of linked list- Singly linked list, Doubly linked list, Circular linked list, Circular Doubly Linked List. Application of Linked list- Representation of polynomial.
3(6L)	**Restricted Linear Data Structure:** Stack: Definition of Stack, implementations of stack using array and linked list Applications of stack- infix to postfix conversion, Postfix Evaluation Recursion: Principles of recursion - use of stack, tail recursion. Tower of Hanoi using recursion. Queue: Definition of Queue; Implementation of queue using array- physical, linear and circular model; Implementation of queue using linked list. Dequeue- Definition and different types of dequeue.
4(9L)	**Nonlinear Data structures:** Trees and Binary Tree: Basic terminologies; Definition of tree and binary tree. Difference between tree and binary tree,

	Representation of binary tree (using array and linked list) Binary tree traversal (pre-, in-, post- order); Threaded binary tree- definition, insertion and deletion algorithm; Binary search tree- Definition, insertion, deletion, searching algorithm; Height balanced binary tree: AVL tree- definition, insertion and deletion with examples only. m –Way Search Tree: B Tree – Definition, insertion and deletion with examples only; B+ Tree – Definition, insertion and deletion with examples only. Heap: Definition (min heap and max heap), creation, insertion and deletion algorithm. Application of heap (priority queue and sorting). Graphs: Definition and representation (adjacency matrix, incidence matrix and adjacency list). Graph traversal– Depth-first search (DFS), Breadth-first search (BFS) - concepts of edges used in DFS and BFS (tree-edge, back-edge, cross-edge, and forward-edge).
5(8L)	**Sorting and Searching :** Sorting Algorithms: Definition and need of sorting, different types of sorting algorithm(internal, external, stable, in-place, comparison based); Bubble sort, Insertion sort, Selection sort, Quick sort, Merge sort, Radix sort – algorithm with analysis (time complexity) Searching: Sequential search – algorithm with analysis (time complexity); improvement using sentinel. Binary search and Interpolation Search algorithm with analysis (time complexity) Hashing: Introduction and purpose of Hashing and Hash functions (division, folding and mid-square), Collision resolution techniques.

Textbook:

1. Data Structures Through 'C' Language by Samiran Chattopadhyay, Debabrata Ghosh Dastidar, Matangini Chattopadhyay, Edition: 2001, BPB Publications
2. Fundamentals of Data Structures of C by Ellis Horowitz, Sartaj Sahni, Susan Anderson-freed 2nd Edition, UniversitiesPress.

ReferenceBooks:

1. J Data Structures, Algorithms, and Software Principles in C by Thomas A. Standish, 1 Edition, Pearson.
2. Data Structures by S. Lipschutz, Special Indian Edition, Tata McGraw Hill Education (India) Private Limited
3. Data Structures and Program Design In C by Robert L. Kruse, Bruce P. Leung 2nd Edition, Pearson

4. Data Structures in C by Aaron M. Tenenbaum, 1St Edition, Pearson.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	1	-	-	-	-	-	-		3	3	3
CO2	3	3	3	3		-	-	-	-	-	-	3	3	3	3
CO3	3	3	3	3	3	-	-	-	-	-	-		3	3	1
CO4	3	3	3	3	1	-	-	2	-	-	-	-	3	3	3
CO5	3	3	3	3	1	-	-	-	-	-	-		3	1	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS

Semester – III

Course Code	**HSMC 303**
Course Name	**Universal Human Values2: Understanding Harmony**
Contact	**3:0:0**
Total Contact Hours	**36**
Credit	**3**

Prerequisites:
None.

Course Outcome:
After completion of this course students will be able to

CO1: Develop holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.

CO2: Cultivate the harmony in the human being, family, society and nature/ existence.

CO3 Strengthen self-reflection

CO4: Build commitment and courage to act.

CO5:Understand different factors ofHarmony of family, **Society, nature** and **Implications** on Professional Ethics.

MODULE NUMBER	COURSE CONTENT
1(8L)	**Course Introduction-Need, Basic Guidelines, Content and Process for Value Education:** Self-Exploration–what is it? -Its content and process; 'Natural Acceptance' and Experiential Validation-as the process for self-exploration. Continuous Happiness and Prosperity- A look at basic Human Aspirations. Right understanding, Relationship and Physical Facility-the basic requirements for fulfillment of aspirations of every human being with the incorrect priority. Understanding Happiness and Prosperity correctly-A critical appraisal of the current scenario. Method to fulfill the above human aspirations: understanding and living in harmony at various levels. Practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking.
2(6L)	**Understanding Harmony in the Human Being – Harmony in Myself!:** Understanding human being as a co-existence of the sentient 'I' and the material 'Body'.

	Understanding the needs of Self ('I') and 'Body' - happiness and physical facility. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer).Understanding the characteristics and activities of 'I' and harmony in 'I'. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail. Programs to ensure Sanyam and Health. Practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Ensuring health vs dealing with disease discussion.
3(7L)	**Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship**: Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship. Understanding the meaning of Trust; Difference between intention and competence. Understanding the meaning of Respect, Difference between respect and differentiation; the othersalient values in relationship. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals. Visualizing a universal harmonious order in society – Undivided Society, Universal Order-from family to world family. Practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Elicit examples from students' lives.
4(8L)	**Understanding Harmony in the Nature and Existence-Whole existence as Coexistence**: Understanding the harmony in the Nature. Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self- regulation in nature. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space. Holistic perception of harmony at all levels of existence. Practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of Technology etc.
5(7L)	**Implications of the above Holistic Understanding of Harmony on Professional Ethics**: Natural acceptance of human values. Definitiveness of Ethical Human Conduct. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems. d. Case studies of typical holistic technologies, management models and production systems. Strategy for transition from the present state to Universal Human Order: e. At the level of individual: as socially and ecologically responsible engineers, technologists and managers f. At the level of society: as mutually enriching institutions and organizations.

	g. Practice Exercises and Case Studies in Practice (tutorial) Sessions to discuss the conduct as an engineer or scientist etc.

Textbook:

1. HumanValuesandProfessionalEthicsbyRRGaur,RSangal,GPBagaria,ExcelBooks,NewDelhi,2010

ReferenceBooks:

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak,1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, NewDelhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautifu l- E.F Schumacher.
6. Slow is Beautiful- Cecile Andrews
7. Economy of Permanence-JC Kumarappa
8. Bharat Mein Angreji Raj-Pandit Sunderlal
9. Rediscovering India-by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K.Gandhi
11. India Wins Freedom-Maulana Abdul KalamAzad
12. Vivekananda-Romain Rolland(English)
13. Gandhi-Romain Rolland(English)

CO-PO Mapping:

CO	PO 1	PO 2	PO3	P O4	P O 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PS O2	PS O 3
CO1	3	2	1	-	2	1	-	-	-	2	3	3	2	3	3
CO2	3	2	-	1	3	2	-	1	2	-	3	3	**3**	3	3
CO3	3	2	2	-	2	3	1	-	2	1	3	3	1	3	3
CO4	3	1	-	2	-	-	-	2	-	3	3	3	3	3	2
CO5	2	1	**3**	2	-	-	-	2	-	3	3	3	3	3	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

Practical

SYLLABUS	
Semester – III	
Course Code	**M(CS)391**
Course Name	**Numerical Methods lab**
Contact	**1:0:3**
Credit	**2.5**

Prerequisites:
Basic programming knowledge

Course Objective(s) :

The objective of the course is to make the students able to –

- Provide basic programming skills for solving the problems in numerical methods and statistics.

Course Outcome:
After completion of this course students will be able to

CO1:Describe and **explain** the theoretical workings of numerical techniques with the help of C/ MATLAB

CO2:Compute basic command and scripts in a mathematical programming language

CO3Apply the programming skills to solve the problems using multiple numerical approaches.

CO4:Analyze if the results are reasonable, and then interpret and clearly communicate the results.

CO5:Apply the distinctive principles of numerical analysis and the associated error measures..

List of Experiment:

1. Assignments on Newton forward /backward, Lagrange's interpolation.
2. Assignments on numerical integration using Trapezoidal rule, Simpson's 1/3 rule
3. Assignments on numerical solution of a system of linear equations using Gauss elimination, Gauss Jacobi and Gauss-Seidel iterations.
4. Assignments on numerical solution of Algebraic Equation by Bisection method, Regula-Falsi method, Newton-Raphson method.
5. Assignments on ordinary differential equation: Euler's method, Euler's modified method, Runge-Kutta methods.
6. Simple problems as assignment on Measures of Central Tendency- mean, median, mode, Measures of Dispersion- variance, standard deviation. Problems related to engineering field.
7. Innovative Experiments

Implementation of numerical methods on computer through C/C++ and commercial Software Packages: Matlab / Scilab / Labview / Mathematica/NAG (Numerical Algorithms Group/Python.

CO-PO Mapping

CO #	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	1	1	-	2	-	1	2	2	2	2
CO2	3	3	3	2	2	1	1	-	2	-	1	2	2	2	2
CO3	3	3	3	2	2	1	1	-	2	-	1	2	2	2	2
CO4	3	3	3	2	2	1	1	-	2	-	1	2	2	2	2
CO5	3	3	3	2	2	1	1	-	2	-	1	2	2	2	2

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS

Semester – III

Course Code	**ESC391**
Course Name	**Digital and Analog Electronics Lab**
Credit	**1.5**

Prerequisites:
Basic concepts of logic gates, truth tables, function realization – minimization of logic expressions by K-map, concept of basic components of a digital computer, binary arithmetic.

Course Objective(s) :
This subject will act as prerequisite for computer organization and architecture. The aims of this lab are to make students familiar with the principles of combinational and sequential digital logic design and optimization at a gate level and designing various circuits with ICs.

Course Outcome:
After completion of this course students will be able to

CO1:Comprehend the working principles of the logic gates and combinational circuits like half and full adder circuits And**execute**and **solve** problems related to digital circuit design which **leads** to the solution of engineering problems.

CO2:Understand the working principle of half and full adder circuit, adder-subtractor composite unit and carry-look-ahead adder circuit and **Demonstrate**the solutions leading to engineering problems.

CO3Design and compare different circuits- adder, subtractor, multiplexer, De- multiplexer, decoder, encoder, comparator and flip flop .

CO4:Analyze and implement sequential circuits like register, counter leading to lifelong learning.

CO5:Understand different circuits and c**onstruct** digital circuits to verify the operations of DAC and different types of logic families and PLDs and **compare** their performances and **solve** related problems possibly as a team.

Course Content:

1. A) Realization of basic gates and universal gates.
   B) Realization of basic gates using universal gates.
2. Design a Half adder and Full Adder circuit using basic gates and verify its output.
3. Design a Half subtractor and Full Subtractor circuit using basic gates and verify its output

4. Design an Adder/Subtractor composite unit.
5. Design of a 'Carry-Look-Ahead' Adder circuit.
6. Realization of a)Encoder, b)Decoder c) Multiplexer , d) De-MUX , e)Comparator and their Truth Table verification.
7. Realization of RS / JK / D flip flops using logic gates.
8. Design of Shift Register using J-K / D Flip Flop.
9. Realization of Synchronous Up/Down counters.
10. Design of MOD- N Counter
11. Study of DAC
12. Study of logic families and PLDs

Text Book:

1. Salivahanan S - Digital Circuits and Design, Oxford
2. Morries Mano - Digital Logic Design- PHI

Reference Book:

1. R.P. Jain - Modern Digital Electronics, 2/e, Mc Graw Hill

Thomas L. Floyd - Digital Fundamentals: A Systems Approach , Pearson,

CO-PO & PSO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	-	-	-	-	-	-	-	2	3	2
CO2	3	3	3	3	3	-	-	-	-	-	-	-	2	3	2
CO3	3	3	3	3	3	-	-	-	-	-	-	3	2	3	2
CO4	3	3	3	3	3	-	-	-	-	-	-	-	2	3	2
CO5	3	3	3	3	3	-	-	-	3	-	2	-	2	3	2
CO	3	3	3	3	3	-	-	-	3	-	2	3	2	3	2

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – III	
Course Code	**CT391**
Course Name	**Programming in Python Lab**
Contact	**0:0:3**
Credit	**1.5**

Prerequisites:
Number system, Boolean Algebra.

Objective of the course:

The objective of the course is to make the students able to –

- Describe the core syntax and semantics of Python programming language.
- Discover the need for working with the strings and functions.
- Illustrate the process of structuring the data using lists, dictionaries, tuples and sets.

Course Outcome:
After completion of this course students will be able to

CO1:Understand the fundamental Python syntax and semantics and be fluent in **writing** simple Python programs in the appropriate platform.

CO2:Develop proficiency in the handling of strings and be fluent in the **use** of Python control flow statements

CO3: Solve different problems while **applyin**g the concepts of loops.

CO4:Develop different programming skills while **correlating** functions.

CO5:Articulate the Object-Oriented Programming concepts such as encapsulation, inheritance and polymorphism as used in Python.

MODULE NUMBER	COURSE CONTENT
1	**Fundamentals of Python :** • Introduction to Python • Running Python Programs • Writing simple Python Code

2	Working with Data : • Data Types and Variables • Using Numeric Variables • Using String Variables
3	Input and Output : • Printing with Parameters • Getting Input from a User • String Formatting
4	Making Decisions : • Logical Expressions • The “if” Statement • Logical Operators • More Complex Expressions
5	Lists and Loops : • Lists and Tuples • List Functions • “For” Loops • “While” Loops
6	Functions : • Writing and Calling Functions • Function Inputs and Outputs • Local and Global Scope
7	**Working with Strings:** • Character Data • String Functions

	• Input Validation with "try / except"

Textbook:

1 Gowrishankar S, Veena A, "Introduction to Python Programming", 1st Edition, CRC Press/Taylor & Francis, 2018.

ReferenceBooks:

2 Jake VanderPlas, "Python Data Science Handbook: Essential Tools for Working with Data", 1st Edition, O'Reilly Media, 2016.
3 AurelienGeron, "Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems", 2nd Edition, O'Reilly Media, 2019.
4 Wesley J Chun, "Core Python Applications Programming", 3rd Edition, Pearson Education India, 2015.
5 Miguel Grinberg, "Flask Web Development: Developing Web Applications with Python", 2nd Edition, O'Reilly Media, 2018.

CO–POMapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	1	3	-	-	-	-	-	-	-	1	3	2
CO2	3	2	3	2	-	-	-	-	-	-	-	-	3	2	3
CO3	3	3	2	2	-	-	-	-	-	-	-	-	3	2	3
CO4	2	3	3	1	-	-	-	-	-	-	-	-	3	3	3
CO5	3	3	3	2	2	-	-	-	-	-	-	-	3	1	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS

Semester – III

Course Code	**CS392**
Course Name	**Data Structures Lab**
Contact	**0:0:3**
Credit	**1.5**

Prerequisites:
Computer Fundamentals and principal of computer programming Lab.

Objective of the course:
The objective of the course is to make the students able to –

1. Identify and propose appropriate data structures and data types to implement list using array and linked list.
2. Design and develop effective programs using stack, queue and recursive functions after implementing stack and queue.
3. Implement different data structures like binary tree, heap and use them to explain and organize data and manipulate them.
4. Implement different sorting and searching algorithm selecting appropriate data structures and analyze the efficiency of the resulting program.
5. Prepare laboratory reports on interpretation of experimental results and analyze it for validating the same.

Course Outcome:
After completion of this course students will be able to

CO1:Identify and **propose** appropriate data structures and data types to **implement** list **using** array and linked list and **design** effective programs to **solve** complex engineering problem using list and modern tools.

CO2:Design and **develop** effective programs for engineering and mathematical problems **using** stack, queue and recursive functions after **implementing** stack and queue **using** modular programming approach possibly as a team maintaining proper ethics of collaboration.

CO3Implement different data structures like binary tree, heap and **use** them to **explain** and **organize** data and manipulate them through programs leading to solution of complex engineering problem.

CO4:Implement different sorting and searching algorithm **selecting** appropriate data structures and **analyze** the efficiency of the resulting program **using** modern engineering tools and methods leading to lifelong learning.

CO5:Prepare laboratory reports on interpretation of experimental results and **analyze** it for validating the same maintaining proper ethics of collaboration.

MODULE NUMBER	COURSE CONTENT
1	**Implementing Non-Restricted Linear Data Structure[2 Lab]:** Problem based on Implementation of Non-Restricted Linear Data Structure like- a) Implementation of list as data structure using array. b) Implementation of listas data structure using linked list of different types. c) Implementation of polynomial as data structure using array and linked list. d) Implementation of sparse matrix as data stricture using array.
2	**Implementing Restricted Linear Data Structure[3 Lab]:** Problem based on Implementation of Restricted Linear Data Structure like- a) Implementation of stack as data structure using array. b) Implementation of stack as data structure using linked list. c) Implementation of queue as data structure using array (physical, linear and circular model). d) Implementation of queue as data structure using linked list. e) Converting infix to post-fix and evaluating post-fix expression using stack. f) Implementing Tower-of-Hanoi problem.
3	**Implementing Non-Linear Data Structure[2 Lab]:** Problem based on Implementation of Non-Linear Data Structure like a) Implementation of Binary Tree as data structure using array and linked list. b) Implementation of Binary Search Tree (BST) as data structure using linked list. c) Implementation of Heap as data structure using array. d) Implementation of Priority Queue as data structure using Heap.
4	**Implementing Sorting and Searching algorithm [5 Lab]:** Problem based on Implementation of Sorting and Searching algorithm like a) Implementation of Bubble sort using appropriate data structure. b) Implementation of Selection sort using appropriate data structure. c) Implementation of Insertion sort using appropriate data structure. d) Implementation of Quick sort using appropriate data structure. e) Implementation of Merge sort using appropriate data structure. f) Implementation of Heap sort using appropriate data structure. g) Implementation of Radix sort using appropriate data structure. h) Implementation of Sequential Search using appropriate data structure. i) Implementation of Binary Search using appropriate data structure. j) Implementation of hashing with collision resolution using linear and quadratic probing

Textbook:

3. Data Structures Through 'C' Language by SamiranChattopadhyay, Debabrata Ghosh Dastidar, Matangini

Chattopadhyay, Edition: 2001, BPB Publications

4. Fundamentals of Data Structures of C by Ellis Horowitz, Sartaj Sahni, Susan Anderson-freed 2nd Edition, Universities Press.

ReferenceBooks:

5. Data Structures, Algorithms, and Software Principles in C byThomas A. Standish, 1 Edition, Pearson.
6. Data Structures by S. Lipschutz, Special Indian Edition, Tata McGraw Hill Education (India) Private Limited
7. Data Structures and Program Design In C by Robert L. Kruse, Bruce P. Leung 2nd Edition, Pearson
8. Data Structures in C by Aaron M. Tenenbaum, 1St Edition, Pearson.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	-	-	-	-	-	-	-	3	3	3
CO2	3	3	3	3	-	-	-	3	3	-	-	-	2	2	3
CO3	3	3	3	3	-	-	-	-	-	-	-	-	3	2	3
CO4	3	3	3	3	3	-	-	-	-	-	-	3	3	2	3
CO5	-	-	-	-	-	-	-	3	-	3	-	-	3	2	3

MANDATORY COURSE

SYLLABUS	
Semester – III	
Course Code	**MC 301**
Course Name	**ENVIRONMENTAL SCIENCE**
Total Lecture Hours	**36**
Credit	**0**

Objective of the course:
- Be able to understand the natural environment and its relationships with human activities.
- Be able to understand environmental laws and regulations to develop guidelines and procedures for health and safety issues.
- Be able to solve scientific problem-solving related to air, water, noise & land pollution.

Course Outcome:
After completion of this course students will be able to

CO1: To understand the natural environment and its relationships with human activities.

CO2: To apply the fundamental knowledge of science and engineering to assess environmental and health risk.

CO3 To develop guidelines and procedures for health and safety issues obeying the environmental laws and regulations.

CO4: Acquire skills for scientific problem-solving related to air, water, noise & land pollution.

CO5:apply the fundamental knowledge of science and engineering to assess environmental and health risk

MODULE NUMBER	COURSE CONTENT
1	**General [11L]:** **Natural Resources**: Forest Resource, water resource, mineral resource, energy resources: alternative source of energy **Population Growth:** Exponential Growth, logistic growth, Maximum sustainable yield, demography **Disaster Management**: Types of disasters (Natural & Man-made), Floods, Earthquake, Tsunamis, Cyclones, landslides (cause, effect & control) **Ecology & Ecosystem:** Elements of ecology, definition of ecosystem- components types and function, Food chain & Food web, Structure and function of the following ecosystem: Forest

	ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems **Environmental Management**: Environmental impact assessment, Environmental laws and protection act of India(The Environment protection Act, Air pollution Act, Water Act, Wildlife Protection Act) , Hazardous waste(management and Handling) Rules.
2	**Air pollution and control [10L]:** **Sources of Pollutants**: point sources, nonpoint sources and manmade sources primary & secondary pollutant **Types of air pollutants:** primary & secondary pollutant ; Suspended particulate matter, oxides of carbon, oxides of nitrogen, oxides of sulphur, particulate, PAN, Smog (Photochemical smog and London smog), **Effects on human health & climate:** Greenhouse effect, Global Warming, Acid rain, Ozone Layer Depletion **Air pollution and meteorology:** Ambient Lapse Rate, Adiabatic Lapse Rate, Atmospheric stability & Temperature inversion control of air pollution (ESP, cyclone separator, bag house, catalytic converter, scrubber (ventury).
3	**Water Pollution [9L]:** Classification of water (Ground & surface water) Pollutants of water, their origin and effects: Oxygen demanding wastes, pathogens, nutrients, Salts, heavy metals, pesticides, volatile organic compounds. **Surface water quality parameters:** pH, DO, 5 day BOD test, BOD reaction rate constants, COD. Numerical related to BOD Lake: Eutrophication [Definition, source and effect]. **Ground water:** Aquifers, hydraulic gradient, ground water flow (Definition only),groundwater pollution (Arsenic & Fluoride; sources, effects, control) **Quality of Boiler fed water:** DO, hardness, alkalinity, TDS and Chloride **Layout of waste water treatment plant** (scheme only).
4	**Land Pollution [3L]:** Types of Solid Waste: Municipal, industrial, commercial, agricultural, domestic, hazardous solid wastes (bio-medical), E-waste Solid waste disposal method: Open dumping, Land filling, incineration, composting, recycling (Advantages and disadvantages). Waste management: waste classification, waste segregation, treatment & disposal
5	**Noise Pollution [3L]:** Definition of noise, effect of noise pollution on human health, Average Noise level of some common noise sources Definition of noise frequency, noise pressure, noise intensity, noise threshold limit value, equivalent noise level, $L10$ (18 hr Index) . Noise pollution control.
Textbook:	

1. A Textbook of Environmental Studies, Shashi Chawla. Tata McGraw Hill EducationPrivate Limited.

ReferenceBooks:

1. Environmental Studies, Dr. J P Sharma, University Science Press
2. Environmental Engineering, J K Das Mohapatra, Vikas Publication

CO–PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO	3	3	3	3	-	-	-	-	-	-	-	-	3	3	3
CO2	3	3	3	3	-	-	-	-	-	-	-	3	3	2	3
CO3	3	3	3	3	-	-	-	-	-	-	-	-	3	3	1
CO4	3	3	3	3	-	-	-	-	3	-	-	-	3	2	3
CO5	3	3	3	3	-	-	-	-	3	2	-	-	3	2	3
CO	3	3	3	3	-	-	-	-	3	2	-	3	3	3	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS

Semester – IV

Course Code	**CS401**
Course Name	**Computer Organization and Architecture**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**3**

Course Objective:

1. Illustrate the basic concept of computer structure & computer arithmetic and apply this knowledge to design real life problem.
2. Summarize the basic concept of Basic Computer Organization and Central processing unit for designing and implementing problem.
3. Illustrate the concept of register transfer, micro operation and micro programmed control to design engineering problem.
4. Illustrate the concept of register transfer, micro operation and micro programmed control.
5. Understand the concept of computer Input-output organization and design an optimized model.

Course Outcome:
After successful completion of this course, students will be able to:

CO1	**Illustrate** the basic concept of computer structure & computer arithmetic and **apply** this knowledge in **designing** solutions for real life engineering problems.

CO2	**Summarize** the basic concept of Basic Computer Organization and Central processing unit for **designing** and **implementing** mathematical and engineering problems leading to lifelong learning.
CO3	**Illustrate** the concept of register transfer, micro operation and micro programmed control to **design** and **solve** engineering problems.
CO4	**Compare** computer memories and **apply** this knowledge for **developing** an approach by means of existing and new methods as a team work.
CO5	**Understand** the concept of computer Input-output organization and **design** an optimized model for **building** a new solution as a professional engineering practice as a team.

MODULE NUMBER	COURSE CONTENT
1	**Structure of Computers (3L)** Computer types[1L], Functional units, Basic operational concepts[1L], Von Neumann Architecture, Bus Structures, Software, Performance[1L]. **Computer Arithmetic(3L)** Fixed-point multiplication - Booth's algorithm. [1L], Fixed-point division - Restoring and non-restoring algorithms. [1L] Floating-point number representation- IEEE 754 format and Floating-point arithmetic operation [1L
2	**Basic Computer Organization and Design(3L)** Instruction codes, Computer Registers [1L], Computer Instructions and Instruction cycle1L]. Timing and Control [1L], Memory-Reference Instructions, Input-Output and interrupt [1L] **Central Processing Unit(5L)** Stack organization[1L], Instruction Formats[1L], Addressing Modes [1L], Data Transfer and Manipulation[1L], Complex Instruction Set Computer (CISC) Reduced Instruction Set Computer (RISC), CISC vs RISC[1L]

3	**Register Transfer and Micro-Operations** Register Transfer Language, Register Transfer[1L], Bus and Memory Transfers[2L], Arithmetic Micro-Operations, Logic Micro-Operations, Shift Micro-Operations, Arithmetic logic shift unit[1L] **Micro-Programmed Control** Control Memory[1L], Address Sequencing[1L], Micro-Program example[1L], Design of Control Unit[1L]
4	**Computer Memory** (7L) Memory Hierarchy, Semiconductor Memories, RAM (Random Access Memory), Read Only Memory (ROM), Types of ROM[1L], Main Memory[1L], Cache Memory [1L], Cache coherence and synchronization mechanisms[1L], Mapping Technique in cache memory: Direct, Full Associative and Set Associative [2L], Cache Performance and optimization techniques [1L] .
5	**Input-Output Organization(6L)** Introduction to I/O operations [1L], Synchronous and asynchronous transfer [1L], Modes of transfer [1L], DMA[1L], Bus Arbitration [1L], Input-output processor [1L]

Text Books:

1. David A. Patterson and John L. Hennessy- Computer Organization and Design: The Hardware/Software Interface

2. Morris Mano- Computer System Architecture, 3rd Edition, Pearson

Reference Books:

1. Hayes J. P., “Computer Architecture & Organisation”, McGraw Hill,

2.William Stallings, Computer Organization and Architecture: Designing for Performance

COs	PO1	PO 2	PO3	PO4	PO 5	PO 6	PO 7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO3
CO 1	3	3	3	3	-	-	-	-	-	-	-	-	3	3	3
CO 2	3	3	3	3	-	-	-	-	-	-	-	3	3	2	3
CO 3	3	3	3	3	-	-	-	-	-	-	-	-	3	3	1
CO 4	3	3	3	3	-	-	-	-	3	-	-	-	3	2	3
CO 5	3	3	3	3	-	-	-	-	3	2	-	-	3	2	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – IV	
Course Code	**CS402**
Course Name	**Design & Analysis of Algorithm**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**3**

Prerequisites: To know data-structure and basic programming ability

Course Objective:

5. The aim is to learn how to develop efficient algorithms for simple computational tasks and reasoning about the correctness of them
6. Through the complexity measures, different range of behaviors of algorithms and the notion of tractable and intractable problems will be understood

Course Outcome:

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

CO1	To understand and illustrate the concepts of time and space complexity, worst case, average case and best-case complexities and the asymptotic notation.
CO2	To analyze and apply the design principles and concepts to various basic algorithm design viz. dynamic programming, greedy method etc.
CO3	To understand and analyze various string matching and graph algorithms.
CO4	To understand, illustrate and analyze the different complexity classes
CO5	To discuss, implement and analyze, verify the efficiency of the randomized and approximation algorithms.

MODULE NUMBER	COURSE CONTENT
1	**Algorithm Development&Complexity Analysis: [4L]** Stages of algorithm development for solving a problem: Describing the problem, identifying a suitable technique, Design of an algorithm, Proof of Correctness of the algorithm. Time and Space Complexity, Different Asymptotic notations – their mathematical significance. Solving Recurrences: Substitution Method, Recurrence Tree Method, Master Theorem (Statement Only).
2	**Algorithm Design Techniques [L]** Brute force techniques – Travelling Sales man Problem, Divide and Conquer - Matrix multiplication: Strassen's algorithm, Greedy techniques - Fractional Knapsack problem, Job Sequencing with Deadline, Graph Coloring, Finding Minimum Cost Spanning Tree, Dynamic programming - O/1 Knapsack problem, Matrix chain multiplication, Travelling Salesman Problem, Backtracking-N-Queens Problem, Knights Tour on Chess Board.
3	**String matching problem: [3L]** Different techniques – Naive algorithm, string matching using finite automata, and Knuth, Morris, Pratt (KMP) algorithm with their complexities
4	**Graph Algorithms [5L]** Single Source Shortest Path – Dijkstra's Algorithm, All pair shortest path – Floyd-Warshall Algorithm. Network Flows, Maximum Flows – Ford-Fulkerson Algorithm,

	Push Re-label Algorithm, Minimum Cost Flows – Cycle Cancelling Algorithm. .
5	**Complexity Classes: [5L]** The Class P, The Class NP, Reducibility and NP-completeness – SAT (without proof), 3-SAT, Vertex Cover, Independent Set, Maximum Clique.
6	**Approximation and Randomized Algorithms [3L]** Approximation Algorithms - The set-covering problem – Vertex cover, K-center clustering. Randomized Algorithms - The hiring problem, Finding the global Minimum.

Textbook:

3. "Introduction to Algorithms" by Cormen, Leiserson, Rivest, Stein.
4. "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

ReferenceBooks:

2. “Design Analysis and Algorithms” by Hari Mohan Pandey.

CO–POMapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	-	-	-	-	3	-	3
CO2	3	3	3	3	-	-	-	-	-	-	-	-	3	-	3
CO3	3	3	3	3	-	-	-	-	-	-	-	-	3	2	3

CO4	3	3	3	3	-	-	-	-	-	-	-	-	3	2	3
CO5	3	3	3	3	-	-	-	-	-	-	-	-	3	2	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – IV	
Course Code	**CS403**
Course Name	**Operating Systems**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**3**

Prerequisites:

1. Computer organization
2. Computer Architecture
3. Data Structures
4. Algorithms & Programming Concept

Course Objectives:

The objective of the course is to make the students able to -

1. Students will learn how Operating System is Important for Computer System.

2.To make aware of different types of Operating System and their services.

3.To learn different process scheduling algorithms and synchronization techniques to achieve better performance of a computer system.

4.To know virtual memory concepts.

5. To learn secondary memory management.

Course Outcome:

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

CO1	**Understand** the basic principles of operating systems and compare
CO2	**Understand** the main principles and techniques for the implementation of processes, threads as well as the different algorithms for process scheduling and inter process communication.
CO3	**Solve** the main problems related to concurrency and the different synchronization mechanisms.
CO4	**Explain** the device and I/O management functions in operating systems as part of a uniform device abstraction.
CO5	**Formulate** the rationale view for virtual memory abstractions and explain the disk organization and file system structure.

MODULE NUMBER	COURSE CONTENT
1	**Introduction(4L)** Functionalities of Operating System, Evolution of Operating System. Types of Operating System: batch, multi-programmed, time-sharing, real-time, distributed, parallel, Structural overview, Protection & Security.
2	**Processes(3L)** Concept of processes, process states, PCB, process scheduling, co-operating processes, independent process, suspended process, Interaction between processes and OS, Inter-process communication: Message passing 3L **Threads(2L):** overview, benefits of threads, user and kernel level threads, Thread models. **CPU scheduling(5L):** Scheduling criteria, preemptive & non-preemptive scheduling, scheduling algorithms (FCFS, SJF, SRTF, RR, priority, multilevel queue, multilevel feedback queue scheduling).
3	**Process Synchronization(5L)** Background, critical section problem, synchronization hardware, classical problems of synchronization (producer-consumer, readers-writer, dining philosophers, etc),

	semaphores, monitors. **Deadlocks(**5L**)** deadlock characterization, methods for handling deadlocks, deadlock prevention, deadlock avoidance, deadlock detection, recovery from deadlock.
4	**Memory Management(3L)** Background, logical vs. physical address space, swapping, contiguous memory allocation, paging, Segmentation, TLB. **Virtual Memory(3L)** background, demand paging, page replacement algorithms (FCFS, LRU, Optimal), thrashing, Working set model.
5	**Disk(2L)** Disk structure, disk scheduling (FCFS, SSTF, SCAN, C-SCAN, LOOK, C-LOOK etc), disk reliability, disk formatting, boot block, bad blocks. **File(2L)** File concept, access methods, directory structure, file system structure, UNIX file structure, allocation methods (contiguous, linked, indexed), free-space management (bit vector**).** **I/O(2L)** I/O hardware, polling, interrupts, DMA, caching, buffering, blocking-non blocking I/O.

Text Book:

1. Abraham Silberschatz, Peter B. Galvin, Greg Gagne, Operating System Concepts.
2. *Operating Systems*& Systems Programming by P *Balakrishna Prasad*

Reference Book:

1. Dietel H. N., “An Introduction to Operating Systems”, Addison Wesley.
2. Andrew Tanenbaum, Modern Operating Systems, Prentice Hall.
3. William Stallings, Operating Systems, Prentice Hall.

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	-	-	-	-	3	3	3
CO2	3	3	3	3	-	-	-	-	-	-	-	-	3	2	3
CO3	3	3	3	3	-	-	-	-	-	-	-	3	3	3	1
CO4	3	3	3	3	-	-	-	-	-	-	-	-	3	3	1
CO5	3	3	3	3	-	-	-	-	3	2	-	-	3	2	1
CO	3	3	3	3	-	-	-	-	3	2	-	3	3	3	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – IV	
Course Code	**CS404**
Course Name	**Formal Language and Automata Theory**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**3**

Prerequisites: Digital Logic, Computer Fundamentals

Course Objectives:

The objectives of this course are to enable students to

1. Construct finite state machines and the equivalent regular expressions.
2. Prove the equivalence of languages described by finite state machines andregular expressions.
3. Construct pushdown automata and the equivalent context free grammars.
4. Prove the equivalence of languages described by pushdown automata andcontext free grammars.
5. Construct Turing machines and to prove the equivalence of languages described by Turing machines

Course Outcome:

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

CO1	**Understand** the fundamental concepts of Finite State Automata to **Explain or Illustrate** and **Identify** problems where students can **Apply** the concept appropriately to **Solve** them.
CO2	**Understand** the fundamental concepts of Regular Expressions and its relation with DFA so that they can **Develop** regular expression for a specified language and **Validate** it.

CO3	**Understand** the fundamental concepts of Context Free Grammar so that they can **Design** grammar for a specified language and **Validate**it.
CO4	**Explain or Illustrate** the fundamental operating principles of Push Down Automata and **Use** it appropriately to **Solve** problems.
CO5	**Understand** the operating principles of Turing Machine and **Design** Turing Machines to **Propose** solutions to the related problems appropriately and **validate** the effectiveness as well as limitations of computations making the students aware of its utilitarian importance for further explorations leading towards lifelong learning.

MODULE NUMBER	COURSE CONTENT
1	**MODULE-1(9L)** Fundamentals:Basicdefinitionofsequentialcircuit,blockdiagram,mathematicalrepresentation,conceptof transition table and transition diagram**[1L]** Introduction to Finite State Model (FSM), Design of sequence detector, Finite State Machine, Finite Automata, Deterministic Finite Automation (DFA) and Non-deterministic Finite Automation (NFA), Transition diagrams, Transition tables and Language recognizers. **[3L]** NFA with empty transitions, Equivalence between NFA with and without empty transitions. NFA to DFA conversion. **[2L]** Minimization of FSM: Minimization Algorithm for DFA, Introduction to Myhill-Nerode Theorem **[2L]** Limitations of FSM, Application of Finite Automata**[1L]**
2	**Module-2:[7L]** Finite Automata with output − Moore & Mealy machine. Representation of Moore & Mealy Machine, Processing of the String through Moore & Mealy Machine, Equivalence of Moore & Mealy Machine –Inter-conversion. **[2L]** Equivalent states and Distinguishable States, Equivalence and k-equivalence, Minimization of Mealy Machine**[1L]** Minimizationofincompletelyspecifiedmachine−MergerGraph,MergerTable,Compatibili

	tyGraph[2L] Lossless and Lossy Machine–Testing Table, Testing Graph **[2L]**
3	**Module-3:[5L]** RegularLanguages,RegularSets,RegularExpressions,AlgebraicRulesforRegularExpressions,Arden'sTheorem statement and proof**[1L]** ConstructingFiniteAutomata(FA)forgivenregularexpressions,RegularstringacceptedbyFA**[2L]** Constructing Regular Expression for a given Finite Automata**[1L]** Pumping Lemma of Regular Sets .Closure properties of regular sets**[1L]**
4	**Module-4:[9L]** GrammarFormalism-ContextFreeGrammars,Derivationtrees,sententialforms.Rightmostandleftmostderivation of strings, Parse Tree, Ambiguity in context freegrammars.**[1L]**. Minimization of Context Free Grammars.**[1L],** Removal of null and unit production**[1L]** Chomsky normal formandGreibach normal form.**[1L]** PumpingLemma for Context FreeLanguages.**[1L]** Enumeration of propertiesof CFL,Closure property of CFL,Ogden'slemma&its applications**[1L],**Regular grammars−right linearandleftlinear grammars**[1L]** PushdownAutomata:Pushdownautomata,definition.IntroductiontoDCFL,DPDA,NCFL,NPDA**[1L]** AcceptanceofCFL,Acceptancebyfinalstateandacceptancebyemptystateanditsequivalence.**[1L]** EquivalenceofCFLandPDA,inter-conversion.**1L]**
5	**Module-5:[5L]**

	Turing Machine: Turing Machine, definition, model**[1L]** Design of TM, Computable functions **[1L]**Church's hypothesis, counter machine **[1L]** Types of Turing machines**[1L]** Universal Turing Machine, Halting problem**[1L]**

Textbook:

1.“IntroductiontoAutomataTheoryLanguageandComputation”,HopcroftH.E.andUllmanJ.D.,Pear on Education.

2. Peter Linz, “An Introduction to Formal Languages and Automata”, Sixth Edition, Jones & Bartlett, 2016. ISBN**:** 978-9384323219

Reference Books:

1. “Formal Languages and Automata Theory”, C.K.Nagpal,Oxford
2. “Switching and Finite Automata Theory”, ZviKohavi,2ndEdition., TataMcGrawHill

CO-PO Mapping:

COs		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		3	2	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2		2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3		2	2	3	2	-	-	-	-	-	-	-	-	2	-	2
CO4		2	2	2	3	-	-	-	-	-	-	-	-	2	-	2
CO5		2	2	3	3	-	-	-	-	-	-	-	2	2	2	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – IV	
Course Code	**HSMC 402**
Course Name	**Gender, Culture and Development**
Lecture (per week)	**2**
Tutorial (per week)	**0**
Contact Hours (per week)	**2**
Total Contact Hours	**24**
Credit	**2**

Prerequisite:

None

Course Outcome:
After successful completion of this course, students will be able to:

CO1	Provide an analysis of the location of women in the processes of economic development; to understand what economic development is, the scales or levels at which it occurs, and the centrality of gender at every level.
CO2	Examine theoretical and conceptual frameworks for that analysis.
CO3	Reflect upon linkages between the global economy and the gendered macro and micro process of development and transitions from 'government' to 'governance.'
CO4	Explain the usefulness of a rights based approach to gender justice.
CO5	Provide basis for research, practical action and policy formulation and or evaluating for evaluating directions and strategies for social change from a gender perspective.

MODULE NUMBER	COURSE CONTENT

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

1	**Module:1[4L]** Introduction to Gender, Definition of Gender, Basic Gender Concepts and Terminology, Exploring Attitudes towards Gender, Social Construction of Gender
2	**Module2:[6L]** Gender Roles and Relations, Types of Gender Roles, Gender Roles and Relationships Matrix, Gender-based Division and Valuation of Labour .
3	**Module 3: [5L]** Gender Development Issues , Identifying Gender Issues, Gender Sensitive Language, Gender, Governance and Sustainable Development, Gender and Human Rights, Gender and Mainstreaming.
4	**Module 4: [5L]** Gender-based Violence, The concept of violence, Types of Gender-based violence, The relationship between gender, development and violence, Gender-based violence from a human rights perspective.
5	**Module5: [4L]** Gender and Culture Gender and Film, Gender and Electronic Media, Gender and Advertisement, Gender and Popular Literature. [4L]

Text Books:

1. Beneria, Lourdes. (2004). Gender, Development, and Globalization: Economics as if All People Mattered. Roultedge Press. (GDGE)
2. Molyneux and Razavi. (2002). Gender Justice, Development and Rights. Oxford University Press (GJDR or WGD)
3. Visvanathan, Duggan,Wiegersma and Nisonoff. (2011). The Women, Gender and Development Reader. 2nd Edition. Zed Press (WGD)

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	2	-	-	-	-	-	-	-	-	3	-	-
CO2	2	3	2	3	-	-	-	-	-	-	-	-	-	3	-
CO3	2	2	3	2	-	-	-	-	-	-	-	-	2	-	2
CO4	2	2	2	3	-	-	-	-	-	-	-	-	2	-	2
CO5	2	2	3	3	-	-	-	-	-	-	-	2	2	2	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – IV	
Course Code	**M401**
Course Name	**Probability and Statistics**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**3**

Prerequisite:

The students to whom this course will be offered must have the concept of (10+2) standard algebra and calculus.

Course Objective(s):

The purpose of this course is

1. Recall the distinctive principles of probability and statistics.
2. Understand the theoretical workings of theory of probability and tests of hypotheses.
3. Apply statistical methods to compute and explain point estimators and interval estimators for mean, variance and proportion.
4. Analyze statistical data from engineering experiments

Course Outcome:

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

CO1	**Understand** the basic concepts of Probability and Random Variables to**Explain or Illustrate** and **Identify** problems where students can **Apply** the concept appropriately to **Solve** them.
CO2	**Understand** the basic concepts of Two dimensional random variables to**Explain or Illustrate** and **Identify** problems where students can **Apply** the concept appropriately to **Solve** them.
CO3	**Understand** the basic concepts of Sampling Distribution to**Explain or Illustrate** and **Identify** problems where students can **Apply** the concept appropriately to **Solve** them.

CO4	**Understand** the basic concepts of Parameter Estimationto**Explain or Illustrate** and **Identify** problems where students can **Apply** the concept appropriately to **Solve** them.
CO5	**Understand** the basic concepts of Testing of Hypotheses to**Explain or Illustrate** and **Identify** problems where students can **Apply** the concept appropriately to **Solve** them.

MODULE NUMBER	COURSE CONTENT
1	**(Probability and Random Variables) (15L)** The axioms of probability, Conditional probability, Baye's theorem, Discrete and continuous random variables, probability mass, probability density and cumulative distribution functions, mathematical expectation, Moments, Moment generating functions, Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.
2	**(Two dimensional random variables) (5 L)** Joint distributions, Marginal and conditional distributions, Covariance , Correlation and linear regression , Transformation of random variables , Central limit theorem (for independent and identically distributed random variables).
3	**(Sampling Distribution) (3 L)** Distributions of the sample mean and the sample variance for a normal population, Chi-Square, t and F distributions, problems
4	**Module 4: (Parameter Estimation) (4 L)** Unbiasedness, consistency, the method of moments and the method of maximum likelihood estimation, confidence intervals for parameters in one sample and two sample problems of normal populations, confidence intervals for proportions, problems
5	**Module 5: (Testing of Hypotheses) (9 L)** Null and alternative hypotheses, the critical and acceptance regions, two types of error, power of the test, the most powerful test and Neyman-Pearson Fundamental Lemma, tests for one sample and two sample problems for normal populations, tests for proportions, Chi square goodness of fit test and its applications, problems.

Text Books:

1. Sheldon M. Ross, "Introduction to Probability and Statistics for Engineers and Scientists", Academic Press, (2009).
2. D. C. Montgomery and G.C. Runger, "Applied Statistics and Probability for Engineers", 5th edition, John Wiley & Sons, (2009)..
3. Robert H. Shumway and David S. Stoffer, "Time Series Analysis and Its Applications with R Examples", Third edition, Springer Texts in Statistics, (2006).

Reference Books:

4. N. G. Das: Statistical Methods, TMH.
5. Sancheti , D. S. &Kapoor ,V.K. : Statistics Theory , Method & Application, Sultan chand& sons , New Delhi
6. N.K.Dutta (2004). Fundamentals of Biostatistics, Kanishka Publishers.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	2	-	-	-	-	-	-	-	-	3	-	-
CO2	2	3	2	3	-	-	-	-	-	-	-	-	-	3	-
CO3	2	2	3	2	-	-	-	-	-	-	-	-	2	-	2
CO4	2	2	2	3	-	-	-	-	-	-	-	-	2	-	2
CO5	2	2	3	3	-	-	-	-	-	-	-	2	2	2	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

Practical

SYLLABUS	
Semester – IV	
Course Code	**CS491**
Course Name	**Computer Organization and Architecture Lab**
Lecture (per week)	**0**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**1.5**

Prerequisites: Digital Electronics

Course Objective:

The objective of the course is to make the students able to

1. Interpret and use proper method in an appropriate platform to design and to solve problems
2. Use the codes and number systems converting circuits and Compare different types of logic families which are the basic unit of different types of logic gates to design the problem using modern tools
3. Outline different types of digital electronic circuit using various mapping and logical tools and summarize the techniques to prepare the most simplified circuit using various mapping and mathematical methods.
4. Apply the knowledge of digital electronic circuits to design memory and ALU.
5. Interpret the result of the experiments, prepare laboratory reports based on observed output and analyse it.

Course Outcome:
After successful completion of this course, students will be able to:

CO1	**Interpret** and **use** proper method in an appropriate platform to design and to **solve** problems related to Mathematics and Engineering field leading to lifelong learning.

CO2	**Use** the codes and number systems converting circuits and **Compare** different types of logic families which are the basic unit of different types of logic gates to **design** the problem using modern tools for **solvin**g complex engineering problems.
CO3	**Outline** different types of digital electronic circuit using various mapping and logical tools and **summarize** the techniques to prepare the most simplified circuit using various mapping and mathematical methods for **solving** the problem as a professional engineering practice as a team.
CO4	**Apply** the knowledge of digital electronic circuits to design memory and ALU and **analyse** the same to **solve** engineering-related computational problems as a team.
CO5	**Interpret** the result of the experiments**, prepare** laboratory reports based on observed output and **analyse** it to validate professional ethics and responsibilities and norms of the engineering practice.

MODULE NUMBER	COURSE CONTENT
1	Study and verify the truth table of a) Logic gates b) Universal gates
2	Study and realize the logic gates from universal gates
3	Study and verify the truth table of a) Half Adder b) Full Adder
4	Study and verify the truth table of a) Half Subtractor b) Full Subtractor
5	Study and verify the truth table of a) Multiplexer b) De-Multiplexer

6	Study and verify the truth table of a) Encoder b) Decoder
7	Study and verify the truth table of a) 7 segment Decoder b) Comparator (1 bit, 2 bits) c) Carry look ahead adder
8	Study and verify the truth table of a) SR flip-flop b) D flip-flop c) JK flip-flop d) T flip-flop
9	Study, design and verify the truth table of 4 bits Serial In-Parallel Out Shift Registers
10	Study, design and verify the 4 bit Synchronous or Asynchronous Counter using JK flip-flop
11	Design a composite ALU for multi bit arithmetic operation
12	Design of RAM

Textbook:

1. M. Morris Mano, Digital Design, Prentice-Hall
2. Digital Circuits and Design, S. Salivahanan and S. Arivazhagan, McGraw-Hill Education

Reference book:

1. Hayes J. P., “Computer Architecture & Organisation”, McGraw Hill,
2. William Stallings, Computer Organization and Architecture: Designing for Performance

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	-	-	-	3	3	3	3
CO2	3	3	3	3	3	-	-	-	-	-	-	-	3	3	3
CO3	3	3	3	3	-	-	-	3	3	-	-	-	3	3	3
CO4	3	3	3	3	-	-	-	3	3	-	-	-	3	3	3
CO5	-	-	-	-	-	-	-	3	-	3	-	-	3	2	3
CO	3	3	3	3	3	-	-	3	3	3	-	3	3	3	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS

Semester – IV

Course Code	**CS492**
Course Name	**Design & Analysis of Algorithm Lab**
Lecture (per week)	**0**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**1.5**

Prerequisites: Programming Knowledge

Objective of the course:

1. Design and implement efficient algorithms for a specified application.
2. Strengthen the ability to identify and apply the suitable algorithm for the given real world problem

Course Outcome:
After successful completion of this course, students will be able to:

CO1	To identify and prove the correctness and analyze the running time of the basic algorithms for those classic problems in various domains.
CO2	To understand and illustrate methods for analyzing the efficiency and correctness of algorithms (such as exchange arguments, recurrence, induction, and average case analysis)
CO3	To analyze and design algorithms using the dynamic programming, greedy method, Backtracking, Branch and Bound strategy, and recite algorithms that employ this strategy.
CO4	To understand, compare, contrast, and choose appropriate implementation of the algorithmic design techniques to present an algorithm that solves a given problem.
CO5	To Identify and analyze criteria and specifications appropriate to new problems.

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

MODULE NUMBER	COURSE CONTENT
1	Implementation of various Divide & Conquer Methods; viz. Matrix Multiplication.
2	Implementations of various Dynamic Programming Methods, viz. Matrix Chain Multiplication Method, Travelling Salesman Problem etc.
3	Implementations of various Brunch & Bound Techniques, Full Adder
4	Implementations of various Backtracking Methods, viz. n-Queen Problem.
5	Implementations of Greedy Method, viz. Fractional Knapsack Problem, Job Sequencing Problem etc.
6	Implementations of String Matching Algorithm viz. Naïve Algorithm, String Matching with Finite Automata etc.
7	Implementations of Various Graph Algorithm, viz. Dijkstra's Algorithm, Floyd Algorithm etc
8	Implementation of some Real Life Trendy Problems.

CO–POMapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	-	-	2	-	2	2	3
CO2	3	3	3	3	-	-	-	-	-	-	-	-	2	3	3
CO3	3	3	3	3	-	-	-	-	-	-	2	-	3	3	3
CO4	3	3	3	3	-	-	-	-	-	-	2	-	3	2	3
CO5	3	3	3	3	-	-	-	-	-	-	2	-	3	3	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – IV	
Course Code	**CS493**
Course Name	**Operating Systems Lab**
Lecture (per week)	**0**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**1.5**

Prerequisites: Programming Knowledge

Course Objectives:

The objective of the course is to make the students able to –

1 .Understand and execute basic commands of shell script

2 . Implement various CPU scheduling Algorithms

3. Implement process creation and inter process communication

4. Implement Deadlock Avoidance and detection Algorithms

5. Implement Page replacements file organization and file allocation strategies.

Course Outcomes:

After completion of the course students will be able to

CO1	**Analyze** and simulate CPU Scheduling Algorithms like FCFS, Round Robin, SJF, and Priority.
CO2	**Understand** the concepts of deadlock in operating systems and implement them in
CO3	**Create** process creation and **implement** inter process communication
CO4	**Analyze**the performance of the various page replacement schemes

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

CO5	**Understand** the concepts of file organization and file allocation strategies

MODULE NUMBER	COURSE CONTENT
1	**Preliminaries of Operating System: [6P]** Basics of UNIX Commands,managing users, managing systems, file managements, useful commands, Shell scripting: shell syntax, executing shell scripts.
2	**CPU Scheduling [12P]** FCFS, SJF, SRTF, RR, PRIORITY algorithms. Display/Gantt chart and Compute and print the average waiting time and average turnaround time.
3	**Process Communication : 3P** Inter-Process Communication (using shared memory, pipes or message queues).
4	**Synchronization : 6P** Producer-Consumer problem using semaphores (using UNIX system calls)
5	**Memory Management and File : 9P** Memory management schemes (paging and segmentation) page replacement algorithm, Memory allocation schemes (First fit, Best fit and Worst fit)

Textbook:

1. Mukesh Singhal and Niranjan Shivaratri, Advanced Concepts in Operating Systems, McGraw-Hill.

ReferenceBooks:

Nancy Lynch, Distributed Algorithms, Morgan Kaufmann.

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

CO–PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	-	-	-	-	3	3	3
CO2	3	3	3	3	-	-	-	-	-	-	-	-	3	2	3
CO3	3	3	3	3	-	-	-	-	-	-	-	3	2	3	2
CO4	3	3	3	3	-	-	-	-	-	-	-	-	3	2	2
CO5	3	3	3	3	-	-	-	-	2	3	-	-	2	2	2
CO	3	3	3	3	-	-	-	-	3	3	-	3	3	3	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – IV	
Course Code	**ESC(CT)491**
Course Name	**IT Workshop Lab (C++/PYTHON)**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**1.5**

Prerequisites: Basic Object Oriented /C++/Python programming knowledge

Course Objectives:

The objectives of this course are to enable students to

- Develop programs with reusability
- Develop programs for file handling
- Handle exceptions in programming
- Develop applications for a range of problems using object-oriented programming techniques

Course Outcome:

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

CO1	**Articulate** the basic Object-Oriented Programming concepts such as class and objects as used in Python/C++.
CO2	**Illustrate** exceptions in Python along with **creating** their own based on the problems or **analyze** various problems based on the knowledge of classes and abstractions in C++.
CO3	**Understand** the concept of multithreading in Python or **write** various programs while **applying** the concept of inheritance in C++.
CO4	**Use** databases in Python or **articulate** the Object-Oriented Programming concepts such as polymorphism in C++.
CO5	**Execute** programs while **applying** the concepts of database connections, transactions etc. in Python or **Illustrate** exceptions in C++ along with **creating** their own based on the

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

MODULE NUMBER	COURSE CONTENT
1	**Python-Object-Oriented Oriented** • Overview of OOP • Creating Classes and Objects • Accessing attributes • Built-In Class Attributes • Destroying Objects **Or Introduction to C++** • Fundamental idea of OOP • Basic terminologies in C++ • Simple programs on C++
2	**Module-II: Python Exceptions Handling** • What is Exception? • Handling an exception • try….except…else • try-finally clause • Argument of an Exception • Python Standard Exceptions • Raising an exceptions • User-Defined Exceptions **Or Module-II: Classes and abstractions in C++** • Class structure • Class objects • Class scope • this pointer • Friends to a class • Static class members • Constant member functions • Constructors and Destructors • Dynamic creation and destruction of objects • Data abstraction • ADT and information hiding.

3	**Module-III: Python Multithreaded Programming** • What is multithreading? • Starting a New Thread • The Threading Module • Synchronizing Threads • Multithreaded Priority Queue **Or Module-III: Inheritance and Virtual Functions and Polymorphism in C++** • Defining a class hierarchy • Different forms of inheritance • Defining the Base and Derived classes • Access to the base class members • Base and Derived class construction • Destructors • Virtual base class • Static and Dynamic binding • virtual functions • Dynamic binding through virtual functions • Virtual function call mechanism • Pure virtual functions • Abstract classes • Implications of polymorphic use of classes • Virtual destructors
4	**Module-IV: Using Databases in Python** • Python MySQL Database Access • Install the MySQLdb and other Packages • Create Database Connection • CREATE, INSERT, READ, UPDATE and DELETE Operation • DML and DDL Operation with Databases • Performing Transactions • Handling Database Errors **Or Module-IV: Exception Handling in C++** • Benefits of exception handling • Throwing an exception • The try block

	• Catching an exception • Exception objects • Exception specifications • Stack unwinding • Rethrowing an exception Catching all exceptions

Text books:

1.Gowrishankar S, Veena A, "Introduction to Python Programming", 1st Edition, CRC Press/Taylor & Francis, 2018.

2.E. Balagurusamy, "Object-Oriented Programming with C++", 8th Edition, Mc Graw Hill, 2020.

Reference books:

1. Wesley J Chun, "Core Python Applications Programming", 3rd Edition, Pearson Education India, 2015.

2. Miguel Grinberg, "Flask Web Development: Developing Web Applications with Python", 2nd Edition, O'Reilly Media, 2018.

CO–PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	-	2	-	-	-	-	-	-	-	2	1	2
CO2	3	3	2	3	2	-	-	-	-	-	2	-	3	3	3
CO3	3	3	3	3	2	-	-	-	-	-	-	-	3	3	3
CO4	3	3	2	3	2	-	-	-	-	-	-	-	3	2	2
CO5	3	3	3	3	3	-	-	-	-	-	-	-	3	3	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

MANDATORY COURSE

Course Name: Learning an Art Form [vocal or instrumental, dance, painting, clay modelling, etc.] OR Environmental Protection Initiatives

Course Code: MC 481

Credits: 3

Total Lectures: 36

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – 5th A. THEORY	
Course Code	**HSMC 505**
Course Name	**Principles of Management**
Lecture (per week)	**2**
Tutorial (per week)	**0**
Contact Hours (per week)	**2**
Total Contact Hours	**24**
Credit	**2**

Course Outcome:
After successful completion of this course, students will be able to

CO1	To recall and identify the relevance of management concepts
CO2	To apply management techniques for meeting current and future management challenges faced by the organization
CO3	To compare the management theories and models critically to solve real-life problems in an organization.
CO4	To apply principles of management in order to execute the role as a manager in an organization
CO5	Analysis Quality control and Understand the Functions of Marketing.

MODULE NUMBER	COURSE CONTENT
1	**Module-1:[4L]** Management Concepts: Definition, roles, functions and importance of Management, Evolution of Management thought-contribution made by Taylor, Fayol,Gilbreth,Elton Mayo, McGregor, Maslow**.**

2	**Module - 2: Planning and Control:[4L]** Planning: Nature and importance of planning, -types of planning, Levels of planning - The Planning Process. –MBO, SWOTanalysis, McKinsey's7S Approach. Organizing for decision making: Nature of organizing, span ofcontrol, Organizational structure –line andstaff authority. Basic control process -control as a feedback system – Feed Forward Control –Requirements for effective control – control
3	**Group dynamics:[4L]** Types of groups, characteristics, objectives of Group Dynamics. Leadership: Definition, styles & functions of leadership, qualities for good leadership, Theories of leadership.
4	**Work Study and work measurement:[4L]** Definition of work study**,** Method Study Steps, Tools and Techniques used in the Method Study and Work Measurement Time Study: Aim & Objectives, Use of stopwatch procedure in making Time Study. Performance rating, allowances and its types. Calculation of Standard Time. Work sampling**.**
5	**Marketing Management:[2L]** Functions of Marketing, Product Planning and development, Promotional Strategy (**2L)**
6	**Quality management**: **[6L]** Quality definition, Statistical quality control,acceptance sampling, Control Charts –Mean chart, range chart,c chart, pchart, np chart, Zero Defects, Quality circles, Kaizen & Six Sigma, ISO -9000 Implementation steps, Total quality management.

Text Books:

1. Essentials of Management, by Harold Koontz & Heinz Weihrich Tata McGraw
2. Production and Operations Management-K.Aswathapa,K .ShridharaBhat,Himalayan Publishing House

References:

1. Organizational Behavior, by Stephen Robbins Pearson Education, New Delhi
2. New era Management, Daft, 11th Edition, Cengage Learning
3. Principles of Marketing, Kotlar Philip and Armstrong Gary, Pearson publication

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	2	-	-	-	-	3	-	3	2	3	3	2
CO2	-	-	-	-	-	2	-	3	3	-	3	3	3	-	3
CO3	2	-	-	2	-	-	-	-	2	-	3	3	3	2	-
CO4	3	-	-	-	-	2	-	2	3	-	3	-	2	3	-
CO5	2	2	-	2	-	-	-	-	2	-	3		-	3	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – 5th	
Course Code	**CS501**
Course Name	**Compiler Design**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**3**

Prerequisites:

- Mathematics
- Concept of programming languages
- Data structures
- Computer architecture
- Formal languages and automata theory
- Some advanced math might be required if you adventure in code optimization

Course Objectives:

The objectives of this course are to enable students to

1. Make the student understand the process involved in a compiler
2. Create an overall view of various types of translators, linkers, loaders, and phases of a compiler
3. Understand the concepts of syntax analysis, various types of parsers especially the top down approach
4. Create awareness among students the various types of bottom up parsers,
5. Understand the syntax analysis and, intermediate code generation, type checking, the role of symbol table and its organization, Code generation, machine independent code optimization and instruction scheduling.

Course Outcome:

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

CO1	Illustrate the basic concept of compilers and discuss on the components as well as the strengths and weaknesses of various phases of designing a compiler.
CO2	Design and analyze algorithms for syntactic or parsing techniques and semantic analysis of the process of designing compilers.
CO3	Develop the parsers and experiment the knowledge of activation tree, activation record and dynamic storage allocation techniques

CO4	Construct the intermediate code representations and generation.
CO5	Apply for various optimization techniques for dataflow analysis.

MODULE NUMBER	**COURSE CONTENT**
1	**Module I [7L]** Compilers, Cousins of the Compiler, Analysis-synthesis model, The phases of the compiler. The role of the lexical analyzer, Tokens, Patterns, Lexemes, Input buffering, Specifications of a token, Recognition of tokens, Finite automata, From a regular expression to an NFA, From a regular expression to DFA, Design of a lexical analyzer generator (Lex).
2	**Module II [10L]** 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, Canonical LR), Parser generators (YACC), Error Recovery strategies for different parsing techniques. Syntax directed translation: Syntax directed definitions, Construction of syntax trees, Bottom-up evaluation of S-attributed definitions, L-attributed definitions, Bottom-up evaluation of inherited attributes.
3	**Module III [7L]** Type systems, Specification of a simple type checker, Equivalence of type expressions, Type conversions Source language issues (Activation trees, Control stack, scope of declaration, Binding of names), Symbol tables, dynamic storage allocation techniques.
4	**Module IV [4L]** Intermediate languages, Graphical representation, Three-address code, Implementation of three address statements (Quadruples, Triples, Indirect triples).

5	**Module V [8L]** Consideration for Optimization, scope of optimization, local optimization, loop optimization, folding, DAG representation, Flow Graph, Data flow equation, global optimization, redundant sub expression elimination, induction variable elimination, copy propagation, basic blocks & flow graphs, transformation of basic blocks, DAG representation of basic blocks, peephole optimization Object code forms, machine dependent code optimization, register allocation and assignment, generic code generation algorithms, DAG for register allocation.

Textbook:

1. Alfred Aho, V. Ravi Sethi, D. Jeffery Ullman, “Compilers Principles, Techniques and Tools”, Addison Wesley, 2nd edition
2. Holub Allen. Compiler Design in C, PHI, 1993.

Reference Books:

1. Chattopadhyay, Santanu. Compiler Design. PHI Learning Pvt. Ltd., 2005
2. Tremblay and Sorenson Compiler Writing-McgrawHill International

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3	3	2
CO2	-	3	3	-	-	-	-	-	-	-	-	-	3	-	3
CO3	-	2	3	2	-	-	-	-	-	-	-	-	3	2	-
CO4	-	-	3	2	3	-	-	-	-	-	-	-	2	3	-
CO5	3	-	2	-	3	3	-	-	-	-	-	-	-	3	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – 5th	
Course Code	**CS502**
Course Name	**Database Management System**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**3**

Prerequisites:

1. Logic of programming language
2. Basic concepts of data structure and algorithms

Course Objectives:

1. To Understand and Describe the basic concepts and utility of Database management system, different data models of Database management system.
2. To Design an Entity Relationship (E-R) Diagram and relational model for any kind of real-life application and able to Apply relational algebra operations, SQL, Neo4j for solving query.
3. To Analyze and Create the relational database for any real-life applications based on normalization.
4. To Apply the query optimization techniques, different file organization techniques and determine whether the transaction satisfies the ACID properties.

Course Outcome:
After successful completion of this course, students will be able to:

CO1	To Understand and Describe the basic concepts and utility of Database management system, different data models of Database management system.
CO2	To Designan Entity Relationship (E-R) Diagram and relational model for any kind of real-life application and able to Apply relational algebra operations, SQL, Neo4j for solving query.
CO3	To Analyze and Createthe relational database for any real-life applications based on normalization.

CO4	To Apply the query optimization techniques, different file organization techniques and determine whether the transaction satisfies the ACID properties.
CO5	**Explore** DBMS based ideasthrough **developing** software programs with adequate documentation in collaborative environment for successfully carrying out projects on DBMS Problems and **investigate** their effectiveness by **analyzing** the performances using proper techniques and tools and **Assess**the limitations of solutions underscoringutilitarian importance for further explorations leading towards lifelong learning.

MODULE NUMBER	**COURSE CONTENT**
1	**Introduction [3L]** Concept & Overview of DBMS, Data Models, Database Languages, Database Administrator, Database Users, Three Schema architecture of DBMS.
2	**Entity-Relationship and Relational Database Model [11L]** Basic concepts, Design Issues, Mapping Constraints, Keys, Entity-Relationship Diagram, Weak Entity Sets, Extended E-R features, case study on E-R Model. Structure of relational Databases, Relational Algebra, Relational Calculus, Extended Relational Algebra Operations, Views, Modifications of the Database.
3	**Graph Based Model [4L]** Concept of graph-based model, difference between relational model and graph-based model, application, overview of Neo4j CQL.
4	**SQL and Integrity Constraints [6L]** Concept of DDL, DML, DCL. Basic Structure, Set operations, Aggregate Functions, Null Values, Domain Constraints, Referential Integrity Constraints, assertions, views, Nested Subqueries, Database security application development using SQL, Stored procedures and triggers.
5	**Relational Database Design [8L]** Functional Dependency, Different anomalies in designing a Database., Normalization using functional dependencies, Decomposition, Boyce-Codd Normal Form, 3NF, Normalization using multi-valued dependencies, 4NF, 5NF, Case Study
6	**Internals of RDBMS [8L]** Physical data structures, Query optimization: join algorithm, statistics and cost bas optimization. Transaction processing, Concurrency control and Recovery Management:

	transaction model properties, state serializability, lock base protocols; two phase locking, Dead Lock handling.
7	**File Organization & Index Structures [3L]** File & Record Concept,Fixed and Variable sized Records, Types of Single-Level Index (primary, secondary, clustering), Multilevel Indexes

Textbook:

1. Henry F. Korth and Silberschatz Abraham, “Database System Concepts”, Mc.Graw Hill.
2. ElmasriRamez and NovatheShamkant, “Fundamentals of Database Systems”, Benjamin Cummings Publishing. Company.

Reference Books:

“Fundamentals of Database Systems”, RamezElmasri, ShamkantB.Navathe, Addison Wesley Publishing.
2. Ramakrishnan: Database Management System, McGraw-Hill

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	2	2	3	2	-	-	-	-	-	-	-	-	2	-	2
CO4	2	2	2	3	-	-	-	-	-	-	-	-	2	-	2
CO5	2	2	3	3	-	-	-	-	-	-	-	2	2	2	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – 5th	
Course Code	**CS503**
Course Name	**Object Oriented Programming using Java**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**3**

Prerequisites:

- Computer Fundamentals
- Basic understanding of Computer Programming and related Programming Paradigms

Problem Solving Techniques with proper logic Implementation

Course Objectives:

The objectives of this course are to enable students to

- It allows to map with real world Object (Object orientation) rather than action(Procedure) that comes to produce software as separated code modules which rise up decoupling and increases code re-usability.
- It demonstrates that how can you change the implementation of an object without affecting any other code by increasing data security and protecting unwanted data access. (Encapsulation).
- It allows you to have many different functions, all with the same name, all doing the same job, but depending upon different data. (Polymorphism).
- It guides you to write generic code: which will work with a range of data, so you don't have to write basic stuff over, and over again. (Generics).
- It lets you write a set of functions, then expand them in different direction without changing or copying them in any way. (Inheritance)

Course Outcome:

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

CO1	Design the process of interaction between Objects, classes & methods w.r.t. Object Oriented Programming.
CO2	Acquire a basic knowledge of Object Orientation with different properties as well as different features of Java.

CO3	Analyze various activities of different string handling functions with various I/O operations.
CO4	Discuss basic code reusability feature w.r.t. Inheritance, Package and Interface.
CO5	Implement Exception handling, Multithreading and Applet (Web program in java) programming concept in Java.

MODULE NUMBER	COURSE CONTENT
1	**Introduction [2L]** Object Oriented Analysis (OOA) &Object Oriented Design (OOD) - Concepts of object oriented programming language, Relationships among objects and classes-Generalization, Specialization, Aggregation, Association, Composition, links, Meta-class. **[1L];** Object Oriented Programming concepts - Difference between Java and C++; Different features of Java **[1L];**
2	**Java Basics [10L]** Basic concepts of java programming - Advantages of java, Byte-code & JVM, Data types, Different types of Variables.**[1L] ;**Java Operators & Control statements **[1L];** Java loops. **[1L];** Array.**[1L] ;**Creation of class, object, method. **[1L];** Constructor- Definition, Usage of Constructor, Different types of Constructor.**[1L];** finalize method and garbage collection, Method & Constructor overloading. **[1L];** this keyword, use of objects as parameter & methods returning objects.**[1L];** Call by value & call by reference. **[1L];** Static variables &methods.Nested& inner classes.**[1L].**
3	**Basic String handling & I/O [5L]** Basic string handling concepts- Concept of mutable and immutable string, Methods of String class- charAt(), compareTo(), equals(), equalsIgnoreCase(), indexOf(), length() , substring(). **[1L];** toCharArray(), toLowerCase(), toString(), toUpperCase() , trim() , valueOf() methods, Methods of String buffer class- append(), capacity(), charAt(), delete(), deleteCharAt(). **[1L];**ensureCapacity(), getChars(), indexOf(), insert(), length(), setCharAt(), setLength(), substring(), toString(). **[1L] ;**Command line arguments, basics of I/O operations – keyboard input using BufferedReader**[1L] ;** Scanner class in Java I/O operation **[1L];**
4	**Inheritance and Java Package[8L]** Inheritance - Definition, Advantages, Different types of inheritance and their implementation.

	[1L] ;Super and final keywords, super() method. **[1L];** Method overriding, Dynamic method dispatch.**[1L];** Abstract classes & methods.**[1L];** Interface - Definition, Use of Interface.**[1L];** Multiple inheritance by using Interface.**[1L] ;**Java Packages -Definition, Creation of packages. **[1L];** Java Access Modifiers - public, private, default and protected,Importing packages, member access for packages. **[1L]**
5	**Exception handling, Multithreading and Applet Programming [11L]** Exception handling - Basics, different types of exception classes.Difference between Checked & Unchecked Exception.**[1L];** Try & catch related case studies.**[1L];** Throw, throws & finally. **[1L];** Creation of user defined exception. **[1L];** Multithreading - Basics, main thread **[1L];** Thread life cycle.**[1L];** Creation of multiple threads-yield(), suspend(), sleep(n), resume(), wait(), notify(), join(), isAlive().**[1L] ;**Thread priorities, thread synchronization.**[1L];**Interthread communication, deadlocks for threads**[1L];** Applet Programming - Basics, applet life cycle, difference between application & applet programming**[1L];** Parameter passing in applets. **[1L]**

Textbook:

1. Herbert Schildt – "Java: The Complete Reference " – 9th Ed. – TMH
2. E. Balagurusamy – " Programming With Java: A Primer " – 3rd Ed. – TMH.

Reference Books:

1. R.K Das – " Core Java for Beginners " – VIKAS PUBLISHING.
2. Rumbaugh, James Michael, Blaha – " Object Oriented Modelling and Design " – Prentice Hall, India.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	3	2	-	-	-	-	-	-	-	-	-	2	3
CO2	3	2	3	1	-	-	-	-	-	-	-	-	3	2	-
CO3	3	3	2	3	-	-	2	-	1	-	-	-	2	-	3
CO4	2	-	2	2	-	-	-	-	-	-	-	-	3	2	-
CO5	2	-	3	1	2	-	-	-	2	-	2	-	-	2	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – 5th	
Course Code	**CT501T**
Course Name	**Microprocessors & Microcontrollers**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**3**

Prerequisites: Digital Electronics

Course Objectives:

The objectives of this course are to enable students to

1. Understand the architecture of 8085 microprocessors and its address bus, data bus, interrupt, I/O device interfacing and apply this knowledge in designing solution to solve real life problems.
2. Summarize the working principle of 8085 microprocessors, addressing modes, counter and time delays, stack and subroutine, timing diagram of the instructions.
3. Identify and understand the 8086 microprocessors and its architecture, pin details, addressing mode interrupts, instruction set, examples of simple assembly language, memory interfacing with 8086.
4. Understand the working principles of 8051 microcontrollers and its architecture, pin details, addressing modes, instruction set, examples of simple assembly language.
5. Understand the concept of AVR Family architecture, register File, ALU, memory access and instruction execution. I/O memory, EEPROM. I/O ports, timers. UART, and Interrupt structure.

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

Course Outcome:
After successful completion of this course, students will be able to:

CO1	**Understand** the architecture of 8085 microprocessors and its address bus, data bus, interrupt, I/O device interfacing and **apply** this knowledge in **designing**solutions for real life engineering problems.
CO2	**Summarize** the working principle of 8085 microprocessors, addressing modes, counter and time delays, stack and subroutine, timing diagram of the instructions and **use** this knowledge for **designing** and **implementing** mathematical and engineering problems leading to lifelong learning.
CO3	**Identify and understand t**he concept of 8086 microprocessors and its architecture, pin details, addressing modes, interrupts, instruction set, examples of simple assembly language, memory interfacing with 8086 to **solve** engineering problems.
CO4	**Understand** the working principlesof 8051 microcontrollers and its architecture, pin details, addressing modes, instruction set, examples of simple assembly language and **apply** this knowledge for **developing** an approach by means of existing and new methods as a team work.
CO5	**Understand** the concept of AVR Family architecture, register File, ALU, memory access and instruction execution. I/O memory, EEPROM. I/O ports, timers. UART, Interrupt Structure and **design** an optimized modelfor **building** a new solution as aprofessional engineering practice as a team.

MODULE NUMBER	COURSE CONTENT
1	**Module -I: [9L]** Introduction to Microcomputer based system. [1L] History of evolution of Microprocessors and Microcontrollers and their advantages and disadvantages. [1L] Architecture of 8085 Microprocessor, Pin description of 8085. [2L] Address/data bus De- multiplexing, Status Signals and the control signals. [1L] Interrupts of 8085 processors (software and hardware) [2L] I/O Device Interfacing - I/O Mapped I/O and Memory Mapped I/O, Memory interfacing with 8085 [2L]
2	**Module -II: [9L]** Instruction set of 8085 microprocessors, Addressing modes. [3L] Assembly language programming with examples, Counter and Time Delays, Stack and Subroutine. [4L] Timing diagram of the instructions (a few examples) [2L]

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

3	**Module III: [7L]** The 8086 microprocessor- Architecture, Pin Details, addressing modes, Interrupts [3L] Instruction set, Examples of Simple Assembly Language [2L], Memory interfacing with 808 [2L]
4	**Module -IV: [6L]** Introduction to 8051 Microcontroller – Architecture, Pin Details [3L], Addressing modes, Instruction set, Examples of Simple Assembly Language. [3L]
5	**Module -V: [5L]** Introduction, AVR Family architecture[1L], Register File, The ALU[1L], Memory access and Instruction execution. I/O memory, EEPROM. I/O ports [2], Timers.UART. Interrupt Structure[1L]

Textbook:

1. MICROPROCESSOR architecture, programming and Application with 8085 - R. Gaonkar (Penram international Publishing LTD.) [For Module 1 and2]
2. Fundamentals of Microprocessor and Microcontrollers - B. Ram (Paperback) [For Module3]
3. 8051 Microcontroller – K. Ayala (Cengage learning) [For Module4]

Reference Books:

1. B.Ram , Fundamental of Microprocessor and Microcontrollers, DhanpatRai Publications.
2. Intel Corp: The 8085 / 8085A. Microprocessor Book – Intel marketing communication, Wiley interscience publications, 1980.
3. Walter A. Tribel– The 8088 and 8086 Microprocessors, Pearson Education

CO – PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	-	-	-	-	3	3	3
CO2	3	3	3	3	-	-	-	-	-	-	-	3	3	2	3
CO3	3	3	3	3	-	-	-	-	-	-	-	-	3	3	1
CO4	3	3	3	3	-	-	-	-	3	-	-	-	3	2	3
CO5	3	3	3	3	-	-	-	-	3	2	-	-	3	2	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – 5th	
Course Code	**CS501S**
Course Name	**Advanced Computer Architecture**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**3**

Prerequisites: Computer Organization and Architecture

Course Objectives:

The objectives of this course are to enable students to

1. Illustrate the basic concept of computer architecture and its performance measurement, parallel processing, Flynn's classification and Amdahl's law to design real life engineering problem.
2. Summarize the basic concept of pipeline, instruction pipeline, arithmetic pipeline, hazards detection and prevention to design and implement mathematical and engineering problem.
3. Identify the concept of Instruction-Level Parallelism to solve engineering problem.
4. Illustrate and Compare concept of Multiprocessor architecture and parallel architecture.
5. Understand the concept of message passing architecture and interconnection network and design an optimized model

Course Outcome:
After successful completion of this course, students will be able to:

CO1	**Illustrate** the basic concept of computer architecture and its performance measurement, parallel processing, Flynn's classification and Amdahl's law and **apply** this knowledge in **designing** solution for real life engineering problem.
CO2	**Summarize** the basic concept of pipeline, instruction pipeline, arithmetic pipeline, hazards detection and prevention and **use**this knowledge for **designing** and **implementing** mathematical and engineering problem leading to lifelong learning.
CO3	**Identify** the concept of Instruction-Level Parallelism to **solve** engineering problem.

CO4	**Illustrate and Compare** concept ofMultiprocessor architecture and parallel architecture and**apply** this knowledge for **developing** an approach by means of existing and new methods as a team work.
CO5	**Understand** the concept of message passing architecture and interconnection network and **design** an optimized modelfor **building** a new solution as aprofessional engineering practice as a team.

MODULE NUMBER	COURSE CONTENT
1	**Introduction [3L]** Review of basic computer architecture [1], Measuring, reporting and summarizing performance [1], quantitative principles of Computer design [1] **Parallel processing [4L]** Parallel processing - concept, architecture [1], Flynn's classification-SISD, SIMD, MISD, MIMD [1], SIMD architecture, MIMD architecture, loosely coupled and tightly coupled computers [1], Amdahl' law [1].
2	**Pipelining[8L]** Introduction of pipelining, classification of pipeline [1], Instruction pipeline [1], Arithmetic pipeline [1], hazard detection and resolution in pipeline [3], dynamic pipeline [1], reservation table and case study [2].
3	**Instruction-Level Parallelism[6L]** Instruction-Level Parallelism: Basic Concepts [2L], Techniques for Increasing ILP, Superscalar, Super Pipelined and VLIW Processor Architectures [2L], Array Processor [1], Vector Processors [1L]
4	**Multiprocessor architecture[8L]** Shared memory architecture - classification, bus based symmetric multiprocessors [1], cache coherence methods, snooping protocols, directory based protocols [1], Centralized and Shared- memory architecture: synchronization[1L] Introduction to Parallel Architecture-Different Classification scheme, Performance of Parallel

	Computers, PRAM model (EREW, CREW, CRCW) [3L], Program flow mechanisms – Control flow, data-driven and demand driven [2]
5	**Message passing architecture [4]** Basic concept, Routing in message passing network [1], switching mechanisms in message passing [1], Examples of message passing architecture [1], Message passing vs Shared memory architectures [1] **Interconnection Network [3]** Interconnection Network- taxonomy, bus based dynamic interconnection networks [1], switch-based interconnection networks [1], static interconnection networks [1], performance analysis [1L]

Textbook:

J. L. Hennessey and D. A. Patterson: Computer Architecture: A Quantitative Approach, 5th edition, Morgan Kaufmann, 2012.

2. K. Hwang and F. A. Briggs: Computer Architecture and Parallel Processing, Tata McGraw Hill, New Delhi.

Reference Books:

Tse-yun Feng, A Survey of Interconnection Networks, IEEE, 1981.

2. Selim G. Akl, The Design and Analysis of Parallel Algorithms, Prentice-Hall, 1989.

CO–POMapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	-	-	-	-	3	3	3
CO2	3	3	3	3	-	-	-	-	-	-	-	3	3	2	3
CO3	3	3	3	3	-	-	-	-	-	-	-	-	3	3	1
CO4	3	3	3	3	-	-	-	-	3	-	-	-	3	2	3
CO5	3	3	3	3	-	-	-	-	3	2	-	-	3	2	3
CO	3	3	3	3	-	-	-	-	3	2	-	3	3	3	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – 5th	
Course Code	**CT501D**
Course Name	**Artificial Intelligence**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**3**

Prerequisites: Data Structure, Design and Analysis of Algorithms, Statistics

Course Objectives:

The objectives of this course are to enable students to

1. Comprehend the fundamental concepts of Knowledge Representation and Inferencing in Artificial Intelligence and its utilitarian importance in current technological context
2. Formulate aproblem as State-Space Exploration Framework or an Inferencing Framework of Artificial Intelligence.
3. Use the strategies of AI-Heuristics to find acceptable solutions avoiding brute-force techniques.
4. Design AI-Frameworks for Inferencing based on knowledge base.
5. Analyze the effectiveness of AI-Inferencing Modelin offering solutions to the respective problem.

Course Outcome:

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

CO1	**Understand and explain** the fundamental concepts of Knowledge Representation and Inferencing in Artificial Intelligence andits utilitarian importance in current technological context for further exploration leading towards lifelong learning.
CO2	**Identify** and **formulate** an engineering problem primarily to fitaState-Space Exploration Frame work or an Inferencing Model/Agent Design Frame work within the scope of Artificial Intelligence paradigm.
CO3	**Explore** relevantliteratureand **apply** the concept of Heuristic Techniques ofArtificial Intelligenceto **solve**problems.
CO4	**Develop** Inferencing Models for **proposing** solutions to the problems of Artificial Intelligence.

CO5	**Implement** Inferencing Models of Artificial Intelligence through **developing**feasible algorithms and **investigate** their effectiveness by **analyzing** their performances in solving the relevant problems.

MODULE NUMBER	COURSE CONTENT
1	**Introduction to Artificial Intelligence [1L]** Basic Concepts, History of Artificial Intelligence, Architecture of an Artificial Intelligent Agent, Applications of Artificial Intelligence
2	**Artificial Intelligence Problem Formulation as State-Space Exploration Problem for Goal Searching [5L]** Basic Concepts, State-Space Exploration Formulation for Water Jug Problem, Missionaries and Cannibals Problems, Farmer-Wolf-Goat-Cabbage Problem, 8-Puzzle Problem, Constraint Satisfaction Problem and Production System for Goal Searching. Blind Search Techniques for Goal Searching: Breadth First Search, Depth First Search, Depth Limited Search, Iterative Deepening Search, Uniform Cost Search, Bi-directional Search.
3	**Heuristic Techniques for Goal Searching [8L]** Basic Concepts of Heuristic Techniques and Properties of Heuristic Functions, Hill Climbing Search. Best First Search, A* Search, Memory-bounded heuristic search: Iterative-deepening A* Search, Recursive Best First Search, Simplified Memory Bounded A* Search. Simulated Annealing Based Stochastic Search, Genetic Algorithm Based Evolutionary Search, Ant Colony Optimization, Particle Swarm Optimization.
4	**Adversarial Search for Game Playing [2L]** Basic Concepts, Minimax Search, Alpha-Beta Pruning.
5	**Knowledge Representation and Inference using Propositional Logic and Predicate**

	Logic[5L] Propositional Logic: Knowledge Representation and Inference using Propositional Logic Predicate Logic:Knowledge Representation, Inference and Answer Extraction using First Order Predicate Logic
6	**Slot-and-Filler Structure for Knowledge Representation [2L]** Weak Slot-and-Filler Structure for Knowledge Representation: Semantic Nets and Frames. Strong Slot-and-Filler Structure for Knowledge Representation: Conceptual Dependency and Script.
7	**Reasoning under Uncertainty [5L]** Bayesian Inferencing and Bayesian Belief Network, Dempster-Shafer Theory, Overview of Fuzzy Logic and Inferencing, Overview of Hidden Markov Model
8	**Planning [5L]** Basic Concepts, Problem of Blocks World, Components of a Planning System, Algorithms for Planning: Goal Stack, Nonlinear Planning Using Constraint Posting, Hierarchical Planning, Algorithms for Planning as State-Space Search, Heuristics for planning, Planning Graphs and GRAPHPLAN Algorithm.
9	**Introduction to Natural Language Processing [1L]** Basic Concepts, Steps of Natural Language Processing, Morphological, Syntactic and Semantic Analysis, Discourse Integration and Pragmatic Analysis, Applications of Natural Language Processing.
10	**Introduction to Machine Learning [2L]** Basic concepts of Machine Learning Model, Supervised Learning, Unsupervised Learning, and Reinforced Learning, Overview of Artificial Neural Network

Textbook:

3. Russell, S. and Norvig, P. 2015. Artificial Intelligence - A Modern Approach, 3rd edition, Prentice Hall.
4. Rich, E., Knight, K and Shankar, B. 2009. Artificial Intelligence, 3rd edition, Tata McGrawHill.

Reference Books:

6. Padhy, N.P. 2009. Artificial Intelligence and Intelligent Systems, Oxford University Press.
7. Deepak Khemani, "A First Course in Artificial Intelligence", McGraw Hill.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	3	3	-	-
CO2	2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	2	2	3	2	-	-	-	-	-	-	-	-	2	-	2
CO4	2	2	2	3	-	-	-	-	-	-	-	2	2	-	2
CO5	2	2	3	3	2				-	-	-	2	2	2	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – 5th	
Course Code	**CT501A**
Course Name	**Computer Graphics**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**3**

Prerequisites: Mathematics, Computer Fundamentals & Principle of Computer Programming

Course Objectives:

1. The objectives of this course are to enable students to Use of the component so fa graphics system and become familiar with building approach of graphics system components and algorithms related with them.
2. Understand thebasicprinciplesof2Dand3Dcomputergraphics.
3. Understand of how to scan convert the basic geometrical primitives, how to transform the shapes to fit the master the picture definition.
4. Understand the mapping from a world co-ordinates to device co-ordinates , clipping ,and projections .
5. Discuss the application of computer graphics concepts in the development of computer games, information visualization ,and business applications .

Course Outcome:
After successful completion of this course, students will be able to:

CO1	**Understand t**he fundamental concept of Computer graphics and mathematical knowledge and explainthefoundationsofcomputergraphicsanddifferentdisplaytechnologyanddevices.
CO2	**Demonstrate** different scan conversion algorithms, drawing algorithms, polygon filling algorithms, curves and surface drawing algorithms, clipping algorithms, surface removal algorithms using graphics tools.

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

CO3	**Understand** the basic concept of graphics programming and implementclippingwiththecomprehensionofwindows,view-portsinrelationtoimages display on screen.
CO4	**Analyze** and compare different drawing algorithms, polygon filling algorithms, curves and surface drawing algorithms hidden surface illumination methods
CO5	**Develop** the concept of geometric models, mathematical and algorithmic approach necessary for programming computer graphics leading to lifelong learning.

MODULE NUMBER	COURSE CONTENT
1	**Introduction [4L]** Introduction: Objective, applications, GKS/PHIGS, normalized co-ordinate system, aspect ratio.
2	**Computer Graphics System [4L]** Graphics System:Vector and raster graphics, various graphics display devices, graphics interactive devices, segmented graphics, attribute table.
3	**Computer Graphics System [4L]** Raster Scan Graphics:Line drawing algorithms, circle/ellipse drawing algorithms, polygon filling algorithms.
4	**Geometric Transformation [4L]** Geometric Transformation: Homogeneous co-ordinate system, 2D and 3D transformations, projection— orthographic and perspective.
5	**Curves and Surfaces [4L]** Curves and Surfaces: Curve approximation and interpolation, Lagrange, Hermite, Bezier and BSpline curves/surfaces and their properties, curves and surface drawing algorithms.
6	**Curves and Surfaces 2 [4L]** Geometric modelling: 3D object representation and its criteria, edge/vertex list, constructive

	solid geometry, wire-frame model, generalized cylinder, finite element methods.
7	**Viewing and Clipping [4L]** Clipping :Window and viewport, 2D and 3D clipping algorithms.
8	**Hidden Surfaces [4L]** Hidden Lines and Hidden Surfaces:Concept of object- and image-space methods, lines and surface removal algorithms.
9	**Illumination and Color models [4L]** Intensify, Coloring and Rendering:RGB, YIQ, HLS and HSV models and their conversions, gamma correction, halftoning. Illumination models, polygon mesh shading, transparency, shadow, texture.

Textbook:

1. D. Hearn and P. M. Baker: Computer Graphics, 2nd ed. Prentice Hall of India, New Delhi, 1997.
2. W. M. Newman and R. F. Sproull: Principles of Interactive Computer Graphics, McGraw Hill, New Delhi, 1979.

Reference Books:

1. F. S. Hill: Computer Graphics, McMillan, New York, 1990.
2. D. P. Mukherjee: Fundamentals of Computer Graphics and Multimedia, Prentice Hall of India, New Delhi, 1999.
3. J. D. Foley et al.: Computer Graphics, 2nd ed., Addison-Wesley, Reading, Mass., 1993.
4. W. K. Giloi: Interactive Computer Graphics: Data Structure, Algorithms, Languages, Prentice Hall, Englewood Cliffs, 1978.

CO–POMapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	-	-	-	-	3	3	3
CO2	3	3	3	3	3	-	-	-	-	-	-	-	3	2	3
CO3	3	3	3	3	-	-	-	-	-	-	-	-	2	3	2
CO4	2	3	2	3	-	-	-	-	-	-	-	-	3	2	3
CO5	3	3	3	3	-	-	-	-	3	2	-	3	3	2	2

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – 5th **B. PRACTICAL**	
Course Code	**CS591**
Course Name	**Compiler Design Lab**
Lecture (per week)	**0**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**1.5**

Course Objectives:

The objectives of this course are to enable students to

- To provide an Understanding of the language translation peculiarities by designing complete translator for mini language.

Course Outcome:
After successful completion of this course, students will be able to:

CO1	Understand the practical approaches of how a compiler works.
CO2	Develop and analyze the role of syntax and semantics of Programming languages in compiler construction.
CO3	Apply the techniques and algorithms used in Compiler Construction in compiler component design.
CO4	Create intermediate code representations and generation.
CO5	Construct different tools in construction of the phases of a compiler for the mini language.

MODULE NUMBER	COURSE CONTENT
1	**[13L]** • Programming to Scan and Count the number of characters, words, and lines in a file. • Design a lexical analyzer for the given language. The lexical analyzer should ignore redundant spaces, tabs and new lines, comments etc.

	• Implement the lexical analyzer using JLex, flex or other lexical analyzer generating tools. • Programming to implement NFAs that recognize identifiers, constants, and operators of the mini language.**[13L]**
2	• Design Predictive Parser for the given language • Design a LALR bottom up parser for the given language • Implementation of SLR Parser • Implementation of Predictive Parser**[3L]**
3	Convert the BNF rules into Yacc form and write code to generate abstract syntax tree.**[4L]**
4	• A program to generate machine code from the abstract syntax tree generated by the parser.**[3L]**
5	• Write a lex program to find out total number of vowels, and consonants from the given input sting**.[3L]**

Textbook:

- Modern compiler implementation in C, Andrew w.Appel, Revised Edn, Cambridge University Press
- lex&yacc , -John R Levine, Tony Mason, Doug Brown; O'reilly.

Reference Books:

- Modern Compiler Design – Dick Grune, Henry E.Bal, Cariel TH Jacobs, Wiley Dreatech
- Compiler Construction,- LOUDEN, Thomson.
- Engineering a compiler – Cooper& Linda, Elsevier

CO–POMapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3	3	2
CO2	-	3	3	3	-	-	-	-	-	-	-	-	3	-	3
CO3	-	2	3	2	3	-	-	-	-	-	-	-	3	2	-
CO4	-	-	3	2	-	-	-	-	-	-	-	-	2	3	-
CO5	3	-	2	-	3	3	-	-	-	-	-	-	-	3	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – 5th	
Course Code	**CS592**
Course Name	**Database Management System Lab**
Lecture (per week)	**0**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**1.5**

Prerequisites:

1. Logic of programming language
2. Basic concepts of data structure and algorithms

Course Outcome:
After successful completion of this course, students will be able to:

CO1	Demonstrate and Explain the database management system and different database languages.
CO2	Understand and Apply the SQL queries related to management of data and transaction processing for solving real life problems.
CO3	Explain and Analyzeabout query processing techniques involved in query optimization.
CO4	Demonstrate andApplythe PL/SQL programming,the concept of Cursor Management, Error Handling, Package and Triggers for solving real life complex problems.
CO5	Design and Assess the commercial database systems.

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

MODULE NUMBER	COURSE CONTENT
1	Conceptual Designing using ER Diagrams (Identifying entities, attributes, keys and relationshipsbetween entities, cardinalities, generalization, specialization etc.)
2	Converting ER Model to Relational Model (Represent entities and relationships in Tabular form,Represent attributes as columns, identifying keys) and apply the normalization techniques.
3	Creation of Tables using SQL- Overview of using SQL tool, Data types in SQL, Creating Tables(along with Primary and Foreign keys), Altering Tables and Dropping Tables
4	Practicing DML commands- Insert, Select, Update, Delete
5	Practicing Queries using ANY, ALL, IN, EXISTS, NOT EXISTS, UNION, INTERSECT, CONSTRAINTS etc., Practicing Sub queries (Nested, Correlated) and Joins (Inner, Outer and Equi).
6	Practice Queries using COUNT, SUM, AVG, MAX, MIN, GROUP BY, HAVING, VIEWS Creation andDropping, Practicing on Triggers - creation of trigger, Insertion using trigger, Deletion using trigger, Updatingusing trigger.
7	Procedures- Creation of Stored Procedures, Execution of Procedure, and Modification of Procedure, PL/SQL, Cursors- Declaring Cursor, Opening Cursor, Fetching the data, closing the cursor.

CO-PO Mapping:

CO#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	2	-	-	-	-	-	-	3	3	2
CO2	3	3	3	3	3	1	1	-	-	-	1	1	3	3	3
CO3	3	3	3	3	3	2	1	-	-	1	1	1	2	3	2
CO4	3	3	3	3	3	2	1	-	-	1	1	-	3	3	3
CO5	3	3	3	3	3	2	1	1	-		2	1	3	3	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – 5th	
Course Code	**CS593**
Course Name	**Object Oriented Programming using Java Lab**
Lecture (per week)	**0**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**1.5**

Course Objectives:

The objectives of this course are to enable students to

- It demonstrates that how can you change the implementation of an object without affecting any other code by increasing data security and protecting unwanted data access. (Encapsulation).
- It allows you to have many different functions, all with the same name, all doing the same job, but depending upon different data. (Polymorphism).
- It guides you to write generic code: which will work with a range of data, so you don't have to write basic stuff over, and over again. (Generics).
- It lets you write a set of functions, then expand them in different direction without changing or copying them in any way. (Inheritance)

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

Course Outcome:
After successful completion of this course, students will be able to:

CO1	Create the procedure of communication between Objects, classes & methods.
CO2	Understand the elementary facts of Object Orientation with various characteristics as well as several aspects of Java.
CO3	Analyze distinct features of different string handling functions with various I/O operations.
CO4	Discuss simple Code Reusability notion w.r.t. Inheritance, Package and Interface.
CO5	Apply Exception handling, Multithreading and Applet (Web program in java) programming concept in Java.

Java Basics

MODULE NUMBER	COURSE CONTENT
1	**Java Basics[10L]** 1. Simple Java programming using operators, control statements & loops, array. 2. Programming on class, object, and method, access specifier. 3. Programming on constructor, method/constructor overloading. 4. Programming on this keyword, call by value, static variables & methods, inner classes
2	**Basic String handling & I/O[12L]** 1. Programming to show the use of String class methods - charAt(), compareTo(), equals(), equalsIgnoreCase(), indexOf(), length() , substring(), toCharArray(), toLowerCase(), toString(), toUpperCase(), trim(), valueOf() methods. 2. Programming to show the use of StringBuffer class methods - append(), capacity(), charAt(), delete(), deleteCharAt(),ensureCapacity(), getChars(), indexOf(), insert(), length(), setCharAt(), setLength(), substring(), toString() methods. 3. Programming on Command line arguments. 4. Programming using keyboard input by implementing BufferedReader& Scanner classes.
3	**Inheritance, Interface and Java Packages[6L]** 1. Programming on Simple Inheritance, super and final keywords, super() method. 2. Programming on method overriding, dynamic method dispatch,abstract classes & methods, multiple inheritance by using interface. 3. Programming on importing system package, creating user-defined package, importing

	user-defined package, using protected access specifier, subclassing an imported class of a package, using same names for classes of different packages, adding multiple public classes to a package.
4	**Exception handling, Multithreading and Applet Programming [8L]** 1. Programming on exception handling using try-catch block, implementing throw and throws keywords, using finally block, creating user-defined exception. 2. Programming on creating child threads i) by extending thread class ii) by implementing runnable interface, creating child threads by assigning thread priorities. 3. Programming on creating simple applet to display some message, creating applet two add 2 integers, creating applet to do GUI based programming.

Textbook:

1. Herbert Schildt – "Java: The Complete Reference " – 9th Ed. – TMH
2. E. Balagurusamy – " Programming With Java: A Primer " – 3rd Ed. – TMH.

Reference Books:

1. R.K Das – " Core Java for Beginners " – VIKAS PUBLISHING.
2. Rambaugh, James Michael, Blaha – " Object Oriented Modelling and Design " – Prentice Hall, India

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	-	-	-	1	-	-	1	-	3	3
CO2	3	2	2	-	1	-	-	-	1	-	-	2	3	2	3
CO3	2	3	2	3	-	-	-	-	2	-	-	-	-	3	3
CO4	1	-	-	-	-	-	-	-	1	2	-	2	3	3	-
CO5	2	1	1	-	1	-	-	-	2	-	-	2	-	2	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – 5th	
Course Code	**CT591T**
Course Name	**Microprocessor & Microcontroller Lab**
Lecture (per week)	**0**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**1.5**

Prerequisites: Digital Electronics

Course Objectives:

The objectives of this course are to enable students to

1. Illustrate and use proper code in appropriate platform using suitable syntax for developing program to solve problems.
2. Apply the knowledge of architecture in the computational area to efficient programming codes to design programs, interface with peripherals using modern tools.
3. Outline different types of basic instruction set (data transfer, load/store, arithmetic, logical), subroutine calls and IN/OUT instructions and trainer kits to design and solve the problems.
4. Analyze the problem by applying the knowledge of microprocessor and microcontroller and implement a new approach for solving engineering-related computational problems.
5. Interpret the result of the experiments, prepare laboratory reports based on observed output and analyze it.

Course Outcome:

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

CO1	**Illustrate** and **use** proper code in appropriate platform using suitable syntax for developing program to **solve** problems related to Mathematics and Engineering field leading to lifelong learning.
CO2	**Apply** the knowledge of architecture in the computational area to efficient programming codes to design programs, interface with peripherals using modern tools like trainer kits for **solving** complex engineering problems.

CO3	**Outline** different types of basic instruction set (data transfer, load/store, arithmetic, logical), subroutine calls and IN/OUT instructions and trainer kits to design and solve the problem as a professional engineering practice as a team.
CO4	**Analyse** the problem by **applying** the knowledge of microprocessor and microcontroller and implement a new approach for **solving** engineering-related computational problems as a team.
CO5	**Interpret** the result of the experiments**, prepare** laboratory reports based on observed output and **analyse** it to validate professional ethics and responsibilities and norms of the engineering practice.

MODULE NUMBER	COURSE CONTENT
1	Familiarization with 8085 register level architecture and trainer kit components including the memory map. Familiarization with process of storing and viewing the contents of memory as well as registers.
2	Familiarization with prewritten program on 8085 trainer kit using the basic instruction set (data transfer, load/store, arithmetic, logical)
3	**:** Implement the following programs using 8085 trainer kit a. Table lookup b. Copying a block of memory c. Shifting a block of memory d. Packing and unpacking of BCD numbers e. BCD to Binary Conversion and vice-versa f. HCF of two numbers g. Addition of numbers using subroutine h. Clearing the flag register i. Addition and subtraction j. Copying and shifting a block of memory k. Packing and unpacking of BCD numbers l. Addition of BCD numbers m. Binary to ASCII conversions n. String matching o. Multiplication of two numbers p. Sorting of array of numbers
4	Implement the following programs using subroutine calls and IN/OUT instructions using

	8255 PPI on the trainer kit. a. Reading switch state & glowing LEDs accordingly b. finding out the frequency of a pulse train c. subroutine for delay.
5	Familiarization with 8051 Micro controller.
6	Implement the following programsusing8051 Micro Controller trainer kit a. Addition and subtraction b. Copying and shifting a block of memory c. Packing and unpacking of BCD numbers d. Addition of BCD numbers e. Binary to ASCII conversions f. String matching g. Multiplication of two numbers h. Sorting of array of numbers

Textbook:

1. MICROPROCESSOR architecture, programming and Application with 8085 - R.Gaonkar (Penram international Publishing LTD.)
2. Fundamentals of Microprocessor and Microcontrollers - B. Ram(Paperback)

Reference Books:

1. The 8051 microcontroller and Embedded systems - Mazidi, Mazidiand McKinley (PEARSON)
2. 8051 Microcontroller – K. Ayala (Cengage learning)

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	-	-	-	3	3	3	3
CO2	3	3	3	3	3	-	-	-	-	-	-	-	3	3	3
CO3	3	3	3	3	-	-	-	3	3	-	-	-	3	3	3
CO4	3	3	3	3	-	-	-	3	3	-	-	-	3	3	3
CO5	-	-	-	-	-	-	-	3	-	3	-	-	3	2	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – 5th	
Course Code	**CS591S**
Course Name	**Advanced Computer Architecture Lab**
Lecture (per week)	**0**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**1.5**

Prerequisites: Computer Organization and Architecture

Course Objectives:

The objectives of this course are to enable students to

1. Illustrate and use proper syntax in appropriate platform using suitable syntax for developing program to solve problems.
2. Apply the knowledge of algorithms in the computational area to efficient programming codes to design the problem using modern tools.
3. Outline different types of digital electronic circuits such as adder, subtractor, encoder, decoder, multiplexer, de-multiplexer, flip-flops, register, counter using various mapping and modern tools to prepare the most simplified circuit.
4. Apply the knowledge of digital electronic circuits to design memory and ALU and analyse the same to solve engineering-related computational problems.
5. Interpret the result of the experiments, prepare laboratory reports based on observed output and analyze it.

Course Outcome:

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

CO1	**Illustrate** and **use** proper syntax in appropriate platform for developing program to **solve** problems related to Mathematics and Engineering field leading to lifelong learning.
CO2	**Apply** the knowledgeofalgorithms in the computational area to efficient programming codes to **design** the problem using modern tools for **solving** complex engineering problems.
CO3	**Outline** different types of digital electronic circuits such as adder, subtractor, encoder, decoder, multiplexer, de-multiplexer, flip-flops, register, counter using various mapping and modern tools to prepare the most simplified circuit and optimize using

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

	various mapping and mathematical methods for **solving**the problem as a professional engineering practice as a team.
CO4	**Apply** the knowledge of digital electronic circuits to design memory and ALU and **analyse** the same to **solve**engineering-related computational problems as a team.
CO5	**Interpret** the result of the experiments**, prepare** laboratory reports based on observed output and **analyse** it to validate professional ethics and responsibilities and norms of the engineering practice.

MODULE NUMBER	COURSE CONTENT
1	Familiarization with Xilinx environment setup, syntax, variables, commands, data types, operators, decisions, loops, vectors, matrix, arrays, functions, and advanced part, creating and editing, compilation and execution of VHDL programs.
2	Study and simulate for truth table verification in Xilinx environment of a. Logic gates b. Universal gates
3	Study and simulate for truth table verification in Xilinx environment of a. Half Adder b. Full Adder
4	Study and simulate for truth table verification in Xilinx environment of a. Half Subtractor b. Full Subtractor
5	Study and simulate for truth table verification in Xilinx environment of a. Multiplexer b. De-Multiplexer c. Encoder Decoder
6	Study and simulate for truth table verification in Xilinx environment of a. 7 Segment Decoder b. Comparator (1 bit, 2 bits) c. Carry look ahead adder

7	Study and simulate for truth table verification in Xilinx environment of a. SR flip-flop b. D flip-flop c. JK flip-flop d. T flip-flop
8	Study and simulate for truth table verification in Xilinx environment of a. SISO b. SIPO c. PISO d. PIPO
9	Study, design and simulate in Xilinx environment of a. ALU b. RAM

Textbook:

1. M. Morris Mano, Digital Design, Prentice-Hall
2.Digital Circuits and Design, S. Salivahanan and S. Arivazhagan, McGraw-Hill Education

Reference Books:

1. Hayes J. P., “Computer Architecture &Organisation”, McGraw Hill,
2. William Stallings, Computer Organization and Architecture: Designing for Performance
3. P. J. Ashenden, "The Designer's Guide to VHDL"
4. Doulos: "VHDL Golden Refernce Guide"

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	-	-	-	3	3	3	3
CO2	3	3	3	3	3	-	-	-	-	-	-	-	3	3	3
CO3	3	3	3	3	-	-	-	3	3	-	-	-	3	3	3
CO4	3	3	3	3	-	-	-	3	3	-	-	-	3	3	3
CO5	-	-	-	-	-	-	-	3	-	3	-	-	3	2	3
CO	3	3	3	3	3	-	-	3	3	3	-	3	3	3	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – 5th	
Course Code	**CT591D**
Course Name	**Artificial Intelligence Lab**
Lecture (per week)	**0**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**1.5**

Prerequisites: Data Structure, Design and Analysis of Algorithms, Statistics

Course Objectives:

The objectives of this course are to enable students to

1. Gain foundational knowledge of PROLOG toimplementanArtificial Intelligent Agent as an executable computer program for Knowledge Representation and Inferencing
2. Formulate aproblemby analyzing its characteristics to fit a State-Space Exploration Frameworkor an Inferencing Frame workofArtificial Intelligence.
3. Apply the concepts of Artificial Intelligence to solve a problem by implementing well-known Artificial Intelligence strategies using proper techniques and tools of PROLOG.
4. Build expert systems offering solutions to the challenging problems of Artificial Intelligence.
5. Implement Artificial Intelligence based ideas as executable PROLOG programs through developing intelligent heuristic strategies

Course Outcome:

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

CO1	**Acquire** foundationalknowledge of PROLOG to**implement**anArtificial Intelligent Agent as an executable computer program for Knowledge Representation and Inferencingand**understand**the working principle ofthe agent and **assess** its utilitarian importance in current technological context leading towards lifelong learning.
CO2	**Identify** and **formulate** an engineering problem by analyzing its characteristics to fit a State-Space Exploration Frameworkor an InferencingAgent Formulation FrameworkofArtificial Intelligence.
CO3	**Explore** relevantliteratureand**apply**the concepts ofArtificialIntelligenceto**solve**aproblem by **implementing** well-known Artificial Intelligencestrategiesusing proper techniques and tools of PROLOG.

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

CO4	**Develop** ideas and **propose**expert systems offering solutions to the challenging problems of Artificial Intelligence.
CO5	**Plan and Implement**ArtificialIntelligencebasedideasas executable PROLOG programs through **developing**intelligent heuristic strategiesor expert systems with adequate documentation in collaborative environment for successfully carrying out projects on Artificial Intelligence Problems and **investigate** their effectiveness by **analyzing** the performances using proper techniques and tools.

MODULE NUMBER	COURSE CONTENT
1	**Introduction to PROLOG Programming along with the IDE and its Basic Components** Assignments for understanding the Basic Components of Knowledge Representation and Inferencing in Artificial Intelligence using PROLOG Programming and its working strategy.
2	**Arithmetic, Boolean Expression, Decision Making Strategies** Assignments for understanding implementation of Arithmetic Expression, Boolean Expression, and Decision-Making Strategies.
3	**Recursion and Looping through Recursion** Assignments for understanding implementation of Recursion and Looping through Recursion.
4	**List of Data Items in PROLOG** Assignments for understanding the utility of List in solving various problems.
5	**Blind Search Techniques – BFS, DFS** Implementation of BFS and DFS Algorithms for Goal Searching to solve Puzzles (8-Puzzle, Water Jug Puzzle)

6	**Heuristic Search Techniques – A* Search** Implementation of A* Search Algorithm for Goal Searching to solve Puzzles (8-Puzzle, Route Finding Puzzle)
7	**Constraint Satisfaction Problem Solving** Implementation of Backtracking Strategies to solve Constraint Satisfaction Problems (Graph Coloring Problem, 8-Queens Problem)
8	**Game Playing** Implementation of Adversarial Search Algorithm with alpha-beta pruning strategy for Game Playing (Tic-Tac-Toe)
9	**Discussion on Project Problems and Allocation (Problem Description Report Submission)**
10	**Designing Solution Model and Proposal Report Submission**
11	**Project Implementation, Verification and Documentation**
12	**Project Demonstration and Project Report Review**

Textbook:

1. Ivan Bratko, Prolog Programming for Artificial Intelligence, 4th Edition, Addison-Wesley
2. Russell, S. and Norvig, P. 2015. Artificial Intelligence - A Modern Approach, 3rd edition, Prentice Hall.
3. Rich, E., Knight, K and Shankar, B. 2009. Artificial Intelligence, 3rd edition, Tata McGrawHill.

Reference Books:

1. Padhy, N.P. 2009. Artificial Intelligence and Intelligent Systems, Oxford University Press.
2. Deepak Khemani, “A First Course in Artificial Intelligence”, McGraw Hill.

CO–POMapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	3	3	-	-
CO2	2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	2	2	3	2	-	-	-	-	-	-	-	-	2	-	2
CO4	2	2	2	3	-	-	-	-	-	-	-	2	2	-	2
CO5	2	2	3	3	2	2	2	2	2	2	2	2	2	2	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – 5th	
Course Code	**CT591A**
Course Name	**Computer Graphics Lab**
Lecture (per week)	**0**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**1.5**

Prerequisites: Mathematics – I, III, Computer Fundamentals & Principle of Computer Programming, Programming with C/C++

Course Objectives:

The objectives of this course are to enable students

1.To understand the need of developing graphics application
2.To learn algorithmic development of graphics primitives like: line, circle, polygon etc.

3.To learn the representation and transformation of graphical images and pictures.

Course Outcome:
After successful completion of this course, students will be able to:

CO1	**Understand t**he fundamental concept of Computer graphics and mathematical knowledge and Implement different scan conversion algorithms and geometric transformations techniques.
CO2	**Demonstrate** different scan conversion algorithms, drawing algorithms, polygon filling algorithms, curves and surface drawing algorithms, clipping algorithms, surface removal algorithms using graphics tools and Implement boundary fill, flood fill and scanlinepolygonfill algorithms.
CO3	**Understand** the basic concept of graphics programming and implement window view port transformations and clipping algorithms
CO4	**Analyze**andApply computer graphics principles and concepts to animation and game design

CO5	**Develop** the concept of geometric models, mathematical and algorithmicapproachnecessaryforprogrammingcomputergraphics leading to lifelong learning.

MODULE NUMBER	COURSE CONTENT
1	**Introduction of Computer Graphics System[9L]** Study of basic graphics functions defined in "graphics.h". Interactive Graphics Systems), CGM (Computer Graphics Metafile),CGI (Computer Graphics Interface).
2	**Output primitives drawing[12L]** Program to implement basic graphics primitives using"graphics.h". Program for Line Drawing using DDA algorithm, Bresenhams algorithm, Program for Circle Drawing using Mid-point, Bresenhams algorithm Implement Polygon filling algorithms [Flood-Fill Algorithm]
3	**Geometric Transformations [6L]** Programs using 2-D transformations and Programs using 3-D transformations .
4	**Window-Viewport Transformations [6L]** Programs to study window to view-port transformations, Program for Cohen Sutherland Line clipping algorithm
5	**Modeling of Objects[3L]** Moving object and Animation programming of object, modeling of objects.

Text Books

D. Hearn and P. M. Baker: Computer Graphics, 2nd ed. Prentice Hall of India, New Delhi, 1997.
W. M. Newman and R. F. Sproull: Principles of Interactive Computer Graphics, McGraw Hill, New Delhi, 1979.

Reference Books

F. S. Hill: Computer Graphics, McMillan, New York, 1990.
D. P. Mukherjee: Fundamentals of Computer Graphics and Multimedia, Prentice Hall of India, New Delhi, 1999.
J. D. Foley et al.: Computer Graphics, 2nd ed., Addison-Wesley, Reading, Mass., 1993.
W. K. Giloi: Interactive Computer Graphics: Data Structure, Algorithms, Languages, Prentice Hall, Englewood Cliffs, 1978

CO–POMapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	-	-	-	-	3	3	3
CO2	3	3	2	2	-	-	-	-	-	-	-	-	3	2	3
CO3	3	3	3	3	-	-	-	-	-	-	-	-	3	3	2
CO4	3	3	3	3	-	-	-	-	3	-	-	-	3	3	3
CO5	3	2	3	2	3	-	-	-	3	2	3	3	3	2	2

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – 5th **C. Mandatory Courses**	
Course Code	**MC501**
Course Name	**Constitution of India**
Lecture [per week]	
Tutorial [per week]	
Contact Hours [per week]	
Total Contact Hours	**36**
Credit	**0**
Pre-requisites: None	
Course Outcome[s]: On completion of the course students will be able to	
CO1	Develophumanvalues,createawarenessaboutlawratificationandsignificanceof Constitution
CO2	ComprehendtheFundamentalRightsand FundamentalDutiesoftheIndianCitizentoimplant morality, socialvaluesand theirsocialresponsibilities.
CO3	CreateunderstandingoftheirSurroundings,Society,Socialproblemsandtheirsuitablesol utions.
CO4	Familiarize withdistributionofpowersandfunctionsofLocalSelfGovernment.
CO5	RealizetheNational EmergencyFinancial Emergency andtheirimpact on Economy the country
MODULE NUMBER	**COURSE CONTENT**
1	**Introduction:[4L]** “Constitution”- Historical Background of the Constituent Assembly, Indian Constitution and its Salient Features, the Preamble of the Constitution.
2	**Fundamental Rights, Fundamental Duties,Directive Principles of State Policy: [8L]** The Right to Equality The Right to Freedom: I (Article 19)

	The Right to Freedom: II (Articles 20, 21 and 22) The Right against Exploitation The Right to freedom of Religion Cultural and Educational rights The Right to Property The Right to Constitutional Remedies The Directive Principles Fundamental Duties
3	**Union Government and its Administration[6L]** Structure of the Indian Union, Parliamentary System, Federal System, Centre-State Relations, Amendment of the Constitutional Powers and Procedure, The historical perspectives of the constitutional amendments in India, Emergency Provisions: National Emergency, President Rule, Financial Emergency, and Local Self Government – Constitutional Scheme in India.
4	**The Machinery of Government in the State[6L]** Powers of Indian Parliament Functions of Rajya Sabha, Functions of Lok Sabha, Powers and Functions of the President, Comparison of powers of Indian President with the United States, Powers and Functions of the Prime Minister, Judiciary – The Independence of the Supreme Court, Appointment of Judges State Executives – Powers and Functions of the Governor, Powers and Functions of the Chief Minister, Functions of State Cabinet, Functions of State Legislature, Functions of High Court and Subordinate Courts.

Textbooks:

1) Indian Constitution by D.D.Basu, The Publisher, LexisNexis
2) Constitution of India by Subhas C Kasyap, Vitasta Publishing
3) The Constitution of India, P.M Bakshi, Universal Law Publishing Co.Ltd, New Delhi, 2003.
4) Indian Constitution Text Book - Avasthi, Avasthi,Publisher: LAKSHMI NARAIN AGARWAL

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	-	-	-	-	3	3	3
CO2	3	-	2	2	2	-	-	-	-	-	-	-	3	2	3
CO3	3	2	3	-	-	2	-	-	-	-	-	-	2	3	2
CO4	3	3	3	3	-	-	-	-	3	-	-	-	3	3	3
CO5	3	2	3	2	3	-	-	-	3	-	3	3	3	2	2

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS		
Semester – 6^{th} A. THEORY		
Course Code		**HSMC 604**
Course Name		**Economics for Engineers**
Lecture [per week]		
Tutorial [per week]		
Contact Hours [per week]		
Total Contact Hours		**24**
Credit		**2**
Pre-requisites: MATH – College Algebra, Pre-Calculus Algebra and Trigonometry.		
Course Outcome[s]: On completion of the course students will be able to		
CO1	Apply the appropriate engineering economics analysis method[s] for problem solving: present worth, annual cost, rate-of-return, payback, break-even, benefit-cost ratio.	
CO2	Evaluate the cost effectiveness of individual engineering projects using the methods learned and drawing references for the investment decisions.	
CO3	Compare the life cycle cost of multiple projects using the methods learned, and make a quantitative decision between alternate facilities and/or systems.	
CO4	Evaluate the profit of a firm, carry out the break even analysis and employ this tool to make production decision.	
CO5	Discuss and solve advanced economic engineering analysis problems including taxation and inflation.	
MODULE NUMBER	**COURSE CONTENT**	
1	**Introduction[3L]** Managerial Economics-Relationship with other disciplines-Firms: Types, Objectives and goals-Managerial Decisions-Decision Analysis	
2	**Demand and Supply Analysis[5L]** Demand-Types of demand-determinants of demand-Demand function-Demand Elasticity-Demand forecasting-Supply-Determinants of supply-Supply function-Supply Elasticity.	
3	**Cost Analysis[5 L]** Element of costs, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost, Break-even analysis– PV ratio.	

4	**Elementary economic Analysis [4 L]** Inflation-Meaning of inflation, types, causes, measures to control inflation. National Income-Definition, Concepts of national income, Method of measuring national income.
5	**Financial Accounting [5 L]** Concepts and Definition of Accounting, Journal, Ledger, Trial Balance. TradingA/C,Profit& Loss A/C and Balance Sheet.
6	**Investment Decision[2L]** Time value of money- Interest - Simple and compound, nominal and effective rate of interest, Cash flow diagrams, Principles of economic equivalence. Evaluation of engineering projects-Present worth method, Future worth method, Annual worth method, Internal rate of return method, Cost benefit analysis for public projects.

Textbooks:
1. Riggs, Bedworth and Randhwa, "Engineering Economics", McGraw Hill Education India
2. Principles of Economics, DevigaVengedasalam; KarunagaranMadhavan, Oxford University Press.

Reference Books:
1. Engineering Economy by William G.Sullivan, Elin M.Wicks, C. PatricKoelling, Pearson
2. R.PaneerSeelvan, " Engineering Economics", PHI
3. Ahuja,H.L., "Principles of Micro Economics" , S.Chand& Company Ltd
4. Jhingan,M.L., "Macro Economic Theory"
5. Macro Economics by S.P.Gupta, TMH
6. Haniff and Mukherjee,Modern Accounting,Vol-1,TMG
7. Modern Economic Theory – K.K. Dewett [S.Chand]

Reference Books:

1. Engineering Economy by William G.Sullivan, Elin M.Wicks, C. PatricKoelling, Pearson
2. R.PaneerSeelvan, " Engineering Economics", PHI
3. Ahuja,H.L., "Principles of Micro Economics" , S.Chand& Company Ltd
4. Jhingan,M.L., "Macro Economic Theory"
5. Macro Economics by S.P.Gupta, TMH
6. Haniff and Mukherjee,Modern Accounting,Vol-1,TMG
7. Modern Economic Theory – K.K. Dewett [S.Chand]

CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	3	-	-	-	-	-	-	-	2	-
CO2	-	3	-	3	-	-	-	-	-	-	-	-
CO3	2	-	-	-	-	-	-	-	-	-	3	-
CO4	3	2	2	-	-	-	-	-	3	-	-	-
CO5	-	3	-	-	-	-	-	-	-	-	1	-

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – 6th	
Course Code	**CS601**
Course Name	**Computer Networks**
Lecture [per week]	**3**
Tutorial [per week]	**0**
Contact Hours [per week]	**3:0:0**
Total Contact Hours	**36**
Credit	**3**

Pre-requisites:

1. Familiarity and knowledge of Operating Systems and Computer Architecture
2. Also require little bit programming languages concepts like C, Java.

Course Objective[s]:

1. To be familiar with the basics of data communication
2. To be familiar with various types of computer networks
3. To have experience in designing communication protocols
4. To be exposed to the TCP/IP protocol suite

Course Outcome[s]:

After competition of the course the student able to do

CO1	Understand OSI and TCP/IP models.
CO2	Analyze MAC layer protocols and LAN technologies.
CO3	Design applications using internet protocols.
CO4	Implement routing and congestion control algorithms.
CO5	Develop application layer protocols and understand socket programming

MODULE NUMBER	COURSE CONTENT
1	**Introduction [6L]** **Introduction [3L]:** Introduction: Computer Network, data communication, topology, OSI & TCP/IP Reference Models, layers and characteristics, Wireless Network, comparison to wired and wireless network.

	Physical Layer: [3L] Overview of data [analog & digital], signal [analog & digital], transmission [analog & digital] & transmission media [guided & unguided]; Circuit switching: time division & space division switch, TDM bus; Telephone Network.
2	**Data Link Layer [10L]** Framing, Error Control, Error Detection and Correction, Flow Control, Data Link Protocols, Simple Stop-and-Wait Protocol, ARQ mechanism, Sliding Window Protocols, One-Bit Sliding Window Protocol, Go-Back-N and Selective Repeat, HDLC, PPP Medium Access Control Sub-layer, The Channel Allocation. **[5L]** Multiple Access Protocols**:** ALOHA, Carrier Sense Multiple Access Protocols, IEEE 802.x Ethernet, Switched Ethernet, Fast Ethernet, Gigabit Ethernet, 10 Gigabit Ethernet, Wireless LANs - IEEE 802.xx, Bluetooth, RFID, Bridges, Virtual LANs, Switching**. [5L]**
3	**Network Layer [10L]** IP Addressing, IPv4and IPv6. Difference IPv4and IPv6, Conversion ofIPv4and IPv6, Subnetting, Super-netting, Design Issues, Store-and-Forward Packet Switching, Virtual-Circuit and Datagram Networks, ARP, IP, ICMP, IPV6, BOOTP and DHCP–Delivery protocols Other Protocols such as mobile IP in wireless Network**. [5L]** Routing: Shortest Path Algorithms, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing, Broadcast Routing, Multicast Routing, Anycast Routing: RIP, OSPF, BGP; Routing for Mobile Hosts**. [5L]**
4	**Transport layer: [6L]** Process to Process delivery; UDP; TCP, SCTP, TCP RENO, TCP/IP in Wireless environment, Congestion control in TCP: Congestion Control: Open Loop, Closed Loop choke packets; Quality of service: techniques to improve QoS: Leaky bucket algorithm, Token bucket algorithm. **[5L]** Advanced topic such as Remote Procedure Call, Delay Tolerant Networks. **[1L]**
5	**Application Layer [3L]** Introduction to DNS, SMTP, SNMP, FTP, HTTP & WWW: Cryptography [Public, Private Key based], Digital Signature, Firewalls
6	**Socket Programming [1L]** Introduction to Socket Programming, UDP socket and TCP Socket

Text books:

1. B. A. Forouzan – “Data Communications and Networking [3rd Ed.] “– TMH
2. S. Tanenbaum – “Computer Networks [4th Ed.]” – Pearson Education/PHI
3. W. Stallings – “Data and Computer Communications [5th Ed.]” – PHI/ Pearson Education
4. Zheng & Akhtar, Network for Computer Scientists & Engineers, OUP

Reference books:

1. Kurose and Rose – “Computer Networking -A top-down approach featuring the internet” – Pearson Education
2. Leon, Garica,Widjaja – “Communication Networks” – TMH

3. Walrand – “Communication Networks” – TMH.
4. Comer – “Internetworking with TCP/IP, vol. 1, 2, 3[4th Ed.]” – Pearson Education/PHI

CO-PO Mapping:

CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1		2	-	2	-	-	-	-	2	-	-	-	3	-	-
CO2		2	-	-	2	-	-	-	2	-	-	-	-	1	3
CO3	2	2	-	-	2	-	-	-	2	-	-	-	-	-	3
CO4	2	2	-	-	3	2	-	-	2	-	-	-		1	3
CO5	3	3	-	-	-	-	-	-	-	-	-	-	3	-	-

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – 6th	
Course Code	**CS 602**
Course Name	**Software Engineering**
Lecture [per week]	**3**
Tutorial [per week]	**0**
Contact Hours [per week]	**3:0:0**
Total Contact Hours	**36**
Credit	**3**

Pre-requisites:

Programming for Problem Solving

Course Objective[s]

1. To understand the working environment in industry and aware of cultural diversity, who conduct themselves ethically and professionally.
2. Graduates use effective communication skills and technical skills to assure production of quality software, on time and within budget.
3. Graduates build upon and adapt knowledge of science, mathematics, and engineering to take on more expansive tasks that require an increased level of self-reliance, technical expertise, and leadership.

Course Outcomes:

After completion of the course students will be able to

CO1	**Understand** the basic concept of Software Engineering and mathematical knowledge and **apply** them in designing solution to engineering problem including he specification, **design**, implementation, and testing of software systems that meet specification, performance, maintenance and quality requirements
CO2	**Analyze,** elicit and specify software requirements through a productive working relationship with various stakeholders of the project
CO3	**Design** applicable solutions in one or more application domains using software engineering approaches that integrates ethical, social, legal and economic concerns.

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

CO4	**Develop** the code from the design and effectively apply relevant standards and perform testing, and quality management and practice team work.
CO5	**Identify** and **Use** modern engineering tools necessary for software project management time management and software reuse, and an ability to engage in life-long learning.
MODULE NUMBER	**COURSE CONTENT**
1	**Introduction[6L]** SoftwareEngineering, Characteristics, Components, Application,Definitions. Software Project Planning-Feasibility Analysis,TechnicalFeasibility, Cost-Benefit Analysis,Basics of estimation : COCOMO[Basic, intermediate, Complete] model.
2	**Software life cycle models[6L]** Evolution and impact of Software engineering, software life cycle models Waterfall, prototyping, Evolutionary, and Spiral models. Feasibility study, Functional and Non-functional requirements, Requirements gathering, Requirements analysis and specification.
3	**Software design[8L]** Basic issues in software design, modularity, cohesion, coupling and layering, function-oriented software design: DFD and Structure chart, object modeling using UML, Object-oriented software development, user interface design. Coding standards and Code review techniques.
4	**Software Testing[7L]** Fundamentals of testing, White-box, and black-box testing, Test coverage analysis and test case design techniques, mutation testing, Static and dynamic analysis, Software reliability metrics, reliability growth modeling.
5	**Software project management[9L]** Software project management, Project planning and control, cost estimation, project scheduling using PERT and GANTT charts, cost-time relations: Rayleigh-Norden results, quality management, ISO and SEI CMMI, PSP and Six Sigma. Computer aided software engineering, software maintenance, software reuse, Component-based software development.
Text Books: 1. Fundamentals of Software Engineering by Rajib Mall, –PHI-3rd Edition, 2009. 2.SoftwareEngineering-PankajJalote[Wiley-India]	

Reference Books:

1.SoftwareEngineering–AgarwalandAgarwal[PHI]

2.Software Engineering, by Ian Sommerville, Pearson Education Inc., New Delhi, [2009].

3. Software Engineering: A Practitioner"s Approach", by Roger S. Pressman, McGraw-Hill.[2005]

CO–POMapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	-	-	-	-	3	3	3
CO2	3	3	2	2	-	-	-	-	-	-	-	-	3	2	3
CO3	3	3	3	3	-	-	-	3	-	-	-	3	3	3	2
CO4	3	3	3	3	-	-	-	-	3	-	-	-	3	3	3
CO5	3	2	3	2	3	-	-	-	3	2	3	3	3	2	2

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – 6th	
Course Code	**CT601T**
Course Name	**Advance Algorithm**
Lecture [per week]	**3**
Tutorial [per week]	**0**
Contact Hours [per week]	**3:0:0**
Total Contact Hours	**36**
Credit	**3**

Pre-requisites:

Design & Analysis of Algorithm [PCC-CS402]

Course Objective[s]:

7. The aim is to learn how to develop efficient algorithms for simple computational tasks and reasoning about the correctness of them
8. Through the complexity measures, different range of behaviors of algorithms and the notion of tractable and intractable problems will be understood.

Course Outcomes:

After completion of the course students will be able to

CO1	Analyze the complexity/performance of different algorithms.
CO2	Determine the appropriate algorithm for solving a particular set of problems.
CO3	Categorize the different problems in various classes according to their complexity.
CO4	Achieve an insight of recent activities in the field of the advanced algorithm.
CO5	Design and build solutions for a real-world problem by applying relevant distributions

MODULE NUMBER	COURSE CONTENT
1	**Sorting:[4L]** Review of various sorting algorithms, topological sorting **Graph:**

	Definitions and Elementary Algorithms: Shortest path by BFS, shortest path in edge-weighted case [Dijkasra's], DFS and computation of strongly connected components, emphasis on correctness proof of the algorithm and time/space analysis, example of amortized analysis.
2	**Matroids:[6L]** 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.
3	**Flow-Networks:[16L]** 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 **Shortest Path in Graphs:** Floyd-Warshall algorithm and introduction to dynamic programming paradigm. More examples of dynamic programming. **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 **Amortized Analysis:** Aggregate, Accounting, and Potential Method
4	**Linear Programming:[10L]** 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 **Problem Solving Application** Recent Trends in problem solving paradigms using recent searching and sorting techniques by applying recently proposed data structures.

Textbook:

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

ReferenceBooks:

1. "Algorithm Design" by Kleinberg and Tardos.
2. Design & Analysis of Algorithms, Gajendra Sharma, Khanna Publishing House, New Delhi

CO–POMapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	-	-	-	2	2	2	3
CO2	3	3	3	3	-	-	-	-	-	-	-	2	2	3	3
CO3	3	3	3	3	-	-	-	-	-	-	-	3	3	3	3
CO4	3	3	3	3	-	-	-	-	-	-	-	3-	3	2	3
CO5	3	3	3	3	-	-	-	-	-	-	-	3	3	3	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – 6th	
Course Code	**CS601S**
Course Name	**Advanced Operating Systems**
Lecture [per week]	
Tutorial [per week]	
Contact Hours [per week]	
Total Contact Hours	**36**
Credit	**3**

Prerequisites:
Operating Systems

Course Objectives:

The objective of the course is to make the students able to -

1. Understand design issues of Advanced Operating systems.
2. Understand basic concepts and need of Distributed operating systems
3. Understand the architecture of Distributed operating system.
4. Understand concepts and working of different advanced Operating systems like Multiprocessor Operating System, Real-time Operating System, Mobile Operating System.
5. Understand some real time Applications of Operating System

Course Outcomes:

After completion of the course students will be able to –

CO1	**Demonstrate** understanding of design issues of advanced operating systems and **compare** different types of operating systems.
CO2	**Analyze** the design aspects and issues of distributed operating systems.
CO3	**Demonstrate** understanding of different architectures used in Distributed Operating System.
CO4	**Demonstrate** understanding of different architectures used in Multiprocessor Operating System.
CO5	**Formulate** the solutions to schedule the real time applications.

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

MODULE NUMBER	COURSE CONTENT
1	**Architectures of Distributed Systems: [7L]** System Architecture Types, Distributed Operating Systems, Issues in Distributed Operating Systems, Communication Primitives. Theoretical Foundations: Inherent Limitations of a Distributed System, Lamports Logical Clocks, Vector Clocks, Causal Ordering of Messages, Termination Detection.
2	**Distributed Mutual Exclusion: [7L]** The classification of Mutual Exclusion Algorithms, Non-Token-Based Algorithms: Lamports Algorithm, The Ricart-Agarwala Algorithm, Maekawas Algorithm, Token-Based Algorithms: Suzuki-Kasamis Broadcast Algorithm, Singhals Heuristics Algorithm, RaymondsHeuristric Algorithm.
3	**Distributed Deadlock Detection: [7L]** Preliminaries : Deadlock Handling Strategies in Distributed Systems, Issues in Deadlock Detection and Resolution, Control Organizations for Distributed Deadlock Detection, Centralized- Deadlock – Detection Algorithms, Distributed Deadlock Detection Algorithms, Hierarchical Deadlock Detection Algorithms.
4	**Multiprocessor System Architectures: [8L]** Introduction **:** Motivation for multiprocessor Systems, Basic Multiprocessor System Architectures, Multi Processor Operating Systems: Introduction, Structures of Multiprocessor Operating Systems, Operating Design Issues, Threads, Process Synchronization, Processor Scheduling, Distributed File Systems: Architecture, Mechanisms for Building Distributed File Systems, Design Issues
5	**Distributed Scheduling: [7L]** Issues in Load Distributing, Components of a load Distributed Algorithm, Stability, Load Distributing Algorithm, Requirements for Load Distributing, Task Migration, Issues in task migration. Distributed Shared Memory: Architecture and Motivation, Algorithms for Implementing DSM, Memory Coherence, Coherence Protocols, Design Issues
Textbook:	

1. Mukesh Singhal and Niranjan Shivaratri, Advanced Concepts in Operating Systems, McGraw-Hill.
2. Andrew S. Tanenbaum, Distributed Operating Systems, ACM Press.

ReferenceBooks:

1. Nancy Lynch, Distributed Algorithms, Morgan Kaufmann.
2. Jie Wu, Distributed Systems, CRC Press.
3. HagitAttiya, Jennifer Welch, Distributed Computing: Fundamentals, Simulations and Advanced Topics, McGraw-Hill.
4. SapeMullender [ed.], Distributed Systems, Addison-Wesley

CO – PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	-	-	-	-	3	3	3
CO2	3	3	3	3	-	-	-	-	-	-	-	-	3	2	3
CO3	3	3	3	3	-	-	-	-	-	-	-	3	3	3	1
CO4	3	3	3	3	-	-	-	-	-	-	-	-	3	3	1
CO5	3	3	3	3	-	-	-	-	3	2	-	-	3	2	1
CO	3	3	3	3	-	-	-	-	3	2	-	3	3	3	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – 6th	
Course Code	**CS601D**
Course Name	**Machine Learning**
Lecture [per week]	
Tutorial [per week]	
Contact Hours [per week]	
Total Contact Hours	**36**
Credit	**3**

Pre-requisites:

Data Structure, Design and Analysis of Algorithms, Statistics, Artificial Intelligence

Course Objectives:

6. Comprehend the fundamental concepts of the evolving technologies in machine learning such as Supervised and Unsupervised Learning
7. Formulate an engineering problem within the scope of machine learning paradigm.
8. Apply the concepts of machine learningto solve problems of making automated decisions dealing with large scale data.
9. Develop and Implement ideas for proposing solutions to the challenging problems of machine learning
10. Analyze the effectiveness of various machine learning Frameworks.

Course Outcomes:

After completion of the course students will be able to

CO1	**Understand** the basic concepts of machine learningto**Explain or Illustrate** and **Identify** problems where students can **Apply** the concept appropriately to **Solve** them.
CO2	**Understand** the fundamental concepts of regressionanalysis so that they can **propose models** for predicting values based on exemplary data and **Analyze** their performances.
CO3	**Explain or Illustrate** the fundamental strategies of unsupervised machine learning paradigm to solve clustering problems and **Analyze** their performances.
CO4	**Explain or Illustrate**the concepts of Mining Frequent Patterns, Associations and Data Streams and Apply them to solve the relevant problems and **Analyse** their performances.
CO5	**Develop** ideas to **Propose** solutions to the problems of supervised

	learningand**Identify**problems where students can **Apply** the concept appropriately and **Analyze** the effectiveness as well as limitations of solutions making the students aware of its utilitarian importance for further explorations leading towards lifelong learning.
MODULE NUMBER	**COURSE CONTENT**
1	**Introduction to Machine Learning[4L]** Basic Concepts, Various types of Machine Learning Techniques and related applications, Issues in Machine Learning Strategies,Data Exploration for Machine Learning: Data Types, Data Attributes, Statistical Description of Data, Data Visualization, Data Similarity Measures; Data Pre-processing: Data Cleaning, Data Integration, Data Reduction, Data Transformation & Discretization.
2	**Classification and Regression[14L]** Basic Concepts, assessing and visualizing performance of classification, k-Nearest-Neighbor Classifier, Decision Tree Classifier, Naïve Bayes Classifier; Ensemble Classification, Random Forest Strategy, Linear and Nonlinear Regression Methods and their performance analysis.
3	**Clustering, Association and Outlier Analysis[10L]** Basic Concepts, Partitioning Methods: k-Means and k-Medoids, Hierarchical Methods: Agglomerative and Divisive Hierarchical Clustering, Density-Based Methods: DBSCAN: Density-Based Clustering Based on Connected Regions with High Density; Outlier Analysis.
4	**Mining Frequent Patterns, Associations and Data Streams[3L]** Basic Concepts, Association analysis and Frequent Itemset Mining Methods: The AprioriAlgorithm,Mining Time Series Data.
5	**Advanced Concepts[5L]** Introduction to advanced concepts of machine learning like Support Vector Machines and Artificial Neural Network and their applications in solving machine learning problems.

Textbook:

5. Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 2007
6. Dr. Rajiv Chopra, Machine Learning, Khanna Publishing House, 2018

7. Machine Learning by SaikatDutt, Subramanian Chandramouli, Amit Kumar Das, Pearson.

ReferenceBooks:

8. Machine Learning using Python, Manaranjan Pradhan and U Dinesh Kumar, Wiley
9. Hands-on Machine Learning with Scikit-Learn, Keras, and TensorFlow, AurélienGéron, O'Reilly
10. Han J &Kamber M, "Data Mining: Concepts and Techniques", Morgan Kaufmann Publishers, Third Edition.

CO–PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	2	2	3	2	-	-	-	-	-	-	-	-	2	-	2
CO4	2	2	2	3	-	-	-	-	-	-	-	-	2	-	2
CO5	2	2	3	3	-	-	-	-	-	-	-	2	2	2	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – 6th	
Course Code	**CS601A**
Course Name	**Web and Internet Technology**
Lecture (per week)	**3L**
Tutorial (per week)	**3**
Contact Hours (per week)	**0**
Total Contact Hours	**36**
Credit	**3**

Course Objective(s):

1. To impart the design, development, and implementation of Static and Dynamic Web Pages.
2. To develop programs for Web using Scripting Languages and .net framework.
3. To give an overview of Server Side Programming in Web.

Course Outcomes:

After completion of the course students will be able to:

CO1	**Understand** networks, IP, DNS, routing and other related technologies used in internet and e**xecute** and **solve** problems related to them leading to engineering problems solutions
CO2	**Understand** different web basedtechnologies like HTML, DHTML, CSS, XML and **demonstrate** their use in design of web based solutions leading to engineering problems
CO3	**Comprehend** and **analyze** different client and server side technologies like JavaScript, Servlet, CGI and **design** appropriateengineering solutions leading to life long learning
CO4	**Understand** and **implement** different types of technologies like JSP, JavaBean, JDBC and ODBC and **evaluate** their performances
CO5	**Understand** different web based applications and network security techniques and **apply** them to protect the network against different attacks and **solve** related problems preferably as a team
MODULE NUMBER	**COURSE CONTENT**
1	**[6L]** Introduction (1L): Overview, Network of Networks, Intranet, Extranet, and Internet. World Wide Web (1L): Domain and Sub domain, Address Resolution, DNS, Telnet, FTP, HTTP.

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

	Review of TCP/IP (1L): Features, Segment, Three-Way Handshaking, Flow Control, Error Control, Congestion control, IP Datagram, IPv4 and IPv6. IP Subnetting and addressing (1L): Classful and Classless Addressing, Subnetting. NAT, IP masquerading, IP tables. Internet Routing Protocol (1L): Routing -Intra and Inter Domain Routing, Unicast and Multicast Routing, Broadcast. Electronic Mail (1L): POP3, SMTP, Clients - Servers Communication.
2	**[9L]** HTML, DHTML & CSS: Introduction, Elements, Attributes, Heading, Paragraph. Formatting[1L]; Link, Table, List, Block, Layout, Html Forms, and input [1L]; Iframe, Colors[1L], Image Maps and attributes of image area [1L]; Introduction to CSS, basic syntax and structure of CSS, different types internal, external and inline CSS [1L]; Basic Introduction of DHTML, Difference between HTML and DHTML, Documentary Object Model (DOM) [1L]. Extended Markup Language (XML) : Introduction, Difference between HTML & XML,XML-Tree [1L]; Syntax, Elements, Attributes, Validation and parsing, DTD [2L].
3	**[15L]** Java Scripts: Basic Introduction, Statements, comments, variable, operators, data types [1L]; condition, switch, loop, break [1L]; Java script functions, objects, and events[1L]. CGI Scripts: Introduction, Environment Variable, GET and POST Methods [1L]. Java Servlet: Servlet environment and role, Servlet life cycle [1L]; Servlet methods- Request, Response, Get and post [1L]; Cookies and Session [1L]. Java Server Page (JSP): JSP Architecture [1L]; JSP Servers, JSP Life Cycle [1L]; Understanding the layout of JSP, JSP Script-let Tag [1L]; JSP implicit object (request and response) [1L]; Variable declaration, methods in JSP [1L]; JSP directive (Taglib and Include), JavaBean- inserting JavaBean in JSP [1L]; JSP Action tags (Forward & Include) [1L]; Creating ODBC data source name, Introduction to JDBC, prepared statement and callable statement [1L].
4	**[6L]** Threats[1L]: Malicious code-viruses, Trojan horses, worms; eavesdropping, spoofing, modification, denial of service attacks. Network security techniques: Password and Authentication; VPN, IP Security [1L], security in electronic transaction, Secure Socket Layer (SSL), Secure Shell (SSH)[1L]. Firewall (1L): Introduction, Packet filtering, Stateful, Application layer, Proxy. Search Engine and Web Crawler: Definition, Meta data, Web Crawler [1L], Indexing, Page rank, overview of SEO[1L].

Textbooks:

1. “Web Technology: A Developer's Perspective”, N.P. Gopalan and J. Akilandeswari, PHI Learning, Delhi, 2013. (Topics covered: html, CSS, imagemap, xml)
2. “Learning PHP, MySQL & JavaScript”, Robin Nixon, O’Reilly Publication. (Topics covered: Java Script)
3. “Head First Servlet’s & JSP”, Bryan Basham, Kathy Sterra, Bert Bates, O’Reilly Publication. (Topics covered: Servlet, JSP)
4. Cryptography and Network Security by William Stallings Publisher: Pearson Education India(Topics covered: Threats, Security techniques, Firewall)

Recommended books:

1. "Programming the World Wide Web", Robert. W. Sebesta, Fourth Edition, Pearson Education,

2007.
2. "Core Web Programming"- Second Edition-Volume I and II, Marty Hall and Larry Brown, Pearson Education, 2001

CO-PO & PSO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	-	-	-	-	-	-	-	2	3	3
CO2	3	3	3	3	2	-	-	-	-	-	-	-	3	3	3
CO3	3	3	3	3	2	-	-	-	-	-	-	3	3	3	3
CO4	3	3	3	3	2	-	-	-	-	-	-	-	3	3	3
CO5	3	3	3	3	2	-	-	-	3	-	2	-	3	3	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – 6th	
Course Code	CS602T
Course Name	PARALLEL AND DISTRIBUTED SYSTEMS
Lecture (per week)	3
Tutorial (per week)	0
Contact Hours (per week)	
Total Contact Hours	36
Credit	3

Prerequisite:

The student have the basic knowledge of Computer Organization Architecture, Distributed System and Operating System.

Course Objective(s)

1. To introduce the concepts of Modern Processors.
2. To introduce Optimization techniques for serial code.
3. To introduce Parallel Programming using OpenMP and MPI

Course Outcome(s)

After competition of the course the student able to do

CO1	Understand of the parallel architecture and Programming
CO2	Design parallel programs develop CUDA programs for GPU.
CO3	Analyze and apply various parallel algorithms.
CO4	Capable to optimize algorithms for better performance
CO5	Understanding the distributed system

MODULE NUMBER	COURSE CONTENT
1	**Introduction of Parallel Programming: [7L]** **Introduction:[2L]** Scope, issues, applications and challenges of Parallel and Distributed Computing **Parallel Programming Platforms:[2L]** Implicit Parallelism: Trends in Microprocessor Architectures, Dichotomy of Parallel Computing Platforms, Physical Organization, Communication Costs in Parallel Machines, Routing Mechanisms for

	Interconnection Networks, GPU, coprocessing. **Principles of Parallel Algorithm Design:[3L]** Decomposition Techniques, Characteristics of Tasks and Interactions, Mapping Techniques for Load Balancing.
2	**CUDA programming model: [7L]** **CUDA programming model**: Overview of CUDA, Isolating data to be used by parallelized code, API function to allocate memory on parallel computing device, to transfer data, Concepts of Threads, Blocks, Grids, Developing a kernel function to be executed by individual threads, Execution of kernel function by parallel threads, transferring data back to host processor with API function.
3	**Analytical Modeling of Parallel Programs: [7L]** **Analytical Modeling of Parallel Programs:** Sources of Overhead in Parallel Programs, Performance Metrics for Parallel Systems, The Effect of Granularity on Performance, Scalability of Parallel Systems, Minimum Execution Time and Minimum Cost-Optimal Execution Time.
4	**Algorithms: [11L]** **Dense Matrix Algorithms:[4L]** Matrix-Vector Multiplication, Matrix-Matrix Multiplication, Issues in Sorting on Parallel Computers, Bubble Sort and Variants, Quick Sort, Other Sorting Algorithms **Graph Algorithms:[4L]** Minimum Spanning Tree: Prim's Algorithm, Single-Source Shortest Paths: Dijkstra's Algorithm, All-Pairs Shortest Paths, Transitive Closure, Connected Components, Algorithms for Sparse Graph. **Search Algorithms for Discrete Optimization Problems:[3L]** Sequential Search Algorithms, Parallel Depth-First Search, Parallel Best-First Search, Speedup Anomalies in Parallel Search Algorithms.
5	**Models of distributed computation [4L**] **Models of distributed computation**; Design issues; Operating systems for distributed computing: Distributed algorithms and applications, Clock synchronization algorithms; Distributed memory systems; Message passing; Middleware; Point to-point communication; Fault Tolerance; Fault tolerant routing.

Text books:

1. A Grama, AGupra, G Karypis, V Kumar. Introduction to Parallel Computing (2nd ed.). Addison Wesley, 2003. 2. C Lin, L Snyder.

2. Principles of Parallel Programming. USA: Addison-Wesley Publishing Company, 2008.

3. J Jeffers, J Reinders. Intel Xeon Phi Coprocessor High-Performance Programming.

Reference Books

1. Morgan Kaufmann Publishing and Elsevier, 2013.
2. T Mattson, B Sanders, B
3. Massingill. Patterns for Parallel Programming. Addison-Wesley Professional, 2004.

CO-PO & PSO Mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO 1	3	2	2	2	1	2	-	-	-	2	2	2	3	-	-
CO 2	2	3	3	2	2	1	-	-	-	1	2	3	-	1	3
CO 3	2	2	3	1	3	2	2	-	-	1	3	2	-	-	3
CO 4	1	3	1	3	2	3	2	-	-	3	1	1		1	3
CO 5	2	1	2	3	2	2	3	-	-	1	2	3	3	-	-

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – 6th	
Course Code	**CS602S**
Course Name	**Embedded System**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	
Total Contact Hours	**36**
Credit	**3**

Prerequisite:

Knowledge of microprocessor and microcontroller

Course Objective(s):

1. An ability to design a system, component, or process to meet desired needs within realistic constraints.
2. Ability to understand microcontroller, microcomputer, embedded system.
3. Understand different components of a micro-controller and their interactions.
4. To become familiar with the programming environment used to develop embedded systems.
5. Understand key concepts of embedded systems like IO, timers, interrupts, interaction with peripheral devices
6. Learn debugging techniques for an embedded system

Course Outcome(s):

After competition of the course the student able to do –

CO1	Understand the architecture and classifications of different embedded systems and the related programming knowledge..
CO2	**Identify and understand** the concepts of embedded systems like I/O, timers, interrupts, interaction with peripheral devices
CO3	Choose case-specific debugging technique for an embedded system
CO4	Design various real time systems using embedded systems.
CO5	**Understand** the working principles of microcontrollers and **apply** this knowledge for **developing** an approach by means of existing and new methods as a team work.
MODULE NUMBER	**COURSE CONTENT**

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

1.	**[5L]** Introduction to the Embedded System: Embedded system Vs General computing systems, Purpose of Embedded systems, classifications of embedded systems, fundamentals of embedded processor and microcontrollers, CISC vs. RISC, ASIC.
2.	**[9L]** Serial and parallel communication: devices and protocols, wireless communication: devices and protocols, parallel communication network using ISA, PCI, PCT-X, Internet embedded system network protocols, USB, Bluetooth.
3.	**[5L]** Program Modeling Concepts ; Fundamental issues in Hardware software co-design, Unified Modeling Language(UML), Hardware Software trade-offs DFG model, state machine programming model, model for multiprocessor system.
4.	**[5L]** Real Time Operating Systems: Operating system basics, Tasks, Process and Threads, Multiprocessing and multitasking, task communication, task synchronization, qualities of good RTOS.
5.	**[12L]** PIC microcontroller: introduction, architecture, comparison of PIC with other CISC and RISC based systems and microprocessors, assembly language programming, addressing modes, instruction set, Interfacing with various sensors and actuators using PIC microcontroller. Programming concepts and embedded programming, embedded architecture

Text Books:
1. Introduction to Embedded Systems : Shibu K. V. (TMH)
2. Embedded System Design – A unified hardware and software introduction: F. Vahid (John Wiley)

Reference Book:
1. Embedded Systems :Rajkamal (TMH)
2. Embedded Systems : L. B. Das (Pearson)
3. Embedded System design : S. Heath (Elsevier)
4. Embedded microcontroller and processor design: G. Osborn (Pearson)

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	3	3	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	2	2	3	2	-	-	-	3	3	-	-	-	2	-	2
CO4	3	2	2	3	-	-	-	3	3	-	-	2	2	-	2
CO5	1	2	3	3	2	-	-	3	-	3	-	2	2	2	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – 6th	
Course Code	**CS602D**
Course Name	**Soft computing**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**3**
Prerequisites: Discrete Mathematics, Probability and Statistics	
Course Outcome(s): After completion of the course students will be able to	
CO1	**Understand and explain** the basic concept of soft computing and hard computing and apply them in designing solution to engineering problem.
CO2	**Identify** and **formulate** learning rules for each of the architectures and learn several neural network paradigms and its applications to solving engineering and other problems
CO3	**Explore** relevant literature and apply fuzzy logic and reasoning to handle uncertainty and solving interdisciplinary engineering problems
CO4	Use genetic algorithms to combinatorial optimization problems and recognize the feasibility of applying a soft computing methodology for a particular problem
CO5	**Implement** the concept and techniques of designing of soft computing methods in real world problem.
MODULE NUMBER	**COURSE CONTENT**
1	Introduction to Soft Computing: **[8L]** An Overview of Artificial Intelligence, Evolution of Computing - Soft Computing Constituents – From Conventional Artificial Intelligence to Computational Intelligence - Machine Learning Basics. Soft Computing: Introduction of soft computing, soft computing vs. hard computing, various types of soft computing techniques, applications of soft computing
2	Fuzzy sets and Fuzzy logic :**[7L]** Introduction, Fuzzy sets versus crisp sets, operations on fuzzy sets, Extension principle, Fuzzy relations and relation equations, Fuzzy numbers, Linguistic variables,

	Fuzzy logic, Linguistic hedges, Applications, fuzzy controllers, fuzzy pattern recognition, fuzzy image processing, fuzzy database.
3	Artificial Neural Networks:**[9L]** Artificial Neural Network: Introduction, basic models, Hebb's learning, Adeline, Perception, Multilayer feed forward network. Back propagation, Different issues regarding convergence of Multilayer Perceptron, Competitive learning, Self-Organizing Feature Maps, Adaptive Resonance Theory, Associative Memories, Applications.
4	Genetic Algorithms:**[7L]** Evolutionary and Stochastic techniques: Genetic Algorithm (GA), different operators of Genetic Algorithm, Analysis of selection operations, Hypothesis of building Blocks, Schema theorem and convergence of Genetic Algorithm, Simulated annealing and Stochastic models, Boltzmann Machine, Applications. Rough Set: Introduction, Imprecise Categories Approximations and Rough Sets, Reduction of Knowledge, Decision Tables, and Applications.
5	Hybrid Systems :**[5L]** Neural-Network-Based Fuzzy Systems, Fuzzy Logic-Based Neural Networks, Genetic Algorithm for Neural Network Design and Learning, Fuzzy Logic controlled Genetic Algorithm. Fuzzy Logic and Genetic Algorithm for Optimization, Applications.

Text book:

1.“Neural Networks, Fuzzy logic, and Genetic Algorithms”, S. Rajasekaran& G. A. V. Pai , PHI.
2.“Principles of Soft Computing”, S.N.Sivanandam, S.N Deepa, wiley publications.

Reference Books:

1. “Genetic Algorithms in Search, Optimization and Machine Learning”, David E. Goldberg, Addison Wesley, 1997.
2.“Intelligent Hybrid Systems”, D. Ruan, Kluwer Academic Publisher, 1997.
3.“Neural Networks”, S. Haykin, Pearson Education, 2ed, 2001.
4.“An Introduction to Genetic Algorithm”, Mitchell Melanie, Prentice Hall, 1998.

CO – PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	3	3	-	-
CO2	2	3	-	-	2	2	-	-	-	-	-	-	-	3	-
CO3	2	2	3	2	2	2	-	-	-	-	-	-	2	-	2
CO4	2	2	2	3	2		-	-	-	-	-	2	2	-	2
CO5	2	2	3	3	-	2	-	-	2	2	-	2	2	2	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – 6th	
Course Code	**CS602A**
Course Name	**Human Computer Interaction**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**3**

Prerequisites:

Computer Programming Knowledge, Object Oriented Programming

Course Objectives:

The objectives of this course are to enable students to

1. learn the foundations of Human Computer Interaction.
2. become familiar with the design technologies for individuals and persons with disabilities.
3. be aware of mobile HCI.
4. learn the guidelines for user interface.

Course Outcome(s):

After completion of the course students will be able to

CO1	**Understand** the fundamental concepts of Human Computer Interactionto**Explain or Illustrate** and **Identify** problems where students can **Apply** the concept appropriately to **Solve** them.
CO2	**Understand** the fundamental concepts of Interactive Designso that they can **Design**user interface as per specification and **Validate** it.
CO3	**Understand**and**Explain**the fundamental concepts of HCI Modelsand**Analyse** their effectiveness and limitations.
CO4	**Explain or Illustrate** the fundamental design principles of HCI for mobile platforms and**Use** it appropriately to **Design** user interface as per specification.
CO5	**Understand** the fundamental design principles of Web-interface and **Design**web-interface as per specificationand**analyse** the effectiveness as well as limitations of themmakingthe students aware of its utilitarian importance for further explorations leading towards lifelong learning.

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

MODULE NUMBER	COURSE CONTENT
1	**FOUNDATIONS OF HCI [9L]** The Human: I/O channels – Memory – Reasoning and problem solving; The Computer: Devices – Memory – processing and networks; Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity- Paradigms. – Case Studies
2	**DESIGN & SOFTWARE PROCESS [9L]** 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
3	**MODELS AND THEORIES [4L]** HCI Models: Cognitive models: Socio-Organizational issues and stakeholder requirements –Communication and collaboration models-Hypertext, Multimedia and WWW
4	**MOBILE HCI [9L]** 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. – Case Studies
5	**WEB INTERFACE DESIGN[5L]** Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow – Case Studies

Textbook:

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, ―Human Computer Interaction, 3rd Edition, Pearson Education.

2. Preece J., Rogers Y.,Sharp H.,Baniyon D., Holland S. and Carey T. Human Computer Interaction,Addison-Wesley, 1994.

Reference Books:

3. Brian Fling, ―Mobile Design and Development, First Edition, O'Reilly Media Inc., 2009
4. Bill Scott and Theresa Neil, ―Designing Web Interfaces, First Edition, O'Reilly

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	2	2	3	2	-	-	-	-	-	-	-	-	2	-	2
CO4	2	2	2	3	-	-	-	-	-	-	-	-	2	-	2
CO5	2	2	3	3	-	-	-	-	-	-	-	2	2	2	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – 6th	
Course Code	**CS601A**
Course Name	**Introduction to Internet of Things**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**3**

Prerequisite:

1. Fundamental knowledge in computer networking.
2. Basic knowledge of Microcontroller fundamentals.

Course Objective(s):

Students will understand the concepts of Internet of Things and can able to build IoT applications.

Course Outcome(s):

After completion of the course students will be able to

CO1	Understand and differentiate the fundamental concepts of Internet of Things and the Internet.
CO2	Demonstrate the concepts of wireless sensor network, Analyze and Identify appropriate
CO3	Analyze and compare the basic protocols used in different OSI layer of wireless sensor netwo and IoT.
CO4	Describe IoT architecture and Machine to machine communication.
CO5	Design basic IoT applications and Solve different real life problems in different domains bas upon the concept of IoT and sensor network.

MODULE NUMBER	COURSE CONTENT
1	**Wireless Sensor Network[9L]** Wireless sensor network, application of it, sensor nodes, Network & Communication aspec Wireless medium access issues, MAC protocol, routing protocols, Sensor deployment & No

	discovery, Data aggregation & dissemination.
2	**Fundamental of IoT [4L]** The Internet of Things, Time for Convergence, Towards the IoT Universe, Internet of Thin Vision, IoT Strategic Research and Innovation Directions, IoT Applications, Future Intern Technologies, Infrastructure, Networks and Communication, Design challenges, Developme challenges, Security challenges, other challenges.
3	**IoT and M2M[7L]** A Basic Perspective– Introduction, Some Definitions, M2M Value Chains, IoT Value Chai An emerging industrial structure for IoT, The international driven global value chain a global information monopolies. M2M to IoT-An Architectural Overview– Building architecture, Main design principles and needed capabilities, An IoT architecture outli standards considerations.
4	**IoT Architecture [7L]** Introduction, ArchitectureReference Model- Introduction, Reference Model and architectu IoT reference Model, IoT Reference Architecture- Introduction, Functional View, Informati View, Deployment and Operational View, Other Relevant architectural views.
5	**IoT Applications for Value Creations [5L]** Introduction to Arduino and Raspberry Pi, Cloud Computing, Fog Computing, Connect Vehicles, Data Aggregation for the IoT in Smart Cities,Introduction, IoT applications f industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications, Fo Aspects in your Business to Master IoT, Value Creation from Big Data and Serialization, IoT health care, Value for Industry, smart home Management.
6	**Internet of Things Privacy, Security and Governance [4L]** Introduction, Overview of Governance, Privacy and Security Issues, Trust in IoT-Da Platforms for Smart Cities, First Steps Towards a Secure Platform, Smartie Approach. Da Aggregation for the IoT in smart cities, Security. Data analytics in IoT.

Text books:

1.Vijay Madisetti and ArshdeepBahga, “Internet of Things (A Hands-on-Approach)”, 1st Edition, VPT, 2014.

2.Francis daCosta, “Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”, 1

Edition, Apress Publications, 2013.

Reference books:

1.Cuno Pfister, Getting Started with the Internet of Things, O‟Reilly Media, 2011, ISBN: 978-1-4493-9357-1

2.Waltenegus Dargie,ChristianPoellabauer, "Fundamentals of Wireless Sensor Networks: Theory an Practice"

CO-PO Mapping:

CO #	PO1	PO2	PO3	PO4	PO5	PO 6	PO 7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	3	3	3	3	1	1	-	-	-	-	-	-	2	3	2
CO2	3	3	3	3	2	1	1	-	-	-	1	1	2	3	3
CO3	3	3	3	2	2	1	-	-	-	-	-	-	2	3	3
CO4	3	3	3	2	2	1	1	-	-	-	-	-	2	2	2
CO5	3	3	3	3	3	2	2		1	1	2	1	3	3	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – 6th	
Course Code	**CS601B**
Course Name	**Bio-informatics**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**35**
Credit	**3**

Course Objective(s):

The objective of the course is to make the student able to:

1. Familiar with the basic concept of the Bioinformatics and Molecular Biology and also Familiar with a variety of currently available genomic and proteomic databases.
2. Search and retrieve information from genomic and proteomic databases (e.g. GenBank, Swiss-Prot), and to analyze their search results using software available on the internet (e.g. BLAST, ClustalW).
3. Familiar with the principles and applications of microarraysand locate consensus sequences, genes and open reading frames within biological sequences.
4. Learn how to compare and analyze biological sequences and how to interpret the results of their analyses and how to construct phylogenetic trees based on biological sequence data.
5. Perform elementary predictions of protein structure and function and use the scientific method of inquiry, through the acquisition of scientific knowledge.

Course Outcomes:

After completion of the course students will be able to

CO1	Acquire the knowledge of Bioinformatics technologies with the related concept of DNA, RNA and their implications
CO2	Develop idea in Molecular Biology
CO3	Understand the concept and techniques of different types of Data Organization and Sequence Databases with different types of Analysis Tools for Sequence Data Banks
CO4	Acquire the knowledge of the DNA Sequence Analysis
CO5	Analyze the performance of different types of Probabilistic models used in Computational Biology

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

MODULE NUMBER	COURSE CONTENT
1	**Introduction to Molecular Biology[7L]** Concepts of Cell, tissue, types of cell, components of cell, organelle, Functions of different organelles; Concepts of DNA: Basic Structure of DNA; Double Helix structure; Watson and crick model. Exons and Introns and Gene Concept; Concepts of RNA: Basic structure, Difference between RNA and DNA. Types of RNA Concept of Protein: Basic components and structure. Introduction to Central Dogma: Transcription and Translation, Introduction to Metabolic Pathways. Introduction to Bioinformatics, Recent challenges in Bioinformatics.
2	**Introduction to Genomic and MSDN [10L]** Introduction to Genomic data, Data Organization and Sequence Databases: Sequence Data Banks - Introduction to sequence data banks - protein sequence data bank. Signal peptide data bank, Nucleic acid sequence data bank - GenBank, AIDS virus sequence data bank. RRNA data bank, structural data banks - protein Data Bank (PDB), The Cambridge Structural Database (CSD) : Genome data bank - Metabolic pathway data : Microbial and Cellular Data Banks. Introduction to MSDN (Microbial Strain Data Network):Numerical Coding Systems of Microbes, Hibridoma Data Bank Structure, Virus Information System Cell line information system; Protein Sequence Databases, DNA sequence databases, sequence database search programs like BLAST and FASTA. NCBI different modules: GenBank; OMIM, Taxonomy browser, PubMed;
3	**DNA Sequence Analysis[8L]** DNA Mapping and Assembly: Size of Human DNA,Copying DNA: Polymerase Chain Reaction (PCR), Hybridization and Microarrays, Cutting DNA into Fragments, Sequencing Secondary Structure predictions; Prediction algorithms; Chao-Fasman algorithm, Hidden-Markov model, Neural Networking Tertiary Structure predictions; Prediction algorithms; Chao-Fasman algorithm, Hidden-Markov model, Neural Networking

4	**Introduction Probabilistic models used in Computational Biology [10L]** Probabilistic Models; Gene Regulatory Method Application of HMM in Bioinformatics:Genefinding, profile searches, multiple sequence alignment and regulatory site identification. Applications in Biotechnology: Protein classifications, Fold libraries, Protein structure prediction: Fold recognition (threading), Protein structure predictions: Comparative modeling (Homology), Advanced topics: Protein folding, Protein-ligand interactions, Molecular Modeling& Dynamics, Drug Designing.

Text Book:

1. Yi-Ping Phoebe Chen (Ed), "BioInformatics Technologies", First Indian Reprint, Springer Verlag, 2007.

References Book:

1. Bryan Bergeron, "Bio Informatics Computing", Second Edition, Pearson Education, 2003.
2. Arthur M Lesk, "Introduction to Bioinformatics", Second Edition, Oxford University Press, 2005

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-		1	1	-	-	-	-	-
CO2		1	2	1	-	-	-	-	-	1		1
CO3	1	2		2	2				1	-	-	-
CO4	2	-	-			2	2	-	-	1	1	-
CO5	-	3		1		3	-	1	-	-	2	-

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – 6th	
Course Code	**CS601C**
Course Name	**Robotics**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**35**
Credit	**3**

Pre-requisite:

1. Microprocessor & Microcontroller
2. Computer Organization & Architecture

Course Objective(s):

1. To study microcontroller operations for robotics.
2. To study how different interfaces are actually implemented in a microcontroller.
3. To learn how Microchip PIC micro PIC16F627 can be erased and reprogrammed
4. To learn how different sensors, outputs, and peripherals can be wired to a microcontroller to work cooperatively and create a high-level control program.
5. To design robots in a real time environment.

Course Outcome(s):

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

CO1	**Understand** the basic concepts of robotics exploring the characteristics of its various components, motion control, actuator and drive system and the functions of various sensors in robotics, and robot programming.
CO2	**Apply** the concepts of robotics for machine loading and their kinematics and **analyze** the kinematics of serial and parallel robots, motion control systems.
CO3	**Illustrate** concepts ofLinear and angular velocity of links, Velocity propagation, Manipulator Jacobians for serial and parallel manipulators.
CO4	**Understand**classical control concepts and **use** advanced topics in non-linear control of

	manipulators.
CO5	**Develop**algorithmic solutions and corresponding robot-programs for designing various robotic systems.
MODULE NUMBER	**COURSE CONTENT**
1	**[5L]** Brief history, types, classification and usage, Science and Technology of robots, Some useful websites, textbooks and research journals. Position and orientation of a rigid body, Homogeneous transformations, Representation of joints, link representation using D-H parameters, Examples of D-H parameters and link transforms, different kinds of actuators – stepper, DC servo and brushless motors, model of a DC servo motor, Types of transmissions, Purpose of sensors, internal and external sensors, commonsensors – encoders, tachometers, strain gauge based force-torque sensors, proximity and distance measuring sensors, and vision.
2	**[8L]** Introduction, Direct and inverse kinematics problems, Examples of kinematics of common serial manipulators, workspace of a serial robot, Inverse kinematics of constrained and redundant robots, Tractrix based approach for fixed and free robots and multi-body systems, simulations and experiments, Solution procedures using theory of elimination, Inverse kinematics solution for the general 6R serial manipulator. Degrees-of-freedom of parallel mechanisms and manipulators, Active and passive joints, Constraint and loop-closure equations, Direct kinematics problem, Mobility of parallel manipulators, Closed-from and numerical solution, Inverse kinematics of parallel manipulators and mechanisms, Direct kinematics of Gough-Stewart platform.
3	**[8L]** Linear and angular velocity of links, Velocity propagation, Manipulator Jacobians for serial and parallel manipulators, Velocity ellipse and ellipsoids, Singularity analysis for serial and parallel manipulators, Loss and gain of degree of freedom, Statics of serial and parallel manipulators, Statics and force transformation matrix of a Gough-Stewart platform, Singularity analysis and statics.

	Mass and inertia of links, Lagrangian formulation for equations of motion for serial and parallel manipulators
4	**[9L]** Joint and Cartesian space trajectory planning and generation, Classical control concepts using the example of control of a single link, Independent joint PID control, Control of a multi-link manipulator, Non-linear model based control schemes, Simulation and experimental case studies on serial and parallel manipulators, Control of constrained manipulators, Cartesian control, Force control and hybrid position/force control, Advanced topics in non-linear control of manipulators.
5	**[5L]** Introduction and some well known wheeled mobile robots (WMR), two and three-wheeled WMR on flat surfaces, Slip and its modeling, WMR on uneven terrain, Design of slip-free motion on uneven terrain, Kinematics, dynamics and static stability of a three-wheeled WMR‘s on uneven terrain, Simulations using Matlab and ADAMS. Introduction to chaos, Non-linear dynamics and chaos in robot equations, Simulations of planar 2 DOF manipulators, Analytical criterion for unforced motion. Gough-Stewart platform and its singularities, use of near singularity for fine motion for sensing, design of Gough-Stewart platform based sensors. Over-constrained mechanisms and deployable structures, Algorithm to obtain redundant links and joints, Kinematics and statics of deployable structures with pantographs or scissor-like elements (SLE‘s).

Textbooks:

Myke Predko, ―Programming Robot Controllers‖ – McGrawHill, 1st edition, 2003.

Reference books:

1. Michael slater, ―Microprocessor – based design: A comprehensive Guide to Effective Hardware Design, Prentice Hall, 1989.
2. Myke Predko, ―Programming and customizing the 8051- micro-controller‖, Tata McGraw-Hill, New Delhi, 2000.

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	1	-	-	-	-	-	2	-
CO2	2	3	-	1	-	-	-	-	-	-	-	-
CO3	2	3	3	-	-	-	-	-	-	-	-	-
CO4	2	2	2	1	1	-	-	-	1	-	-	3
CO5	3	3	3	3	3	2	2	-	2	-	2	2

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – 6th B. PRACTCAL	
Course Code	**CS691**
Course Name	**Computer Networks Lab**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**1.5**

Course Outcome(s)

After competition of the course the student able to do

CO1	To design and implement small size network and to understand various networking commands.
CO2	To provide the knowledge of various networking tools and their related concepts.
CO3	To understand various application layer protocols for its implementation in client/server environment
CO4	Understand the TCP/IP configuration for Windows and Linux
CO5	Learn the major software and hardware technologies used on computer networks
MODULE NUMBER	**COURSE CONTENT**
1	Familiarization of UNIX or Linux environment, UNIX or Linux general Commands specially Network Commands. Familiarization of Internetworking - Network Cables - Color coding - Crimping. Internetworking Operating Systems - Configurations. **[5L]**
2	Implementation of flow control mechanisms **[4L]**
3	Socket Programming using TCP and UDP **[15L]**
4	Implementing routing protocols such as RIP, OSPF **[4L]**

5	Familiarization of advanced simulators like Packet Tracer, NS2/NS3, OMNET++, TinyOS.[4L] Server Configuration: only web server **[4L]**

Text books:

1. B. A. Forouzan – "Data Communications and Networking (3rd Ed.) " – TMH
2. S. Tanenbaum – "Computer Networks (4th Ed.)" – Pearson Education/PHI

Recommended books:

1. TCP sockets in C programs-Practical guide for Programmers ByMicheal J Donahoo and Kenneth Calvert.
2. Socket Programming by rajkumarBuyaa.

CO-PO mapping

CO #	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO 1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	3
CO 2	-	3	-	-	-	-	-	-	-	-	-	-	-	1	3
CO 3	-	-	-	-	-	-	-	-	3	2	3	2	3	-	-
CO 4	2	-	3	-	-	2	2	-	-	-	-	-	-	2	3
CO 5	1	-	-	-	-	-	-	-	-	-	3	-	-	-	2

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – 6th	
Course Code	**CS692**
Course Name	**Software Engineering Lab**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**1.5**

Pre-requisites:
Programming for Problem Solving

Course Objective(s)
1. 1.To learn software development skill through various stages of software life cycle.
2. To ensure the quality of software through software development with various protocol based environment.
3. Graduates build upon and adapt knowledge of science, mathematics, and engineering to take on more expansive tasks that require an increased level of self-reliance, technical expertise, and leadership.

Course Outcomes:

After completion of the course students will be able to

CO1	**Understand** the basic concept of Software Engineering and mathematical knowledge and **apply** them in designing solution to engineering problem including he specification, **design**, implementation, and testing of software systems that meet specification, performance, maintenance and quality requirements
CO2	**Analyze,** elicit and specify software requirements through a productive working relationship with various stakeholders of the project
CO3	**Design** applicable solutions in one or more application domains using software engineering approaches that integrates ethical, social, legal and economic concerns.
CO4	**Develop** the code from the design and effectively apply relevant standards and perform testing, and quality management and practice team work.
CO5	**Identify** and **Use** modern engineering tools necessary for software project management time management and software reuse, and an ability to engage in life-long learning.

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

MODULE NUMBER	**COURSE CONTENT**
1	**Introduction[6P]** Preparation of requirement document for standard application problems in standard format. (e.g. Library Management System, Railway Reservation system, Hospital management System, University Admission system) .DFD of standard application problems.
2	**Software life cycle models [6P]** Software Requirement Analysis: Describe the individual Phases/ modules of the project, Identify deliverables. Compute Process and Product Metrics (e.g Defect Density, Defect Age, Productivity, Cost etc.) Estimation of project size using Function Point(FP) for calculation.
3	**Software design [6P]** Use Case diagram, Class Diagram, Sequence Diagram, Activity Diagram and prepare Software Design Document using tools like Rational Rose.(For standard application problems)
4	**Software Coding& Testing[9P]** Software Development, Coding Practice and Debugging, Design Test Script/Test Plan(both Black box and White Box approach)
5	**Software project management[9P]** Software project management, Project planning and control, configuration control, cost estimation, project scheduling using PERT and GANTT charts, cost-time relations using standard tools.

Text Books:

1. Fundamentals of Software Engineering by Rajib Mall, –PHI-3rd Edition, 2009.

2.SoftwareEngineering-PankajJalote(Wiley-India)

Reference Books:

1.SoftwareEngineering–AgarwalandAgarwal(PHI)

2.Software Engineering, by Ian Sommerville, Pearson Education Inc., New Delhi, (2009).

3. Software Engineering: A Practitioner‟s Approach", by Roger S. Pressman, McGraw-Hill.(2005)

CO–POMapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	-	-	-	-	3	3	3
CO2	3	3	2	2	-	-	-	-	-	-	-	-	3	2	3
CO3	3	3	3	3	-	-	-	3	-	-	-	3	3	3	2
CO4	3	3	3	3	-	-	-	-	3	-	-	-	3	3	3
CO5	3	2	3	2	3	-	-	-	3	2	3	3	3	2	2

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – 6th	
Course Code	**CT691T**
Course Name	**Advanced Algorithms Lab**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**1.5**

Prerequisites:

1. Programming knowledge
2. Knowledge of Design and Analysis of Algorithm

Objective of the course:

1. Design and implement efficient algorithms for a specified application.
2. Strengthen the ability to identify and apply the suitable algorithm for the given real-world problem

Course Outcomes:

After completion of the course students will be able to

CO1	Introduce students to the advanced strategies of designing and analyzing algorithms.
CO2	The student should be able to prefer suitable algorithms and use it for a precise problem.
CO3	To familiarize students with basic paradigms and data structures used to solve advanced algorithmic problems.
CO4	Students should be able to understand different classes of problems concerning their computation difficulties.
CO5	To introduce the students to recent developments in the area of algorithmic design.
MODULE NUMBER	**COURSE CONTENT**

Write the following problems in any programming language. Programming Language used: C

1	**Divide and Conquer:** Implementation of finding Maximum and Minimum element from an array of integer, Quick Sort, Check the running time for different positions of pivot elements. Randomized version of quick sort using Divide and Conquer Method
2	**Dynamic Programming:** Calculation of the minimum number of scalar multiplications needed for chain of Matrices Multiplication Technique, Implementation of Single Source shortest Path for a graph (Dijkstra and Bellman Ford Algorithm), Implement all pair Shortest path for a graph (FloydWarshall Algorithm)
3	**Greedy method:** Implementation of fractional Knapsack Problem, MST by Prim's algorithm, Implement MST by Kruskal's algorithm
4	**Graph Traversal Algorithm:** Implement Depth First Search (DFS), application of DFS (do topological sorting, identify strongly connected components)
5	**String Matching:** Implement KMP algorithm
6	**Network Flow:** Implement Ford-Fulkerson algorithm to get maximum flow of a given flow network.
7	**Modulo Representation of integers/ polynomials:** Chinese Remainder Theorem
8	**Linear Programming:** Simplex Algorithm

CO–POMapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	-	-	3	3	2	2	3
CO2	3	3	3	3	-	-	-	-	-	-	3	3	2	3	3
CO3	3	3	3	3	-	-	-	-	-	-	3	3	3	3	3
CO4	3	3	3	3	-	-	-	-	-	-	3	3	3	2	3
CO5	3	3	3	3	-	-	-	-	-	-	3	3	3	3	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – 6th	
Course Code	**CS691S**
Course Name	**Advanced Operating Systems Lab**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**1.5**

Pre-requisites: Operating Systems

Course Objectives:

The objective of the course is to make the students able to -

1.Understand and execute basic commands of shell script

2 Apply basic operations in shell scripts which are required for different applications.

3 Identify and understand concept of file systems in shell script

4 able to understand theconcept of creating new process from parent process.

5 Able to understand concept of virtual file and execute basic commands on it

Course Outcomes:

After completion of the course students will be able to

CO1	**Understand** and implement basic services and functionalities of the operating system using system calls and able to **Understand** the benefits of thread over process and implement synchronized programs using multithreading concepts.
CO2	**Analyze** the design aspects and issues of distributed operating systems.
CO3	**Analyze** and simulate CPU Scheduling Algorithms like FCFS, Round Robin, SJF, and Priority.
CO4	**Implement** memory management schemes and page replacement schemes
CO5	**Understand** the concepts of deadlock in operating systems and implement them in Multiprogramming system.
MODULE NUMBER	**COURSE CONTENT**

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

1	**Preliminaries of Operating System: [6P]** managing users, managing systems, file managements, useful commands, Shell scripting : shell syntax, executing shell scripts.
2	**Process :[12P]** creating new process, counting maximum number of processes a system can handle at a time, handling system calls; inter process communication through pipes and message passing, zombie process, orphan process.
3	**Process Synchronization:[6P]** handling threads and semaphores to achieve synchronization among processes using POSIX standard functions.
4	**Signal :[6P]** study of some POSIX signals (SIGINT, SIGILL, SIGFPE, SIGKILL, SIGHUP, SIGALRM, SIGABRT).
Textbook: 1. Mukesh Singhal and Niranjan Shivaratri, Advanced Concepts in Operating Systems, McGraw-Hill.	
ReferenceBooks: Nancy Lynch, Distributed Algorithms, Morgan Kaufmann	

CO–POMapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	-	-	-	-	3	3	3
CO2	3	3	3	3	-	-	-	-	-	-	-	-	3	2	3
CO3	3	3	3	3	-	-	-	-	-	-	-	3	3	3	2
CO4	3	3	3	3	-	-	-	-	-	-	-	-	3	3	2
CO5	3	3	3	3	-	-	-	-	3	3	-	-	3	2	2
CO	3	3	3	3	-	-	-	-	3	3	-	3	3	3	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – 6th	
Course Code	**CS691D**
Course Name	**Machine Learning Lab**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**3**

Pre-requisites:
Data Structure, Design and Analysis of Algorithms, Statistics, Artificial Intelligence, Python Programming

Course Objectives:
1. Comprehend and Implementthe fundamental concepts of the evolving technologies in machine learningsuch as Supervised and Unsupervised Learning
2. Formulate an engineering problem within the scope of machine learningparadigm.
3. Implement the concepts of machine learningto solve problems of making automated decisions dealing with large scale data.
4. Develop and Implement ideas for proposing solutions to the challenging problems of machine learning
5. Analyze the effectiveness of various machine learningFrameworks using appropriate tools.

Course Outcomes:

After completion of the course students will be able to

CO1	**Understand** and**Implement**the basics concepts of machine learningto **Explain or Illustrate** and **Identify** problems where students can **Apply** the concept appropriately to **Solve** them.
CO2	**Understand** and**Implement**the fundamental concepts of regression analysis so that they can **propose models** for predicting values based on exemplary data and **Analyze** their performances.
CO3	**Understand** and**Implement**the fundamental strategies of unsupervised machine learning paradigm to solve clustering problems and **Analyze** their performances.
CO4	**Understand** and**Implement**the concepts of Mining Frequent Patterns, Associations and Data Streams and Apply them to solve the relevant problems and **Analyze** their performances.
CO5	**Develop** ideas to **Propose** solutions to the problems of supervised learning and **Identify** problems where students can **Apply**and **Implement** the concept appropriately with adequate documentation in collaborative environment for successfully carrying

	out projects on machine learning problems and **investigate** their effectiveness by **analyzing** the performances using proper techniques and tools and **Assess** the limitations of solutions underscoringutilitarian importance for further explorations leading towards lifelong learning.
MODULE NUMBER	**COURSE CONTENT**
1	**WEEK-1: Introduction to Machine Learning Programming Platform& Python Programming Basics** Introduction to Machine Learning Programming Platform and Python Programming Basics
2	**WEEK-2: Data Exploration** Data Exploration: Data Types, Data Attributes, Statistical Description of Data, Data Visualization, Data Feature Vectors, Data Preprocessing: Data Cleaning, Data Transformation
3	**WEEK -3: Regression** Implementation and Analysis of Linear and Nonlinear Regression Methods
4	**WEEK -4: Classification** Implementation and Analysis of k-Nearest-Neighbour Classifier, Decision Tree Classifier, Naïve Bayes Classifier
5	**WEEK -5: Classification** Implementation and Analysis of ANN-Backpropagation and SVM Based Classifier
6	**WEEK-6: Clustering** Implementation and Analysis of k-Means and k-Medoids
7	**WEEK -7: Association Analysis** Implementation and Analysis of Apriori Algorithm
8	**WEEK -8: Mining Time-Series Data** Implementation and Analysis of Time-Series Data Mining Models
9	**WEEK -9:** Discussion on Project Problems and Allocation (Problem Description Report

	Submission)
10	**WEEK -10:** Designing Solution Model and Proposal Report Submission
11	**WEEK -11:** Project Implementation, Verification and Documentation
12	**WEEK -12:** Project Demonstration and Project Report Review

Textbook:

1. Hands-on Machine Learning with Scikit-Learn, Keras, and TensorFlow, AurélienGéron, O'Reilly
2. Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 2007
3. Dr. Rajiv Chopra, Machine Learning, Khanna Publishing House, 2018

ReferenceBooks:

1. Machine Learning by SaikatDutt, Subramanian Chandramouli, Amit Kumar Das, Pearson.
2. Machine Learning using Python, Manaranjan Pradhan and U Dinesh Kumar, Wiley

CO–POMapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	3	3	-	-
CO2	2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	2	2	3	2	-	-	-	-	-	-	-	-	2	-	2
CO4	2	2	2	3	-	-	-	-	-	-	-	2	2	-	2
CO5	2	2	3	3	2	2	2	2	2	2	2	2	2	2	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – 6th	
Course Code	**CS691A**
Course Name	**Web and Internet Technology**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**3**

Course Objective(s):

1. To impart the design, development, and implementation of Static and Dynamic Web Pages.
2. To develop programs for Web using Scripting Languages and .net framework.
3. To give an overview of Server Side Programming in Web.

Course Outcomes:

After completion of the course students will be able to:

CO1	**Understand**networks, IP, DNS, routing and other related technologies used in internetand e**xecute** and **solve** problems related to them leading to engineering problems solutions
CO2	**Understand** different web basedtechnologies like HTML, DHTML, CSS, XML and **demonstrate**their use in design of web based solutions leading to engineering problems
CO3	**Comprehend** and **analyze** different client and server side technologies like JavaScript, Servlet, CGI and **design**appropriateengineering solutions leading to life long learning
CO4	**Understand** and **implement** different types of technologies like JSP, JavaBean, JDBC and ODBC and **evaluate** their performances
CO5	**Understand** different web based applications and network security techniques and **apply** them to protect the network against different attacks and **solve** related problems preferably as a team
MODULE NUMBER	**COURSE CONTENT**
1	**[6L]** Introduction (1L): Overview, Network of Networks, Intranet, Extranet, and Internet.World Wide Web (1L): Domain and Sub domain, Address Resolution, DNS, Telnet, FTP,

	HTTP.Review of TCP/IP (1L): Features, Segment, Three-Way Handshaking, Flow Control, Error Control, Congestion control, IP Datagram, IPv4 and IPv6.IP Subnetting and addressing (1L): Classful and Classless Addressing, Subnetting. NAT, IP masquerading, IP tables.Internet Routing Protocol (1L): Routing -Intra and Inter Domain Routing, Unicast and Multicast Routing, Broadcast.Electronic Mail (1L): POP3, SMTP, Clients - Servers Communication.
2	**[9L]** HTML, DHTML &CSS: Introduction, Elements, Attributes, Heading, Paragraph. Formatting[1L]; Link, Table, List, Block, Layout, Html Forms, and input [1L]; Iframe, Colors[1L], Image Maps andattributes of image area [1L];Introduction to CSS, basic syntax and structure of CSS, different typesinternal, external and inline CSS [1L];Basic Introduction of DHTML, Difference between HTMLand DHTML, Documentary Object Model (DOM) [1L].Extended Markup Language (XML) : Introduction, Difference between HTML & XML,XML-Tree [1L]; Syntax, Elements, Attributes, Validation and parsing, DTD [2L].
3	**[15L]** Java Scripts: Basic Introduction, Statements, comments, variable, operators, data types[1L];condition, switch, loop, break [1L]; Java script functions, objects, and events[1L].CGI Scripts: Introduction, Environment Variable, GET and POST Methods[1L].Java Servlet: Servlet environment and role, Servlet life cycle [1L]; Servlet methods- Request,Response, Get and post [1L]; Cookies and Session [1L]. Java Server Page (JSP): JSP Architecture [1L]; JSP Servers, JSP Life Cycle [1L]; Understanding the layout of JSP, JSPScriptlet Tag [1L]; JSP implicit object (request and response) [1L]; Variable declaration, methodsin JSP [1L]; JSP directive (Taglib and Include), JavaBean- inserting JavaBean in JSP [1L]; JSPAction tags (Forward & Include) [1L]; Creating ODBC data source name, Introduction to JDBC,prepared statement and callable statement [1L].
4	**[6L]** Threats[1L]: Malicious code-viruses, Trojan horses, worms; eavesdropping, spoofing, modification, denial of service attacks.Network security techniques: Password and Authentication; VPN, IP Security[1L], security in electronic transaction, Secure Socket Layer (SSL), Secure Shell (SSH)[1L].Firewall (1L): Introduction, Packet filtering, Stateful, Application layer, Proxy.Search Engine and Web Crawler: Definition, Meta data, Web Crawler [1L], Indexing, Page rank, overview of SEO[1L].

Textbooks:

1. “Web Technology: A Developer's Perspective”, N.P. Gopalan and J. Akilandeswari, PHILearning, Delhi, 2013. (Topics covered: html, CSS, imagemap, xml)
2. “Learning PHP, MySQL & JavaScript”, Robin Nixon, O’Reilly Publication. (Topics covered:Java Script)
3. “Head First Servlet’s & JSP”, Bryan Basham, Kathy Sterra, Bert Bates, O’Reilly Publication.
(Topics covered: Servlet, JSP)
4.Cryptography and Network Security by William Stallings Publisher: Pearson Education India(Topics covered: Threats, Security techniques, Firewall)

Recommended books:

1. "Programming the World Wide Web", Robert. W. Sebesta, Fourth Edition, Pearson Education, 2007.
2. “Core Web Programming”- Second Edition-Volume I and II, Marty Hall and Larry Brown, Pearson Education, 2001

CO-PO & PSO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	-	-	-	-	-	-	-	2	3	3
CO2	3	3	3	3	2	-	-	-	-	-	-	-	3	3	3
CO3	3	3	3	3	2	-	-	-	-	-	-	3	3	3	3
CO4	3	3	3	3	2	-	-	-	-	-	-	-	3	3	3
CO5	3	3	3	3	2	-	-	-	3	-	2	-	3	3	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – 6th **C. MANDATORY ACTIVITIES / COURSES**	
Course Code	**MC 601**
Course Name	**Intellectual Property Right**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**24**
Credit	**0**

Pre-requisite: None

Course Outcome(s):

After completion of the course students will be able to:

CO1	Explain fundamental aspects of Intellectual property Rights to students
CO2	To disseminate knowledge on patents, patent regime in India and abroad and registration aspects
CO3	To disseminate knowledge on copyrights and its related rights and registration aspects
CO4	To aware about current trends in IPR and Govt. steps in fostering IPR
CO5	To disseminate knowledge on Design, Geographical Indication (GI), Plant Variety and Layout Design Protection and their registration aspects

MODULE NUMBER	COURSE CONTENT
1.	**[4L]** **Overview of the IPR**: Introduction and the need for intellectual property right (IPR) - Kinds of Intellectual Property Rights: Patent, Copyright, Trade Mark, Design, Geographical Indication, Plant Varieties and Layout Design – Genetic Resources and Traditional Knowledge – Trade Secret - IPR in India : Genesis and development – IPR in abroad - International organizations. Agencies and treaties,
2.	**[4L]** **Patents-** Trips Definition, kind of inventions protected by patent-Patentable and Non patentable inventions. Elements of Patentability: Novelty , Non Obviousness (Inventive

	Steps), Le8al requirements for patents — Granting of patent - Rights of a patent-exclusive right. Patent application process: Searching a patent- Drawing of a patent-Filing of a patent- Types of patent applications- Parent document: specification and Claims. Registration Procedure, Rights and Duties of Patentee, Restoration of lapsed Patents, Surrender and Revocation of Patents, Infringement, Remedies & Penalties
3.	**[4L]** **Trademarks**- Concept of Trademarks - Different kinds of marks (brand names, logos, signatures, symbols, well known marks, certification marks and service marks) - Non Registrable Trademarks - Registration of Trademarks - Rights of holder and assignment and licensing of marks - Infringement, Remedies & Penalties - trade mark registration processes.
4.	**[4L]** **Copyrights- Right and protection covered by copyright** - Law of copy rights: Fundamental of copyright law. originality **of material,** rights of reproduction, rights to perform the worth publicly, copy right ownership issues, obtaining copy right registration, notice of copy right. International copy right law. Infringement of Copyright under Copyright Act **The Role arid Liabilities of lPRs in India** - Cyberlaw issues: Criminallaw. data safety, online privacy. Health privacy, Freedom of expression and human rights, net neutrality, national security.
5.	**[4L]** **Geographical Indication of Goods**: Types, why and how GI need protection and GI laws. Indian GI act. Industrial Designs: protection. Kind of protection provided by industrial designs. Integrated Circuits
6.	**[4L]** **India`s New National IP Policy, 2016** – Govt. of India step towards promoting IPR – Govt. Schemes IPR – Career Opportunities in IP - IPR in current scenario with case studies
Text book: 1. Fundamentals oflP for Engineers: K.Bansl&P.Bansal 2. Nithyananda, K V. (2019). Intellectual Property Rights: Protection and Management. India, IN: Cengage Learning India Private Limited.	

3. Neeraj, P., &Khusdeep, D. (2014). Intellectual Property Rights. India, IN: PHI learning Private Limited.

Reference book:

1. Ahuja, V K. (2017). Law relating to Intellectual Property Rights. India, IN: Lexis Nexis.

CO-PO & PSO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	-	-	-	-	-	-	-	2	3	3
CO2	3	3	3	3	2	-	-	-	-	-	-	-	3	3	3
CO3	3	3	3	3	2	-	-	-	-	-	-	3	3	3	3
CO4	3	3	3	3	2	-	-	-	-	-	-	-	3	3	3
CO5	3	3	3	3	2	-	-	-	3	-	2	-	3	3	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – 7th A.THEORY	
Course Code	CS701T
Course Name	Information Theory and Coding
Lecture (per week)	3
Tutorial (per week)	0
Contact Hours (per week)	3
Total Contact Hours	36
Credit	3

Pre-requisites:
Probability & Statistics

Course Objective:

The objective of the course is to make the students able to

1. Illustrate the basic concept of information and apply this knowledge in designing solution.
2. Illustrate the basic concept of coding theory and use this knowledge to design and solve problem.
3. Interpret the concept of channel models to determine the mutual information in the channels.
4. Compare the existing error detection techniques and design a model for building a new solution.
5. Understand convolutional theory and develop a new approach.

Course Outcomes:

After completion of the course students will be able to

CO1	**Illustrate** the basic concept of information and **apply** this knowledge to **design** solution for real life engineering problem.
CO2	**Illustrate** the basic concept of coding theory and **use** this knowledge to **design**and**solve** mathematical and engineering problem leading to lifelong learning.
CO3	**Interpret** the concept of channel models to **find** amount ofmutual information in the channels.
CO4	**Compare** the existing error detection techniques and **design a model** for **building** a new solution as aprofessional engineering practice as a team.
CO5	**Understand** how convolutional theory works and**develop** an approach by means of existing and new methods as a team work.

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

MODULE NUMBER	COURSE CONTENT
1.	Information Theory **[4L]** Introduction, Measure of Information, Average Information Content (Entropy) of a Zero Memory Source, Extension of Zero Memory Source, Entropy of a Source with Memory.
2.	Source Coding **[9L]** Introduction, Types of Codes, Prefix Codes, Source Coding Theorem, Shannon's Encoding Theorem, Huffman Coding, Arithmetic Coding, Lempel-Ziv Algorithm, Run Length Encoding, An Overview on Speech and Image Compression
3.	Information Channels**[4L]** Introduction, Channel Models, System Entropies, Mutual Information (Trans information), Channel Capacity, Capacity of Channels, Continuous Channels.
4.	Error Control Coding **[8L]** Introduction, need for Error Control Coding, Types of Codes, Coding Gain, Linear Block Codes, The Hamming Codes, Probability of an Undetected Error Pattern for an LBC over a BSC, Equivalent Codes, Cyclic Codes, Golay Codes, Shortened Cyclic Codes.
5.	Burst Error Correcting Codes **[6L]** Introduction, Burst Errors, Interleaved Codes, Product Codes, Fire Codes, BCH Codes, Non-Binary BCH Codes and Reed-Solomon Codes.
6.	Convolution Codes**[5L]** Introduction, Convolution Encoder, Representation of Convolution Code, Transfer Function of a Convolution Code, Distance Properties of Convolution Codes, Decoding of Convolution Codes, Stack Algorithm, Known Good Convolution Codes.

Textbook:
1. Information theory, coding and cryptography - Ranjan Bose; TMH.
2. Information and Coding - N Abramson; McGraw Hill.

ReferenceBooks:
1.Introduction to Information Theory - M Mansurpur; McGraw Hill.
2. Information Theory - R B Ash; Prentice Hall.
3. Error Control Coding - Shu Lin and D J Costello Jr; Prentice Hall.

CO–POMapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	-	-	-	-	3	3	3
CO2	3	3	3	3	-	-	-	-	-	-	-	3	3	2	3
CO3	3	3	3	3	-	-	-	-	-	-	-	-	3	3	1
CO4	3	3	3	3	-	-	-	-	3	-	-	-	3	2	3
CO5	3	3	3	3	-	-	-	-	3	2	-	-	3	2	3
CO	3	3	3	3	-	-	-	-	3	2	-	3	3	3	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – 7th	
Course Code	**CS701S**
Course Name	**Ad-Hoc and Sensor Networks**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**35**
Credit	**3**

Prerequisite:
1. Basic concept of computer network and communication engineering
2. Basic programming knowledge

Course Objective(s)

The objective of the course is to make the students able to –
1. To understand and illustrate the principles of mobile ad-hoc networks and sensor networks, and their impact on protocol design
2. To design and develop MAC and routing protocols for mobile ad-hoc and sensor networks
3. To develop efficient protocols for mobile ad-hoc and sensor networks
4. To analyze and develop information dissemination protocols for mobile ad-hoc and sensor networks

Course Outcome(s)
After completion of the course students will be able to

CO1	**Understand** and **explain** the Fundamental Concepts and applications of ad- hoc and wireless sensor networks
CO2	**Describe** and **analyze** the MAC protocol issues of ad-hoc networks
CO3	**Design** and **develop** routing protocols for ad-hoc wireless networks with respect to TCP design issues
CO4	**Explain** the concepts of network architecture and MAC layer protocol for WSN
CO5	**Develop** and **analyze** the WSN routing issues by considering QoS measurements
MODULE NUMBER	**COURSE CONTENT**

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

1.	**Introduction [5L]:** Fundamentals of Wireless Communication Technology -The Electromagnetic Spectrum - Radio propagation Mechanisms - Characteristics of the Wireless channel mobile ad-hoc networks (MANETs) - Wireless Sensor Networks (WSNs): concepts and architectures - Applications of Ad-Hoc and Sensor Networks - Design Challenges in Ad-hoc and Sensor Networks.
2.	**MAC Protocols for Ad Hoc Wireless Networks [7L]** Issues in designing a MAC Protocol - Issues in Designing a MAC Protocol for Ad-Hoc Wireless Networks - Design Goals of a MAC Protocol for Ad-Hoc Wireless Networks - Classification of MAC Protocols -Contention based protocols - Contention based protocols with Reservation Mechanisms - Contention based protocols with Scheduling Mechanisms - Multi channel MAC - IEEE 802.11.
3.	**Routing Protocols and Transport Layer in Ad Hoc Wireless Networks [10L]** Routing Protocol: Issues in designing a routing protocol for Ad-hoc networks - Classification- proactive routing - reactive routing (on-demand) - hybrid routing - Transport Layer protocol for Ad-hoc networks - Design Goals of a Transport Layer Protocol for Ad-Hoc Wireless Networks -Classification of Transport Layer solutions-TCP over Ad-hoc wireless. Network Security - Security in Ad-Hoc Wireless Networks – Network Security Requirements.
4.	**Wireless Sensor Networks (WSNs) and MAC Protocols [5L]** Single node architecture: hardware and software components of a sensor node -WSN Network architecture: typical network architectures -data relaying and aggregation strategies -MAC layer protocols: self-organizing - Hybrid TDMA/FDMA and CSMA based MAC -IEEE 802.15.4.
5.	**WSN Routing, Localization & QOS [8L]** Issues in WSN routing –OLSR - Localization –Indoor and Sensor Network Localization -

	absolute and relative localization - triangulation - QOS in WSN - Energy Efficient Design – Synchronization.

Text books:

1. C. Siva Ram Murthy, and B. S. Manoj, "Ad Hoc Wireless Networks: Architectures and Protocols ", Pearson Education, 2008.

2.Labiod. H, "Wireless Adhoc and Sensor Networks", Wiley, 2008.

3. Li, X, "Wireless ad -hoc and sensor Networks: theory and applications", Cambridge University Press, 2008.

Reference books:

1. Carlos De Morais Cordeiro, Dharma Prakash Agrawal "Ad Hoc & Sensor Networks: Theory and Applications", World Scientific Publishing Company, 2nd edition, 2011.

2. Feng Zhao and LeonidesGuibas, "Wireless Sensor Networks", Elsevier Publication

3. Holger Karl and Andreas Willig "Protocols and Architectures for Wireless Sensor Networks", Wiley, 2005

4. Kazem Sohraby, Daniel Minoli, &TaiebZnati, "Wireless Sensor Networks Technology, Protocols, and Applications", John Wiley, 2007.

5. Anna Hac, "Wireless Sensor Network Designs", John Wiley, 2003.

CO-PO Mapping

CO #	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	2	1	1	-	-	3	2	3	2	2	2
CO2	3	3	3	3	2	1	1	-	-	3	2	3	2	2	2
CO3	3	3	2	3	2	1	1	-	-	3	2	3	2	2	2
CO4	3	3	2	2	2	1	1	-	-	3	2	3	2	2	2
CO5	3	3	3	3	2	1	1	-	-	3	2	3	2	2	2
CO	3	3	2	3	2	1	1	-	-	3	2	3	2	2	2

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – 7th	
Course Code	**CS701D**
Course Name	**Data Mining and Data Warehousing**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**3**

Pre-requisites:
Data Structure, Design and Analysis of Algorithms, Database Management Systems, Statistics, Artificial Intelligence

Course Objectives:

1. Comprehend the fundamental concepts of the evolving technologies in Data Mining (such as Mining Frequent Patterns and Data Streams, Associations, Supervised and Unsupervised Learning, Graph Mining, Web Mining etc.) and Data Warehousing (such as Data Cube and OLAP)
2. Formulate an engineering problem within the scope of Data Mining and Data Warehousing paradigm.
3. Apply the concepts of Data Mining and Data Warehousing to solve problems of making automated decisions dealing with large scale data.
4. Develop and Implement ideas for proposing solutions to the challenging problems of Data Mining and Data Warehousing.
5. Analyze the effectiveness of various Data Mining and Data Warehousing Frameworks.

Course Outcomes:

After completion of the course students will be able to

CO1	**Understand and explain** the fundamental concepts of the evolving technologies in Data Mining (such as Mining Frequent Patterns and Data Streams, Associations, Supervised and Unsupervised Learning, Graph Mining, Web Mining etc.) andData Warehousing (such as Data Cube and OLAP)recognizing their utilitarian importance in current technological context for further exploration leading towards lifelong learning.
CO2	**Identify** and **formulate** an engineering problem within the scope of Data Mining and Data Warehousingparadigm.
CO3	**Explore** relevantliteratureand **apply** the concepts ofData Mining and Data Warehousingto **solve**problems of making automated decisions dealing with large scale data.

CO4	**Develop** ideas for **proposing** solutions to the challenging problems of Data Mining and Data Warehousing.
CO5	**Implement** ideas of Data Mining and Data Warehousing through **developing**feasible algorithms or frameworks and **investigate** their effectiveness in solving the relevant problems by **analyzing** the performances using proper techniques.
MODULE NUMBER	**COURSE CONTENT**
1.	**Introduction to Data Mining [5L]** Basic Concepts, Data Exploration: Data Types, Data Attributes, Statistical Description of Data, Data Visualization, Data Similarity Measures; Data Pre-processing: Data Cleaning, Data Integration, Data Reduction, Data Transformation & Discretization.
2.	**Introduction to Data Warehousing [6L]** Basic Concepts, Data Warehouse Modeling: Data Cube and OLAP (OnLine Analytical Processing); Data Warehouse Design, Usage, and Implementation; Data Generalization by Attribute-Oriented Induction.
3.	**Mining Frequent Patterns, Associations and Correlation Analysis [5L]** Basic Concepts, Frequent Itemset Mining Methods: The Apriori Algorithm, Mining Frequent Item Sets without Candidate Generation, Mining Frequent Item Sets Using Vertical Data Format, Correlation Analysis; Pattern Mining in Multilevel and Multidimensional Space.
4.	**Classification and Regression [6L]** Basic Concepts, k-Nearest-Neighbour Classifier, Decision Tree Classifier, Naïve Bayes Classifier; ANN-Backpropagation Based Classifier, Support Vector Machine Based Classifier, Linear and Nonlinear Regression Methods.
5.	**Clustering and Outlier Analysis [5L]** Basic Concepts, Partitioning Methods: k-Means and k-Medoids, Hierarchical Methods: Agglomerative and Divisive Hierarchical Clustering, Density-Based Methods: DBSCAN: Density-Based Clustering Based on Connected Regions with High Density, Frequent Pattern–Based Clustering Method; Outlier Analysis.
6.	**Mining Data Stream, Time-Series, and Sequence Data [3L]** Basic Concepts of Data Stream Mining; Mining Time Series Data; Mining Sequence Patterns in Biological Data.

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

7.	**Introduction to Graph Mining, Social Network Analysis, Multi-relational Data Mining, Text Mining and World Wide Web (WWW) Mining [6L]** Graph Mining: Methods for Mining Frequent Subgraphs (Apriori-based Approach & Pattern Growth Approach); Basic Concepts of Social Network Analysis and Multi-relational Data Mining; Basic Concepts of Text Mining; Basic Concepts of World Wide Web (WWW) Mining.

Textbook:

1. Han J &Kamber M, "Data Mining: Concepts and Techniques", Morgan Kaufmann Publishers, Third Edition.
2. Parteek Bhatia, "Data Mining and Data Warehousing: Principles and Practical Techniques", Cambridge University Press.

ReferenceBooks:

1. Pang-Ning Tan, Vipin Kumar, Michael Steinbanch, "Introduction to Data Mining", PearsonEducation.
2. Robert Layton, "Learning Data Miningwith Python", Packt Publishing

CO–POMapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	3	3	-	-
CO2	2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	2	2	3	2	-	-	-	-	-	-	-	-	2	-	2
CO4	2	2	2	3	-	-	-	-	-	-	-	2	2	-	2
CO5	2	2	3	3	2	2	2	-	-	-	-	2	2	2	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – 7th	
Course Code	**CS701A**
Course Name	**Cloud Computing**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**3**

Pre-requisite:

1. The student must have basic knowledge in Computer Network and Distributed System

Course Objectives(s):

1. To provide students with the fundamentals and essentials of Cloud Computing.
2. Understand the importance of virtualization in distributed computing and how this has enabled the development of Cloud Computing.
3. Understand the importance of protocols and standards in computing

Course Outcome(s)

After competition of the course the student able to do

CO1	Identify the appropriate cloud services for a given application
CO2	Assess the comparative advantages and disadvantages of Virtualization technology
CO3	Analyze authentication, confidentiality and privacy issues in cloud computing
CO4	Identify security implications in cloud computing.
CO5	Understand the importance of protocols and standards in management for cloud services.
MODULE NUMBER	**COURSE CONTENT**
1.	**Definition of Cloud Computing and its Basics [8L]** Definition of Cloud Computing: Defining a Cloud, Cloud Types – NIST model, Cloud Cube model, Deployment models (Public, Private, Hybrid and Community Clouds), Service models – Infrastructure as a Service, Platform as a Service, Software as a Service with examples of services/ service providers, Cloud Reference model, Characteristics of Cloud

	Computing – a shift in paradigm Benefits and advantages of Cloud Computing [3] Cloud Architecture: Cloud Infrastructure, Architecture of each components, Virtualization versus Traditional Approach, Virtualization Model for Cloud Computing. [2] Services and Applications by Type [3] IaaS – Basic concept, Workload, partitioning of virtual private server instances, Pods, aggregations, silos. PaaS – Basic concept, tools and development environment with examples SaaS - Basic concept and characteristics, Open SaaS and SOA, examples of SaaS platform Identity as a Service (IDaaS) Compliance as a Service (CaaS)
2.	**Use of Platforms in Cloud Computing [6L]** Concepts of Abstraction and Virtualization [2L] Virtualization technologies: Types of virtualization, Load Balancing and Virtualization: Basic Concepts, Network resources for load balancing; Classification of Virtualization Environment: Scheduling-based Environment, Load-Distribution-Based Environment, Energy Aware-Based Environment, Operational-Based Environment, Distributed Pattern-Based Environment, Transactional-Based Environment Mention of The Google Cloud as an example of use of load balancing Hypervisors: Virtual machine technology and types, VMware vSphere Machine imaging (including mention of Open Virtualization Format – OVF) [2L] Porting of applications in the Cloud: The simple Cloud API and AppZero Virtual Application appliance Concepts of Platform as a Service [2L] Definition of services, Distinction between SaaS and PaaS (knowledge of Salesforce.com and Force.com), Application development.Use of PaaS Application frameworks.
3.	**Cloud Service Models [6L]** Use of Google Web Services [2L] Discussion of Google Applications Portfolio – Indexed search, Dark Web, Aggregation and disintermediation, Productivity applications and service, Adwords, Google Analytics, Google Translate, a brief discussion on Google Toolkit (including introduction of Google APIs in

	brief), major features of Google App Engine service. Use of Amazon Web Services [2L] Amazon Web Service components and services: Amazon Elastic Cloud, Amazon Simple Storage system, Amazon Elastic Block Store, Amazon SimpleDB and Relational Database Service Use of Microsoft Cloud Services [2L] Windows Azure platform: Microsoft's approach, architecture, and main elements, overview of Windows Azure AppFabric, Content Delivery Network, SQL Azure, and Windows Live services
4.	**Cloud Infrastructure [10L]** Types of services required in implementation – Consulting, Configuration, Customization and Support Cloud Management [3L] An overview of the features of network management systems and a brief introduction of related products from large cloud vendors, Monitoring of an entire cloud computing deployment stack – an overview with mention of some products, Lifecycle management of cloud services (six stages of lifecycle) Live Migration of Virtual Machines: [2L] Need of Live Migration of Virtual Machine, A Designing Process of Live Migration, and Security Issues during live migration. Concepts of Cloud Security [3L] Infrastructure Security, Infrastructure Security: The Network Level, The Host Level, The Application Level, Data Security and Storage, Aspects of Data Security, Data Security Mitigation Provider Data and Its Security, Identity and Access Management. Auditing and Compliance in Cloud Environment: [2L] Data Security in Cloud Computing Environment, Need for Auditing in Cloud Computing Environment, Third Party Service Provider, Cloud Auditing Outsourcing Lifecycle Phases, Auditing Classification.

5.	**Concepts of Services and Applications [6L]** Service Oriented Architecture: Basic concepts of message-based transactions, Protocol stack for an SOA architecture, Event-driven SOA, Enterprise Service Bus, Service catalogs [6] Applications in the Cloud: Concepts of cloud transactions, functionality mapping, Application attributes, Cloud service attributes, System abstraction and Cloud Bursting, Applications and Cloud APIs [2] Cloud-based Storage: Cloud storage definition – Manned and Unmanned. [1] Webmail Services: Cloud mail services including Google Gmail, Mail2Web, Windows Live Hotmail, Yahoo mail, concepts of Syndication services [1]

Text Book

1. Kai Hwang, Geoffrey C Fox, Jack J Dongarra: Distributed and Cloud Computing – From Parallel Processing to the Internet of Things, Morgan Kaufmann Publishers – 2012.
2. Barrie Sosinsky, "Cloud Computing Bible", Wiley India Edition.

Reference books

1. Anthony Velte, tobyVelte, Robert Elsenpeter, "Cloud Computing – A Practical Approach", Tata McGraw-Hill Edition.
2. Alex Amies, Harm Sluiman, QiangGuo Tong and Guo Ning Liu: Developing and Hosting Applications on the cloud, IBM Press, 2012.
3. George Reese: Cloud Application Architectures: Building Applications and Infrastructure in the Cloud (Theory in Practice), O'Reilly Publications, 2009
4. Haley Beard: Cloud Computing Best Practices for Managing and Measuring Processes for On-demand Computing – applications and Data Centers in the Cloud with SLAs, Emereo Pty Limited, July 2008
5. Michael Miller: Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online, Pearson Education, 2009.
6. Richard N. Katz: The Tower and The Cloud, Higher Education in the Age of Cloud Computing, 2008.

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

CO-PO mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	3	3	1	-	-	-	1	-	-	-	-	3	-	2
CO2	3	-	-	2	-	-	1	-	-	-	-	-	-	1	3
CO3	2	2	-	-	3	-	-	-	1	-	-	-	-	-	3
CO4	-	1	3	3	-	-	-	-	-	1	-	-		1	3
CO5	1		-	-	-	-	-	-	-	-	-	-	3	-	-

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – 7th	
Course Code	**CS702T**
Course Name	**Quantum Computing**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**3**

Prerequisites:
Discrete Structures

Objective of the course:

The objective of the course is to make the students able to –

1. Understand the basic idea of quantum computing including background of mathematics and physics.
2. Understand and explain the concept of quantum circuits using single and multiple qubit gates and also designing of quantum circuits.
3. Compare between classical and quantum information theory and explain and apply Bell states, Quantum teleportation, Quantum Cryptography and no cloning theorem.
4. Understand, explain and apply different quantum algorithms including classical computation on quantum computers like Deutsch's algorithm, Deutsch's-Jozsa algorithm, Shor factorization, Grover search and also relate between quantum and classical complexity classes.
5. Understand noise and error correction including graph states and codes, quantum error correction, fault-tolerant.

Course Outcomes:

After completion of the course students will be able to

CO1	**Understand** the basic idea of quantum computing including background of mathematics and physics required for **developing** and **solving** complex engineering problem in the domain of quantum computing possibly using modern engineering tools.
CO2	**Understand** and **explain** the concept of quantum circuits **using** single and multiple qubit gates and also **designing** of quantum circuits for solving engineering problem including societal and environmental issues.
CO3	**Compare** between classical and quantum information theory and **explain** and **apply** Bell states, Quantum teleportation, Quantum Cryptography and no cloning theorem in

	solving engineering problem possibly in a team maintain proper ethics of professional collaboration.
CO4	**Understand, explain and apply** different quantum algorithms including classical computation on quantum computers like Deutsch's algorithm, Deutsch's-Jozsa algorithm, Shor factorization, Grover search and also **relate** between quantum and classical complexity classes for solving engineering problem.
CO5	**Understand** noise and error correction including graph states and codes, quantum error correction, fault-tolerant computation and **apply** it in **designing** and **solving** complex engineering problems leading to their lifelong learning.
MODULE NUMBER	**COURSE CONTENT**
1.	**Introduction to Quantum Computation: 8L** Quantum bits, Bloch sphere representation of a qubit,multiple qubits. Background Mathematics and Physics: Hilber space, Probabilities andmeasurements, entanglement, density operators and correlation, basics of quantum mechanics,Measurements in bases other than computationalbasis.
2.	**Quantum Circuits: 6L** Single qubit gates, multiple qubit gates, design of quantum circuits.
3.	**Quantum Information and Cryptography: 6L** Comparison between classical and quantum information theory. Bell states. Quantum teleportation. Quantum Cryptography, no cloning theorem.
4.	**Quantum Algorithms: 8L** Classical computation on quantum computers. Relationship between quantum and classical complexity classes. Deutsch's algorithm, Deutsch's-Jozsa algorithm, Shor factorization, Grover search.
5.	**Noise and error correction: 8L** Graph states and codes, Quantum error correction, fault-tolerant computation.

Text book:

1. Nielsen M. A., Quantum Computation and Quantum Information, Cambridge University Press.
2. Benenti G., Casati G. and Strini G., Principles of Quantum Computation and Information, Vol. I: Basic Concepts, Vol II: Basic Tools and Special Topics, World Scientific.

3. Pittenger A. O., An Introduction to Quantum Computing Algorithms

Reference Books:

1. P Kaye, R Laflamme and M Mosca, An Introduction to Quantum Computing.
2. Eleanor G. Rieffel , Wolfgang H. Polak , "Quantum Computing - A Gentle Introduction" (Scientific and Engineering Computation)
3. Yanofsky's and Mannucci, Quantum Computing for Computer Scientists.
4. Riley Tipton Perry, "Quantum Computing from the Ground Up", World Scientific Publishing Ltd.
5. Scott Aaronson, "Quantum Computing since Democritus", Cambridge.
6. P. Kok, B. Lovett, "Introduction to Optical Quantum Information Processing", Cambridge.

CO – PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	-	-	-	-	-	-	2	3	1	1
CO2	3	3	3	3	-	2	2	-	-	-	-	2	3	1	3
CO3	3	3	3	3	-	-	-	2	2	-	-	2	3	3	1
CO4	3	3	3	3	-	-	-	-	-	-	-	2	3	3	1
CO5	3	3	3	3	-	-	-	-	-	-	-	3	3	3	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – 7th	
Course Code	**CS702S**
Course Name	**Mobile Computing**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**35**
Credit	**3**

Prerequisite:

3. Basic concept of computer network and communication engineering
4. Basic programming knowledge

Course Objective(s)

The objective of the course is to make the students able to –

1. Understand and illustrate the basic concepts and principles in mobile computing
2. Understand and demonstrate the various routing algorithms for both infrastructure based and ad hoc networks.
3. Identify and develop mobility and bandwidth management in cellular network
4. Design and build an energy efficient and secure mobile computing environment using heterogeneous wireless technologies
5. Predictand explain the technical issues related to recent mobile computing environment

Course Outcome(s)

After completion of the course students will be able to

CO1	**Illustrate** the concepts and working of modern communication technologies.
CO2	**Demonstrate** the various routing algorithms for both infrastructure based and ad hoc networks.
CO3	**Develop**mobility and bandwidth management in cellular network
CO4	**Design** and build an energy efficient and secure mobile computing environment using heterogeneous wireless technologies
CO5	**Predict** the technical issues related to recent mobile computing environment.
MODULE NUMBER	**COURSE CONTENT**

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

1.	**Introduction [6L]** Evolution of different types of wireless communication devices; Effects of mobility of devices; Cellular mobile networks – mobility management (call setup, handoff, interoperability and internetworking), bandwidth management, energy management, security; Brief introduction about different generations of wireless communication technology – 1G, 2G, 3G, 4G, 5G.
2.	**Mobile Data Communication [5L]** Mobile Data Communication, WLANs (Wireless LANs) IEEE 802.11 standard, Bluetooth technology, Bluetooth Protocols, Ad hoc networks initialization, leader election, location identification, communication protocols, energy and security.
3.	**Mobility Management in Cellular Networks [4L]** Call setup in PLMN (location update, paging), GPRS, Call setup in mobile IP networks; Handoff management; Mobility models- random walk, random waypoint, Brownian, map-based, group-based.
4.	**Bandwidth Management in Cellular Mobile networks [3L]** Mathematical formulation of the channel assignment problem (CAP); CAP and generalized graph coloring; Benchmark instances; Lower bound on bandwidth, Genetic algorithms for channel assignment- concept of critical block in a hexagonal cellular network, coalesced CAP, fast near-minimal channel assignment algorithm.
5.	**Localization of Nodes in a Mobile Network [4L]** Different approaches, Indoor and outdoor localizations, LOS and NLOS signals, Outdoor localization techniques – triangulation (TOA-based, AOA- based), errors due to inaccuracies in coordinates of beacon nodes and in measurements, selection of beacon nodes; Location region identification- computational geometric technique.
6.	**Message Communication in Ad Hoc Networks [6L]** Collision avoidance mechanism (different schemes for a deterministic transmission schedule), collision resolution mechanism – successive partitioning approach; Time slot assignment based on location information, Point-to-point routing in ad hoc networks – proactive, reactive and hybrid approaches, different protocols - DSDV, DSR, AODV, TORA, ZRP
7.	**Energy-efficient Communication [3L]** Energy efficiency at various layers - Physical layer, MAC layer, Network layer, Application layer, performance analysis in noisy channel environment.
8.	**Secure Wireless Communication [4L]** Introduction-different types of attacks, internal attacks, external attacks; measures against attacks (authentication, intrusion detection, encryption); RC4 algorithm, Lightweight cryptographic algorithms; antijamming techniques.

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

Text books:

1) K. Sinha, S.Ghosh and B. P. Sinha, Wireless Networks and Mobile Computing. CRC Press : New York, 2015.
2) J. Schiller, Mobile Communication, Pearson
3) Yi-Bing Lin &ImrichChlamtac, Wireless and Mobile Networks Architectures, John Wiley & Sons, 2001
4) Raj Pandya, Mobile and Personal Communication systems and services, Prentice Hall of India, 2001
5) 5. XiangYang Li, Wireless Adhoc and Sensor Networks, Cambridge University Press.

Recommended books:

1) Research articles published on secure wireless communication (authentication, mitigation of DoS, DDoS, eavesdropping) published in leading journals.
2) Mark Ciampa, Guide to Designing and Implementing wireless LANs, Thomson learning, Vikas Publishing House, 2001.
3) P.Stavronlakis, Third Generation Mobile Telecommunication systems, Springer Publishers.

CO-PO Mapping

CO #	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	3	2	2	2	2	1	1	-	-	3	2	3	2	2	2
CO2	3	3	3	3	2	1	1	-	-	3	2	3	2	2	2
CO3	3	3	2	3	2	1	1	-	-	3	2	3	2	2	2
CO4	3	3	2	2	2	1	1	-	-	3	2	3	2	2	2
CO5	3	3	3	3	2	1	1	-	-	3	2	3	2	2	2

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – 7th	
Course Code	**CS702D**
Course Name	**Natural Language Processing**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**3**

Prerequisites:

Statistics, Automata, Compiler Design

Objective of the course:

1. To learn the basics and details of NLP algorithms, principles & application, different NLP techniques and different tools and their uses.
2. To familiarize the concepts and techniques of Natural language Processing for analyzing words based on Morphology and CORPUS.
3. To learn the fundamental strategies of Language Modelling and Word Sense Disambiguation acquiring enough knowledge to Propose models for Word Prediction & Disambiguation.
4. To learn the concepts of Markov Model for POS Tagging and Probabilistic Context Free Grammars and Probabilistic parsing.
5. To learn the techniques of Syntax & Semantics Analysis for Machine Translation and Identify problems where students can Apply the concept appropriately.

Course Outcomes:

After completion of the course students will be able to

CO1	**Understand** the basic concepts of NLPto**Explain or Illustrate** and **Identify** problems where students can **Apply** the concept appropriately to **Solve** them.
CO2	**Understand** the fundamental concepts of Text Pre-processing and Morphologyso that they can **Apply** the concept to**Analyze** their CORPUS.
CO3	**Explain or Illustrate** the fundamental strategies of Language Modelling and Word Sense Disambiguation acquiring enough knowledge to **Propose**modelsforWord Prediction&Disambiguation and **Evaluate** their performances.
CO4	**Explain or Illustrate**the concepts of Markov Model for POS TaggingandProbabilistic Context Free Grammars and Probabilistic parsing so that they can **Apply** them to solve the relevant problems and **Analyze** their performances.

CO5	**Develop** ideas to **Propose** solutions to the problems of Syntax & Semantics Analysis for Machine Translation and **Identify** problems where students can **Apply** the concept appropriately and **Analyze** the effectiveness as well as limitations of solutions underscoring the utilitarian importance for further exploration of NLP issues leading towards lifelong learning.
MODULE NUMBER	**COURSE CONTENT**
1.	**Introduction to NLP [4L]** Introduction to NLP - Various stages of NLP –The Ambiguity of Language: Why NLP Is Difficult Parts of Speech: Nouns and Pronouns, Words: Determiners and adjectives, verbs, Phrase Structure. Statistics Essential Information Theory: Entropy, perplexity, The relation to language, Cross entropy.
2.	**Text Pre-processing and Morphology [5L]** Character Encoding, Word Segmentation, Sentence Segmentation, Introduction to Corpora, Corpora Analysis. Inflectional and Derivation Morphology, Morphological analysis and generation using Finite State Automata and Finite State transducer.
3.	**Language Modeling [4L]** Introduction to N-grams, Chain Rule, Smoothing – Add-One Smoothing, Witten-Bell Discounting; Backoff, Deleted Interpolation, N-grams for Spelling and Word Prediction, Evaluation of language models.
4.	**Word Sense Disambiguation [5L]** Methodological Preliminaries, Supervised Disambiguation: Bayesian classification, Anin-formation theoretic approach, Dictionary-Based Disambiguation: Disambiguation based onsense, Thesaurus based disambiguation, Disambiguation based on translations in a second-language corpus.
5.	**Markov Model and POS Tagging [5L]** Markov Model: Hidden Markov model, Fundamentals, Probability of properties, Parameterestimation, Variants, Multiple input observation. The Information Sources in Tagging: Markovmodel taggers, Viterbi algorithm, Applying HMMs to POS tagging,

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

	Applications of Tagging.
6.	**Probabilistic Context Free Grammars and Probabilistic parsing [5L]** The Probability of a String, Problems with the Inside-Outside Algorithm, Parsing for disambiguation, Treebanks, Parsing models vs. language models, Phrase structure grammars and dependency, Lexicalized models using derivational histories, Dependency-based models.
7.	**Syntax &Semantics Analysis and Machine Translation [8L]** Shallow Parsing and Chunking, Shallow Parsing with Conditional Random Fields (CRF), Lexical Semantics, WordNet, Thematic Roles, Semantic Role Labelling with CRFs. Statistical Alignment and Machine Translation, Text alignment, Word alignment, Information extraction, Text mining, Information Retrieval, NL interfaces, Sentimental Analysis, Question Answering Systems, Social network analysis.

Textbook:

3. Speech and Language Processing, Jurafsky and Martin, Pearson Education
4. Foundation of Statistical Natural Language Processing, Manning and Schutze, MIT Press
5. Multilingual Natural Language Processing Applications from Theory to Practice: Bikel, Pearson.
6. Ela Kumar, “Natural Language Processing’, Wiley

ReferenceBooks:

1. Allen, James. 1995. – “Natural Language Understanding”. Benjamin/Cummings, 2ed. 2.
2. Bharathi, A., Vineet Chaitanya and Rajeev Sangal. 1995. Natural Language Processing- “A Paninian Perspective”. Prentice Hll India, Eastern Economy Edition.
3. Hobson lane, Cole Howard, Hannes Hapke, “Natural language processing in action” MANNING Publications, 2019

CO–POMapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	-	-	3	2	3	2	3
CO2	3	2	2	3	-	-	-	-	-	-	2	3	2	2	3
CO3	3	2	2	3	-	-	-	-	-	-	3	-	2	3	3
CO4	3	3	3	3	-	-	-	-	-	-	3	3	2	3	3
CO5	3	3	3	3	-	-	-	-	-	-	3	-	2	3	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – 7th	
Course Code	**CS702A**
Course Name	**Cryptography and Network Security**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**3**

Pre-requisite:

1. The student must have basic knowledge about Computer Network and mathematics.

Course Objective(s):

1. To provide introduction to the concept of Network Security Model and Cryptography systems.
2. To give the knowledge of Digital Signature and other Security Measures available.
3. To familiarize with the various techniques like PGP and S/MIME.
4. To showcase IP Security Architecture & Transport Layer Security to identify the vulnerability of the Internet systems and recognize the mechanisms of the attacks.
5. To explain the firewall design principles and various intrusion detection system.

Course Outcome(s)

CO1	Understand cryptography and network security concepts and application.
CO2	Apply security principles to system design.
CO3	Identify and investigate network security threat
CO4	Analyze and design network security protocols
CO5	Conduct research in network security

MODULE NUMBER	**COURSE CONTENT**
1.	**[7L]** Introduction - Services, Mechanisms, and Attacks, OSI security architecture, Network security model[1L] Classical Encryption techniques (Symmetric cipher model, substitution techniques, transposition techniques, steganography) [3L] Finite Fields and Number Theory: Groups, Rings, Fields, Modular arithmetic, Euclid’s

	algorithm[1L] Polynomial Arithmetic, Prime numbers, Fermat's and Euler's theorem[1L] Testing for primality -The Chinese remainder theorem - Discrete logarithms [1L]
2.	**[9L]** Data Encryption Standard- Block cipher principles, block cipher modes of operation[2L] Advanced Encryption Standard (AES), Triple DES, Blowfish, RC5 algorithm[3L] Public key cryptography: Principles of public key cryptosystems, The RSA algorithm[2L] Key management - Diffie Hellman Key exchange, Elliptic curve arithmetic, Elliptic curve cryptography [2L]
3.	**[6L]** Authentication requirement, Authentication function, MAC, Hash function [2L] Security of hash function and MAC, MD5, SHA, HMAC, CMAC [2L] Digital signature and authentication protocols, DSS, ElGamal, Schnorr [2L]
4.	**[7L]** Authentication applications, Kerberos, X.509 [1L] Internet Firewalls for Trusted System: Roles of Firewalls, Firewall related terminology- Types of Firewalls, Firewall designs principles [1L] SET for E-Commerce Transactions [1L] Intruder, Intrusion detection system [1L] Virus and related threats, Countermeasures [1L] Trusted systems, Practical implementation of cryptography and security [2L]
5.	**[7L]** E-mail Security: Security Services for E-mail-attacks possible through E-mail, Establishing keys privacy, authentication of the source [1L] Message Integrity, Non-repudiation, Pretty Good Privacy, S/MIME [2L] IP Security: Overview of IPSec, IPv4 and IPv6-Authentication Header, Encapsulation Security Payload (ESP) [1L] Internet Key Exchange (Phases of IKE, ISAKMP/IKE Encoding) [1L]

	Web Security: SSL/TLS Basic Protocol, computing the keys, client authentication [1L] PKI as deployed by SSL Attacks fixed in v3, Exportability, Encoding, Secure Electronic Transaction [1L]

Textbooks

[1] Kahate, A. (2013). Cryptography and network security. Tata McGraw-Hill Education.

[2] Forouzan, B. A., &Mukhopadhyay, D. (2015). Cryptography and network security. New York, NY: Mc Graw Hill Education (India) Private Limited.

Reference Books

[1] Stallings, W. (2006). Cryptography and network security, 4/E. Pearson Education India.

[2] Daras, N. J., &Rassias, M. T. (Eds.). (2015). Computation, cryptography, and network security (pp. 253-287). Springer.

[3] Kumar, A., & Bose, S. (2017). Cryptography and network security. Pearson Education India.

CO-PO mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	2	-	2	-	-	-	-	2	-	3	3	2	3
CO2	1	1	2	-	2	-	-	-	-	2	-	2	2	2	3
CO3	3	2	3	3	-	-		-	-	-	-	1	2	3	3
CO4	3	2	3	-		-		-	-	-	-	-	2	3	3
CO5	3	2	3	2		-		2	-	2	-	1	2	3	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – 7th	
Course Code	**CS701A**
Course Name	**High Performance Computing**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**3**

Prerequisites:

Computer Architecture Lab, Operating System Lab, Compiler design Lab

Course Objectives:

The objective of the course is to make the students able to -

1. Explain the basic knowledge of Parallel Processing.
2. Understand the development and design of parallel system with Compute Unified Device Architecture (CUDA).
3. Differentiate and analyze different Design Issues in Parallel Computing.
4. Understand the limitation of Parallel Computing.
5. Understand and distinguish different Power-Aware Computing and Communication system and also different elements of cloud computing services.

Course Outcomes:

After completion of the course students will be able to

CO1	**Understand** the basic knowledge of Parallel Processing and **apply** it in **solving** Complex Engineering Problem.
CO2	**Develop** and **design** parallel system with Compute Unified Device Architecture (CUDA) for engineering problem leading to lifelong learning.
CO3	**Differentiate** and **analyze** different Design Issues in Parallel Computing and **apply** the knowledge in **solving** Complex Engineering Problem including the problem in societal and environmental contexts.
CO4	**Understand** the limitation of Parallel Computing and **apply** the knowledge to **create** and **select** appropriate techniques, resources, and modern engineering and IT tools to complex engineering problem.
CO5	**Understand** and **distinguish** different Power-Aware Computing and Communication system and also different elements of cloud computing services leading to **developing** new computing system and **analyzing** of existing one.

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

MODULE NUMBER	COURSE CONTENT
1.	**Parallel Processing Concepts (Quick Overview) 10L** Levels of parallelism (instruction, transaction, task, thread, memory, function); Models (SIMD, MIMD, SIMT, SPMD, Dataflow Models, Demand-driven Computation etc); Architectures: N-wide superscalar architectures, multi-core, multi-threaded.
2.	**Parallel Programming with CUDA (Compute Unified Device Architecture) 8L** Processor Architecture, Interconnect, Communication, Memory Organization, and Programming Models in high performance computing architectures: (Examples: IBM CELL BE, Nvidia Tesla GPU, Intel Larrabee Microarchitecture and Intel Nehalem microarchitecture); Memory hierarchy and transaction specific memory design; Thread Organization.
3.	**Fundamental Design Issues in Parallel Computing 6L** Synchronization; Scheduling; Job Allocation; Job Partitioning; Dependency Analysis; Mapping Parallel Algorithms onto Parallel Architectures; Performance Analysis of Parallel Algorithms
4.	**Fundamental Limitations Facing Parallel Computing 4L** Bandwidth Limitations; Latency Limitations; Latency Hiding/Tolerating Techniques and their limitations
5.	**Power-Aware Computing and Communication 6L** Power-aware Processing Techniques; Power-aware Memory Design; Power-aware Interconnect Design; Software Power Management
6.	**Cloud computing services 2L** Infrastructure as a service; Platform as a service; Software as a service

Textbook:

1. High Performance Cluster Computing, Volume 1, Architecture and Systems, Rajkumar Buyya, Pearson Education.
2. Berman, Fox and Hey, Grid Computing – Making the Global Infrastructure a Reality, Wiley India.
3. Hurwitz, Bllor, Kaufman, Halper, Cloud Computing for Dummies, Wiley India.

ReferenceBooks:

1. Ronald Krutz, Cloud Security, Wiley India.
2. Cloud Computing, A Practical Approach, Anthony Velte, Toby Velte, Robert Elsenpeter, McGrawHill.

CO–POMapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3									3	3	
CO2	3	3	3	3								3			3
CO3	3	3	3	3		2	2						3	3	
CO4	3	3	3	3	2								3	3	
CO5	3	3	3	3									3		3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – 7th	
Course Code	**CT701B**
Course Name	**VLSI**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**3**

Pre-requisite:

Concept of courses Solid State Devices; Analog Electronic Circuit; Digital Electronic and Circuit

Course Objective(s):
Objective of the course is:
1. To understand the basic concepts of designing combinational and sequential circuits and the design of VLSI ICs
2. To motivate students to design VLSI circuits in the area of digital , analog
3. To encourage for the design of IC with low power and high speed.
4. To study various programmable logic devices like PLDs and FPGA.

Course Outcome(s):

After completion of the course students will be able to

CO1	Understand basic CMOS circuits and properties of CMOS transistors and able to draw stick diagram and layout of CMOS circuits.
CO2	Apply CMOS realization for combinational logic design and analyze the delay models for combinational circuits and understand power dissipation and low power design principles in CMOS circuits.
CO3	Describe fabrication steps of IC and construct stick diagram & layout of CMOS inverter and basic gates based on Layout design rules
CO4	Understand different architectures for address and analyze the speed and area trade off and also understand accumulators, multipliers, dividers and barrel shifters.
CO5	Understandthe techniques of chip design using programmable devices like VHDL or Verilog Combinational & Sequential Logic circuit Design
MODULE NUMBER	**COURSE CONTENT**

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

1.	**Introduction to VLSI Design [9L]** Historical perspective development of VLSI from discrete electronic circuit to VLSI.IC, MSI, LSI, Microelectronics & VLSI Types of VLSI Chips (General purpose, ASIC, PLA, FPGA),photo-resist Basic CMOS Technology – (Steps in fabricating CMOS), Basic n-well CMOS procVLSI Design Concepts, Moor's Law, Scale of Integration (SSI, MSI, LSI, VLSI, ULSI – basic idea only), Types of VLSI Chips (Analog & Digital VLSI chips, General purpose, ASIC, PLA, FPGA), Design principles (Digital VLSI – Concept of Regularity, Granularity etc), Design Domains (Behavioural, Structural, Physical), Y-Chart, Digital VLSI Design Steps.
2.	**MOS structure [2L]** E-MOS & D-MOS, Charge inversion in E-MOS, Threshold voltage, Flat band voltage, Potential balance & Charge balance, Inversion, MOS capacitances. Three Terminal MOS Structure: Body effect. Four Terminal MOS Transistor: Drain current, I-V characteristics. Current-voltage equations (simple derivation).Scaling in MOSFET,General scaling, Constant Voltage & Field scaling.] CMOS: CMOS inverter, Simple Combinational Gates - NAND gate and NOR Gate using CMOS
3.	**Micro-electronic Processes for VLSI Fabrication [10L]** Silicon Semiconductor Technology- An Overview, Wafer processing, Oxidation, Epitaxial deposition, Ion-implantation & Diffusion, Cleaning, Etching, Photo-lithography – Positive & Negative-ness, p-well CMOS process, Twin tub process, Silicon on insulator Layout Design Rule: Stick diagram with examples, Layout rules.
4.	**Hardware Description Language [6L]** VHDL or Verilog Combinational & Sequential Logic circuit Design.

Text Books:

1. Digital Integrated Circuit ,J.M.Rabaey, Chandrakasan, Nicolic, Pearson Education
2. CMOS Digital Integrated Circuits Analysis and Design , S.M.Kang&Y.Leblebici,TMH.

Reference Books:

1. Microelectronic Circuits ,Sedra& Smith , Oxford
2. Introduction to VLSI Circuits and System ,Uyemura , Wiley

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	2	2	-	-	-	-	-	-	2	2
CO2	3	3	3	3	2	-	-	-	-	-	2	2
CO3	2	2	3	2	-	-	-	-	-	-	2	2
CO4	3	2	2	3	-	-	-	-	-	1	2	2
CO5	3	2	2	3	-	1	1	1	-	1	2	2

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS

Semester – 7th

Course Code	**CS701C**
Course Name	**Optimization Techniques**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**3**

Pre-requisite:

1. Linear algebra
2. Probability

Course Objective(s):

1. To build an understanding on the basics of optimization techniques.
2. To introduce basics of linear programming and meta- heuristic search techniques)
3.

Course Outcome(s):

After completion of the course students will be able to

CO1	Understand Decision making procedure and its applications - **Explain or Illustrate** and **Identify** queuing model and simulation in real life scenario.
CO2	Understand the essential features and scope of optimization techniques - Learn and **Analyze the** properties of objective function and formalization of optimization problem.
CO3	Learn numerical methods to find optimum point and value of a function - Learn to solve the LPP.
CO4	**Explain or Illustrate** transportation problems and assignment problems. - Apply in real life situations.
CO5	Learn applications of network models and analyse the model – Learn to use Tabu Search methods in various fields.
MODULE NUMBER	**COURSE CONTENT**

1.	**[7L]** Decision -making procedure under certainty and under uncertainty – Operations Research – Probability and decision – making – Queuing or Waiting line theory – Simulation andMonte – Carlo Technique – Nature and organization of optimization problems – Scope and hierarchy of optimization – Typical applications of optimization.
2.	**[6L]** Essential features of optimization problems – Objective function – Formulation of optimization problems – Continuous functions – Discrete functions – Unimodal functions – Convex and concave functions, Investment costs and operating costs in objective function – Optimizing profitably constraints – Internal and external constraints.
3.	**[6L]** Necessary and sufficient conditions for optimum of unconstrained functions – Numerical methods for unconstrained functions – One – dimensional search – Gradient – free search with fixed step size. Linear Programming – Basic concepts of linear programming – Graphical interpretation – Simplex method – Apparent difficulties in the Simplex method.
4.	**[6L]** Transportation Problem, Loops in transportation table, Methods of finding initial basic feasible solution, Tests for optimality. Assignment Problem, Mathematical form of assignment problem, methods of solution.
5.	**[6L]** Network analysis by linear programming and shortest route, maximal flow problem. Introduction to Non – traditional optimization, Computational Complexity – NP – Hard,NP – Complete. Tabu Search – Basic Tabu search, Neighbourhood, Candidate list, Short term andLong term memory.
6.	**[5L]** Genetic Algorithms – Basic concepts, Encoding, Selection, Crossover, Mutation.

	Simulated Annealing – Acceptance probability, Cooling, Neighbourhoods, Cost functionApplication of GA and Simulated Annealing in solving sequencing and scheduling problems and Travelling salesman problem.

Text Books:

1. Rao S.S., Optimization Theory and Applications, Wiley Eastern.
2. Hamdy A. Taha, Operations Research – An introduction, Prentice – Hall India.

Reference books:

1. Gass S. I., Introduction to Linear Programming, Tata McGraw Hill.
2. Reeves C., Modern heuristic techniques for combinatorial problems, Orient Longman.
3. Goldberg, Genetic algorithms in Search, optimization and Machine Learning, Addison Wesley.
4. K. Deb, Optimization for engineering design – algorithms and examples, Prentice Hall of India.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	2	2	3	2	-	-	-	-	-	-	-	-	2	-	2
CO4	2	2	2	3	-	-	-	-	-	-	-	-	2	-	2
CO5	2	2	3	3	-	-	-	-	-	-	-	2	2	2	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – 7th	
Course Code	**CS702A**
Course Name	**Cyber Law and Ethics**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**3**

Prerequisite:
1. Familiarity in computer Networking.
2. Basic concepts about network security.

Course Objective(s) :
1. To understand, explore and acquire acritical understanding of Cyber Law.
2. To learn the basics of a Cyber security

Course Outcome(s):

After completion of the course students will be able to

CO1	Tounderstand the importance of professional practice, Law and Ethics in their personal lives and professional careers.
CO2	To acquire in depth knowledge of information technology act, security policies, and legal framework of right to privacy, data security and data protection
CO3	Todevelop the understanding of relationship between commerce and cyberspace
CO4	To be familiar with network security threats and countermeasures
CO5	To develop competencies fordealing withfrauds anddeceptions (Confidence Tricks, Scams
MODULE NUMBER	**COURSE CONTENT**
1.	**Introduction of Cybercrime** [7L] Cybercrime, Forgery, Hacking, Software Piracy, Computer Network intrusion Jurisdiction to prescribe/Legislative Jurisdiction; Jurisdiction to adjudicate to enforce; Cyber Jurisdiction in Civil, Criminal & International Cases. Criminals plan attacks, passive attack, Active attacks, cyberstalking.

2.	**Cybercrime Mobile & Wireless devices**[8] Security challenges in mobile devices, cryptographic security for mobile devices, Attacks on mobile/cell phones, Theft, Virus, Hacking. Bluetooth; Different viruses on laptop.
3.	**Tools and Methods used in Cyber-crime[7L]** Proxy servers, Password checking, Random checking, Trojan Horses and Backdoors; DOS & DDOS attacks; SQL injection: Buffer over flowAttacks, Scripts Kiddies and Packaged Defense.
4.	**Cybercrime & Cyber security[4L]** Phising methods, ID Theft; Online identity method Legal aspects, Indian laws, IT act, Public key certificate, Design of Cyber Security Policy of an Organization ,Unicritral Model Law.
5.	**Cyber Ethics[5L]** The Importance of Cyber Law, Significance of cyber Ethics, Need for Cyber regulations and Ethics. Ethics in Information society, Introduction to Artificial Intelligence Ethics: Ethical Issues in AI and core Principles, Introduction to Block chain Ethics.

Text Books:

1. Cyber security by Nina Gobole&SunitBelapune; Pub: Wiley India.
2. Chris Reed & John Angel, Computer Law, OUP, New York, (2007).
3. Justice Yatindra Singh, Cyber Laws, Universal Law Publishing Co, New Delhi, (2012).
4. Verma S, K, Mittal Raman, Legal Dimensions of Cyber Space, Indian Law Institute, New Delhi, (2004)

Recommended Books:

1. Kenneth J. Knapp, "Cyber Security and Global Information Assurance: Threat Analysis and Response Solutions", IGI Global, 2009.
2. Jonathan Rosenoer, "Cyber law: the Law of the Internet", Springerverlag, 1997
3. Sudhir Naib, The Information Technology Act, 2005: A Handbook, OUP, New York,
4. Vasu Deva, Cyber Crimes and Law Enforcement, Commonwealth Publishers, New Delhi, (2003) .

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	3	-	-	-	-	-	-	-	-	3	-	-
CO2	2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	2	2	3	2	-	-	-	-	-	-	-	-	2	-	2
CO4	2	-	2	3	-	-	-	-	-	-	-	-	2	-	2
CO5	2	2	3	3	-	-	-	-	-	-	-	2	2	2	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – 7th	
Course Code	**CS702B**
Course Name	**Soft Skills and Interpersonal Communication**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**3**

MODULE NUMBER	**COURSE CONTENT**

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS

Semester – 7th

Course Code	**CS702C**
Course Name	**Foreign Language**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**3**

French (Open Elective)

Pre-requisites:
Basic high school level reading, writing and communication skills in English

Course Outcome(s):

By the end of the course the students will be able to –

CO1	Read basic French and interpret the meaning
CO2	Construct simple sentences in French
CO3	Interact with others and hold simple conversations in French
CO4	Demonstrate a basic knowledge of French culture, manners, geography and world view

MODULE NUMBER	COURSE CONTENT
1.	**[6L]** **Vocabulaire** • L' alphabet français (The Alphabets) • Les nombres (cardinaux et ordinaux) (Numbers) • Les mois de l'année (The Months of the Year) • Les saisons (The Seasons) • Les jours de la semaine (The Days of the Week) • Les couleurs (The Colours) • La famille (The Family) • Les nationalités (The Nationalities) **Grammaire** • Les Verbes—être, avoir etaller • Nouns—Gender and Number

	• Les articles (définis, indéfinis, contracté et partitif) • Les adjectifs—possessifs et demonstraifs **FrançaisIntéractif (Listening and Speaking)** • Les salutations • Les forms de politesse • Présentez-vous (About Yourself)
2.	**[6L]** **Vocabulaire** • L'heure (the time) • La maison (the house) • Le corps (the body) • Les vêtements (clothes) • Les professions (professions) • Les loisirs (pastimes) • Le sport (Sports) **Grammaire** • Le Verbes—voir, savoir, venir, aller, sortir, connaître, partir. • Les négations • Le futur • Les interrogatifs **FrançaisIntéractif (Listening and Speaking)** • Décrivez les images • La dictée • Liséz le journal
3.	**[6L]** **Vocabulaire** • La nourriture (Food) • Les repas (Meals) • Les légumes (Vegetables) • Les fruits (Fruits) • Les fleurs (Flowers) • Les animaux (Animals) • Les oiseaux (Birds) **Grammaire** • Les adverbes • Les adjectifs • Les prépositions **FrançaisIntéractif (Listening and Speaking)** • Ecoutez la radio/la télévision • Dialogues—À la médecin, au café, a la gare

4.	**[6L]** **Vocabulaire** • Le jardin (The Garden) • Le temps (the weather) • Les voyages (Travel) • La ville (the City) • Les vacances (Holidays) **Grammaire** • Pronomsinterrogatifs • Mood—subjonctif et l'impératif **FrançaisIntéractif** (Listening and Speaking) • Se présenter (expressing ideas/opinions on general topics) • Ecoutez le programme sur la radio/la télévision
5.	**[6L]** **Vocabulaire** • Les modes de transport (Transport) • L'Ecole (the School) • À la Campagne (in the Country) • À la restaurant (at the Restaurant) • Le Cinema (at the Cinema) La Marché (at the Market) **Grammaire** • PasséComposé • PasséRécent **EcrivezenFrançais** (Writing) • Decrivezvotreville • Decrivezvotremaison/appartement • Qu'est que son métier?
6.	**[6L]** En France • Les villes de France (the Cities of France) • Les montagnes et rivières de France (Mountains and Rivers) • La geographie de France (Geography of France) • La gastronomiefrançaise (French Food and Gastronomy) • Le fêtes (Festivals of France) Grammaire • Les VerbesPronominaux • Les PronomsPersonnels

	EcrivezenFranςais (Writing) • Decrivezvotre vacation à l'mer • Quelssont les loisirspréféres? • Les magazins de supermarché

Recommended Texts:

1. Le Nouveau Sans Frontières-1 (Paris: CLE International, 1999)
2. Dondo, Modern French Course (1930, Oxford:Oxford UP, 1999)
3. Dictionnaire Larousse

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	3	-	-	-	-	-	-	-	-	3	-	3
CO2	2	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO3	2	2	3	2	-	-	-	-	-	-	-	-	2	2	2
CO4	2	-	2	3	-	-	-	-	-	-	-	-	2	-	2
CO5	2	2	3	3	-	-	-	-	-	-	-	2	2	2	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – 7th **B.PRACTICAL**	
Course Code	**CS791T**
Course Name	**Information Theory and Coding Lab**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**1.5**

Pre-requisites:

Knowledge of C programming and MATLAB

Course Objective:
The objective of the course is to make the students able to

1. Illustrate and apply proper code in appropriate platform using suitable syntax to solve problems.
2. Understandthe concept of variables, constants, data type, operator, expression, statements, loops, vector, matrix, array, function, file handling and apply this knowledge to design the problem
3. Apply systematic approach to design the programs for solving problems.
4. Solve and analyse engineering-related computational problems by applying a variety of common numeric techniques
5. Interpret the result of the experiments, prepare laboratory reports based on observed output and analyze it.

Course Outcomes:

After completion of the course students will be able to

CO1	**Illustrate** and **apply** proper code in appropriate platform using suitable syntax for developing program to **solve** problems related to Mathematics and Engineering field leading to lifelong learning.
CO2	**Understand**the concept of variables, constants, data type, operator, expression, statements, loops, vector, matrix, array, function, file handling and **apply** this knowledge to **design** the problem using modern tools for **solvin**g complex engineering problems.
CO3	**Apply** systematic approach to **design** the programs for **solving** problems as a professional engineering practice.
CO4	**Solve** and **analyse** engineering-related computational problems by **applying**a variety of common numeric techniques
CO5	**Interpret** the result of the experiments**, prepare** laboratory reports based on observed

	output and**analyse** it to validate professional ethics and responsibilities and norms of the engineering practice.
MODULE NUMBER	**COURSE CONTENT**
1.	Revision on programming using C language.Familiarization with MATLAB environment setup, syntax, variables, commands, data types, operators, decisions, loops, vectors, matrix, arrays, functions, and advanced part, creating and editing basic MATLAB program in an editor, compilation and execution of MATLAB program.
2.	Determination of various entropies and mutual information using C/MATLAB of the following channels a. Noise free channel b. Noisy channel
3.	Generation and evaluation of following variable source coding using C/MATLAB a. Shannon – Fano coding b. Huffman Coding and Decoding **c.** Lempel Ziv Coding and Decoding
4.	Coding & Decoding of the following codes using C/MATLAB a. Linear block codes b. Cyclic codes c. Convolutional codes
5.	Coding & Decoding of the following codes using C/MATLAB a. BCH code b. RS code
6.	Problem based on a. Coded and uncoded communication system (Calculate the error probability) using C/MATLAB. b. Source coding and channel coding for transmitting a text file using C/MATLAB.

Textbook:

1. Information theory, coding and cryptography - Ranjan Bose; TMH.
2. Process Control – A First Course with MATLAB - Pao C. Chau; Cambridge University Press

ReferenceBooks:

1.Introduction to Information Theory - M Mansurpur; McGraw Hill.
2. Information Theory - R B Ash; Prentice Hall.
3. Error Control Coding - Shu Lin and D J Costello Jr; Prentice Hall.
4.Information and Coding - N Abramson; McGraw Hill.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	-	-	-	3	3	3	3
CO2	3	3	3	3	3	-	-	-	-	-	-	-	3	3	3
CO3	3	3	3	3	-	-	-	3	-	-	-	-	3	3	3
CO4	3	3	3	3	-	-	-	3	3	-	-	-	3	3	3
CO5	-	-	-	-	-	-	-	3	-	3	-	-	3	2	3
CO	3	3	3	3	3	-	-	3	3	3	-	3	3	3	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS

Semester – 7th

Course Code	**CS791S**
Course Name	**Ad-Hoc and Sensor Networks Lab**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**1.5**

Prerequisite:

1. Basic concept of computer network and communication engineering
2. Basic programming knowledge

Course Objective(s)

The objective of the course is to make the students able to –

1. To understand and illustrate the principles of mobile ad-hoc networks and sensor networks, and their impact on protocol design
2. To design and develop MAC and routing protocols for mobile ad-hoc and sensor networks
3. To develop efficient protocols for mobile ad-hoc and sensor networks
4. To analyze and develop information dissemination protocols for mobile ad-hoc and sensor networks

Course Outcome(s)

After completion of the course students will be able to

CO1	**Understand** and **explain** the Fundamental Concepts and applications of ad- hoc and wireless sensor networks
CO2	**Describe**and **analyze**the challenges of designing MAC protocol in mobile ad-hoc networks
CO3	**Describe**and **analyze** the challenges in designing routing and transport protocols for mobile ad-hoc networks.
CO4	**Describe**and **analyze**the challenges of designing MAC protocol insensor networks
CO5	**Describe**and **analyze** the challenges in designing routing and transport protocols for sensor networks.

MODULE NUMBER	COURSE CONTENT
All the Experiments may be Conducted using Network Simulation software like NS-2/ NSG2.1/ ONE Simulator/ Wire SHARK/ SDR etc.	
1	Introduction of Ad-hoc network and sensor network applications and its simulation
2	Network Simulator installation for ad-hoc network.
3	Network Simulator installation for wireless sensor network.
4	Evaluation of the performance of various LAN Topologies
5	Evaluation of the performance of various routing protocols of ad-hoc network
6	Evaluation of the performance of TCP and UDP Protocols
7	Evaluation of the performance of AODV, DSR and DSDV routing protocols
8	Evaluation of the performance of IEEE 802.11 and IEEE 802.15.4
9	Capturing and Analysis of TCP and IP Packets
10	Analysis of CDMA Downlink

CO-PO Mapping

CO #	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	3	2	2	2	2	1	1	-	-	3	2	3	2	2	2
CO2	3	3	3	3	2	1	1	-	-	3	2	3	2	2	2
CO3	3	3	2	3	2	1	1	-	-	3	2	3	2	2	2
CO4	3	3	2	2	2	1	1	-	-	3	2	3	2	2	2
CO5	3	3	3	3	2	1	1	-	-	3	2	3	2	2	2

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – 7th	
Course Code	**CS791D**
Course Name	**Data Mining and Data Warehousing Lab**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**1.5**

Prerequisites:

Data Structure& Programming, Design and Analysis of Algorithms, Database Management Systems, Statistics, Artificial Intelligence, Python Programming

Course Objectives:
The objective of the course is to enable students to

6. Comprehend the practicalaspects of Data Mining and Data Warehousing through implementationof ideas using proper techniques and tools.
7. Formulate a problem to fit Data Mining and Data Warehousingframeworks by exploring the contextual data and its characteristics.
8. Explore the well-known strategiesof Data Mining and Data Warehousing by implementing their respective algorithmic solutions to large scale data using proper techniques and tools to solve contextual problems.
9. Developideas and propose technical solutions to the challenging problems of Data Mining and Data Warehousing.
10. Analyzethe effectiveness of a Data Mining ModelandData WarehousingFrameworksin offeringsolutions to the respective problem.

Course Outcomes:

After completion of the course students will be able to

CO1	**Understand**thepracticalaspects of Data Mining and Data Warehousingthroughimplementation of ideasusing proper techniques and tools to recognizetheir utilitarian importance in current technological context for further exploration leading towards lifelong learning.
CO2	**Identify** and **formulate** an engineering problem by exploring contextual data and its

	characteristics within the scope of Data Mining and Data Warehousingparadigm.
CO3	**Explore** relevantliteratureand **apply** the concepts ofData Mining and Data Warehousingby**implementing** well-known algorithmicsolutionsto large scale data using proper techniques and toolsto**solve** contextual problems.
CO4	**Develop** ideasand**propose**technicalsolutions to the challenging problems of Data Mining and Data Warehousing.
CO5	**Plan and Implement** Data Mining basedideasasexecutableprograms**(**preferably termed asmodels)**by developing** suitablealgorithmswith adequate documentation in collaborative environment for successfully carrying out projects on Data Mining and Data Warehousing and **investigate** their effectiveness by **analyzing** the performances using proper techniques and tools.
MODULE NUMBER	**COURSE CONTENT**
1	**Introduction to Data Mining Programming Platform** Introduction to Data Mining Programming Platform and Data Exploration: Data Types, Data Attributes, Statistical Description of Data, Data Visualization, Data Feature Vectors, Data Preprocessing: Data Cleaning, Data Transformation
2	**Affinity Analysis** Implementation and Analysis of Recommending Engine
3	**Association Analysis** Implementation and Analysis of Apriori Algorithm
4	**Regression** Implementation and Analysis of Linear and Nonlinear Regression Methods
5	**Classification** Implementation and Analysis of k-Nearest-Neighbor Classifier, Decision Tree Classifier, Naïve Bayes Classifier
6	**Classification** Implementation and Analysis of ANN-Backpropagation and SVM Based Classifier
7	**Clustering** Implementation and Analysis of k-Means and k-Medoids

8	**Mining Time-Series Data** Implementation and Analysis of Time-Series Data Mining Models
9	**Discussion on Project Problems and Allocation (Problem Description Report Submission)**
10	**Designing Solution Model and Proposal Report Submission**
11	**Project Implementation, Verification and Documentation**
12	**Project Demonstration and Project Report Review**

Textbook:

1. Han J &Kamber M, "Data Mining: Concepts and Techniques", Morgan Kaufmann Publishers, Third Edition.
2. Parteek Bhatia, "Data Mining and Data Warehousing: Principles and Practical Techniques", Cambridge University Press.

ReferenceBooks:

1. Pang-Ning Tan, Vipin Kumar, Michael Steinbanch, "Introduction to Data Mining", PearsonEducation.
2. Robert Layton, "Learning Data Miningwith Python", Packt Publishing

CO–POMapping:

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	-	-	-	-	-	-	-	-	-	3	3	-	-
CO2	2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	2	2	3	2	-	-	-	-	-	-	-	-	2	-	2
CO4	2	2	2	3	-	-	-	-	-	-	-	2	2	-	2
CO5	2	2	3	3	2	2	2	2	2	2	2	2	2	2	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – 7th	
Course Code	**CS791A**
Course Name	**Cloud Computing Lab**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**1.5**

Prerequisite:

1. The student must have basic knowledge in Computer Network and Distributed System

Course Objectives(s):

1. To provide students with the fundamentals and essentials of VM.
2. Understand the importance of virtualization in distributed computing and how this has enabled the development of Cloud Computing.
3. Understand the importance of protocols and standards in computing.

Course Outcome(s)

After competition of the course the student able to do

CO1	Understand the concept of virtual machines in cloud computing
CO2	Implementation of virtual machines on different platforms
CO3	To provide the knowledge of various cloud computing tools and their related concepts.
CO4	To work on tools used in cloud computing online
CO5	Exploring different cloud computing and analysis there capability

Students are advised to do laboratory/practical practice not limited to, but including the following types of problems:

1. Create virtual machines that access different programs on same platform. [4L]
2. Create virtual machines that access different programs on different platforms. [4L]
3. Working on tools used in cloud computing online [16L]
   a. Storage
   b. Sharing of data

c. manage your calendar, to-do lists
d. a document editing tool

4. Exploring Google cloud [4L]
5. Exploring Microsoft cloud [4L]
6. Exploring Amazon cloud [4L]

LIST OF EXPERIMENTS

1. Install Virtualbox/VMware Workstation with different flavours of linux or windows OS on topofwindows7 or 8.
2. Install a C compiler in the virtual machine created using virtual box and execute Simple Programs
3. Install Google App Engine. Create hello world app and other simple web applications using python/java.
4. Use GAE launcher to launch the web applications.
5. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.
6. Find a procedure to transfer the files from one virtual machine to another virtual machine.
7. Find a procedure to launch virtual machine using trystack (Online Openstack Demo Version)
8. Install Hadoop single node cluster and run simple applications like wordcount.
9. Hands on virtualization using XenServer
10. Hands on containerisation using Docker 3
11. Deployment and Configuration options in Amazon (AWS)
12. Deployment and Configuration options in Google Cloud
13. Deployment and Configuration options in Microsoft Azure
14. Building a 'HelloWorld' app for the cloud
15. Deploying the 'HelloWorld' app for the cloud

CO-PO mapping

CO #	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO 1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	3
CO 2	-	3	-	-	-	-	-	-	-	-	-	-	-	1	3
CO 3	-	-	-	-	-	-	-	-	3	2	3	2	3	-	-
CO 4	2	-	3	-	-	2	2	-	-	-	-	-	-	2	3
CO 5	1	-	-	-	-	-	-	-	-	-	3	-	-	-	2

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – 7th	
Course Code	**CS791A**
Course Name	**High Performance Computing Lab**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**1.5**

Prerequisites:
Computer Architecture Lab, Operating System Lab, Compiler design Lab

Objective of the course:

The objective of the course is to make the students able to -

1. Understand, design and develop effective programs applying device Query, Vector Addition, different Matrix Multiplication, different Image processing algorithms using Xeon Phi Programming.
2. Understand, design and develop effective programs applying device Query, Vector Addition, different Matrix Multiplication, different Image processing algorithms using OpenMPI programming.
3. Design and develop effective programs to solve problems like DAXPY, Matrix Multiply, Calculation of pi using work sharing and reduction, Producer consumer problem, Molecular dynamics simulation using Open MPI programming.
4. Implement and analyze program to solve problems like DAXPY, Calculation of π - MPI Bcast and MPI Reduce, Ocean Kernel, and also for different Large Matrices using MPI programming.
5. Prepare laboratory reports on interpretation of experimental results and analyze it for validating the same.

Course Outcomes:

After completion of the course students will be able to

CO1	**Understand, design** and **develop** effective programs for engineering and mathematical problems **applying** device Query, Vector Addition, different Matrix Multiplication, different Image processing algorithms **using** Xeon Phi Programming or modern programming tools leading to lifelong learning.
CO2	**Understand, design** and **develop** effective programs for engineering and mathematical problems **applying** device Query, Vector Addition, different Matrix Multiplication, different Image processing algorithms **using**OpenMPI programming or modern

	programming tools leading to lifelong learning.
CO3	**Design** and **develop** effective programs for engineering and mathematical problems likeDAXPY, Matrix Multiply, Calculation of pi using work sharing and reduction, Producer consumer problem, Molecular dynamics simulation**using** Open MPI programming possibly as a team maintaining proper ethics of collaboration.
CO4	**Implement** and **analyze** program for engineering and mathematical problems like DAXPY, Calculation of π - MPI Bcast and MPI Reduce, Ocean Kernel, and also for different Large Matrices **using** MPI programming leading to lifelong learning.
CO5	**Prepare** laboratory reports on interpretation of experimental results and **analyze** it for validating the same maintaining proper ethics of collaboration.
MODULE NUMBER	**COURSE CONTENT**
1	Device Query, Vector Addition, Matrix Multiplication, Tiled Matrix Multiplication,Picture Scaling, Image Blur, Image Grayscaling. 1D, 2D, and 3D Stencil Operations.Histogramming, Convolution, Scan, Reduction using Xeon PhiProgramming**(3 Labs**)
2	Vector Addition, Matrix Multiplication, Tiled Matrix Multiplication, Picture Scaling,ImageBlur, Image Grayscaling. 1D, 2D, and 3D Stencil Operations. Histogramming,Convolution,Scan, Reduction using OpenMPI programming(**3 Labs**)
3	DAXPY, Matrix Multiply, Calculation of pi using worksharing and reduction, Producerconsumer problem, Molecular dynamics simulation problem using Open MPI programming(**3 Labs**)
4	DAXPY, Calculation of π - MPI Bcast and MPI Reduce, Ocean Kernel, Reductionexample,Collective Communication - Scatter – Gather, MPI Derived Datatypes,Matrix Multiplication ona Cartesian Grid (2D Mesh) using Cannon's Algorithm, MartixMultiplication using Cannon'sAlgorithm for Large Matricesusing MPI programming.(**3 Labs**)

Text book:

1. High Performance Cluster Computing, Volume 1, Architecture and Systems, Rajkumar Buyya, Pearson Education.
2. Berman, Fox and Hey, Grid Computing – Making the Global Infrastructure a Reality, Wiley India.
3. Hurwitz, Bllor, Kaufman, Halper, Cloud Computing for Dummies, Wiley India.

Reference Books:

1. Ronald Krutz, Cloud Security, Wiley India.
2. Cloud Computing, A Practical Approach, Anthony Velte, Toby Velte, Robert Elsenpeter, McGrawHill.

CO–POMapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	-	-	-	-	-	-	3	3	3	3
CO2	3	3	3	3	3	-	-	-	-	-	-	3	3	3	3
CO3	3	3	3	3	2	-	-	2	2	-	-	-	1	1	3
CO4	3	3	3	3	-	-	-	-	-	-	-	3	3	1	3
CO5	-	-	-	-	-	-	-	3	-	3	-	-	3	2	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – 7th	
Course Code	**CT791B**
Course Name	**VLSI Lab**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**3**

Prerequisite:

Concept of courses Solid State Devices; Analog Electronic Circuit; Digital Electronic and Circuit

Course Objective:
The objective of the course is to make the students able to
1 Plan a sequence of processing steps to fabricate a solid state device to meet geometric, electrical, and/or processing parameters.

2 Design VLSI circuits by keeping technological process constraints in mind.

3 Design code converters, parity generator and comparator using various styles of modeling.

Course Outcomes:

After completion of the course students will be able to

CO1	Design basic and universal gates, adder and subtractor using VHDL.
CO2	Design multiplexers, demultiplexers, encoders and decoders
CO3	Design code converters, parity generator and comparator using various styles of modeling.
CO4	Design sequential circuits like counters, shift registers and flip-flops.
CO5	Implement digital circuit on FPGA kit.
MODULE NUMBER	**COURSE CONTENT**

Perform the following experiments using VHDL:

1	Design of gates: AND, OR, NOT, NAND and NOR.
2	Design of Half-Adder and Full Adder.
3	Design of Half Subtractor and Full Subtractor.
4	Design of 4:1 MUX.
5	Design of 1:8 DEMUX
6	Design of 3:8 Decoder
7	Design of 8:3 Priority Encoder.
8	Design of 4 Bit Binary to Grey code Converter.
9	Design of 4 Bit Binary to BCD Converter using sequential statement
10	Design of 4-Bit Binary to Excess-3 converter using sequential statement.
11	Design of 9-Bit parity generator using structural style.
12	Design of 4-bit comparator.
13	Design of all type of Flip-Flops using sequential statements
14	Design of 8-Bit Shift Register.

Text Book:

1. Microelectronic Circuits ,Sedra& Smith , Oxford
2. Introduction to VLSI Circuits and System ,Uyemura , Wiley

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	2	2	-	-	-	-	-	-	2	2
CO2	3	3	3	3	2	-	-	-	-	-	2	2
CO3	2	2	3	2	-	-	-	-	-	-	2	2
CO4	3	2	2	3	-	-	-	-	-	1	2	2

CO5	3	2	2	3	-	1	1	1	-	1	2	2

SYLLABUS

Semester – 7th

Course Code	**CS791C**
Course Name	**Optimization Techniques Lab**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**1.5**

Course Objective(s):

1. To introduce the optimization techniques using both linear and non-linear programming.
2. To focus on the convex optimization though some techniques will be covered for non-convex function optimization.
3. To frame engineering minima maxima problems in the framework of optimization problems.

Course Outcome(s):

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

CO1	Demonstrate the basic principles and concepts of Python
CO2	Explore the applicability of programming skills in Python
CO3	Summarize various optimization techniques like LPP models.
CO4	Analyse the transportation, inventory and assignment problems.
CO5	Evaluate the concepts of sequencing, game theory and dynamic programming.

List of Experiments (Includes but Not Limited to)

1. Matrix Operations
2. Minimum Cost Path
3. Finding Maximum Number in An Array
4. Array Sorting
5. Linear Programming Problem
6. Queuing Problem
7. Sequencing Problem
8. Game Theory

9. Assignment Problem
10. Dynamic Programming Problem
11. Inventory Problem

Recommended Books :

1. [1] Foulds, L. R. (2012). Optimization techniques: an introduction. Springer Science & Business Media.
2. [2] Onwubolu, G. C., & Babu, B. V. (2013). New optimization techniques in engineering (Vol. 141). Springer.
3. [3] Lopez, C. (2014). MATLAB optimization techniques. Apress.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	-	-	-	-	-	-	-	-	-	-	2	2	3
CO2	3	2	-	2	3	-	-	-	-	-	-	-	2	3	2
CO3	3	3	-	-	-	-	-	-	-	-	-	-	3	2	3
CO4	1	3	-	3	3	-	-	-	-	-	-	-	2	2	2
CO5	1	3	-	2	2	-	-	-	-	-	-	-	3	2	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – 7th **C. MANDATORY ACTIVITIES / COURSES**	
Course Code	**MC 781**
Course Name	Entrepreneurship & Innovation Skill
Lecture (per week)	
Tutorial (per week)	
Contact Hours (per week)	
Total Contact Hours	**24**
Credit	**0**

Prerequisite: None

Course Outcome(s):

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

CO1	Comprehend the role of bounded rationality, framing, causation and effectuation in entrepreneurial decision making.
CO2	Demonstrate an ability to design a business model canvas.
CO3	Evaluate the various sources of raising finance for startup ventures.
CO4	Explain the fundamentals of developing and presenting business pitching to potential investors.
CO5	**Implement** case study of entrepreneurial venture in your nearby area

MODULE NUMBER	COURSE CONTENT
1	**[4L]** **Introduction to Entrepreneurship:** Entrepreneurs; entrepreneurial personality and intentions - characteristics, traits and behavioral; entrepreneurial challenges. Entrepreneurial Opportunities: Opportunities. discovery/ creation, Pattern identification and recognition for venture creation: prototype and exemplar model, reverse engineering.
2	**[4L]** **Entrepreneurial Process and Decision Making:** Entrepreneurial ecosystem, Ideation, development and exploitation of opportunities; Negotiation, decision making process and approaches, Effectuation and Causation; Advantage and Limitations of Entrepreneurship;

	Process of Entrepreneurship.
3	**[4L]** **Crafting business models and Lean Start-ups:** Introduction to business models; Creating value propositions-conventional industry logic, value innovation logic; customer focused innovation; building and analyzing business models; Business model canvas, Introduction to lean startups, Business Pitching.
4	**[4L]** **Organizing Business and Entrepreneurial Finance:** Forms of business organizations; organizational structures; Evolution of Organisation, sources and selection of venture finance options and its managerial implications.Policy Initiatives and focus; role of institutions in promoting entrepreneurship.
5	**[4L]** **Entrepreneurs as problem solvers:** Innovations and Entrepreneurial Ventures – Global and Indian; Role of Technology – E-commerce and social media; Social Entrepreneurship – Concept; Entrepreneurship – The Indian Scenario
6	**[4 L]** **Project/Case Study: (Any One)** 1. Visit of the District Industries Centre and prepare a report of activities and programs undertaken by them 2. Conduct a case study of any entrepreneurial venture in your nearby area. 3. Field Visit: Visit any business firm near your locality; interact with the owner of the business firm and prepare a field report on parameters like: type of business, scale of business, product/service dealing in, target customer, problems faced and measures to solve the faced challenges. 4. Know your State Handicraft and Handlooms as a means of economic activity

Text Books:

1. Bessant, J. (2003) High Involvement Innovation: Building and Sustaining Competitive Advantage Through Continuous Change. Chicester: John Wiley & Sons.
2. Bygrave, W and Zackarakis, A (2013) Entrepreneurship, 3rd Edition, John Wiley and Co. Drucker, P. (1999) Innovation and Entrepreneurship, Butterworth Heinemann, Oxford.

Reference Books:

1. Fagerberg, J, Mowery, DC and Nelson, RR (2005) The Oxford Handbook of Innovation, Oxford University Press, NY.
2. Hisrich, R.D., Peters, M.P., and Shepherd, D. (2013) Entrepreneurship, McGraw-Hill Irwin, Boston.

3. Kuratko, D. (2013) Entrepreneurship: Theory, Process, and Practice, 9th Edition, Wiley online library.
4. Moore, Geoffrey, (1999) Crossing the Chasm, Harper & Collins.
5. Porter, ME, Competitive Advantage: Creating and Sustaining Superior Performance, Free Press, New York, NY, 1985

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	-	-	-	-	-	-	-	-	-	-	2	2	3
CO2	3	2	-	2	3	-	-	-	-	-	-	-	2	3	2
CO3	3	3	-	-	-	-	-	-	-	-	-	-	3	2	3
CO4	1	3	-	3	3	-	-	-	-	-	-	-	2	2	2
CO5	1	3	-	2	2	-	-	-	-	-	-	-	3	2	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – 8th A. THEORY	
Course Code	**CS801T**
Course Name	**Advance Graph Algorithms**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**3**

Pre-requisites:
Discrete Mathematics, Graph Theory, Data Structures and Algorithms

Course Objectives:

1. Useofa graph algorithm and apply them in designing solution to Computer Science and engineering domain problem.
2. Understand thebasic concept of graph implementation programming and use of data structure to represent graph for developing the solution to the graph based problems
3. Understandofhowtoa pply the graph theory principles and concepts to design an efficient algorithm and use suitable data structure for problem solving.
4. Understandthe design better algorithm in compare to some existing algorithm and create new efficient data structures for solving many graph based real life problem in Computer science domain.
5. Discuss the application of graph concepts in the development of computer algorithms and applications.

Course Outcomes:

After completion of the course students will be able to

CO1	**Understand** the basic concept of Graph theory and Graph Algorithm and apply them in designing solution to Computer Science and engineering domain problem.
CO2	**Demonstrate** the basic concept of graph implementation programming and use of data structure to represent graph for developing the solution to the graph based problems in computer science domain
CO3	**Formulate** graph algorithms and programs in solving Computer science and engineering problem leading to lifelong learning and Analyze the efficiency of algorithms using time and space complexity.
CO4	**Apply** the graph theory principles and concepts to design an efficient algorithm and use

	suitable data structure for problem solving.
CO5	**Design** and **develop** better algorithm in compare to some existing algorithm and create new efficient data structures for solving many graph based real life problem in Computer science domain.
MODULE NUMBER	**COURSE CONTENT**
1	**Introduction ofGraph[6L]** Fundamental concept ofGraph :Definition of Graphs, Representations of graphs, degree sequences, distance in graphs, complete, regular and bipartite graphs, basic properties of Paths, Cycles, and Trails, Connection,Bipartite Graphs, Eulerian Circuits, Vertex Degrees and Counting, Degree-sum formula.
2	**Graph algorithms [5L]** Graph traversal algorithm-Introduction to Graphs & its Applications:Breadth-first search and tree, Depth-first search and tree , Topological sort, Strongly connected components
3	**Tree [5L]** Trees and connectivity –Properties of trees, vertex and edge,connectivity, Mengers theorem, Minimum Spanning Trees, Growing a minimum spanning tree, The algorithms of Kruskal and Prim
4	**Shortest Paths problem [5L]** Shortest Paths problem: Single-source shortest paths in directed acyclic graphs, Dijkstra’s algorithm, The Bellman-Ford algorithm, All-Pairs Shortest Paths, The Floyd-Warshall algorithm
5	**Flow networks problem [7L]** Flow networks problem: The Ford-Fulkerson method, Maximum bipartite matching, Cuts and Connectivity, k-Connected Graphs, Max-Flow Min-cut Theorem, Menger'sProof using Max-Flow Min-Cut Theorem.
6	**Planar Graphs [4L]** Planar Graphs, Characterization of Planar Graphs, Kuratowski's Theorem, Wagner's Theorem,Graph-coloring, Hamiltonian Graph, Traveling Salesman Problem

7	**Matchings and Cover [4L]** Matchings and Covers: Hall's Condition, Min-Max Theorem, Independent Sets, Covers and Maximum Bipartite Matching, Augmenting Path Algorithm, Weighted Bipartite Matching, Hungarian Algorithm, Stable Matchings and Faster Bipartite Matching, Factors & Perfect Matching in General

Text Books:

1. Graph Theory, by J. A. Bondy and U. S. R. Murthy, Springer Verlag (2008.)
2. Introduction to Graph Theory,by D. B. West, PHI, 2004.
3. T. H. Cormen, C. E. Leiserson, R. L. Rivest and C. Stein, “Introduction to Algorithms”

Reference Books:

1 Graph Theory, by R. Diestel : Springer Verlag (Free Download available).(2003)

N. Deo, Graph Theory, Prentice Hall of India, 1974.

2. E.M.Reingold, J.Nievergelt and N.Deo“CombinationalAlgorithmsTheory and Practice”, Prentice Hall.

CO–POMapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	2	2	-	-	-	-	-	-	-	3	3	3
CO2	3	3	2	3	-	-	-	-	-	-	-	-	3	2	3
CO3	3	3	3	2	-	-	-	-	2	2	-	3	3	3	2
CO4	3	3	3	3	-	-	-	-	-	-	-	-	3	3	2
CO5	3	3	3	3	-	-	-	-	3	2	-	-	3	2	2

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – 8th	
Course Code	**CS801S**
Course Name	**Real Time Systems**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**3**

Prerequisites:

1. Concepts of Operating systems and Algorithm.
2. Knowledge of Distributed System basics.

Course Objective(s):

1. To understand the real-time systems
2. Obtain a broad understanding of the technologies and applications for emerging and exciting domain of real-time systems.
3. Get in-depth hands-on experience in designing and developing a real time system.

Course Outcome(s):

After completion of the course students will be able to

CO1	Understand the concepts of Real-Time systems
CO2	Recognize the characteristics of a real-time system
CO3	Understand and develop document on an architectural design of a real-time system.
CO4	Develop and document Task scheduling, resource management, real-time operating systems and fault tolerance applications of real-time systems.
CO5	Apply the basics of RTOS in interpretation of real time systems.

MODULE NUMBER	COURSE CONTENT
1	**Introduction [8L]** Definition, Typical Real Time Applications: Digital control, High Level Controls, Signal processing etc. , Release Times, Deadline period and time constraints, Hard and soft real time

	systems, Reference models for RTOS: Processors and Resources, Temporal parameters of Real-time workload, Periodic Task Model, Precedence Constraints and Data Dependency.
2	**Real Time Scheduling [8L]** Common Approaches to Real Time Scheduling: Clock Driven Approach, Weighted Round Robin Approach, Priority Driven Approach, Dynamic Versus Static Systems, Optimality of Effective-Deadline-First (EDF) and Least-Stack-Time-First (LST) algorithms, Rate Monotonic algorithm, Offline versus Online Scheduling.
3	**Resources Sharing [8L]** Effect of Resource Contention and Resource Access Control (RAC), Non-pre-emptive Critical Sections, Basic Priority- Inheritance and Priority-Ceiling Protocols, Stack based Priority Ceiling Protocol, Use of Priority Ceiling Protocol in Dynamic priority systems, Pre-emption Ceiling Protocol, Access control in Multiple Module Resources, Controlling Concurrent Accesses to Data Objects.
4	**Real Time Communication[6L]** Basic Concepts of Real time Communication, Soft and Hard real-time Communication systems, Model of Real-time Communication, Priority based service and Weighted Round Robin Service disciplines for switched Networks, Medium Access control protocols for broadcast networks, Internet and resource reservation protocols
5	**Real Time Operating Systems and Databases[6L]** Features of RTOS, Time Services, UNIX as RTOS, POSIX Issues, Characteristic of temporal data, temporal consistency, on-currency Control, and Overview of Commercial Real Time databases.

Text Books

1. Real Time Systems – Jane W. S. Liu, Pearson Education Publication

Reference Books

1. Real Time Systems – Mall Rajiv, Pearson Education
2. Real-Time Systems: Scheduling, Analysis, and Verification – Albert M. K. Cheng, Wiley.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	1	2	-	-	-	-	-	-	-	3	2	
CO2	3	2	3	3	-	-	-	-	-	-	-	-	3	2	
CO3	3	3	3	3	2	-	-	-	-	-	-	-	2	2	2
CO4	3	2	3	3	2	-	-	-	-	-	-	-	3	2	
C05	3	3	3	3	2								3	2	

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – 8th	
Course Code	**CS801D**
Course Name	**Data Analytics**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**3**

Prerequisites:
Data Structure, Design and Analysis of Algorithms, Database Management Systems, Statistics, Artificial Intelligence, Programming skills of Python

Course Objectives:

2. Comprehend the fundamental concepts of the Big DataAnalytics exploring machine learning strategies such as Supervised and Unsupervised Learning etc. for analyzing various types of large scale structured as well as unstructured data distributed across multiple locations (Map Reduce, Hadoop and NoSQL Framework).
3. Formulate an engineering problem of analyzing large scale data distributed across multiple locations to make automated meaningful decisions
4. Apply the concepts of Big Data Analytics to solve problems of making automated decisions dealing with large scale structured as well as unstructured datadistributed across multiple locations.
5. Excogitate and Implement ideas to address the challenging issues of Big DataAnalytics.
6. Analyze the effectiveness of various Big DataAnalyticsFrameworks.

Course Outcomes:

After completion of the course students will be able to

CO1	**Understand and explain** the fundamental concepts of the Big Data Analytics which are primarily explored for making automated decisions using machine learning strategies on analyzing large scale structured as well as unstructured data distributed across multiple locations (Map Reduce, Hadoopand NoSQL Framework) underscoring the utilitarian importance in current technological context for further exploration leading towards lifelong learning.
CO2	**Identify** and **formulate** an engineering problem of analyzing large scale data distributed across multiple locations to make automated meaningful decisions within the scope of Big Data Analytics Frameworks.
CO3	**Explore** relevantliteratureand **apply** the concepts ofBig Data Analytics to **solve**problems of making automated decisions dealing with large scalestructured as well as unstructured data using Map Reduce, Hadoop and advanced SQL Frameworks.
CO4	**Excogitate**ideas for **proposing** solutions to the challenging problems of Big Data Analytics.

CO5	**Implement** ideas of Big Data Analytics through **developing**feasible algorithms or frameworks and **investigate** their effectiveness in solving the relevant problems by **analyzing** the performances using proper techniques.
MODULE NUMBER	**COURSE CONTENT**
1.	**Introduction to Basic Analytics [10L]** Introduction: Big data overview, Analyst's perspective on data repositories, Current analytical architecture, Drivers of big data, Examples of big data analytics. Life Cycle of Data Analytics:Phase 1: Discovery, Phase 2: Data preparation, Phase 3: Model planning, Phase 4: Model building, Phase 5: Communication of results, Phase 6: Making operational. Basic Analytic Methods: Visualization, Dirty data, Data exploration versus presentation, Statistical methods for evaluation – hypothesis testing, difference of means, rank sum test, type I and type II errors, ANOVA.
2.	**Advanced Analytic Methods I [8L]** Clustering: Overview, K-means, Determining the number of clusters, Diagnostics. Association Rules: Overview, Apriori algorithm, Evaluation of candidate rules, Application of association rules, Validation and testing, Diagnostics. Regression: Linear regression - model description, Logistic regression – model description, Other regression models. Classification: Decision trees – overview, General algorithm, Decision tree algorithms, Evaluating a decision tree, Naïve Bayes – Bayes theorem, Naïve Bayes classifier, Diagnostics of classifiers.
3.	**Advanced Analytic Methods II [8L]** Time Series Analysis: Overview, Box-Jenkins methodology, Autocorrelation function (ACF), Autoregressive model, Moving average model, ARMA and ARIMA model, Building and evaluating an ARIMA model. Text Analysis: Steps in text analysis, Collecting raw text, Representing text, Term Frequency-Inverse Document Frequency (TFIDF), Categorizing documents by types, Determining sentiments.

	Map Reduce and Hadoop:Analytics for unstructured data – map reduce, Apache Hadoop, Hadoop Ecosystem – Pig, Hive, Hbase, Mahout.
4.	**Advanced Analytic Methods III [10L]** Technology and Tools: SQL essentials - Join, Set, Grouping extensions, Advanced SQL – Window functions, User-defined functions, Ordered aggregates, MADlib, NoSQL. Integration of Techniques: Communicating and operationalizing an analytic project. Creating final deliverables – Developing core materials, project goals, Main findings, Approach, Model description and model details, Recommendations, Providing technical specifications and code. Data visualization basics - Key points, evolution of a graph, common representation methods, how to clean up a graphic.

Textbook:

1. EMC Education Services (Editor), Data Science and Big Data Analytics. John Wiley & Sons, 2015.
2. Mike Barlow, Real-Time Big Data Analytics: Emerging Architecture. O'Reilly, 2013.

ReferenceBooks:

1. Nathan Marz and James Warren, Big Data: Principles and Best Practices for Scalable Real-time Data Systems. Manning Publications, 2015.
2. Venkat Ankam, Big Data Analytics. Packt Publishing Ltd., UK, 2016.

CO–POMapping:

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	3	3	-	-
CO2	2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	2	2	3	2	-	-	-	-	-	-	-	-	2	-	2
CO4	2	2	2	3	-	-	-	-	-	-	-	2	2	-	2
CO5	2	2	3	3	2	2	2	-	-	-	-	2	2	2	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – 8th	
Course Code	**CT801A**
Course Name	**Image Processing**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**3**

Prerequisites: Design and Analysis of Algorithms, UG Level Mathematics

Course Objectives:
1. Understand the basic concepts of digital image processing and identify problems where students can apply the concept appropriately.
2. Understand the fundamental concepts of image enhancement strategies and identify the scope of enhancement where students can apply the appropriate strategy and analyze the performance.
3. Illustrate the fundamental image restoration strategiesandapply them appropriately to eliminate noise in the image.
4. Illustratevarious Image Compression Techniques and Analyze their performances.
5. Understand the ideas of Morphological Image Processing and Image Segmentation to propose solutions to the related problems and analyze the effectiveness as well as limitations of solutions underscoringits utilitarian importance for further explorations leading towards lifelong learning.

Course Outcomes:

After completion of the course students will be able to

CO1	**Understand** the basic concepts of digital image processing to **Explain or Illustrate** and **Identify** problems where students can **Apply** the concept appropriately to **Solve** them.
CO2	**Understand** the fundamental concepts of image enhancement strategies and **Identify**the scope of enhancement where students can **Apply** the appropriate strategy and **Analyze**the performance.
CO3	**Illustrate** the fundamental image restoration strategies and **Apply** them appropriately to eliminate noise in the image.
CO4	**Illustrate** various Image Compression Techniques and **Apply** them to compress the images and **Analyze** their performances.
CO5	**Understand** and **Develop** ideas to **Propose** solutions to the problems of Morphological Image Processing and Image Segmentation and **Analyze** the effectiveness as well as limitations of solutions under scoring its utilitarian importance for further explorations leading towards lifelong learning.

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

MODULE NUMBER	COURSE CONTENT
1	**Introduction to Digital Image Processing [3L]** Applications of digital image processing, fundamental steps in digital image processing, components of image processing system. Digital Image Fundamentals: A simple image formation model, image sampling and quantization, Some Basic Relationships Between Pixels- Neighbors and Connectivity of pixels in image, Color Image Models.
2	**Image Enhancement [10L]** Image Enhancement in The Spatial Domain: Some Basic Gray Level Transformations, Histogram Processing, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters. Image Enhancement in Frequency Domain: Introduction, Fourier Transform, Discrete Fourier Transform (DFT) and its relation with image characterization, fundamental steps of image enhancement in Frequency Domain, Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters.
3	**Image Restoration [5L]** Basics of Image restoration and Noise characterization, Estimating the degradation function, Noise removal using spatial and frequency domain filtering, Image Restoration techniques.
4	**Morphological Image Processing [5L]** Basic Concepts, Erosion, Dilation, Opening,Closing, Skeletonization, Hole filling, Connected components, Boundary Detection.
5	**Image Compression [5L]** Basic Concepts – Types of redundancy, Types of coding techniques, Lossless Compression: Run-Length Encoding, Huffman Coding, Lossy Compression: Vector Quantization, Sequential DCT-based Compression (JPEG Baseline Algorithm).
6	**Image Segmentation [8L]**

	Detection of Points, lines and Edges (Sobel and Canny); Edge Linking, Image Thresholding (Otsu's method), Region based segmentation, color-feature based segmentation in color images.

Textbook:

1. Digital Image Processing, Rafael C. Gonzales, Richard E. Woods, Third Edition, Pearson Education, 2010.
2. Digital Image Processing, S. Sridhar, Oxford University Press, 2nd Ed, 2016.

ReferenceBooks:

1. Fundamentals of Digital Image Processing- Anil K. Jain, 2nd Edition, Prentice Hall of India.
2. Image Processing, analysis and Machine Vision, Milan Sonka,Thomson Press India Ltd, Fourth Edition.

CO–POMapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	2	2	3	2	-	-	-	-	-	-	-	-	2	-	2
CO4	2	2	2	3	-	-	-	-	-	-	-	-	2	-	2
CO5	2	2	3	3	-	-	-	-	-	-	-	2	2	2	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – 8th	
Course Code	**CS801A**
Course Name	**Human Resource Development and Organizational Behaviour**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**3**

Course Objective(s):

1. To develop an understanding of the nature, functioning and design of organisation as social collectivises.
2. The basic concepts and theories underlying individual behaviour besides developing better insights into one's own self.
3. To gain insight into the organisational learning processes, how they can be fostered and enhanced.
4. Individual behaviour in groups, dynamics of groups and team building besides developing a better awareness of how they can be better facilitators for building effective teams as leaders themselves.

Course Outcome(s):

At the end of the course students are able to:

CO1	To understand key functions in management as applied in practice.
CO2	To identify and analyze major practices associated with HRD in modern work and organization
CO3	To evaluate the connections between the HRD process and the contemporary performance management concerns of organisations
CO4	To assess the potential effects of organisational-level factors (such as structure, culture and change) on organisational behaviour.
CO5	To evaluate the potential effects of important developments in the externalenvironment (such as globalisation and advances in technology) on organisationalbehaviour

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

MODULE NUMBER	COURSE CONTENT
1	HRD-Macro Perspective: HRD Concept, Origin and Need, HRD as a Total System; Approaches to HRD; Human Development and HRD; HRD at Macro and Micro Climate. **3L**
2	HRD–Micro Perspective: Areas of HRD; HRD Interventions Performance Appraisal, Potential Appraisal, Feedback and Performance Coaching, Training, Career Planning, OD or Systems Development, Rewards, Employee Welfare and Quality of Work Life and Human Resource Information; Staffing for HRD: Roles of HR Developer; Physical and Financial Resources for HRD; HR Accounting; HRD Audit, Strategic HRD **6L**
3	Instructional Technology for HRD: Learning and HRD; Models and Curriculum; Principles of Learning; Group and Individual Learning; Transactional Analysis; Assessment Centre; Behaviour Modeling and Self Directed Learning; Evaluating the HRD.**5L**
4	Human Resource Training and Development: Concept and Importance; Assessing Training Needs; Designing and Evaluating T&D Programmes; Role, Responsibilities and challenges to Training Managers.**4L**
5	Organisational Effectiveness (OE): Concept; Approaches to O E; Adoptive Coping Cycle for Effectiveness; Achieving OE; Organisational Climate: Concept, Determinants of Organisational Climate.**3L**
6	Organization Theory: Classical Theory; Neo-Classical Theory, Modern Behavioural Theories, contingency theory, system theory, modern structural models; Organizational Culture; Creating and Sustaining Culture; Work Culture.**6L**
7	Motivation: Types of Motives; Theories of Maslow; Herzberg, McGregor, Alderfers, Porter and Lawler's Model; Job Enlargement, Job Enrichment, Behaviour Modification. **3L**
8	(a)Group & Group Dynamics - concept, importance, classification of groups, reason for group, formation, group cohesiveness. (b) Team work: meaning, concept, types, creating, and an effective team. (c) Leadership: Concept, Leader vs. Manager; Classical Studies on Leadership; Trait Theories; Behavioral Theories; Group and Exchange Theories; Contingency Theory of Leadership; Leadership Styles.**6L**
References:	

1) Rao, T.V and Pareek, Udai: Designing and Managing Human Resource Systems, Oxford IBH Pub. Pvt.Ltd., New Delhi , 2005
2) Viramani, B.R and Seth, Parmila: Evaluating Management Development, Vision Books, New Delhi.
3) Rao, T.V: Human Resource Development, Sage Publications, New Delhi.
4) Luthans, Fred: OrganisationalBehaviour, Tata McGraw-Hill Co. New Delhi, 2004.
5) Stephen, P. Robins: OrganisationalBehaviour, Prentice-Hall of India Pvt., Ltd., 2004.
6) John, W. Mewstrom& Davis, Keith :Organisational Behavior (Human Behavior at Work), Tata McGraw-Hill, New Delhi , 2002

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	-	1								3	3	3
CO2	3	3	-	3								3	3	3	3
CO3	3	3	3	3	3								3	3	1
CO4	3	-	3	3	1			2					3	3	3
CO5	3	3	3	3	1								3	1	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – 8th	
Course Code	CT801B
Course Name	Block Chain
Lecture (per week)	3
Tutorial (per week)	0
Contact Hours (per week)	3
Total Contact Hours	36
Credit	3

Course Objective:

1. The students should be able to understand a broad overview of the essential concepts of blockchain technology.
2. To familiarize students with Bitcoin protocol followed by the Ethereum protocol – to lay the foundation necessary for developing applications and programming.
3. Students should be able to learn about different types of blockchain and consensus algorithms.

Course Outcome(s):

After completion of the course students will be able to

CO1	Understand blockchain terminologies and its properties and the emerging models for blockchain technology
CO2	Familiarize with the functional/operational aspects of crypto currency ecosystem
CO3	Design, code, deploy and execute a smart contract – the computational element of the blockchain technology using Solidity and Remix IDE
CO4	Build private - permissioned blockchain -based applications for enterprises and businesses
CO5	Explore the blockchain decentralization and cryptography concepts.
MODULE NUMBER	**COURSE CONTENT**
1.	**[6L]** **Basics:** The Double-Spend Problem, Byzantine Generals' Computing Problems, Public-

	KeyCryptography, Hashing, Distributed Systems, Distributed Consensus.
2.	**[10 L]** **Technology Stack:** Blockchain, Protocol, Currency. **Bitcoin Blockchain:** Structure, Operations, Features, Consensus Model, IncentiveModel.
3.	**[10 L]** **Ethereum Blockchain:** Smart Contracts, Ethereum Structure, Operations, ConsensusModel,Incentive Model.
4.	**[6 L]** **Tiers of Blockchain Technology**: Blockchain 1.0, Blockchain 2.0, Blockchain 3.0, Typesof Blockchain: Public Blockchain, Private Blockchain, Semi-Private Blockchain,Sidechains.
5.	**[10 L]** **Types of Consensus Algorithms:** Proof of Stake, Proof of Work, Delegated Proof ofStake, Proof Elapsed Time, Deposite-Based Consensus, Proof of Importance, FederatedConsensus or Federated Byzantine Consensus, Practical Byzantine Fault Tolerance.Blockchain Use Case: Supply Chain Management.

Text Books/References:

1. Kirankalyan Kulkarni, Essentials of Bitcoin and Blockchain, Packt Publishing.

2. Anshul Kaushik, Block Chain & Crypto Currencies, Khanna Publishing House.

3. Tiana Laurence, Blockchain for Dummies, 2nd Edition 2019, John Wiley & Sons.

4. Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin,and popular Blockchain frameworks by Imran Bashir, Packt Publishing (2017).

5. Blockchain: Blueprint for a New Economy by Melanie Swan, Shroff Publisher O'ReillyPublisher Media; 1st edition (2015).

6. Mastering Bitcoin: Programming the Open Blockchain by Andreas Antonopoulos.

Corresponding Online Resources:

1. https://www.coursera.org/specializations/blockchain.

2. https://nptel.ac.in/courses/106105184/

3. Introduction to Blockchain Technology and Applications,https://swayam.gov.in/nd1_noc20_cs01/preview

CO-POMapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	-	-	-	-	-	-	-	-	3	3	2
CO2	2	3	-	-	-	-	-	-	-	-	-	-	-	3	2
CO3	2	2	3	2	-	-	-	-	-	-	-	-	2	3	2
CO4	2	2	2	3	-	-	-	-	-	-	-	-	2	3	2
CO5	2	2	3	3	-	-	-	-	-	-	-	2	2	2	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – 8th	
Course Code	**CS801C**
Course Name	**Simulation and Modeling**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**3**

Prerequisites:

1. Programming and Data Structures
2. Discrete Mathematics and Probability theory
3. Game theory
4. Numerical Analysis

Course Objective(s):

1. To understand the Models and Simulation of Continuous and Discrete Systems.
2. To enable students to analyze Continuous Uniformly Distributed Random Numbers
3. To assess the strengths and weaknesses of various methods and to analyze their behavior.

Course Outcome(s):

On completion of the course students will be able to

CO1	Student will be able to summarize the issues in Modelling and Simulation and to explain the System Dynamics & Probability concepts in Simulation.
CO2	Student will be able to solve the Simulation of Queuing Systems
CO3	Student will be able to analyze the Simulation output.
CO4	Student will be able to identify the application area of Modeling and Simulation, and apply them.

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

CO5	Student will be able to implement new model by applying their knowledge
MODULE NUMBER	**COURSE CONTENT**
1.	**Introduction to Modeling and Simulation [7L]** Nature of Simulation. Systems , Models and Simulation, Continuous and Discrete Systems, system modeling, Components of a simulation study, Introduction to Static and Dynamic System simulation , Application areas, Advantages ,Disadvantages and pitfalls of Simulation.
2.	**System Dynamics & Probability concepts in Simulation [10L]** Exponential growth and decay models, Generalization of growth models, Discrete and Continuous probability functions, Continuous Uniformly Distributed Random Numbers, Generation of a Random numbers, Generating Discrete distributions, Non-Uniform Continuously Distributed Random Numbers, Rejection Method.
3.	**Simulation of Queuing Systems and Discrete System Simulation [14L]** Poisson arrival patterns, Exponential distribution, Service times, Normal Distribution Queuing Disciplines, Simulation of single and two server queue. Application of queuing theory in computer system. Discrete Events ,Generation of arrival patterns ,Simulation programming tasks Gathering statistics, Measuring occupancy and Utilization , Recording Distributions and Transit times .
4.	**Analysis of Simulation output [5L]** Sensitivity Analysis, Validation of Model Result

Text Books:

1. Jerry Banks, John Carson, B.L.Nelson and D.M.Nicol ― Discrete Event System Simulation‖,

Fifth Edition, Pearson.

2. NarsinghDeo, 1979, System Simulation with Digital Computers, PHI.

Reference Books:

1. Averill M. Law and W.DavidKelton, ―Simulation Modeling and Analysis‖, Third Edition,

McGraw Hill 5. J. N. Kapoor.. Mathematical Modeling, Wiley eastern Limited

2. Geoffrey Gordon, ―System Simulation‖, PHI.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	1	-	-	-	-	-	-	-	3	3	3
CO2	3	3	3	3	-	-	-	-	-	-	-	3	3	3	3
CO3	3	3	3	3	3	-	-	-	-	-	-	-	3	3	1
CO4	3	3	3	3	1	-	-	2	-	-	-		3	3	3
CO5	3	3	3	3	1	-	-	-	-	-	-	-	3	1	3

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – 8th	
Course Code	**CS802A**
Course Name	**Values and Ethics in Profession**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**34**
Credit	**3**

Prerequisites: Basic knowledge of engineering and management.

Course Outcome(s):

On Completion of this course student will be able to

CO1	Understand the core values that shape the ethical behaviour of an engineer and Exposed awareness on professional ethics and human values.
CO2	Understand the concept of profession, professional ethics, and various moral issues.
CO3	Understand various social issues, industrial standards, code of ethics and role of professional ethics in engineering field.
CO4	Aware of responsibilities of an engineer for safety and risk benefit analysis, professional rights and responsibilities of an engineer
CO5	Acquire knowledge about various roles of engineers in variety of global issues and able to apply ethical principles to resolve situations that arise in their professional lives.
MODULE NUMBER	**COURSE CONTENT**
1	**Introduction** **6L** Basic Concepts, Governing Ethics, Personal & Professional Ethics, Ethical Dilemmas, Life Skills, Emotional Intelligence, Thoughts of Ethics, Value Education, Dimensions of Ethics, Profession and professionalism, Professional Associations, Professional Risks, Professional Accountabilities, Professional Success, Ethics and Profession.

2	**Theories of Self Development** **6L** Emotional Intelligence (EI): Concept, Johari Window, Importance and Measurement, Concept of Motivation, Maslow's theory, Kohlberg's theory,Gilligan's theory – towards a comprehensive approach to moral behaviour – truth – approach to knowledge in technology.
3	**Moral and Ethical Concerns** **4L** Variety of Moral Issues, Moral Dilemmas, Nature of values, Value Crisis in contemporary society, Value Spectrum of a good life, Steven Covey's Pursuit of Excellence.
4	**Professional Practices in Engineering** **8L** Professions and Norms of Professional Conduct, Norms of Professional Conduct vs. Profession; Responsibilities, Obligations and Moral Values in Professional Ethics, Professional codes of ethics, the limits of predictability and responsibilities of the engineering profession, Ethical and Unethical practices – case studies, Whistle blowing and beyond and Case studies.
5	**Global issues in Professional Ethics** **10L** Introduction – Current Scenario, Technology Globalization of MNCs, International Trade, World Summits, Issues, Business Ethics and Corporate Governance, Sustainable Development Ecosystem, Energy Concerns, Ozone Deflection, Pollution, Ethics in Manufacturing and Marketing, Media Ethics; Bio Ethics, Intellectual Property Rights.

Reference Books

1. 1. Govindarajan M, Natarajan S, Senthil Kumar V S, "Engineering Ethics" PHI India, 2004
2. P AarneVesblind, Alastair S Gunn, " Engineering Ethics and the Environment"
3. Edmund G Seebauer, Robert L Barry, " Fundamentals of Ethics for scientists and engineers" Oxford University Press 2001
4. Mike W Martin, Roland Schinzinger, " Ethics in Engineering", Tata McGraw -Hill, 2003
5. Professional Ethics: R. Subramanian, Oxford University Press
6. . Engineering Ethics, Concepts Cases: Charles E Harris Jr., Michael S Pritchard, Michael J Rabins, 4e , Cengage learning, 2015
7. Business Ethics concepts & Cases: Manuel G Velasquez, 6e, PHI, 2008.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	-	-	-	-	-	-	-	2	3	2
CO2	3	3	3	3	3	-	-	-	-	-	-	-	2	3	2
CO3	3	3	3	3	3	-	-	-	-	-	-	3	2	3	2
CO4	3	3	3	3	3	-	-	-	-	-	-	-	2	3	2
CO5	3	3	3	3	3	-	-	-	3	-	2	-	2	3	2
CO	3	3	3	3	3	-	-	-	3	-	2	3	2	3	2

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – 8th	
Course Code	**CS802B**
Course Name	**History of Science and Technology in India**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**3**

Prerequisites: None

Course Outcome(s):

After completion of the course students will be able to

CO1	To understand the development of science and technology in ancient India.
CO2	To understand that development is not solo pursuit rather an interactive and collective process.
CO3	To familiarize with the evolution of scientific ideas and technical solution and their linkages with the socio-culture necessities
CO4	To analyse the socio-cultural and philosophical context in which the various scientific
CO5	To apply technological ideas got developed in India. and thereby help in repositioning India's contributions in science and technology

MODULE NUMBER	COURSE CONTENT
1	**Historical Perspective [5L]** The nature of science and technology, Roots of science and technology in India, Science and society, Scientists and society, Science and Faith and the rise of applied sciences.
2	**Policies and Plans after Independence [7L]** Nehru's vision of science for independent independent India, Science and technology developments in the new era science and technology developments during the Five Year Plan Periods and science and technology policy resolutions.

3	**Research and Development (R&D) in India [7L]** Expenditure in R&D, Science and Technology Education, Research activities and promotion of technology development, Technology mission, Programs aimed at technological self-reliance, activities of council of scientific and industrial research (CSIR).
4	**Science and Technological Developments in Major Areas [11L]** Space – Objectives of space programs, Geostationary Satellite Services – INSAT system and INSAT services remote sensing applications, Launch Vehicle Technology Ocean Development – Objectives of ocean development, Biological and mineral resources, Marine research and capacity building Defence Research – Spin-off technologies for civilian use, Biotechnology – Applications of biotechnology in medicine, Biocatalysts, Agriculture, Food, Fuel and Fodder, Development of biosensors and animal husbandry Energy – Research and development in conservation of energy, India's nuclear energy program, technology spin-offs.
5	**Nexus between Technology Transfer and Development [6L]** Transfer of Technology – Types, Methods, Mechanisms, Process, Channels and Techniques, Appropriate technology, Technology assessment, Technological forecasting, Technological innovations and barriers of technological change.

Textbooks:

1. Kalpana Rajaram, Science and Technology in India, Published and Distributed by Spectrum Books (P) Ltd., New Delhi – 58.
2. Srinivasan, M., Management of Science and Technology (Problems & Prospects), East-West Press (P) Ltd., New Delhi.

Reference Books:

1. Ramasamy, K.A., and Seshagiri Rao, K., (Eds), Science, Technology and education for Developlemnt, K., Nayudamma Memorial Science Foundation, Chennai – 8.
2. Kohili, G.R., The Role and Impact of Science and Technology in the Development of India, Surjeet Publications.
3. Government of India, Five Year Plans, Planning Commission, New Delhi.
4. Sharma K.D., and Quresh M.A., Science, Technology and Development, Sterling Publications (P) Ltd., New Delhi.

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	-	-	-	-	-	-	-	2	3	2
CO2	3	3	3	3	3	-	-	-	-	-	-	-	2	3	2
CO3	3	3	3	3	3	-	-	-	-	-	-	3	2	3	2
CO4	3	3	3	3	3	-	-	-	-	-	-	-	2	3	2
CO5	3	3	3	3	3	-	-	-	3	-	2	-	2	3	2

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – 8th	
Course Code	**CS802C**
Course Name	**Economic Policies in India**
Lecture (per week)	**3**
Tutorial (per week)	**0**
Contact Hours (per week)	**3**
Total Contact Hours	**36**
Credit	**3**

Course Objective(s):

This course reviews major trends in Indian Economic Policies towards the attainment of economic and social development in the post-independence period.

Course Outcome(s):

CO1	To understand the basic characteristics of Indian economy, it's potential
CO2	To understand the importance, causes and impact of population growth and its distribution, translate and relate them with economic development
CO3	Tounderstand the importance of planning undertaken by the government of India, have knowledge on the various objectives, failures and achievements as the foundation of the ongoing planning and economic reforms taken by the government
CO4	To analyse the progress and changing nature of different sectors and their contribution to the economy as a whole.
CO5	To analyse the developmental trends of Indian economy.

MODULE NUMBER	**COURSE CONTENT**
1	**Introduction:[4L]** Indian Economy on the eve of Independence, British rule and its impact on Indian Economy, Emergence and development of Planning exercise in India – historical debates, plan models and shift in focus over time
2	Issues in Growth, Development and Sustainability[4L]

	Output (National Income) and Employment Structure of Indian Economy; Composition and relative rates of growth of agriculture, industry and services sectors; Sub-sectoral analysis.
3	Factors in development: Capital formation (physical and human)[12L] Trends and patterns in structure of population over time – growth rate, gender, rural-urban, literacy, regional; Structure and trends of Poverty and Inequality (interpersonal and regional); Inflation – trends, structure and causes; Unemployment – trends, structure and types.
4	Trends in Agricultural Production and Productivity [6L] Firm size and productivity, Land Reforms – Genesis, Progress and current status, new agricultural strategies.
5	Trends and Patterns of Industrial Sector[6L] Changes in the structure of Indian Industry; Small Scale Industries – Growth, Structure and its contribution in national economy; Public Sector – Growth, Structure, Historical role, Evolution and Dilution.
6	Trends in Exports and Imports[4L] Composition and Direction of Foreign Trade; Balance of Payments – Current Status

References:

1) R Dutta and K P M Sundaram: Indian Economy, S Chand
2) A.N.Agarwal: Indian Economy, Problems of Development and Planning, New Age.
3) Mishra and Puri: Indian Economy, Himalaya.
4) Planning Commission: Eleventh Five Year Plan, Vol I, II and III, Academic Foundation.
5) Government of India: Economic Survey (latest issue)

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	-	-	-	-	-	-	-	2	3	2
CO2	3	3	-	3	3	-	-	-	-	-	-	-	2	3	2
CO3	3	3	3	3	3	-	-	-	-	-	-	3	2	3	2
CO4	3	-	3	3	2	-	-	-	-	-	-	-	2	3	2
CO5	3	3	3	3	3	-	-	-	3	-	2	-	2	3	2
CO	2	3	3	3	3	-	-	-	3	-	2	3	2	3	2

Curriculum for B.TechUnder Autonomy
B.Tech. – Computer Science & Technology
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

SYLLABUS	
Semester – 8th C. MANDATORY ACTIVITIES / COURSES	
Course Code	**MC 801**
Course Name	**Essence of Indian Knowledge Tradition**
Lecture (per week)	
Tutorial (per week)	
Contact Hours (per week)	
Total Contact Hours	**36**
Credit	**3**

Prerequisite: None

Course Outcome(s) :
At the end of the course, student will be able to:

CO1	Identify the concept of Traditional knowledge and its importance
CO2	Explain the need and importance of protecting traditional knowledge.
CO3	Interpret the concepts of Intellectual property to protect the traditional knowledge.
CO4	Illustrate the various enactments related to the protection of traditional knowledge.
CO5	Explain the importance of Traditional knowledge in Agriculture and Medicine.
MODULE NUMBER	**COURSE CONTENT**
1	**[7L]** **Introduction to traditional knowledge:** Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, Indigenous Knowledge (IK), characteristics, traditional knowledge vis-a-vis indigenous knowledge, traditional knowledge Vs western knowledge traditional knowledge.
2	**[8L]** **Protection of traditional knowledge**: The need for protecting traditional knowledge Significance of traditional knowledge Protection, value of TK in global economy, Role of Government to harness traditional knowledge.
3	**[6L]** **Legal framework and TK:** The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, Plant Varieties Protection and Farmer's Rights Act, 2001 (PPVFR Act); The Biological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill, 2016.

4	[7L] **Traditional knowledge and intellectual property:** Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge.
5	[8L] **Traditional Knowledge in Different Sectors:** Traditional knowledge and engineering, Traditional medicine system, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Food security of the country and protection of traditional knowledge.
Text Books: 1. Traditional Knowledge System in India, by Amit Jha, 2009.	
Reference Books: 1. Traditional Knowledge System in India by Amit Jha Atlantic publishers, 2002. 2. "Knowledge Traditions and Practices of India" Kapil Kapoor1, Michel Danino2	

Web Links:
1.https://www.youtube.com/watch?v=LZP1StpYEPM
2.http://nptel.ac.in/courses/121106003/

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	3	-	-	-	-	-	-	-	2	3	2
CO2	3	3	3	3	-	-	-	-	-	-	-	-	2	3	2
CO3	3	3	3	3	3	-	-	-	-	-	2	3	2	3	2
CO4	3	2	3	3	-	-	-	-	-	-	-	-	2	3	2
CO5	3	3	3	3	3	-	-	-	3	-	2	-	2	3	2
CO	3	3	3	3	3	-	-	-	3	-	2	3	2	3	2