Narula Institute of Technology

Department of Computer Science and Engineering

Curriculum & Syllabus

Autonomy Regulation 2018

DEPARTMENT OF

COMPUTER SCINECE AND ENGINEERING

Departmental Vision

To develop responsible citizens who would ‘think global and act local’ and become the change agents of society to meet the challenges of future.

Departmental Mission

The mission of the Computer Science and Engineering Department is to build and sustain a high quality and broad area-based teaching and research program in computer science, to prepare students for successful professional careers both in industry, academics and as entrepreneur, and to provide service to the nation as a good human being.

Program Educational Objectives (PEOs)

PEO1: Graduates are prepared to be employed in IT industries and be engaged in learning, understanding, and applying new ideas.

PEO2: Graduates are prepared to take up Masters / Research programs.

PEO3: Graduates are prepared to be responsible computing professionals in their own area of interest.

PEO4: Graduates are prepared to be good entrepreneur and responsible social representatives.

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.

Program Specific Outcomes (PSOs)

PSO1. The ability to understand, illustrate, discuss, explain the fundamental design and working principle of any existing or new computing model or concept related to the field of computer science and engineering and analyze the utility of the model or concept in respect of its capability of addressing and solving the relevant issues or problems.

PSO2. The ability to identify and formulate a problem within the scope of computer science and engineering domain for proposing software application-based or research-based solution models with adequate justification by applying the relevant domain knowledge.

PSO3. The ability to ideate, design, implement and analyse a solution proposal with proper documentation demonstrating adequate software engineering management skill along with the necessary technical skill for driving propensity towards technological innovation boosted with research and entrepreneurial aptitude for producing globally competent engineering professionals capable of making meaningful contributions in the field of computer science and engineering.

Curriculum for B.Tech

Under Autonomy (GR A: ECE, EE, EIE, BME; GR B: CSE, IT, ME, CE, FT)

1st Semester								
Sl.No.	Course Code	Paper Code	Theory	Contact Hours/Week				Credit Points
				L	T	P	Total	
A. THEORY								
1	BS	M 101	Mathematics -I	3	1	0	4	4
2	BS	CH 101/ PH 101	Chemistry (Gr. A) / Physics- I (Gr. B)	3	0	0	3	3
3	ES	EE 101/ EC 101	Basic Electrical Engineering (Gr. A) / Basic Electronics Engineering (Gr. B)	3	0	0	3	3
4	HS	HU 101	English	2	0	0	2	2
Total of Theory							**12**	**12**
B. PRACTICAL								
5	BS	CH 191/ PH191	Chemistry Lab (Gr. A) / Physics- I Lab (Gr. B)	0	0	3	3	**1.5**
6	ES	EE 191/ EC 191	Basic Electrical Engineering Lab (Gr. A) / Basic Electronics Engineering Lab (Gr. B)	0	0	3	3	**1.5**
7	ES	ME 191/ ME 192	Engineering Graphics & Design (Gr A) / Workshop/Manufacturing Practices (Gr-B)	0	0	3	3	**1.5**
8	PROJ	PR 191	Project-IA	0	0	1	1	**0.5**
9	PROJ	PR 192	Project-IB	0	0	1	1	**0.5**
C. MANDATORY ACTIVITIES / COURSES								
10	MC	MC 181	Induction Program	0	0	0	0	
Total of Theory, Practical & Mandatory Activities/Courses							23	**17.5**

2nd Semester								
Sl.No.	**Course Code**	**Paper Code**	**Theory**	**Contact Hours/Week**				**Credit Points**
				L	**T**	**P**	**Total**	
A. THEORY								
1	BS	M 201	Mathematics -II	3	1	0	4	4
2	BS	CH 201/ PH 201	Chemistry - (Gr. B) / Physics – I (Gr. A)	3	0	0	3	3
3	ES	EE 201/ EC 201	Basic Electrical Engineering (Gr. B) / Basic Electronics Engineering (Gr. A)	3	0	0	3	3
4	ES	CS 201	Programming for Problem Solving	3	0	0	3	3
5	ES	ME 201	Engineering Mechanics	3	0	0	3	3
Total of Theory							**16**	**16**
B. PRACTICAL								
6	ES	CS291	Programming for Problem Solving Lab	0	0	3	3	**1.5**
7	BS	CH 291/ PH 291	Chemistry Lab (Gr. B) / Physics - I Lab (Gr. A)	0	0	3	3	**1.5**
8	ES	EE 291/ EC 291	Basic Electrical Engineering Lab (Gr. B) / Basic Electronics Engineering Lab (Gr. A)	0	0	3	3	**1.5**
9	ES	ME 291/ ME 292	Engineering Graphics & Design (Gr B) / Workshop/Manufacturing Practice (Gr-A)	0	0	3	3	**1.5**
10	HS	HU 291	Language Lab	0	0	2	2	**1**
11	PROJ	PR 291	Project-II	0	0	1	1	**0.5**
12	PROJ*	PR 292	Innovative activities-I	0	0	0	0	**0.5**
C. MANDATORY ACTIVITIES / COURSES								
13	MC	MC 281	NSS/ Physical Activities/Meditation & Yoga/Photography/ Nature Club	0	0	0	3	
Total of Theory, Practical & Mandatory Activities/Courses							34	**24.0**

* Inter/ Intra Institutional Activities viz; Training with higher Institutions; Soft skill training organized by
Training and Placement Cell of the respective institutions; contribution at incubation/ innovation /entrepreneurship cell of the institute; participation in conferences/ workshops/ competitions etc.; Learning at Departmental Lab/ Tinkering Lab/ Institutional workshop; Working in all the activities of
Institute's Innovation Council for eg: IPR workshop/Leadership Talks/ Idea/ Design/ Innovation/ Business Completion/ Technical Expos etc. (evaluation by Programme Head through certification)

Innovative activities to be evaluated by the Programme Head/ Event coordinator based on the viva voce
and submission of necessary certificates as evidence of activities.

3rd Semester								
Sl.No.	Type	Code	Theory	Contact Hours/Week				Credit Points
				L	T	P	Total	
A. THEORY								
1	BS	M(CSE)301	Mathematics-III	3	1	0	4	4
2	BS	PH301	Physics-II	3	0	0	3	3
3	PC	CS301	Digital Electronics and Computer Organization	3	0	0	3	3
4	PC	CS302	Data Structures	3	0	0	3	3
5	ES	CS 303	Circuit Theory and Network	2	0	0	2	2
Total of Theory							**15**	**15**
B. PRACTICAL								
6	BS	PH391	Physics-II Lab					
7	PC	CS391	Digital Electronics and Computer Organization Lab	0	0	3	3	**1.5**
8	PC	CS392	Data Structures Lab	0	0	3	3	**1.5**
9	PC	CS393	Programming with C++	0	0	3	3	**1.5**
10	PROJ	PR 391	Project-III	1	0	2	3	**1.5**
11	PROJ*	PR 392	Innovative activities-II	0	0	2	2	**1**
				0	0	0	1	**0.5**
C. MANDATORY ACTIVITIES / COURSES								
12	MC	MC 381	Behavioural and Interpersonal Skills	0	0	0	3	
Total of Theory, Practical & Mandatory Activities/Courses							33	**22.5**

*Students may choose either to work on participation in all the activities of Institute's Innovation Council
for eg: IPR workshop/ Leadership Talks/ Idea/ Design/ Innovation/ Business Completion/ Technical Expos
etc.

Innovative activities to be evaluated by the Programme Head/ Event coordinator based on the viva voce and
submission of necessary certificates as evidence of activities.

4 th Semester

Sl.No.	Course Code	Paper Code	Theory	Contact Hours/Week				Credit Points
				L	T	P	Total	
A. THEORY								
1	ES	M(CSE)401	Numerical Methods and Statistics	3	1	0	4	4
2	HS	HU 402	Economics for Engineers	3	0	0	3	3
3	PC	CS401	Computer Architecture	3	0	0	3	3
4	PC	CS402	Design and Analysis of Algorithms	3	0	0	3	3
5	PC	CS403	Formal Language and Automata Theory	3	0	0	3	3
Total of Theory							**16**	**16**
B. PRACTICAL								
6	ES	M(CSE)491	Numerical Methods and Statistics Lab	0	0	3	3	**1.5**
7	PC	CS491	Computer Architecture Lab	0	0	3	3	**1.5**
8	PC	CS492	Algorithms Lab	0	0	3	3	**1.5**
9	PROJ	PR 491	Project-IV	0	0	2	2	**1**
10	PROJ*	PR 492	Innovative activities-III	0	0	0	0	**0.5**
C. MANDATORY ACTIVITIES / COURSES								
11	MC	MC401	Constitution of India	3	0	0	3	
Total of Theory, Practical & Mandatory Activities/Courses							28	**20**

*Students may choose either to work on participation in all the activities of Institute's Innovation Council for eg:
IPR workshop/ Leadership Talks/ Idea/ Design/ Innovation/ Business Completion/ Technical Expos etc.

Innovative activities to be evaluated by the Programme Head/ Event coordinator based on the viva voce and submission of necessary certificates as evidence of activities.

Sl.No.	Course Code	Paper Code	Theory	Contact Hours/Week				Credit Points
				L	T	P	Total	
A. THEORY								
1	PC	CS501	Computer Graphics	3	0	0	3	3
2	PC	CS502	Operating System	3	0	0	3	3
3	PC	CS503	Data Base Management System	3	0	0	3	3
4	OE	CS504	A. Object Oriented Programming using Java B. Multimedia Technology C. Communication Engineering	3	0	0	3	3
5	PE	CS505	A. Operations Research B. Computational Geometry C. Distributed Algorithms	3	0	0	3	3
Total of Theory							**15**	**15**
B. PRACTICAL								
6	PC	CS591	Computer Graphics Lab	0	0	3	3	**1.5**
7	PC	CS592	Operating System Lab	0	0	3	3	**1.5**
8	PC	CS 593	Data Base Management System Lab	0	0	3	3	**1.5**
9	OE	CS594	A. Object Oriented Programming Lab B. Multimedia Technology Lab C. Communication Engineering Lab	0	0	2	2	**1**
10	PROJ	PR 591	Project-V	0	0	0	0	**0.5**
11	PROJ*	PR 592	Innovative activities-IV					
C. MANDATORY ACTIVITIES / COURSES								
12	MC	MC 501	Environmental Science	3	0	0	3	
Total of Theory, Practical & Mandatory Activities/Courses							32	**22.5**

* Students may choose either to work on participation in Hackathons etc. Development of new product/
Business Plan/ registration of start-up.
Students may choose to undergo Internship / Innovation / Entrepreneurship related activities.
Students may

choose either to work on innovation or entrepreneurial activities resulting in start-up or undergo internship
with industry/ NGO's/ Government organizations/ Micro/ Small/ Medium enterprises to make themselves
ready for the industry/ Long Term goals under rural Internship. (Duration 4-6 weeks)

Innovative activities to be evaluated by the Programme Head/ Event coordinator based on the viva voce and
submission of necessary certificates as evidence of activities.

6th Semester

Sl.No.	Course Code	Paper Code	Theory	Contact Hours/Week				Credit Points
				L	T	P	Total	
A. THEORY								
1	PC	CS601	Computer Network	3	0	0	3	3
2	PC	CS602	Microprocessors and Microcontrollers	2	1	0	3	3
3	PC	CS603	Software Engineering	3	0	0	3	3
4	PE	CS604	A. Compiler Design B. Computer Vision C. Simulation and modelling	3	0	0	3	3
5	OE	CS605	A. Pattern Recognition B. Distributed Operating System C. Distributed Database	3	0	0	3	3
6	OE	CS606	A. Data Warehousing and Data Mining B. Digital Image Processing C. E-commerce and ERP	3	0	0	3	3
Total of Theory							**18**	**18**
B. PRACTICAL								
7	PC	CS691	Computer Network Lab	0	0	3	3	**1.5**
8	PC	CS692	Microprocessors and Microcontrollers Lab	0	0	3	3	**1.5**
9	PC	CS693	Software Engineering Lab	0	0	3	3	**1.5**
10	PROJ	PR 691	Project-VI	0	0	2	2	**1**
11	PROJ*	PR 692	Innovative activities-V	0	0	0	0	**0.5**
C. MANDATORY ACTIVITIES / COURSES								
12	MC	MC 681	Technical Lecture Presentation & Group Discussion-I	0	0	3	3	
Total of Theory, Practical & Mandatory Activities/Courses							32	**24.0**

*Students may choose either to work on participation in all the activities of Institute's Innovation Council for
eg: IPR workshop/ Leadership Talks/ Idea/ Design/ Innovation/ Business Completion/ Technical Expos etc.

Innovative activities to be evaluated by the Programme Head/ Event coordinator based on the viva voce
and submission of necessary certificates as evidence of activities.

Sl No	Course Code	Paper Code	Theory	Contact Hours/Week				Points Total
				L	T	P	Credit	
A. THEORY								
1	HS	HU701	Values & Ethics in Profession	2	0	0	2	2
2	OE	CS701	A. Artificial Intelligence B. Robotics C. Data Analytics D. Accounting & Order to Cash	3	0	0	3	3
3	PE	CS702	A. Soft Computing B. Natural Language Processing C. Web Technology D. Advanced Database Management System E. Web Analytics F. Advanced Javascript G. Data Wrangling & Pattern analysis	3	0	0	3	3
4	PE	CS703	A. Cloud Computing B. Sensor Network and IOT C. Cryptography and Network Security D. Essentials of Organizational Behavior	3	0	0	3	3
Total of Theory								**11**
B. PRACTICAL								
5	OE	CS791	A. Artificial Intelligence Lab B. Robotics Lab C. Data Analytics Lab D. Accounting & Order to Cash Lab	0	0	3	3	1.5
6	PE	CS792	A. Soft Computing Lab B. Natural Language Processing Lab C. Web Technology Lab D. Advanced Database Management System Lab E. Web Analytics Lab F. Advanced Javascript Lab G. Data Wrangling & Pattern analysis Lab	0	0	3	3	1.5
7	PROJ	CS 791	Project-VII	0	0	0	6	3
8	PROJ*	CS 792	Innovative activities-VI	0	0	0	0	0.5
9	MC	MC 781	Social Awareness	0	0	3	3	
							26	17.5

*Students may choose either to work on participation in Hackathons etc. Development of new product/
Business Plan/ registration of start-up.

Students may choose to undergo Internship / Innovation / Entrepreneurship related activities. Students may
choose either to work on innovation or entrepreneurial activities resulting in start-up or undergo internship
with industry/ NGO's/ Government organizations/ Micro/ Small/ Medium enterprises to make themselves
ready for the industry/ Long Term goals under rural Internship. (Duration 4-6 weeks)

Innovative activities to be evaluated by the Programme Head / Event Coordinator based on the viva voce and
submission of necessary certificates as evidence of activities.

8th Semester

Sl No	Course Code	Paper Code	Theory	Contact Hours/Week				Points Total
				L	T	P	Credit	
A. THEORY								
1	HS	HU804	Principles of Management	2	0	0	2	2
2	PE	CS801	A. Mobile Computing B. Bio-informatics C. Cyber Law and Security Policy D. VLSI Design E. Client Relationship Management F. Application of Wordpress G. Agile Project Management	3	0	0	3	3
3	PE	CS802	A. Parallel Computing B. Machine Learning C. Real Time Embedded System D. Advanced Computer Architecture E. Business Essentials	3	0	0	3	3
Total of Theory							**8**	**8**
B. PRACTICAL								
4	PROJ	CS 891	Design Lab	0	0	2	2	1
5	PROJ*	CS 892	Project-VIII	0	0	0	6	3
6	MC	MC 801	Essence of Indian Knowledge Tradition	3	0	0	3	
							19	12

NOTE:

1. **Students may choose credit transfer from MOOCS (Preferably SWAYAM platform) or can take from industry only in the final year for Elective subjects on approval of the Department.**
2. **Project in final year in collaboration with industry are encouraged but mentor from department has to be assigned and progress of work should be shared with the mentor on regular basis. Also department will evaluate the project even if the industry concerned evaluates the same.**

Mandatory Credit Point=160

For Honors additional 20 Credit Point is to be earned (1st Sem to 8th Sem) through MOOCs courses. All the Certificates received by the students across all semester for MOOCs Courses from approved organization (Appendix A) are to be submitted to CoE office prior to 8th Semester Examination.

Syllabus

Department: Computer Science & Engineering

Curriculum Structure & Syllabus
(Effective from 2018-19 admission batch)

Under Autonomy (**GR A:** ECE, EE, EIE, BME; **GR B:** CSE, IT, ME, CE, FT)

1st Semester								
Sl.No.	**Course Code**	**Paper Code**	**Theory**	**Contact Hours/Week**				**Credit Points**
				L	**T**	**P**	**Total**	
A. THEORY								
1	BS	**M 101**	Mathematics -I	3	1	0	4	4
2	BS	CH 101/ PH 101	Chemistry (Gr. A) / Physics- I (Gr. B)	3	0	0	3	3
3	ES	EE 101/ EC 101	Basic Electrical Engineering (Gr. A) / Basic Electronics Engineering (Gr. B)	3	0	0	3	3
4	HS	HU 101	English	2	0	0	2	2
Total of Theory							**12**	**12**
B. PRACTICAL								
5	BS	CH 191/ PH191	Chemistry Lab (Gr. A) / Physics- I Lab (Gr. B)	0	0	3	3	**1.5**
6	ES	EE 191/ EC 191	Basic Electrical Engineering Lab (Gr. A) / Basic Electronics Engineering Lab (Gr. B)	0	0	3	3	**1.5**
7	ES	ME 191/ ME 192	Engineering Graphics & Design (Gr A) / Workshop/Manufacturing Practices (Gr-B)	0	0	3	3	**1.5**
8	PROJ	PR 191	PROJECT-IA	0	0	1	1	**0.5**
9	PROJ	PR 192	PROJECT-IB	0	0	1	1	**0.5**
C. MANDATORY ACTIVITIES / COURSES								
10	MC	MC 181	Induction Program	0	0	0	0	
Total of Theory, Practical & Mandatory Activities/Courses							23	**17.5**

Syllabus- 1st Semester

Course Name: Mathematics-I
Course Code: M 101
Contact: 3:1:0
Total Contact Hours: 48
Credits: 4

Course Objectives:
The objective of this course is to disseminate the prospective engineers with techniques in matrix algebra and calculus. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

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

Course Outcomes (COs):

After completion of the course students would be able to

CO1	Understand and recall the properties and formula related to matrix algebra, differential calculus,
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
CO5	Apply different engineering problems linked with matrix algebra, differential calculus, multivariable calculus, vector calculus

Course Content:
Module I: Matrix Algebra (11)
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.

Module II: Differential Calculus and Infinite Series (10)
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, Power series; Taylor's series, Series for exponential, trigonometric and logarithm functions.

Module III: Multivariable Calculus (Differentiation) - I (9)
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.

Module IV: Multivariable Calculus (Differentiation) - II (7)

Maxima and minima of functions of two variables, Method of Lagrange multipliers; Directional derivatives, Gradient, Divergence, Curl.

Module V: Integral Calculus (11)
Evolutes and involutes; Evaluation of definite integrals and its applications to evaluate surface areas and volumes of revolutions; Improper integrals; Beta and Gamma functions and their properties.

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.

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, 1969

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
M101.1	3	2	3	2								2
M101.2	3	3	3	3								2
M101.3	3	3	3	3								2
M101.4	3	3	3	3								2
M101.5	3	3	3	3								2

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
M101.1	2	2	2
M101.2	2	2	2
M101.3	2	2	2
M101.4	2	2	2
M101.5	2	2	2

Course Name: Physics –I
Course Code: PH 101
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Course Objective:
The aim of courses in Physics is to provide an adequate exposure and develop insight about the basic physics principles along with the possible applications. The acquaintance of basic principles of physics would help engineers to understand the tools and techniques used in the industry and provide the necessary foundations for inculcating innovative approaches. It can also create awareness of the vital role played by science and engineering in the development of new technologies. It also gives necessary exposure to the practical aspects, which is an essential component for learning sciences.
Course Objectives

Pre requisites: Knowledge of Physics up to 12th standard.

Course Content:
Module 1 (6L):
Waves & Oscillations:
Simple Harmonic Motion (only preliminary idea), 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.

Module 2 (8L):
Classical Optics:
2.01- Interference of light: Huygens' s principle, superposition of waves, conditions of sustained interference, Newton's ring (qualitative descriptions of working principles and procedures-no deduction required). Engineering applications, Numerical Problems.

2.02- Diffraction of light: Fresnel and Fraunhofer class, Fraunhoffer diffraction of a single slit, multiple slits, intensity distributions, missing order, Rayleigh criterion (no deduction) and resolving power of grating and microscope (no deduction), related numerical problems.

Module 3 (8L):
Quantum Mechanics-I:
3.01 Quantum Theory: Inadequacy of classical physics and its modifications by Planck' s quantum hypothesis-qualitative (no deductions), 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: Concept of wave function, physical significance of wave function, probability interpretation; normalization of wave functions; uncertainty principle, relevant numerical problems.

Module 4 (7L):
Solid State Physics-I:
4.01 Crystal Structure: 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.

4.02 Semiconductor: Physics of semiconductors, electrons and holes, metal, insulator and semiconductor, intrinsic and extrinsic semiconductor, p-n junction.

Module 5 (7L):
Modern Optics-I:
5.01- Laser: Concepts of various emission and absorption process, Einstein A and B 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.

5.02-Fibre optics: Principle and propagation of light in optical fibres- Numerical aperture and Acceptance angle, Numerical problems.

Text Books:

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

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. Physical Optics Möler
8. Optics -F.A. Jenkins and H.E White

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

Solid State Physics-I:

1. Solid state physics-Puri & Babbar (S. Chand publishers)
2. Materials Science & Engineering-Kakani Kakani
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.)

Reference 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 Prakashani Pvt. Ltd.)
3. Perspective & Concept of Modern Physics -Arthur Baiser
4. Principles of engineering physics − Md. N Khan and S Panigrahi.

Course Outcomes (COs):

After completion of the course students would be able to

PH101.1	Describe various types of mechanical resonance and its electrical equivalence
PH101.2	Explain basic principles of Laser, Optical fibers and Polarization of light
PH101.3	Apply superposition principle to explain interference and diffraction
PH101.4	Analyze different crystallographic structures according to their co-ordination number and packing factors
PH101.5	Determine and justify the need of a quantum mechanics as remedy to overcome limitations imposed by classical physics

CO.PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PH101.1	3	3	2	2								
PH101.2	3	3	2	2								
PH101.3	3	3	2	2								
PH101.4	3	3	2	2								
PH101.5	3	3	2	2								

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
PH101.1	2	2	2
PH101.2	2	2	2
PH101.3	2	2	2
PH101.4	2	2	2
PH101.5	2	2	2

Course Name: Basic Electronics Engineering
Course Code: EC101

Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Course Objective:

1. To understand the behavior of Conductors, Insulators, and Semiconductors based on energyband theory and relevant problems.
2. To instill the knowledge of working principles of P-N Junction Diode, Zener diode and analyze their applications in the rectifier, clipper, clamper, regulator etc.
3. To familiarize with the characteristics of Bipolar junction transistor(BJT) under CE, CE, CC mode of operation and its biasing mechanisms.
4. To understand working principles of JFET, MOSFET and perform operations under CG, CS, CD configurations for parametric observation.
5. To determine the parameters due to the effect of feedback in amplifier to ,adder circuit , integrator and differentiator circuit using Operational Amplifier

Prerequisites:
Electric current and voltage-D.C and A.C., Complex impedance, conductivity, resistivity, transformer charging and discharging of capacitor, active and passive elements.

Course Outcomes (COs):

After completion of the course students would be able to

CO1	Study PN junction diode, ideal diode, diode models and its circuitanalysis,
CO2	Learn how operational amplifiers are modeled and analyzed, and to design Op-Amp circuits to perform operations such as integration, differentiation on electronic signals
CO3	Study the concepts of both positive and negative feedback in electroniccircuits
CO4	Develop the capability to analyze and design simple circuits containing non-linear elements such as transistors using the concepts of load lines, operating points and incremental analysis.
CO5	Learn how the primitives of Boolean algebra are used to describe theprocessing of binary signals.

Course Content:

Module-I: Basics of semiconductor (6L)
Conductors, Insulators, and Semiconductors- crystal structure, Fermi Dirac function, Fermi level, Energy band diagrams, valence band, conduction band, and band gap; intrinsic, and extrinsic (p-type and n-type) semiconductors, position of Fermi level in intrinsic and extrinsic semiconductor, drift and diffusion current – expression only (no derivation) , mass action law , charge neutrality in
semiconductor, Einstein relationship in semiconductor , Numerical problems.

Module-II: P-N Junction Diode and its applications (8L)
p-n junction formation and depletion region, energy band diagram of p-n junction at equilibrium and barrier energy, built in potential at p-n junction, energy band diagram and current through p-n junction at forward and reverse bias, Static and Dynamic resistance of Diode, Transition capacitance and diffusion capacitance, V-I characteristics and current expression of diode, temperature dependencies of V-I characteristics of diode, p-n junction breakdown – conditions, avalanche and Zener breakdown,
Concept of Junction capacitance, Zener diode and characteristics..

Diode half wave and full wave rectifiers (centre tapped and bridge) circuits and operation (I_{DC}, I_{rms}, V_{Dc}, V_{rms}), ripple factor without filter, efficiency, PIV, TUF; Reduction of ac ripples using filter circuit (Qualitative analysis); Design of diode clipper and clamper circuit - explanation with example, application of Zener diode in regulator circuit. Numerical problems.

Module-III: Bipolar junction transistor (6L)
Concept of "Transistor", Formation of PNP/NPN Transistors, energy band diagram, current conduction mechanism, CE, CB, CC configurations, transistor static characteristics in CE, CB and CC mode,
junction biasing condition for active, saturation and cut-off modes, current gain α, β and γ, early effect. Biasing and bias stability; biasing circuits - fixed bias; voltage divider bias; collector to base bias, D.C.
load line and Quiescent point, calculation of stability factors for different biasing circuits. BJT as an amplifier and as a switch – Graphical analysis; Numerical Problems.

Module-IV: Field effect transistor (6L)
Concept of "field effect", Classification of FETs-JFET, MOSFET, operating principle of JFET. Drain and transfer characteristics of JFET (n-channel and p-channel), CS, CG, CD configurations, Relation between JFET parameters. FET as an amplifier and as a switch– graphical analysis. E-MOSFET (nchannel and p-channel), D-MOSFET (n-channel and p-channel), Numerical Problems.

Module-V: Feedback and Operational Amplifier (8L)
Concept of feedback with block diagram, positive and negative feedback, gain with feedback. Feedback topologies, effect of feedback on input and output impedance, distortion, concept of oscillation and Barkhausen criterion. Operational amplifier – electrical equivalent circuit, ideal characteristics, non-ideal characteristics of op-amp – offset voltages; bias current; offset current; Slew rate; CMRR and bandwidth, Configuration of inverting and non-inverting amplifier using Op-amp, closed loop voltage gain of inverting and noninverting amplifier, Concept of virtual ground, Applications op-amp – summing amplifier; differential
amplifier; voltage follower; basic differentiator and integrator, Numerical Problems.

Module-VI: Cathode Ray Oscilloscope (2L)
Operating principle of CRO with block diagram, measurement of voltage, frequency and phase.

Text Books :

1. D. Chattopadhyay, P. C. Rakshit, Electronics Fundamentals and Applications, New Age International
2. Millman & Halkias, Integrated Electronics, Tata McGraw Hill.
3. Sedra & Smith, Microelectronics Engineering

Reference Books :

1. John D. Ryder, Electronic Fundamentals and Applications, PHI
2. J.B.Gupta, Basic Electronics, S.K. Kataria.
3. Malvino: Electronic Principle.
4. Boyelstad & Nashelsky: Electronic Devices & Circuit Theory, McGraw Hill, 1976.

Course Outcomes (COs):

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EC101.1	2	3	3	3			-	-				
EC101.2	3		3				-	-				
EC101.3	3		3	3			-	-				
EC101.4	2	3	3				-	-				
EC101.5	3	3	2	3			-	-				

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
EC101.1	2	2	2
EC101.2	2	3	2
EC101.3	2	2	2
EC101.4	3	2	2
EC101.5	2	2	2

Course Name: English
Course Code: HU101
Contact: 2:0:0
Total Contact Hours: 24
Credits: 2

Course Objectives: The basic objectives of this course are to impart professional communication skills in the globalized workplace context, to enable functional competence in reading and writing so as to create industry-ready personnel.

Prerequisites: The course presupposes a high school level knowledge of English grammar, punctuation, and elementary to intermediate reading and writing skills.

Course Outcomes (COs):

After completion of the course students would be able to

CO1	Understand about and use the modalities and nuances of communication in a workplace context.
CO2	Understand about communicating across cultures and societies.
CO3	Understand and know about and apply the basic formats, templates of business and official communication.
CO4	Understand and know about and employ formal communication modes in meetings and reports.
CO5	Understand and know about and use objective and culturally neutral language in interpersonal and business communication.

Course Content:

Module 1: Communication in a Globalized World **4L**

1.1 Definition, Process, Types of Communication
1.2 Verbal and Non-Verbal Communication
1.3 Barriers to Communication
1.4 Workplace Communication

Module 2: Functional Grammar **4L**

2.1Articles, Prepositions and Verbs
2.2 Verb-Subject Agreement
2.3 Voice, Modality and Modifiers
2.4 Direct and Indirect Speech
2.5 Common Errors in English

Module 3: Vocabulary and Reading **6L**

3.1 Word Roots, Prefixes and Suffixes
3.2 Antonyms, Synonyms and one word Substitution
3.3 Reading– Purposes and Skills (Skimming, Scanning & Intensive Reading)
3.4 Reading Comprehension (Fictional and Non-fictional prose)
Pre-requisite-

Module 4: Professional Writing 10L

4.1Writing Functions: Describing, Defining, Classifying
4.2 Structuring– coherence and clarity
4.3 Business Writing– Letters (Enquiry, Order, Sales, Complaint, Adjustment, Job Application letters), Memos, Notices, Circulars, Agendas and Minutes of Meetings).

4.4 E-mails– types, conventions, jargons and modalities.
4.5 Reports and Proposals
4.6 Précis writing
4.7 Essay writing
4.8 Punctuation and its importance in writing
4.9 Writing for an Audience

Text Books:

1. Ruskin Bond: The Night Train at Deoli OR Khushwant Singh: The Portrait of a Lady
2. Roald Dahl: Lamb to the Slaughter OR Somerset Maugham: The Man with the Scar
3. Anne Frank: The Diary of a Young Girl (Letters of 3rd February 1944, 12th February 1944 and 13th February 1944) OR Jawaharlal Nehru: "How Britain Ruled India" (Glimpses of World History, Chap 112)

Reference Books:

1. Raymond Murphy. English Grammar in Use. 3rd Edn. CUP, 2001.
2. A. J Thomson and A. V. Martinet. A Practical English Grammar Oxford: OUP, 1980.
3. Michael Swan. Practical English Usage. Oxford: OUP, 1980.
4. Simeon Potter. Our Language. Oxford: OUP, 1950.
5. Pickett, Laster and Staples. Technical English: Writing, Reading & Speaking. 8th ed. London: Longman, 2001.
6. Ben Heasley and Liz Hamp-Lyons. Study Writing. Cambridge: CUP, 2006.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
HU101.1						2			3	3		3
HU101.2						2			3	3		3
HU101.3						2			3	3		3
HU101.4						2			3	3		3
HU101.5						2			3	3		3

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
HU101.1	2	2	2
HU101.2	2	2	2
HU101.3	2	2	2
HU101.4	2	2	2
HU101.5	2	2	2

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

Pre requisites: Knowledge of Physics upto 12th standard.

Course Outcomes (COs):

After completion of the course students would be able to

CO1	Demonstrate experiments allied to their theoretical concepts
CO2	Conduct experiments using LASER, Optical fiber, Torsional pendulum, Spectrometer
CO3	Analyze and participate as 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.
CO5	Design solutions for real life challenges.

List of 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 period using various load of the oscillator.

2. Determination of elastic moduli of different materials (Young's modulus /Rigidity modulus)

Experiments on Classical Optics:

3. Determination of wavelength of light by Newton's ring method.

4. Determination of wavelength of light by Laser diffraction method.

Experiments on Quantum Physics-I:

5. Determination of Planck's constant using photoelectric cell.

6. Verification of Bohr's atomic orbital theory through Frank-Hertz experiment.

7. Determination of Stefan's Constant

Experiments on Solid State Physics-I:

8. Determination of Band gap of a semiconductor

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

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 Poiseullie's capillary flow method/using Stoke's law.
5. Measurement of nodal and antinodal points along transmission wire and measurement of wave length.
6. Any other experiment related to the theory**.**
7. Innovative Experiments

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PH191.1	2	3	2	3	3							
PH191.2	2	3	2	3	3							
PH191.3	2	3	2	3	3							
PH191.4	2	3	2	3	3							
PH191.5	2	3	2	3	3							

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
PH191.1	2	2	2
PH191.2	2	2	2
PH191.3	2	2	2
PH191.4	2	2	2
PH191.5	2	2	2

Course Name: Basic Electronics Engineering Lab
Course Code: EC 191
Contact: 0:0:3
Credit: 1.5

Course Objective:
The objectives of this course are

1. To prepare the students to have a basic knowledge of active and passive components.
2. To build knowledge to distinguish pure and impure DC signals.
3. To grow measuring ability of signals through multi meter and CRO
4. To understand characteristics of proper biasing for BJT and FET.
5. To encourage in developing circuits using diodes, transistors, FETs and OPAMPs.

Prerequisites: A basic course in electronics and Communication engineering Progresses from the fundamentals of electricity, active and passive components, basic electronics laws like Ohms law, Ampere's law.

Course Outcomes (COs):

After completion of the course students would be able to

CO1	Knowledge of Electronic components such as Resistors, Capacitors, Diodes, Transistors measuring equipment like DC power supply, Multimeter, CRO, Signal generator, DC power supply.
CO2	Analyze the characteristics of Junction Diode, Zener Diode, BJT & FET anddifferent types of Rectifier Circuits.
CO3	Determination of input-offset voltage, input bias current and Slew rate, Common-mode Rejection ratio, Bandwidth and Off-set null of OPAMPs.
CO4	Able to know the application of Diode, BJT &OPAMP.
CO5	Familiarization and basic knowledge of Integrated Circuits

List of Experiments:

1. Familiarization with passive and active electronic components such as Resistors, Inductors, Capacitors, Diodes, Transistors (BJT) and electronic equipment like DC power supplies, millimeters etc.
2. Familiarization with measuring and testing equipment like CRO, Signal generators etc.
3. Study of I-V characteristics of Junction diodes.
4. Study of I-V characteristics of Zener diodes.
5. Study of Half and Full wave rectifiers with Regulation and Ripple factors.
6. Study of I-V characteristics of BJTs.
7. Study of I-V characteristics of Field Effect Transistors.
8. Determination of input-offset voltage, input bias current and Slew rate of OPAMPs.
9. Determination of Common-mode Rejection ratio, Bandwidth and Off-set null of OPAMPs.
10. Study of OPAMP circuits: Inverting and Non-inverting amplifiers, Adders, Integrators and Differentiators.
11. Study of Logic Gates and realization of Boolean functions using Logic Gates.
12. Study of Characteristic curves for CB, CE and CC mode transistors.
13. Innovative Experiment

Text Books:

1. D. Chattopadhyay, P. C. Rakshit, Electronics Fundamentals and Applications, New Age International
2. Millman & Halkias, Integrated Electronics, Tata McGraw Hill.

3. Sedra & Smith, Microelectronics Engineering

Reference Books:

1. John D. Ryder, Electronic Fundamentals and Applications, PHI
2. J.B. Gupta, Basic Electronics, S.K. Kataria.
3. Malvino: Electronic Principle.
4. Boyelstad & Nashelsky: Electronic Devices & Circuit Theory, McGraw Hill, 1976.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EC191.1	3	3	3	3	3							
EC191.2	3	3	3	3	3							
EC191.3	3	3	3	3	3							
EC191.4	3	3	3	3	3							
EC191.5	3	3	3	3	3							

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
EC191.1	2	2	2
EC191.2	2	2	2
EC191.3	2		2
EC191.4	2	2	2
EC191.5	2	2	2

Course Name: Workshop/Manufacturing Practices
Course Code: ME 192
Contact: 0:0:3
Credit: 1.5

Course Objectives:
To understand the basic knowledge of Workshop Practice and Safety. To identify and use of different hand tools and other instruments like Hack Saw, Jack Plane, Chisels etc. and operations like Marking, Cutting etc. To expose students to different types of manufacturing/fabrication processes

Prerequisite: Higher Secondary with Mathematics, Physics and Chemistry

Course Outcomes (COs):

After completion of the course students would be able to

CO1	Understand Engineering Graphics and visual aspects of design.
CO2	Understand and apply common drafting tools with the knowledge of drafting standards.
CO3	Apply computer aided drafting techniques to represent line, surface or solid models in different Engineering viewpoints.
CO4	Create part models; carry out assembly operation and show working procedure of a designed project work using animation.
CO5	Apply common drafting tools with the knowledge of drafting standards and create project work using animation.

Course Content:

(i) Theoretical discussion & videos: (3P)

Detailed contents:

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.

(ii) Workshop Practice:

Module 1 - Machine shop (6P)
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.

Module 2 - Fitting shop (6P)
Typical jobs that may be made in this practice module:
i. To make a Gauge from MS plate.

Module 3 - Carpentry (6P)
Typical jobs that may be made in this practice module:
i. To make wooden joints and/or a pattern or like.

Module 4 - Welding shop (Arc welding 3P + gas welding 3P) (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 metal arcwelding.
ii. GAS WELDING (3P): To join two thin mild steel plates or sheets by gas welding.

Module 5 - Electrical & Electronics (3P)
House wiring, soft Soldering

Module 6 – Smithy (3P)
Typical jobs that may be made in this practice module:
i. A simple job of making a square rod from a round bar or like.
For further study (Optional)

Module 7 - Casting
Typical jobs that may be made in this practice module:
i. One/ two green sand moulds to prepare, and a casting be demonstrated.

Module 8 - Plastic moulding & Glass Cutting (3P)
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.

iii. Innovative experiment

Text Books:

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of WorkshopTechnology", 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
ME192.1	3	3	3	3	3	3						
ME192.1	3	3	3	3	3	3						
ME192.1	3	3	3	3	3	3						
ME192.1	3	3	3	3	3	3						
ME192.1	3	3	3	3	3	3						

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
ME192.1	2	2	2
ME192.1	2	2	2
ME192.1	2	2	2
ME192.1	2	2	2
ME192.1	2	2	2

Curriculum for B.Tech 2nd Semester

Under Autonomy (**GR A:** ECE, EE, EIE, BME; **GR B:** CSE, IT, ME, CE, FT)

2nd Semester								
Sl.No.	**Course Type**	**Course Code**	**Theory**	**Contact Hours/Week**				**Credit Points**
				L	**T**	**P**	**Total**	
A. THEORY								
1	BS	M 201	Mathematics -II	3	1	0	4	4
2	BS	CH 201/ PH 201	Chemistry - (Gr. B) / Physics – I (Gr. A)	3	0	0	3	3
3	ES	EE 201/ EC 201	Basic Electrical Engineering (Gr. B) / Basic Electronics Engineering (Gr. A)	3	0	0	3	3
4	ES	CS 201	Programming for Problem Solving	3	0	0	3	3
5	ES	ME 201	Engineering Mechanics	3	0	0	3	3
Total of Theory							**16**	**16**
B. PRACTICAL								
6	ES	CS291	Programming for Problem Solving Lab	0	0	3	3	**1.5**
7	BS	CH 291/ PH 291	Chemistry Lab (Gr. B) / Physics - I Lab (Gr. A)	0	0	3	3	**1.5**
8	ES	EE 291/ EC 291	Basic Electrical Engineering Lab (Gr. B) / Basic Electronics Engineering Lab (Gr. A)	0	0	3	3	**1.5**
9	ES	ME 291/ ME 292	Engineering Graphics & Design (Gr B) / Workshop/Manufacturing Practice (Gr-A)	0	0	3	3	**1.5**
10	HS	HU 291	Language Lab	0	0	2	2	**1**
11	PROJ	PR 291	Project-II	0	0	1	1	**0.5**
12	PROJ*	PR 292	Innovative activities-I	0	0	0	0	**0.5**
C. MANDATORY ACTIVITIES / COURSES								
13	MC	MC 281	NSS/ Physical Activities/Meditation & Yoga/Photography/ Nature Club	0	0	0	3	
Total of Theory, Practical & Mandatory Activities/Courses							34	**24**

* Inter/ Intra Institutional Activities viz; Training with higher Institutions; Soft skill training organized by Training and Placement Cell of the respective institutions; contribution at incubation/ innovation /entrepreneurship cell of the institute; participation in conferences/ workshops/ competitions etc.; Learning at Departmental Lab/ Tinkering Lab/ Institutional workshop; Working in all the activities of Institute's Innovation Council for eg: IPR workshop/Leadership Talks/ Idea/ Design/ Innovation/ Business Completion/ Technical Expos etc. (evaluation by Programme Head through certification)

Innovative activities to be evaluated by the Programme Head/ Event coordinator based on the viva voce and submission of necessary certificates as evidence of activities.

Syllabus- 2nd Semester

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

Course Objectives: The objective of this course is to disseminate the prospective engineers with techniques in multivariable calculus, ordinary differential equations and Laplace transform. It aims to equip the students with concepts and tools at an intermediate to advanced level of mathematics and applications that they would find useful in their disciplines.

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

Course Outcomes (COs):

After completion of the course students would be able to

CO1	Determine and 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.
CO5	Apply engineering solutions by using differential equation, Laplace Transform and Numerical Methods.

Course Content:
Module I: Multivariable Calculus (Integration): (12 L)
Double integration, Change of order of integration in double integrals, Triple integrals, vector line integrals, scalar surface integrals, vector surface integrals, Green's theorem, Gauss divergence theorem and Stokes' theorem.

Module II: First Order Ordinary Differential Equations: (10 L)
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 , solvable for y solvable for and Clairaut's equation.

Module III: Second Order Ordinary Differential Equations: (12 L)
Solution of second order ODE with constant coefficients: C.F. & P.I., Method of variation of parameters, Cauchy-Euler equations, Reduction of 2nd order ODE to a pair of first order ODEs, Solution of simultaneous linear ODEs.

Module IV: Laplace Transform: (14L)
Definition and existence of LT, LT of elementary functions, First and second shifting properties, Change of scale property, LT of , LT of , LT of derivatives of f (t), LT of ,
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.

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.

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.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
M201.1	3	3	3	3								2
M201.2	3	3	3	3								2
M201.3	3	3	3	3								2
M201.4	3	3	3	3								2
M201.5	3	3	3	3								2

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
M201.1	2	2	2
M201.2	2	2	2
M201.3	2	2	2
M201.4	2	2	2
M201.5	2	2	2

Course Name: Chemistry
Course Code: CH201
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Course Objective:
The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications.

Pre requisites: Knowledge of Chemistry up to 12th standard.

Course Outcomes (COs):

After completion of the course students would be able to

CO1	Able to apply fundamental concepts of thermodynamics in different engineering applications.
CO2	Able to analyze & design simple and technologically advanced electrical and energy storagedevices.
CO3	Able to synthesize nanomaterials, composites, polymers.
CO4	Able to apply the basic concept of Organic Chemistry and knowledge of chemical reactions to industries , and technical fields.
CO5	Able to apply the knowledge of different fuels and corrosion to different industries

Course Content:

Module I: Inorganic Chemistry (9 L) (i) Atomic structure (5 L)

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 (4 L)

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.

Module II: Physical Chemistry (8 L)

(i) Use of free energy in chemical equilibria (6 L)

Thermodynamic functions: internal energy, enthalpy, entropy and free energy. 2nd Law of Thermodynamics, Estimations of entropy and free energies, Free energy and emf, Cell potentials, the Nernst equation and applications.

(ii) **Real Gases (2 L)**

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.

Module III: Organic Chemistry (8 L)

(i) **Stereochemistry (4 L)**

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)

Module IV: Industrial Chemistry 8L
(i) **Water (2 L):** Hardness, alkalinity, numerical
(ii) **Corrosion. (2 L):** Types of corrosion: wet & dry, preventive measures
(iii) **Polymers (3 L):** Classification of polymers, conducting polymers, biodegradable polymers
(iv) **Synthesis of a commonly used drug molecule. (1 L):** Paracetamol, Aspirin

Module V: Spectroscopic techniques in Chemistry (3L)
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
(i) A Text Book of Organic Chemistry, Arun Bahl & Arun Bahl
(ii) General & Inorganic Chemistry, P.K. Dutt
(iii) General & Inorganic Chemistry, Vol I, R.P. Sarkar
(iv) Physical Chemistry, P.C. Rakshit

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

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CH201.1	3	2	3	2			3					
CH201.2	3	2	3	2			3					
CH201.3	3	2	3	2			3					
CH201.4	3	2	3	2			3					
CH201.5	3	2	3	2			3					

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CH201.1	2	2	2
CH201.2	2	2	2
CH201.3	2	2	2
CH201.4	2	2	2
CH201.5	2	2	2

Course Name: Basic Electrical Engineering
Course Code: EE201
Contact: 3:0:0
Total Contact hours: 36
Credits: 3

Course Objective:
To introduce the students to basic principles of DC and AC circuits, Electrical Machines and Electrical
Systems.

Prerequisites:

- Basic 12th standard Physics and Mathematics.
- Concept of components of electric circuit.

Course Outcomes (COs):

After completion of the course students would be able to

CO1	Understand and analyze basic electric circuits
CO2	Determine and study the working principles of electrical machines.
CO3	Understand the components of low voltage electrical installations
CO4	Design the fundamentals of electrical Power systems and Control Systems
CO5	Analyze and study the fundamentals of electrical Power systems and Control Systems

Course contents:
Module I: DC Circuits (9L)
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.

Module II: AC Fundamentals (9L)
Sinusoidal quantities, Average and RMS values, peak factor, Form factor, Phase and Phase difference, concept of phasor diagram, V-I Relationship in R, L, C circuit, Combination R-L-C in series and parallel circuits with phasor diagrams, impedance and admittance, impedance triangle and power triangle, Power factor, concept of resonance, Power in AC circuit, simple problems (series and parallel circuit only), Three-phase balanced circuits, Concept of three-phase power measurement.

Module III: Single-Phase Transformer (5L)
Brief idea on constructional parts, classifications, working principle. Problems on EMF equation. Phasor diagram, Equivalent circuit.

Module IV: Electrical Rotating Machines (8L)
a)DC Machines (4L)
Brief idea on constructional features, classifications, working principle of both motor and generator. Simple problems on Voltage equation.

b) Three-Phase Induction Motor (4L)
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). No

numerical problem.

Module V: General Structure of Electrical Power System (1L)
Power generation to distribution through overhead lines and underground cables with single line diagram.

Module VI: Electrical Installations (4L)
Earthing of Electrical Equipment, ideas of basic components- MCB, MCCB, ELCB, SFU, Megger.

Text books:
1. D. 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**.**

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EE201.1	3	3	3	3								
EE201.2	3	3	3	3								
EE201.3	3	3	3	3								
EE201.4	3	3	3	3								
EE201.5	3	3	3	3								

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
EE201.1	2	2	2
EE201.2	2	2	2
EE201.3	2	2	2
EE201.4	2	2	2
EE201.5	2	2	2

Reference books:

1. E. Hughes, “Electrical and Electronics Technology”, Pearson, 2010.
2. V. D. Toro, “Electrical Engineering Fundamentals”, Printice Hall India, 1989.

Course Name: Programming for Problem Solving
Course Code: CS 201
Contact: 3:0:0
Total Contact Hours: 36 Credits: 3

Prerequisites: Number system, Boolean algebra

Course Outcomes (COs):

After completion of the course students would 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	Understand the 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
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.

Course Content:

Fundamentals of Computer: (8 L)
History of Computer, Generation of Computer, Classification of Computers, Basic structure of Computer System, Primary & Secondary Memory, Processing Unit, Input & Output devices. 2L

Binary and Allied number systems representation of signed & unsigned numbers, BCD, ASCII, Binary number. Arithmetic – Addition and Subtraction (using 1's complement and 2's complement). 2L

Overview of Procedural vs Structural language, compiler and assembler (basic concepts) 1L Problem solving- Algorithm & flow chart. 2L

C Fundamentals: (28 L)
Variable and Data Types: The C character set identifiers and keywords, data type & sizes, variable names, declaration, statements. 2L

C 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, bit fields. 4L

Branching and Loop Statements:
Statement and blocks, if - else, switch, goto and labels, Loops - while, for, do while, break and continue.

4L

Fundamentals and Program Structures:
auto, external, static and register variables Functions, function types, function prototypes, functions returning values, functions not returning values, scope rules, recursion, C preprocessor and macro.

5L

Arrays, Strings and Pointers:
One dimensional arrays, Two-dimensional arrays, Multidimensional arrays. Passing an array to a function Character array and string, array of strings, Passing a string to a function, String related functions, Pointers, Pointer and Array, Pointer and String, Pointer and functions, Dynamic memory allocation. 7L

Structures and Unions:
Basic of structures, arrays of structures, structures and pointers, structures and functions. 3L

Files handling with C:
formatted and unformatted files, Command line arguments, fopen, fclose, fgetc, fputc, fprintf, fscanf function. 3L

Text book:

Kerninghan B.W. & Ritchie D.M. - The C Programming Language ,PHI, 2nd Edition Kanetkar Y. - Let us C, BPB Publication, 15th Edition

Reference Books:

E Balagurusamy – Programming in ANSI C, TMH, 3rd Edition
K R Venugopal & S R Prasad – MASTERING C, TMH, 2nd Edition
Reema Thareja – INTRODUCTION TO C PROGRAMMING, OXFORD UNIVERSITY PRESS,

Edition

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS201.1	3	3	3	2	2							
CS201.2	3	2	2	2	2							
CS201.3	3	3	3	2	2							
CS201.4	3	3	3	2	2							
CS201.5	3	3	3	2	2							

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CS201.1	3	3	3
CS201.2	3	3	3
CS201.3	3	3	3
CS201.4	3	3	3
CS201.5	3	3	3

Course Name: Engineering Mechanics
Course Code: ME 201
Contacts: 3:0:0
Total Contact Hours: 36
Credits: 3

Course Objective:
This course teaches students how to apply Newtonian physics to relatively simple real life applications. This course covers statics, dynamics and elementary part of strength of materials.

Prerequisites: Basic Concept of Physics

Course Outcomes (COs):

After completion of the course students would be able to

CO1	Know about thermodynamic equilibrium, heat & work transfer, First law and its application.
CO2	Understand the basic concepts of Heat Engine, Entropy from Second law of thermodynamics
CO3	Know the thermodynamic characteristics of a pure substance and its application in power cycles (Simple Rankine cycles, Air Standard cycles)
CO4	Knowledge of basic principles of fluid mechanics.
CO5	Ability to analyze fluid flow problems with the application of the momentum and energy equations.

Course Content:

Module 1: Introduction to Engineering Mechanics: Force Systems Basic concepts, Particle equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space − Resultant- Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems; Static Indeterminacy. 6L

Module 2: Friction: Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw jack & differential screw jack. 2L

Module 3: Basic Structural Analysis: Equilibrium in three dimensions; Method of Sections; Method of Joints; How to determine if a member is in tension or compression; Simple Trusses; Zero force members; Beams & types of beams; Frames & Machines. 3L

Module 4: Centroid and Centre of Gravity: Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia- Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Mass moment inertia of circular plate, Cylinder, Cone, Sphere, Hook. 5L

Module 5: Virtual Work and Energy Method: Virtual displacements, principle of virtual work for particle and ideal system of rigid bodies, degrees of freedom. Active force diagram, systems with friction, mechanical efficiency. Conservative forces and potential energy (elastic and gravitational), energy equation for equilibrium. Applications of energy method for equilibrium. Stability of equilibrium. 5L

Module 6: Review of particle dynamics: Rectilinear motion; Plane curvilinear motion (rectangular, path, and polar coordinates). 3-D curvilinear motion; Relative and constrained motion; Newton's 2nd law (rectangular, path, and polar coordinates). Work-kinetic energy, power, potential energy.Impulsemomentum
(linear, angular); Impact (Direct and oblique). 5L

Module 7: Introduction to Kinetics of Rigid Bodies: Basic terms, general principles in dynamics; Types of motion, Instantaneous centre of rotation in plane motion and simple problems; D'Alembert's principle and its applications in plane motion and connected bodies; Work energy principle and its application in plane motion of connected bodies; Kinetics of rigid body rotation. 5L

Module8: Mechanical Vibrations: Basic terminology, free and forced vibrations, resonance and its effects; Degree of freedom; Derivation for frequency and amplitude of free vibrations without damping and single degree of freedom system, simple problems, types of pendulum, use of simple, compound and torsion pendulums. 5L

Text books:

1. Irving H. Shames (2006), Engineering Mechanics, 4th Edition, Prentice Hall
2. F. P. Beer and E. R. Johnston (2011), Vector Mechanics for Engineers, Vol I - Statics, Vol II, − Dynamics, 9th Ed, Tata McGraw Hill
3. R.C. Hibbler (2006), Engineering Mechanics: Principles of Statics and Dynamics, Pearson Press.
4. Andy Ruina and Rudra Pratap (2011), Introduction to Statics and Dynamics, Oxford University Press
5. Shanes and Rao (2006), Engineering Mechanics, Pearson Education,
6. Hibler and Gupta (2010),Engineering Mechanics (Statics, Dynamics) by Pearson Education

Reference books:

1. Reddy Vijaykumar K. and K. Suresh Kumar(2010), Singer's Engineering Mechanics
2. Bansal R.K.(2010), A Text Book of Engineering Mechanics, Laxmi Publications
3. Khurmi R.S. (2010), Engineering Mechanics, S. Chand & Co.
4. Tayal A.K. (2010), Engineering Mechanics, Umesh Publications

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
ME201.1	3	3	3	3								
ME201.2	3	3	3	3								
ME201.3	3	3	3	3								
ME201.4	3	3	3	3								
ME201.5	3	3	3	3								

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
ME201.1	2	2	2
ME201.2	2	2	2
ME201.3	2	2	2
ME201.4	2	2	2
ME201.5	2	2	2

Course Name: Programming for Problem Solving Lab Course
Code: CS291
Contacts: 0:0:3
Credits: 1.5

Prerequisites: Number system, Boolean Algebra.

List of Experiment:

- Some basic commands of DOS, Windows and Linux Operating System, File handling and Directory structures, file permissions, creating and editing simple C program, compilation and execution of C program.
- Writing C Programs on variable, expression, operator and type-casting.
- Writing C Programs using different structures of if-else statement and switch-case statement.
- Writing C Programs demonstrating use of loop (for loop, while loop and do-while loop) concept and use of break and continue statement.
- Writing C Programs demonstrating concept of Single & Multidimensional arrays.
- Writing C Programs demonstrating concept of Function and Recursion.
- Writing C Programs demonstrating concept of Pointers, address of operator, declaring pointers and operations on pointers.
- Writing C Programs demonstrating concept of structures, union and pointer to structure.
- Writing C Programs demonstrating concept of String and command line arguments.
- Writing C Programs demonstrating concept of dynamic memory allocation.
- Writing C Programs demonstrating concept of File Programming.
- Innovative Experiments

Course Outcomes (COs):

After completion of the course students would be able to

CO1	Understand and propose 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 propose appropriate data type, arithmetic operators, input/output functions and also conditional statements in designing effective programs to solve complex engineering problem using modern tools.
CO3	Design and develop effective programs for 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.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS291.1	3	3	3	3	3							
CS291.2	3	3	2	3	3							
CS291.3	3	3	3	3	3							
CS291.4	3	3	3	3	3							
CS291.5	3	3	3	3	3							

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CS291.1	3	3	3
CS291.2	3	3	3
CS291.3	3	3	3
CS291.4	3	3	3
CS291.5	3	3	3

Course Name: Chemistry Lab
Course Code: CH 291
Contact: 0:0:3
Credits: 1.5

Course Objective:

- Study the basic principles of pH meter and conductivity meter for different applications.
- Analysis of water for its various parameters & its significance in industries.
- Learn to synthesis Polymeric materials and drugs.
- Study the various reactions in homogeneous and heterogeneous medium.

Prerequisites: Knowledge of Physics up to 12th standard.

List of Experiment:

Choice of 10-12 experiments from the following:

- Determination of surface tension and viscosity
- Thin layer chromatography
- Determination of hardness of water
- Determination of chloride content of water
- Determination of the rate constant of a reaction
- Determination of cell constant and conductometric tritration
- pH metric titrations
- Synthesis of a polymer/drug
- Saponification/acid value of an oil
- Chemical analysis of a salt
- Chemical oscillations- Iodine clock reaction
- Determination of the partition coefficient of a substance between two immiscible liquids
- Adsorption of acetic acid by charcoal

Innovative experiments (any one)

- Synthesis of silver nano particles
- Green synthesis

Course Outcomes (COs):

After completion of the course students would be able to

CO1	Understand different types of instruments for estimation of small quantities chemicals used in industries and scientific and technical fields.
CO2	Analyze and determine the composition of liquid and solid samples working as an individual and also as a team member.
CO3	Analyze different parameters of water considering environmental issues.
CO4	Synthesize drug and polymer materials.
CO5	Design innovative experiments applying the fundamentals of chemistry.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CH291.1	2	3	3	3	3	2	3					
CH291.2	2	3	3	3	3	2	3					
CH291.3	2	3	3	3	3	2	3					
CH291.4	2	3	3	3	3	2	3					
CH291.5	2	3	3	3	3	2	3					

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CH291.1	2	2	2
CH291.2	2	2	2
CH291.3	2	2	2
CH291.4	2	2	2
CH291.5	2	2	2

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

Course Objective:
To impart and apply knowledge about the Basic Electrical Components, Machineries, Instruments and Safety measures.

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

List of Experiment:
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 method.
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.

Course Outcomes (COs):

After completion of the course students would 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 behaviour.
CO3	Apply and analyze the basic characteristics of transformers and electrical machines.
CO4	Illustrate the venin's, Norton's, superposition and maximum power transfer theorem.
CO5	Create resonance condition in R-L-C series and parallel circuit and learn how to draw phasor diagram for the circuit

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EE291.1	2	2	3	3	3							
EE291.2	3	2	2	3	3							
EE291.3	2	3	2	3	2							
EE291.4	2	2	2	3	2							
EE291.5	2	3	2	3	3							

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
EE291.1	3		2
EE291.2	3		
EE291.3	3	2	3
EE291.4	3	2	3
EE291.5	3		

Course Name: Engineering Graphics & Design
Course Code: ME 291
Contact: 0:0:3
Credits: 1.5

Course Objectives:
To learn detailed drawing and modeling of a system, component, or process which meets desired needs within realistic constraints. It will help students to use the techniques, skills, and modern engineering tools and communicate effectively.

Prerequisites: Basic knowledge of geometry

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 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.

Module 2: Orthographic & Isometric Projections
Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes 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.

Module 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 Modeling; Solid Modeling.

Module 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].

Module 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); Printing documents; Drawing sectional views of solids and project the true shape of the sectioned surface; Drawing annotation, CAD modeling of parts and assemblies with animation, Parametric and non parametric solid, surface and wireframe modeling, Part editing and two dimensional documentation of models.

Module 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.

Module 7:
Innovative experiments

Course Outcomes (COs):

After completion of the course students would be able to

CO1	Understand Engineering Graphics and visual aspects of design.
CO2	Understand and apply common drafting tools with the knowledge of drafting standards.
CO3	Apply computer aided drafting techniques to represent line, surface or solid models in different Engineering viewpoints.
CO4	Create part models; carry out assembly operation and show working procedure of a designed project work using animation.
CO5	Apply common drafting tools with the knowledge of drafting standards and create project work using animation.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
ME 291.1	3	3	3	3	3	3						
ME 291.1	3	3	3	3	3	3						
ME 291.1	3	3	3	3	3	3						
ME 291.1	3	3	3	3	3	3						
ME 291.1	3	3	3	3	3	3						

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
ME 291.1	2	2	2
ME 291.1	2	2	2
ME 291.1	2	2	2
ME 291.1	2	2	2
ME 291.1	2	2	2

Text Books:

1. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
2. (Corresponding set of) CAD Software Theory and User Manuals

Reference Books:

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

Course Name: Lang. Lab. and Seminar Presentation
Course Code: HU 291
Contact: 0:0:2
Credit: 1

Course Objective: To train the students in acquiring interpersonal communication skills by focussing on language skill acquisition techniques and error feedback.

Pre requisites: Basic knowledge of LSRW skills.

Course Content:

Module 1: Introduction to the Language Lab

a. The Need for a Language Laboratory
b. Tasks in the Lab
c. Writing a Laboratory Note Book

Module 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 Recordings

Module 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

Module 4: Lab Project Work

a. Making a brief Animation film with voice over (5 minutes)OR
b. Making a brief Documentary film (10 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.

Course Outcomes (COs):

After attending the course students should be able to

CO1	Understand and make use of a wide taxonomy of listening skills & sub-skillsfor comprehending & interpreting data in English
CO2	Speak in English, using appropriate vocabulary and pronunciation incontextualized situations
CO3	Understand and put into effective practice the pragmatics of Group Discussion
CO4	Understand and write a detailed technical report as per organizational needs
CO5	Understand and interact in professional presentations and interviews

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
HU291.1	2	2	2	2			3	3	3	3		3
HU291.2	2	2	2	2			3	3	3	3		3
HU291.3	2	2	2	2			3	3	3	3		3
HU291.4	2	2	2	2			3	3	3	3		3
HU291.5	2	2	2	2			3	3	3	3		3

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
HU291.1	2	2	2
HU291.2	2	2	2
HU291.3	2	2	2
HU291.4	2	2	2
HU291.5	2	2	2

Course Name: NSS/Physical Activities/ Meditation & Yoga/ Photography/Nature Club
Course Code: MC 281
Contact: 0:0:3
Course Objectives:

- To increase student awareness about the weaker and unprivileged sections of society
- To expose students to environmental issues and ecological concerns
- To make students self aware about their participatory role in sustaining society and the environment

List of Activities:

a) Creating awareness in social issues
b) Participating in mass education programmers
c) Proposal for local slum area development
d) Waste disposal
e) Environmental awareness ``
f) Production Oriented Programmes
g) Relief & Rehabilitation work during Natural calamities

Creating awareness in social issues:

1. Women's development – includes health, income-generation, rights awareness.
2. Hospital activities – Eg. writing letters for patients, guiding visitors
3. Old age home – visiting the aging in-mates, arranging for their entertainment.
4. Children's Homes - visiting the young in-mates, arranging for their entertainment
5. Linking with NGOs to work on other social issues. (Eg. Children of sex-workers)
6. Gender issues- Developing an awareness, to link it with Women's Cell of college

Participating in mass education programmes: 1.Adult education 2. Children's education
Proposal for local slum area development: One or two slums to be identified and according to the needs, activities to be developed and proposals and reports are to be submitted.

Environmental awareness

- Resource conservation – Awareness to be developed on water, energy, soil.
- Preservation of heritage monuments- Marches, poster campaigns
- Alternative energy consciousness amongst younger school-children.
- Plantation and beautification- Plantation of trees, their preservation and upkeep, developing NSS parks.
- Waste disposal- Proper methods of domestic waste disposal.

Production Oriented Programmes

5. Working with people and explaining and teaching improved agricultural practices
6. Rodent control land pest control practices;
7. Soil-testing, soil health care and soil conservation;
8. Assistance in repair of agriculture machinery;
9. Work for the promotion and strengthening of cooperative societies in villages;
10. Assistance and guidance in poultry farming, animal husbandry, care of animal health etc.;
11. Popularization of small savings and
12. Assistance in procuring bank loans

Relief & Rehabilitation work during Natural calamities

g) Assisting the authorities in distribution of rations, medicine, clothes etc.;
h) Assisting the health authorities in inoculation and immunization, supply of medicine etc.;
i) Working with the local people in reconstruction of their huts, cleaning of wells, building roads etc.;
j) Assisting and working with local authorities in relief and rescue operation; Collection of clothes and other materials, and sending the same to the affected areas;

Course Outcomes (COs):

After completion of the course students would be able to

CO1	To increase student awareness about the weaker and unprivileged sections of society
CO2	To expose students to environmental issues and ecological concerns
CO3	To make students self aware about their participatory role in sustaining society and the environment
CO4	Apply and produce small devices of their interest in project or research purpose.
CO5	Apply safety measures with simple components with their own hands.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MC281.1						3	3	3	3			
MC281.2						3	3	3	3			
MC281.3						3	3	3	3			
MC281.4						3	3	3	3			
MC281.5						3	3	3	3			

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
MC281.1	2	2	2
MC281.2	2	2	2
MC281.3	2	2	2
MC281.4	2	2	2
MC281.5	2	2	2

2nd Year

3rd Semester

Sl.No.	Type	Code	Theory	Contact Hours/Week				Credit Points
				L	T	P	Total	
A. THEORY								
1	BS	M(CSE)301	Mathematics-III	3	1	0	4	4
2	BS	PH301	Physics-II	3	0	0	3	3
3	PC	CS301	Digital Electronics and Computer Organization	3	0	0	3	3
4	PC	CS302	Data Structures	3	0	0	3	3
5	ES	CS 303	Circuit Theory and Network	2	0	0	2	2
Total of Theory							**15**	**15**
B. PRACTICAL								
6	BS	PH391	Physics-II Lab	0	0	3	3	**1.5**
7	PC	CS391	Digital Electronics and Computer Organization Lab	0	0	3	3	**1.5**
8	PC	CS392	Data Structures Lab	0	0	3	3	**1.5**
9	PC	CS393	Programming with C++	1	0	2	3	**1.5**
10	PROJ	PR 391	Project-III	0	0	2	2	**1**
11	PROJ*	PR 392	Innovative activities-II	0	0	0	1	**0.5**
C. MANDATORY ACTIVITIES / COURSES								
12	MC	MC 381	Behavioural and Interpersonal Skills	0	0	3	3	
Total of Theory, Practical & Mandatory Activities/Courses							33	**22.5**

*Students may choose either to work on participation in all the activities of Institute's Innovation Council for eg: IPR workshop/ Leadership Talks/ Idea/ Design/ Innovation/ Business Completion/

Technical Expos etc.
Innovative activities to be evaluated by the Programme Head/ Event coordinator based on the viva voce and submission of necessary certificates as evidence of activities.

Course Name: Mathematics - III
Course Code: M(CSE) 301
Contact: 3:1:0
Total Contact Hours: 48
Credits: 4

Prerequisites:

The students to whom this course will be offered must have the concept of (10+2) standard set theory, calculus, basic probability.

Course Content:

MODULE I: ***Probability Distributions: (10 Lectures)***
Random Variable: Discrete and Continuous (definition & examples); Probability Distribution (definition & examples); Probability Mass Function, Probability Density Function and Distribution Function for a single random variable only (definition, properties & related problems); Expectation, Variance and Standard Deviation for a single random variable only (definition, properties & related problems); Binomial Distribution, Poisson Distribution, Binomial Approximation to Poisson Distribution and Normal Distribution (problems only), Mean, Variance and Standard Deviation of Binomial, Poisson and Normal Distribution (problems only).

Module II: ***Propositional Logic: (6 Lectures)***
Introduction to Propositional Calculus**,** Propositions, Logical Connectives, Conjunction, Disjunction, Negation and their truth table. Conditional Connectives, Implication, Converse, Contrapositive, Inverse, Bi-conditional statements with truth table, Logical Equivalence, Tautology, Normal forms-CNF, DNF.

Module III: ***Number Theory: (8 Lectures)***
Well Ordering Principle, Divisibility theorem (without proof) and properties of divisibility; Fundamental theorem of Arithmetic; Euclidean Algorithm for finding G.C.D and some basic properties of G.C.D with simple examples.

Module IV: ***Recurrence Relation: (6 Lectures)***
Recurrence relations: Formulation of different counting problems in terms of recurrence relations, Solution of recurrence relations with constant coefficients by (i) The iterative method (ii) Characteristic roots method (iii) Generating functions method.

Module V: ***Algebraic Structures: (8 Lectures)***
Group (definition), Lagrange’ s theorem, Subgroup, Normal subgroup, Cyclic group, Permutation group, Symmetric group (S3), Definition of Ring and Field.

Module VI: ***Graph Theory: (10 Lectures)***
Graph theory, important theorems and problems, digraphs, weighted graph, connected and disconnected graph, Bipartite graph, complement of a graph, regular graph, complete graph, walk, path, circuit, Euler graph, cut set, cut vertices, adjacency and incidence matrices of a graph(digraph),Isomorphism,
Tree, Important theorems: Binary Tree, Spanning Tree, minimal spanning tree, Dijkstra’ s algorithm, Kruskal’ s Algorithm, Prim’ s Algorithm.

Project Domains:

1. Study of physical processes through Graph theory.
2. Application of Propositional Logic in real world engineering problems.
3. Study of uncertainty in real world phenomena using probability distribution.
4. Application of Abstract Algebra in engineering problems.

Text Books:

1. Das, N.G. *Probability and Statistics*; The McGraw Hill Companies.
2. Gupta, S. C. and Kapoor, V. K. *Fundamentals of Mathematical Statistics*, Sultan Chand & Sons.
3. Deo, N. *Graph Theory with Applications to Engineering and Computer Science*, Prentice Hall.
4. Mapa, S. K. *Higher algebra: Abstract and Linear*, Levant, 2011.
5. Chakraborty, S. K. and Sarkar, B. K. *Discrete Mathematics*, OXFORD University Press.

Reference Books:

1. Lipschutz, S. *Theory and Problems of Probability (Schaum's Outline Series)*, McGraw Hill Book. Co.
2. Spiegel, M. R. *Theory and Problems of Probability and Statistics (Schaum's Outline Series),* McGraw Hill Book Co.
3. Grewal, B. S. *Higher Engineering Mathematics*, Khanna Pub.
4. Kreyzig, E. *Advanced Engineering Mathematics*, John Wiley and Sons.
5. Sharma, J.K. *Discrete Mathematics*, Macmillan.
6. Spiegel, M. R., Schiller, J.J. and Srinivasan, R.A. *Probability and Statistics* (Schaum's Outline Series), TMH.

Course Outcome(s):

After completion of the course students will be able to

CO1	Understand the fundamental concepts of Set Theory to Explain or Illustrate and Identify problems where students 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 students can 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.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
M(CSE)301.1	3	3	2									
M(CSE)301.2	3	3	2	2								
M(CSE)301.3	3	3	2									
M(CSE)301.4	3	3	2									
M(CSE)301.5	3	3	2	3								

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
M(CSE)301.1	2	2	2
M(CSE)301.2	2	2	2
M(CSE)301.3	2	2	2
M(CSE)301.4	2	2	2
M(CSE)301.5	2	2	2

Course Name: Physics-II
Course Code: PH 301
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisites:
Basic knowledge of Physics I

Course Content:

Module 1: Quantum Mechanics-II, Quantum Computation and Communication (12L)
1.01: Quantum Mechanics-II
Formulation of quantum mechanics and Basic postulates; Operator correspondence-Measurements in Quantum Mechanics- Eigen value, Eigen function, superposition principle, orthogonality of wave function, expectation value. Commutator. 3L
Time dependent Schrödinger's equation, formulation of time independent Schrödinger's equation by method of separation of variables, Schrödinger's equation as energy eigen value equation, Application of Schrödinger equation – Particle in an infinite square well potential (1-D and 3-D potential well; Discussion on degenerate levels), 1D finite barrier problem and concept of quantum tunnelling (solve only $E<V_0$). 4L

1.02: Quantum Computation and Communication
The idea of n- dimensional vector space, use of 'bra-ket' notation, matrix representation of bra &kets; basis, Hilbert space; Pauli matrices. 2L
Idea of qubit and examples of single qubit logic gates- Classical bits, qubit as a two level system; Bloch vector, Pauli gate, Hadamard gate, Phase shift gate, Quantum circuits related to Quantum gates. 3L

Module 2: Statistical Mechanics (6L)
Module 2.01: Basics of Statistical Mechanics:
Concept of energy levels and energy states. Microstates, macrostates and thermodynamic probability, MB, BE, FD, statistics (Qualitative discussions)- physical significance, conception of bosons, fermions, classical limits of quantum statistics, Fermi distribution at zero & non-zero temperature, Concept of Fermi level. 4L

Module 2.02: Applications of Statistical Mechanics:
Qualitative study: Fermi level in metals, total energy at absolute zero and total number of particles.Fermi level for intrinsic and extrinsic semiconductors (pictorial representations on temperature dependence and doping concentration viz. p type, n-type). 2L

Module 3: Storage and display devices (3L)
3.01: Different storage and display devices-Magnetic storage materials, Hard disc (examples related to computers compared with semiconductor storage viz. Pendrive),
Operation and application of CRT, Liquid crystal display (LCD), LED, Plasma display, Thin film transistor display). 3L

Module 4 : Concept of Polarisation (4L)
4.01 : 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, Nicol's prism, Engineering applications in E.M.Theory, Numerical problems 3L

Module 5: Electricity and Magnetism (8L)

Module 5.01:Electrostatics

Gauss's law in integral form and conversion into differential form, Equation of continuity, Extend to Poisson's & Laplace's equation, Application to parallel plate, spherical and cylindrical capacitors. 3L

Module 5.02: Magnetostatics:

Lorentz force (concept in Hall effect-), force on a small current element placed in a magnetic field. Biot-Savart law- non existence of magnetic monopole, Ampere's circuital law, Magnetic vector and scalar potential. 3L

Module 5.03: Electro-magnetism &Electromagnetic theory

Faraday's law, Concept of displacement current, Maxwell's field equations with physical significance, wave equation in free space, transverse nature of electromagnetic wave. 2L

Module 6: Physics of Nanomaterials (3L)

Reduction of dimensionality, properties of nanomaterials, Quantum wells (two dimensional), Quantum wires (one dimensional), Quantum dots (zero dimensional); Application of nanomaterials (CNT, grapheme, electronic, environment, medical). 3L

Text Book:

1. Engineering Physics by Khan and Panigrahi Publisher: Oxford.

Recommended Books:

Module 1:

1. Advanced Quantum Mechanics-J. J. Sakurai (TMH)
2. Quantum Mechanics-Schiff (Addison-Wesley)
3. Quantum Computation and Quantum Information(10th Anniversary Edition)-Nielsen & Chuang (Cambridge University Press)
4. The physics of quantum information-Dirk Bouwmeester, Artur K. Ekert, Anton Zeilinger (Springer)
5. Quantum Mechanics-Cohen Tanuje.
6. Advanced Quantum Mechanics-P.A.M. Dirac

Module 2:

Statistical Mechanics by B.B. Laud
Statistical Mechanics by Singh and Singh
Statistical Mechanics by Satyaprakash

Module 3:

1 Introduction to solid state physics-Kittel (TMH)
2. Solid State Physics- Ali Omar (Pearson Eduction)
3. Solid state physics- S. O. Pillai
4. Solid State Physics-A. J. Dekker (Prentice-Hall India)
5. Materials Science-Raghavan

Module 4:

Optics-A. K. Ghatak (TMH)
Optics-B.D. Gupta (Books and Allied Publ)

Module 5:

1. Electromagnetics-B.B. Laud (TMH)
2. Electricity Magnetism-B.Ghosh (Book & Allied Publisher)
3. Electricity Magnetism-Chattopadhyay & Rakshit (New Central Book Agency)

4. Electricity Magnetism-Fewkes and Yardwood (Oxford University Press)

Module 6:

6. Nanotechnology-Rakesh Rathi (S. Chand Publishers)
7. Integrated Electronics-Millman Halkias (TMH)
8. Nanotechnology-Rakesh Rathi (S. Chand Publishers)
9. Nanoscience-H. E. Schaefer (Springer)

Course Outcomes (COs):

After completion of the course students would be able to

CO1	Understand basic postulates of Quantum Mechanics.
CO2	Understand the basic postulates of Quantum Mechanics.
CO3	Understand the macro state for thermodynamic system, thermodynamic probability and phase space.
CO4	Understand Guass's law, Faraday's law and Ampere's critical law.
CO5	Understand the properties of Nano material.

CO-PO Mapping

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PH301.1	3	2	3	3								
PH301.2	3	3	2	2								
PH301.3	3	2	3	3								
PH301.4	3	2	2	2								
PH301.5	3	2	2	2								

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
PH301.1	3	2	2
PH301.2	2	3	2
PH301.3	3	2	2
PH301.4	2	2	2
PH301.5	3	3	3

Course Name: Digital Electronics and Computer Organization
Course Code: CS301
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Course Content:
Module – 1: [**3L**]
Introduction, concepts and laws of Boolean algebra [1L], Boolean functions and Representation in SOP and POS forms [1L], Minterm and maxterm , Minimization of logic expressions by Karnaugh Map [1L]

Module – 2: [**7L**]
Combinational circuits:
Adder and Subtractor (half-full adder & subtractor) [2L],Carry look ahead adder and Parity Generator[1L], Encoder, Decoder, Multiplexer [2L], De-Multiplexer ,Comparator[[1L], Basic Concepts of A/D and D/A converters[1L]

Module – 3: [**8L**]
Sequential Circuits:
Basic Flip-flop- SR, JK, D, T and JK Master-slave Flip Flops [3L], Registers (SISO, SIPO, PIPO, PISO) [2L]
Ring counter, Johnson counter [1L], Basic concept of Synchronous and Asynchronous counters [1L], Design of Modulo-N Counter [1L],

Module – 4: [9L]
Stored program concept-Von Neumann and Harvard architecture [1L]
Introduction to CPU and concepts of ALU [2L], Instruction format and Instruction Cycle [1L], Addressing Modes [1L]
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 [2L]

Module – 5: [**4L**]
Introduction to memory-RAM and ROM [2L], Register transfer, memory transfer, Tri-state bus buffer [1L], Microprogrammed and hardwired control unit [1L]

Module – 6: [5L]
Introduction to I/O operations [1L], Synchronous and asynchronous transfer [1L], Modes of transfer [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. Morries Mano- Digital Logic Design- PHI

Reference Books:

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

Course Outcomes (COs):

After attending the course students should be able to

CO1	Understand the basic gate operations and laws Boolean algebra.
CO2	Understand basic mechanism of digital computer and digital logic behind different arithmetic and control unit operations.
CO3	Design combinational circuits and combinational functions for larger more complex circuits.
CO4	Perform different operations with sequential circuits.
CO5	Understand fundamental concepts and techniques used in Logic families and PLDs.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS301.1	3	3	3	2	3							2
CS301.2	3	3	3	2	3							2
CS301.3	3	3	3	2	3							2
CS301.4	3	3	3	2	3							2
CS301.5	3	3	3	2	3							2

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CS301.1	3	3	3
CS301.2	3	3	3
CS301.3	3	3	3
CS301.4	3	3	3
CS301.5	3	3	3

Course Name: Data Structures
Course Code: CS302
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisites:

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

Course Content:

Module I: Linear Data Structure [10L]

Introduction (2L):
Concepts of data structures: a) Data and data structure b) Abstract Data Type and Data Type.
Algorithms and programs, basic idea of pseudo-code (1L)
Algorithm efficiency and analysis, time and space analysis of algorithms − order notations (1L) Array (2L):
Different representations − row major, column major (1L)
Sparse matrix - its implementation and usage, Array representation of polynomials (1L)
Linked List (6L):
Singly linked list − operations, Doubly linked list − operations (4L)
Circular linked list − operations, Linked list representation of polynomial and applications (2L)

Module II: Linear Data Structure [6L]

Stack and Queue (4L):
Stack and its implementations (using array and linked list) (1L)
Applications (infix to Postfix, Postfix Evaluation) (1L)
Queue, circular queue, de-queue (1L)
Implementation of queue- linear and circular (using array and linked list) (1L)
Recursion (2L):
Principles of recursion - use of stack, tail recursion. (1L)
Applications - The Tower of Hanoi(1L)

Module III: Nonlinear Data structures [12L]

Trees (8L):
Basic terminologies, forest, tree representation (using array and linked list) (1L)
Binary trees - binary tree traversal (pre-, in-, post- order) (1L)
Threaded binary tree (1L)
Binary search tree- operations (creation, insertion, deletion, searching) (1L)
Concept of Max-Heap and Min-Heap (creation, deletion) (1L)
Height balanced binary tree − AVL tree (insertion with examples only) (1L)
Height balanced binary tree − AVL tree (deletion with examples only) (1L)
m − Way Search Tree, B Tree − operations (insertion, deletion with examples only) (1L) Graphs (4L):
Graph theory review (1L)
Graph traversal and connectivity − 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) (2L)
Minimal spanning tree − Prim's algorithm, Kruskal's algorithm (basic idea of greedy methods) (1L)

Module IV: Searching, Sorting [8L]

Sorting Algorithms (4L):

Bubble sort, Insertion sort, Selection sort − with notion of complexity (1L)

Quick sort, Merge sort − with complexity

(2L) Radix sort − with complexity (1L)

Searching (2L):

Sequential search − with complexity (1L)

Binary search, Interpolation Search− with complexity

(1L) Hashing (2L):

Introduction to Hashing and Hashing functions (1L)

Collision resolution techniques (1L)

Text Books:

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, Universities Press

Reference Books:

1. 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

Course Outcomes (COs):

After attending the course students should 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
CO3	Understand and implement stack, queue and dequeue by selecting appropriate methods and use it for solving real life and engineering problem choosing appropriate modern
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 to validate 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.

CO-PO Mapping

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS302.1	3	3	3	3	2							
CS302.2	3	3	3	3								3
CS302.3	3	3	3	3								
CS302.4	3	3	3	3	2			2				
CS302.5	3	3	3	3	2							

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CS302.1	3	3	3
CS302.2	3	3	3
CS302.3	3	3	2
CS302.4	3	3	3
CS302.5	3	2	3

Course Name: Circuit Theory and Network
Course Code: CS303
Contact Hours: 2:0:0
Total Contact Hours: 24
Credits: 2

Prerequisites: Fundamental concepts of Basic Electrical Engineering

Course Content:
Module 1: 2L
Introduction: Continuous & Discrete, Fixed & Time varying, Linear and Nonlinear, Passive and Active networks and systems. Independent & Dependent sources, Step, Ramp, Impulse, Sinusoidal, Square, Saw tooth signals.

Module 2: 5L
Network Equations: Formulation of network equations, Source transformation, Loop variable analysis, Node variable analysis. Network theorem: Superposition, Thevenin's, Norton's & Maximum power transfer theorem and Millman's theorem. Solution of Problems with DC & AC sources.

Module 3: 3L
Resonance circuits: Series and parallel resonance- their frequency response, Quality factor, Half Power Points, and bandwidth. Phasor diagrams, Transform diagrams**,** Practical resonant and series circuits, Solution of Problems

Module 4: 2L
Coupled circuits: Magnetic coupling, polarity of coils, polarity of induced voltage, concept of Self and mutual inductance, Coefficient of coupling, Solution of Problems.

Module 5: 3L
Graph of Network: Concept of Tree and Branch, tree link, junctions, **(*)** Incident matrix, Tie set matrix, Determination of loop current and node voltages.

Module 6: 2L
Circuit transients: DC transients in R-L and R-C Circuits with and without initial charge, (*) R-L-C Circuits, AC Transients in sinusoidal R-L, R-C and R-L-C Circuits, Solution of Problems

Module 7: 4L
Laplace transforms: Concept of Complex frequency , transform of *f(t)* into *F(s)* , transform of step, exponential, over damped surge, critically damped surge, damped and un-damped sine functions , properties of Laplace transform , linearity, real differentiation, real integration, initial value theorem and final value theorem , inverse Laplace transform , application in circuit analysis, Partial fraction expansion, Solution of problems.

Module 8: 3L
Two Port Networks Analysis: Relationship of Two port network variables, short circuit admittance parameters, open circuit impedance parameters, transmission parameters, relationship between parameter sets, network functions for ladder network and general network.

Text Books:
1. A. Chakrabarti: Circuit Theory Analysis & Synthesis

Reference Books:

a. Sudhakar:Circuits & Networks:Analysis & Synthesis 2/e TMH New Delhi
b. Roy Choudhury D., "Networks and Systems", New Age International Publishers.

Course Outcomes (COs):

After completion of the course students would be able to

CO1	Understand various kinds of sources and their symbols, identify and use Kirchhoff's Laws and Networks theorem for simple circuit analyses.
CO2	Understand the concept of DC & AC transient analysis.
CO3	Understand expressions and perform calculations relating to the Transient response, Laplace transform, Two port network and Graph theory
CO4	Understand initial & final value theorem and its applications both time & s domain.
CO5	Will solve circuits using node, branch, cutest & tie set and tree the properties of Nano material.

CO-PO Mapping

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS303.1	3	2	2	2								
CS303.2	3	2	3	2								
CS303.3	3	2	2	2								
CS303.4	3	2	2	2								
CS303.5	3	2	2	2								

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CS303.1	2	2	2
CS303.2	3	3	2
CS303.3	2	3	2
CS303.4	2	3	2
CS303.5	2	3	2

Course Name: PHYSICS-II Lab
Course Code: PH 391
Contact: 0:0:3
Credits: 1.5
***At least 7 experiments to be performed during the semester**

Prerequisites: Experiments done in Physics I

List of Experiments:
Experiments on Module 1: Quantum Mechanics-II (6L)

1. To study current-voltage characteristics, load response, areal characteristics and spectral response of photo voltaic solar cells & measurement of maximum workable power.
2. Measurement of specific charge of electron using CRT.
3. Determination of band gap of a semiconductor.

Experiments on Module 3: Storage and display devices

4. Identification of various types of magnetic materials through the study of Hysteresis loop

Experiments on Module 4 –Polarization

5. To determine the angle of optical rotation of a polar solution using polarimeter

Experiments on Module 5 -Electricity magnetism

6. Study of dipolar magnetic field behavior.
7. Study of hysteresis curve of a ferromagnetic material using CRO.
8. Use of paramagnetic resonance and determination of Lande-g factor using ESR setup.
9. Measurement of Curie temperature of the given sample.
10. Determination of dielectric constant of given sample (frequency dependent).
11. Determination of Hall co-efficient of a semiconductor and measurement of Magnetoresistance of a given semiconductor
12. Study of transducer property: Determination of the thermo-electric power at a certain temperature of the given thermocouple.

In addition to regular 7 experiments it is **recommended that each student should carry out at least one experiment beyond the syllabus/one experiment as Innovative experiment.

Probable experiments beyond the syllabus:

1. Determination of thermal conductivity of a bad conductor by Lees and Chorlton’ s method.
2. Determination of thermal conductivity of a good conductor by Searle’ s mothod.
3. Study of I-V characteristics of a LED.
4. Study of I-V characteristics of a LDR
5. Innovative experiments

Course Outcomes (COs):

After completion of the course students would be able to

CO1	Demonstrate experiments allied to their theoretical concepts
CO2	Conduct experiments using LASER, Optical fiber, Torsional pendulum, Spectrometer
CO3	Analyze and participate as 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.
CO5	Design solutions for real life challenges.

CO-PO Mapping

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PH391.1	2	3	2	3	3							
PH391.2	2	3	2	3	3							
PH391.3	2	3	2	3	3							
PH391.4	2	3	2	3	3							
PH391.5	2	3	2	3	3							

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
PH391.1	2	2	2
PH391.2	2	2	2
PH391.3	2	2	2
PH391.4	2	2	2
PH391.5	2	2	2

Course Name: Digital Electronics and Computer Organization Lab
Course Code: CS391
Contact: 0:0:3
Credits: 1.5
Prerequisites: Basic concepts of Logicgates, Truth Tables, function realization – minimization of Logic expressions by K-map, Concept of basic components of a digital computer, Binary Arithmetic

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 subtrator 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 flipflops 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. Design a composite ALU for multi-bit arithmetic operation.
12. Design of RAM.
13. Innovative Experiments

Course Outcomes (COs):

After attending the course students should be able to

CO1	Understand the basic gate operations.
CO2	Understand and realize the process of Analog to Digital conversion and vice versa
CO3	Understand basic structure of different combinational circuit components- multiplexer, decoder, encoder etc.
CO4	Understand and apply different operations with flip-flop.
CO5	Understand, realize and apply different PLD operations for the given logical problem.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS391.1	3	3	3	2	3							2
CS391.2	3	3	3	2	3							2
CS391.3	3	3	3	2	3							2
CS391.4	3	3	3	2	3							2
CS391.5	3	3	3	2	3							2

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CS391.1	3	3	3
CS391.2	3	3	3
CS391.3	3	3	3
CS391.4	3	3	3
CS391.5	3	3	3

Course Code: Data Structures Lab
Course Code: CS392
Contact: 0:0:3
Credits: 1.5

Perquisites:

1. Computer Fundamentals and principal of computer programming Lab

List of Experiment:

1. Write a C program to implement Single Link List

2. Write a C program to implement Double Link List

3. Write a C program to implement Single Circular Link List

4. Write a C program to implement Double Circular Link List

5. Write a C program to implement Polynomial addition and Polynomial multiplication using Linked List.

6. Write a C program to convert a given infix expression into its postfix Equivalent.

7. Write C programs to implement a queue ADT using i) array and ii) doubly linked list respectively.

8. Write a C program to implement Binary Search Tree (BST).

9. Write C programs for implementing the following sorting methods to arrange a list of integers in ascending order:
   a. Insertion sort
   b. Merge sort

10. Write C programs for implementing the following sorting methods to arrange a list of integers in ascending order:
   a. Quick sort
   b. Selection sort

11. Write C programs for implementing the following searching methods:
   a. Linear Search
   b. Binary Search

12. Write a C program to implement all the functions of a dictionary (ADT) using hashing.

13. Write C programs for implementing the following graph traversal algorithms:
   a. Depth first search
   b. Breadth first search

14. Innovative experiments

Text Books:

1. Data Structures using C, R. Thareja, 2nd Edition, Oxford University Press.
2. Data Structures Using C E. Balagurusamy, Mcgraw Hill 3

Reference Books:

1. Data Structures in C by Aaron M. Tenenbaum, 1st Edition, Pearson
2. Data Structures Through 'C' Language by Samiran Chattopadhyay, Debabrata Ghosh Dastidar, Matangini Chattopadhyay, Edition: 2001, BPB Publications
3. Data structures using C, A.K.Sharma, 2nd Edition, Pearson
4. Fundamentals of Data Structures of C by Ellis Horowitz, Sartaj Sahni, Susan Anderson-freed 2nd Edition, Universities Press

Course Outcomes (COs):

After attending the course students should 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
CO3	Implement 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.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS392.1	3	3	3	2	3			–				2
CS392.2	3	3	3	2	3			–				2
CS392.3	3	3	3	2	3			–				2
CS392.4	3	3	3	2	3			–				2
CS392.5	3	3	3	2	3			–				2

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CS392.1	3	3	3
CS392.2	3	3	3
CS392.3	3	3	3
CS392.4	3	3	3
CS392.5	3	3	3

Course Name: Programming with C++ Lab
Course Code: CS393
Contact: 1:0:2
Credits: 1.5

Perquisites:
Computer Fundamentals and principles of computer programming

Course Content:

1. Introduction of UNIX/Linux Operating System which includes preliminary commands, start-up & shutdown methodology, file **[3P]**
2. Handling as well as introduction to editors like Vi editor, introduction to GNU C & C++ compiler, as well as introduction to GNU & GDB script. **[2P]**
3. Introduction to C++, basic loop control, executing programs. [2P]
4. Writing functions, selection statements, review of functions and parameters, command line arguments, recursion, I/O streams, arrays and string manipulation, pointers, structures & unions**. [6P]**
5. Object-Oriented Programming in C++, fundamentals of classes, constructors-destructors. [2P]
6. Dealing with member functions, operator overloading and polymorphism (both static & dynamic). [6P]
7. Dealing with inheritance, derived class handling.[2P]
8. Abstract class, virtual class, overriding, template class, name-space & exception handling. [6P]
9. Dynamic memory allocation, implementation of Linked Lists, using C++. [4P]
10. Innovative experiments

Note: GNU C++ can be used for the programming, since it is free and has no licensing anomaly

Text Books

1. The C++ Programming Language by Bjarne Stroustrup
   Addison-Wesley publisher
2. Object-Oriented Programming in C++ b by Robert Lafore
   Publisher: Sams

Reference Books

1. Object Oriented Programming with C++ by Balagurusamy McGraw Hill Education; Sixth edition.

Course Outcomes (COs):

After attending the course students should be able to

CO1	Demonstrate a thorough understanding of modular programming by designing programs that requires the use of programmer-defined functions.
CO2	Demonstrate a thorough understanding of arrays by designing and implementing programs that search and sort arrays.
CO3	Demonstrate a thorough understanding of the object-oriented programming concepts of encapsulation, data abstraction and composition by designing and implementing classes including the use of overloaded functions and constructors.
CO4	Demonstrate a thorough understanding of the concept of pointers and dynamic memory allocation, the implementation of programmer-defined functions and classes by writing code, performing unit testing and debugging of multiple complex programs.
CO5	Demonstrate an understanding of the differences between C and C++ in the areas of strings, pass by reference/passing pointers, and structs by designing and implementing programs that use C strings, C++

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS393.1	3	3	3	2	2				3			
CS393.2	3	2	2	2	2				3			
CS393.3	3	3	3	2	2				3			
CS393.4	3	3	3	2	2				3			
CS393.5	3	3	3	2	2				3			

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CS393.1	3	3	3
CS393.2	3	3	3
CS393.3	3	3	3
CS393.4	3	3	3
CS393.5	3	3	3

Course Name: Behavioral & Interpersonal Skills
Course Code: MC-381
Contact:3:0:0
Total Contact Hours: 36

Course Content:

MODULE ONE – INTERPERSONAL COMMUNICATON

1. The skills of Interpersonal Communication.
2. Gender/Culture Neutrality.
3. Rate of Speech, Pausing, Pitch Variation and Tone.
4. Corporate Communication.
5. Branding and Identity.

MODULE TWO- INTERPERSONAL COMMUNICATION BASED ON WORKPLACE COMMUNICATION

6. Workplace Communication.
7. Modes of Communication (Telephone, Conference Call, Team Huddle, Public Relation etc.)
8. Communication with Clients, Customers, Suppliers etc.
9. Organizing/Participating in Business Meeting.
10. Note Taking.
11. Agenda.
12. Minutes.

MODULE THREE – BUSINESS ETIQUETTE AND CORPORATE LIFE

13. Presenting oneself in the Business Environment.
14. Corporate Dressing and Mannerism.
15. Table Etiquette (Corporate Acculturation, Office parties, Client/Customer invitations etc.)
16. E-mail Etiquette.
17. Activity based Case Study.

MODULE FOUR – MOVIE MAKING: CORPORATE BUSINESS MEETING

18. Team based Brainstorming.
19. Process Planning and Developing Plot.
20. People management.
21. Documentation and Scripting.
22. Shooting the Movie: Location and Camera.
23. Post Production and Editing.
24. Movie Review: Feedback and Analysis

LIST OF REFERENCE:

1. Interpersonal Communication, Peter Hartley, Routledge, 1993.
2. Workplace Vagabonds: Career and Community in Changing Worlds of Work, Christina Garsten, Palgrave Macmillan, 2008.
3. Transnational Business Cultures Life and Work in a Multinational Corporation, Fiona Moore, Ashgate, 2005.
4. Global Business Etiquette: A Guide to International Communication and Customs, Jeanette S. Martin and Lillian H. Chaney, Praeger Publishers, 2006.
5. Making Teams Work: 24 Lessons for Working Together Successfully, Michael Maginn, McGraw-Hill, 2004.
6. Corporate Communications: Convention, Complexity, and Critique, Lars Thøger Christensen, Mette Morsing and George Cheney, SAGE Publications Ltd., 2008.
7. The Business Meetings Sourcebook: A Practical Guide to Better Meetings and Shared Decision Making, Eli Mina, AMACOM, 2002.

8.Moving Images: Making Movies, Understanding Media, Carl Casinghino, Delmar, 2011.

Course Outcome:

CO1: It will equip the student to handle workplace interpersonal communication in an effective manner.

CO2: To enable students with strong oral and written interpersonal communication skills.

CO3: To prepare students to critically analyze workplace situations and take appropriate decisions.

CO4: To make students campus ready through proper behavioral and interpersonal grooming.

CO5: Integration of enhanced skill set to design and frame team based Project Report and Presentation.

2nd Year

4th Semester								
Sl.No.	Course Code	Paper Code	Theory	Contact Hours/Week				Credit Points
				L	T	P	Total	
A. THEORY								
1	ES	M(CSE)401	Numerical Methods and Statistics	3	0	0	3	3
2	HS	HU 402	Economics for Engineers	2	0	0	2	2
3	PC	CS401	Computer Architecture	3	0	0	3	3
4	PC	CS402	Design and Analysis of Algorithms	3	0	0	3	3
5	PC	CS403	Formal Language and Automata Theory	3	0	0	3	3
Total of Theory							**14**	**14**
B. PRACTICAL								
6	ES	M(CSE)491	Numerical Methods and Statistics Lab	0	0	3	3	**1.5**
7	PC	CS491	Computer Architecture Lab	0	0	3	3	**1.5**
8	PC	CS492	Algorithms Lab	0	0	3	3	**1.5**
9	PROJ	PR 491	Project-IV	0	0	2	3	**1**
10	PROJ*	PR 492	Innovative activities-III	0	0	0	2	**0.5**
C. MANDATORY ACTIVITIES / COURSES								
11	MC	MC401	Constitution of India	3	0	0	3	
Total of Theory, Practical & Mandatory Activities/Courses							28	**20**

*Students may choose either to work on participation in all the activities of Institute's Innovation Council for eg: IPR workshop/ Leadership Talks/ Idea/ Design/ Innovation/ Business Completion/ Technical Expos
etc.

Innovative activities to be evaluated by the Programme Head/ Event coordinator based on the viva voce and submission of necessary certificates as evidence of activities.

Course Name: Numerical Methods and Statistics
Course Code: M (CSE) 401
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

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

Course Content:

MODULE I: ***Error Analysis and Interpolation (8 Lectures)***
Approximation in Numerical Computation: Truncation and rounding errors, Propagation of errors, Fixed and floating-point arithmetic.
Interpolation: Difference Operators: Forward and Backward, Shift Operator; Newton forward interpolation, Newton backward interpolation, Lagrange's Interpolation.

MODULE II: ***Numerical Solution of Linear and Non-linear Equations (8 Lectures)***
Numerical Solution of a System of Linear Equations: Gauss elimination method, LU Factorization method, Gauss-Seidel iterative method.
Solution of Polynomial and Transcendental Equations: Bisection method, Regula-Falsi, Newton-Raphson method.

MODULE III: ***Numerical Integration and Numerical Solution of Differential Equation (6 Lectures)***
Numerical Integration: Trapezoidal rule, Simpson's 1/3 rule, Expression for corresponding error terms.
Numerical solution of ordinary differential equation: Euler's method,Euler's modified method,Fourth order Runge-Kutta method.

MODULE III: ***Statistics (14 Lectures)***
Basic Statistics: Basic statistics, measure of central tendency, mean, median, mode, dispersion, correlation coefficient and regression.
Sampling theory: Random sampling. Statistic and its Sampling distribution.Sampling distribution of sample mean and variance in random sampling from a normal distribution (statement only) and related problems.

Estimation of parameters: Unbiased and consistent estimators. Interval estimation. Maximum likelihood estimation of parameters (Binomial, Poisson).Confidence intervals and related problems

Text Books:

1. Shishir Gupta &S.Dey, Numerical Methods, Mc. Grawhill Education Pvt. Ltd.
2. C.Xavier: C Language and Numerical Methods, New age International Publisher.
3. Dutta& Jana: Introductory Numerical Analysis. PHI Learning
4. J.B.Scarborough: Numerical Mathematical Analysis.Oxford and IBH Publishing
5. Jain, M. K., Iyengar, S. R. K. and Jain, R. K. *Numerical Methods (Problems and Solution)*. New age International Publisher.
6. Prasun Nayek: Numerical Analysis, Asian Books
7. N. G. Das: Statistical Methods, TMH.
8. *Sancheti , D. S. & Kapoor ,V.K. : Statistics Theory , Method & Application,* Sultan chand & sons , New Delhi

Reference Books:

1. Balagurusamy, E. *Numerical Methods*, Scitech. TMH.
2. Dutta, N. *Computer Programming & Numerical Analysis*, Universities Press.
3. Guha, S. and Srivastava, R. *Numerical Methods*, Oxford Universities Press.
4. Shastri, S. S. *Numerical Analysis*, PHI.
5. Mollah, S. A. *Numerical Analysis*, New Central Book Agency.
6. Numerical Methods for Mathematics ,Science&Engg., Mathews, PHI.
7. Rao, G. S. *Numerical Analysis*, New Age International.
8. Rao, G.S, Programmed Statistics (Questions − Answers), New Age International

Course Outcomes (COs):

After attending the course students should be able to

CO1	Recall the distinctive characteristics of various numerical techniques and theassociated error measures and Statistics.
CO2	Understand the theoretical workings of various numerical techniques and Statisticsto
CO3	Understand and put into effective practice the pragmatics of Group Discussion
CO4	Understand and write a detailed technical report as per organizational needs
CO5	Understand and interact in professional presentations and interviews

CO-PO Mapping

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
M(CSE)401.1	3	3	2	2								
M(CSE)401.2	3	3	2	2								
M(CSE)401.3	3	3	2	2								
M(CSE)401.4	3	3	2	2								
M(CSE)401.5	3	3	2	2								

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
M(CSE)401.1	2	2	2
M(CSE)401.2	2	2	2
M(CSE)401.3	2	2	2
M(CSE)401.4	2	2	2
M(CSE)401.5	2	2	2

Course Name: Economics for Engineers
Course Code: HU402
Contact: 2:0:0
Total Contact Hours: 24
Credits: 2

Pre-requisites:
MATH – College Algebra, Pre-Calculus Algebra and Trigonometry.

Course Content:
MODULE I Introduction[3L]
Managerial Economics-Relationship with other disciplines-Firms: Types, Objectives and goals-Managerial Decisions-Decision Analysis.

MODULE II Demand and Supply Analysis[5 L]
Demand-Types of demand-determinants of demand-Demand function-Demand Elasticity-Demand forecasting-Supply-Determinants of supply-Supply function-Supply Elasticity.

MODULE III Cost Analysis [5 L]
Element of costs, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost, Break-even analysis – PV ratio.

MODULE IV 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.

MODULE V: Financial Accounting [5 L]
Concepts and Definition of Accounting,Journal,Ledger,Trial Balance.
TradingA/C,Profit & Loss A/C and Balance Sheet.

MODULE VI: 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.

Text Books:

1. Riggs, Bedworth and Randhwa, "Engineering Economics", McGraw Hill Education India
2. Principles of Economics, Deviga Vengedasalam; Karunagaran Madhavan, Oxford University Press.

Reference Books:

1. Engineering Economy by William G.Sullivan, Elin M.Wicks, C. Patric Koelling, Pearson
2. R.Paneer Seelvan, " 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)

Course Outcomes (COs):

After attending the course students should 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 draw inferences 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.

CO-PO Mapping

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
HU402.1							2	3			3	3
HU402.2							2	3			3	3
HU402.3							2	3			3	3
HU402.4							2	3			3	3
HU402.5							2	3			3	3

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
HU402.1	2	2	2
HU402.2	2	2	2
HU402.3	2	2	2
HU402.4	2	2	2
HU402.5	2	2	2

Course Name: Computer Architecture
Course Code: CS401
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Perquisites:
Digital Electronics and Computer Organization

Course Content:
Module – 1: [5L]
Introduction-
Introduction to basic computer architecture [1L], Stored Program Concepts: Von Neumann & Havard Architecture [1L], RISC VS CISC [1L], Amdahl's law [1L], Performance Measure: MIPS, Benchmark Programs(SPECINT,SPECFP).[1L]

Module – 2: [7L]
Different Classification Scheme: Serial Vs. Parallel [1L], Pipelining: Basic concepts, Linear vs. Non Linear, Static vs. Dynamic, Unifunction vs. Multifunction [2L], Instruction Pipeline [1L] Arithmetic pipeline [1L], Hazards: Data hazards, control hazards and structural hazards [1L] Techniques for handling hazards [1L]

Module – 3:[5L]
Pipeline vs. Parallelism, Levels of parallelism, Instruction-Level Parallelism: Basic Concepts [2L], Techniques for Increasing ILP, Superscalar, Super Pipelined and VLIW Processor Architectures [2L], Array and Vector Processors [1L]

Module – 4: [11L]
Memory Hierarchy: Secondary memory [2L], Main Memory[1L], Cache Memory [1L], Cache coherence and synchronization mechanisms[1L], Mapping Technique in cache memory: Direct, Full Associative and Set Associative [3L], Performance Implementation in Cache Memory [1L], Virtual memory Concepts[1L], page replacement policies [1L].

Module – 5:[8L]
Multiprocessor architecture-
Introduction to Parallel Architecture-Different Classification scheme, Performance of Parallel Computers, PRAM model (EREW,CREW,CRCW) [3L], Centralized and Shared- memory architecture: synchronization[2L], Interconnection Network (Omega, Baseline, Butterfly, Crossbar)[3L]

Text Books:

1. **'**Advanced Computer Architecture Parallelism Scalability Programmability', Tata McGraw-Hill Education Private Limited ISBN-13: 978-0-07-053070-6 ISBN-10: 0-07-053070-X
2. Hwang & Briggs– Computer Architecture & Parallel Processing, TMH

Reference Books:

1. Patterson D.A. and Hennessy, J.L. "Computer architecture a quantitative approach", 2nd ed., Morgan Kaufman, 1996
2. Hayes J. P., "Computer Architecture & Organisation", McGraw Hill
3. Siegel, H.J., "Interconnection Network for Large Scale parallel Processing", 2nd Ed., McGraw Hill, 1990
3. Design and Analysis of Parallel Algorithm-Schim G. Akl

Course Outcomes (COs):

After attending the course students should 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 of Multiprocessor 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 model for building a new solution as a professional engineering practice as a team.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS401.1	3	3	3	2								
CS401.2	3	3	3	3								3
CS401.3	2	2	2	3								
CS401.4	3	3	3	3								
CS401.5	3	3	3	3								

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CS401.1	3	3	3
CS401.2	3	3	3
CS401.3	3	3	3
CS401.4	3	3	3
CS401.5	3	3	3

Course Name: Design & Analysis of Algorithm
Course Code: CS402
Contact: 3:0:0
Total Contact hour: 36
Credits: 3

Course Content:

Module 1

Complexity Analysis: [4L]

Time and Space Complexity, Different Asymptotic notations – their mathematical significance. Solving Recurrences: Substitution Method, Recurrence Tree Method, Master Theorem.(Proof of Master theorem)

Module 2

Divide and Conquer: [4L]

Basic method, use, Examples – Binary Search, Merge Sort, Quick Sort and their complexity(all three cases).Heap Sort and its complexity, Multiplication of two large numbers and its time complexity.

Lower Bound Theory: [1L]

O(nlgn) bound for comparison sort

Module 3

Dynamic Programming: [7L]

Basic method, use, Examples – Matrix Chain Manipulation, Strassen's matrix multiplication algorithm, Longest Common Subsequence, All pair shortest paths (Floyd Warshall), Single source shortest path (Dijkstra, Bellman-Ford), 0/1 Knapsack problem, Travelling Salesman Problem

Disjoint set manipulation: [1L]

Set manipulation algorithm like UNION-FIND, union by rank.

Greedy Method: [5L]

Basic method, use, Examples – Fractional Knapsack problem, Job sequencing with deadlines, Minimum cost spanning tree by Prim's and Kruskal's algorithm, Huffman encoding and decoding

Backtracking: [2L]

Basic method, use, Examples – n-queens problem, Graph coloring problem.

Module 4

String matching problem: [3L]

Different techniques – Naive algorithm, string matching using finite automata, and Knuth, Morris, Pratt (KMP) algorithm with their complexities.

Amortized Analysis: [1L]

Aggregate, Accounting, and Potential Method.

Network Flow: [3L]

Ford Fulkerson algorithm, Max-Flow Min-Cut theorem (Statement and Illustration)

Module 5

Notion of NP-completeness: [5L]

P class, NP class, NP hard class, NP complete class – their interrelationship, Reductions and Polynomial time Reducibility, Satisfiability problem (3-SAT and 2-SAT), Cook-Levin's theorem (Statement only), Clique decision problem, Vertex Cover problem

Text Books:

1. T. H. Cormen, C. E. Leiserson, R. L. Rivest and C. Stein, "Introduction to Algorithms"
2. E.Horowitz and Shani "Fundamentals of Computer Algorithms"

Reference Books:

1. K.Mehlhorn, "Data Structures and Algorithms" - Vol. I & Vol. 2.
2. S.Baase "Computer Algorithms"
3. A. Aho, J.Hopcroft and J.Ullman "The Design and Analysis of Algorithms" D.E.Knuth "The Art of Computer Programming", Vol. 3 Jon Kleiberg and Eva Tardos, "Algorithm Design"

Course Outcomes (COs):

After attending the course students should 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.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS402.1	2	2	2	2								2
CS402.2	3	3	3	3								2
CS402.3	3	3	3	3								2
CS402.4	3	3	3	3								2
CS402.5	3	3	3	3								2

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CS402.1	3	3	3
CS402.2	3	3	3
CS402.3	3	3	3
CS402.4	3	3	3
CS402.5	3	3	3

Course Name: Formal Language and Automata Theory
Course Code: CS403
Contacts: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisites:
Digital Logic, Computer organization, Computer Fundamentals

Course Content:

Module-1:[9L]
Fundamentals: Basic definition of sequential circuit, block diagram,
mathematical representation, concept of transitiont ableandtransitiondiagram,**[1L]**
IntroductiontoFiniteStateModel(FSM),Designofsequencedetector,FiniteStateMachine,FiniteAutomata,Deter ministicFiniteAutomation(DFA)andNon-
deterministicFiniteAutomation(NFA),Transitiondiagrams,TransitiontablesandLanguagerecognizers.**[3L]**
NFAwithemptytransitions,EquivalencebetweenNFAwithandwithoutemptytransitions.NFAtoDFAconversion. **[2L]**
MinimizationofFSM:MinimizationAlgorithmforDFA,IntroductiontoMyhill-NerodeTheorem**[2L]**
LimitationsofFSM,ApplicationofFiniteAutomata**[1L]**

Module-2:[7L]
FiniteAutomatawithoutput−Moore&Mealymachine.RepresentationofMoore&MealyMachine,Processingofth eStringthroughMoore&MealyMachine,EquivalenceofMoore&MealyMachine–Inter-conversion.**[2L]**
EquivalentstatesandDistinguishableStates,Equivalenceandk-equivalence,MinimizationofMealyMachine**[1L]**
Minimizationofincompletelyspecifiedmachine−MergerGraph,MergerTable,CompatibilityGraph[2L]
LosslessandLossyMachine–TestingTable,TestingGraph**[2L]**

Module-3:[5L]
Regular Languages, RegularSets, Regular Expressions, Algebraic Rules for Regular Expressions, Arden'sTheoremstatementandproof**[1L]**
ConstructingFiniteAutomata(FA)forgivenregularexpressions,RegularstringacceptedbyFA**[2L]**
ConstructingRegularExpressionforagivenFiniteAutomata**[1L]**
PumpingLemmaofRegularSets.Closurepropertiesofregularsets**[1L]**

Module-4:[9L]
Grammar Formalism- Context Free Grammars, Derivation trees, sentential forms. Right mostandleftmostderivationofstrings,ParseTree,Ambiguityincontextfreegrammars.**[1L]**
MinimizationofContextFreeGrammars.**[1L],**Removalofnullandunitproduction**[1L]**
ChomskynormalformandGreibachnormalform.**[1L]**
PumpingLemmaforContextFreeLanguages.**[1L]**
EnumerationofpropertiesofCFL,ClosurepropertyofCFL,Ogden'slemma&itsapplications**[1L],**
Regulargrammars−rightlinearandleftlineargrammars**[1L]**
Push down Automata: Push down automata, definition. Introduction to DCFL,DPDA, NCFL,NPDA**[1L]**
AcceptanceofCFL,Acceptancebyfinalstateandacceptancebyemptystateanditsequivalence.**[1L]**
EquivalenceofCFLandPDA,inter-conversion.**1L]**

Module-5:[5L] TuringMachine:TuringMachine,definition,model**[1L]**
DesignofTM,Computablefunctions**[1L]**Church'shypothesis,countermachine**[1L]**TypesofTuringmachines **[1L]** UniversalTuringMachine,Haltingproblem**[1L]**

TextBooks:

1.“IntroductiontoAutomataTheoryLanguageandComputation”,HopcroftH.E.andUllmanJ.D.,Pearson Educatio n.

ReferenceBooks:

1. “FormalLanguagesandAutomataTheory”,C.K.Nagpal,Oxford
2. “SwitchingandFiniteAutomataTheory”,ZviKohavi,2ndEdition.,TataMcGrawHill

Course Outcomes (COs):

After attending the course students should 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.

CO-PO Mapping

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS403.1	3	3	3	3								3
CS403.2	2	2	2	2								3
CS403.3	3	3	3	3								3
CS403.4	3	3	3	3								3
CS403.5	3	3	3	3					2	2		3

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CS403.1	3	3	3
CS403.2	3	3	3
CS403.3	3	3	3
CS403.4	3	3	3
CS403.5	3	3	3

Course Name: Numerical Methods and Statistics (Lab)
Course Code: M (CSE) 491
Contact: 0:0:3
Credits: 1.5

Prerequisites: Any introductory course on programming language (example. C/Matlab).

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.

Course Outcomes (COs):

After attending the course students should be able to

CO1	Describe and explain the theoretical workings of numerical techniques with the help of C
CO2	Compute basic command and scripts in a mathematical programming language
CO3	Apply the programming skills to solve the problems using multiple numerical
CO4	Analyze if the results are reasonable, and then interpret and clearly communicate the
CO5	Apply the distinctive principles of numerical analysis and the associated error

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
M(CSE)491.1	3	3	2	2	3	2			3			
M(CSE)491.2	3	3	2	2	3	2			3			
M(CSE)491.3	3	3	2	2	3	2			3			
M(CSE)491.4	3	3	2	2	3	2			3			
M(CSE)491.5	3	3	2	2	3	2			3			

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
M(CSE)491.1	2	2	2
M(CSE)491.2	2	2	2
M(CSE)491.3	2	2	2
M(CSE)491.4	2	2	2
M(CSE)491.5	2	2	2

Course Name: Computer Architecture Lab
Course Code: CS491
Contact: 0:0:3
Credits: 1.5

Prerequisites:
Knowledge of designing different circuits in Computer Organization Lab

List of Experiment:

1. Implement different types of Basic gates and simulate for truth table verification.
2. Implement half adder circuit and simulate for truth table verification.
3. Implement full adder circuit and simulate for truth table verification.
4. Implement half subtractor circuit and simulate for truth table verification.
5. Implement full subtractor circuit and simulate for truth table verification.
6. Implement Multiplexer, DeMultiplexer circuit and simulate for truth table verification.
7. Implement Encoder, Decoder circuit and simulate for truth table verification.
8. Implement different types of flip flop and simulate for truth table verification.
9. Implement different types of parallel circuits (SISO,SIPO,PISO,PIPO) and simulate the result.
10. Implement ALU and simulate the result.
11. Implement RAM chip and simulate the result.
12. Innovative Experiments.0

Course Outcomes (COs):

After attending the course students should 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 knowledge of algorithms 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, subtract or, encoder, decoder, multiplexer, de-multiplexer, flip-flops, register, counter using various mapping and modern tools to prepare the most simplified circuit and optimize 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.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS491.1	3	3	3	2	3				3			
CS491.2	3	3	3	3	3				3			
CS491.3	3	3	3	3	3				3			
CS491.4	3	3	3	3	3				3			
CS491.5	3	3	3	3	3				3			

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CS491.1	3	3	3
CS491.2	3	3	3
CS491.3	3	3	3
CS491.4	3	3	3
CS491.5	3	3	3

Course Name: Design & Analysis of Algorithm Lab
Course Code: CS492
Contact: 0:0:3
Credits: 1.5

Prerequisites:
Programming Knowledge.

List of Experiment:
Write the following problems in any programming language. Programming Language used: C

1. Divide and Conquer:

a. Implement Binary Search (Recursive & Iterative) using Divide and Conquer approach
b. Implement Merge Sort using Divide and Conquer approach
c. Implement Quick Sort using Divide and Conquer approach
d. Implement Heap Sort using Divide and Conquer approach
e. Find Maximum and Minimum element from a array of integer using Divide and Conquer approach

2. Dynamic Programming:

a. Find the minimum number of scalar multiplications needed for chain of matrix
b. Implement all pair of Shortest path for a graph (Floyed Warshall Algorithm)
c. Implement Single Source shortest Path for a graph (Dijkstra , Bellman Ford)
d. Implement Longest Common Subsequence problem

3. Backtracking:

a. Implement n-Queens Problem
b. Graph Coloring Problem

4. Greedy method:

a. Knapsack Problem
b. Job sequencing with deadlines
c. Minimum Cost Spanning Tree by Prim's Algorithm
d. Minimum Cost Spanning Tree by Kruskal's Algorithm

5. Innovative experiments

Course Outcomes (COs):

After attending the course students should 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.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS492.1	3	3	2	2	3				3			3
CS492.2	3	3	3	2	3				3			3
CS492.3	3	3	2	3	3				3			3
CS492.4	3	3	2	2	3				3			3
CS492.5	3	3	3	2	3				3			3

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CS492.1	3	3	3
CS492.2	3	3	3
CS492.3	3	3	3
CS492.4	3	3	3
CS492.5	3	3	3

Course Name: Constitution of India
Course Code: MC401
Contact: 3:0:0
Total Contact Hours: 32

Prerequisite: NA

Course content:

1. Meaning of the constitution law and constitutionalism (2L)
2. Historical perspective of the Constitution of India (2L)
3. Salient features and characteristics of the Constitution of India (1L)
4. Scheme of the fundamental rights (2L)
5. The scheme of the Fundamental Duties and its legal status (2L)
6. The Directive Principles of State Policy − Its importance and implementation (2L)
7. Federal structure and distribution of legislative and financial powers between the Union and the States (3L)
8. Parliamentary Form of Government in India − The constitution powers and status of the President of India (2L)
9. Amendment of the Constitutional Powers and Procedure (2L)
10. The historical perspectives of the constitutional amendments in India (2L)
11. Emergency Provisions: National Emergency, President Rule, Financial Emergency (3L)
12. Local Self Government − Constitutional Scheme in India (3L)
13. Scheme of the Fundamental Right to Equality (2L)
14. Scheme of the Fundamental Right to certain Freedom under Article 19 (2L)
15. Scope of the Right to Life and Personal Liberty under Article 21. (2L)

Text Books:

1. Introduction to Constitution of India, D.D. Basu, Lexis Nexus
2. The Constitution of India, PM Bhakshi, Universal Law

Course Outcomes (COs):

After attending the course students should be able to

CO1	Develop human values, create awareness about lawratification and significance of Constitution
CO2	Comprehend the Fundamental Rights and Fundamental Duties of the Indian Citizen to implant morality, social values and their social responsibilities.
CO3	Create understanding of their Surroundings, Society, Social problems and their suitable solutions.
CO4	Familiarize with distribution of powers and functions of Local Self Government.
CO5	Realize the National Emergency, Financial Emergency and their impact on Economy of the country.

CO-PO Mapping:

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

Department: Computer Science & Engineering

Curriculum Structure & Syllabus

(Effective from 2018-19 admission batch)
Under Autonomy (**GR A:** ECE, EE, EIE, BME; **GR B:** CSE, IT, ME, CE, FT)

3rd Year

5th Semester

Sl.No.	Course Code	Paper Code	Theory	Contact Hours/Week				Credit Points
				L	T	P	Total	
A. THEORY								
1	PC	CS501	Computer Graphics	3	0	0	3	3
2	PC	CS502	Operating System	3	0	0	3	3
3	PC	CS503	Data Base Management System	3	0	0	3	3
4	OE	CS504	A. Object Oriented Programming using Java B. Multimedia Technology C. Communication Engineering	3	0	0	3	3
5	PE	CS505	A. Operations Research B. Computational Geometry C. Distributed Algorithms	3	0	0	3	3
Total of Theory							**15**	**15**
B. PRACTICAL								
6	PC	CS591	Computer Graphics Lab	0	0	3	3	**1.5**
7	PC	CS592	Operating System Lab	0	0	3	3	**1.5**
8	PC	CS 593	Data Base Management System Lab	0	0	3	3	**1.5**
9	OE	CS594	A. Object Oriented Programming Lab B. Multimedia Technology Lab C. Communication Engineering Lab	0	0	3	3	**1.5**
10	PROJ	PR 591	Project-V	0	0	2	2	**1**
11	PROJ*	PR 592	Innovative activities-IV	0	0	0	0	**0.5**
C. MANDATORY ACTIVITIES / COURSES								
12	MC	MC 501	Environmental Science	3	0	0	3	
Total of Theory, Practical & Mandatory Activities/Courses							32	**22.5**

* Students may choose either to work on participation in Hackathons etc. Development of new product/Business Plan/ registration of start-up.

Students may choose to undergo Internship / Innovation / Entrepreneurship related activities. Students may choose either to work on innovation or entrepreneurial activit ies resulting in start-up or undergo

internship with industry/ NGO's/ Government organizations/ Micro/ Small/ Medium enterprises to make themselves ready for the industry/ Long Term goals under rural Internship. (Duration 4-6 weeks)

Innovative activities to be evaluated by the Programme Head/ Event coordinator based on the viva voce and submission of necessary certificates as evidence of activities.

Course Name: Computer Graphics
Course Code: CS501
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Course Objective(s)

- To provide comprehensive introduction about computer graphics system, design algorithms and two dimensional transformations.
- To make the students familiar with techniques of clipping, three dimensional graphics and three dimensional transformations.
- The computer graphics course prepares students for activities involving in design, development and testing of modeling, rendering, and shading.

Prerequisites:
1. Mathematics – I,III
2. Computer Fundamentals & Principle of Computer Programming
3. Programming with C++

CourseContent:

Module – 1: **4L**

Introduction: Objective, applications, GKS/PHIGS, normalized co-ordinate system, aspect ratio.

Module -2: **4L**

Graphics System:Vector and raster graphics, various graphics display devices, graphics interactive devices, segmented graphics, attribute table.

Module -3: **4L**

Raster Scan Graphics:Line drawing algorithms, circle/ellipse drawing algorithms, polygon filling algorithms.

Module -4: **4L**

Geometric Transformation: Homogeneous co-ordinate system, 2D and 3D transformations, projection—orthographic and perspective.

Module – 5: **4L**

Curves and Surfaces: Curve approximation and interpolation, Lagrange, Hermite, Bezier and BSpline curves/surfaces and their properties, curves and surface drawing algorithms.

Module – 6: **4L**

Geometric modelling: 3D object representation and its criteria, edge/vertex list, constructive solid geometry, wire-frame model, generalized cylinder, finite element methods.

Module – 7: **4L**

Clipping: Window and viewport, 2D and 3D clipping algorithms.

Module –8: **4L**

Hidden Lines and Hidden Surfaces:Concept of object- and image-space methods, lines and surface removal algorithms.

Module – 9: **4L**

Intensify, Coloring and Rendering:RGB, YIQ, HLS and HSV models and their conversions, gamma correction, half toning. Illumination models, polygon mesh shading, transparency, shadow, texture.

Text Books

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.

Course Outcomes (COs):

After attending the course students should be able to

CO1	Understand the fundamental concept of Computer graphics and mathematical knowledge and explain the foundations of computer graphics and different display technology and devices.
CO2	Demonstrate different scan conversion algorithms, drawing algorithms, polygon filling algorithms, curves and surface drawing algorithms, clipping algorithms, surface removal algorithms using graphics tools.
CO3	Understand the basic concept of graphics programming and implement clipping with the comprehension of windows, view-ports in relation to images 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.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS501.1	3	3	3	3	3							3
CS501.2	3	3	3	3	3							3
CS501.3	3	3	3	3	3							3
CS501.4	3	3	3	3	3							3
CS501.5	3	3	3	3	3							3

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CS501.1	3	3	3
CS501.2	3	3	3
CS501.3	3	3	3
CS501.4	3	3	3
CS501.5	3	3	3

Course Name: Operating System
Course Code: CS502
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Course Objectives:

1. To understand the services provided by and the design of an operating system.
2. To understand the structure and organization of the file system.
3. To understand what a process is and how processes are synchronized and scheduled.
4. To understand different approaches to memory management.
5. Students should be able to use system calls for managing processes, memory and the file system.
6. Students should understand the data structures and algorithms used to implement an OS.

Prerequisites:

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

Course Contents:

Module – 1: [3L]
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. [3L]

Module – 2: [10L]
Processes: 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: overview, benefits of threads, user and kernel level threads, Thread models. [2L]
CPU scheduling: scheduling criteria, preemptive & non-preemptive scheduling, scheduling algorithms (FCFS, SJF, SRTF, RR, priority, multilevel queue, multilevel feedback queue scheduling)[5L]

Module – 3: [11L]
Process Synchronization: background, critical section problem, synchronization hardware, classical problems of synchronization(producer-consumer, readers-writer, dining philosophers, etc), semaphores, monitors. [6L]
Deadlocks: deadlock characterization, methods for handling deadlocks, deadlock prevention, deadlock avoidance, deadlock detection, recovery from deadlock.
[5L]

Module – 4: [6L]
Background, logical vs. physical address space, swapping, contiguous memory allocation, paging, Segmentation, TLB.[3L]
Virtual Memory: background, demand paging, page replacement algorithms (FCFS, LRU, Optimal), thrashing, Working set model.[3L]

Module – 5: [6L]
Disk structure, disk scheduling (FCFS, SSTF, SCAN,C-SCAN,LOOK,C-LOOK etc),disk reliability, disk formatting, boot block, bad blocks. [2L]
File: File concept, access methods, directory structure, file system structure, UNIX file structure, allocation methods (contiguous, linked, indexed), free-space management (bit vector) [2L]
I/O: I/O hardware, polling, interrupts, DMA, caching, buffering, blocking-non blocking I/O.

[2L]

Text Books:

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

Reference Books:

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.

Course Outcomes (COs):

After attending the course students should be able to

CO1	Understand the fundamental concepts of Operating System, Protection & Security and differentiate different types of Operating System.
CO2	Understand and implement process & thread; understand, apply, compare different process synchronization algorithm and inter process communication to solve engineering problems.
CO3	Understand/explain/analyze different synchronization techniques, critical section problems and deadlock and apply them to solve engineering problems.
CO4	Understand/explain different memory management techniques including virtual memory management; also able to apply, compare, and implement different page replacement algorithms to solve engineering problems.
CO5	Understand/explain different I/O mechanisms, File structures and disk management techniques and solving engineering problem applying different disk scheduling algorithm.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS502.1	3	3	3	3								3
CS502.2	3	3	3	3								3
CS502.3	3	3	3	3								3
CS502.4	3	3	3	3								3
CS502.5	3	3	3	3								3

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CS502.1	3	3	3
CS502.2	3	3	3
CS502.3	3	3	3
CS502.4	3	3	3
CS502.5	3	3	3

Course Name: DATABASE MANAGEMENT SYSTEM
Course Code: CS503
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Course Objectives:

1. To learn the data models, conceptualize and depict a database system
2. To design system using E-R diagram.
3. To learn SQL & relational database design.
4. To understand the internal storage structures using different file and indexing techniques.
5. To know the concepts of transaction processing, concurrency control techniques and recovery procedure**.**

Prerequisites:

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

Course Contents:

Module 1:

Introduction [3L]

Concept & Overview of DBMS, Data Models, Database Languages, Database Administrator, Database Users, Three Schema architecture of DBMS.

Module 2:

Entity-Relationship and Relational Database Model [9L]

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.

Module 3:

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.

Module 4:

Relational Database Design [6L]

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

Module 5:

R18 B.TECH CSE

Internals of RDBMS [6L]

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

Module 6:

File Organization & Index Structures [6L]

File & Record Concept, Placing file records on Disk, Fixed and Variable sized Records, Types of Single-Level Index (primary, secondary, clustering), Multilevel Indexes

Text Books:

1. Henry F. Korth and Silberschatz Abraham, "Database System Concepts", Mc.Graw Hill.
2. Elmasri Ramez and Novathe Shamkant, "Fundamentals of Database Systems", Benjamin Cummings Publishing. Company.

Reference Books:

1. Jain: Advanced Database Management System CyberTech
2. Date C. J., "Introduction to Database Management", Vol. I, II, III, Addison Wesley.
3. "Fundamentals of Database Systems", Ramez Elmasri, Shamkant B.Navathe, Addison Wesley Publishing Edition
4. Gray Jim and Reuter Address, "Transaction Processing : Concepts and Techniques", Moragan Kauffman Publishers.
5. Ullman JD., "Principles of Database Systems", Galgottia Publication.

Course Outcomes (COs):

After attending the course students should 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 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
CO3	To Analyze and Create the 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	To Implement and organize the database of an organization as a team.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS503.1	3	3	2	2								3
CS503.2	3	3	2	2								3
CS503.3	3	3	2	2								3
CS503.4	3	3	2	2								3
CS503.5	3	3	2	2								3

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CS503.1	3	3	3
CS503.2	3	3	3
CS503.3	3	3	3
CS503.4	3	3	3
CS503.5	3	3	3

Course Name: Object Oriented Programming using Java
Course Code: CS504A
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Course Objectives:

- 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 Contents:
Module 1: [5L]
Introduction:
Object Oriented Analysis & Design-Concepts of object oriented programming language, Object, Class.**[1L];** Relationships among objects and classes-Generalization, Specialization, Aggregation, Association, Composition, links, Meta-class. **[1L] ;**Object Oriented Programming concepts - Difference between OOP and other conventional programming – advantages and disadvantages. Class, object, Method. **[1L];** Properties of OOP- message passing, inheritance, encapsulation, polymorphism, Data abstraction. **[1L];** Difference between different OOPs Languages. **[1L].**

Module 2: [9L]
Java Basics:
Basic concepts of java programming - Advantages of java, Byte-code & JVM, Data types, Different types of Variables. **[1L] ;**Access specifiers, Operators, Control statements & 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].**

Module 3:[4L]
Basic String handling & I/O :
Basic string handling concepts- Concept of mutable and immutable string, Methods of String classcharAt(), 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& Scanner classes. **[1L].**

Module 4: [8L]
Inheritance and Java Packages :
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];** Importing packages, member access for packages. **[1L]**

Module 5: [10L]

Exception handling, Multithreading and Applet Programming :

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, 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]**

Textbooks:

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.

Course Outcomes (COs):

After attending the course students should 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
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.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS504A.1	3	3	2	3	2							
CS504A.2	3	3	3	3	2							
CS504A3	3	3	3	3	2							
CS504A.4	3	3	3	3	2							
CS504A.5	3	3	3	3	2							

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CS504A.1	3	3	3
CS504A.2	3	3	3
CS504A3	3	3	3
CS504A.4	3	3	3
CS504A.5	3	3	3

Course Name: Multimedia Technology
Course Code: CS504B
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Course Objectives:
After understanding different technical aspects of Multimedia Systems specially the standards available for different audio, video and text applications, students can be able to Design and develop various Multimedia Systems applicable in real time. Then can deal with various network related issues used for multimedia audio, video and image related applications. The knowledge is very essential for a student to develop any audio-visual multimedia application and analyze the performance of the same.

Prerequisites: Computer Graphics

Course Contents:
Module 1: Introduction, Text and Audio [6L]
Multimedia: Impact of Multimedia, Multimedia Systems, Components and Its Applications. Text: Types of Text, Ways to Present Text, Aspects of Text Design, Character, Character Set, Codes, Unicode,Encryption.Audio: Basic Sound Concepts, Types of Sound, Digitizing Sound, Computer Representation of Sound (Sampling Rate,Sampling Size, Quantization), Audio Formats, Audio tools, MIDI.

Module 2: Image and Video (15L)
Image: Formats, Image Color Scheme, Image Enhancement, Image representation, segmentation; Lossless Image Compression: Huffman Coding, Arithmetic and Lempel-Ziv Coding; Lossy Image Compression Systems: Theory of Quantization, Delta Modulation and DPCM, Transform Coding & K-L Transforms, Discrete Cosine Transforms; Image retrieval: Image retrieval by color, shape and texture. Video: Analogue and Digital Video, Recording Formats and Standards (JPEG, MPEG, H.261) Transmission of Video Signals, Video Capture, and Computer based Animation,Different Case studies- QBIC, Virage. Video Content, querying, video segmentation, Indexing- kd trees, R-trees, quad trees
.
Module 3: Synchronization, Multi-Resolution Analysis, Storage models and Access Techniques [8L]
Temporal relationships, synchronization accuracy specification factors, quality of service, Magnetic media, optical media, file systems (traditional, multimedia); Multimedia devices: Output devices, CD ROM, DVD, Scanner, CCD,Theory of Wavelets, Theory of Subband Coding (z-transform), Multiresolution Analysis: Discrete Wavelet Transforms.

Module 4: Embedded Wavelet Coding and Multimedia Applications (7L)
Zerotree Approach, SPIHT algorithm and EBCOT Algorithm, Interactive television, Video-on-demand, Video Conferencing, Educational Applications, Industrial Applications, Multimedia archives and digital libraries, media editors.

Text Books:

1. Ralf Steinmetz and KlaraNahrstedt , Multimedia: Computing, Communications & Applications , Pearson Ed.
2. Fred Halsall , Multimedia Communications , Pearson Ed.

Reference Books:

1. KoegelBuford , Multimedia Systems , Pearson Ed.
2. Nalin K. Sharda , Multimedia Information System , PHI.
3. Fred Hoffstetter , Multimedia Literacy , McGraw Hill.
4. J. Jeffcoate , Multimedia in Practice: Technology and Application , PHI.
5. Prabhat K. Andleigh& Kiran Thakrar , Multimedia Systems Design , PHI.

Course Outcomes (COs):

After attending the course students should be able to

CO1	Identify different media; representations of different multimedia data and data formats
CO2	Analyze various compression techniques.
CO3	Compare various audio and video file formats.
CO4	Apply different coding technique for solving real world problems
CO5	Choose optical storage media suitable for multimedia applications.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS504.1	3	3	2	3								
CS504.2	3	3	3	3								
CS504.3	3	3										
CS504.4	3	3	3	3								
CS504.5	3	3	3	3								

CO-PSO Mapping

Cos	PSO1	PSO2	PSO3
CS504.1	3	2	2
CS504.2	3	2	2
CS504.3	3	2	3
CS504.4	3	2	3
CS504.5	3	3	3

Course Name: Communication Engineering
Course Code: CS 504C
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Course Objectives:
To present the fundamentals of analog and modern digital communication system design. Students should evaluate the performance of analog and digital signaling schemes on realistic communication channels. Emphasis is placed on physical layer digital communications and coding techniques, including waveform analysis, transmitter design and receiver design. The student will learn about theoretical bounds on the rates of digital data transportation systems.

Prerequisites: Knowledge in different types of signals.

Course Contents:
Module - 1: **Elements of Communication system, Analog Modulation & Demodulation, Noise, SNR. (Basic ideas in brief) [10L]**
Introduction to Base Band transmission & Modulation (basic concept) (1L); Elements of Communication systems (mention of transmitter, receiver and channel); origin of noise and its effect, Importance of SNR in system design (1L); Basic principles of Linear Modulation (Amplitude Modulation, DSB-SC, SSB-SC and VSB) (4L); Basic principles of Non-linear modulation (Angle Modulation - FM, PM) (1L); Sampling theorem, Sampling rate, Impulse sampling, Reconstruction from samples, Aliasing (1L); Analog Pulse Modulation - PAM (Natural & flat topped sampling), PWM, PPM (1L). Multiplexing - TDM, FDM (1L).

Module - 2: Digital Transmission: [9L]
Concept of Quantisation & Quantisation error, Uniform Quantiser (2L); Non-uniform Quantiser, A-law &μ-law companding (mention only) (1L); concept of Pulse Code Modulation ; Delta modulation, Adaptive delta modulation, DPCM (basic concept and importance only, no details) (2L); Encoding, Coding efficiency (1L); Line coding & properties, NRZ & RZ, AMI, Manchester coding (2L); Baseband Pulse Transmission(1L)

Module - 3: Digital Carrier Modulation & Demodulation Techniques: [9L]
Bit rate, Baud rate (1L); M-ary encoding, Introduction to the different digital modulation techniques - ASK, FSK, PSK, BPSK, QPSK, mention of 8 BPSK, 16 BPSK (5L); Introduction to QAM, mention of 8QAM, 16 QAM without elaboration (2L); Spread Spectrum Modulation - concept only (1L).

Module - 4: Information Theory & Coding: [8L]
Introduction, News value & Information content (1L); Entropy (1L); Mutual information (1L); Information rate (1L); The Shannon limit, Shanon-Fano algorithm for encoding (1L); Shannon's Theorem - Source Coding Theorem (1L); Channel Coding Theorem, Information Capacity Theorem (basic understanding only) (1L); Error Control & Coding – basic principle only (1L).

Text Books:
1. An Introduction to Analog and Digital Communications by Simon Haykin; Published by Wiley India.
2. Principles of Communication Systems, H. Taub and D. L.Schilling, TMH Publishing Co.

Reference Books :
1. Communication Systems 4th Edition by Simon Haykin; Published by Wiley India (Student Edition).
2. Communication Systems by A. B. Carlson, Published by McGraw-Hill.
3. Modern Digital and Analog Communication Systems, B.P.Lathi and Z.Ding, Oxford University Press.
4. Communications System (Analog and Digital) by Dr. Sanjay Sharma S K Kataria and Sons.

Course Name: Operations Research
Course Code: CS 505A
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Course Objective: Purpose of this course to develop models and then analyze the model using the techniques of Operations Research, Decision making under uncertainty and risk.

Prerequisites: Basic Knowledge of Function, plotting of Equation and inequations, Formulation of Mathematical Problem. Finding maximum and minimum from row or column or from Matrix.

Course Contents:

Module I [10L]
Linear Programming Problem(LPP):Basicsof Linear Programming Problem(LPP) and its Applications. General Mathematical Formulation of LPP; Definit ions: Convex set, Solution, Feasible Solution, Basic and Non-Basic Variables, Basic Feasible Solution, Degenerate and Non-Degenerate solution, Optimum/Optimal Solution; Solution of LPP by Graphical Analysis/Method, Simplex Method, Charnes' Big M-Method; Duality Theory.

Module II [6L]
Transportation Problem, Assignment Problem.

Module III [5L]
Game Theory: Introduction; Two person Zero Sum game, Saddle Point; Mini-Max and Maxi-Min Theorems (statement only) and problems; Games without Saddle Point; Graphical Method; Principle of Dominance

Module IV [5L]
Network Optimisation Models: CPMPERT(Arrow network),Time estimates, earliest expected time, latest allowable occurrence time, latest allowable occurrence time and stack. Critical path, Probability of meeting scheduled date of completion of project. Calculation of CPM network. Various floats for activities

Module V [2L]
Sequencing: Johnson's Algorithm (1957) For n Jobs and twomachines,n Jobs and three machines.

Module VI [5L]
Queuing Theory: Introduction and Basic Structure of Queuing Theory; Basic Definations and Notations; Birth-and-Death Model (Poisson / Exponential distribution); Poisson Queue Models: (M/M/1):(∞/FIFO) and (M/M/1):(N/FIFO) and Problems

Module VII [3L]
Inventory Control: Determination of EOQ, Components, Deterministic Continuous & Deterministic Periodic Review Models, Stochastic Continuous & Stochastic Periodic Review Models

Text Books:

1. Operations Research by Kanti Swaroop and P.K. Man Mohan, Sultan Chand and Sons
2. Linear Programming and Theory of Games by Ghosh and Chakraborty, Central Book Agency

Reference Books:

1. Linear Programming and Theory of Games by P.M.Karak, ABS Publishing House
2. Operations Research, D.K.Jana & T.K.Roy, Chhaya Prakashani Pvt. Ltd.

3. Operations Research, Kalavati,VIKAS
4. Operations Research,Humdy A Taha,PHI / Pearson
5. Operations Research Theory and Applications by J.K.Sharma, Macmillan India Limited.

Course Outcomes (COs):

After attending the course students should 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.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS505A.1	2	3	3	2								
CS505A.2	2	3	3	2								
CS505A.3	2	3	3	2								
CS505A.4	2	3	3	2								
CS505A.5	2	3	3	2								

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CS505A.1	3	3	3
CS505A.2	3	3	3
CS505A.3	3	3	3
CS505A.4	3	3	3
CS505A.5	3	3	3

Course Name: Computational Geometry
Course Code: CS505B
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Course Objective(s):

1. To introduce precise algorithmic analysis for problems in Computational Geometry
2. To discuss applications of Computational Geometry to graphical rendering
3. To familiarize with the notions of Voronoi diagrams and Delaunay Triangulations
4. To develop expected case analyses for linear programming problems in small dimensions

Prerequisites:

1. Mathematics-II
2. Algorithms &Programming Concept

Course Contents:

Module 1: [11L]

CONVEXHULLS ALGORITHMS [5L]: Orientation test; Degeneracy; Jarvis' march, Divide & conquer; Graham's scan, Chan's algorithm

PLANE-SWEEP ALGORITHMS [6L]: Line segment intersections (Plane-sweep), Doubly linked edge list, Overlay subdivisions, Polygon Triangulation (Triangulating monotone polygons, Partitioning simple polygons), Convex Partitioning(Lower and upper bounds, A factor 4 approximation algorithm)

Module 2: [9L]

LINEAR PROGRAMMING [4L]: Manufacturing with Molds (Necessary and Sufficient condition, Half-Plane Intersections), Linear Programming (Feasible Region, Optimal solution; Incremental and randomized algorithms)

ORTHOGONAL SEARCH [5L]: Geometric data structures; Range search (Quad-tree, kd-tree), Improvements on range searching (Range tree, fractional cascading), Inverse Range Search (Segment tree, interval tree, priority search tree)

Module 3 [7L]:

VORONOI DIAGRAMS & DELAUNAY TRIANGULATIONS [9L]: Voronoi diagrams (furthest point Voronoi diagram, other distance metrics, and Fortune’s plane sweep algorithm), Delaunay triangulation (Empty circles, local Delaunay hood, edge-flip, lifting, analysis, max min angles), Randomized incremental algorithm (Incremental construction, backward analysis etc.) , Point Location (DAG structure for point location in triangulations), Steiner triangulations (quality measure; quad-trees) , Delaunay refinement (Circum center insertion , Sphere packing argument)

Module 4: [9L]

ARRANGEMENTS [4L]: Zones (Duality, line arrangements; complexity, incremental algorithm, zone theorem), Levels and discrepancy (Super-sampling for rendering; Half-plane discrepancy)

OTHER GEOMETRY APPLICATIONS [5L]: Geometric Approximation Algorithms (TSP, Metric TSP, Euclidean TSP Polynomial Time Approximation Scheme (PTAS)), Motion Planning (Trapezoidal Maps, Robotics, Configuration Space. Connectedness, Visibility Graphs)

Text Books:

M. de Berg, M. van Kreveld, M. Overmars, and O. Schwarzkopf. Computational Geometry: Algorithms and Applications. Springer-Verlag, 2nd edition, 2000

Reference Books:

1. Franco P. Preparata and Michael Ian Shamos, Computational geometry: An Introduction, 1 st edition, Springer-Verlag New York
2. M. Bern and D. Eppstein. Mesh generation and optimal triangulation. Computing in Euclidean

Geometry (2nd ed.)
3. H. Edelsbrunner. Triangulations and meshes in computational geometry. Acta Numerica (2000), 133-213

Course Name: Distributed Algorithms
Paper Code: CS505C
Contact: 3:0:0
Total Contact Hours: 36
Credits: 2

Prerequisites:

1. Familiarity with the basic concept of Algorithm and protocols
2. A solid background in mathematics, including probability, connective arithmetic.

Course Contents:

Module– 1: [8L]

Introduction to Distributed Algorithms, Kinds of Distributed Algorithm (**1L**); Timing Models (**1L**), Synchronous Network Algorithms: Synchronous Network Model, (**1L**); Leader Election in a synchronous Ring (**1L**);
Algorithms in General Synchronous Networks (**1L**);
Distributed Consensus with Link Failures, Distributed Consensus with Process failures (**1L**); More Consensus problems (**2L**)

Module – 2:[5L]

Asynchronous System and network Model (2**L**); Shared Memory Algorithms and Model (**1L**); Mutual Exclusion, Resource Allocation (**1L**); Consensus; Atomic Objects(**1L**)

Module – 3: [5L]

Basic Network Algorithms(**2L**);
Synchronizers, Shared Memory versus Networks (**2L**); Logical Time, Global Snapshots and Stable properties (**1L**)

Module – 4: [11L]

Network Resource Allocation: Mutual Exclusion, General Resource Allocation (**2L**); Process Failures: Network methodology (**1L**);

Impossibility of Agreement in the presence of Faults, A Randomized Algorithm (**2L**); Failure Detectors, Approximate Agreement (**2L**);
Data Link Protocols: The Problem, Stenning'sProtocol (**2L**); Alternating Bit Protocol (**1L**);
Bounded Tag protocols tolerating Reordering, Tolerating Crashes (**1L**)

Module – 5: [7L]

Partially Synchronous Algorithms: Partially Synchronous System Models: MMT and General Timed Automata (**2L**);
Properties and Proof methods, Modeling Shared Memory and Network Systems (**2L**); Mutual Exclusion with Partial Synchrony: A single-register algorithm (**1L**);
Resilience to Timing Failures, Consensus with partial Synchrony: An Efficient algorithm (**2L**).

Text Books:

1.Joseph Jaja, "An Introduction to Parallel Algorithms", Addison Wesley
2.Nancy A. Lynch, "Distributed Algorithms", Morgan Kaufmann Publishers, 2000

Reference Books:

1. Geral Tel, "Introduction to Distributed algorithms", 2nd Edit ion, Cambridge,2004
2. Nicola Santoro, "Design and Analysis of Distributed Algorithms", Wiley Inter-science, John Wiley &
Sons, Inc., Publication,2007.
3. A.D. Kshemkalyani, M. Singhal, "Distributed Computing: Principles, Algorithms, and Systems", Cambridge University Press, March 2011.

Course Outcomes (COs):

After attending the course students should be able to

CO1	Develop the fundamental knowledge of parallel and distributed models
CO2	Design, development, and performance analysis of parallel and distributed
CO3	Develop and implement parallel and distributed algorithms
CO4	Analyze the performance issues in parallel computing and trade-offs
CO5	Understand the different issues involved in distributed environment

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS505C.1	3	3	3	3								3
CS505C.2	3	3	2	2								3
CS505C.3	3	2	3	3								3
CS505C.4	3	2	3	3								3
CS505C.5	2	2	2	2								3

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CS505C.1	3	3	3
CS505C.2	2	2	2
CS505C.3	3	3	2
CS505C.4	2	2	3
CS505C.5	3	3	3

Course Name: Computer Graphics Lab
Course Code: CS591
Contact: 0:0:3
Credits: 1.5

Course Objective(s)

- To understand the need of developing graphics application
- To learn algorithmic development of graphics primitives like: line, circle, polygon etc.
- To learn the representation and transformation of graphical images and pictures.

Prerequisites: Knowledge of C programming language

Course Contents:

1. Study of basic graphics functions defined in "graphics.h".
2. Program for Line Drawing using DDA algorithm.
3. Program for Line Drawing using Bresenhams algorithm.
4. Program for Circle Drawing using Bresenhams algorithm.
5. Program for Ellipse Drawing using Bresenhams algorithm.
6. Programs for 2-D transformations on different objects.
7. Program for Polygon filling algorithms [Flood-Fill Algorithm].
8. Program for Polygon filling algorithms [Boundary-Fill Algorithm].
9. Program for Polygon filling algorithms [Scan Line Algorithm].
10. Programs to study window to viewport transformations
11. Program for Cohen Sutherland Line clipping algorithm.
12. Programs to study 3-D transformations in C.

Course Outcomes (COs):

After attending the course students should be able to

CO1	Understand the fundamental concept of Computer graphics and mathematical knowledge and explain the foundations of computer graphics and different display technology and devices.
CO2	Demonstrate different scan conversion algorithms, drawing algorithms, polygon filling algorithms, curves and surface drawing algorithms, clipping algorithms, surface removal algorithms using graphics tools.
CO3	Understand the basic concept of graphics programming and implement clipping with the comprehension of windows, view-ports in relation to images 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.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS591.1	3	3	3	3	2				3			
CS591.2	3	3	3	3	2				3			
CS591.3	3	3	3	3	2				3			
CS591.4	3	3	3	3	2				3			
CS591.5	3	3	3	3	2				3			

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CS591.1	3	3	3
CS591.2	3	3	3
CS591.3	3	3	3
CS591.4	3	3	3
CS591.5	3	3	3

Course Name: Operating Systems Lab
Course Code: CS 592
Contacts: 0:0:3
Credits: 1.5

Course Objectives:

- To familiarize the students with the Operating System.
- To demonstrate the process, memory, file and directory management issues under the UNIX/ LINUX operating system.
- To introduce LINUX basic commands.
- To make students how to make simple programs in LINUX and administrative task of LINUX

Prerequisites:

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

List of Experiments:

1. **Essential Linux Commands[9P]:** Commands for files and directories cd, cp, mv, rm, mkdir, more, less, creating and viewing files, using cat, file comparisons, View files, kill, ps, who, sleep, grep, fgrep, find, sort, cal, banner, touch, file related commands – ws, sat, cut, grep etc.

Mathematical

commands –expr, factor, units, Pipes(use functions pipe, popen, pclose), named Pipes (FIFOs, accessing (FIFO)

2. **Shell Programming [6P]:** Creating a script, making a script executable, shell syntax (variables, conditions, control structures, functions, and commands).
3. **Process [3P]**: Starting new process, replacing a process image, duplicating a process image.
4. **Semaphore [3P]:** Programming with semaphores (use functions semget, semop, semaphore_p, semaphore_v).
5. **POSIX Threads[6P]:** Programming with pthread functions(viz. pthread_create, pthread_join, pthread_exit, pthread_attr_init, pthread_cancel)
   Shared Memory [9P]: Create the shared memory , Attach the shared memory segment to address space of the calling process , Read information from the standard input and write to the shared memory, Read the content of the shared memory and write on to the standard output , Delete the shared memory

Text Books:

Yashavant P. Kanetkar, UNIX Shell Programming, 1st edition, BPB Publications Beej's Guide to Unix IPC

Reference Books:

W. Richard Stevens, UNIX Network Programming, 2nd edition, Prentice Hall

Course Outcomes (COs):

After attending the course students should 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.
CO3	Implement them in Multiprogramming system.
CO4	Create process creation and implement inter process communication
CO5	Analyze the performance of the various page replacement schemes

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS592.1	3	3	3	3	3				3			
CS592.2	3	3	3	3	3				3			
CS592.3	3	3	3	3	3				3			
CS592.4	3	3	3	3	3				3			
CS592.5	3	3	3	3	3				3			

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CS592.1	3	3	3
CS592.2	3	3	3
CS592.3	3	3	3
CS592.4	3	3	3
CS592.5	3	3	3

Course Name: DATABASE MANAGEMENT SYSTEM LAB
Course Code: CS593
Contacts: 0:0:3
Total Contact Hours: 36
Credits: 1.5

Course Objectives:

1. To learn the data models, conceptualize and depict a database system
2. To learn the fundamental concepts of SQL queries.
3. To understand the concept of designing a database with the necessary attributes.
4. To know the methodology of Accessing, Modifying and Updating data & information from the relational databases
5. To learn database design as well as to design user interface and how to connect with database.

Prerequisites:

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

Course Contents:

- Structured Query Language

Module1: [6L]
Creating Database
Creating a Database
Creating a Table Specifying Relational Data Types
Specifying Constraints Creating Indexes

Module2: [3L]
Table and Record Handling
INSERT statement
Using SELECT and INSERT together
DELETE, UPDATE, TRUNCATE statements
DROP, ALTER statements

Module3: [6L]
Retrieving Data from a Database
The SELECT statement
Using the WHERE clause
Using Logical Operators in the WHERE clause
Using IN, BETWEEN, LIKE , ORDER BY, GROUP BY and HAVING Clause Using Aggregate Functions
Combining Tables Using JOINS
Sub-queries

Module 4: [3L]
Database Management
Creating Views
Creating Column Aliases
Creating Database Users
Using GRANT and REVOKE

Module 5:[6L]
PL/SQL

Module 6:[6L]
Database design using E-R model and Normalization

Module 7:[6L]
Design and implementation of some on line system [Library Management System]

Text Books:

1) SQL, PL/SQL by Ivan Bayross, BPB Publications
2) Oracle PL/SQL Programming, 6th Edition - O'Reilly Media By Steven Feuerstein, Bill Pribyl

Course Outcomes (COs):

After attending the course students should 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 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.
CO3	To Analyze and Create the 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	To Implement and organize the database of an organization as a team.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS593.1	3	2	2	2	2				3			3
CS593.2	3	2	2	2	2				3			3
CS593.3	3	3	2	2	2				3			3
CS593.4	3	2	2	2	2				3			3
CS593.5	3	2	2	2	2				3			3

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CS593.1	3	3	3
CS593.2	3	3	3
CS593.3	3	3	3
CS593.4	3	3	3
CS593.5	3	3	3

Course Name: Object Oriented Programming Lab
Course Code: CS594A
Contact: 0:0:3
Credits: 1.5

Course Objectives:

- 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)

Prerequisites:

1. Computer Fundamentals
2. Basic understanding of Computer Programming and related Programming Paradigms
3. Problem Solving Techniques with proper logic Implementation.

Course Contents:

Module 1: Java Basics:

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 & call by reference, static variables & methods, inner classes.

Module 2: Basic String handling & I/O:

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.

Module 3: Inheritance, Interface and Java Packages:

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 userdefined 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.

Module 4: Exception handling, Multithreading and Applet Programming:

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.

Textbooks:

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.
   Rambaugh, James Michael, Blaha – " Object Oriented Modelling and Design " – Prentice Hall, India

Course Outcomes (COs):

After attending the course students should 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
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.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS594A.1	3	3	2	3	2				3			2
CS594A.2	3	3	3	3	2				3			2
CS594A.3	3	3	3	3	2				3			2
CS594A.4	3	3	3	3	3				3			2
CS594A.5	3	3	3	3	3				3			2

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CS594A.1	3	2	2
CS594A.2	3	2	2
CS594A.3	3	2	3
CS594A.4	3	2	3
CS594A.5	3	3	3

Course Name: Multimedia Technology Lab
Course Code: CS594B
Contacts: 0:0:3
Credits: 1.5

Perquisites: Computer Graphics Programming

Course Contents:

1. Point plotting, line & regular figure algorithms
2. Raster scan line & circle drawing algorithms
3. Clipping & Windowing algorithms for points, lines & polygons
4. 2-D / 3-D transformations
5. Simple fractals representation
6. Filling algorithms
7. Web document creation using Dreamweaver
8. Creating Animation using Flash.

Course Name: Communication Engineering Lab
Course Code: CS 594C
Contacts: 0:0:3
Credits: 1.5

Course Objective:
To provide the basic skills required to understand, develop, and design of various engineering applications involving analog and digital communication theory. To provide basic laboratory exposures for communication principles and applications.

Prerequisites: Knowledge in Electronics and Communication

List of Experiments:

1. Measurement of modulation index of an AM signal.
2. Generation of FM using VCO chip (to view the wave shapes).
3. Study of PAM and demodulation.
4. Study of PCM and demodulation.
5. Study of ASK modulator and demodulator.
6. Study of BPSK modulator and demodulator.
7. Study of BFSK modulator and demodulator.
8. Study on QPSK modulator and demodulator.
9. One innovative experiment on bread-board realization of any one analog or digital communication circuit.

Text Books:

1. An Introduction to Analog and Digital Communications by Simon Haykin; Published by Wiley India.
2. Principles of Communication Systems, H. Taub and D .L.Schilling, TMH Publishing Co.

Reference Books:

1. Communication Systems 4th Edition by Simon Haykin; Published by Wiley India (Student Edition).
2. Communication Systems by A. B. Carlson, Published by McGraw-Hill.
3. Modern Digital and Analog Communication Systems, B.P.Lathi and Z.Ding, Oxford University Press.
4. Communications System (Analog and Digital) by Dr. Sanjay Sharma S K Kataria and Sons.

Course Name: ENVIRONMENTAL SCIENCE
Course Code: MC 501
Credits: 0
Total Lectures: 36

Course Objectives:

- Be able to understand the natural environment and its relationships with human activities.
- Be able to apply the fundamental knowledge of science and engineering to assess environmental and health risk.
- 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 Contents:

Module 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.

Module 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).

Module 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),ground water 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).

Module 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

Module 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.

Text Book:

A Textbook of Environmental Studies, Shashi Chawla. Tata McGraw Hill Education Private Limited

References Books:

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

Course Outcomes (COs):

After attending the course students should be able to

CO1	Understand the natural environment and its relationships with human activities.
CO2	Apply the fundamental knowledge of science and engineering to assess environmental and health risk.
CO3	Understand guidelines and procedures for health and safety issues obeying the environmental laws and regulations.
CO4	Develop guidelines and procedures for health and safety issues obeying the environmental laws and regulations. Acquire skills for scientific problem-solving related to air, water, noise& land pollution.
CO5	Develop skills for scientific problem-solving related to air, water, noise & land pollution.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MC501.1			2			3	3					
MC501.2			2			3	3					
MC501.3			2			3	3					
MC501.4			2			3	3					
MC501.5			2			3	3					

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
MC501.1	2	2	2
MC501.2	2	2	2
MC501.3	2	2	2
MC501.4	2	2	2
MC501.5	2	2	2

Department: Computer Science & Engineering

Curriculum Structure & Syllabus

(Effective from 2018-19 Admission Batch)
Under Autonomy (**GR A:** ECE, EE, EIE, BME; **GR B:** CSE, IT, ME, CE, FT)

3rd Year

6th Semester

Sl.No.	Course Code	Paper Code	Theory	Contact Hours/Week				Credit Points
				L	T	P	Total	
A. THEORY								
1	PC	CS601	Computer Networks	3	0	0	3	3
2	PC	CS602	Microprocessors and Microcontrollers	2	1	0	3	3
3	PC	CS603	Software Engineering	3	0	0	3	3
4	PE	CS604	A. Compiler Design B. Computer Vision C. Simulation and modeling	3	0	0	3	3
5	OE	CS605	A. Pattern Recognition B. Distributed Operating System C. Distributed Database	3	0	0	3	3
6	OE	CS606	A. Data Warehousing and Data Mining B. Digital Image Processing C. E-commerce and ERP	3	0	0	3	3
Total of Theory							**18**	**18**
B. PRACTICAL								
7	PC	CS691	Computer Networks Lab	0	0	3	3	**1.5**
8	PC	CS692	Microprocessors and Microcontrollers Lab	0	0	3	3	**1.5**
9	PC	CS693	Software Engineering Lab	0	0	3	3	**1.5**
10	PROJ	PR 691	Project-VI	0	0	2	2	**1**
11	PROJ*	PR 692	Innovative activities- V	0	0	0	0	**0.5**
C. MANDATORY ACTIVITIES / COURSES								
12	MC	MC 681	Technical Lecture Presentation & Group Discussion-I	3	0	0	3	
Total of Theory, Practical & Mandatory Activities/Courses							32	**24.0**

*Students may choose either to work on participation in all the activities of Institute's Innovation Council foreg: IPR workshop/ Leadership Talks/ Idea/ Design/ Innovation/ Business Completion/ Technical Expos etc.

Innovative activities to be evaluated by the Programme Head/ Event coordinator based on the viva voce and submission of necessary certificates as evidence of activities.

Course Name: Computer Networks
Course Code: CS601
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Course Objective(s):

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

Prerequisite:

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

Course Contents:

Module I: 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;

Module II: 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]**

Module III: Network Layer [10L]

IP Addressing, IPv4and IPv6. Difference IPv4and IPv6, Conversion ofIPv4and IPv6, Subnetting, Supernetting, 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]**

Module IV: 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]**

Module V: Application Layer [3L]

Introduction to DNS, SMTP, SNMP, FTP, HTTP & WWW: Cryptography (Public, Private Key based), Digital Signature, Firewalls

Module VI: 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. 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

Course Outcomes (COs):

After attending the course students should be able to

CO1	Understand basics of computer network and different architecture and topologies of computer network and analyze the requirements for a given organizational structure and select the most appropriate networking architecture and technologies.
CO2	Understand/analyze different protocol of data link layer and apply them to solve engineering problems.
CO3	Understand/analyze different protocol of Network and Transport Layer and apply them to solve engineering problems.
CO4	Understand/analyze different protocol of session and application layer and apply them to solve engineering problems.
CO5	Develop Analyze, specify and design the topological and routing strategies using socket programming.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS601.1	3	3	2	2	2				2	2		3
CS601.2	3	3	3	3	3				2	2		3
CS601.3	3	3	3	3	3				2	2		3
CS601.4	3	3	3	3	3				2	2		3
CS601.5	2	3	3	3	3				2	2		3

CO-PSO Mapping

Cos	PSO1	PSO2	PSO3
CS601.1	3	3	3
CS601.2	3	3	3
CS601.3	3	3	3
CS601.4	3	3	3
CS601.5	3	3	3

Course Name: Microprocessors & Microcontrollers
Course Code: CS602
Contact: 2:1:0
Total Contact Hours: 36
Credits: 3

Course Objective(s):

- To learn the basics of a particular microprocessor.
- To learn the basics of a particular microcontroller.
- To learn the interfacing of microprocessor.

Prerequisite:

1. Familiarity with the number system
2. A solid background in digital logic.

CourseContents: Module-1:

[9L]

Introduction to Microcomputer based system. [1L]
History of evolution of Microprocessor 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 processor (software and hardware) [2L]
I/O Device Interfacing - I/O Mapped I/O and Memory Mapped I/O, Memory interfacing with 8085 [2L]

Module -2: [11L]
Instruction set of 8085 microprocessor, Addressing modes. [3L]
Assembly language programming with examples, Counter and Time Delays, Stack and Subroutine. [6L]
Timing diagram of the instructions (a few examples) [2L]

Module 3: [9L]
The 8086 microprocessor- Architecture, Pin Details, Addressing modes, interrupts [4L] Instruction set, Examples of Simple Assembly Language [3L]
Memory interfacing with 8086 [2L]

Module -4: [7L]
Introduction to 8051 Microcontroller – Architecture, Pin Details. [3L]
Addressing modes, Instruction set, Examples of Simple Assembly Language. [4L]

Text Books:

1. MICROPROCESSOR architecture, programming and Application with 8085 - R. Gaonkar (Penram international Publishing LTD.) ***[For Module 1 and 2]***
2. Fundamentals of Microprocessor and Microcontrollers - B. Ram (Paperback) ***[For Module 3]***
3. 8051 Microcontroller – K. Ayala (Cengage learning) ***[For Module 4]***

ReferenceBooks:

1. 8086 Microprocessor – K Ayala (Cengage learning)
2. The 8051 microcontroller and Embedded systems- Mazidi, Mazidi and McKinley (PEARSON)

Course Outcomes (COs):

After attending the course students should be able to

CO1	To acquire the knowledge of hardware details of 8085 and 8086 microprocessor AND 8051 microcontroller with the related signals and their implications.
CO2	To develop skill in assembly Language programming of 8085
CO3	To understand the concept and techniques of designing and implementing interfacing of microprocessor with memory and peripheral chips involving system design.
CO4	To analyze the performance of computers and its architecture to real-life applications
CO5	Analyze the data transfer information through serial & parallel ports.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS602.1	3	3	3	2								
CS602.2	3	3	3	2								
CS602.3	3	3	3	2								
CS602.4	3	3	3	2								
CS602.5	3	3	3	2								

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CS602.1	3	3	3
CS602.2	3	3	3
CS602.3	3	3	3
CS602.4	3	3	3
CS602.5	3	3	3

Course Name: Software Engineering
Course Code: CS603
Contact: 3:0:0
Total Contact Hours: 36
Credits:3

Course Objective(s):

1. To develop basic Knowledge in Software Engineering and its applications.
2. To understand software Engineering layered architecture and the process frame work.
3. To analyze software process models such as the waterfall, spiral, evolutionary models and agile method for software development.
4. To design software requirements and specifications of documents.
5. To understand project planning, scheduling, cost estimation, risk management.
6. To describe data models, object models, context models and behavioral models.
7. To learn coding style and testing issues.
8. To know about the quality checking mechanism for software process and product

Prerequisites:

1. An understanding of basic computer software
2. Object Oriented programming skills.

Course Contents: Module- 1:[6L]
SoftwareEngineeringCharacteristics,Components,Application,Definitions,SoftwareProcessmodels-WaterfallModel,Prototypemodel,RAD,EvolutionaryModels,Incremental,Spiral. Agile Method SoftwareProjectPlanning-
FeasibilityAnalysis,TechnicalFeasibility,CostBenefitAnalysis,COCOMO (Basic, intermediate, Complete) model

Module– 2: [3L]
SystemAnalysis:PrincipleofStructureAnalysis,RequirementAnalysis,DFD,EntityRelationship Diagram,DataDictionary,DataModeling,SoftwareRequirementsSpecification

Module – 3:[3L**]**
SoftwareDesignAspects:Objectives,Principles,Concepts,Top-DownandBottom-Updesign;Decision tree,decisiontableandstructuredEnglish,Structurechart,TransformanalysisFunctional Vs.Object-Orientedapproach

Module- 4:[4L**]**
UnifiedModelingLanguage:Classdiagram,interactiondiagram:collaborationdiagram,sequencediagram,statechartdiagram,activity, diagram,implementationdiagram, Use Case diagram
Module –5:[14L]
Coding&Documentation StructuredProgramming,ModularProgramming,ModuleRelationship-Coupling,Cohesion,OOP Programming,InformationHiding,Reuse,SystemDocumentation.
Testing–LevelsofTesting,IntegrationTesting,SystemTesting**.**
TestCases-
WhiteBoxandBlackBoxtestingSoftwareQuality,QualityAssurance,SoftwareMaintenance, SoftwareConfigurationManagement,SoftwareArchitecture.

Module– 6:[6L]
Software Project Management – Project Scheduling, Staffing, Quality Assurance, Risk Management: Reactive vs. Proactive Risk strategies, software risks, Risk identification, Risk projection, Risk refinement Project Monitoring.

Text Books:

1. SoftwareEngineering:Apractitioner'sapproach–Pressman (MH)
2. SoftwareEngineering-PankajJalote(Wiley-India)

ReferenceBooks:

1. Fundamentals of SoftwareEngineering-RajibMall(PHI)
2. SoftwareEngineering–AgarwalandAgarwal(PHI)
3. SoftwareEngineering- Sommerville (Pearson)

Course Outcomes (COs):

After attending the course students should be able to

CO1	Understand the basic concept of Software Engineering and mathematical knowledge and apply them in designing solution to engineering problem including the 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.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS603.1	3	3	3	2								3
CS603.2	3	3	3	2								3
CS603.3	3	3	3	2								3
CS603.4	3	3	3	2								3
CS603.5	3	3	3	2								3

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CS603.1	3	3	3
CS603.2	3	3	3
CS603.3	3	3	3
CS603.4	3	3	3
CS603.5	3	3	3

Name of the Paper: Compiler Design
Paper Code: CS604A
Contact (Periods/Week): 3L / Week
Credit Point: 3
No. of Lectures: 35

Course Objectives:

- To make the student understand the process involved in a compiler, create an overall view of various types of translators, linkers, loaders, and phases of a compiler,
- To Understand what is syntax analysis, various types of parsers especially the top-down approach, awareness among students the various types of bottom-up parsers,
- To 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.

Prerequisite:
Mathematics
Concept of programming languages
Data structures
Computer architecture
Formal languages and automata theory

Syllabus:

Module I [7L]
Compilers, Cousins of the Compiler, Analysis-synthesis model, The phases of the compiler. The role of the lexical analyser, Tokens, Patterns, Lexemes, Input buffering, Specifications of atoken, Recognition of tokens, Finite automata, From a regular expression to an NFA, From a regular expression to DFA, Design of a lexical analyser generator (Lex).

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-upevaluation of S-attributed definitions, L-attributed definitions, Bottom-up evaluation of inheritedattributes.

Module III [7L]
Type systems, Specification of a simple type checker, Equivalence of type expressions, Type conversionsSource language issues (Activation trees, Control stack, scope of declaration,Binding of names),Symbol tables, dynamic storage allocation techniques.

Module IV[3L]
Intermediate languages, Graphical representation, Three-address code, Implementation of threeaddress statements (Quadruples, Triples, Indirect triples).

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 optimizationObject code forms, machine dependent code optimization, register allocation and assignment,generic code generation algorithms, DAG for register allocation.

Recommended Text Books:

[1] Alfred Aho, V. Ravi Sethi, D. Jeffery Ullman, "Compilers Principles, Techniques andTools", Addison Wesley, 2nd edition
[2] Holub Allen. Compiler Design in C, PHI, 1993.

Recommended reference Books:
[1] Chattopadhyay, Santanu. Compiler Design. PHI Learning Pvt. Ltd., 2005
[2] Tremblay and Sorenson Compiler Writing-McGraw-Hill International

Course Outcomes (COs):

After attending the course students should 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.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS604A.1	3	3	2	3								3
CS604A.2	3	3	3	3								3
CS604A.3	3	2	2	3								3
CS604A.4	2	2	3	3								3
CS604A.5	3	2	3	3								3

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CS604A.1	3	3	3
CS604A.2	3	3	3
CS604A.3	3	3	3
CS604A.4	3	3	3
CS604A.5	3	3	3

Course Name: Computer Vision
Course Code: CS604B
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Course Objective:
Computer Vision focuses on development of algorithms and techniques to analyze and interpret the visible world around us. This requires understanding of the fundamental concepts related to multidimensional
signal processing, feature extraction, pattern analysis visual geometric modeling,
stochastic optimization etc. Knowledge of these concepts is necessary in this field, to explore and contribute to research and further developments in the field of computer vision. Applications range from Biometrics, Medical diagnosis, document processing, mining of visual content, to surveillance, advanced rendering etc.

Prerequisites:
No prior experience with computer vision is assumed, although previous knowledge of visual computing or signal processing will be helpful. The following skills are necessary for this class:

- Data structures
- Programming: Projects are to be completed and graded in Python. All project starter code will be in Python.
- Mathematics: Linear algebra, vector calculus, and probability.

Course Contents:
Introduction [2L]
Introduction to Computer Vision: Low-level, Mid-level, High-level, Impact of Computer Vision, Components and its applications.
Digital Image Formation and low-level processing [5L]
Overview: Fundamentals of Image Formation, Transformation: Orthogonal, Euclidean, Affine, Projective etc. Fourier Transform, Convolution and Filtering, Light and Color and Image Filtering, Image Enhancement, Restoration, Histogram Processing.
Depth estimation and Multi-camera views [5L]
Perspective, Binocular Stereopsis: Camera and Epipolar Geometry; Image sensing, pixel arrays, CCD cameras. Image coding, Homography, Rectification, DLT, RANSAC, 3-D reconstruction framework; Auto-calibration.Apparel.
Feature Extraction [7L]
Edge detection - Canny, LOG, DOG; Line detectors (Hough Transform), Corners - Harris and Hessian Affine, Orientation Histogram, SIFT, Image preprocessing, Image representations (continuous and discrete) , Scale-Space Analysis- Image Pyramids and Gaussian derivative filters, Gabor Filters and DWT.
Image Segmentation [4L]
Contour based representation, Region based representation, Deformable curves and surfaces, Snakes and active contours, Level set representations, Fourier and wavelet descriptors, Medial representations, Multi-resolution analysis.
Pattern Analysis [7L]
Clustering: K-Means, K-Medoids, Mixture of Gaussians, Classification: Discriminant Function, Supervised, Un-supervised, Semi-supervised; Classifiers: Bayes, KNN, ANN models; Dimensionality Reduction: PCA, LDA, ICA; Non-parametric methods.
Motion Analysis [3L]
Background Subtraction and Modeling, Regularization theory, Optical computation, Stereo Vision, Motion estimation, Structure from motion.

Shape representation [3L]
Inferring 3D shape from shading; surface geometry.Boundary descriptors; codons; super-quadrics.

Text Books:

1. Szeliski, R., 2010. Computer vision: algorithms and applications. Springer Science & Business Media.
2. Forsyth, D.A. and Ponce, J., 2003. A modern approach. Computer vision: a modern approach, 17, pp.21-48.

Reference Books:

1. Hartley, R. and Zisserman, A., 2003. Multiple view geometry in computer vision.Cambridge university press.
2. Fukunaga, K., 2013. Introduction to statistical pattern recognition.Elsevier.
3. Gonzalez, R.C. and Woods, R.E., 1992. Digital image processing addison-wesley. Reading, Ma, 2.
4. Gonzalez, R.C., Woods, R.E. and Eddins, S.L., 2004. Digital image processing using MATLAB.Pearson Education India.
5. Forsyth, D.A., Mundy, J.L., diGesu, V. and Cipolla, R. eds., 2003. Shape, contour and grouping in computer vision. Springer.
6. Gruen, A. and Huang, T.S. eds., 2013. Calibration and orientation of cameras in computer vision (Vol. 34). Springer Science & Business Media.

Journals:

1. Hong, L. and Wan, Y., 1995. IEEE transactions on pattern analysis and machine intelligence. Mean shift, mode seeking, and clustering [J], 17, pp.790-799.
2. Fu, K.S., 2004. IEEE Transactions on Pattern Analysis and Machine Intelligence.Encyclopedia of Statistical Sciences.
3. Mitiche, A. and Bouthemy, P., 1996. Computation and analysis of image motion: A synopsis of current problems and methods. International journal of computer vision, 19(1), pp.29-55.
4. Uijlings, J.R., Van De Sande, K.E., Gevers, T. and Smeulders, A.W., 2013. Selective search for object recognition. International journal of computer vision, 104(2), pp.154-171.
5. Russakovsky, O., Deng, J., Su, H., Krause, J., Satheesh, S., Ma, S., Huang, Z., Karpathy, A., Khosla, A., Bernstein, M. and Berg, A.C., 2015. Imagenet large scale visual recognition challenge. International journal of computer vision, 115(3), pp.211-252.
6. Krishna, R., Zhu, Y., Groth, O., Johnson, J., Hata, K., Kravitz, J., Chen, S., Kalantidis, Y., Li, L.J., Shamma, D.A. and Bernstein, M.S., 2017. Visual genome: Connecting language and vision using crowdsourced dense image annotations. International Journal of Computer Vision, 123(1), pp.32-73.

Course Outcomes (COs):

After attending the course students should be able to

CO1	Identify basic concepts, terminology, theories, models and methods in the field of computer vision
CO2	Describe known principles of human visual system
CO3	Describe basic methods of computer vision related to multi-scale representation, edge detection and detection of other primitives, stereo, motion and object recognition
CO4	Suggest a design of a computer vision system for a specific problem
CO5	Identify, formulate and solve problems in image procecssing and computer vision.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS604B.1	3	3	2	2		2						3
CS604B.2	3	2	3	2		2						3
CS604B.3	3	3	2	3		2						3
CS604B.4	3	2	2	2		2						3
CS604B.5	3	3	2	2		2						3

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CS604B.1	3	3	3
CS604B.2	3	3	3
CS604B.3	3	3	3
CS604B.4	3	3	3
CS604B.5	3	3	3

Course Name: Simulation and Modeling
Course Code: CS604C
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

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.

Prerequisites:

- Programming and Data Structures
- Discrete Mathematics and Probability theory
- Game theory
- Numerical Analysis

Course Contents:

Module-I: 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.

Module –II : 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.

Module-III : 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 .

Module-IV : Analysis of Simulation output [5L]
Sensitivity Analysis, Validation of Model Results

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.

Course Outcomes (COs):

After attending the course students should be able to

CO1	Student will be able to summarize the issues in Modeling 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.
CO5	Student will be able to implement new model by applying their knowledge

CO-PO Mapping:

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

Paper Name: Pattern Recognition
Code: IT(CSE) 605A
Contacts: 3L
Credits: 3
Allotted hours: 35L

Course Objectives

- Understand the concept of a pattern and the basic approach to the development of pattern recognition and machine intelligence algorithms
- Understand the basic methods of feature extraction, feature evaluation, and data mining
- Understand and apply both supervised and unsupervised classification methods to detect and characterize patterns in real-world data
- Develop prototype pattern recognition algorithms that can be used to study algorithm behaviour and performance against real-world multivariate data

Prerequisites:

- Probability theory,
- Artificial Intelligence

Course Contents:

Module – I [4L]
Introduction[2]: The nature of statistical pattern recognition, Definitions, data sets for Pattern Recognition
Different Paradigms of Pattern Recognition [1]
Representations of Patterns and Classes [1]
Different learning paradigms, The basic structure of a pattern recognition system[2]

Module –II [6L]
Feature extraction [6]:
Feature Extraction, Feature subset selection and classification stages [2]
Dimensionality reduction: Principal component analysis, Fisher discriminant analysis, Factor Analysis[4]

Module –III[13L]
Different Approaches to Prototype Selection [2]
Nearest Neighbour Classifier and variants [2]
Bayes Classifier [3]
Decision Trees [3]
Linear Discriminant Function [3]

Module – IV[13L]
Support Vector Machines [2]
Clustering [3]
Clustering Large datasets [3]
Combination of Classifiers [3]
Applications - Document Recognition [2]

Text Books:

- R.O.Duda, P.E.Hart and D.G.Stork, Pattern Classification, John Wiley, 2001
- Devi V.S.; Murty, M.N. (2011) Pattern Recognition: An Introduction, Universities Press, Hyderabad.

Reference books:

- S.Theodoridis and K.Koutroumbas, Pattern Recognition, 4th Ed., Academic Press, 2009
- C.M.Bishop, Pattern Recognition and Machine Learning, Springer, 2006

Course Outcomes (COs):

After attending the course students should be able to

CO1	Explain and compare a variety of pattern classification, structural pattern recognition, and pattern classifier combination techniques.
CO2	Summarize, analyze, and relate research in the pattern recognition area verbally and in writing.
CO3	Apply performance evaluation methods for pattern recognition, and critique comparisons of techniques made in the research literature.
CO4	Apply pattern recognition techniques to real-world problems such as document analysis and recognition.
CO5	Implement simple pattern classifiers, classifier combinations, and structural pattern recognizers.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
IT(CSE) 605A.1	3	2	2	2								
IT(CSE) 605A.2	3	2	2	2								
IT(CSE) 605A.3	3	3	2	2								
IT(CSE) 605A.4	3	2	2	2								
IT(CSE) 605A.5	3	2	2	2								

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
IT(CSE) 605A.1	3	3	3
IT(CSE) 605A.2	3	3	3
IT(CSE) 605A.3	3	3	3
IT(CSE) 605A.4	3	3	3
IT(CSE) 605A.5	3	3	3

Course Name: Distributed Operating system

Course Code: CS605B

Contact: 3:0:0

Total Contact Hours: 36

Credits: 3

Course Objective(s):

This course covers general issues of design and implementation of distributed operating systems. The focus is on issues that are critical to the applications of distributed systems and computer networks, which include inter-process communication, distributed processing, sharing and replication of data and files.

Prerequisites:

1. Have to knowledge about Computer Network, operating system and Computer architecture.
2. Required C and UNIX knowledge.

Course Contents:

Module I [6L]

Functions of an Operating System, Design Approaches, Review of Network Operating System and Distributed Operating System, Issue in the design of Distributed Operating System, Overview of Computer Networks, Modes of communication, System Process, Interrupt Handling, Handling Systems calls, Protection of resources, Micro-Kernel Operating System, client server architecture.

Module II [8L]

The Critical Section Problem, Other Synchronization Problems, Language Mechanisms for Synchronization, Axiomatic Verification of Parallel Programs, Inter process communication (Linux IPC Mechanism), Remote Procedure calls, RPC exception handling, security issues, RPC in Heterogeneous Environment, Case studies.

Module III [8L]

Clocks: Logical clocks, Physical clocks, Vector Clock, clock synchronization algorithms, Mutual Exclusion, Non-Token Based Algorithms – Lamppost's Algorithm, Token-Based Algorithms, Suzuki-Kasami's Broadcast Algorithm, Election Algorithms-Bully algo etc, Dead locks in Distributed Systems, Thrashing, Resource Management (Load Balancing approach, Load Sharing approach), Process Management, process Migration, Thread, and Case studies.

Module IV [8L]

Overview of shared memory, Architecture, Algorithm, Protocols, Design Issues, consistency model, Page based Distributed Shared Memory, Shared variable Distributed shared Memory, and Object based Distributed shared Memory, Heterogeneous DSM, Distributed Scheduling, Issues, Components, Algorithms Case studies.

Module V [6L]

File models, File access, File sharing, file-caching, File Replication, Features of Naming system terminologies and concepts of naming, fault Tolerance, Network File System (case study), 8NFS on Linux Directory Services, Security in Distributed File system, Tools (Cuda, , Amazon AWS, OpenStack, Cilk, gdb, threads, OpenMP, Hadoop), Case studies

Text Books:

- P.K. Sinha Distributed Operating system (Willey publication)
- M. Beck et al Linux Kernel, Internal Addition Wesley, 1997.

Reference Books:

- T. L. Casavant and M. Singhal, Distributed Computing Systems, IEEE Computer Society Press (1994) ISBN 0-8186-3032-9
- R. Chow and T. Johnson, Distributed Operating Systems & Algorithms, Addison-Wesley (1997) ISBN 0-201-49838-3
- G. Coulouris, J. Dollimore, and T. Kindberg, Distributed Systems: Concepts & Design, 3rd edition, Addison-Wesley (2001) ISBN 0-201-61918-0
- D. L. Galli, Distributed Operating Systems, Prentice-Hall (2000) ISBN 0-13-079843-6
- C. Leopold, Parallel and Distributed Computing, John Wiley & Sons (2001) ISBN 0-471-35831-2
- G. J. Nutt, Centralized and Distributed Operating Systems, Prentice-Hall (1992) ISBN 0-201-61251-8
- M. Raynal, M. Beeson, trans., Algorithms for Mutual Exclusion, MIT Press (1986) ISBN 0-262-18119-3
- M. Raynal, J. Howlett, trans., Distributed Algorithms and Protocols, J. Howlett, trans., Wiley & Sons (1988) ISBN 0-471-91754-0
- B.W. Kernighan and R Pide, the UNIX Programming Environment Prentice Hall of India-2000
- Asilberschatz P.B Garvin Operating System Concept, John Wiley & Sons (Asia) Pte 2000.
- Cox K, "Red Hat Linux Administrator's Guide". PHI (200)

Course Outcomes (COs):

After attending the course students should be able to

CO1	Develop the fundamental knowledge of parallel and distributed models
CO2	Design, development, and performance analysis of parallel and distributed algorithms
CO3	Develop and implement parallel and distributed algorithms
CO4	Analyze the performance issues in parallel computing and trade-offs
CO5	Understand the different issues involved in distributed environment

CO-PO Mapping

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS605B.1	3	3	3	3								
CS605B.2	3	3	3	3								
CS605B.3	3	3	3	3								

CS605B.4	3	3	3	3								
CS605B.5	3	3	3	3								

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CS605B.1	3	3	3
CS605B.2	3	3	3
CS605B.3	3	3	3
CS605B.4	3	3	3
CS605B.5	3	3	3

Course Name: Distributed Database

Course Code: CS605C

Contact: 3:0:0
Contact Hours: 36
Credits: 3

Course Objective(s):

- To learn the principal and foundation of distributed database.
- To learn the architecture, design issue and integrity control of distributed database.
- To learn the details of query processing and query optimization technique.
- To learn the concept of transaction management in distributed database.

Prerequisites:

- Good knowledge in Database Management System.
- Determination to learn new and difficult things.

Course Contents:
Module I: [9L]
Introductory concepts and design of (DDBMS)
Data Fragmentation; Replication; and allocation techniques for DDBMS; Methods for designing and implementing DDBMS, designing a distributed relational database; Architectures for DDBMS: cluster federated, parallel databases and client server architecture.

Module II: [9L]
QueryProcessing [4L]
Overview of Query Processing: Query processing problem; Objectives of Query Processing; Complexity of Relational Algebra operations; characterization of Query processors; Layers of Query Processing; Translation of global queries.
Transaction Management [5L]
Introduction to Transaction Management: Definition of Transaction, Properties of Transaction, types of transaction; Distributed Concurrency Control: Serializability theory; Taxonomy of concurrency control mechanisms; locking bases concurrency control algorithms.

Module III: [5L]
Partitioned network; check point and cold start; Management of distributed transaction; Architectural aspect; Node and link failure recoveries

Module IV: [3L]
Distributed data dictionary management. Distributed database administration. Heterogeneous databases- federated database, reference architecture, loosely and tightly coupled.

Module V: [5L]
Distributed Object Database Management systems [5L]
Fundamental Object concepts and Object models; Object distribution design; Architectural issues; Object management; Distributed object storage; Object query processing

Module IV: [5L]
Current trends & developments related to Distributed database applications technologies [5L]
Distributed Object/component-based DBMS; Database Interoperability including CORBA; DCOM and Java RMI;Distributed document-based systems; XML and Workflow management.

Text books:

1. Distributed Databases - Principles and Systems; Stefano Ceri; GuiseppePelagatti; Tata McGraw Hill; 1985.
2. Fundamental of Database Systems; Elmasri&Navathe; Pearson Education;Asia

Reference books:

1. Database System Concepts; Korth&Sudarshan;TMH
2. Principles of Distributed Database Systems; M. Tamer Özsu; and Patrick Valduriez PrenticeHall

Course Outcomes (COs):

After attending the course students should be able to

CO1	Understand distributed database systems architecture and design
CO2	Be able to apply methods and techniques for distributed quey processing and optimisation
CO3	Understand the broad concepts of distributed transaction process
CO4	Understand the basic concepts of Data warehousing and OLAP technology
CO5	Be able to apply methods and techniques for association analysis, data classification and clustering

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS605C.1	3	2	2	2								
CS605C.2	3	2	2	3								
CS605C.3	3	3	2	2								
CS605C.4	3	3	2	3								
CS605C.5	3	2	2	2								

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CS605C.1	3	3	3
CS605C.2	3	3	3
CS605C.3	3	3	3
CS605C.4	3	3	3
CS605C.5	3	3	3

Course Name: Data Warehousing & Data Mining
Course Code: CS606A
Contact: 3:0:0
Contact Hours: 36
Credits: 3

Course Objective(s):

1. To understand classical models and algorithms in data warehousing and data mining.
2. To enable students to analyze the data, identify the problems, and choose the relevant models and algorithms to apply.
3. To assess the strengths and weaknesses of various methods and algorithms and to analyze their behavior.

Perquisites:

Programming and Data Structures, Database Management System

Course Contents:

Module I: Introduction to Data Warehousing [8L]

Data Warehousing: Data warehouse Architecture and Infrastructure , Data warehousing Components –Building a Data warehouse –- Mapping the Data Warehouse to a Multiprocessor Architecture – DBMS Schemas for Decision Support –Data Extraction, Cleanup, and Transformation Tools –Metadata.

Module II: Business Analysis [5L]

Business Analysis: Reporting and Query tools and Applications – Tool Categories – The Need for Applications – Cognos Impromptu – Online Analytical Processing (OLAP) – Need – Multidimensional Data Model – OLAP Guidelines – Multidimensional versus Multirelational OLAP – Categories of Tools – OLAP Tools and the Internet.

Module III: Data Mining and Classification [12L]

Data Mining: Introduction – Data – Types of Data – Data Mining Functionalities – Interestingness of Patterns – Classification of Data Mining Systems – Data Mining Task Primitives –Integration of a Data Mining System with a Data Warehouse – Issues –Data Preprocessing.

Association Rule Mining and Classification: Mining Frequent Patterns, Associations and Correlations – Mining Methods – Mining Various Kinds of Association Rules – Correlation Analysis – Constraint Based Association Mining – Classification and Prediction - Basic Concepts - Decision Tree Induction – Bayesian Classification – Rule Based Classification – Classification by Back propagation – Support Vector Machines – Associative Classification – Lazy Learners – Other Classification Methods – Prediction.

Module IV: Clustering and Applications [11L]

Clustering and Applications and Trends in Data Mining: Cluster Analysis - Types of Data – Categorization of Major Clustering Methods – Kmeans – Partitioning Methods – Hierarchical Methods - Density-Based Methods –Grid Based Methods – Model-Based Clustering Methods – Clustering High Dimensional Data - Constraint – Based Cluster Analysis – Outlier Analysis – Data Mining Applications.

Text Books:

1. Jiawei Han and MichelineKamber, “Data Mining Concepts and Techniques”, Second Edition, Elsevier, 2007.
2. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, “ Introduction To Data Mining”,Person Education, 2007.

Reference Books:

1. Daniel T.Larose, “Data Mining Methods and Models”, Wile-Interscience, 2006.
2. Margaret H. Dunham, "Data Mining: Introductory and Advanced Topics", Prentice Hall, 2003.

Course Outcomes (COs):

After attending the course students should be able to

CO1	Understand the functionality of the various data mining and data warehousing component
CO2	Appreciate the strengths and limitations of various data mining and data warehousing models
CO3	Explain the analyzing techniques of various data
CO4	Describe different methodologies used in data mining and data ware housing
CO5	Compare different approaches of data ware housing and data mining with various technologies

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS606A.1	3	2	2	2								
CS606A.2	3	2	2	2								
CS606A.3	3	3	2	2								
CS606A.4	3	2	2	2								
CS606A.5	3	2	2	2								

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CS606A.1	3	3	3
CS606A.2	3	3	3
CS606A.3	3	3	3
CS606A.4	3	3	3
CS606A.5	3	3	3

Course Name: Digital Image Processing
Course Code: CS606B
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Course Objective(s)

- To learn discrete Fourier transform and its properties
- To study the monochrome and color image fundamentals
- To learn the analytical tools and methods which are currently used in digital image processing as applied to image information for human viewing.
- To learn image compression and segmentation techniques.

Prerequisite:

- Fourier analysis
- Linear algebra
- Probability

Course Contents:

Module -1: Introduction:[5L]

Digital Image Fundamentals **:** Overview, Computer imaging systems , Digital Image Representation, Fundamental steps in Image Processing **[1L]**, Elements of Digital Image Processing - Image Acquisition, Storage, Processing, Communication, Display **[1L]**. Digital Image Formation: A Simple Image Model, Use and Analysis of Color Models in Image Processing **[2L]**, Sampling & Quantization - Uniform & Non-uniform **[1L]**.

Module -2: Mathematical Preliminaries : [5L]

Neighbour of pixels, Connectivity, Relations, Equivalence & Transitive Closure **[1L]**; Distance Measures, Arithmetic/Logic Operations, Discrete Signals and Systems **[1L]-** A Review – Fourier Transformation, Properties of The Two Dimensional Fourier Transform **[2L]**, Discrete Fourier Transform, Discrete Cosine & Sine Transform **[1L]**.

Module 3: Image Enhancement : [6L]

Spatial Domain: Gray level transformations – Histogram processing **[2L]** Basics of Spatial Filtering–Smoothing and Sharpening Spatial Filtering – Frequency Domain **[2L]**– Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters **[2L]**.

Module -4: Image Restoration, Segmentation and Filtering :[14L]

Image Restoration and Segmentation:Image restoration: noise removal: mean & adaptive filters, degradation model, inverse filter **[2L]**. Discrete Formulation, Algebraic Approach to RestorationUnconstrained & Constrained **[1L]**; Constrained Least Square Restoration, Restoration by Homomorphic Filtering **[1L]**, Geometric Transformation - Spatial Transformation, Gray Level Interpolation **[1L]**. Image Segmentation : Point Detection, Line Detection, Edge detection, Combined detection **[2L]**,

Module -5: Edge Linking, Boundary Detection and Image compression : [5L]

Edge Linking & Boundary Detection- Local Processing, Global Processing via The Hough Transform **[2L]**; Thresholding - Foundation, Simple Global Thresholding, Optimal Thresholding**[2L]**; Region Oriented Segmentation - Basic Formulation, Region Growing by PixelAggregation, Region Splitting & Merging **[2L]**.
Image compression: system model, lossless methods, lossy methods [2L]

Module -6: Image Representation and Recognition :**[5L]**
Image Representation and Recognition :Boundary representation – Chain Code – Polygonal

approximation **[1L]**, signature, boundary segments – Boundary description **[1L]** – Shape number- Fourier Descriptor **[1L]**, moments- Regional Descriptors –Topological feature **[1L]**, Texture – Patterns and Pattern classes – Recognition based on matching **[1L]**.

Text Books:

1. Chanda&Majumder , Digital Image Processing & Analysis, PHI

Reference books:

1.Malay K. Pakhira, Digital Image Processing and Pattern Recognition, First Edition, PHI Learning Pvt. Ltd., 2011.
2. Rafael C. Gonzales and Richard E. Woods, Digital Image Processing, Third Edition, Pearson Education, 2010.

Course Outcomes (COs):

After attending the course students should 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 underscoring its utilitarian importance for further explorations leading towards lifelong learning.

CO-PO

Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS606B.1	3	2	2	2								
CS606B.2	3	3	2	3								
CS606B.3	3	3	2	2								
CS606B.4	3	2	3	2								
CS606B.5	3	2	2	2								

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CS606B.1	3	3	3
CS606B.2	3	3	3
CS606B.3	3	3	3
CS606B.4	3	3	3
CS606B.5	3	3	3

Course Name: E-commerce and ERP
Course Code: CS606C
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Course Objective(s)

- To impart knowledge on E-Commerce & ERP and its various applications.
- To understand E-Commerce framework and business model applications of E-Commerce
- To understand e-payment mechanisms

Perquisites: Knowledge of basic and Networking

Course Contents:

Module 1: Overview of E-Commerce [10L]

Introduction to E-Commerce [4L]: Definition, Scope of E-Commerce, Hardware requirements, ECommerce
and Trade Cycle, Electronic Markets, Electronic Data Interchange and Internet Commerce. **Business to Business E-Commerce [6L]:** Business Models of e–commerce: Model Based On Transaction Type, Model Based On Transaction Party - B2B, B2C, C2B, C2C, E – Governance.Electronic Markets, Electronic Data Interchange (EDI): Technology, Standards (UN/EDIFACT), Communications, Implementations, Agreements, Security, EDI and Business, Inter- Organizational E-commerce.

Module 2: Security Issues in E-Commerce [10L]

Legal issues [4L]: Risks: Paper Document vs. Electronic document, Authentication of Electronic document, Laws, Legal issues for Internet Commerce: Trademarks and Domain names, Copyright, Jurisdiction issues, Service provider liability, Enforceable online contract.

Security Issues [6L]:

Risk of E – Commerce: Overview, Security for E – Commerce, Security Standards, Firewall, Cryptography, Key Management, Password Systems
Security Solutions: Symmetric and Asymmetric Cryptosystems, RSA, DES, and Digital Signature, Protocols for secure messaging, Secure Electronic Transaction (SET) Protocol, Electronic cash over internet, Internet Security.

Module 3: Applications [2L]

E-business [2L]: Internet bookshops, Software supplies and support, Electronic Newspapers, Internet Banking, Virtual Auctions, Online Share Dealing, Gambling on the net, E-Diversity, Case studies through internet.

Module 4: Overview of ERP (7L)

The evolution of ERP systems: A historical perspective [3L]

Evolution through Payroll system, Inventory Control system, Materials Requirement Planning (MRP I) system, Manufacturing Resource Planning (MRP II) system, their advantages and disadvantages. Definition and Concept of ERP, Business reasons for rise and popularity of ERP system - Benefits of an ERP system

Business processes supported by ERP systems [4L]

Various business functions in an Organization – Purchasing, Materials Management, Manufacturing, Sales & Distribution, Plant Maintenance, Quality Management, Finance & Accounting including Costing, Human Resources etc.
ERP market place – SAP, Oracle, PeopleSoft, JD Edwards, Baan, Microsoft's suit of products etc. Business modules in these ERP packages – a brief comparative description of business function modules and sub-modules.

Overview of key end-to-end business processes supported in two major ERP systems (preferably SAP and Oracle) – Order to Cash, Procure to Pay, Plan to Produce and Despatch.

Module 5 : Emerging Trends and Future of ERP systems (7L)

Emerging Technologies and ERP [5L]

Service-oriented Architecture (SOA): Enterprise SOA layers – Business processes, Business services, Difference between multi-layered Client-server architecture and SOA, basic awareness of NetWeaver from SAP, Websphere from Oracle and .Net from Microsoft. Enterprise Application Integration (EAI): Basic understanding of the concept, Types of EAI (levels) – User Interface, Method (logic), Application Interface, Data.

Radio Frequency Identification (RFID) and ERP: awareness of RFID technology, Benefits of RFID integrated with ERPs.

M-Commerce: basic concept and applications, difference with E-Commerce, benefits of integration with ERPs.

Future of ERP Technology [2L]

Enterprise Application Integration (EAI), ERP and E-Commerce, ERP and Internet, Growing mobile applications, Economical and Easy models of ERP deployment etc.

Text books:

1. E-Commerce-Strategy, Technologies & Applications by David Whitley, TMH
2. Enterprise Resource Planning – A Managerial Perspective by D P Goyal, Tata McGraw Hill Education

Recommended books:

1. E-Commerce- The cutting edge of business by Kamlesh K. Bajaj, TMH
2. Global Electronic Commerce- Theory and Case Studies by J. Christopher Westland and Theodore H. K Clark, University Press
3. Enterprise Resource Planning by Ashim Raj Singla, Cengage Learning
4. E-Commerce,M.M. Oka, EPH
5. Kalakotia, Whinston : Frontiers of Electronic Commerce , Pearson Education.

Course Outcomes (COs):

After attending the course students should be able to

CO1	Understand the basic concepts and technologies used in the field of management information Systems
CO2	Have the knowledge of the different types of management information systems
CO3	Understand the processes of developing and implementing information systems.
CO4	Be aware of the ethical, social, and security issues of information systems.
CO5	An ability to effectively integrate IT-based solutions into the user environment

CO-PO

Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS606C.1	3	2	2	2								
CS606C.2	3	2	2	2								
CS606C.3	3	3	2	2								
CS606C.4	3	2	2	2								
CS606C.5	3	2	2	2								

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CS606C.1	2	2	2
CS606C.2	2	2	2
CS606C.3	2	2	2
CS606C.4	2	2	2
CS606C.5	2	2	2

Course Name: Computer Networks Lab
Course Code: CS691
Contact: 0:0:3
Credit Point: 1.5

Prerequisites:

1. Familiarity and knowledge of Computer Network and Computer Architecture
2. Also require strong knowledge of programming languages like C, Java and UNIX or Linux environment.

Course Contents:

- 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. **[6L]**
- Socket Programming using TCP and UDP **[18L]**
- Implementing routing protocols such as RIP, OSPF. **[2L]**
- Familiarization of advanced simulators like Packet Tracer, NS2/NS3, OMNET++, TinyOS**[4L]**
- Server Configuration: only web server (If time permit..instructor can do more than that) **[6L]**

Text books:

1. TCP sockets in C programs-Practical guide for Programmers ByMicheal J Donahoo and Kenneth L calvert.
2. Socket Programming by rajkumar Buyaa.

Course Outcomes (COs):

After attending the course students should be able to

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

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS691.1	3	3	3	2	3							2
CS691.2	3	3	3	3	3							2
CS691.3	3	3	3	3	3							2
CS691.4	3	3	3	3	3							2
CS691.5	2	3	2	2	3							2

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CS691.1	3	3	3
CS691.2	3	3	3
CS691.3	3	3	3
CS691.4	3	3	3
CS691.5	3	3	3

Course Name: Microprocessors & Microcontrollers Lab
Course Code: CS692
Contact: 0:0:3
Credits: 1.5

Course Objective(s)

- To learn the assembly language programming of a microprocessor.
- To learn the assembly language programming of a microcontroller.
- To learn the interfacing of microprocessor.
- To be familiar with microprocessor and microcontroller based projects.

Prerequisites:

1. Familiarity with the number system
2. A solid background in digital logic and implementation of digital circuit in a bread board.

Course Content:

Module -1: [3L]
Study of Prewritten programs on 8085 trainer kit using the basic instruction set (data transfer,Load/Store, Arithmetic, Logical).

Or,

Familiarization with 8085 simulator on PC.
Programs using basic instruction set (data transfer,Load/Store, Arithmetic, Logical) on the simulator.

Module -2: [24L]
Programming using kit or Simulator for:

1. Table look up
2. Copying a block of memory
3. Shifting a block of memory
    a. Packing and unpacking of BCD numbers
    b. Addition of BCD numbers
    c. Binary to ASCII conversion and vice-versa (Using Subroutine Call)
    d. BCD to Binary Conversion and vice-versa
    e. HCF of two numbers
    f. Addition of numbers using subroutine
    g. Clearing the flag register

Module -3: [3L]
Study of Prewritten programs on 8051 Microcontroller Kit using the basic instruction set (datatransfer, Load/Store, Arithmetic, Logical).

Or,

Familiarization with 8051 Simulator on PC.
Study of prewritten programs using basic instruction set (data transfer, Load/Store, Arithmetic, Logical).

Text Books:

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

Reference books:

1. The 8051 microcontroller and Embedded systems - Mazidi, Mazidi and McKinley (PEARSON)

Course Outcomes (COs):

After attending the course students should be able to

CO1	To understand and apply the fundamentals of assembly level programming of microprocessors and Microcontroller.
CO2	To work with standard microprocessor real time interfaces including GPIO, serial ports, digital-to-analog converters and analog-to-digital converters.
CO3	To troubleshoot interactions between software and hardware.
CO4	To analyze abstract problems and apply a combination of hardware and software to address the problem

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS692.1	3	3	3	2	3				3			
CS692.2	3	3	3	2	3				3			
CS692.3	3	3	3	2	3				3			
CS692.4	3	3	3	2	3				3			
CS692.5	3	3	3	2	3				3			

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CS692.1	3	3	3
CS692.2	2	3	3
CS692.3	3	3	2
CS692.4	3	2	3
CS692.5	3	3	3

Course Name: Software Engineering Lab
Course Code: CS693
Contact: 0:0:3
Credits: 1.5

Course Contents:
Assignments to be given as following:

1. 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).
2. Project Schedule preparation. Software Requirement Analysis: Describe the individual Phases/ modules of the project, Identify deliverables, and draw DFD
3. 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 Development and Debugging. Estimation of project size using Function Point (FP) for calculation.
5. Design Test Cases/Test Plan (both Black box and White Box approach)
6. Compute Process and Product Metrics (e.g. Defect Density,DefectAge,Productivity,Cost etc.) Cost Estimation models. COCOMO

Prerequisites:
For Software Engineering Lab, design a project proposal which will be used throughout the lab for performing different experiments using CASE Tools.

Course Outcomes (COs):
After attending the course students should be able to

CO1	Understand the basic knowledge of how to apply Software Engineering and mathematical knowledge and designing solution to software engineering problem including the specification.
CO2	Analyze the cost-benefit trade-off.
CO3	Design solutions to the one or more application domains using software engineering approaches that integrates ethical.
CO4	Develop the code from the design and effectively apply relevant standards and perform testing .
CO5	Identify and use of modern software engineering tools necessary for software project management.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS693.1	3	3	3	3	3				3			3
CS693.2	3	3	3	3	3				3			3
CS693.3	3	3	3	3	3				3			3
CS693.4	3	3	3	3	3				3			3
CS693.5	3	3	3	3	3				3			3

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CS693.1	3	3	3
CS693.2	3	3	3
CS693.3	3	3	3
CS693.4	3	3	3
CS693.5	3	3	3

7th Semester								
Sl No	Course Code	Paper Code	Theory	Contact Hours/Week				Points Total
				L	T	P	Credit	
A. THEORY								
1	HS	HU701	Values & Ethics in Profession	2	0	0	2	2
2	OE	CS701	A. Artificial Intelligence B. Robotics C. Data Analytics D. Accounting & Order to Cash	3	0	0	3	3
3	PE	CS702	A. Soft Computing B. Natural Language Processing C. Web Technology D. Advanced Database Management System E. Web Analytics F. Advanced Javascript G. Data Wrangling & Pattern analysis	3	0	0	3	3
4	PE	CS703	A. Cloud Computing B. Sensor Network and IOT C. Cryptography and Network Security D. Essentials of Organizational Behavior	3	0	0	3	3
Total of Theory								**11**
B. PRACTICAL								
5	OE	CS791	A. Artificial Intelligence Lab B. Robotics Lab C. Data Analytics Lab D. Accounting & Order to Cash Lab	0	0	3	3	1.5
6	PE	CS792	A. Soft Computing Lab B. Natural Language Processing Lab C. Web Technology Lab D. Advanced Database Management System Lab E. Web Analytics Lab F. Advanced Javascript Lab G. Data Wrangling & Pattern analysis Lab	0	0	3	3	1.5
7	PROJ	PR 791	Project-VII	0	0	0	6	3
8	PROJ*	PR 792	Innovative activities-VI	0	0	0	0	0.5
9	MC	MC 781	Social Awareness	0	0	3	3	
							26	17.5

*Students may choose either to work on participation in Hackathons etc. Development of new product/
Business Plan/ registration of start-up.

Students may choose to undergo Internship / Innovation / Entrepreneurship related activities. Students may
choose either to work on innovation or entrepreneurial activities resulting in start-up or undergo internship
with industry/ NGO's/ Government organizations/ Micro/ Small/ Medium enterprises to make themselves
ready for the industry/ Long Term goals under rural Internship. (Duration 4-6 weeks)

Innovative activities to be evaluated by the Programme Head / Event Coordinator based on the viva voce and
submission of necessary certificates as evidence of activities.

Paper Name: Values and Ethics in Profession
Paper Code: HU702
Contact: L-T-P= 2-0-0
Credit: 2

Pre requisites:
Basic knowledge of communication, Knowledge about environment science

Course Objective:
To create awareness on professional ethics and Human Values

Course contents:

Module: 1 Introduction: Definition of Ethics; Approaches to Ethics: Psychological, Philosophical, Social.

Module: **2 Psycho-social theories of moral development**: View of Kohlberg; Morality and Ideology, Culture and Morality, Morality in everyday Context.

Module: **3 Ethical Concerns**: Work Ethics and Work Values, Business Ethics, Human values in organizations: Values Crisis in contemporary society Nature of values: Value Spectrum of a good life.

Module: 4 Ethics of Profession:
Engineering profession: Ethical issues in Engineering practice, Conflicts between business demands and professional ideals.
Social and ethical responsibilities of Technologists. Codes of professional ethics. Whistle blowing and beyond, Case studies.

Module: 5 Self Development: Character strengths and virtues, Emotional Intelligence, Social intelligence, Positive cognitive states and processes (Self-efficacy, Empathy, Gratitude, Compassion, and Forgiveness).

Module: 6 Effects of Technological Growth:
Rapid Technological growth and depletion of resources, Reports of the Club of Rome. Limits of growth: sustainable development Energy Crisis: Renewable Energy Resources, Environmental degradation and pollution. Eco-friendly Technologies. Environmental Regulations, Environmental Ethics
Appropriate Technology, Movement of Schumacher; Problems of man, machine, interaction.

Text / Reference Books:

1. Stephen H Unger, Controlling Technology: Ethics and the Responsible Engineers, John Wiley & Sons, New York 1994 (2nd Ed)
2. Deborah Johnson, Ethical Issues in Engineering, Prentice Hall, Englewood Cliffs, New Jersey 1991.
3. A N Tripathi, Human values in the Engineering Profession, Monograph published by IIM, Calcutta 1996.

Course Outcomes (COs):

After attending the course students should be able to

CO1	Identify and analyze an ethical issue in the subject matter under investigation or in a relevant field
CO2	Identify the multiple ethical interests at stake in a real-world situation or practice
CO3	Articulate what makes a particular course of action ethically defensible
CO4	Assess their own ethical values and the social context of problems
CO5	Demonstrate knowledge of ethical values in non-classroom activities, such as service learning, internships, and field work integrate, synthesize, and apply knowledge of ethical dilemmas and resolutions in academic settings, including focused and interdisciplinary research

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
HU702.1		2				2	3	3				3
HU702.2		2				2	3	3				3
HU702.3		2				2	3	3				3
HU702.4		2				2	3	3				3
HU702.5		2				2	3	3				3

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
HU702.1	2	2	2
HU702.2	2	2	2
HU702.3	2	2	2
HU702.4	2	2	2
HU702.5	2	2	2

Name of the Paper: Artificial Intelligence
Paper Code: CS701A
Contact (Periods/Week):=3L/Week
Credit Point: 3
No. of Lectures: 36

Prerequisite:
1. Basics of Design and Analysis of Algorithm
2. A solid background in mathematics, including probability.

Course Objective(s)
- To learn the overview of artificial intelligence principles and approaches.
- To develop a basic understanding of the building blocks of AI as presented in terms of intelligent agents.
- This course also covers fundamental areas of Local Search Algorithms, Adversarial Searching and Neural Networks.

Course contents:

Module 1: Basics of AI [7L]:
Introduction [2]
Overview of Artificial intelligence- Problems of AI, AI technique, Tic - Tac - Toe problem.
Intelligent Agents [2]
Agents & environment, nature of environment, structure of agents, goal based agents, utility based agents, learning agents.
Learning [3]
Forms of learning, inductive learning, learning decision trees, explanation based learning, learning using relevance information, neural net learning & genetic learning.

Module 2: Different types of searching algorithms [14L] Problem Solving [3]
Problems, Problem Space & search: Defining the problem as state space search, production system, constraint satisfaction problems, issues in the design of search programs.
Search techniques [4]
Solving problems by searching: Problem solving agents, searching for solutions; uniform search strategies: breadth first search, depth first search, depth limited search, bidirectional search, comparing uniform search strategies.
Heuristic search strategies [4]
Greedy best-first search, A* search, memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, simulated annealing search, local beam search, genetic algorithms; constraint satisfaction problems, local search for constraint satisfaction problems.
Adversarial search [3]
Games, optimal decisions & strategies in games, the minimax search procedure, alpha-beta pruning, additional refinements, iterative deepening.

Module 3: Knowledge & Reasoning [11L]
Knowledge & Reasoning [3]
Knowledge representation issues, representation & mapping, approaches to knowledge representation, issues in knowledge representation.
Using predicate logic [4]
Representing simple fact in logic, representing instant & ISA relationship, computable functions & predicates, resolution, natural deduction.
Representing knowledge using rules [2]
Procedural verses declarative knowledge, logic programming, forward verses backward reasoning, matching, control knowledge.

Probabilistic reasoning [2]
Representing knowledge in an uncertain domain, the semantics of Bayesian networks, Fuzzy sets, and fuzzy logics.

Module 4: Different fields of AI [4L]
Natural Language Processing [2]
Introduction, Syntactic processing, semantic analysis, discourse, and pragmatic processing.
Expert Systems [2]
Representing and using domain knowledge, expert system shells, and knowledge acquisition. Basic knowledge of programming language like Prolog

Text books:
1. Artificial Intelligence, Ritch & Knight, TMH
2. Artificial Intelligence, A Modern Approach, Stuart Russel, Peter Norvig ,Pearson

Recommended books:

1. Introduction to Artificial Intelligence & Expert Systems, Patterson, PHI
2. Poole, Computational Intelligence, OUP
3. Logic &Prolog Programming, Saroj Kaushik, New Age International
4. Expert Systems, Giarranto, VIKAS

Course Outcomes (COs):

After attending the course students should be able to

CO1	Understand and explain the fundamental concepts of Knowledge Representation and Inferencing in Artificial Intelligence and its 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 Framework or an Inferencing Model/Agent Design Framework within the scope of Artificial Intelligence paradigm.
CO3	Explore relevant literature and apply the concept of Heuristic Techniques of Artificial Intelligence to 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.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS701A.1	3	3	2	2			2	-	-	-		3
CS701A.2	3	3	3	3			2	-	-	-		3
CS701A.3	3	3	3	3			2	-	-	-		3
CS701A.4	3	3	3	3			2	-	-	-		3
CS701A.5	3	3	3	3			2	-	-	-		3

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CS701A.1	3	3	3
CS701A.2	3	3	3
CS701A.3	3	3	3
CS701A.4	3	3	3
CS701A.5	3	3	3

Paper Name: ROBOTICS
Code: CS701B
Contacts: 3L
Credits: 3
Allotted hours: 35L

Prerequisite:

1. Microprocessor & Microcontroller
2. Computer Organization & Architecture

Course Objective

- To study microcontroller operations for robotics.
- To study how different interfaces are actually implemented in a microcontroller.
- To learn how Microchip PIC micro PIC16F627 can be erased and reprogrammed
- To learn how different sensors, outputs, and peripherals can be wired to a microcontroller to work cooperatively and create a high-level control program.
- To design robots in a real time environment.

Syllabus:
MODULE I (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, common sensors – encoders, tachometers, strain gauge based force-torque sensors, proximity and distance measuring sensors, and vision.

MODULE II (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.

MODULE III (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.

MODULE IV
(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.

MODULE V
(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).

Text books:

1. 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.
3. Kenneth J. Ayala, ―The 8051 micro-controller architecture, programming and applications, Penram International publishers, Mumbai, 1996.
4. Murphy Robin R,‖ Introduction to AI Robotics‖, MIT Press, 2000.
5. Siegwart R and Nourbakhsh I.R, ―Introduction to Autonomous mobile Robots‖, Prentice Hall India, 2005.
6. Roland Siegwart, Illah R. Nourbakhsh, ―Introduction to Autonomous mobile Robots‖, MIT Press, 2005.

Course Outcomes (COs):

After attending the course students should 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 of Linear 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.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS701B.1	3	3	3	3		3	3					
CS701B.2	3	3	3	3		3	3					
CS701B.3	3	2	3	3		3	3					
CS701B.4	2	2	3	3		3	3					
CS701B.5	3	2	3	3		3	3					

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CS701B.1	3	3	3
CS701B.2	3	3	3
CS701B.3	3	3	3
CS701B.4	3	3	3
CS701B.5	3	3	3

Name of the Paper: Data Analytics
Paper Code: CS701C
Contact (Periods/Week):=3L/Week
Credit Point: 3
No. of Lectures: 36

Prerequisite:

1. Familiarity and knowledge of Database Management Systems
2. Concepts of probability and statistics
3. Proficiency of algorithms
4. Programming skills of C, Python

Course Objective(s):

- Conceptualization and summarization of big data and trivial data versus big data
- Big data computing technologies.
- Help students learn, understand, and practice big data analytics with distributed approaches.
- Learn and understand different programming model of big data.

Course Content

Module I: Data Definitions and Analysis Techniques [10L]

Elements, Variables, and Data categorization [2L]
Levels of Measurement [1L]
Data management and indexing [2L]
Introduction to statistical learning and R-Programming- BASE (Basically Available Soft State Eventual Consistency)- Few top Analytics tools [3L]

Descriptive Statistics Measures of central tendency**,** Measures of location of dispersions [2L]

Module II: Basic analysis techniques [8L]

Statistical hypothesis generation and testing [2L], Chi-Square test [1L], t-Test [1L]
Analysis of variance [1L], Correlation analysis [2L], Maximum likelihood test [1L]

Module III: Data analysis techniques [9L]

Regression analysis [2L], Classification techniques [3L], Clustering [2L], Association rules analysis [2L]

Module IV: Case studies and projects [9L]

Understanding business scenarios [1L], Feature engineering and visualization [2L], Scalable and parallel computing with Hadoop and Map-Reduce [4L], Sensitivity Analysis [2L]

Text books:

1. Mark Dexter, Louis Landry, “Joomla Programming”, 2012 Pearson Education.

2. Seema Acharya and Subhashini C, “Big Data and Analytics”, Wiley Publication, 2015

Recommended books:

1. Judith Hurwitz, Alan Nugent, Fern Halper, Marcia Kaufman, “Big data for dummies”, Wiley Publication, 2013.
2. Tom White, “Hadoop: The Definitive Guide”, O‟Rilly Publication, 2015.
3. Chuck Lam, “Hadoop in action”, Dreamtech Press, 2011.
4. Dirk Deroos, Paul C. Zikopoulos, Roman B. Melnyk, Bruce Brown, “Hadoop for dummies”, Wileypublication, 2015.

Course Outcomes (COs):

After attending the course students should 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, Hadoop and No SQL 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 relevant literature and apply the concepts of Big Data Analytics to solve problems of making automated decisions dealing with large scale structured 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.

CO-PO

Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS701C.1	3	2	2	1								3
CS701C.2	3	3	3	2								3
CS701C.3	3	3	2	3								3
CS701C.4	2	3	2	2								3
CS701C.5	3	2	2	3								3

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CS701C.1	3	2	2
CS701C.2	3	3	2
CS701C.3	3	2	3
CS701C.4	2	2	3
CS701C.5	2	3	3

Paper Name: Soft Computing
Code: CS 702A
Contacts: 3L
Credits: 3
Allotted hours: 36L

Prerequisite:

1. A solid background in mathematical and programming Knowledge

Course Objective(s)

- To learn the basics of Soft Computing usage
- To learn the basics of many optimization algorithm
- To learn to solve and optimize the real world problem using soft computing methodology

Course Content:
Soft Computing: Module-I [6L]

1. An Overview of Artificial Intelligence
2. Soft Computing: Introduction of soft computing, soft computing vs. hard computing, various types of soft computing techniques, applications of soft computing.
3. Artificial Intelligence : Introduction, Various types of production systems, characteristics of production systems, breadth first search, depth first search techniques, other Search Techniques like hill Climbing, Best first Search, A* algorithm, AO* Algorithms and various types of control

Soft Computing: Module-II [8L]
Introduction to derivative free optimization, GA; biological background, search space of genetic algorithm, genetic algorithm Vs. Traditional algorithm; Simple genetic algorithm, Genetic algorithm Operators: Encoding, selection criteria, Crossover, Mutation, advantages and disadvantages of genetic algorithm, Convergence of GA, Applications & advances in GA, Differences & similarities between GA & other traditional method.

Soft Computing: Module-III [12L]
1. Neural Network : Biological neuron, artificial neuron, definition of ANN, Taxonomy of neural net, Difference between ANN and human brain, Structure and Function of a single neuron, characteristics and applications of ANN, single layer network, Perceptron training algorithm, Linear separability, Widrow&Hebb;s learning rule/Delta rule, ADALINE, MADALINE, AI v/s ANN.
2. Introduction of MLP, different activation functions, Error back propagation algorithm, derivation of EBPA, momentum, heuristic, limitation, characteristics and application of EBPA.
3.Adaptive Resonance Theory: Architecture, classifications, Implementation and training, Associative Memory.

Soft Computing: Module-IV [10L]
1. Fuzzy Logic: Fuzzy set theory, Fuzzy set versus crisp set, Crisp relation & fuzzy relations, Fuzzy systems: crisp logic, fuzzy logic, introduction & features of membership functions,
2. Fuzzy rule base system: fuzzy propositions, formation, decomposition & aggregation of fuzzy rules, fuzzy reasoning, fuzzy inference systems, fuzzy decision making & Applications of fuzzy logic.

Text Books:
1. Fuzzy logic with engineering applications, Timothy J. Ross, John Wiley and Sons.
2.Neural Networks: A Comprehensive Foundation (2nd Edition), Simon Haykin, Prentice Hall.

Reference Books:

1. K.H.Lee. First Course on Fuzzy Theory and Applications, Springer-Verlag.
2. J. Yen and R. Langari.. Fuzzy Logic, Intelligence, Control and Information, Pearson Education.

Course Outcomes (COs):

After attending the course students should 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.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS702A.1	3	3	3	3								3
CS702A.2	3	3	3	3								3
CS702A.3	3	3	3	3								3
CS702A.4	3	3	3	3								3
CS702A.5	3	3	3	3								3

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CS702A.1	3	3	3
CS702A.2	3	3	3
CS702A.3	3	3	3
CS702A.4	3	3	3
CS702A.5	3	3	3

Name of the Paper: Natural Language Processing
Paper Code: CS702B
Contact (Periods/Week):=3L/Week
Credit Point: 3
No. of Lectures: 35

Prerequisite:
A solid background in mathematics and statistics, including probability, set theory.

Course Objective(s)

- To learn the basics of NLP
- To learn the principles and application of different NLP techniques
- To learn the details of NLP algorithms, different tools and knowing their use

Course Content

Module I: [9L]

Introduction to NLP [2L]

Human languages, models, definition of NLP, text representation in computers, encoding schemes, issues and strategies, application domain, tools for NLP, Linguistic organisation of NLP, phase in natural language processing, applications.

Regular Expression and Automata [2L]
Finite State Automata. Introduction to CFG and different parsing technniques.

Tokenization [4L]
Word Tokenization, Normalization, Sentence Segmentation, Named Entity Recognition,Multi Word Extraction, Spell Checking – Bayesian Approach, Minimum Edit Distance

Morphology [1L]
Morphology – Inflectional and Derivational Morphology, Finite State Morphological Parsing, The Lexicon and Morphotactics, Morphological Parsing with Finite State Transducers, Orthographic Rules and Finite State Transducers, Porter Stemmer.

Module II: [9L]

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. Spelling errors, detection and elimination using probabilistic models, pronunciation variation (lexical, allophonic, dialect), decision tree model, counting words in Corpora

Hidden Markov Models and POS Tagging [5L]
Markov Chain, Hidden Markov Models, Forward Algorithm, Viterbi Algorithm, Part of Speech Tagging – Rule based and Machine Learning based approaches, concept of HMM tagger Evaluation. Handling of unknown words, named entities, multi word expressions.

Module III: [9L]

Text Classification [4L]
Text Classification, Naïve Bayes' Text Classification, Evaluation, Sentiment Analysis – Opinion Mining and Emotion Analysis, Resources and Techniques.

Context Free Grammar [5L]
Context Free Grammar and Constituency, Some common CFG phenomena for English, Top-Down and Bottom-up parsing, Probabilistic Context Free Grammar, Dependency Parsing

Module IV: [8L]

Computational Lexical Semantics [5L]

Introduction to Lexical Semantics – Homonymy, Polysemy, Synonymy, Thesaurus – WordNet, VerbNet, Computational Lexical Semantics – Thesaurus based and Distributional Word Similarity, Lexemes (homonymy, polysemy, synonymy, hyponymy), word structure, metaphor, metonymy.

Word sense disambiguation, machine learning approaches, dictionary based approaches.

Information Retrieval [3L]

Boolean Retrieval, Term-document incidence, The Inverted Index, Query Optimization, Phrase Queries, Ranked Retrieval , Term Frequency and Inverse Document Frequency based ranking, Zone Indexing, Query term proximity, Cosine ranking, Combining different features for ranking, Search Engine Evaluation, Relevance Feedback.

Resource management with XML, Management of linguistic data with the help of GATE, NLTK

Text books:

1. D. Jurafsky& J. H. Martin – "Speech and Language Processing – An introduction to Language processing, Computational Linguistics, and Speech Recognition",Pearson Education
2. Chris Manning and Hinrich Schütze, "Foundations of Statistical Natural Language Processing", MIT Press. Cambridge, MA: May 1999.

Reference books:

1. Allen, James. 1995. – "Natural Language Understanding". Benjamin/Cummings, 2ed.
2. Bharathi, A., Vineet Chaitanya and Rajeev Sangal. 1995. Natural Language Processing- "A Pananian Perspective". Prentice Hll India, Eastern Economy Edition.
3. Siddiqui T., Tiwary U. S.. "Natural language processing and Information retrieval", OUP, 2008.
4. Eugene Cherniak: "Statistical Language Learning", MIT Press, 1993.
5. Manning, Christopher and Heinrich Schütze. 1999. "Foundations of Statistical Natural Language Processing". MIT Press.

Course Outcomes (COs):

After attending the course students should be able to

CO1	Analyze and apply the morality and method of Human Languages such as English and other Indian Languages using computers.
CO2	Understand the semantics and pragmatics of English language for text processing
CO3	Create CORPUS linguistics based on digestive approach (Text Corpus method)
CO4	Illustrate, analyze and apply for the modern techniques for statistical approaches to machine translation.
CO5	Analyze and apply the POS tagging for a given natural language and select a suitable language modelling technique based on the structure of the language.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS702B.1	3	3	3	3								3
CS702B.2	3	3	3	3								3
CS702B.3	3	3	3	3								3
CS702B.4	3	3	3	3								3
CS702B.5	3	3	3	3								3

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CS702B.1	3	3	3
CS702B.2	3	3	3
CS702B.3	3	3	3
CS702B.4	3	3	3
CS702B.5	3	3	3

Name of the Paper: Web Technology
Paper Code: CS702C
Contact (Periods/Week): 3L/Week
Credit Point: 3
No. of Lectures: 35
Course Objective(s):

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

Course Outcome(s) (CO):

CO1 To understand the notions of World Wide Web(www), Internet, HTTP Protocol, Web Browsers, Client-Server, etc.
CO2 To develop interactive web pages using HTML, DHTML and CSS
CO3 To procure the knowledge of different information interchange formats like XML
CO4 To design web applications using scripting languages like JavaScript, CGI, PHP
CO5 To acquire the server side programming concepts using servlet, JSP and .Net framework.

Course Content

Module 1: [4L]
Introduction to Web [4L]: Concept of World Wide Web (www), Internet and the relation with www **[1L];** The Internet - Basic Internet Protocols, HTTP Protocol - Request and Response, Web browser **[1L];** Web clients and Web servers, Dynamic IP **[1L];** Clients, Servers, and Communication, Web site design principles, Planning the site and navigation **[1L].**

Module -2: [9L]
HTML, DHTML & CSS [6L]: Introduction, Elements, Attributes, Heading, Paragraph. Formatting **[1L];** Link, Table, List, Block, Layout, Html Forms and input **[1L];** Iframe, Colors, Image Maps and attributes of image area **[2L];**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) [3L]: Introduction, Difference between HTML & XML, XML-Tree **[1L];** Syntax, Elements, Attributes, Validation and parsing, DTD **[2L].**

Module 3: [8L]
Java Scripts [4L]: Basic Introduction, Statements, comments, variable, operators, data types**[1L];** condition, switch, loop, break **[1L];** Java script functions, objects and events**[1L].**
CGI Scripts [1L]: Introduction, Environment Variable, GET and POST Methods.
PHP Scripting [4L]: Introduction, Syntax, Variables, Output, Data types, String, Constants**[1L];** Operator, Decision Control statements**[1L];** switch-case, Loop, PHP function**[1L];** array, Form Handling**[1L].**

Module-4: [14L]
Java Server Page (JSP) [8L]:
JSP Architecture **[1L];** JSP Servers, JSP Life Cycle **[1L];** Understanding the layout of JSP, JSP Scriptlet 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].**
Java Servlet [3L]: Servlet environment and role, Servlet life cycle **[1L];** Servlet methods- Request, Response, Get and post **[1L];** Cookies and Session **[1L].**
.NET Framework [3L]:ASP.Net with MVC introduction, MVC Architecture, MVC routing, controller,

Action method, Action Selector and Action verb, Model and View **[1L];**.net framework, C#.net introduction, environment variable, basic syntax of conditional statement, loop and function**[2L].**

Text Books:

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: PHP, Java Script)**
3. "Head First Servlet's & JSP", Bryan Basham, Kathy Sterra, Bert Bates, O'Reilly Publication.(**Topics covered: Servlet, JSP)**
4. ASP.NET Core 2.0 MVC And Razor Pages For Beginners:" Jonas Frajerberg, O'Reilly Publication. (**Topics covered: MVC, ASP.Net, C#)**

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.

Course Outcomes (COs):

After attending the course students should be able to

CO1	To develop interactive web pages using HTML, DHTML, CSS and image map
CO2	To procure the knowledge of information interchange formats like XML
CO3	To validate fields of web pages using scripting languages like JavaScript
CO4	To develop web applications using PHP and ASP.net
CO5	To acquire the server side programming concepts using servlet, JSP

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS702C.1	3	3	3	3								3
CS702C.2	3	3	3	3								3
CS702C.3	3	3	3	3								3
CS702C.4	3	3	3	3								3
CS702C.5	3	3	3	3								3

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CS702C.1	3	3	3
CS702C.2	3	3	3
CS702C.3	3	3	3
CS702C.4	3	3	3
CS702C.5	3	3	3

Paper Name: Cloud Computing
Code: CS703A
Contacts: 3:0:0
Credits: 3
Total Contact hours: 36L

Prerequisite
- Should have the basic knowledge of Operating Systems
- Should be aware of the fundamental concepts of Networking.
- Should have knowledge of heterogeneous systems and resource management.

Course Objectives
- To learn the work-flow of cloud business model and optimized resource allocation.
- To gain knowledge of cloud service and delivery models and develop an understanding of the risk and compliance responsibilities and Challenges for each Cloud type and service delivery model.
- To learn virtualization techniques, load balancing, and work strategy of different cloud infrastructure.
- To know the security and privacy issues in cloud infrastructure

Course Content
Module 1: Definition of Cloud Computing and its Basics [8L]

1. 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]

2. Cloud Architecture: Cloud Infrastructure, Architecture of each components, Virtualization versus Traditional Approach, Virtualization Model for Cloud Computing. [2]

3. 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)

Module 2: Use of Platforms in Cloud Computing [6L]

1. 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

2. 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

3. 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

Module 3: Cloud Service Models [6L]

1. 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.

2. 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

3. 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

Module 4: Cloud Infrastructure [10L]

Types of services required in implementation – Consulting, Configuration, Customization and Support

1. 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)

2. 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

3. 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

4. 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.

Module 5: Concepts of Services and Applications [6L]

1. Service Oriented Architecture: Basic concepts of message-based transactions, Protocol stack for an SOA architecture, Event-driven SOA, Enterprise Service Bus, Service catalogs [6]

2. 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]

3. Cloud-based Storage: Cloud storage definition – Manned and Unmanned. [1]

4. Webmail Services: Cloud mail services including Google Gmail, Mail2Web, Windows Live Hotmail, Yahoo mail, concepts of Syndication services [1]

Text Books:

1.Mastering Cloud Computing by Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, McGraw Hill Education (India)PrivateLimited,2013
2. Fundamentals of Cloud Computing by P. K. Pattnaik, S. Pal, M. R. Kabat, Vikas Publications, 2014.

Reference Books:

1. Cloud Computing Bible by Barrie Sosinsky, Wiley India Pvt. Ltd, 2013
2. Cloud Computing: A Practical Approach, Anthony T. Velte, Tata Mcgraw-Hill

Course Outcomes (COs):

After attending the course students should be able to

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.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS703A.1	3	2	2	2								3
CS703A.2	3	3	3	2								3
CS703A.3	3	3	2	3								3
CS703A.4	2	3	2	2								3
CS703A.5	3	2	2	3								3

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CS703A.1	3	3	3
CS703A.2	3	3	3
CS703A.3	3	3	3
CS703A.4	3	3	3
CS703A.5	3	3	3

Course Name: Sensor Network and IOT
Course Code: CS703B
Contact: 3L/Week
Total Contact Hours: 35
Credit Point: 3
Prerequisites:
1. Familiar with basic Computer Networks concepts
2. Basic knowledge of Microcontroller fundamentals

Course Objective(s):
- To gain knowledge of the sensor network protocols and sensor deployment strategies
- explore the interconnection and integration of the physical world and the cyberspace
- To understand building blocks of Internet of Things and characteristics
- To design and develop IoT Device

Course Content:
Module -1: [11L] Wireless Sensor Networks Fundamentals
Wireless medium access issues [1L]
MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols and Wakeup Concepts - S-MAC, The Mediation Device Protocol, Wakeup Radio Concepts, Contention based protocols (CSMA, PAMAS) [2L] Schedule based protocols (LEACH, SMACS, TRAMA) Address and Name Management in WSNs, Assignment of MAC Addresses [2L]
Routing Protocols- Energy-Efficient Routing, Geographic Routing, Hierarchical networks by clustering. [2L]
Sensor deployment & Node discovery [2L]
Data aggregation & dissemination [2L]
Module -2: [6L] Fundamentals on IoT
Definition of IoT and Characteristics of IoT [1L] Physical and logical design of IoT [2L] Functional blocks of IoT [1L]
Communication models &APIs: Internet connectivity, Internet-based communication, IPv4, IPv6,6LoWPAN protocol, IP Addressing in the IoT, Application layer protocols: HTTP, HTTPS, FTP, TELNET and ports. [2L]

Module 3: [7L]
Machine to machine Communication and IoT
M2M communication and Modified OSI Model for the IoT/M2M Systems [1L]
Data enrichment, data consolidation and device management at IoT/M2M Gateway [2L] Web communication protocols used by connected IoT/M2M devices [2L]
Message communication protocols (CoAP-SMS, CoAP-MQ, MQTT, XMPP) for IoT/M2M devices [2L]

Module -4: [11L]
IoT Prototyping and Security
Introduction to Prototyping Embedded device software [1L] Programming Embedded Device Arduino Platform using IDE [1L]
Reading data from sensors and devices, Devices, Gateways [2L] Internet and Web/Cloud services software development [1L] Programming MQTT clients and MQTT server [2L] Introduction to IoT privacy and security [2L]
Vulnerabilities, security requirements and threat analysis [1L] Domain specific applications of IoT [1L]

Text Books:
1. Vijay Madisetti, ArshdeepBahga, “Internet of Things: A Hands-On Approach”, Orient BlackSwan
2. WaltenegusDargie,ChristianPoellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice", Wiley

Recommended books:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton, Jerome Henry, Rowan Trollope, "IoT Fundamentals: Networking Technologies, Protocols and Use Cases for the Internet of Things", Pearson
2. C. Siva Ram Murthy, B. S. Manoj, "Ad Hoc Wireless Networks: Architectures and Protocols", Prentice Hall

Course Outcomes (COs):

After attending the course students should 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

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS703B.1	3	2	2	1								3
CS703B.2	3	3	3	2								3
CS703B.3	3	3	2	3								3
CS703B.4	2	3	2	2								3
CS703B.5	3	2	2	3								3

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CS703B.1	3	2	2
CS703B.2	3	3	3
CS703B.3	3	3	2
CS703B.4	2	3	2
CS703B.5	3	2	2

Name of the Paper: Cryptography and Network Security
Paper Code: CS703C
Contact (Periods/Week): 3L/Week
Credit Point: 3
No. of Lectures: 36

Prerequisite:
- Knowledge of Computer Networks and Operating Systems fundamentals
- Understanding of Discreet Mathematics concepts

Course Objective(s)
- To impart concepts on cryptography and Network security
- To gain knowledge of the standard algorithms used to provide confidentiality, integrity, and authenticity
- To recognize the various key distribution and management systems for security of a cryptosystem

Module -1: [7L]
INTRODUCTION AND NUMBER THEORY
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]**

Module -2: [9L]
BLOCK CIPHERS AND PUBLIC KEY CRYPTOGRAPHY
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 curveM cryptography **[2L]**

Module 3: [6L]
HASH FUNCTIONS AND DIGITAL SIGNATURES
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]**

Module -4: [7L]
SECURITY PRACTICE AND SYSTEM SECURITY
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]**

Module -5: **[7L]**
E-MAIL, IP,AND WEB SECURITY
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]**

Text Books:

1. Atul Kahate, "Cryptography and Network Security", Third edition, McGraw Hill Education

Recommended books:

1. William Stallings, "Cryptography and Network Security: Principles and Practice", Sixth edition, Pearson
2. Behrouz A. Forouzan, Debdeep Mukhopadhyay, "Cryptography and Network Security",Second edition, McGraw Hill Education
3. Atul Kahate, "Cryptography and Network Security", Third edition, McGraw Hill Education
4. William Stallings, "Cryptography and Network Security: Principles and Practice", Sixth edition, Pearson
5. Behrouz A. Forouzan, Debdeep Mukhopadhyay, "Cryptography and Network Security",Second edition, McGraw Hill Education

Course Outcomes (COs):

After attending the course students should be able to

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.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS703C.1	3	3	3	2	2							2
CS703C.2	3	2	2	2	2							3
CS703C.3	2	3	2	2	3							2
CS703C.4	2	2	3	2	3							2
CS703C.5	3	2	2	2	2							3

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CS703C.1	3	3	3
CS703C.2	3	2	2
CS703C.3	2	2	2
CS703C.4	3	3	3
CS703C.5	3	3	3

Course Name: Artificial Intelligence Lab
Course Code: CS791A
Objective(s):

- To learn the fundamentals of PROLOG/ LISP Programming.
- To impart adequate knowledge on the need of PROLOG/ LISP programming languages and problem solving techniques.

Syllabus:

Programming Languages such as PROLOG or LISP covering the sample following topics (but not limited to):-

1. Write a program to find the maximum of three numbers.
2. Write a program to calculate factorial of a number.
3. Write a program in PROLOG to calculate GCD of two numbers.
4. Write a program in PROLOG to generate Fibonacci series.
5. Write a program in PROLOG to count the number of elements in a list.
6. Write a program to insert an element at the beginning/ middle/ end of a list.
7. Write a program in PROLOG to find the GCD of the elements of a list.
8. Write a program in PROLOG to find the maximum of a list.
9. Write a program in PROLOG to reverse a list
10. Write a program in PROLOG to check whether a number or string is palindrome or not.
11. Write a program in PROLOG to delete an element from a list.
12. Write a program in PROLOG for linear search/ binary search in a list.
13. Write a program in PROLOG to sort n numbers using bubble sort algorithm.
14. Write a program in PROLOG for Towers of Hanoi problem.
15. Write a program in PROLOG for 4-Queens problem.

Course Outcomes (COs):

After attending the course students should be able to

CO1	Acquire foundational knowledge of PROLOG to implement an Artificial Intelligent Agent as an executable computer program for Knowledge Representation and Inferencing and understand the working principle of the 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 Framework or an Inferencing Agent Formulation Framework of Artificial Intelligence.
CO3	Explore relevant literature and apply the concepts of Artificial Intelligence to solve a problem by implementing well-known Artificial Intelligence strategies using proper techniques and tools of PROLOG.
CO4	Develop ideas and propose expert systems offering solutions to the challenging problems of Artificial Intelligence.
CO5	Plan and Implement Artificial Intelligence based ideas as executable PROLOG programs through developing intelligent heuristic strategies or 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.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS791A.1	3	3	2	2	3				3	-		3
CS791A.2	3	2	2	3	3				3	-		3
CS791A.3	3	3	2	2	3				3	-		3
CS791A.4	3	3	3	3	3				3	-		3
CS791A.5	3	3	3	3	3				3	-		3

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CS791A.1	3	2	2
CS791A.2	3	3	3
CS791A.3	3	3	3
CS791A.4	3	2	3
CS791A.5	3	3	3

Course Name: ROBOTICS LAB
Course Code: CS791B
Year: 4TH
Semester: 7th Semester
Total Contact Hours: 3P
Credits: 1.5

Course Objective
To gain knowledge on handling robots and program them according to a specific objective
Course Outcomes:
After the completion of this course, the student should be able to:

CO1	**Understand** the basic concepts of robotics exploring the characteristics ofits various components and their kinematics, motion control, actuator and drive system and the functions of various sensor in robotics, and robot programming.
CO2	**Apply** the concepts of robotics for machine loading, pick and place operations, wielding, painting, inspection. Assembly task, medical surgery etc.
CO3	**Illustrate**concepts of robot kinematics with screw-based mechanics, motion control, actuator and drive system.
CO4	**Analyze** the kinematics of serial and parallel robots, motion control systems.
CO5	**Develop**algorithmic solutionsand **Implement**the corresponding robot-programs fordesigning various robotic systems.

Course contents:
1. Demonstration of ROBOT with 2 DOF, 3 DOF, 4 DOF
2. Study and selection of Gripper.
3. Programming exercise of robots for Pick and Place activity.
4. Case studies of applications in industry like Spray Painting or Welding
5. Exercise on Robotic Simulation software, using Fanuc Robo guide

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10 PO11	PSO	PS	PSO3
CO1	3											3	
CO2	3	3	3	2	1					2	2	2	
CO3	3											3	
CO4	3	2		2								3	
CO5	3	3	3	3	2					2	3	2	3

Name of the Paper: Data Analytics Lab
Paper Code: CS791C
Contact (Periods/Week): 3P/Week
Credit Point: 1.5

Prerequisite:
Familiarity with and knowledge of Database Management Systems

Course Objectives
1. To implement Map Reduce programs for processing big data
2. To analyze big data using linear models
3. To analyze big data using machine learning techniques such as SVM / Decision tree classification and clustering

Course Outcomes:

CO1	**Understand** the basic concepts ofbig data, Hadoop Architecture, MapReduce, Graph Analytics, Data Visualization
CO2	**Apply** the concepts of Hadoop Architecture, MapReduce programmingforhandling different kinds of data.
CO3	**Explore**variousData Visualizationtools.
CO4	**Assess** the effectiveness of various big data tools.
CO5	**Develop** frameworks for solving large scale data handlingproblems.

Course Content
1. Install, configure and run Hadoop and HDFS
2. Implement word count / frequency programs using MapReduce
3. Implement an MR program that processes a weather dataset using Hadoop
4. Implement Linear and logistic Regression using R
5. Implement SVM / Decision tree classification techniques using R
6. Implement clustering techniques using R
7. Visualize data using any plotting framework using R

CO-PO Mapping:

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

Paper Name: Soft Computing Lab
Code: CS 792A
Contacts: 3P
Credits: 1.5

Prerequisite:

1. Familiarity with the Matlab/ Python command
2. A solid background in mathematical and programming Knowledge

Course Objective(s)

- To learn to implement soft computing methods.
- To learn to solve the real world problem through program of Matlab/ Python
- To learn to solve and optimize the real world problem using Matlab /Python

Lab

1. Python/Matlab programming introduction
2. Python/Matlab programming fundamental
3. Matlab tool box implementation. / Python introduction to numerical calculation programming(scitific python, Numerical python, Image processing)
4. Python/ Matlab programming to simulate a single layer neural network designs
5. Python/ Matlab programming to simulate multiple layer neural network designs
6. Python/ Matlab programming to observe the perceptron learning algorithm performances for a single layer network. In this experiment, consider the XOR dataset
7. Write a Matlab/ python code for maximizing F(x)=x2,where x ranges from say 0 to 31 using Genetic Algorithm.
8. Use of Genetic Algorithm toolbox in matlab for optimization problem solving. Implementation of Simple Genetic Algorithm in python for solving optimization problem
9. WriteaMatlab/pythonprogramtoimplementthedifferentFuzzyMembershipfunctions
10. Write a Matlab/ python program to implement Fuzzy set operations and its properties

Course Outcomes (COs):

After attending the course students should 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.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS792A.1	3	3	3	3	3	2	2		2			3
CS792A.2	3	3	3	3	3	2	2		2			3
CS792A.3	3	3	3	3	3	2	2		2			3
CS792A.4	3	3	3	3	3	2	2		2			3
CS792A.5	3	3	3	3	3	2	2		2			3

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CS792A.1	3	3	3
CS792A.2	3	3	3
CS792A.3	3	3	3
CS792A.4	3	3	3
CS792A.5	3	3	3

Name of the Paper: Natural Language Processing Lab
Paper Code: CS792B
Contact (Periods/Week):3L/Week
Credit Point: 2

Prerequisite:

1. Familiarity with the programming concepts in any language
2. A solid background in mathematics, including probability and statistics.

Course Objective(s)

- To learn the basics of NLTK toolkit
- To learn the principles of NLP through programming
- To build an application using different algorithms and natural language processing techniques

Course Outcomes (COs):

After attending the course students should be able to

CO1	Analyze and apply the morality and method of Human Languages such as English and other Indian Languages using computers.
CO2	Understand the semantics and pragmatics of English language for text processing
CO3	Create CORPUS linguistics based on digestive approach (Text Corpus method)
CO4	Illustrate, analyze and apply for the modern techniques for statistical approaches to machine translation.
CO5	Analyze and apply the POS tagging for a given natural language and select a suitable language modelling technique based on the structure of the language.

Course Content

1. Introduction to list, dictionaries etc., input and output handling, saving data to files, retrieving data from files.
2. Writing functions and code reusing
3. Introduction to working knowledge of matplotlib, SciKit, NumPy and other necessary tools and libraries as per the need.
4. Language processing with python. Manipulating texts and words by writing programs programs.
5. Accessing text corpora, lexical resources,using WordNet through NLTK tool kit.
6. Processing raw text, normalizing, segmenting, applying regular expressions.
7. Writing programs to categorize texts, words, tagging words using tagger, generating tagged tokens, N-Gram tagging, text classification.
8. Writing programs to extract information from texts.
9. Writing programs to analyze sentence, its meaning etc.
10. Managing linguistic data through programs.

Text books:

1. Steven Bird, Ewan Klein, and Edward Loper. "Natural Language Processing– Analyzing Text with the Natural Language Toolkit". 2009, O'Reilly, 1ed.

Reference books:

1. Learning Python: Powerful Object-Oriented Programming: 5th Edition by Mark Lutz, 2013, O'Reilly.
2. Natural Language Toolkit documentation (https://www.nltk.org/)

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS792B.1	3	3	3	3	3	3	2		3			3
CS792B.2	3	3	3	3	3	3	2		3			3
CS792B.3	3	3	3	3	3	3	2		3			3
CS792B.4	3	3	3	3	3	3	2		3			3
CS792B.5	3	3	3	3	3	3	2		3			3

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CS792B.1	3	3	3
CS792B.2	3	3	3
CS792B.3	3	3	3
CS792B.4	3	3	3
CS792B.5	3	3	3

Name of the Paper: Web Technology Lab
Paper Code: CS792C
Contact (Periods/Week): 3P/Week
Credit Point: 2
No. of Lectures: 30
Prerequisite:
Fundamentals of Programming
Course Objective(s):

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

Course Outcomes (COs):

After attending the course students should be able to

CO1	To develop interactive web pages using HTML, DHTML, CSS and image map
CO2	To procure the knowledge of information interchange formats like XML
CO3	To validate fields of web pages using scripting languages like JavaScript
CO4	To develop web applications using PHP and ASP.net
CO5	To acquire the server side programming concepts using servlet, JSP

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS792C.1	3	3	3	3	3				2			3
CS792C.2	3	3	3	3	3				2			3
CS792C.3	3	3	3	3	3				2			3
CS792C.4	3	3	3	3	3				2			3
CS792C.5	3	3	3	3	3				2			3

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CS792C.1	3	3	3
CS792C.2	3	3	3
CS792C.3	3	3	3
CS792C.4	3	3	3
CS792C.5	3	3	3

List of Experiments:

1. Write a single html program through which you can explain a) anchor tag, b)'img' tag with 'src' attribute, c)paragraph d) heading.

2. Write a single html program through which you can draw a table which consists of 3 row and 4 columns where 1st row contains 4 different column fields of a student's information with red text color and Calibri font style with font 12. Rest cells of whole table contain values with blue text colors and Times new roman font style with font 10.

3. Write a single html program where 1st paragraph can collect its specified style from internal stylesheet describes inside that html program and 2nd paragraph can collect its specified style from another file (external stylesheet).

4. Write a single html program which implements image map concept using 'usemap' and <map>.

5. Write a html program to find out Celsius temperature of a given Fahrenheit temperature using JavaScript.

6. Write a html program to find out m to the power n (m, n valid integer no) using a function using javascript.

7. Write a xml parsing technique through which parse a text string into an XML DOM object, and extracts the info from it with JavaScript.

8. Write a simple php program through which you can find out maximum and minimum among three no's specified by the user.

9. Write a simple php program through which you can implement the concept of GET & POST method w.r.t PHP Form handling.

10. Write a simple program in ASP.net through which you can create a login page of your own website.

11. Write a simple JSP program through which you can print even and odd no separately within a given range.

12. Create a Online Registration form for individual user of an website using Servlet.

Text Books:

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: PHP, Java Script)**
3. "Head First Servlet's & JSP", Bryan Basham, Kathy Sterra, Bert Bates, O'Reilly Publication.(**Topics covered: Servlet, JSP)**
4. ASP.NET Core 2.0 MVC And Razor Pages For Beginners:" Jonas Frajerberg, O'Reilly Publication.(**Topics covered: MVC, ASP.Net, C#)**

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.
3. "Web Technologies", Black Book, Dreamtech Press

Paper Name: Social Awareness
Code: MC781
Contact: 0:0:3

Course Objectives:

- To increase student awareness about the different societal issues
- To expose students to environmental issues and ecological concerns
- To make students self aware about their participatory role in sustaining society and the environment

List of Activities:

a) Social awareness camp at the college premises
b) Creating awareness in social issues
c) Environmental awareness ``
d) Activity related to social network, mobile awareness

8th Semester								
Sl No	**Course Code**	**Paper Code**	**Theory**	**Contact Hours/Week**				**Points Total**
				L	**T**	**P**	**Credit**	
A. THEORY								
1	HS	HU804	Principles of Management	2	0	0	2	2
2	PE	CS801	A. Mobile Computing B. Bio-informatics C. Cyber Law and Security Policy D. VLSI Design E. Client Relationship Management F. Application of Wordpress G. Agile Project Management	3	0	0	3	3
3	PE	CS802	A. Parallel Computing B. Machine Learning C. Real Time Embedded System D. Advanced Computer Architecture E. Business Essentials	3	0	0	3	3
Total of Theory							**8**	**8**
B. PRACTICAL								
4	PROJ	PR 891	Design Lab	0	0	2	2	1
5	PROJ*	PR 892	Project-VIII	0	0	0	6	3
6	MC	MC 801	Essence of Indian Knowledge Tradition	3	0	0	3	
							19	12

NOTE:

1. **Students may choose credit transfer from MOOCS (Preferably SWAYAM platform) or can take from industry only in the final year for Elective subjects on approval of the Department.**
2. **Project in final year in collaboration with industry are encouraged but mentor from department has to be assigned and progress of work should be shared with the mentor on regular basis. Also department will evaluate the project even if the industry concerned evaluates the same.**

Theory

Paper Name: Principles of Management
Paper Code: HU 804
Contact: L-T-P= 3-0-0
Credits: 3

Course Objective(s):

- To develop ability to critically analyze and evaluate a variety of management practices in the contemporary context
- To understand and apply a variety of management and organizational theories in practice
- To be able to mirror existing practices or to generate their own innovative management competencies required for today's complex and global workplace
- To be able to critically reflect on ethical theories and social responsibility ideologies to create sustainable organizations

Course Content:

Module 1: [4L]
Introduction to Management: definitions, managerial roles and functions; Science or Art perspectives- External environment-global, innovative and entrepreneurial perspectives of Management (3 Hrs.)– Managing people and organizations in the context of New Era- Managing for competitive advantage - the Challenges of Management.

Module 2: [6]
Early Contributions and Ethics in Management: Scientific Management- contributions of Taylor, Gilbreths, Human Relations approach-contributions of Mayo, McGregor's Theory, Ouchi's Theory Z .Systems Approach, the Contingency Approach, the Mckinsey 7-S Framework Corporate Social responsibility- Managerial Ethics.

Module 3: [6]
Planning: Nature and importance of planning, -types of plans (3 Hrs.)- Steps in planning, Levels of planning - The Planning Process. – MBO
Organising for decision making: Nature of organizing, organization levels and span of control in management Organisational design and structure –departmentation, line and staff concepts
Leading and Controlling: Leading Vs Managing – Trait approach and Contingency approaches to leadership - Dimensions of Leadership (3 Hrs.) - Leadership Behavior and styles – Transactional and Transformational Leadership
Basic control processcontrol as a feedback system – Feed Forward Control – Requirements for effective control – control techniques – Overall controls and preventive controls – Global controlling.

Module 4: [6]
Management of Physical Resources Plant: site selection procedures, factors affecting selection.
Layout-types and relative merits and demerits,
Maintenance-Objectives, different types of associated decisions, strategies for effective maintenance, computer applications.
Material : Functions, objectives, planning and control including inventory models with or without storage costs, price break (excluding dynamic and probabilistic considerations). Different classes of inventory. Material Requirement Planning (MRP).

Module 5: [4]

Quality management: Quality definition, quality planning, quality control and quality management, Total quality management, ISO 9000 systems, simple quality control techniques like control charts and acceptance sampling, Kaizen & Six Sigma.

Module 6: [4]
Marketing management consumer behavior, market research, product design and development pricing and promotion.

References
1. Harold Kooritz& Heinz Weihrich “Essentials of Management”, Tata McGraw-Hill.
2. L.M. Prasad, Principles of Management , Sultan Chand & sons, New Delhi.
3. Sherlekar&sherlekar, Principles of Management, Himalaya Publishing House, New Delhi.

Name of the Paper: Mobile Computing
Paper Code: CS801A
Contact (Periods/Week):3L/Week
Credit Point: 3
No. of Lectures: 35

Prerequisite:
1. Basic concept of computer network and communication engineering
2. Basic programming knowledge

Course Objective(s):
- To understand the basic concepts and principles in mobile computing .
- To know the wireless communication and networking principles, that support connectivity to cellular networks, wireless internet and sensor devices.
- To understand positioning techniques and location-based services and security issues .

Course Content:

Module 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.

Module 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.

Module 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, map-based, group-based.

Module 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.

Module 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.

Module 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.

Module 7: Energy-efficient Communication [3L]
Energy efficiency at various layers - Physical layer, MAC layer, Network layer, Application layer, performance analysis in noisy channel environment.

Module 8: Secure Wireless Communication [4L]
Introduction-different types of attacks, internal attacks, external attacks; measures against attacks (authentication, intrusion detection, encryption); RC4 algorithm.

Text books:
1. K. Sinha, S.Ghosh and B. P. Sinha, Wireless Networks and Mobile Computing. CRC Press : New York, 2015.

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.

Course Outcomes (COs):

After attending the course students should 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.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS801A.1	3	3	3	3								3
CS801A.2	3	3	3	3								3
CS801A.3	3	3	3	3								3
CS801A.4	3	3	3	3								3
CS801A.5	3	3	3	3								3

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CS801A.1	3	3	3
CS801A.2	3	3	3
CS801A.3	2	3	3
CS801A.4	3	3	2
CS801A.5	3	3	3

Name of the Paper: Bio-informatics
Paper Code: CS801B
Contact (Periods/Week): L-T-P=3-0-0
Credit Point: 3
No. of Lectures: 35

Course Objective(s):

- To familiar with the Bio-modeling techniques
- To Learn microarray analysis
- To Understand the Pattern Matching and Visualization

Course Contents:

Module -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.

Module -2: **[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.

Module 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.

Module -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:

1.Bryan Bergeron, "Bio Informatics Computing", Second Edition, Pearson Education, 2003.
2.Arthur M Lesk, "Introduction to Bioinformatics", Second Edition, Oxford University Press, 2005

Course Outcomes (COs):

After attending the course students should 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

CO-PO Mapping:

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

Name of the Paper: Cyber law and Security Policy
Paper Code: CS801C
Contact (Periods/Week): 3L/Week
Credit Point: 3
No. of Lectures: 35

Prerequisite:
1. Familiarity in computer Networking.
2. Basic concepts about network security.

Course Objective(s)
- To understand, explore and acquire a critical understanding of Cyber Law.
- To learn the basics of a Cyber security
- To develop competencies for dealing with frauds and deceptions (Confidence Tricks, Scams)

Course Contents:
Module – 1A: Introduction of Cybercrime [7]
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.
Module – 1B: Category of Cybercrime [5]
Criminals plan attacks, passive attack, Active attacks, cyber stalking. Unicitral Model Law, Information Technology Act.

Module – 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.

Module -3: Tools and Methods used in Cyber-crime[8]
Proxy servers, panword checking, Random checking, Trojan Horses and Backdoors; DOS & DDOS attacks; SQL injection: buffer over flow.Most Common Attacks, Scripts Kiddies and Packaged Defense.

Module – 4A: Phishing & Identity Theft[4]
Phising methods, ID Theft; Online identity method.
Module – 4B: Cybercrime & Cyber security[3]
Legal aspects, Indian laws, IT act, Public key certificate, Design of Cyber Security Policy of an Organization

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)

Course Outcomes (COs):

After attending the course students should be able to

CO1	To understand 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	To develop the understanding of relationship between commerce and cyberspace
CO4	To be familiar with network security threats and countermeasures

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS801C.1	3	3	3	3								3
CS801C.2	3	3	3	3								3
CS801C.3	3	3	3	3								3
CS801C.4	3	3	3	3								3
CS801C.5	3	3	3	3								3

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CS801C.1	3	3	3
CS801C.2	3	3	3
CS801C.3	2	3	3
CS801C.4	3	3	2
CS801C.5	3	3	3

Course: VLSI Design
Course code: CS 801D
Contracts: 3L
Credits- 3
Total: 36L

Prerequisite:
1. Analog Electronic Circuit.
2. Digital Electronic and Circuit.

Course Objective(s):

- To get clear concepts on electrical behavior of NMOS, PMOS, CMOS, BiCMOS circuits and their fabrication Procedures.
- To understand the concepts of VLSI design flow of digital systems and various tools used for VLSI circuit.
- To understand area, power and cost aspects have made silicon, the popular semiconductor material used in fabrication technology for electronics in a very wide range of applications.

Course Contents:

Module1 [6L]

Introduction to VLSI Design: VLSI Design Flow, 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 (Behavioral, Structural, Physical), Y-Chart, Digital VLSI Design Steps.

Module2 [8L]

Micro-electronic Processes for VLSI Fabrication: Silicon Semiconductor Technology- An Overview, Wafer processing, Oxidation, Epitaxial deposition, Ion-implantation & Diffusion, Cleaning, Etching, Photolithography - Positive & Negative photo-resist

Basic CMOS Technology - (Steps in fabricating CMOS), CMOS inverter, Basic n-well CMOS process, p-well CMOS process, Twin tub process, Silicon on insulator.

Module 3 [8L]

VLSI CIRCUIT DESIGN PROCESSES: Simple Combinational Gates - NAND gate and NOR Gate using CMOS , MOS Layers, Layout Design Rule (Stick diagram with examples, Layout rules), Design Rules and Layout, 2 m CMOS Design rules for wires, Contacts and Transistors Layout Diagrams for NMOS and CMOS Inverters and Gates, Scaling of MOS circuits, Limitations of Scaling.

Module 4 [14L]

COMBINATIONAL & SEQUENTIAL CIRCUIT DESIGN USING HARDWARE DESCRIPTION LANGUAGE: Logic gates, Adders, Subtractor, Mux, Decoder, ALUs, Multipliers, Parity generators, Comparators, Zero/One Detectors, Subsystem Design, Flip-flops, Shifters, Counters, High Density Memory Elements.

Text Books

1. CMOS Digital Integrated Circuits: Sung-Mo Kang, Yusuf Leblebici, Mcgraw Hill Education
2. VLSI Design – Debaprasad Das, Oxford University Press
3. VLSI Technology – S.M. SZE, 2nd Edition, TMH, 2003.

References Books

1. Chip Design for Submicron VLSI: CMOS Layout & Simulation, - John P. Uyemura, Thomson Learning.
2. Introduction to VLSI Circuits and Systems - John .P. Uyemura, JohnWiley, 2003.

3. Digital Integrated Circuits - John M. Rabaey, PHI, EEE, 1997.
4. Modern VLSI Design - Wayne Wolf, Pearson Education, 3rd Edition, 1997.
5. VLSI Technology – S.M. SZE, 2nd Edition, TMH, 2003.
6. Principles of CMOS VLSI Design - Weste and Eshraghian, Pearson Education, 1999.

Course Outcomes (COs):

After attending the course students should 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	Understand the techniques of chip design using programmable devices like VHDL or Verilog Combinational & Sequential Logic circuit Design

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS801D.1	3	3	3	3	2							3
CS801D.2	3	3	3	3	3							3
CS801D.3	3	3	3	3	3							3
CS801D.4	3	3	3	3	3							3
CS801D.5	3	3	3	3	3							3

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CS801D.1	3	3	3
CS801D.2	3	3	3
CS801D.3	2	3	3
CS801D.4	3	3	2
CS801D.5	3	3	3

Name of the Paper: Parallel Computing
Paper Code: CS802A
Contact (Periods/Week): 3L/Week
Credit Point: 3
No. of Lectures: 35

Prerequisite:
1. Familiarity with Operating Systems
2. A solid background in Computer Organization, Architecture and Algorithm

Course Objective(s):

- To learn the basics of parallel system and how parallel computers work.
- To learn how to analyze the correct designs of parallel architectures, especially within the technological constraints.
- To prepare students for a career in designing the computer systems of the future.

Course Outcomes (COs):

After attending the course students should be able to

CO1	Understand the evolution of High Performance Computing (HPC) with respect to laws and the contemporary notion that involves mobility for data, hardware devices and software agents.
CO2	Understand, appreciate and apply parallel and distributed algorithms in problem Solving.
CO3	Evaluate the impact of network topology on parallel/distributed algorithm formulations and traffic their performance.
CO4	Gain hand-on experience with the agent-based and Internet-based parallel and distributed programming techniques.
CO5	Master skills to measure the performance of parallel and distributed programs.

Course Contents:

Module 1: (Introduction) [7L]
Concepts of pipelining and parallelism, Temporal vs. spatial parallelism, differences between distributed computing and parallel computing, loosely coupled vs. tightly coupled systems, Types of parallel architectures – Instruction vs. data (SIMD, MISD, MIMD) (Flynn's classification), Series vs. parallel (Feng's classification), Pipelining vs. parallelism (Haendler'sclassification). Performance measures – Speed-up factor, AT and AT2 measures, Amdahl's law,.
Models of parallel computation – Parallel RAM (PRAM) model, (EREW, CREW, CRCW models), Interconnection network based model, Interrelationship among the performances under EREW, CREW and CRCW models.
Memory interleaving - S-access and C-access organization. Concept of reservation table in multifunction static pipeline and minimum average latency. Elementary concepts of data low architecture.

Module 2: (Interconnection Networks) [9L]
Static interconnection networks – concept of network graph and the desirable features of a network graph in terms of node degree, diameter, fault-tolerance and bisection width, Different types of interconnection network - Crossbar, Clos, loop, star, wheel, double-loop, tree, mesh, torus, multi-mesh, mesh of trees, multi-mesh of trees, shuffle-exchange, pyramid, hypercube, butterfly, cube-connected cycles, Moebius network, De Bruijn network, OTIS architecture.

Dynamic interconnection networks – concept of blocking, non-blocking and re-arrangeable networks, Baseline, Omega and Benes networks.

Module 3: (Parallel Arithmetic) [10L]

Addition/Subtraction - Addition of two n-bit numbers in O(log n) time with O(n log n) logic gates using precarry addition, carry-propagation free addition in redundant binary number system.

Multiplication – Dadda's generalized multiplier, column compression technique, parallel algorithm for multiplying two n-bit signed integers in O(log n) time, parallel multiplication in redundant binary and quarternary number systems.

Division : O(log 2 n) division algorithm using repeated multiplications and additions. Parallel algorithm for prefix sum computation on different architectures.

Matrix transpose : O(n) algorithm on a mesh architecture, O(log n) algorithm on a shuffleexchange network.

Matrix multiplication : parallel algorithms for multiplying two n x n matrices in O(n2), time, O(n log n) time, O(n) time, O(log n) time and O(1) time on appropriate parallel architectures, matrix by vector computation.

Module 4: (Numerical Problems) [4L]

Solution of simultaneous linear equations: parallel algorithm based on Gauss-Jordan elimination; parallel algorithm based on Gauss-Seidel iteration. Finding roots of a polynomial equation: parallel algorithms based on bisection method and Newton-Raphson method.

Module 5: (Sorting and Searching) [5L]

Odd-even transposition sort, sorting networks, 0-1 principle, Batcher's odd-even merge sort, Batcher's bitonic sort, sorting n2 elements in O(n) time on a 2-D mesh, brief discussion on sorting n4 elements in O(n) time a on a multi-mesh. Parallel algorithms for searching.

Text books:

1. Design and Analysis of Parallel Algorithms- Selim G. Akl, Prentice Hall.
2. Computer Architecture and Parallel Processing – Kai Hwang and F. A. Briggs, McGraw-Hill.

Recommended books:

1. Parallel Computing –Theory and Practice -Michael J. Quinn. McGraw-Hill.
2. The Art of Computer Programming Vol. 3 (Sorting and Searching) – Donald E. Knuth, Addison-Wesley.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS802A.1	3	3	3	3	2							3
CS802A.2	3	3	3	3	2							3
CS802A.3	3	3	3	3	2							3
CS802A.4	3	3	3	3	2							3
CS802A.5	3	3	3	3	2							3

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CS802A.1	3	3	3
CS802A.2	3	3	3
CS802A.3	3	3	3
CS802A.4	3	3	3
CS802A.5	3	3	3

Name of the Paper: Machine Learning
Paper Code: CS802B
Contact (Periods/Week): 3L/Week
Credit Point: 3
No. of Lectures: 35

Prerequisite:

1. Basic programming skills
2. Algorithm design
3. Fundamental knowledge of probability and statistics

Course Objective(s)

- To be able to formulate machine learning problems corresponding to different applications
- To understand a range of machine learning algorithms along with their strengths and weaknesses
- To understand the basic theory underlying machine learning
- To be able to apply machine learning algorithms to solve problems of moderate complexity
- To be able to read current research papers and understand the issues raised by current research

Course Contents:

Module1: Introduction [3L]

Applications and problems, learning scenarios, concepts of tasks (problems to be solved by machine learning), models (output of machine learning) and features (workhorses of machine learning). geometric models, probabilistic models, logical models.

Module 2: Classification Schemes [5L]

Binary classification, assessing and visualizing performance of classification, scoring and ranking, turning rankers into classifiers, class probability estimation. [3L]

Multiclass classification, multiclass scores and probabilities, regression, unsupervised and descriptive learning, predictive and descriptive clustering.[2L]

Module 3: Various Models [15L]

Tree Models [3L]

Decision trees, ranking and probability estimation trees, tree learning as variance reduction, regression trees. [3L]

Rule Models [2L]

Learning ordered rule lists, learning unordered rule sets, descriptive rule learning, rule learning for subgroup discovery, association rule mining, first-order rule learning. [2L]

Linear Models [4L]

Least squares method, multivariate linear regression, regularized regression. [1L]

Perceptron, support vector machine, soft margin SVM, probabilities from linear classifiers, beyond linearity with kernel methods.[3L]

Distance-based Models [3L]

Nearest neighbour classification, distance-based clustering, K-means algorithm, clustering around medoids. Hierarchical clustering.[3L]

Probabilistic Models [3L]

Normal distribution, probabilistic models for categorical data, naïve Bayes model for classification, probabilistic models with hidden variables, Gaussian mixture model, compression-based model.[3L]

Module 4 : Features [4L]

Types of features, calculation on features, categorical, ordinal and quantitative features, structured features, thresholding and discretization, normalization and calibration, incomplete features, feature selection - matrix transformations and decompositions. [4L]

Module 5: Model Ensembles and Machine Learning Experiments [4L]

Model Ensembles [2L]

Bagging and random forests, boosted rule learning, mapping the ensemble landscape – bias, variance and margins, meta learning. [2L]

Machine Learning Experiments [2L]

What to measure, how to measure, how to interpret, interpretation of results over multiple data set. [2L]

Module 6 : More Selected Topics in Machine Learning [4L]

Support vector machines – separable and unseparable cases, primal optimization and dual optimization problems, kernel methods – positive definite symmetric kernels and negative definite symmetric kernels, kernel-based algorithms. [4L]

Text Book

1.Peter Flach, Machine Learning. Cambridge University Press, 2012.

Reference Books

1.M. Mohri, A. Rostamizadeh and A. Talwalkar, Foundations of Machine Learning, MIT Press, 2012.
2.Kevin P. Murphy, Machine Learning : A Probabilistic Perspective. MIT Press, 2012.

Course Outcomes (COs):

After completion of the course students would be able to

CO1	Understand the fundamental concepts of basics of machine learning to Explain or Illustrate and Identify problems where students can Apply the concept appropriately to Solve them.
CO2	Understand the fundamental concepts of regression problems 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 learning 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.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS802B.1	3	3	3	3								3
CS802B.2	3	3	3	3								3
CS802B.3	3	3	3	3								3
CS802B.4	3	3	3	3								3
CS802B.5	3	3	3	3								3

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CS802B.1	3	3	3
CS802B.2	3	3	3
CS802B.3	3	3	3
CS802B.4	3	3	3
CS802B.5	3	3	3

Course Name: Real Time Operating System and Embedded system
Course Code: CS802C
Total Contact Hours: 36
Credit: 3

Prerequisites:
1. Concepts of Operating systems and Algorithm.
2. Knowledge of Distributed System basics.

Course Objective(s):
- To understand the real-time systems
- To learn computing required for the real-time embedded systems
- To understand the communication required for the real-time embedded systems

Course Contents:
Module 1: Real time systems and Resources [10]
Real-Time Systems and Resources [4]: Brief history of Real Time Systems, A brief history of Embedded Systems, Requirements of Embedded System, Challenges in Embedded System. System Resources, Resource Analysis, Real-Time Service Utility.
Processing with Real Time Scheduling [6]: Scheduler Classes, Preemptive Fixed Priority Scheduling Policies with timing diagrams, Rate Monotonic least upper bound, Necessary and sufficient feasibility, Deadline – Monotonic Policy, Dynamic priority policies, Worst case execution time, Deadlock and lovelock.
Module 2: Real Time Operating Systems [8]
Operating System basics, The Kernel and its subsystems, Kernel Space and User Space, Kernel Architecture, Types of operating system, Task, process and Threads, Multi-Processing and Multitasking, Types of multitasking, Task Scheduling, Task states, Non-Preemptive scheduling, Preemptive Scheduling, Round Robin Scheduling, Idle Task, Task Communication, Task Synchronization, Thread Safe Reentrant Functions.
Module 3: Embedded Firmware Design [10]
Embedded Firmware Design, development and Free RTOS: Embedded Firmware Design Approaches, Super-loop based approach, Embedded Operating System based approach, Programming in Embedded C, Integrated development environment (IDE), Overview of IDEs for Embedded System Development.[6]
FreeRTOS: Introduction to FreeRTOS , multitasking on an LPC17xx Cortex-M3 Microcontroller, LPC17xx Port of FreeRTOS, Resources Used by FreeRTOS, Task Management, Task Functions, Task Priorities, Idle task and task hook function, Creation and Deletion of tasks.[4L]
Module 4: Embedded System Design with RTOS [6]
Queue Management, Characteristics of a Queue, Working with Large Data, Interrupt Management, and Queues within an Interrupt Service Routine, Critical Sections and Suspending the Scheduler, Resource Management, Memory Management.
Case Studies:
Commercial RTOS - µC/OS, VxWorks, Linux POSIX system, RTLinux / RTAI, Windows system, Vxworksetc.[2]
Text Books:
1. Sam Siewert , “Real-Time Embedded Systems And Components”.
2. Shibu K V, “Introduction to Embedded System”.

Reference books:
1. “Using the FreeRTOS Real Time Kernel” From FreeRTOS.
2. Manuals and Technical Documents from the ARM Inc, web site.

Course Outcomes (COs):

After attending the course students should be able to

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 microcontroller and apply this knowledge for developing an approach by means of existing and new methods as a team work.

CO-PO Mapping

COs	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO 11	PO12
CS802C.1	3	3	3	3	2							3
CS802C.2	3	3	3	3	2							3
CS802C.3	3	3	3	3	2							3
CS802C.4	3	3	3	3	2							3
CS802C.5	3	3	3	3	2							3

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CS802C.1	3	3	3
CS802C.2	3	3	3
CS802C.3	3	3	3
CS802C.4	3	3	3
CS802C.5	3	3	3

Name of the Paper: Advanced Computer Architecture
Paper Code: CS802D
Contact (Periods/Week):3L/Week
Credit Point: 3
No. of Lectures: 35

Prerequisite:
1. Familiarity with the functionalities of basic digital computer system.
2. Fundamentals of Computer Architecture.

Course Objective(s):
- To understand the Concept of Parallel Processing and its applications
- To implement the Hardware for Arithmetic Operations
- To analyze the performance of different scalar Computers
- To understand the Pipelining Concept for a given set of Instructions
- To learn the performance of pipelining and non-pipelining environment in a processor

Module 1: Introduction to Advanced Computer Architectures [5L]
Different types of architectural classifications – instruction vs. data (SISD, SIMD, MISD, MIMD), serial vs. parallel, pipelining vs. parallelism; Pipelining: Definition, different types of pipelining, hazards in pipelining. Concept of reservation tables, issue of multiple instructions with minimum average latency (MAL).

Module2: Parallel Processing & ILP[8L]
RISC architecture, characteristics of RISC instruction set & RISC pipeline, its comparisons with CISC,necessity of using optimizing compilers with RISC architecture, Review of instruction-level parallelism-Super pipelining, Superscalar architecture, Diversified pipelines and out of order execution, VLIW architecture, Dataflow and Control Flow Architectures, Loop Parallelization

Module 3: Interconnection Networks[13L]
Desirable properties of interconnection networks, static interconnection networks – path, cycle, double-loop, star, wheel, 2D mesh and its variants, multi-mesh, tree, shuffle-exchange, cube, cube-connected cycles
Dynamic interconnection networks: concepts of blocking, rearrange able and blocking but rearrange able networks, various types of multistage interconnection networks (MIN)- crossbar, clos, baseline, omega, Benes.

Module 4: Shared Memory Architecture [4L]
Fundamentals of UMA, NUMA, NORMA, COMA architectures, Performance measurement for parallel architectures –Amadahl's law, Gustafson's law

Module 5: Embedded System Architecture [5L]
Definition, Example, Classification of Embedded system, Embedded System Design Issues: Hardware issues (Processor, Memory, Peripherals), Software issues (Programming Languages, Time Criticality, RTOS)

Text Books
1. 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
1. Tse-yun Feng, A Survey of Interconnection Networks, IEEE, 1981.
2. Selim G. Akl, The Design and Analysis of Parallel Algorithms, Prentice-Hall, 1989.
3. Raj Kamal, Embedded Systems Architectures Programming and Design, Second Edition The MacGraw-Hill(for Embedded System) .

Course Outcomes (COs):

After attending the course students should 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 of Multiprocessor 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 model for building a new solution as a professional engineering practice as a team.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS802D.1	3	3	3	3	2							3
CS802D.2	3	3	3	3	2							3
CS802D.3	3	3	3	3	2							3
CS802D.4	3	3	3	3	2							3
CS802D.5	3	3	3	3	2							3

CO-PSO Mapping

COs	PSO1	PSO2	PSO3
CS802D.1	3	3	3
CS802D.2	3	3	3
CS802D.3	3	3	3
CS802D.4	3	3	3
CS802D.5	3	3	3