HIMACHALPRADESHTECHNICAL UNIVERSITY
HAMIRPUR

Syllabus & Examination Scheme

for

B.Tech.

Computer Science & Engineering (CSE)

(Batch 2022-26)

HPTU Main Campus

(1st to 6th Semester)

As per National Education Policy (NEP) - 2020

Semester-I

Sr. No.	Category	Subject Code	Subject Title	L	T	P/D	Credits	Evaluation Scheme (Marks)		
								Internal Assessment (IA)	ESE	Subject Total
Theory:										
1	BS	PHY-101L	Applied physics	3	0	0	03	40	60	100
2	ES	CS-101L	Computer Programming and Problem Solving	3	0	0	03	40	60	100
3	ES	EE-101L	Basic Electrical Engineering	3	0	0	03	40	60	100
4	BS	MA-101L	AppliedMathematics-1	3	1	0	04	40	60	100
5	HS	EVS-101L	Energy and Environment	3	0	0	03	40	60	100
6	HS	HS-111L	Technical Communication Skills	2	0	2	03	40	60	100
Labs:										
1	BS	PHY-101P	Applied Physics Lab	0	0	2	01	30	20	50
2	ES	CS-201P	Computer Programming Lab	0	0	2	01	30	20	50
3	ES	EE-101P	Electrical Engineering Lab	0	0	2	01	30	20	50
			Total	**17**	**01**	**08**	**22**			

Semester-II

Sr. No.	Category	Subject Code	Subject Title	L	T	P/D	Credits	Evaluation Scheme(Marks)		
								Internal Assessment (IA)	ESE	Subject Total
Theory:										
1	PC	CHM-201L	Applied Chemistry	3	0	0	03	40	60	100
2	PC	CS-201L	Object Oriented Programming	3	0	0	03	40	60	100
3	PC	EC-101L	Basics Of Electronics Engineering	3	0	0	03	40	60	100
4	PC	MA-201L	Applied Mathematics-II	3	1	0	04	40	60	100
5	PC	HS-115L	Universal Human Values for Holistic, Value-Based Education	2	1	0	03	40	60	100
6	FC	HS-116L	Human Consciousness &Yoga	2	0	2	03	40	60	100
Labs:										
1	BS	CHM-201P	Applied Chemistry Lab	0	0	2	01	30	20	50
2	PC	CS-201P	Object Oriented Programming Lab	0	0	2	01	30	20	50
3	BS	EC-201P	Basics Of Electronics Engineering Lab	0	0	2	01	30	20	50
			Total	**16**	**02**	**08**	**22**			**750**

Legends:

L- Lecture
T- Tutorial
P- Practical
CT–Class Test
IA– Internal Assessment
ESE–End Semester Examination
FW–Documentation/File work and presentation
LP–Lab performance
ESVE–End Semester Exam./Viva-voce Exam.
PC–Programme Core

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Semester-III

Sr. No.	Category	Subject Code	Subject Title	L	T	P/D	Credits	Evaluation Scheme(Marks)		
								Internal Assessment (IA)	ESE	Subject Total
Theory:										
1	PC	MA-311	Discrete Mathematical Structure	3	1	0	4	40	60	100
2	PC	CS-311	Operating System	3	1	0	4	40	60	100
3	PC	CS-312	Data Structure and Algorithms	3	1	0	4	40	60	100
4	PC	CS-313	Java Programming	3	0	0	3	40	60	100
5	PC	EC-311	Digital Electronics	3	0	0	3	40	60	100
6	FC	HS-311	Economic Engineering	3	0	0	3	40	60	100
7	MC	HS-312	Indian Knowledge System	2	0	0	2	40	60	100
	Labs:									
1	PC	CS-311P	Operating System Lab	0	0	2	1	30	20	50
2	PC	CS-312P	Data Structure and Algorithms Lab	0	0	2	1	30	20	50
3	PC	CS-313P	Java Programming Lab	0	0	2	1	30	20	50
4	PC	EC-311P	Digital Electronics Lab	0	0	2	1	30	20	50
			Total	**20**	**03**	**08**	**27**			**900**

Semester-IV

S. No.	Category	Subject Code	Subject Title	L	T	P/D	Credits	Evaluation Scheme(Marks)		
								Internal Assessment (IA)	ESE	Subject Total
Theory:										
1	PC	MA-411	Optimization and Calculus of Variations	3	1	0	4	40	60	100
2	PC	CS-411/CS-314	Python Programming	3	0	0	3	40	60	100
3	PC	CS-412	Design and Analysis of Algorithms	3	1	0	4	40	60	100
4	PC	CS-413	Artificial Intelligence and Expert System	3	1	0	4	40	60	100
5	PC	CS-414/CS-315	Computer Architecture & Organization	3	1	0	4	40	60	100
6	PC	EC-411	Microprocessors and Interfacing	3	1	0	4	40	60	100
7	FC	HS-411	Entrepreneurship and Startups	2	0	0	2	40	60	100
Labs:										
1	PC	CS-411P/CS-314P	Python Lab	0	0	2	1	30	20	50
2	PC	CS-412P	DAA Lab	0	0	2	1	30	20	50
3	PC	CS-413P	AI Lab	0	0	2	1	30	20	50
			Total	**20**	**05**	**06**	**28**			**850**

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Semester-V

S. No.	Category	Subject Code	Subject Title	L	T	P/D	Credits	Evaluation Scheme(Marks)		
								Internal Assessment (IA)	ESE	Subject Total
Theory:										
1	PC	CSPC-511	Computer Networks	3	1	0	4	40	60	100
2	PC	CSPC-512	Theory of Computation	3	1	0	4	40	60	100
3	PC	CSPC-513	Introduction to Machine Learning	3	1	0	4	40	60	100
4	PC	CSPC-514	Software Engineering	3	0	0	3	40	60	100
5	PC	CSPC-415	Database Management System	3	1	0	4	40	60	100
Labs:										
1	PC	CSPC-511P	Computer Networks Lab	0	0	2	1	30	20	50
2	PC	CSPC-513P	Machine Learning Lab	0	0	2	1	30	20	50
3	PC	CSPC-415P	DBMS Lab	0	0	2	1	30	20	50
			Total	**15**	**04**	**06**	**22**			**650**

Semester-VI

S. No.	Category	Subject Code	Subject Title	L	T	P/D	Credits	EvaluationScheme(Marks)		
								Internal Assessment (IA)	ESE	Subject Total
Theory:										
1	PC	CSPC-611	Digital Image Processing	3	1	0	4	40	60	100
2	PC	CSPC-612	Information and Network Security	3	0	0	3	40	60	100
3	PC	CSPC-613	Compiler Design	3	1	0	4	40	60	100
4	PE	CSPE-611x	Professional Elective-I	3	0	0	3	40	60	100
5	PE	CSPE-612x	Professional Elective-II	3	1	0	4	40	60	100
6	BS	MAFC-311	Probability Theory and Statistics	3	1	0	4	40	60	100
Labs:										
1	PC	CSPC-611P	DIP Lab	0	0	2	1	30	20	50
2	EE	CSEE-612P	Capstone Project-I	0	0	4	2	40	60	100
			Total	**18**	**04**	**06**	**25**			**750**

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List of Professional Electives

Professional Elective-I								
S. No.	Category	Subject Code	Subject Title	Teaching Hours Per Week			Credits	Stream /Specialization
				L	T	P/D		
1	PE	CSPE-611(i)	Distributed Operating Systems	3	0	0	3	CSE
2	PE	CSPE-611(ii)	Internet of Things	3	0	0	3	CSE
3	PE	CSPE-611(iii)	Advanced Algorithms	3	0	0	3	CSE

Professional Elective-II								
S. No.	Category	Subject code	Subject Title	Teaching Hours Per Week			Credits	Stream /Specialization
				L	T	P/D		
1	PE	CSPE-612(i)	Advanced Computer Architecture	3	1	0	4	CSE
2	PE	CSPE-612(ii)	Mobile Computing and Wireless Networks	3	1	0	4	CSE
3	PE	CSPE-612(iii)	Cloud Computing	3	1	0	4	CSE

Professional Elective-III								
S. No.	Category	Subject code	Subject Title	Teaching Hours Per Week			Credits	Stream /Specialization
				L	T	P/D		
1	PE	CSPE-711(i)	Data Visualization	3	1	0	4	CSE
2	PE	CSPE-711(ii)	Deep Learning	3	1	0	4	CSE
3	PE	CSPE-711(iii)	Wireless Sensor Networks	3	1	0	4	CSE

Professional Elective-IV								
S. No.	Category	Subject code	Subject Title	Teaching hours Per Week			Credits	Stream /Specialization
				L	T	P/D		
1	PE	CSPE-712(i)	Big Data Mining and Analytics	3	1	0	4	CSE
2	PE	CSPE-712(ii)	Computer Vision	3	1	0	4	CSE
3	PE	CSPE-712(iii)	Generative AI	3	1	0	4	CSE

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Open Elective-I								
S. No.	Category	Subject code	Subject Title	Teaching Hours Per Week			Credits	Stream /Specialization
				L	T	P/D		
1	PE	CSOE-712(i)	Cyber Law and Ethics	3	0	0	3	CSE
2	PE	CSOE-712(ii)	Basics of Java Programming	3	0	0	3	CSE
3	PE	CSOE-712(iii)	Digital Marketing	3	0	0	3	CSE
4	PE	CSOE-712(iii)	Basics of Python programming	3	0	0	3	CSE
5	PE	CSOE-712(iv)	Mobile Application Development	3	0	0	3	CSE

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B. Tech. Computer Science & Engineering (CSE)

(2022 - 2023 Scheme)

SEMESTER-I

S. N.	SUBJECT CODE	SUBJECT TITLE	L	T	P	CR
1	PHY-101L	APPLIED PHYSICS	3	0	0	03
2	CS-101L	COMPUTER PROGRAMMING AND PROBLEM SOLVING	3	0	0	03
3	EE-101L	BASIC ELECTRICAL ENGINEERING	3	0	0	03
4	MA-101L	APPLIED MATHEMATICS-I	3	1	0	04
5	EVS-101L	ENERGY AND ENVIRONMENT	3	0	0	03
6	HS-111L	TECHNICAL COMMUNICATION SKILLS	2	0	2	03
7	PHY-101P	APPLIED PHYSICS LAB	0	0	2	01
8	CS-101P	COMPUTER PROGRAMMING LAB	0	0	2	01
9	EE-101P	ELECTRICAL ENGINEERING LAB	0	0	2	01
		TOTAL				22

SEMESTER-II

S. N.	SUBJECT CODE	SUBJECT TITLE	L	T	P	CR
1	CHM-201L	APPLIED CHEMISTRY	3	0	0	03
2	CS-201L	OBJECT ORIENTEDPROGRAMMING	3	0	0	03
3	EC-201L	BASICS OF ELECTRONICS ENGINEERING	3	0	0	03
4	MA-201L	APPLIED MATHEMATICS-II	3	1	0	04
5	HS-115L	Universal Human Values for Holistic, Value -based Education	2	1	0	03
6	HS-116L	HUMAN CONSCIOUSNESS & YOGA*	2	0	2	03
7	CHM-201P	APPLIED CHEMISTRY LAB	0	0	2	01
8	CS-201P	OBJECT ORIENTEDPROGRAMMING LAB	0	0	2	01
9	EC-201P	BASICS OF ELECTRONICS ENGINEERING LAB	0	0	2	01
		TOTAL				22

*Either of one can be selected

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B. TECH. COMPUTER SCIENCE AND ENGINEERING

(Main Campus)

SEMESTER -I

APPLIED MATHEMATICS-I (MA -101L)

Course Code	**MA-101L**	**Credits – 04**	**L-3, T-1, P-0**
Name of Course	**APPLIED MATHEMATICS-I**		
Semester End Examination	**MM:60**	**Min. Marks :24**	**Time Allowed :3 Hrs.**
Internal Assessment	**MM:40**	**Min. Marks :16**	
Internal Assessment Structure – 15 (Quizzes, Seminars, Presentation, Class Performance) + 5 (Attendance) + 20 (Sessional/MSTs)			

INSTRUCTIONS:

1. The question paper will consist of five sections A, B, C, D and E. Section E will be Compulsory, it will consist of a single question with 10-20 subparts of short answer type. which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C and D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

2. Candidates are required to attempt five questions in all selecting one question from each of the section A, B, C and D of the question paper and all the subparts of the questions in section E. Use of non-programmable calculators are allowed.

Course Objectives: To provide students with skills and knowledge in sequence and series, advanced calculus and calculus of several variables which would enable them to devise solutions for given situations they may encounter in their engineering profession.

UNIT-I

Sequences and Series: Introduction to sequences and Infinite series, Tests for convergence/divergence, Limit comparison test, Ratio test, Root test, Cauchy integral test, Alternating series, Absolute convergence and conditional convergence.

Series Expansions: Power series, Taylor series, Convergence of Taylor series, Error estimates, Term by term differentiation and integration.

UNIT-II

Calculus: Mean value theorem, Rolle's theorem, Lagrange's Cauchy mean value theorem, Application of definite integral to evaluate areas of bounded region, Arc length of a plane curve, volume of solids, surface areas of a solid revolution (Cartesian coordinates), Improper integrals.

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UNIT-III

Partial Differentiation and applications: Functions of several variables, Limits and continuity, Chain rule, change of variables, Partial differentiation of implicit functions, Directional derivatives and its properties, Maxima and minima by using second order derivatives, Lagrange's method of multipliers.

UNIT-IV

Multiple Integrals and applications: Double integral (Cartesian), Change of order of integration in double integral, Polar coordinates, graphing of polar curves, Change of variables (Cartesian to polar), Applications of double integrals to areas and volumes, evaluation of triple integral (Cartesian).

Course Learning Outcomes (CLOs) :

Upon completion of this course, the students will be able to

1. Examine functions of several variables, define and compute partial derivatives, directional derivatives and their use in finding maxima and minima in some engineering problems.
2. Evaluate multiple integrals in Cartesian and Polar coordinates, and their applications to engineering problems.
3. Determine the convergence/divergence of infinite series, approximation of functions using power and Taylor's series expansion and error estimation.
4. Evaluate surface areas and volumes of revolution in some engineering problems.

Textbooks:

1. Thomas, G.B. and Finney, R.L., Calculus and Analytic Geometry, Pearson Education (2007), 9th ed.
2. Stewart James; Essential Calculus; Thomson Publishers (2007), 6th ed.
3. R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics (2003), 2nd ed.

Reference Books:

1. Wider David V, Advanced Calculus: Early Transcendentals, Cengage Learning (2007).
2. Apostol Tom M, Calculus, Vol I and II, John Wiley (2003).
3. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons (2011) 9th Edition.

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COMPUTER PROGRAMMING AND PROBLEM SOLVING(CS-101L)

Course Code	**CS-101L**	**Credits – 03**	**L - 3, T - 0, P - 0**
Name of Course	**COMPUTER PROGRAMMING AND PROBLEM SOLVING**		
Semester End Examination	**MM:60**	**Min. Marks :24**	**Time Allowed :3 Hrs.**
Internal Assessment	**MM:40**	**Min. Marks :16**	
Internal Assessment Structure – 15 (Quizzes, Seminars, Presentation, Class Performance) + 5 (Attendance) + 20 (Sessional/MSTs)			

INSTRUCTIONS:

1. The question paper will consist of five sections A, B, C, D and E. Section E will be Compulsory, it will consist of a single question with 10-20 subparts of short answer type. which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C and D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

2. Candidates are required to attempt five questions in all selecting one question from each of the section A, B, C and D of the question paper and all the subparts of the questions in section E. Use of non-programmable calculators are allowed.

Course Objectives: This course is designed to explore computing and to show students the art of computer programming. Students will learn some of the design principles for writing good programs.

UNIT-I

Computers Fundamentals: Binary Number System, Computer memory, Computer Software.
Algorithms and Programming Languages: Algorithm, Flowcharts, Generation of Programming Languages.

UNIT-II

C Language: Structure of C Program, Life Cycle of Program from Source code to Executable, Compiling and Executing C Code, Keywords, Identifiers, Primitive Data types in C, variables, constants, input/output statements in C, operators, type conversion and type casting. Conditional branching statements, iterative statements, nested loops, break and continue statements.
Functions: Declaration, Definition, Call and return, Call by value, Call by reference, showcase stack usage with help of debugger, Scope of variables, Storage classes, Recursive functions, Recursion vs. Iteration.

UNIT-III

Arrays, Strings and Pointers: One-dimensional, Two-dimensional and Multi-dimensional arrays, operations on array: traversal, insertion, deletion, merging and searching, Inter- function communication via arrays: passing a row, passing the entire array, matrices. Reading, writing and manipulating Strings, understanding computer memory, accessing via pointers, pointers to arrays, dynamic allocation, drawback of pointers.

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UNIT-IV

Structures and Union: Defining a Structure, declaring a structure variables, Accessing Structure Elements, and Union.

File Handling: Defining and Opening a File, closing a File, reading from a File, Writing into a File.

Course Learning Outcomes (CLOs):

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

1. Comprehend and analyze the concepts of number system, memory, compilation and debugging of the programs in C language.
2. Understanding of the fundamental data types, operators and console I/O functions as an aspect of programs.
3. Design and create programs involving control flow statements, arrays, strings and implement the concept of dynamics of memory allocations.
4. Evaluate and analyze the programming concepts based on user define data types and file handling using C language.

Textbooks:

1. Brian W. Kernighan Dennis M. Ritchie, C Programming Language, 2nd ed, 2012.
2. Balagurusamy G., Programming in ANSI C, 8th ed., 2019

Reference Books:

1. Kanetkar Y., Let Us C, 16th ed.,2017

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BASIC ELECTRICAL ENGINEERING (EE-101L)

Course Code	**EE-101L**	**Credits – 03**	**L - 3, T - 0, P - 0**
Name of Course	**BASIC ELECTRICAL ENGINEERING**		
Semester End Examination	**MM:60**	**Min. Marks :24**	**Time Allowed :3 Hrs.**
Internal Assessment	**MM:40**	**Min. Marks :16**	
Internal Assessment Structure – 15 (Quizzes, Seminars, Presentation, Class Performance) + 5 (Attendance) + 20 (Sessional/MSTs)			

INSTRUCTIONS:

1. The question paper will consist of five sections A, B, C, D and E. Section E will be Compulsory, it will consist of a single question with 10-20 subparts of short answer type. which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C and D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

2. Candidates are required to attempt five questions in all selecting one question from each of the section A, B, C and D of the question paper and all the subparts of the questions in section E. Use of non-programmable calculators are allowed

Course Objectives: To introduce concepts of DC and AC circuits and electromagnetism. To make the students understand the concepts and working of single-phase transformers, DC motor and generators.

UNIT-1

DC Circuits: Kirchhoff's voltage and current laws; power dissipation; Voltage source and current source; Mesh and Nodal analysis; Star-delta transformation; Superposition theorem. Thevenin's theorem; Norton's theorem; Maximum power transfer theorem; Millman's theorem and Reciprocity theorem; Transient response of series RL and RC circuits.

UNIT-II

Steady state analysis of DC Circuits: The ideal capacitor, permittivity; the multi-plate capacitor, variable capacitor; capacitor charging and discharging, current-voltage relationship, time-constant, rise-time, fall-time, inductor energisation and de-energisation, inductance current-voltage relationship, time-constant; Transient response of RL, RC and RLC Circuits.

UNIT-III

AC Circuits: Sinusoidal sources, RC, RL and RLC circuits, Concept of Phasors, Phasor representation of circuit elements, Complex notation representation, Single phase AC Series and parallel circuits, power dissipation in AC circuits, power factor correction, Resonance in series and parallel circuits, Balanced and unbalanced 3-phase circuit - voltage, current and power relations, 3-phase power measurement, Comparison of single phase and three phase supply systems.

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Electromagnetism: Electromagnetic induction, Dot convention, Equivalent inductance, Analysis of Magnetic circuits, AC excitation of magnetic circuit, Iron Losses, Fringing and stacking, applications: solenoids and relays.

UNIT-IV

Single Phase Transformers: Constructional features of transformer, operating principle and applications, equivalent circuit, phasor analysis and calculation of performance indices.

Motors and Generators: DC motor operating principle, construction, energy transfer, speed torque relationship, conversion efficiency, applications, DC generator operating principle, reversal of energy transfer, EMF and speed relationship, applications.

Course Learning Outcomes (CLOs):

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

1. Apply networks laws and theorems to solve electric circuits.
2. Analyze transient and steady state response of DC circuits.
3. Signify AC quantities through phasor and compute AC system behaviour during steady state.
4. Explain and analyse the behaviour of transformer.
5. Elucidate the principle and characteristics of DC motor and DC generator.

Textbooks:

1. Hughes, E., Smith, I.M., Hiley, J. and Brown, K., Electrical and Electronic Technology, PHI (2008).
2. Nagrath, I.J. and Kothari, D.P., Basic Electrical Engineering, Tata McGraw Hill (2002).
3. Naidu, M.S. and Kamashaiah, S., Introduction to Electrical Engineering, Tata McGraw Hill (2007).

Reference Books:

1. Chakraborti, A., Basic Electrical Engineering, Tata McGraw–Hill (2008).
2. Del Toro, V., Electrical Engineering Fundamentals, Prentice–Hall of India Private Limited (2004)

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APPLIED PHYSICS(PHY-101L)

Course Code	PHY-101L	Credits – 03	L - 3, T - 0, P - 0
Name of Course	APPLIED PHYSICS		
Semester End Examination	MM:60	Min. Marks :24	Time Allowed :3 Hrs.
Internal Assessment	MM:40	Min. Marks :16	
Internal Assessment Structure – 15 (Quizzes, Seminars, Presentation, Class Performance) + 5 (Attendance) + 20 (Sessional/MSTs)			

INSTRUCTIONS:

3. The question paper will consist of five sections A, B, C, D and E. Section E will be Compulsory, it will consist of a single question with 10-20 subparts of short answer type. which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C and D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

4. Candidates are required to attempt five questions in all selecting one question from each of the section A, B, C and D of the question paper and all the subparts of the questions in section E. Use of non-programmable calculators are allowed

Course Objectives: To introduce the students, basic physical laws of oscillations, acoustics of buildings, ultrasonics, electromagnetic waves, optics, quantum mechanics and demonstrate their technological applications. To explore the ideas for the measurement, principles, and their applications to investigate physical phenomena.

Unit-I

Oscillations and Waves: Oscillatory motion and damping, Applications - Electromagnetic damping – eddy current; ***Acoustics***: Reverberation time, absorption coefficient, Sabine's and Eyring's formulae (Qualitative idea), Applications - Designing of hall for speech, concert, and opera; ***Ultrasonics***: Production and Detection of Ultrasonic waves, Applications - green energy, sound signaling, dispersion of fog, remote sensing, Car's airbag sensor.

Unit-II

Electromagnetic Waves: Scalar and vector fields; Gradient, divergence, and curl; Stokes' and Green's theorems; Concept of Displacement current; Maxwell's equations; Electromagnetic wave equations in free space and conducting media, Application - skin depth.

Unit-III

Optics: ***Interference***: Parallel and wedge-shape thin films, Newton rings, Applications as Non-reflecting coatings, Measurement of wavelength and refractive index. ***Diffraction***: Single and Double slit diffraction, and Diffraction grating, Applications - Dispersive and Resolving Powers. ***Polarization***: Production, detection, Applications – Anti-glare automobile headlights, Adjustable tint windows.

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Unit-IV

Quantum Mechanics: Introduction to quantum physics, Black body radiation, Planck's law, Photoelectric effect, Compton effect, de-Broglie's hypothesis, Wave-particle duality, Davisson and Germer experiment, Heisenberg's Uncertainty principle, Schrodinger's wave equation, Particle in one dimensional box.

Course Learning Outcomes (CLOs):

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

- Understand the knowledge of fundamentals of oscillation and waves, electromagnetic waves, optics and quantum mechanics enable the students to apply to various systems as per their applications.
- help the students to prepare new objectives and materials for various engineering applications.
- help the students to be exposed to different physical phenomena.

Text Books:

1. R. N. Chaudhuri, Waves and Oscillations, New Age International-Publisher.
2. Ajay Ghatak, Optics, McGraw-Hill-Publisher.
3. B.K. Pandey, S. Chaturvedi, Engineering Physics, Cengage Learning-Publisher.
4. A. Beiser, Concept of Modern Physics, Tata McGraw Hill-Publisher
5. D.J. Griffiths, Introduction to Electrodynamics, Prentice Hall of India-Publisher

Reference Books:

1. M.R. Wehr, J.A. Richards, T.W. Adair, Physics of the Atom, Narosa Publishing House.
2. N.K. Verma, Physics for Engineers, Prentice Hall.
3. Pedrotti, Frank L., Pedrotti, Leno S., and Pedrotti, Leno M., Introduction to Optics, Pearson Prentice Hall.

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TECHNICAL COMMUNICATION SKILLS (HS-111 L)

Course Code	HS-111L	Credits – 03	L - 2, T - 0, P - 2
Name of Course	TECHNICAL COMMUNICATION SKILLS		
Semester End Examination	MM:60	Min. Marks :24	Time Allowed :3 Hrs.
Internal Assessment	MM:40	Min. Marks :16	
Internal Assessment Structure – 15 (Quizzes, Seminars, Presentation, Class Performance) + 5 (Attendance) + 20 (Sessional/MSTs)			

INSTRUCTIONS:

1. The question paper will consist of five sections A, B, C, D and E. Section E will be Compulsory, it will consist of a single question with 10-20 subparts of short answer type. which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C and D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

2. Candidates are required to attempt five questions in all selecting one question from each of the section A, B, C and D of the question paper and all the subparts of the questions in section E. Use of non-programmable calculators are allowed

Course Objective: The primary objective of the course is to develop in the under-graduate students of engineering, a level of competence in English required for independent and effective communication for academic and social needs.

Unit-I

Communication Fundamentals: Analysing Communication; Technical Communication: Objectives and Definitions; Information and Communication Technology (ICT) in Organizations; Levels of Communication, Barriers to Communication, Communication in Professional Context, and Importance of Effective Communication.

Unit-II

Listening Skills: Kinds of Listening, Hearing and Listening, Barriers in Listening, Enhancing Listening Skills.

Speaking Skills: Art of Speaking, Stages of Speaking, Speech Style and Techniques, Types - Extempore, Impromptu, Debate.

Reading Skills: Introduction of Different Kinds of Reading Material: Technical and Non-Technical; Reading Comprehension: Effective Reading Skills, Reading Strategies, Textual Reading of Essays - (i) CEM Joad's "A Dialogue on Civilization," (ii) A G Gardiner's "On Saying Please."

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Writing Skills: Effective Writing Practice; Brevity and Clarity in Writing – Cohesion and Coherence in Writing; Report Writing, Proposals, Writing Minutes, Professional Correspondences - Letter Writing, Job Application Letter, Résumé and CV.

Unit-III

Speech Mechanism: Focus on Organs of Speech, Sound and Speech, Vowels and Consonants, Diphthongs, Speech Process,

Phonetics; Phonology, Phonemes, Stress, Rhythm, Intonation, Morphemes, Register, Style, Cluster, Variety in English; Places and Manners of Articulations.

Developing Speaking Skills: Instructions, Face to Face Communication, Meetings, Public Speaking, Group Discussion, Team Talk, Presentations, Seminars, Conferences, Interviews' Techniques, and Mock Interviews, Conversation - Practice Based on Audio and Visual Aids, Dialogue Delivery, Speech and Debate, Speaking on a Given Topic, Extempore, Words Exercise and Words Games to enhance Self-Expression, and Pronunciation Practices.

Verbal Ability: Verbal Ability focalizes on three levels of Language Viz. World Level, Sentence Level and Paragraph Level.

Non Violent Communication (NVC): Nonviolent Communication (NVC) is an approach to communication based on principles of nonviolence. Nonviolent Communication was developed by clinical psychologist Marshall Rosenberg beginning in the 1960s and 1970s, his book *Nonviolent Communication: A Language of Life* is an authoritative text. The objective is interpersonal harmony and obtaining knowledge for future cooperation. The concepts include rejection of coercive forms of discourse, gathering facts through observing without evaluating, genuinely and concretely expressing feelings and needs, and formulating effective and empathetic requests. Nonviolent communication is used both as a clinical psychotherapy modality and as a self-help technique, particularly to seek harmony in relationships and at workplaces. Nonviolent communication holds that most conflicts between individuals or groups arise from miscommunication about their human needs, due to coercive or manipulative language that aims to induce fear, guilt, shame, etc. These "violent" modes of communication, when used during a conflict, divert the attention of the participants away from clarifying their needs, their feelings, their perceptions, and their requests, thus perpetuating the conflict.

Components: There are four components to practice nonviolent communication: Observation, Feelings, Needs and Requests.

Modes: There are three primary modes of application of NVC: Self Empathy, Receiving Empathically and Expressing Honestly.

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Unit-IV

Remedial Grammar: Parts of Speech, Determiners, Modals, Tenses -Verb Agreement, Active and Passive Voice, Direct and Indirect Speech, Transformation of Sentences, Sentence Structure, Finding Common Errors.

Vocabulary Building: Synonyms, Antonyms, One Word Substitution, Word Formation, Idioms and Phrases, Homophones, Prefix, Suffix and Vocabulary Usage.

Textbooks:

Bansal, R. K. and J B Harrison. Spoken English: A Manual of Speech and Phonetics. Orient BlackSwan, 2013.

Green, David. Contemporary English Grammar Structures and Composition. Macmillan Publishers India Limited, 2013.

Sharma, Sangeeta and Binod Mishra. Communication Skills for Engineers and Scientists. Prentice-Hall of India Pvt.Ltd, 2009, Sixth Reprint 2015.

Kumar, Sanjay & Pushp Lata. Communication Skills. New Delhi: OUP, 2016.

Additional Books:

Allen, W. S. Living English Speech. Orient Longman, 1984.

Wallace, H. R. and Masters, L. A. Personality Development for Work. South-Western Educational Publication, 1996.

Carnegie, D. and Napoleon Hill. Public Speaking & Pleasing Personality. BN Publishing, 2006.

Balasubramanian, T. A Textbook of English *Phonetics* for Indian Students. MacMillan, 2000.

Mohan, Krishna and Meera Banerji. Developing Communication Skills. MacMillan, 2013.

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ENERGY AND ENVIRONMENT SCIENCE (EVS-101L)

Course Code	**EVS-101L**	**Credits – 03**	**L - 3, T - 0, P - 0**
Name of Course	**ENERGY AND ENVIRONMENT SCIENCE**		
Semester End Examination	**MM:60**	**Min. Marks :24**	**Time Allowed :3 Hrs.**
Internal Assessment	**MM:40**	**Min. Marks :16**	
Internal Assessment Structure – 15 (Quizzes, Seminars, Presentation, Class Performance) + 5 (Attendance) + 20 (Sessional/MSTs)			

INSTRUCTIONS:

1. The question paper will consist of five sections A, B, C, D and E. Section E will be Compulsory, it will consist of a single question with 10-20 subparts of short answer type. which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C and D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

2. Candidates are required to attempt five questions in all selecting one question from each of the section A, B, C and D of the question paper and all the subparts of the questions in section E. Use of non-programmable calculators are allowed

Course Objectives: The exposure to this course would facilitate the students inunderstanding the terms, definitions and scope of environmental and energy issues pertaining to current global scenario; understanding the value of regional and global natural and energy resources; and emphasize on need for conservation of energy and environment.

UNIT-I

Introduction: Natural Resources & amp; its types, Concept of sustainability and sustainable use of natural resources, Pollution based environmental issues and case-studies.

Conventions on Climate Change: Origin of Conference of Parties (COPs), United Nations Framework Convention on Climate Change (UNFCCC) and Intergovernmental Panel on Climate Change (IPCC); Kyoto Protocol, instruments of protocol – CDM, JI and IET; Montreal Action Plan; Paris Agreement and post-Paris scenario.

UNIT-II

Air Pollution: Origin, Sources and effects of air pollution; Primary and secondary meteorological parameters; Wind roses; Atmospheric Stability; Inversion; Plume behavior; Management of air pollution: Source reduction and Air Pollution Control Devices for particulates and gaseous pollutants in stationary and mobile sources.

Water Pollution: Origin, Sources of water pollution, Category of water pollutants, Physico-Chemical characteristics, Components of wastewater treatment systems, Advanced treatment technologies.

Solid Waste Management: Introduction to solid waste management, Sources, characteristicsof municipal and industrial solid waste, Solid waste management (Chemicals

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and Biological Methods): Incineration, composting, Biomethanation, landfill, E-waste management, Movements of Hazardous Waste management (Basal convention).

UNIT-III

Energy Resources: Classification of Energy Resources; Conventional energy, resources-Coal, petroleum and natural gas, nuclear energy, hydroelectric power; Non-conventional energy resources – Biomass energy, Thermo-chemical conversion and biochemical conversion route; Generation of Biogas and biodiesel as fuels; Solar energy-active and passive solar energy absorption systems; Type of collectors; Thermal and photo conversion applications; Wind energy, Electric Vehicles System (Introduction and Revolution of Batteries), Introduction to Hydrogen Economy.

UNIT-IV

Facilitated through Online Platforms:

Ecology and Environment: Concept of an ecosystem; structural and functional units of an ecosystem; Food Chain, Food Web, Trophic Structures and Pyramids; Energy flow; Ecological Succession; Types, Characteristics, Biodiversity, Biopiracy.

Human population & Their Environment : Population Growth , Variation Among nations ,: Population Explosion : Family welfare Programmes , Environment & human Health

Human Rights; Value Education; Women and Child Welfare; Role of Information Technology in Environment and Human Health, Environmental Ethics.

Course Learning Outcomes :

On the completion of course, students will be able to:

Comprehend the interdisciplinary context with reference to the environmental issues and case studies.

Assess the impact of anthropogenic activities on the various elements of environment and apply suitable techniques to mitigate their impact.

Conceptualize and explain the structural and functional features of ecological systems.

Correlate environmental concerns with the conventional energy sources associated and assess the uses and limitations of non-conventional energy technologies.

Recommended Books:

Moaveni, S., Energy, Environment and Sustainability, Cengage (2018)

Down to Earth, Environment Reader for Universities, CSE Publication (2018)

Chapman, J.L. and Reiss, M.J., Ecology - Principles and Application, Cambridge University Press (LPE) (1999).

Eastop, T.P. and Croft, D.R., Energy Efficiency for Engineers and Technologists, Longman and Harow (2006).

O'Callagan, P.W., Energy Management, McGraw Hill Book Co. Ltd. (1993).

Peavy H.S. and Rowe D.R. Environmental Engineering, McGraw Hill (2013).

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Applied Physics Lab (PHY-101P)

Course Code	PHY-101P	Credits – 01	L - 0, T - 0, P - 2
Name of Course	Applied Physics Lab		
Practical Internal Assessment	MM:30	Min. Marks :12	Total: 50 Marks
Practical External Assessment	MM:20	Min. Marks :8	

Course Objectives: To introduce the students, basic physical laws of oscillations, acoustics of buildings, ultrasonics, electromagnetic waves, optics, quantum mechanics and demonstrate their technological applications. To explore the ideas for the measurement, principles, and their applications to investigate physical phenomena.

Laboratory Work:

1. Characteristics of P-N junction diode.
2. Characteristics of solar cell.
3. Characteristics of light emitting diode.
4. Hall co-efficient of a given Semiconductor.
5. Wavelength of He-Ne laser using transmission diffraction grating.
6. Wavelength of sodium light using spectrometer/diffraction grating.
7. Planck's constant using photocell/stopping potential
8. Study of B-H Curve
9. Ionization potential of Mercury.
10. Study of Malus' Law in polarization.

Note: Students are required to perform at least Eight experiments. Other experiments may also be included at Institutional/Departmental level if equipment's are available.

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Computer Programming Lab (CS-101P)

Course Code	**CS-101P**	**Credits – 01**	**L - 0, T - 0, P - 2**
Name of Course	**Computer Programming Lab**		
Practical Internal Assessment	**MM:30**	**Min. Marks :12**	**Total: 50 Marks**
Practical External Assessment	**MM:20**	**Min. Marks :8**	

Course Objectives: This course is designed to explore computing and to show students the art of computer programming. Students will learn some of the design principles for writing good programs.

Laboratory/ Practical's:
To implement Programs for various kinds of programming constructs in C Language.

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Electrical Engineering Lab (EE-101P)

Course Code	EE-101P	Credits – 01	L - 0, T - 0, P - 2
Name of Course	Electrical Engineering Lab		
Practical Internal Assessment	MM:30	Min. Marks :12	Total: 50 Marks
Practical External Assessment	MM:20	Min. Marks :8	

Course Objectives: To introduce concepts of DC and AC circuits and electromagnetism. To make the students understand the concepts and working of single-phase transformers, DC motor and generators.

Laboratory Works:

1. To verify KVL and KCL
2. Verification of Superposition and Thevenin Theorem
3. Verification of Maximum Power and Norton Theorem
4. Transient analysis of RL an RC series circuits
5. To study LCR series circuit.
6. To study LCR parallel circuit.
7. Power Consumption of a Fluorescent Lamp
8. Measurement of efficiency of a single-phase transformer by load test.
9. Study of a single-phase energy meter.

Note: Students are required to perform at least Eight experiments. Other experiments may also be included at Institutional/Departmental level if equipment's are available.

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B.Tech. COMPUTER SCIENCE & ENGINEERING

SEMESTER-II

APPLIED MATHEMATICS-II (MA-201L)

Course Code	**MA-201L**	**Credits – 04**	**L - 3, T - 1, P - 0**
Name of Course	**APPLIED MATHEMATICS-II**		
Semester End Examination	**MM:60**	**Min. Marks :24**	**Time Allowed :3 Hrs.**
Internal Assessment	**MM:40**	**Min. Marks :16**	
Internal Assessment Structure – 15 (Quizzes, Seminars, Presentation, Class Performance) + 5 (Attendance) + 20 (Sessional/MSTs)			

INSTRUCTIONS:

3. The question paper will consist of five sections A, B, C, D and E. Section E will be Compulsory, it will consist of a single question with 10-20 subparts of short answer type. which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C and D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

4. Candidates are required to attempt five questions in all selecting one question from each of the section A, B, C and D of the question paper and all the subparts of the questions in section E. Use of non-programmable calculators are allowed

Course Objectives: To introduce students the theory and concepts of differential equations, linear algebra, Laplace transformations and Fourier series which will equip them with adequate knowledge of mathematics to formulate and solve problems analytically.

UNIT-I

Linear Algebra: Row reduced echelon form, Solution of system of linear equations, Matrix inversion, Linear spaces, Subspaces, Basis and dimension, Linear transformation and its matrix representation, Eigenvalues, Eigenvectors and Diagonalisation, Inner product spaces and Gram-Schmidt orthogonalization process.

UNIT-II

Ordinary Differential Equations: Review of first order differential equations, Exact differential equations, Second and higher order differential equations, Solution techniques using one known solution, Cauchy - Euler equation, Method of undetermined coefficients, Variation of parameters method, Engineering applications of differential equations.

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UNIT-III

Laplace Transform: Definition and existence of Laplace transforms and its inverse, Properties of the Laplace transforms, Unit step function, Impulse function, Applications to solve initial and boundary value problems.

UNIT-IV

Fourier Series: Introduction, Fourier series on arbitrary intervals, Half range expansions, Complex Fourier series, Harmonic analysis.

Course learning outcome (CLO) :

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

1. Solve the differential equations of first and second order and basic application problems described by these equations.
2. Find the Laplace transformations and inverse Laplace transformations for various functions. Using the concept of Laplace transform students will be able to solve the initial value and boundary value problems.
3. Solve systems of linear equations by using elementary row operations.
4. Identify the vector spaces/subspaces and to compute their bases / orthonormal bases. Further, students will be able to express linear transformation in terms of matrix and find the Eigen values and Eigen vectors.

Textbooks:

1. Simmons, G.F., Differential Equations (With Applications and Historical Notes), Tata McGraw Hill (2009).
2. Krishnamurthy, V.K., Mainra, V.P. and Arora, J.L., An introduction to Linear Algebra, Affiliated East West Press (1976).
3. Seymour Lipschutz, Marc Lipson, Schaum's Outline of Linear Algebra, 3rd ed.

Reference Books:

1. Kreyszig Erwin, Advanced Engineering Mathematics, John Wiley (2006), 8th ed.
2. Jain, R.K. and Iyenger, S.R.K., Advanced Engineering Mathematics, Narosa

Publishing House (2011), 11th ed

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APPLIED CHEMISTRY(CHM-201L)

Course Code	**CHM-201L**	**Credits – 03**	**L - 3, T - 0, P - 0**
Name of Course	**APPLIED CHEMISTRY**		
Semester End Examination	**MM:60**	**Min. Marks :24**	**Time Allowed :3 Hrs.**
Internal Assessment	**MM:40**	**Min. Marks :16**	
Internal Assessment Structure – 15 (Quizzes, Seminars, Presentation, Class Performance) + 5 (Attendance) + 20 (Sessional/MSTs)			

INSTRUCTIONS:

1. The question paper will consist of five sections A, B, C, D and E. Section E will be Compulsory, it will consist of a single question with 10-20 subparts of short answer type. which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C and D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

2. Candidates are required to attempt five questions in all selecting one question from each of the section A, B, C and D of the question paper and all the subparts of the questions in section E. Use of non-programmable calculators are allowed

Course Objectives: The course aims at elucidating principles of applied chemistry in industrial systems, water treatment, engineering materials and analytical techniques.

UNIT-I

Electrochemistry: Specific, equivalent and molar conductivity of electrolytic solutions, migration of ions, transference number and its determination by Hittorf's method, conductometric titrations, types of electrodes, concentration cells, liquid junction potential. **Fuels:** Classification of fuels, calorific value, cetane and octane number, fuel quality, comparison of solid liquid and gaseous fuels, properties of fuel, alternative fuels: biofuels, power alcohol, synthetic petrol.

UNIT-II

Water Treatment and Environment: Hardness and alkalinity of water, units and determination, external and internal methods of softening of water, domestic water treatment, Waste water and its treatment, BOD and COD, Greenhouse effect and global warming, Carbon credit.

UNIT-III – Engineering Materials

Nano Materials: Introduction, Preparation, Properties of nanomaterials, Graphene, Graphite, Fullerenes, Carbonnano-tubes, nano-wires, nano-cones, Application of nano-materials, **Polymers:** Introduction to polymers, types of polymerization, molecular weight determination, tacticity of polymers, catalysis in polymerization, conducting, biodegradable and inorganic polymers.

UNIT-IV- Spectroscopy Techniques:

Introduction to spectroscopy, atomic and molecular spectroscopy, Beer-Lambert`s Law, UV-Visible, IR and NMR spectroscopic techniques - Principle, instrumentation and applications.

Course Learning Outcomes (CLOs) :

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The students will be able to reflect on:

1. Concepts of electrodes in electrochemical cells, migration of ions, liquid junction potential and conductometric titrations.
2. Atomic and molecular spectroscopy fundamentals – Beer's Law and its application, Basic principle, instrumentation, and application of UV – Vis, IR and NMR technique.
3. Water treatment methods specifically in domestic and industrial applications and environment.
4. Laboratory techniques like pH metry, potentiometry, colourimetry, conductometry and volumetry.

Textbooks:

1. Ramesh, S. and Vairam S. Engineering Chemistry, Wiley India (2012) 1st Ed.
2. Puri, B.R, Sharma, L.R, and Pathania, M.S. Principles of physical Chemistry, Vishal Publishing Co. (2008)
3. Agarwal's. Engineering Chemistry : Fundamentals and applications, Cambridge University press(2015).

Reference Books:

1. Brown, H, Chemistry for Engineering students, Thompson,1st ed.
2. Sivasankar, B., Engineering Chemistry, Tata McGraw-HillPub. Co. Ltd, New Delhi(2008)
3. Shulz, M.J. Engineering Chemistry, Cengage Learning (2007) 1st ed.

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BASIC ELECTRONICS ENGINEERING (EC-201L)

Course Code	EC-201L	Credits – 03	L - 3, T - 0, P - 0
Name of Course	BASIC ELECTRONICS ENGINEERING		
Semester End Examination	MM:60	Min. Marks :24	Time Allowed :3 Hrs.
Internal Assessment	MM:40	Min. Marks :16	
Internal Assessment Structure – 15 (Quizzes, Seminars, Presentation, Class Performance) + 5 (Attendance) + 20 (Sessional/MSTs)			

INSTRUCTIONS:

1. The question paper will consist of five sections A, B, C, D and E. Section E will be Compulsory, it will consist of a single question with 10-20 subparts of short answer type. which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C and D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

2. Candidates are required to attempt five questions in all selecting one question from each of the section A, B, C and D of the question paper and all the subparts of the questions in section E. Use of non-programmable calculators are allowed

Course Objectives: To enhance comprehension capabilities of students through understanding of electronic devices, various logic gates, SOP, POS, and their minimization techniques, various logic families and information on different IC's and working of combinational circuits and their applications.

UNIT-1

Semiconductor Devices: p-n junction diode: Ideal diode, V-I characteristics of diode, Diode small signal model, Diode switching characteristics, Zener diode.

UNIT-2

Electronics Devices and Circuits: PN Diode as a rectifier, Clipper and clamper, Operation of Bipolar Junction Transistor and Transistor Biasing, CB, CE, CC (Relationship between α, β, γ) circuit configuration Input-output characteristics, Transistor as a switch, as an Amplifier and its frequency Response, Introduction to Field Effect Transistor and its characteristics, N and P channel MOS transistors, CMOS inverter, NAND and NOR gates, General CMOS Logic, TTL and CMOS logic families.

UNIT-3

Operational Amplifier Circuits: The ideal operational amplifier, The inverting, noninverting amplifiers, Op-Amp Characteristics, Applications of Op-amp.

Combinational and Sequential Logic: Code converters, multiplexors, decoders, Addition circuits and priority encoder, Master-slave and edge-triggered flip-flops, Synchronous and Asynchronous counters, Registers, IEEE Representation of Digital ICs.

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UNIT-4

Digital Systems and Binary Numbers: Introduction to Digital signals and systems, Number systems, Positive and negative representation of numbers, Binary arithmetic, Definitions and basic theorems of Boolean Algebra, Algebraic simplification, Sum of products and product of sums formulations (SOP and POS), Gate primitives, AND, OR, NOT and Universal Gate, Minimization of logic functions, Karnaugh Maps.

Course Learning Outcomes (CLOs) / Course Objectives (COs):

The student will be able to:

1. Demonstrate the use of semiconductor diodes in various applications.
2. Discuss and explain the working of transistors and operational Amplifiers, their configurations and applications.
3. Recognize and apply the number systems and Boolean algebra.
4. Reduce Boolean expressions and implement them with Logic Gates.
5. Analyze, design and implement combinational and sequential circuits.

Textbooks:

1. Boylestad, R. L. and Nashelsky, L., Electronic Devices & Circuit Theory, Pearson (2009).
2. M. M. Mano and M. D. Ciletti, Digital Design, Pearson, Prentice Hall, 2013.

Reference Books:

1. Milliman, J. and Halkias, C. C., Electronic Devices and Circuits, Tata McGraw Hill, 2007.
2. Donald D Givone, Digital Principles and Design, McGraw-Hill, 2003.
3. John F Wakerly, Digital Design: Principles and Practices, Pearson, (2000).
4. N Storey, Electronics: A Systems Approach, Pearson, Prentice Hall, (2009).

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Holistic Health & Yoga (HS-116L)

Course Code	HS-116L	Credits – 03	L - 2, T - 0, P - 2
Name of Course	Holistic Health & Yoga		
Semester End Examination	MM:60	Min. Marks :24	Time Allowed :3 Hrs.
Internal Assessment	MM:40	Min. Marks :16	
Internal Assessment Structure – 15 (Quizzes, Seminars, Presentation, Class Performance) + 5 (Attendance) + 20 (Sessional/MSTs)			

INSTRUCTIONS:

1. The question paper will consist of five sections A, B, C, D and E. Section E will be Compulsory, it will consist of a single question with 10-20 subparts of short answer type. which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C and D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

2. Candidates are required to attempt five questions in all selecting one question from each of the section A, B, C and D of the question paper and all the subparts of the questions in section E. Use of non-programmable calculators are allowed

Course Objectives:

1. To promote health in it's all aspects physical, mental, emotional, spiritual, social through yoga.
2. To inculcate moral values in students.
3. To bring awareness about health in society
4. To educate students about different practices of yoga and their techniques in systematic manner.

Course Outcomes:

The Successful completion of this course shall enable the student to :

CO1: Understand the Ancient Indian Yogic concept and meaning of Yoga.
CO2: Learn various yogic techniques.
CO3: Attain physical, mental, and spiritual fitness.
CO4: Enhance concentration, mental peace, and realization of inner self.
CO5: Inculcate human values through yoga.

Course Introduction:

Theory: Introduction of Yoga, Different Definitions of Yoga. General Guidelines for Yogic Practices.

Traditional Schools of Yoga: (Bhakti yoga, karma yoga, Gyana yoga, Hatha yoga, Mantra yoga, Laya yoga, Raja yoga)

Ashtanga Yoga of Sage Patanjali.

Concept of Shatkriyas: Dhauti, Basti, Neti, Nauli, Trataka and Kapalbhati.

Concept of Surya namaskar: Introduction, Technique, benefit, precaution. (As per Syllabus)

Concept of Asanas: Introduction, Types, Technique, benefit, precaution. (As per Syllabus)

Concept of Pranayama: Introduction, Types, Technique, benefit, precaution.(As per Syllabus)

Meditation: Concept, technique, benefit, and precaution.

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Practical:
Practical: Shatkriyas (Cleansing Process): Jala neti, Sutra neti. Kunjala, Vastra Dhauti, Danda Dhauti, kapalbhati, Surya namaskar.
Asanas:
1. Standing Poses: Tadasana, Kati chakrasana, tiryak tadasana, vrikshasana, veer bhadrasana, garudasana, trikonsana,
2. **Sitting Poses:** Padmasana, Swastikasana, Vajrasana, Bhadrasana, Gomukhasana, Mandukasana, Singhasana.

Lying Down Poses:
Spine Position: uttanpadasana, Pawan muktasana, Naukasana, markatasana, halasana, sarvangasana, matsyasana, setubandhasana, chakarasana and shavasana.
Prone Position: Bhujangasana, Shalabhasana, Dhanurasana, Vipreet naukasana
Dhyana: Sthoola Dhyana, Jyoti Dhyana, Sukshama Dhyana, (According to Gheranda Samhita).
Mantra Chanting- Omkar (Pranav Jaap), Gayatri Mantra, Maha Mrityunjaya Mantra, Shanti Mantra.

Readings:

- BKS Iyengar (2012), Light on Yoga
- I.V Basvaraddi & S.P.Pathak (2016), Yogic Suksham Vyayam Evem Sthula Vyayam
- Swami Satyananda Saraswati (2012), Asana Pranayama Mudra Bandha

able to make out how these courses can be made appropriate and holistic.

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OBJECT ORIENTED PROGRAMMING(CS-201L)

Course Code	CS-201L	Credits – 03	L - 3, T - 0, P - 0
Name of Course	OBJECT ORIENTED PROGRAMMING		
Semester End Examination	MM:60	Min. Marks :24	Time Allowed :3 Hrs.
Internal Assessment	MM:40	Min. Marks :16	
Internal Assessment Structure – 15 (Quizzes, Seminars, Presentation, Class Performance) + 5 (Attendance) + 20 (Sessional/MSTs)			

INSTRUCTIONS:

1. The question paper will consist of five sections A, B, C, D and E. Section E will be Compulsory, it will consist of a single question with 10-20 subparts of short answer type. which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C and D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

2. Candidates are required to attempt five questions in all selecting one question from each of the section A, B, C and D of the question paper and all the subparts of the questions in section E. Use of non-programmable calculators are allowed

Course Objectives: To become familiar with object-oriented programming concepts and be able to apply these concepts in solving diverse range of applications.

UNIT-I

Objects and Classes: Structure in C and C++, Class specification, Objects, Data hiding, Encapsulation and abstraction, namespaces, Array of objects, Passing objects as arguments, Returning object from a function, inline functions, Static data member and member function, 'const' member function.

Constructor and Destructor: Constructors, Parameterized Constructors, Constructor Overloading, Constructors in array of objects, Constructors with default arguments, Dynamic Initialization, Pointer to objects, this pointer, Dynamic memory allocation, Array of pointer to objects, Copy Constructor, Static objects, Friend function, and Friend classes.

UNIT-II

Operator Overloading and Type Conversion: Syntax of operator overloading, Overloading Unary operator and Binary operator, Overloading arithmetic operator, relational operator, Overloading Unary operator and Binary operator using friend function, Data conversion, Overloading some special operators like (), [].

UNIT-III

Inheritance: Derived Class declaration, Public, Private and Protected Inheritance, friend function and Inheritance, Overriding member function, Forms of inheritance, virtual base class, Abstract class, Constructor and Inheritance, Destructor and Inheritance, Advantage and disadvantage of Inheritance.

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Polymorphism: Classification of Polymorphism, Compile time and Run time Polymorphism, Pointers to derived class object, Virtual functions, Pure virtual functions.
File handling: Formatted I/O, Hierarchy of file stream classes, Opening and closing a file, Working with multiple files, file modes, file pointers, Text vs. Binary Files.

UNIT-IV
Templates: Need of template, Function templates, Function template with non-type parameter, Overloading function templates, Class templates, Class template with non-type parameter.
Exception Handling: Exception handling mechanism, Multiple Catch Blocks, Catch All exceptions, Throw an exception, Exception Specification.
Standard Template Library: Fundamental idea about string, iterators, hashes and other types, The String and Vector classes vs. C-style pointers.

Course Learning Outcomes (CLOs) / Course Objectives (COs):
On completion of this course, the students will be able to:
1. Understand the basic concept of Classes, objects and Object Orientation, with basic layout of an object-oriented program.
2. Comprehend the concept of constructors and destructors.
3. Demonstrate the prime concepts viz. overloading, polymorphism, abstraction and Inheritance of an object-oriented paradigm.
4. Grasp the File handling concepts and be able to use files.
5. Use template and Exception handling in an object-oriented programming.

Textbooks:
1. Schildt H., C++: The Complete Reference, Tata McGraw Hill (2003) 4th ed.
2. Lippman B. S., Lajoie J., and Moo E. B., C++ Primer, Addison-Wesley Professional (2013) 5th ed.
Reference books:
1. Lafore R., Object-Oriented Programming in C++, Pearson Education (2002) 4th ed.
2. E. Balagurusamy, Object Oriented Programming with C++ (2017) 7th ed.
3. Stroustrup B., The C++ programming language, Pearson Education India (2013) 4th ed.

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Universal Human Values for Holistic, Value -based Education (HS-115L)

Course Code	**HS-115L**	**Credits – 03**	**L - 2, T - 1, P - 0**
Name of Course	**Universal Human Values for Holistic, Value -based Education**		
Semester End Examination	**MM:60**	**Min. Marks :24**	**Time Allowed :3 Hrs.**
Internal Assessment	**MM:40**	**Min. Marks :16**	
Internal Assessment Structure – 15 (Quizzes, Seminars, Presentation, Class Performance) + 5 (Attendance) + 20 (Sessional/MSTs)			

INSTRUCTIONS:

1. The question paper will consist of five sections A, B, C, D and E. Section E will be Compulsory, it will consist of a single question with 10-20 subparts of short answer type. which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C and D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

2. Candidates are required to attempt five questions in all selecting one question from each of the section A, B, C and D of the question paper and all the subparts of the questions in section E. Use of non-programmable calculators are allowed

COURSES ON HUMAN VALUES

During the Induction Program, students would get an initial exposure to human values through Universal Human Values for Holistic, Value -based Education. This exposure is to be augmented by this compulsory full semester foundation course.

Objectives of UHV-II Course

This introductory course input is intended:

1. To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
2. To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value- based living in a natural way.
3. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.

Thus, this course is intended to provide a much-needed orientational input in value education to the young enquiring minds.

Salient Features of the Course

The salient features of this course are:

1. It presents a universal approach to value education by developing the right understanding of reality (i.e. a worldview of the reality "as it is") through the process of self-exploration.
2. The whole course is presented in the form of a dialogue whereby a set of proposals about various aspects of the reality are presented and the students are encouraged to self-explore the proposals by verifying them on the basis of their natural acceptance within oneself and validate experientially in living.

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3. The prime focus throughout the course is toward affecting a qualitative transformation in the life of the student rather than just a transfer of information.
4. While introducing the holistic worldview and its implications, a critical appraisal of the prevailing notions is also made to enable the students discern the difference on their own right.

UNIT-1 – Introduction to Value Education (6 lectures and 3 tutorials for practice session)

Lecture 1: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education)
Lecture 2: Understanding Value Education
Tutorial 1: Practice Session PS1 Sharing about Oneself
Lecture 3: Self-exploration as the Process for Value Education
Lecture 4: Continuous Happiness and Prosperity – the Basic Human Aspirations
Tutorial 2: Practice Session PS2 Exploring Human Consciousness
Lecture 5: Happiness and Prosperity – Current Scenario Lecture 6: Method to Fulfil the Basic **Human Aspirations Tutorial 3:** Practice Session PS3 Exploring Natural Acceptance

UNIT-2 – Harmony in the Human Being (6 lectures and 3 tutorials for practice session)
Lecture 7: Understanding Human being as the Co-existence of the Self and the Body
Lecture 8: Distinguishing between the Needs of the Self and the Body
Tutorial 4: Practice Session PS4 Exploring the difference of Needs of Self and Body
Lecture 9: The Body as an Instrument of the Self
Lecture 10: Understanding Harmony in the Self
Tutorial 5: Practice Session PS5 Exploring Sources of Imagination in the Self
Lecture 11: Harmony of the Self with the Body
Lecture 12: Programme to ensure self-regulation and Health
Tutorial 6: Practice Session PS6 Exploring Harmony of Self with the Body

UNIT-3 – Harmony in the Family and Society (6 lectures and 3 tutorials for practice session)
Lecture 13: Harmony in the Family – the Basic Unit of Human Interaction
Lecture 14: 'Trust' – the Foundational Value in Relationship Tutorial 7: Practice Session PS7 Exploring the Feeling of Trust Lecture 15: 'Respect' – as the Right Evaluation
Tutorial 8: Practice Session PS8 Exploring the Feeling of Respect Lecture 16: Other Feelings, Justice in Human-to-Human Relationship Lecture 17: Understanding Harmony in the Society
Lecture 18: Vision for the Universal Human Order
Tutorial 9: Practice Session PS9 Exploring Systems to fulfil Human Goal

UNIT-4 – Harmony in the Nature/Existence (4 lectures and 2 tutorials for practice session)
Lecture 19: Understanding Harmony in the Nature
Lecture 20: Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature
Tutorial 10: Practice Session PS10 Exploring the Four Orders of Nature
Lecture 21: Realizing Existence as Co-existence at All Levels
Lecture 22: The Holistic Perception of Harmony in Existence
Tutorial 11: Practice Session PS11 Exploring Co-existence in Existence

Reference Books :
1. JeevanVidya: EkParichaya, A Nagaraj, JeevanVidyaPrakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).

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4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj – Pandit Sunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

OUTCOME OF THE COURSE:

By the end of the course, students are expected to become more aware of themselves, and their surroundings (family, society, nature); they would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.

They would have better critical ability. They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society). It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

Therefore, the course and further follow up is expected to positively impact common graduate attributes like:

1. Holistic vision of life
2. Socially responsible behaviour
3. Environmentally responsible work
4. Ethical human conduct
5. Having Competence and Capabilities for Maintaining Health and Hygiene
6. Appreciation and aspiration for excellence (merit) and gratitude for all

This is only an introductory foundational input. It would be desirable to follow it up by

a) Faculty-student or mentor-mentee programs throughout their time with the institution

b) Higher level courses on human values in every aspect of living.

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Applied Chemistry Lab (CHM-201P)

Course Code	CHM-201P	Credits – 01	L - 0, T - 0, P - 2
Name of Course	Applied Chemistry Lab		
Practical Internal Assessment	MM:30	Min. Marks :12	Total: 50 Marks
Practical External Assessment	MM:20	Min. Marks :8	

Course Objectives: The course aims at elucidating principles of applied chemistry in industrial systems, water treatment, engineering materials and analytical techniques.

Laboratory Work:

- Electrochemical measurements: Experiments involving use of pH meter, conductivity meter.
- Water Chemistry: Determination of hardness, alkalinity, DO, free chlorine, Chlorides, chromium, iron and copper in aqueous medium
- Properties of Liquids: Determination of Viscosity, Surface Tension
- Spectrophotometry: UV-Vis spectrophotometer related experiments
- Fuel's: Proximate Analysis of Coal
- Polymers: Preparation of Phenol/Urea-formaldehyde resins/ Biodegradable and conducting polymer
- Nanomaterials: Synthesis of nanoparticles of Au/Ag/NiO/ZnO/Iron Oxide.

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Object Oriented Programming Lab (CS-201P)

Course Code	**CHM-201P**	**Credits – 01**	**L - 0, T - 0, P - 2**
Name of Course	**Object Oriented Programming Lab**		
Practical Internal Assessment	**MM:30**	**Min. Marks :12**	**Total: 50 Marks**
Practical External Assessment	**MM:20**	**Min. Marks :8**	

Course Objectives: To become familiar with object-oriented programming concepts and be able to apply these concepts in solving diverse range of applications.

Laboratory work:
To implement Programs for various kinds of programming constructs in C++ Language.

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Basic of Electronic Engineering Lab (EC-201P)

Course Code	EC-201P	Credits – 01	L - 0, T - 0, P - 2
Name of Course	Basic of Electronic Engineering Lab		
Practical Internal Assessment	MM:30	Min. Marks :12	Total: 50 Marks
Practical External Assessment	MM:20	Min. Marks :8	

Course Objectives: To enhance comprehension capabilities of students through understanding of electronic devices, various logic gates, SOP, POS, and their minimization techniques, various logic families and information on different IC's and working of combinational circuits and their applications.

Laboratory Work:
Familiarization with CRO, DSO and Electronic Components, Diodes characteristics - Input-Output and Switching, BJT and MOSFET Characteristics, Zener diode as voltage regulator, Rectifiers, Clippers and Clampers, adder circuit implementation, Multiplexer & its application, Latches/Flip-flops, up/down counters.

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Syllabus

for

B.Tech CSE 2nd Year

As per National Education Policy (NEP-2020)

(w.e.f. the Academic Year 2023-2024)

Department of

Computer Science & Engineering

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Semester-III

Sr. No.	Category	Subject Code	Subject	L	T	P/D	Credits	Evaluation Scheme (Marks)				
								Internal Assessment (IA)			ESE	Subject Total
								CT	IA	Total		
Theory:												
1	PC	MA-311	Discrete Mathematical Structure	3	1	0	4	20	20	40	60	100
2	PC	CS-311	Operating System	3	1	0	4	20	20	40	60	100
3	PC	CS-312	Data Structure and Algorithms	3	1	0	4	20	20	40	60	100
4	PC	CS-313	Java Programming	3	0	0	3	20	20	40	60	100
5	PC	EC-311	Digital Electronics	3	0	0	3	20	20	40	60	100
6	FC	HS-311	Economic Engineering	3	0	0	3	20	20	40	60	100
7	MC	IKS-311	Indian Knowledge System	2	0	0	2	20	20	40	60	100
	Labs:							**FW**	**LP**	**Total**	**ESVE**	**Sub. Total**
1	PC	CS-311P	Operating System Lab	0	0	2	1	10	20	30	20	50
2	PC	CS-312P	Data Structure and Algorithms Lab	0	0	2	1	10	20	30	20	50
3	PC	CS-313P	Java Programming Lab	0	0	2	1	10	20	30	20	50
4	PC	EC-311P	Digital Electronics Lab	0	0	2	1	10	20	30	20	50
			Total	**20**	**03**	**08**	**27**					**900**

Legends:

L - Lecture
T - Tutorial
P - Practical
CT - Class Test
IA - Internal Assessment
ESE - End Semester Examination
FW - Documentation/ File work and presentation
LP - Lab performance
ESVE - End Semester Exam. / Viva-voce Exam.
PC - Programme Core

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Semester-IV

S. No.	Category	Subject Code	Subject	L	T	P/D	Credits	Evaluation Scheme (Marks)				
								Internal Assessment (IA)			ESE	Subject Total
								CT	IA	Total		
Theory:												
1	FC	MA-411	Optimization and Calculus of Variations	3	1	0	4	20	20	40	60	100
2	PC	CS-411/CS-314	Python Programming	3	0	0	3	20	20	40	60	100
3	PC	CS-412	Design and Analysis of Algorithms	3	1	0	4	20	20	40	60	100
4	PC	CS-413	Artificial Intelligence and Expert Systems	3	1	0	4	20	20	40	60	100
5	PC	CS-414/CS-315	Computer Architecture& Organisation	3	1	0	4	20	20	40	60	100
6	PC	EC-411	Microprocessors and Interfacing	3	1	0	4	20	20	40	60	100
7	FC	HS-411	Entrepreneurship and Startups	2	0	0	2	20	20	40	60	100
	Labs:							**FW**	**LP**	**Total**	**ESVE**	**Sub. Total**
1	PC	CS-411P/CS-314P	Python Lab	0	0	2	1	10	20	30	20	50
2	PC	CS-412P	DAA Lab	0	0	2	1	10	20	30	20	50
3	PC	CS-413P	AI Lab	0	0	2	1	10	20	30	20	50
			Total	**20**	**05**	**06**	**28**					**850**

Legends:

L - Lecture

T - Tutorial

P - Practical

CT - Class Test

IA - Internal Assessment

ESE - End Semester Examination

FW - Documentation/ File work and presentation

LP - Lab performance

ESVE - End Semester Exam. / Viva-voce Exam.

PC - Programme Core

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MA-311 Discrete Mathematical Structure							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
3	1	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:

Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questions in all, i.e one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus.

Course Objectives(COs): Detailed study of various discrete and algebraic structures, basic logic, basics of counting and proof techniques.

Unit-I
Sets, Relations and Functions: Operations on Set, Inclusion -exclusion principle, Representation of Discrete Structures, Fuzzy Set, Multi-set, bijective function, Inverse and Composition of functions, Floor and Ceiling functions, Growth of functions: Big-O notation, functions, Recursive function, Functions applications.
Unit-II
Relations: Reflexivity, Symmetry, transitivity, Equivalence, and partial ordered relations, Asymmetric, Irrelexivity relation, Inverse and Complementary relations, partitions and Covering of a set, N-ary Relations and database, Representation relation using matrices and digraph, Closure of relations, Warshall's algorithms, Lexicographic Ordering, Hasse diagram, Lattices, Boolean algebra, Application of transitive Closure in medicine and engineering. Application: Embedding a partial order.
Unit-III
Graph Theory: Representation, Type of Graphs, Paths, and Circuits: Euler Graphs, Hamiltonians Paths &Circuits: Cut Sets, Connectivity and Separability, Planar Graphs, Isomorphisms, Graph Coloring, Covering and Partitioning, Max flow: Ford -Fulkerson algorithm, Application of Graph Theory in real life applications. **Basic Logic:** Propositional Logic, Logical connectives, Truth Tables, Normal Forms (Conjunctive and Disjunctive), Validity of well-formed formula, Propositional inference rules (Concepts of modus ponens and modus tollens), Predicate Logic, Universal and existential quantification.
Unit-IV
Proof Techniques and Counting: Notations of implication, equivalence, converse, inverse, contra positive, negation and contradiction, the structure of mathematical proofs, Direct Proofs, disproving by counter example, Proof by contradiction, Induction over natural numbers, structural induction, weak and strong induction, The pigeonhole principle, solving homogenous and heterogenous recurrence relations. **Algebraic Structure:** Group, Semi-group, Monoids, Homomorphism, Congruencies, Ring, Field, Homomorphism, Congruencies, Applications of algebra to control structure of a program, the application of Residue Arithmetic to Computers.

Course Learning Outcomes (CLOs):

After the completion of the course, the student will be able to:

- Perform operations on various discrete structures such as set, function and relation.

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- Apply basic concepts of asymptotic notation in analysis of algorithm.
- Illustrate the basic properties and algorithms of graphs and apply them in modeling and solving real world problems.
- Comprehend formal Logical arguments and translate statements from a natural language into its symbolic structures in logic.
- Identify and prove various properties of rings, field, and groups.

Textbooks:

- Rosen H.K., Discrete mathematics and its Applications, McGraw Hill (2011)7th ed.
- Tremblay P.J. and Manohar, R., Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw Hill (2008).

Reference Books:

- Gallian A.J., Contemporary Abstract Algebra, Cengage Learning (2017) 9th ed.
- Lipschutz S., Lipson M., Discrete Mathematics, McGraw Hill (2007) 3rd ed.

CS-311 Operating System							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
3	1	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:

Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questions in all, i.e one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus.

Course Objectives(COs): To understand the role, responsibilities and the algorithms involved for achieving various functionalities of an Operating System.

Unit-I
Introduction and System Structures: Computer-System Organization, Computer-System Architecture, Operating-System Structure, Operating-System Functions, Operating-System Services, User and Operating-System Interface, System Calls, Types of System Calls, Operating-System Design and Implementation. **Process Management:** Process Concept, Process Scheduling, Operations on Processes, Inter-process Communication, **Multi-threaded programming:** Multi-core Programming, Multithreading Models.
Unit-II
Process Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms, Multiple-Processor Scheduling. **Concurrency:** The Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Mutex Locks, Semaphores, Classic Problems of Synchronization, Monitors. **Deadlock:** System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.
Unit-III
Memory Management: Basic Hardware, Address Binding, Logical and Physical Address, Dynamic linking and loading, Shared Libraries, Swapping, Contiguous Memory Allocation, Segmentation, Paging, Structure of the Page Table, Virtual Memory Management: Demand Paging, Page Replacement, Allocation of Frames, Thrashing. **File Systems:** File Concept, Access Methods, Directory and Disk Structure, File-System Mounting, File Sharing, Protection, File-System Structure, File-System Implementation, Directory Implementation, Allocation Methods, Free-Space Management.
Unit-IV
Disk Management: Mass Storage Structure, Disk Structure, Disk Attachment, Disk Scheduling, Disk Management, Swap-Space Management, RAID Structure. **Networks, Security and Design Principles:** Overview of network operating system, distributed operating system, security attacks, security mechanisms and policies, OS Virtualization, Unix/Linux Case study.

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Course Learning Outcomes (CLOs) :

After the completion of the course, the student will be able to:

- Explain the basic of an operating system viz. system programs, system calls, user mode and kernel mode.
- Select particular CPU scheduling algorithms for specific situation and analyses the environment leading to deadlock and its rectification.
- Explicate memory management techniques viz. caching, paging, segmentation, virtual memory, and thrashing.
- Understand the concepts related to file systems, disk scheduling and security, protection.
- Comprehend the concepts related to concurrency.

Text Books:

1. Silberschatz A., Galvin B. P. and Gagne G., Operating System Concepts, John Wiley & Sons Inc (2013) 9 th ed.
2. Stallings W., Operating Systems Internals and Design Principles, Prentice Hall (2018) 9 th ed.

Reference Books:

1. Bovet P. D., Cesati M., Understanding the Linux Kernel, O'Reilly Media (2006), 3 rd ed.
2. Kifer M., Smolka A. S., Introduction to Operating System Design and Implementation: The OSP 2 Approach, Springer (2007).

CS-312 Data Structure and Algorithms							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
3	1	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:

Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questions in all, i.e one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus.

Course Objectives (COs): To become familiar with different types of data structures and them applications.

Unit-I
Data Structures: Definition, primitive and derived data types, abstract data types, need for data structures, types of data structures. **Algorithm:** Definition, characteristics, development of algorithm, Analysis of complexity: - time complexity, space complexity, order of growth, asymptotic notation with example, obtaining the complexity of the algorithm. **Arrays:** Definition, 1d and 2d arrays, operations on arrays, sparse matrices, structures and arrays of structures.
Unit-II
Linked list: Representation of linked list in memory, allocation & garbage collection, operations on linked list, doubly linked lists, circular linked list, linked list with header node, applications. **Stacks:** representation of stack in memory, operations on stack and applications. **Queues:** Representation of queues in memory, operations on queues, circular queues, double ended queues, priority queues, applications.
Unit-III
Trees: Introduction, representation of tree in memory. **Binary Trees:** Terminology, binary tree traversal, binary search tree, insertion, deletion & searching in binary search tree, heap trees, types of heap trees, insertion, deletion in heap tree with example, heap sort algorithm, introduction of AVL trees & B-trees. **Graphs:** Definition, representation of graph (adjacency matrix, adjacency list), traversing a graph (DFS & BFS), dijkstra's algorithm for shortest distance, minimum spanning tree.
Unit-IV
Searching and sorting: Need for searching and sorting, linear and binary search, insertion sort, selection sort, merge sort, quick sort, radix sort and bubble sort. Hash Tables: Introduction, hash function, collision resolution techniques in hashing, deletion from hash table.

Course Learning Outcomes (CLOs):

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

- Implement basic data structures in solving fundamental problems.
- Implement various searching and sorting techniques.
- Implement tree and graph data structures along with their related operations.
- Evaluate and apply appropriate data structure(s) for real-world problems.

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Text Books:

- Seymour Lipschutz: Theory and practice of Data structure , Tata Mc. Graw Hill 1998
- Tenebaum, A. Langsam Y and Augenstein, A. J: Data structures using C++, Prentice Hall Of India.

Reference Books:

- Data structures and Algorithms in C++ by Micheal T. Goodrich, Wiley India publication.
- Data structures, R.Venkatesan, S.Lovelyn Rose, Wiley India publication.
- Data Structures using C++ By Patil, Oxford University press.
- Data Structures, Algorithm and Object-Oriented programming, Gregory L.Heileman, TataMc-Graw Hills.
- S. Sahni, — Data structure Algorithms ad Applications in C++‖, WCB/McGraw Hill.
- J.P. Tremblay and P.G. Sorenson, —An Introduction to Data Structures with applications‖, Tata McGraw Hill.

CS-313 Java Programming							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
3	0	0	3	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:

Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questions in all, i.e one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus.

Course Objectives(COs): Professionals and students who want to get themselves certified in Core Java or JDBC can refer to this syllabus for learning and enhancing their knowledge of Java during their academic sessions.

Unit-I
An overview of Java: - Java features how java differs from C &C++, data types, constants &variables, operators &expressions, control structure in java, classes, objects &methods, arrays, strings &vectors introduction to Java Design patterns. Overview of UML use in program design.
Unit-II
Interfaces &Packages: - Defining, extending, implementing interfaces, accessing interface variables, Packages: - Introduction using system package, accessing a package, using a package, adding a class to a package &hiding class, Introduction to multithread programming.
Unit-III
Applet Programming: - Applet fundamentals, life cycle of applet, creating an executable applet, applet tags, running the applet &passing parameters to applet. Introduction to AWT with windows.
Unit-IV
Software development using Java beans: - Introduction to Java beans, introspection, Introduction to swings, Japplet, Jframe &Jcomponent, Buttons, Introduction to servlet :- Life cycle of a servlet, tomcat for a servlet development.

Course Learning Outcomes (CLOs):

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

- Use an integrated development environment to write, compile, run, and test simple object-oriented Java programs.
- Read and make elementary modifications to Java programs that solve real-world problems.
- Validate input in a Java program.
- Identify and fix defects and common security issues in code.
- Document a Java program using Javadoc.
- Use a version control system to track source code in a project.

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Textbooks:

- Ivor Horton Beginning Java 2 – JDK 5 Edition, Wiley-India
- Mark Grand Patterns in Java Vol. 1-3, Wiley-India
- Steve Holzner Java 2 (JDK 5 Edition) Black Book Wiley-India
- B. Eckel Thinking in JAVA, Pearson Education.
- Deitel & Deitel How to Program JAVA. Pearson Education.

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EC-311 Digital Electronics							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
3	0	0	3	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:

Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questions in all, i.e one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus.

Course Objectives: The educational objectives of this course are:

- To present a problem oriented introductory knowledge of Digital circuits and its applications.
- To focus on the study of electronic circuits.

Unit-I
Number System: Binary, Octal, Hexadecimal, and decimal numbers of systems and their inter conversion, BCD numbers (8421-2421), gray code, excess-3 code, cyclic code, code conversion, ASCII, EBCDIC codes. Binary addition and subtraction, Signed and unsigned binary numbers, 1's and 2's complement representation.
Unit-II
Boolean Algebra: Basic logic circuits: Logic Gates (AND, OR, NOT, NAND, NOR, EX-OR, Ex Nor and their truth tables), Universal Gates, laws of Boolean algebra, De- Morgan's theorem, Min term, Max term, POS, SOP, K-Map, Simplification of Boolean theorem, don't care condition.
Unit-III
Logic Families: Introduction to digital logic family such as RTL, DTL, TTL, ECL, CMOS, IIR, HTL etc., their comparative study, Basic circuit, performance characteristics, Wired logic, open collector output etc. **Combinational Logic:** The Half adder, the full adder, subtractor circuit. Multiplexer, demultiplexer, decoder, BCD to seven segment Decoder, encoders. **Flip-flop and Timing circuit:** Set-reset laches, D-flipflop, R-S flip flop, J-K Flip flop, Master slave flip flop, edge triggered flip flop, T flip flop.
Unit-IV
Registers &Counters: Synchronous/Asynchronous counter operation, Up/Down synchronous counter, application of counter, Serial In / Serial Out Shift register, Serial In/Parallel Out Shift register, Parallel In/Parallel Out shift register, parallel in/ Serial Out shift Register, Bi-Directional Register.

Course Learning Outcomes (CLOs):

On successful completion of the course

- The student can acquire the basic knowledge of measurement principles and their application in electrical engineering.
- The students will be able to effectively employ electrical and electronics instruments for measurements of various electrical quantities.

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Textbooks:

- Digital Fundamentals by Morris and Mano, PHI Publication.
- Fundamental of digital circuits by A. ANAND KUMAR, PHI Publication.
- Digital Fundamentals by FLOYD & JAIN, Pearson's Pub

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HS-311 Economic Engineering							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
3	0	0	3	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:

Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questions in all, i.e., one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus.

Course Objectives(COs): The educational objectives of this course are Choose the concept of scarcity to explain economic trade-offs, opportunity costs, and rational behaviour. Discover the determinants of foreign trade flows and exchange rates, and their effects on the domestic economy.

Unit-I
Introduction: Definition, Nature, Scope, Importance and significance of Economics. For Engineers, Distinction between Micro and Macroeconomics. Concept of Utility and Its Types. **Demand and Supply:** Demand, Kinds of Demand, Demand Function, Law of Demand. Elasticity of Demand: Concept, Types, Measurement and importance. Demand Forecasting and its techniques.
Unit-II
Production Function: Concept and types, Returns to Factor and Returns to Scale, Law of Variable Proportions. **Cost and Revenue:** Concept of Cost, Short run and Lung-run Cost Curves, Relationships among various costs, Break-even Analysis. Revenue Curves: Concept and Types.
Unit-III
Market Structure: Perfect Competition, Monopoly, Monopolistic Competition Oligopoly. **Banking:** Commercial Banks- Function, Central Bank (RBI)- Function and Role of Banks in Economic Development.
Unit-IV
National Income: Definition of National Income and its Aggregates, Methods of Calculating National Income. **Inflation:** Meaning, Types, Theories, Causes, Effects and Control. Business Cycle – Meaning-Phases of business cycle. Balance of Payments, Monetary and Fiscal Policies.

Course Learning Outcomes (CLOs):

After the completion of the course, the student will be able to:

- Identify the determinants of supply and demand; demonstrate the impact of shifts in both market supply and demand curves on equilibrium price and output.
- Determine the roles that prices and markets play in organizing and directing economic activity
- Calculate and graph the short-run and long-run costs of production, supply and demand elasticities.
- Describe governmental efforts to address market failure such as monopoly power.

public goods.

- Examine and interpret a nation's economic performance indicators such as economic growth, unemployment and inflation from a macroeconomic perspective.
- Articulate the mechanics and institutions of international trade and their impact on the macro economy.

Textbooks:

- Steven A. Greenlaw, David Shapiro, "Principles of Economics",2nd Edition, Rice University – OpenStax, 2020.ISBN-13: 978-1947172371.

Reference Books:

- N. Gregory Mankiw, **"Principles of Economics",**8th Edition, Cengage Learning, 2016.ISBN-13:978-0357038314.
- 3Niall Kishtainy, **"The Economics Book: Big Ideas Simply Explained",**1st Edition, DKPublishers, 2012.ISBN-13:978-0756698270.
- Yves Hilpisch, **"Python for Finance: Mastering Data-Driven Finance",** 2nd Edition, O'Reilly Media, 2018 ISBN-13:978-1492024330.

IKS-311 Indian Knowledge System							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
2	0	0	2	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:

Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questions in all, i.e one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus.

Unit-I: The Constitution – Introduction
• The history of the making of the Indian constitution • Preamble and the basic structure, and its interpretations • Fundamentals rights and duties and their interpretation • State policy Principles
Unit-II: Union Government
• Structure of the Indian Union • President- role and power • Prime minister and council of ministers • Lok Sabha and Rajya Sabha
Unit-III: State Government
• Governor- Role and Power • Chief Minister and Council of Ministers • State Secretariat
Unit-IV: Local Administration
• District Administration • Municipal Corporation • Zila Panchayat

Suggested Learning Resources:

Sr No.	Title of Book	Author	Publications
1	Ethics and Politics of the Indian Constitution	Rajeev Bhargava	Oxford university Press, New delhi, 2008
2	The Constitution of India	B.L. Fadia	Sahitya Bhawan, New edition, 2017
3	Introduction of the Constitution of India	DD Basu	Lexis Nexis; twenty Third 2018 edition

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CS-311P Operating System Lab							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
0	0	2	1	Maximum Marks: 30	Maximum Marks: 20	50	2 Hours
				Minimum Marks: 12	Minimum Marks: 08	20	

Following is the list of experiments out of which minimum 08 experiments must be performed in the lab. The additional experiments may be performed by the respective institution depending on the infrastructure available.

List of experiments:

1. Overview of single user systems, network operating system and multiuser system.
2. User administration in window sand Linux operating system.
3. Write a program for the simulation of following non-pre emptive CPU scheduling algorithms to find turn around time and waiting time.
   1. FCFS b)SJF c) Round Robin(pre-emptive) d)Priority
4. Write a program for the simulation of following file allocation strategies.
   1. Sequential b) Indexed c) Linked
5. Write a program for the simulation of following contiguous memory allocation techniques
   1. Worst-fit b)Best-fit c)First-fit
6. Write a program for the simulation of following file organization techniques
   1. Single level directory b)Two level directory c)Hierarchical
7. Write a program for the simulation of Bankers algorithm for the purpose of deadlock avoidance.
8. Write a program for the simulation of following disk scheduling algorithms
   1. FCFS b)SCAN c)C-SCAN
9. Write a program for the simulation of following page replacement algorithms
   1. FIFO b)LRU c)LFU
10. Write a program for the simulation of producer-consumer problem using semaphores.
11. Study the Linux operating system and implement various commands.
12. Write a program do the following:
    1. Find the attribute of file. b) To change the attribute of file. c) Create the directory. d) Delete the directory. e) Create the file. f) Delete the file g) Find the size of Hard Disk, RAM, and VRAM, cache.
13. Study of various viruses / worms and tools.

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CS-312P Data Structure and Algorithms Lab							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
0	0	2	1	Maximum Marks: 30	Maximum Marks: 20	50	2 Hours
				Minimum Marks: 12	Minimum Marks: 08	20	

Following is the list of experiments out of which minimum 08 experiments must be performed in the lab. The additional experiments may be performed by the respective institution depending on the infrastructure available.

List of experiments:

1. Write recursive program which computes then Fibonacci number.
2. Write recursive program which computes the factorial of a given number.
3. Write a program to implement linear search using arrays.
4. Write a program to implement binary search using arrays.
5. Write c program to implement bubble sort, to sort a given list of integers in ascending order.
6. Program to implement insertion sort to sort a given list of integers in ascending order.
7. Program to implement INSERTIONSORT to sort a list of numbers.
8. Write a C program that implement merge sort, to sort a given list of integers in ascending order.
9. Write C programs that implement stack using arrays.
10. Write C programs that implement stack using linked list Program.
11. Write c programs that implement Queue using array.
12. Write C programs that implement Queue using linked lists.
13. Write program to implement linked list operations (Creation, Insertion, Deletion, reversing).
14. Write a program to implement binary tree.
15. Write a program to implement heap sort using arrays.

CS-313P Java Programming Lab							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
0	0	2	1	Maximum Marks: 30	Maximum Marks: 20	50	2 Hours
				Minimum Marks: 12	Minimum Marks: 08	20	

Following is the list of experiments out of which minimum 08 experiments must be performed in the lab. The additional experiments may be performed by the respective institution depending on the infrastructure available.

List of experiments:

1. Install JDK, write a simple "Hello World" or similar java program, compilation, debugging, executing using java compiler and interpreter.
2. Write a program in Java to generate first n prime numbers.
3. Write a program in Java to find maximum of three numbers using conditional operator.
4. Write a program in Java to reverse the digits of a number using while loop.
5. Write a program in Java to convert number into words & print it.
6. Write a program in Java to develop overloaded constructor. Also develop the copy constructor to create a new object with the state of the existing object.
7. Write a program in Java to demonstrate the use of 'final' keyword in the field declaration. How it is accessed using the objects.
8. Write a program in Java to demonstrate single inheritance, multilevel inheritance and hierarchical inheritance.
9. Create a class to find out whether the given year is leap year or not. (Use inheritance for this program).
10. Write a program that illustrates interface inheritance. Interface P12 inherits from both P1 and P2. Each interface declares one constant and one method. The class Q implements P12 . Instantiate Q and invoke each of its methods. Each method displays one of the constants.
11. Write an application that illustrates method overriding in the same package and different packages. Also demonstrate accessibility rules in inside and outside packages.
12. Describe abstract class called Shape which has three subclasses say Triangle, Rectangle, Circle. Define one method area() in the abstract class and override this area() in these three subclasses to calculate for specific object i.e. area() of Triangle subclass should calculate area of triangle etc. Same for Rectangle and Circle.
13. Write a program in Java to demonstrate implementation of multiple inheritance using interfaces.
14. Write a program in Java to develop user defined exception for 'Divide by Zero' error.
15. Write a program in Java to demonstrate multiple try block and multiple catch exception.
16. Write a program in Java to demonstrate JComponents and JFrames.

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EC-311P Digital Electronics Lab							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
0	0	2	1	Maximum Marks: 30	Maximum Marks: 20	50	2 Hours
				Minimum Marks: 12	Minimum Marks: 08	20	

Following is the list of experiments out of which minimum 08 experiments must be performed in the lab. The additional experiments may be performed by the respective institution depending on the infrastructure available.

List of experiments:

1. Verify the truth table of AND, OR, NOT, X-OR and X-NOR gates
2. Verify the NAND and NOR gates as universal logic gates.
3. Verify the AND and OR gates as universal logic gates.
4. Design and verification of the truth tables of Half and Full adder circuits.
5. Design and verification of the truth tables of Half and Full subtractor circuits.
6. Verification of the truth table of the Multiplexer 74150.
7. Verification of the truth table of the De-Multiplexer 74154.
8. Design and test of an S-R flip-flop using NOR/NAND gates.
9. Verify the truth table of a S-R flip-flop
10. Verify the truth table of a J-K flip-flop
11. Verify the truth table of a D flip-flop
12. Design of 4-bit shift register.
13. Design of modulo-4 counter using J K flip flop
14. To study a BCD to 7 Segment LED display using 7447IC

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SEMESTER-IV

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MA-411 Optimization and Calculus of Variations							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
3	1	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:

Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questions in all, i.e one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus.

Unit-I:
Introduction: A survey of some simplified examples of common real-world situations leading to optimization problems, basic formulation and theory of optimization problems. **Linear programming:** Linear programming (optimization of linear functions subject to linear constraints): basic theory; simplex method, duality, practical techniques.
Unit-II:
Linear programming: Basic LPP-solution techniques (Simplex, Artificial Basis), complimentary slackness theorem, fundamental theorem of duality, degenerate solutions, cycling, applications - elements of dynamic programming including Hamiltonian, bellman's optimality principle. **Transportation and Assignment Problems:** Solution of a balanced transportation problem, degeneracy in transportation problems and alternate solutions, mathematical problems in formulation of assignment problems.
Unit-III:
Non-linear programming: Non-linear programming (optimization of non-linear functions subject to constraints) with lagrange multipliers, Karush-Kuhn-Tucker optimality conditions, convexity, duality. **Approximation methods for nonlinear programming:** Line search methods, gradient methods, conjugate gradient methods, Networking techniques – PERT and CPM.
Unit-IV:
Calculus of Variations: Basic definitions-functional, extremum, variations, function spaces; necessary conditions for an extremum, euler- lagrange equation, convexity and its role in minimization, minimization under constraints; existence and nonexistence of minimizers, applications - isoperimetric problems, geodesics on the surface.

Text Books:

- C. B. Gupta, —***Optimization Techniques in Operation Research,*** I. K. International Publishing House Pvt. Ltd.

- A.S. Gupta, ***Calculus of Variations and Applications***, PHI Prentice hall India.
- Mukesh Kumar Singh, ***Calculus Of Variations*** ,Krishna Prakashan Media(P)Ltd.
- J.K. Sharma, ***Operations Research–Problems and Solutions***, Macmillian Pub.

Reference books:

- I.M. Gelfand S.V. Fomin, ***Calculus of Variations*** Dover Publications Inc Mineola, New York.
- Purna Chand Biswal, ***Optimization in Engineering***, Scitech Publications India Pvt. Ltd.
- B.S. GREWAL, ***Higher Engineering Mathematics***, Krishna Publications
- G. Hadly, ***Linear Programming***, Narosa Publishing House
- Kanti Swarup, P.K. Gupta and Manmohan, ***Operations Research,*** Sultan Chand & amp; Sons.

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CS-411/ CS-314 Python Programming							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
3	0	0	3	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:

Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questions in all, i.e., one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus.

Course Objectives: This course will help you to understand the basics of Data Science which includes Programming, Mathematics, and Statistics before getting started with advanced machine learning techniques. Students will also gain knowledge in various data pre-processing techniques and data visualization techniques.

Unit-I:
Introduction to Python: Identifiers, Keywords, Statements and Expressions, Variables, Operators, Precedence and Associativity, Data Types, Indentation, Comments, Reading Input, Print Output, Type Conversions, type () Function and Is Operator, Dynamic and Strongly Typed Language. **Control Flow Statements:** if Decision Control Flow Statement, the if…else Decision Control Flow Statement, the if-elif-else, Decision Control Statement, Nested if Statement, the while Loop, The for Loop, The continue and break Statements
Unit–II:
Functions, Built-In Functions, Commonly Used Modules, Function Definition and Calling the Function, The return Statement and void Function, Scope and Lifetime of Variables, Default Parameters. **Strings,** Creating and Storing Strings, Basic String Operations, Accessing Characters in String by Index Number, String Slicing and Joining, String Methods, Formatting Strings,
Unit–III
Lists, Creating Lists, Basic List Operations, Indexing and Slicing in Lists, Built-In Functions Used on Lists, List Methods, The del Statement. **Dictionaries**, Creating Dictionary, Accessing and Modifying key: value Pairs in Dictionaries, Built-In Functions Used on Dictionaries, Dictionary Methods, The del Statement,
Unit-IV:
Tuples and Sets, Creating Tuples, Basic Tuple Operations, Indexing and Slicing in Tuples, Built-In Functions Used on Tuples, Relation between Tuples and Lists, Relation between Tuples and Dictionaries. **Files,** Types of Files, Creating and Reading Text Data, File Methods to Read and Write Data, Reading and Writing Binary Files. Reading and Writing CSV file.

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Course Learning Outcomes (CLO):

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

1. To know the concept of functions in Python, like "if" and different types of loops.
2. Be able to convert datatypes and work with lists.
3. To know the difference between running Python programs on Mac and Windows
4. Be able to work with CSV files

Textbooks:

1. Gowri Shankar S, Veena A, **"Introduction to Python Programming"**, 1st edition, CRC Press/Taylor & Francis, 2018. ISBN-13: 978-0815394372.

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CS-412 Design and Analysis of Algorithm							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
3	1	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:

Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questions in all, i.e one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus.

Unit-I:
Introduction and Complexity Analysis: Algorithms Introduction: Algorithm Design paradigms-motivation, concept of algorithmic efficiency, run time analysis of algorithms, Asymptotic Notations
Unit–II:
Divide and Conquer Approach: Structure of divide-and-conquer algorithms: sets and disjoint sets: Union and Find algorithms, quick sort, Finding the maximum and minimum, Quick Sort, Merge sort, Heap, and heap sort. **Greedy Algorithms:** Optimal storage on tapes, Knapsack problem, Job sequencing with deadlines, Minimum Spanning trees: Prim's algorithm and Kruskal's algorithm, Huffman codes.
Unit–III
Graph Algorithms: Representation of graphs, BFS, DFS, Topological sort, strongly connected components; single source shortest paths: Bellmen-Ford algorithm, Dijkstra's algorithm; All pairs shortest path: The Warshall's algorithm. **Dynamic Programming:** Overview, difference between dynamic programming and divide and conquer, Matrix chain multiplication, Traveling salesman Problem, longest Common sequence, 0/1 knapsack. **Backtracking:** 8-Queen Problem, Sum of subsets, graph coloring, Hamiltonian cycles.
Unit-IV:
Branch and Bound: LC searching Bounding, FIFO branch and bound, LC branch and bound application: 0/1 Knapsack problem, Traveling Salesman Problem. **Computational Complexity**: Complexity measures, Polynomial vs. non polynomial time complexity; NP-hard and NP-complete classes, examples, cook's theorem (without proof).

Course Learning Outcomes (CLOs):

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

1. Analyse the complexity of algorithms, to provide justification for the selection, and t

algorithm in a particular context.

2. Apply various algorithmic design paradigms such as greedy, dynamic, backtracking etc. to solve common engineering problems.
3. Identify basic properties of graphs and apply their algorithms to solve real life problems.
4. Demonstrate the application of algorithms and selection of appropriate data structures under several categories such as string matching, randomized algorithms and genetic logarithms.

Textbooks & References:

1. Fundamentals of Computer Algorithms by E. Horowitz and S. Sahni, Galgotia.
2. Introduction to Algorithms by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, MIT Press, Cambridge.
3. The Design and Analysis of Computer Algorithms by A.V. Aho, J.E. Hopcroft and J.D. Ullman, Addison Wesley.

CS- 413 Artificial Intelligence and Expert Systems							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
3	1	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:

Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questions in all, i.e one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus.

Unit-I:

Introduction: Introduction to artificial intelligence, background and applications, turing test and rational agent approaches, introduction to intelligent agents, their structure, behaviour and environment. **Problem Solving and Searching Techniques**: Problem characteristics, production systems, breadth first search, depth first search, heuristics search techniques, best first search, A*algorithm, hill climbing, AND/OR graph AO*, constraint satisfaction problem, means-end analysis, introduction to game playing, min max and alpha beta pruning.

Unit–II:

Knowledge Representation: introduction to first order predicate logic, well-formed formulas, quantifiers, rule-based system, resolution principle, unification, forward reasoning: conflict resolution, backward reasoning, structured knowledge representation. AI programming language: PROLOG: Syntax, procedural and declarative meaning, PROLOG unification mechanism, converting english to PROLOG facts and rules, goals, anonymous variable, lists, use of fail, CUT, NOT

Unit–III:

Introduction to Neural Network: Hop field network, single and multi layer networks, perceptions, back-propagations learning, Boltzman machine. Introduction to genetic algorithm: The genetic algorithm, genetic operators, working of genetic algorithm, problem with genetic algorithm.

Unit-IV:

Expert System: introduction, skills/knowledge, characteristics of expert system, knowledge engineering, inferencing, forward chaining and backward chaining expert system tools, applications and future scope

Natural language processing: Introduction, language parsing, syntactic and semantic analysis, top down and bottom-up parsing, chart parsing, knowledge representation languages, ELIZA, speech Recognition

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Text Books:

- Russell and Norvig, ***Artificial Intelligence- A Modern Approach***, Pearson Prentice Hall.
- DW Patterson, ***Artificial Intelligence and Expert Systems***, Prentice Hall of India.
- B. Vegnanarayana, ***Artificial neural networks,*** Prentice Hall of India P Ltd.

Reference Books:

- Elaine Rich, Kevin Knight, ***Shivashankar B. Nair, Artificial Intelligence***, Tata Mc Graw Hill.
- Nils J Nilsson, ***Artificial Intelligence A New Synthesis***, Morgan Kaufmann

CS-315/ CS-414 Computer Architecture & Organisation							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
3	1	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:

Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questions in all, i.e., one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus.

Unit-I:
Basics of Digital Electronics: Codes, logic gates, flip flops, registers, counters, multiplexer, de multiplexer, decoder, and encoder. **Register Transfer and Micro operations:** Register transfer language, register transfer, bus & memory transfer, logic micro-operations, shift micro-operation. **Computer Arithmetic:** Unsigned, signed and floating-point data representation, addition, subtraction, multiplication and division algorithms. booths multiplication algorithm.
Unit–II:
Basic Computer Organization: Instruction codes, computer instructions, timing & control, instruction cycles, memory reference instruction, input/output & interrupts, complete computer description & design of basic computer. **Control Unit:** Hardwired vs Micro programmed control unit. **Central Processing Unit:** General register organization, stack organization, instruction format, addressing modes, data transfer & manipulation, program control, RISC, CISC.
Unit–III
Input-Output Organization: Peripheral devices, I/O interface, Modes of data transfer: Programmed I/O, Interrupt-Initiated I/O, DMA transfer, I/O processor. Serial Communication. **Memory Unit:** Memory hierarchy, processor vs. memory speed, main memory, auxiliary memories, high-speed memories, cache memory, associative memory, virtual memory, and memory management hardware.
Unit-IV:
Introduction to Parallel Processing: Flyn's classification, pipelining, arithmetic pipeline, instruction pipeline, characteristics of multiprocessors, inter connection structures, inter processor arbitration, inter processor communication & synchronization. Performance evaluation SPEC marks LINPACK Whetstone Dhrystone etc., transaction processing benchmarks. **Case Studies:** Case studies of some contemporary advanced architecture for processors of families like Intel, AMD, IBM etc./ Seminar on state-of the-art technology.

Text Books:

1. Mano, Morris M., Computer System Architecture, Prentice Hall.
2. Hayes, J.P., Computer Architecture and Organization, Mc Graw Hill.

Reference Books:

- Hennessy, J.L., Patterson, D.A, and Goldberg, D., Computer Architecture A Quantitative Approach, Pearson Education Asia.
- Leigh, W.E. and Ali, D.L., System Architecture: software and hardware concepts, South Wester Publishing Co.

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EC-411 Microprocessors and Interfacing							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
3	1	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:

Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questions in all, i.e one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus.

Course Objectives: The educational objectives of this course are to understand the basics of processors and microprocessors and interfacing with real world to study basic programming.

Unit-I:
Introduction to Microprocessor: History and Evolution, types of microprocessors, 8085 Microprocessor, Architecture, Bus Organization, Registers, ALU, Control section, Instruction set of 8085, Instruction format, Addressing modes, Types of Instructions. Microprocessor timings, Microinstructions, Instruction cycle, Machine cycles, T states, State transition diagrams, Timing diagram for different machine cycles. **Assembly Language Programming and Timing Diagram:** Assembly language programming in 8085, Macros, Labels and Directives
Unit–II:
Serial I/O, Interrupts and Comparison of Contemporary Microprocessors: Serial I/O using SID, SOD. Interrupts in 8085, RST instructions, Issues in implementing interrupts, Multiple interrupts and priorities, Daisy chaining, Interrupt handling in 8085, Enabling, disabling and masking of interrupts.
Unit–III
Data Transfer techniques: Data transfer techniques, programmed data transfer, parallel data transfer using 8155. Programmable parallel ports and handshake input/output, Asynchronous and Synchronous data transfer using 8251A. Programmable interrupt controller 8259A. DMA transfer, cycle stealing and burst mode of DMA, 8257 DMA controller
Unit-IV:
Microprocessor Interfacing Techniques: Interfacing memory and I/O devices, addressing memory, interfacing static RAMs, Interfacing and refreshing dynamic RAMs, interfacing a keyboard, Interfacing LED and seven segment displays, interfacing a printer, Interfacing A/D converters, D/A converters. **Architecture of 8086:** Memory Address space and data organization, segment registers and memory segmentation, generating memory addresses, IO address space, addressing modes, Comparison of 8086 and 8088, minimum mode maximum mode, system timing, introduction to Pentium and further series of microprocessors. Brief comparison of contemporary 8-bit microprocessors like Z-80, M68000 with 8085.

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Course Outcomes: On completion of this course the student will be able to:

- Describe the architecture & organization of 8085 & 8086 Microprocessor.
- Understand and classify the instruction set of 8085/8086 microprocessor and distinguish the use of different instructions and apply it in assembly language programming.
- Relate the addressing modes used in the instructions.
- Realize the Interfacing of memory & various I/O devices with 8085/8086 microprocessor.
- Familiarize the architecture and operation of Programmable Interface Devices and realize the programming & interfacing of it with 8085 microprocessors.
- Interface various peripheral IC's with Intel 8085/8086 microprocessor for its various applications

Textbooks & References:

- Fundamentals of Microprocessors and Microcomputers by B. Ram, Dhanpat Rai and Sons.
- Microprocessor Architecture, Programming and applications with the 8085/8080A by R.S. Gaonkar, Wiley.
- Microprocessors& Interfacing by Douglas V Hall, McGraw Hill.
- Microprocessors and Digital Systems by Douglas V Hall, McGraw Hill.
- Introduction to Microprocessor by A.P. Mathur, Tata McGraw Hill.

HS-411 Entrepreneurship and Startups

Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
2	0	0	2	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:

Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questions in all, i.e one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus.

Course Objectives: To understand the Entrepreneurship, Idea and Customer, business models, Marketing, Sales, and Support.

Unit-I:

Entrepreneurship Concepts: Understanding nuances of being an entrepreneur; Difference between a startup venture and small business; Identifying entrepreneurial styles. **Idea/Problem and Customer:** Identifying problems worth solving, identifying business opportunities, methods for problem interviews; Design thinking process; Generation of potential solutions; Identifying customer segment and early adopters, difference between a consumer and a customer, craft your value proposition, outcome driven innovation, testing out solutions for the problems; Unique value proposition

Unit–II:

Business Model Validation: Basic lean approach and canvas, types of business models, documenting business plan with a lean canvas, documenting hypotheses; Introduction to risks; Develop solution demos; The problem-solution test, solution interviews, sizing the opportunity, building a minimum viable product; The product-market fit test; Revenue streams; How companies with different business models earn money; Understanding income, costs, gross and net margins; Identifying primary and secondary revenue streams; Costing and pricing; How to finance your business idea; Financing your venture at different stages, what investors expect from you; Various sources of funding and pros & cons of each

Unit–III

Building a Resourceful Team: Shared leadership model, role of a good team in a venture's success, what to look for in a team, define clear roles and responsibilities; How to pitch to candidates to attract to join your team, explore collaboration tools and techniques - brainstorming, mind mapping; Kanban board.

Unit-IV:

Marketing, Sales, and Support: Understanding the difference between product and brand and link between them; Product/service positioning; Channels and strategies, budgeting and planning; Sales planning, target setting; Unique sales propositions (USP); Follow-up and closing sale; Planning and tracking, importance of project management to launch and track progress; Understanding time management, workflow, delegation of tasks; Business regulations of starting and operating a business; Documentation, how to find help to get started; Various government scheme

Course Learning Outcomes (CLOs):

After the completion of the course, the student will be able to:

- Understanding nuances of being an entrepreneur; Difference between a startup venture and small business.
- Identifying problems worth solving, find the difference between customer and consumer.
- Make resourceful team and manage it.
- For marketing, sales and Support to the startup and business.

Textbooks:

- Blank, S. G., & Dorf, B. (2012). The startup owner's manual: The step-by-step guide for building a great company. Pescadero, Calif: K & S Ranch.
- Reference Books:
- Maurya, A (2016). Scaling Lean: Mastering the Key Metrics for Startup Growth. Portfolio/Penguin. Sethi, A. (2016). From Science to Startup, Springer.

References:

- Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning, Springer 2009

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CS-411P/CS-314P Python Lab							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
0	0	2	1	Maximum Marks: 30	Maximum Marks: 20	50	2 Hours
				Minimum Marks: 12	Minimum Marks: 08	20	

NOTE: - Following is the list of experiments out of which 8-10 experiments must be performed in the lab. The additional experiments may be performed by the respective institution depending on the infrastructure and student intake.

List of experiments:

1. Demonstrate about Basics of Python Programming
2. Demonstrate about fundamental Data types in Python Programming. (i.e., int, float, complex, bool and string types) Demonstrate the working of following functions in Python. i) id () ii) type() iii)range()
3. Write a Python program to demonstrate various base conversion function
4. Write a Python program to demonstrate various type conversion functions
5. Demonstrate the following Operators in Python with suitable examples: i) Arithmetic Operators ii) Relational Operators iii) Assignment Operator iv) Logical Operators v) Bit wise Operators vi) Ternary Operator vii) Membership Operators viii) Identity Operators
6. Write Python programs to demonstrate the following:
   1. Input() ii)print()iii)'sep'attributeiv)'end'attributev)replacementOperator({})
7. Demonstrate the following Conditional statements in Python with suitable examples. i) if statement ii) if else statement iii) if-else-if statement
8. Demonstrate the following Iterative statements in Python with suitable examples. i) while loop ii) for loop
9. Write a Python program to demonstrate various ways of accessing the string. i) By using Indexing (Both Positive and Negative) ii) By using Slice Operator
10. Python program to perform read and write operations on a file.

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CS- 412P DAA Lab							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
0	0	2	1	Maximum Marks: 30	Maximum Marks: 20	50	2 Hours
				Minimum Marks: 12	Minimum Marks: 08	20	

Following is the list of experiments out of which minimum 08 experiments must be performed in the lab. The additional experiments may be performed by the respective institution depending on the infrastructure available.

List of experiments:

1. Write a program to perform Insertion sort for any given list of numbers.
2. Write a program to perform Quick Sort for the given list of integer values.
3. Write a program to find Maximum and Minimum of the given set of integer values.
4. Write a Program to perform Merge Sort on the given two lists of integer values.
5. Write a Program to perform Binary Search for a given set of integer values recursively and non-recursively.
6. Write a program to find solution for knapsack problem using greedy method.
7. Write a program to find minimum cost spanning tree using Prim's Algorithm.
8. Write a program to find minimum cost spanning tree using Kruskal's Algorithm.
9. Write a program to perform Single source shortest path problem for a given graph.
10. Write a program to find solution for job sequencing with deadlines problem.
11. Write a program for all pairs shortest path problem.
12. Write a program to solve N-QUEENS problem.
13. Write a program to solve Sum of subsets problem for a given set of distinct numbers.

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CS-413P AI Lab							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
0	0	2	1	Maximum Marks: 30	Maximum Marks: 20	50	2 Hours
				Minimum Marks: 12	Minimum Marks: 08	20	

Following is the list of experiments out of which minimum 08 experiments must be performed in the lab. The additional experiments may be performed by the respective institution depending on the infrastructure available.

List of experiments:

1. Write a program to implement breadth first search algorithm.
2. Write a program to implement depth first search algorithm.
3. Study of PROLOG programming language, functions and its facts.
4. Write a program to implement the Hill Climbing algorithm.
5. Write a program to build and display Neural network using Tenser flow Keres.
6. Write a program to implement back-propagations learning.
7. Write a program to implement Genetic algorithm.
8. Study of expert system tools and its applications.
9. Write a program to implement Traveling salesman problem.
10. Write a program to implement four queen problem.
11. Write a program to solve monkey banana problem.
12. Write a program to implement Tower of Hanoi.

SEMESTER V

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CSPC-511 Computer Networks							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
3	1	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:

Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questions in all, i.e. one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus.

Course Objectives:

- The objective of the course is to equip the students with a general overview of the concepts and fundamentals of computer networks.
- Familiarize the students with the standard models for the layered approach to communication between machines in a network and the protocols of the various layers.

Unit-I:
Introductory Concepts: Goals and Applications of Networks, LAN, WAN, MAN, Wireless network, Network software: Protocol hierarchies, design issues of layers, Interfaces and services. Reference Model: The OSI reference model, TCP/IP reference model **Physical Layer**: Data Modems, Multiplexing Techniques, Frequency Division, Multiplexing Hierarchies, Transmission Media, Error Detection: Parity Check Codes, Cyclic Redundancy Codes.
Unit-II:
Data Link Layer: Data link layer design issues, services provided to network layers, Framing, Error control, Flow control, Error detection and correction, Elementary data link protocols, An unrestricted Simplex protocol, A Simplex Stop-and-Wait protocol, Simplex Protocol for a noisy channel, Sliding Window protocols, A one-bit Sliding protocol, A protocol using go-back-N, A protocol using selective repeat, Protocol specification and verification, Example data link protocol-HDLC, PPP and SLIP
Unit-III:
Network Layer: Design issues, Routing algorithms, Congestion Control Algorithms, Quality of Service, Internetworking. **Transport Layer:** Transport services, Design issues, elements of transport protocols, simple transport protocols, Connection management, TCP, UDP.
Unit-IV:
Session, Presentation and Application Layer: Session Layer, Design issues, remote procedure call. Presentation Layer, Design issues, Data compression techniques, cryptography. Application Layer - File Transfer, Access and Management, Electronic mail, Virtual Terminals, Other applications

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Course Learning Outcomes (CLOs):

After the completion of the course, the student will be able to:

- Gain the knowledge of the basic computer network technology.
- Gain the knowledge of the functions of each layer in the OSI and TCP/IP reference model.
- Obtain the skills of sub netting and routing mechanisms.
- Familiarity with the essential protocols of computer networks, and how they can be applied in network design and implementation.

Textbooks:

- Computer Networks—Andrew S Tanenbaum, David.j. Wetherall,5th Edition. Pearson Education/PHI

Reference Books:

- An Engineering Approach to Computer Networks- S.Keshav, 2nd Edition, Pearson Education
- Data Communications and Networking – Behrouz A. Forouzan. Third Edition TMH.

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CSPC-512 Theory of Computation							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
3	1	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:
Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questions in all, i.e. one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus.

Course Objectives:

- To provide introduction to some of the central ideas of theoretical computer science from the perspective of formal languages.
- To introduce the fundamental concepts of formal languages, grammars and automata theory, classify machines by their power to recognize languages.
- Employ finite state machines to solve problems in computing, and to understand deterministic and non-deterministic machines.
- To understand the differences between decidability and undecidability.

Unit-I:
Machines: Basic machine, FSM, Transition graph, Transition matrix, Deterministic and nondeterministic FSMS, Equivalence of DFA and NDFA, Mealy and Moore machines, minimization of finite automata, Two-way finite automata.
Unit-II:
Regular Sets and Regular Grammars: Alphabet, words, Operations, Regular sets, Finite automata and regular expression, Pumping lemma and regular sets, Application of pumping lemma, closure properties of regular sets.
Unit-III:
Formal Grammars and Languages: Basic definitions and examples of languages, Chomsky hierarchy, Regular grammars, context free & context sensitive grammars, context free languages, non-context free languages, Chomsky normal forms, binary operations on languages. Simplification of CFG, Elimination of Useless symbols, Unit productions, Null productions, Greiback Normal form, Chomsky normal form – Problems related to CNF and GNF
Unit-IV:
Turing Machines and Pushdown Automata: TM model, representation and languages acceptability of TM Design of TM, Universal TM and Other modification, composite and iterated TM, Pushdown automata, Acceptance by PDA.

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Course Learning Outcomes (CLOs): After the completion of the course, the student will be able to:

- Able to understand the concept of abstract machines and their power to recognize the languages.
- Able to employ finite state machines for modeling and solving computing problems.
- Able to design context free grammars for formal languages.
- Able to distinguish between decidability and undecidability.
- Able to gain proficiency with mathematical tools and formal methods.

Textbooks:

- Introduction to Automata Theory, Languages, and Computation, 3rd Edition, John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, Pearson Education.
- Theory of Computer Science – Automata languages and computation, Mishra and Chandrashekaran, 2nd edition, PHI.

Reference Books:

- Introduction to Languages and The Theory of Computation, John C Martin, TMH.
- Introduction to Computer Theory, Daniel I.A. Cohen, John Wiley.
- A Text book on Automata Theory, P. K. Srimani, Nasir S. F. B, Cambridge University Press.
- Introduction to the Theory of Computation, Michael Sipser, 3rd edition, Cengage Learning.
- Introduction to Formal languages Automata Theory and Computation Kamala Krithivasan, Rama R, Pearson.
- K. L. P Mishra, N. Chandrashekaran (2003), Theory of Computer Science-Automata Languages and Computation, 2nd edition, Prentice Hall of India, India.

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CSPC-513 Introduction to Machine Learning							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
3	1	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:

Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questions in all, i.e. one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus.

Course Objectives:

- To review and strengthen important mathematical concepts required for ML.
- Introduce the concept of learning patterns from data and develop a strong theoretical foundation for understanding state of the art Machine Learning algorithms.

Unit-I:
Introduction: Machine Learning Paradigms: Introduction to machine learning, data sets, feature sets, data set division-test, train and validation sets, Cross Validation, applications of Machine Learning, process involved in machine learning, Types.
Unit-II:
Supervised Learning: Classification and Regression: K- Nearest neighbor, Linear regression, multi-linear Regression, Logistic Regression, Support Vector Machine (SVM), Decision Trees, Naïve Bayes algorithm, Random Forest Algorithm.
Unit-III:
Unsupervised learning: Types: Clustering, Association, dimensionality reduction, Clustering Hierarchical- Agglomerative clustering and divisive clustering, Partitional clustering. Clustering Algorithms: K-means clustering, mean -shift algorithm, hierarchical clustering. Association rules. Dimensionality Reduction: PCA, k-nearest neighbors and discriminant analysis.
Unit-IV:
Reinforcement learning: Types of reinforcement learning: positive and negative, reinforcement learning. **Algorithms models:** model based and model free algorithms, on policy and off policy, Markov decision process, Q Learning, Application of reinforcement Learning.

Course Learning Outcomes (CLOs):

After the completion of the course, the student will be able to:

- Design and implement machine learning solutions to classification, regression and clustering problems.

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- Evaluate and interpret the results of the different ML techniques.
- Design and implement various machine learning algorithms in a range of Real-world applications.

Textbooks:

- Machine Learning, Tom M. Mitchell, MGH.
- Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2011.
- RS Suttonand, A. G. Barto., "Reinforcement Learning-An Introduction", MIT Press.1998
- Vaibhav, "Supervised Larning with Python: Concepts and Practical Implementation using Python".
- Yuxi (Hayden) Liu, "Python Machine Learning by Example", Packet Publishing Limited, 2017.
- Tom Mitchell, Machine Learning, McGraw Hill, 2017.
- Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer, 2011.
- T. Hastie, R. Tibshirani, J. Friedman. The Elements of Statistical Learning, 2e, 2011.

CSPC-514 Software Engineering							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
3	0	0	3	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:
Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questions in all, i.e. one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus.

Course Objectives:

- The aim of the course is to provide an understanding of the working knowledge of the techniques for estimation, design, testing and quality management of large software development projects.
- Topics include process models, software requirements, software design, software testing, software process/product metrics, risk management, quality management and UML diagrams.
- These practices help in developing large size and complex software.
- With concepts and knowledge gained from this course, one can easily become part of industrial software production.

Unit-I:
Introduction to Software Engineering: The evolving role of software, changing nature of software, software myths. A Generic view of process: Software engineering- a layered technology, a process framework, the capability maturity model integration (CMMI), process patterns, process assessment, personal and team process models. **Software Development Processes:** Waterfall model, Incremental Models – Iterative Model and RAD Model, Evolutionary Models – Prototype and Spiral Model, Component Based Development, Unified Process, Rapid Software Development. **Software Requirements:** Functional and non-functional requirements, user requirements, system requirements, interface specification, the software requirements document.
Unit-II:
Requirements engineering process: Feasibility studies, requirements elicitation and analysis, requirements validation, requirements management. System models: Context models, behavioral models, data models, object models, structured methods. Software architecture, data design, architectural styles and patterns, architectural design, conceptual model of UML, basic structural modeling, class diagrams, sequence diagrams, collaboration diagrams, use case diagrams, component diagrams.
Unit-III:
Testing Strategies: A strategic approach to software testing, test strategies for conventional software, black-box and white-box testing, validation testing, system testing, the art of debugging. **Product metrics:** Software quality, metrics for analysis model, metrics for design model, metrics for source code, metrics for testing, metrics for maintenance.

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Unit-IV:
Metrics for Process and Products: Software measurement, metrics for software quality. Risk management: Reactive Vs proactive risk strategies, software risks, risk identification, risk projection, risk refinement, RMMM, RMMM plan. **Quality Management**: Quality concepts, software quality assurance, software reviews, formal technical reviews, statistical software quality assurance, software reliability, the ISO 9000 quality standards.

Course Learning Outcomes (CLOs):

After the completion of the course, the student will be able to:

- Get familiar with various software development process models, requirement engineering concepts and software design principles.
- Understand software project metrics, quality concepts and estimate effort in software development.
- Understand software design and principles.
- Understand coding practices, styles and software testing approaches.
- Develop software cooperatively in a team with an understanding about software risk.

Textbooks:

- Software Engineering, A practitioner's Approach- Roger S. Pressman, 6th edition, Mc Graw Hill International Edition.
- Software Engineering- Sommerville, 7th edition, Pearson Education.
- The unified modeling language user guide Grady Booch, James Rambaugh, Ivar Jacobson, Pearson Education.

Reference Books:

- Software Engineering, an Engineering approach- James F. Peters, Witold Pedrycz, John Wiley.
- Software Engineering principles and practice- Waman S Jawadekar, The Mc Graw-Hill Companies.
- Fundamentals of object-oriented design using UML Meiler page-Jones: Pearson Education.

CSPC-415 Database Management System							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
3	1	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:

Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questions in all, i.e. one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus.

Course Objectives:

- To understand the basic concepts and the applications of database systems
- To master the basics of SQL and construct queries using SQL
- To understand the relational database design principles
- To become familiar with the basic issues of transaction processing and concurrency control
- To become familiar with database storage structures and access techniques

Unit-I:
Data base System Applications, Purpose of Database Systems, View of Data – Data Abstraction – Instances and Schemas – data Models – the ER Model – Relational Model – Other Models – Database Languages – DDL – DML – Database Architecture – Storage Manager – the Query Processor Data base design. ER diagrams – ER Model - Entities, Attributes and Entity sets – Relationships and Relationship sets – ER Design Issues – Concept Design – Conceptual Design. Introduction to the Relational Model – Structure – Database Schema, Keys – Schema Diagrams
Unit-II:
Relational Query Languages, Relational Operations. Relational Algebra – Selection and projection set operations – renaming – Joins – Division. Overview of the SQL Query Language – Basic Structure of SQL Queries, Set Operations, Aggregate Functions – GROUPBY – HAVING, Nested Sub queries, Views, Triggers.
Unit-III:
Normalization – Introduction, non-loss decomposition and functional dependencies, First, Second, and third normal forms, Boyce /Codd normal form. Higher Normal Forms - Introduction, Multi-valued dependencies and fourth normal form, Join dependencies and fifth normal form
Unit-IV:
Transaction Concept- Transaction State- Implementation of Atomicity and Durability – Concurrent – Executions – Serializability- Recoverability – Implementation of Isolation –Recovery and Atomicity

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Course Learning Outcomes (CLOs):

After the completion of the course, the student will be able to:

- Explain the features of database management systems and Relational database.
- Create and populate a RDBMS for a real life application, with constraints and keys, using SQL and retrieve any type of information from a data base by formulating complex queries in SQL.
- Analyze the existing design of a database schema and apply concepts of normalization to design an optimal database and build indexing mechanisms for efficient retrieval of information from a database.

Textbooks:

- Data base Management Systems, Raghurama Krishnan, Johannes Gehrke, TATA McGraw Hill 3rd Edition.
- A Silberschatz, H Korth, S Sudarshan, "Database System and Concepts", fifth Edition McGraw-Hill.
- Data base System Concepts, Silberschatz, Korth, McGraw hill, Sixth Edition.

Reference Books:

- Fundamentals of Database Systems, Elmasri Navathe Pearson Education.
- An Introduction to Database systems, C.J. Date, A.Kannan, S.Swami Nadhan, Pearson, Eight Edition.

CSPC-511P Computer Networks Lab							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
0	0	2	1	Maximum Marks: 30	Maximum Marks: 20	50	2 Hours
				Minimum Marks: 12	Minimum Marks: 08	20	

Following is the list of experiments out of which minimum 08experiments must be performed in the lab. The additional experiments may be performed by the respective institution depending on the infrastructure available.

List of experiments:

1. To become familiar with networking accessories and facilities in the Department of Computer Science and Engineering:
   - Find out what networking devices are installed in the department
   - Describe the network type and topology of the department
   - File and printer sharing in different OSs
   - Network address configuration in different OSs
   - Finding IP and MAC address in different OSs
   - Workgroup and domain configuration
   - Use of utilities: arp, ipconfig/ifconfig, tracert, nslookup
2. Examine packets flow across a network segment and see the operation of various Internet protocols across the different layers in TCP/IP stack. (Hint: Use utilities netstat, snoop, tcpdump, …)
3. Use UNIX sockets to implement a simple client and server that communicate over the network. (Reference: Unix Network Programming by W. Richard Stevens, Prentice Hall)
4. Simulate various multiple access protocols (Aloha, slotted Aloha, p-persistent and non-persistent) and compare their performance at different loads.
5. Write a program to display the IP address and MAC address of a machine.
6. Implement ARP and RARP protocols for CSE LAN.
7. Install Ethereal on a computer. Set Ethereal to capture with a filter option of your choice. Load a webpage or send an email to a friend and stop capturing. Analyze the packets. See if you can read any or all of the data transmitted. Write down your findings.
8. Write a program to simulate routing using flooding. Each packet should contain a counter that is decremented on each hop. When the counter gets to zero, the packet is discarded. Time is discrete, with each line handling one packet per time interval. Make three versions of the program: all lines are flooded, all lines except the input line are flooded, and only the (statically chosen) best k lines are flooded. Compare flooding with deterministic routing (k = 1) in terms of both delay and the bandwidth used.
9. Write a program that simulates a computer network using discrete time. The first packet on each router queue makes one hop per time interval. Each router has only a finite number of buffers. If a

packet arrives and there is no room for it, it is discarded and not transmitted. Instead, there is an end-to-end protocol, complete with timeouts and acknowledgement a packet, which eventually regenerates the packet from the source router. Plot the throughput of the network as a function of the end-to-end timeout interval, parameterized by error rate.

10. Design and implement a chat system that allows multiple groups of users to chat. A chat coordinator resides at a well-known network address, uses UDP for communication with chat clients, sets up chat servers for each chat session, and maintains a chat session directory. There is one chat server per chat session. A chat server uses TCP for communication with clients. A chat client allows users to start, join, and leave a chat session. Design and implement coordinator, server, and client code.

11. Study different networking devices such as repeaters, bridge, switch, router, gateways, firewall, proxy server.

12. Study different networking tools like, crimping tool, LAN tester, connecting cables, screw driver, NIC, LAN card, RJ45, RJ11, I/O box etc.

13. Create and connect straight and cross ethernet cable in Lab.

14. Study and implement LAN in Lab using switch.

15. Study and implement firewall setting in Lab.

16. Study and implement router configuration using simulation software like packet tracer, network simulator (ns2/ns3) etc.

CSPC-513P Machine Learning Lab							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
0	0	2	1	Maximum Marks: 30	Maximum Marks: 20	50	2 Hours
				Minimum Marks: 12	Minimum Marks: 08	20	

Following is the list of experiments out of which minimum 08experiments must be performed in the lab. The additional experiments may be performed by the respective institution depending on the infrastructure available.

List of experiments:

1. Write a python program to import and export data using Pandas library functions.
2. Demonstrate various data pre-processing techniques for a given dataset scaling
3. Implement Dimensionality reduction using Principle Component Analysis (PCA) method.
4. Write a Python program to demonstrate various Data Visualization Techniques.
5. Implement Simple and Multiple Linear Regression Models.
6. Develop Logistic Regression Model for a given dataset.
7. Develop Decision Tree Classification model for a given dataset and use it to classify a new sample.
8. Implement Naïve Bayes Classification in Python
9. Build KNN Classification model for a given dataset.
10. Build Artificial Neural Network model with back propagation on a given dataset.
11. a) Implement Random Forest ensemble method on a given dataset. b) Implement Boosting ensemble method on a given dataset.
12. Write a python program to implement K-Means clustering Algorithm.

CS-415P DBMS Lab							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
0	0	2	1	Maximum Marks: 30	Maximum Marks: 20	50	2 Hours
				Minimum Marks: 12	Minimum Marks: 08	20	

Following is the list of experiments out of which minimum 08experiments must be performed in the lab. The additional experiments may be performed by the respective institution depending on the infrastructure available.

List of experiments:

1. Design a Database and create required tables. For e.g. Bank, College Database
2. Apply the constraints like Primary Key, Foreign key, NOT NULL to the tables.
3. Write a sql statement for implementing ALTER,UPDATE and DELETE
4. Write the queries to implement the joins
5. Write the query for implementing the following functions: MAX(),MIN(),AVG(),COUNT()
6. Write the query to implement the concept of Integrity constraints.
7. Write the query to create the views
8. Perform the queries for triggers.
9. Perform the following operation for demonstrating the insertion, updation and deletion using the referential integrity constraints.
10. Write the query for creating the users and their role.

SEMESTER

VI

CSPC-611 Digital Image Processing							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
3	1	0	4	Maximum Marks: 40 Minimum Marks: 16	Maximum Marks: 60 Minimum Marks: 24	100 40	3 Hours

Instructions to the question paper setter:

Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questions in all, i.e. one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus.

Course Objectives:

- To study the image fundamentals and mathematical transforms necessary for image processing.
- To design and implement algorithms that perform basic image processing (e.g. noise removal and image enhancement) and advanced image analysis (e.g. image compression, image segmentation, Pattern Recognition).
- To assess the performance of image processing algorithms and systems.

Unit-I
Digital Image Fundamentals: Digital Image Processing, Origins of Digital Image Processing Application of Digital Image Processing, Steps in Digital Image Processing, Components of an Image Processing System, Image formation, Image sampling and Quantization, Image transforms – Fourier transforms.
Unit-II
Image Enhancement Techniques: Histogram modification techniques - Image smoothening Image Sharpening - Image Restoration - Degradation Model – Noise models - Spatial filtering – Frequency domain filtering.
Unit-III
Image Compression & Segmentation: Compression Models - Elements of information theory, Error free Compression -Image segmentation –Detection of discontinuities, Thresholding, Otsu's Threshold, Region based segmentation - Morphology.
Unit-IV
Representation and Description: Representation schemes- Boundary descriptors- Regional descriptors - Relational Descriptors. **Pattern Recognition:** Classification, Structure of PR System.

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Course Learning Outcomes (CLOs):

After the completion of the course, the student will be able to:

- Learn different techniques employed for the enhancement of images.
- Understand the need for image compression and to learn the spatial and frequency domain techniques of image compression.
- Learn different feature extraction techniques for image analysis and recognition.
- Understand the rapid advances in Machine vision.

Textbooks:

- Digital Image Processing by R. Gonzalez and R. E. Wood, Prentice Hall of India.
- Digital Image Processing by W.K. Pratt, McGraw Hill.
- Fundamentals of Digital Image Processing by A. K. Jain, Prentice Hall of India.
- Pattern Recognition-Statistical, Structural and neural approach by R. Schalkoff, John Willey & Sons.

Reference Books:

- Feature Extraction and Image Processing for Computer Vision by M. Nixon, Academic Press.
- Introductory Computer Vision and Image Procession by A. Low, McGraw Hill.
- Image Processing: Analysis and Machine Vision by Milan Sonka, Roger Boyle, and Vaclav Hlavac.

CSPC-612 Information and Network Security							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
3	1	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:

Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questions in all, i.e. one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus.

Course Objectives:

- To be able to secure a message over insecure channel by various means.
- To learn about how to maintain the Confidentiality, Integrity and Availability of a data.
- To understand various protocols for network security to protect against the threats in the networks.

Unit-I
Computer Security: Introduction, The need for security, Security approaches, Principles of security, Types of Security attacks, Security services, Security Mechanisms, A model for Network Security. **Cryptography:** Concepts and Techniques: Introduction, plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption, symmetric and asymmetric key cryptography.
Unit-II
Administering Security: Security Planning, Risk Analysis, Organizational Security policies, Physical Security. **Program Security**: Secure Programs, Non-malicious Program Errors, viruses, and other malicious code, Targeted Malicious code, controls Against Program Threats, File Protection Mechanisms.
Unit-III
Network Security Introduction: Model for network security. Threats in Network, Network Security Controls, Firewalls, Intrusion Detection Systems, Secure E-Mail. Database Security: Security requirements, Reliability and integrity, Sensitive data, Inference, multilevel database.
Unit-IV
Network Security: Packet sniffing and spoofing, Attacks on TCP protocol, SYN flood, TCP reset attack, session hijacking attack, Firewalls: Packet filter, Stateful firewall, Application firewall. IP tables. **Authentication Requirement**, Functions, Message Authentication Code, Hash Functions, Security of Hash Functions And Macs, Digital Signatures, Key Management: Key Distribution Techniques, Kerberos.

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Course Learning Outcomes (CLOs):

After the completion of the course, the student will be able to:

- Provide security of the data over the network.
- Do research in the emerging areas of information and network security.
- Implement various networking protocols.
- Protect any network from the threats in the world.

Textbooks:

- Nina Godbole, Information Systems Security: Security Management, Metrics, Frameworks and Best Practices, First Edition, Wiley India Pvt Ltd, 2009.
- Cryptography and Network Security: Principles and Practice 5th Edition, William Stallings, Pearson,2010.
- Michael Whitman and Herbert Mattord, Management of Information Security, Fourth Edition, Cengage Learning, 2014.

Reference Books:

- Charles P. Pfleeger, Shari Lawrence Pfleeger – Security in computing – Prentice Hall of India.
- Behrouz A Fourouzan, Debdeep Mukhopadhyay, Cryptography and Network, 2nd Edition,TMH,2011.
- Harold F. Tipton, Information Security Management Handbook, Sixth edition, CRC Press, 2012.
- Atul Kahate, Cryptography and Network Security, Tata McGraw-Hill, 2013.
- Michael Whitman and Herbert Mattord, Principles of Information Security, Fifth Edition, Cengage Learning, 2015.

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CSPC-613 Compiler Design							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
3	1	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:

Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questions in all, i.e. one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus.

Course Objectives:

- To teach concepts of language translation and phases of compiler design.
- To inculcate knowledge of common forms of parsers, parsing LL parser and LR parser.
- To demonstrate intermediate code using technique of syntax directed translation.
- To illustrate the various optimization techniques for designing various optimizing compilers.

Unit-I
Introduction to Compilers: Definition of compiler, interpreter and its differences, Structure of a compiler, pass and phases of translation, bootstrapping, Lexical Analysis, Role of Lexical Analyzer, Input Buffering, Specification of Tokens, Recognition of Tokens, Lex, Finite Automata, Regular Expressions to Automata, Minimizing DFA.
Unit-II
Syntax Analysis: Parsing, Role of Parser, Grammars, Context-free grammars, derivations, ambiguity, classes of parsing, Top Down Parsing: Recursive Descent Parser, Predictive Parser-LL(1), Bottom Up Parsing: Shift Reduce Parser-LR Parser-LR(0), Introduction to SLR Parser, CLR Parser and LALR Parser, Error Handling and Recovery in Syntax Analyzer, YACC, Precedence Parser.
Unit-III
Intermediate Code Generation: Syntax Directed Definitions, Evaluation Orders for Syntax Directed Definitions, Intermediate Languages: Syntax Tree, Three Address Code, Types and Declarations, Translation of Expressions, Type Checking.
Unit-IV
Run-Time Environment: Need for runtime memory management, Address resolution of runtime objects at compile time, Type checking, Language features influencing run time memory management. **Code Generation:** Storage Organization, Stack Allocation Space, Access to Non-local Data on the Stack, Heap Management, Issues in Code Generation, Design of a simple Code Generator. **Code Optimization:** Principal Sources of Optimization, Basic Blocks, Peep-hole optimization, DAG, Data Flow Analysis.

Course Learning Outcomes (CLOs):

After the completion of the course, the student will be able to:

- Use compiler construction tools and describes the Functionality of each stage of compilation process.
- Construct Grammars for Natural Languages and find the Syntactical Errors/Semantic errors during the compilations using parsing techniques.
- Analyze different representations of intermediate code.
- Construct new compiler for new languages

Textbooks:

- Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman (2007), Compilers Principles, Techniques and Tools, 2nd edition, Pearson Education, New Delhi, India.
- Tremblay, J .P. a nd Sorenson, P .G., " Theory and Practice o f Compiler Writing", SR Publications.
- K. L. P Mishra, N. Chandrashekaran (2003), Theory of computer science- Automata Languages and computation, 2nd edition, Prentice Hall of India, New Delhi, India.

Reference Books:

- Louden, K .C., "Compiler Construction: Principles and Practice", Course Technology.
- Tremblay, J.P. and Sorenson, P.G., "Parsing Techniques: A Practical Guide", Ellis Horwood.
- Andrew W. Appel (2004), Modern Compiler Implementation C, Cambridge University Press, UK.
- Cooper, K .D. a nd T orczon, L., "Engineering a Compiler", M organ Kaufmann.

MAFC-311 Probability Theory and Statistics							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
3	1	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:

Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questions in all, i.e. one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus.

Course Objectives:

- To understand the basic probability concepts.
- To have an in-depth knowledge of standard distribution & hypothesis testing which can describe real- life phenomena.
- To introduce numerical methods for solving interpolation problems and finding the roots of system of equations.
- To analyze the various methods related to numerical differentiation & integration along with the solution of ordinary differential equations.

Unit-I
Probability Theory: Counting principles, probability axioms, sample space and events, conditional probability & Baye's Theorem. Random variable, discrete & continuous probability distribution, expectation, variance, standard deviation. Joint probability distribution, mass function, distribution function, marginal distribution function, covariance. **Probability Distributions**: Discrete Probability Distributions: Uniform, Bernoulli, Binomial Distribution and Poisson distribution. Continuous Probability Distributions: Normal and exponential distribution.
Unit-II
Sampling and Testing of Hypothesis: Basic sampling models, sampling distribution of mean and standard deviation, testing of hypothesis, level of significance, confidence intervals for known and unknown means, simple sampling of attributes, tests of significance for large samples, comparison of large samples, central limit theorem, test of significance for two large samples. Student's t- test, Chi-square test, Goodness of fit, F-distribution.
Unit-III
Solution of System of Linear, Transcendental Equations & Interpolation Bisection method, Regula-Falsi method Newton Raphson's method, Gauss elimination method, LU factorization method. **Introduction to Interpolation:** Lagrange's interpolation, Newton's divided difference interpolation, Difference operators and relations.

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Unit-IV
Numerical Differentiation& Integration: Numerical differentiation using forward difference, backward difference and central difference formula. Integration by trapezoidal and Simpson's rules $1/3^{rd}$ and $3/8^{th}$ rule. **Numerical Solution of Ordinary Differential Equations:** Picard's method, Taylor series method, Euler's method, Modified Euler's method, Runge's and Runge- Kutta method.

Course Learning Outcomes (CLOs):

After the completion of the course, the student will be able to:

- Solve problems using concept of probability covering axiomatic approach for discrete and continuous distributions.
- Identify different distributions and apply the concept in various probability problems.
- Apply different tests for sampling distribution and hypothesis testing in real-life problems.
- Implement numerical techniques for interpolation and solving system of equations.
- Inspect numerical methods for differentiation, integration and for the solution of ordinary differential equations.

Text Books:

- R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics (2003), 2nd ed.
- B.S. Grewal, —Higher Engineering Mathematic, Khanna Publishers.
- S.C. Gupta & V.K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand & Sons.
- K. E. Atkinson, An Introduction to Numerical Analysis (2nd edition), Wiley-India, 1989.

Reference Books:

- Seymour Lipschutz, and John J. Schiller, Introduction to Probability and Statistics, Schaum's Outlines by Mc Graw Hill Education.
- E. Kreyszig, Advanced Engineering Mathematics (8th Edition), John Wiley (1999).
- H.K. Dass and Rajnish Verma, —Engineering Mathematic, S. Chand Publications.

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CSPC-611P Digital Image Processing							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
0	0	2	1	Maximum Marks: 30	Maximum Marks: 20	50	2 Hours
				Minimum Marks: 12	Minimum Marks: 08	20	

Following is the list of experiments out of which minimum 08experiments must be performed in the lab. The additional experiments may be performed by the respective institution depending on the infrastructure available.

List of experiments:

1. To acquire an image, store in different formats and display the properties of the images.
2. Perform image enhancement, smoothing and sharpening, in spatial domain using different spatial filters and compare the performances.
3. Perform image enhancement, smoothing and sharpening, in frequency domain using different filters and compare the performances.
4. Apply histogram equalization for enhancing the given images.
5. Perform noise removal using different spatial filters and compare their performances.
6. For any image perform edge detection using different operators and compare the results.
7. To find the discrete Fourier transform of a gray scale image and perform inverse transform to get back the image.
8. Analyze the rotation and convolution properties of the Fourier transform using any gray scale image.

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CSEE-612P Capstone Project-I							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
0	0	4	2	Maximum Marks: 40	Maximum Marks: 60	50	2 Hours
				Minimum Marks: 16	Minimum Marks: 24	20	

Course Objectives: To facilitate the students, learn and apply an engineering design process in electrical engineering, including project resource management. As a part of a team, the students will make a project, that emphasizes, hands-on experience, and integrates analytical and design skills. The idea is to provide an opportunity to the students to apply what they have learned throughout the course of graduate program by undertaking a specific problem.

Course Description/Guidelines: Capstone Project is increasingly interdisciplinary and requires students to function on multidisciplinary teams. It is the process of devising a system, component or process to meet desired needs. It is a decision-making process (often iterative), in which the basic sciences, mathematics, and the engineering sciences are applied to convert resources optimally to meet these stated needs. It typically includes both analysis and synthesis performed in an iterative cycle. Thus, students should experience some iterative design in the curriculum. As part of their design experience, students have an opportunity to define a problem, determine the problem scope and to list design objectives.

The project must also demonstrate that students have adequate exposure to design, as defined, in engineering contexts. Engineering standards and realistic constraints are critical in engineering design. The program must clearly demonstrate where standards and constraints are taught and how they are integrated into the design component of the project. The students will work in groups as:

- Each group will have 4-5 students.
- Each group should select their team leader and maintain daily diary.
- Each Group will work under mentorship of a faculty supervisor.
- Each group must meet the assigned supervisor (2hrs slot/week) till the end of the semester (record of attendance will be maintained), as per the time slot which will be provided to them by the respective supervisor.

This is mandatory requirement for the fulfilment of the attendance as well as the successful completion of the project. The faculty supervisor of the project will continuously assess the progress of the works of the assigned groups. Completed Capstone Project-I and documentation in the form of Capstone Project-I report (template is provided in annexure-I) is to be submitted at the end of semester and appear for project demonstration and viva.

1. **Capstone Project Report:** Students should prepare a mini project report as per the given template and guidelines.
2. **PowerPoint Presentation:** Prepare a PPT of around 10 slides. The PPT content must be as follows:
   - Project Tile, Student Details and Mentor Name (First Slide)
   - Introduction and Problem Statement (Max 2 Slides)
   - Methodology (Max 3 Slides)

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- Results and Discussion (Max 3 Slides)
- Conclusion and Future Work (1 Slide)

Course Learning Outcomes (CLOs): After the completion of the course, the student will be able to:

- Develop skills necessary for structuring, managing, and executing the projects.
- Design, develop, debug, document, and deliver a project and learn to work in a team environment.
- Develop written and oral communication skills.
- Become proficient with software development tools and environments
- Apply interdisciplinary knowledge to engineering design solutions, taking into account professional and ethical issues.

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Professional Electives-I

CSPE-611(i) Distributed Operating System							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
3	0	0	3	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:

Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questions in all, i.e. one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus.

Course Objectives:

• To have a broad and up-to-date coverage of the principles and practice in the area of Distributed Systems.

• To understand the heterogeneous systems such as computers, mobile phones, other devices and Internet and their functionalities.

Unit-I
Basic Concepts: Definition of a distributed systems, Examples, Resource sharing and the Web, Challenges, System models, Architectural and fundamental models, Networking Interprocess communication, External data representation and marshalling, Client-server and Group communication. Remote procedure call, Events and notifications, The operating system layer, Protection, Processes and Threads, Communication and invocation, OS Architecture.
Unit-II
Operating System Issues: Distributed file systems - Name services, Domain name system, Directory and discovery services, Peer to peer systems, Napster file sharing system, Peer to peer middleware routing overlays, Clocks, Events and process states Clock Synchronization, Logical clocks Global states, Distributed debugging, Distributed mutual exclusion, Elections, Multicast communication.
Unit-III
Distributed Transaction Processing: Transactions, Nested transactions, Locks, Optimistic concurrency control, Timestamp ordering, Concurrency control in distributed transactions, Distributed deadlocks, Transaction recover, Overview of replication, Distributed shared memory and Web services.
Unit-IV
Distributed Algorithms: Synchronous network model - Algorithms: leader election, maximal independent set, Asynchronous system model: I/O automata, operations on automata, fairness, Asynchronous shared memory model, Mutual exclusion: model, the problem, stronger conditions, lockout-free mutual exclusion algorithms, Asynchronous network model - algorithms: leader election in a ring and an arbitrary network.

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Course Learning Outcomes (CLOs):

After the completion of the course, the student will be able to:

- Developing skill set in developing a distributed system.
- Designing and evaluation of algorithms and protocols for various distributed systems.

Textbooks/ Reference Books:

1. G. Coulouris, J. Dollimore, and T. Kindberg, "Distributed Systems: Concepts and Design", Pearson Education.

2. M. Signal & N. Shivaratri, Advanced Concepts in Operating Systems: Distributed, Database and Multiprocessor Operating Systems, McGraw Hill International Edition.

3. R.K. Sinha, "Distributed Operating Systems", Prentice Hall

CSPE-611(ii) Internet of Things							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
3	0	0	3	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:
Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questions in all, i.e. one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus.

Course Objectives:

- Students will be explored to the interconnection and integration of the physical world and the cyber space.
- Students will also be able to design & develop IOT Devices.

Unit-I
Introduction to IOT, Sensing, Actuation, Basics of IoT Networking, IoT Components, IoT vs Web, MQTT, CoAP, AMQP, Connectivity Technologies, RFID, NFC, HART, Wireless HART, Zigbee, Bluetooth, Zwave, ISA100.11a, Sensor Networks, Wireless Ad-hoc sensor network, Sensor network behavior, Target Tracking, WMSN, WSN coverage, OGDC, Static Networks, UAV Networks, Flying Ad-hoc Networks
Unit-II
Machine to Machine Communication, Interoperability in Internet of Things, Introduction to Arduino, Integration of sensors and Actuators with Arduino, Introduction to python programming, Introduction to Raspberry Pi, Implementation of IoT with Raspberry Pi.
Unit-III
Software Defined Networking, Cloud computing fundamentals, Service Model, Service Management and Security, Case Studies, Introduction to SDN, SDN for IoT, Data Handling and Analytics.
Unit-IV
Sensor Cloud, Fog Computing, Smart Cities and Smart Homes, Connected Vehicles, Smart Grid, Industrial Internet of Things, Data Handling and Analytics, Case Studies : Agriculture, Healthcare, Activity Monitoring

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Hamirpur - 177 001, HP

Course Learning Outcomes (CLOs):

After the completion of the course, the student will be able to:

- Able to understand the application areas of IOT
- Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks.
- Able to understand building blocks of Internet of Things and characteristics.

Textbooks:

- Vijay Madisetti, Arshdeep Bahga," Internet of Things A Hands-On- Approach",2014, ISBN:978 0996025515

Reference Books:

1. Adrian McEwen, "Designing the Internet of Things", Wiley Publishers, 2013, ISBN: 978-1-118-43062-0
2. Daniel Kellmereit, "The Silent Intelligence: The Internet of Things". 2013, ISBN 0989973700

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CSPE-611(iii) Advanced Algorithms							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
3	0	0	3	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:
Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questions in all, i.e. one question each from sections A, B, C, D and the compulsory question from section
E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit- II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus.

Course Objectives:
- Introduces the recurrence relations for analyzing the algorithms.
- Introduces the graphs and their traversals.
- Describes major algorithmic techniques (divide-and-conquer, greedy, dynamic programming, Brute Force, Transform and Conquer approaches) and mention problems for which each technique is appropriate.

Unit-I
Introduction: Role of Algorithms in Computing, Order Notation, Recurrences. Sorting and Order Statistics: Heap sort, Quick sort, and Sorting in Linear Time. **Advanced Design and Analysis Techniques**: Dynamic Programming- Matrix chain Multiplication, longest common Subsequence, and optimal binary Search trees.
Unit-II
Greedy Algorithms - Huffman Codes, Activity Selection Problem. **Graph Algorithms**: Topological Sorting, Minimum Spanning trees, Single Source Shortest Paths, Maximum Flow algorithms.
Unit-III
Sorting Networks: Comparison Networks, Zero-one principle, bitonic Sorting Networks, Merging Networks, Sorting Networks. **Matrix Operations**- Strassen's Matrix Multiplication, Inverting matrices, Solving system of linear Equations.
Unit-IV
String Matching: Naive String Matching, Rabin-Karp algorithm, matching with finite Automata, Knuth Morris - Pratt algorithm.

Course Learning Outcomes (CLOs): After the completion of the course, the student will be able to:

- Ability to analyze the performance of algorithms
- Ability to choose appropriate data structures and algorithm design methods for a specified application
- Ability to understand how the choice of data structures and the algorithm design methods impact the performance of programs.

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TEXTBOOK:

- Introduction to Algorithms," T.H. Cormen, C.E. Leiserson, R.L. Rivest, and C. Stein, Third Edition, PHI.

REFERENCE BOOKS:

- Fundamentals of Computer Algorithms, Ellis Horowitz, Satraj Sahni and Rajasekharam, Galgotia Publications Pvt. Ltd.
- Design and Analysis Algorithms - Parag Himanshu Dave, Himanshu Bhalchandra Dave Publisher: Pearson
- Algorithm Design: Foundations, Analysis and Internet examples, M.T. Goodrich and R. Tomassia, John Wiley and Sons.
- Data structures and Algorithm Analysis in C++, Allen Weiss, Second edition, Pearson education

Professional Electives-II

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CSPE-612(i) Advanced Computer Architecture							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
3	1	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:
Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questions in all, i.e. one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus.

Course Objectives:

- To understand the advance hardware and software issues of computer architecture.
- To understand the multi-processor architecture & connection mechanism.
- To understand multi-processor memory management.

Unit-I
Basic Concepts: Evolution of Computer architecture, system attributes to performance, Multi processors and multi computers, Multi-vector and SIMD computers. Parallelism in Programming, conditions for Parallelism, Program Partitioning and Scheduling-program flow Mechanisms, Speed up performance laws, Amdahl's law, Gustafson's law.
Unit-II
Memory Systems and Buses: Memory hierarchy, cache and shared memory concepts, Cache memory organization, cache addressing models, Aliasing problem in cache, cache memory mapping techniques, Shared memory organization, Interleaved memory organization. **Advanced Processors:** Instruction set architectures-CISC and RISC scalar processors, Super scalar processors, VLIW architecture, Multivector and SIMD computers, Vector processing principles, Inter processor communication.
Unit-III
Multi-Processor and Multi Computers: Multiprocessor system interconnects- Cross bar switch, Multiport memory, Hot spot problem, Message passing mechanisms, Pipelined processors, Linear pipeline, on linear pipeline, Instruction pipeline design, Arithmetic pipeline design.
Unit-IV
Data Flow Computers and VLSI Computations: Data flow computer architectures-Static, Dynamic, VLSI Computing Structures, Systolic array architecture, mapping algorithms into systolic arrays, Reconfigurable processor array-VLSI matrix arithmetic processors, VLSI arithmetic models, partitioned matrix algorithms, matrix arithmetic pipelines.

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Course Learning Outcomes (CLOs):

After the completion of the course, the student will be able to:

- Analyze the abstraction of various advanced architecture of a computer.
- Analyze the multi-processor architecture & connection mechanism.
- Work out the tradeoffs involved in designing a modern computer system.

Textbooks:

- John L. Hennessy and David A. Patterson, Computer Architecture: A Quantitative Approach, Morgan Kaufmann, 6th edition, 2017.
- Kai Hwang, Advanced Computer Architecture: Parallelism, Scalability, Programmability, McGraw-Hill, 3rd Ed, 2015.
- William Stallings, Computer Organization and Architecture, Prentice Hall, 10th edition, 2015.
- Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Computer Organization, McGraw Hill, 5th Ed, 2014.

Reference Books:

- Patterson, J.L. Hennessy, Computer Organization and Design: The Hardware/Software Interface, Morgan Kaufmann, 5th edition, 2013, ISBN-13:9780124078864
- Andrew S. Tanenbaum, Structured Computer Organization, Prentice Hall, 6th edition, 2012, ISBN: 978-0132916523.
- C. Hamacher, Z. Vranesic and S. Zaky, Computer Organization, McGraw-Hill, 5th edition,2002, ISBN: 0072320869.

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CSPE-612(ii) Mobile Computing and Wireless Networks							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
3	1	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:
Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questions in all, i.e. one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus.

Course Objectives:

- To identify the basics problems, strengths and current trends of mobile computing.

Unit-I
Introduction: issues in mobile computing, overview of wireless telephony: cellular concept, GSM, channel structure, location management: HLR-VLR, hierarchical, handoffs, channel allocation in cellular systems, CDMA, GPRS. **Wireless LAN Overview:** MAC issues, IEEE 802.11, Blue Tooth, Wireless multiple access protocols, TCP over wireless, Wireless applications.
Unit-II
Mobile IP: WAP Architecture, protocol stack, application environment, applications. Data management issues, data replication for mobile computers, adaptive clustering for mobile wireless networks. **Introduction to Adhoc networks:** definition, characteristics, applications. Characteristics of Wireless channel, Adhoc Mobility Models: - Indoor and outdoor models.
Unit-III
MAC Protocols: design issues, goals, and classification. Contention based protocols-with reservation, scheduling algorithms, protocols using directional antennas. IEEE standards: 802.11a, 802.11b, 802.11g, 802.15.
Unit-IV
Routing: Proactive Vs reactive routing, Unicast routing algorithms, Multicast routing algorithms, hybrid routing algorithm, Energy aware routing algorithm, Hierarchical Routing, **End-End Delivery and Security Transport layer:** Issues in designing-Transport layer classification, adhoc transport protocols.

Course Learning Outcomes (CLOs):

- The students will be able to understand the interface of mobile computing systems to hardware and networks.
- Design applications on mobile computing systems interacting with servers and database systems.

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Textbooks:

- Frank Adelstein, S.K.S. Gupta, Golden G. Richard III, and Loren Schwiebert, "Fundamentals of Mobile andPervasive Computing", McGraw-Hill Professional.
- David Taniar, "Mobile Computing: Concepts, Methodologies, Tools, and Applications".

Reference Books:

- Feng Zhao, Leonidas Guibas "Wireless Sensor Networks-An Information Processing Approach". Morgan Kauffman.
- Siva-RAM-Murthy, Ad-Hoc Wireless Networks - Architectures and Protocols, Addison-Wesley.

CSPE-612(iii) Cloud Computing							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
3	1	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:
Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questions in all, i.e. one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus.

Course Objectives:
- To provide an in-depth and comprehensive knowledge of the Cloud Computing fundamental issues, technologies, applications and implementations.
- To motivate students to do programming and experiment with the various cloud computing environments
- To expose the students to the frontier areas of Cloud Computing.
- To shed light on the Security issues in Cloud Computing.

Unit-I
Basic Concepts: Cloud Computing Overview, Origins of CC, Cloud components, Essential characteristics, On-demand self-service, Broad network access, Location independent resource pooling, Rapid elasticity, Measured service, Comparing cloud providers with traditional IT service providers, Roots of cloud computing.
Unit-II
Cloud Insights: Architectural influences, High-performance computing, Utility and Enterprise grid computing, Cloud scenarios, Benefits, scalability, simplicity, vendors, security, Limitations Sensitive information, Application development security level of third party, security benefits, Regularity issues, Government policies.
Unit-III
Cloud Architecture- Layers and Models: Layers in cloud architecture, Software as a Service (SaaS), features of SaaS and benefits, Platform as a Service (PaaS), features of PaaS and benefits, Infrastructure as a Service (IaaS), features of IaaS and benefits, Service providers, challenges and risks in cloud adoption. Cloud deployment model: Public clouds, Private clouds, Community clouds, Hybrid clouds, Advantages of Cloud computing.
Unit-IV
Cloud Programming and Software Environments: Parallel and Distributed Programming paradigms, Programming on Amazon AWS and Microsoft Azure, Programming support of Google App Engine, Emerging Cloud software Environment, Cloud Access: authentication, authorization and accounting, Reliability and fault-tolerance, security, privacy policy and compliance, federation, interoperability and standards.

Course Learning Outcomes (CLOs): After the completion of the course, the student will be able to:

- Articulate the main concepts, key technologies, strengths, and limitations of cloud computing and the possible applications for state-of-the-art cloud computing

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- Identify the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS, public cloud, private cloud, hybrid cloud, etc.
- Provide the appropriate cloud computing solutions and recommendations according to the applications used.
- Explain the core issues of cloud computing such as security, privacy, and interoperability.

TEXT BOOK:

- Essentials of cloud Computing: K. Chandrasekhran, CRC press, 2014
- Kai Hwang, Geoffrey C. Fox and Jack J. Dongarra, "Distributed and cloud computing from Parallel Processing to the Internet of Things", Morgan Kaufmann, Elsevier – 2012.
- Cloud computing a practical approach - Anthony T. Velte, Toby J. Velte Robert Elsenpeter, TATA McGraw- Hill, New Delhi – 2010.
- Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online - Michael Miller - Que 2008.

REFERENCE BOOKS:

- Cloud Computing: Principles and Paradigms by Rajkumar Buyya, James Broberg and Andrzej M. Goscinski, Wiley, 2011.
- Distributed and Cloud Computing, Kai Hwang, Geoffery C. Fox, Jack J. Dongarra, Elsevier, 2012.
- Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance, Tim Mather, Subra Kumaraswamy, Shahed Latif, O'Reilly, SPD, rp 2011.
- Cloud computing for dummies- Judith Hurwitz, Robin Bloor, Marcia Kaufman, Fern Halper, Wiley Publishing, Inc, 2010.
- Tim Mather, Subra Kumaraswamy, and Shahed Latif, Cloud Security and Privacy An Enterprise Perspective on Risks and Compliance, O'Reilly 2009.

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Capstone Project-I Report

on

TITLE

Submitted in partial fulfilment of the requirement for the award of the degree of

BACHELOR OF TECHNOLOGY

IN

COMPUTER SCIENCE & ENGINEERING

Submitted by:

Student Name **University Roll No.**

Under the Mentorship of

Mentor Name

Designation

Department of Computer Science and Engineering

Himachal Pradesh Technical University

Main Campus, at Daruhi. Hamirpur

(Session Year)

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CANDIDATE'S DECLARATION

I hereby certify that the work which is being presented in the project report entitled **"Title of the project"** in partial fulfillment of the requirements for the award of the Degree of Bachelor of Technology in Computer Science and Engineering of the Graphic Era (Deemed to be University), Dehradun shall be carried out by the under the mentorship of **Mentor Name, Designation**, Department of Computer Science and Engineering, Himachal Pradesh Technical University, Hamirpur.

Name:

University Roll no:

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Table of Contents

Chapter 1

Introduction

(2 to 3 pages)

In the following sections, a brief introduction and the problem statement for the work has been included.

1.1 Introduction

As estimated by John et al. in [1], ……..The detailed review of related techniques has been given in [2, 3].

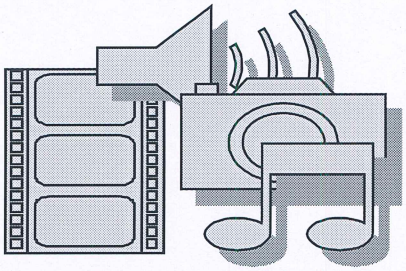

Figure 1.1 Wrapper method for feature selection

Chapter 2

Literature Survey

(2 to 3 pages)

In this chapter some of the major existing work in these areas has been reviewed.

Chapter 3

Methodology

Explain your methodology using phrases, flowcharts, detailed diagrams, etc.

(2 to 3 pages)

Chapter 4

Result and Discussion

This section will contain all your results from the above methodology used.

The result could be graphs, diagrams, tables, matrices, etc.

Chapter 5

Conclusion and Future Work

This section will contain conclusion of your work. Further contains vision and ideas about future methods or new solution to your current problem statement.

References

[1] N. K. Kanhere and S. T. Birchfied, "Real-time incremental segmentation and tracking of vehicles at low camera angles using stable features," *IEEE Trans. Intell. Transp. Syst.*, vol. 9, no. 1, pp.148-160, March 2008 **(Example : Journal papers)**

[2] K. Onoguchi, "Moving object detection using a cross correlation between a short accumulated histogram and a long accumulated histogram", Proc. 18th Int. Conf. on Pattern Recognition, Hong Kong, August 20 - 24, 2006, vol. 4, pp. 896 – 899 **(Example : Conference papers)**

[3] T. H. Cormen, C. E. Leiserson, R. L. Rivest and C. Stein, "Introduction to Algorithms", 2nd ed., The MIT Press, McGraw-Hill Book Company, 2001 **(Example : Text Book/ Magazine)**

[4] Open Source Computer Vision (OpanCV) [Online]. Accessed on 21st April 2022: http://opencv.willowgarage.com/wiki/ **(Example : Website)**

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