HERITAGE INSTITUTE OF TECHNOLOGY

(An Autonomous Institution affiliated to MAKAUT, West Bengal)

DEPARTMENT

OF

INFORMATION TECHNOLOGY

B.TECH. PROGRAMME

Curriculum and Detailed Syllabus

Release Version 1: JULY 2023

Release Version 2: JUNE 2024

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Preamble

The curriculum for the B. Tech. in Information Technology program has been modified as per the guidelines of AICTE and MAKAUT, and considering the new education policy (NEP) under Academic Regulation 2022 from the academic session 2023 - 2024. In addition, this outcome-based curriculum (OBC) is created with a choice-based credit system (CBCS) which enables students to develop professional competency through multidisciplinary approach that satisfies the requirements of industry, academics and the different accreditation bodies like NBA and NAAC. Courses such as Cloud Computing, Mobile Computing, Block Chain Technology, Internet of Things, Design Thinking and Idea Lab etc. are included in the syllabus keeping in mind the industry demand as well as the suggestions given by the experts in recent BOS meetings. Basic mathematical courses like Discrete Mathematics, Algebraic Structures, Linear Algebra and Statistics and Information Theory are included to strengthen students' mathematical skills that enable them to learn latest developments of Information Technology and be more innovative. Students are being motivated to select and study MOOC subjects of their choice towards attaining the degree with honors. Apart from this, the course code is now changed from 4 letters to 3 letters from the session 2023 – 2024 as per the suggestions from the office of the Controller of Examinations. This will help to distinguish the new courses from the old ones. In accordance with this, the curriculum and syllabi are revised in a structured manner by implementing feedback mechanism on Curriculum from various stakeholders including Academic experts from Institute of National repute, potential Employers, Alumni and Parents.

Institutional Vision & Mission

VISION:

To prepare dynamic and caring citizens to meet the challenges of global society while retaining their traditional values.

MISSION:

- To prepare students with strong foundation in their disciplines and other areas of learning.
- To provide an environment for critical and innovative thinking, and to encourage life-long learning.
- To develop entrepreneurial and professional skills.
- To promote research and developmental activities and interaction with industry.
- To inculcate leadership qualities for serving the society.

Departmental Vision & Mission

VISION:

To serve our nation by becoming a recognized hub of academic excellence focused on the career of the students and to develop workforce through partnership with reputed industries and academic communities.

MISSION:

M1: To provide quality technical education for the employment and work force development by partnering with industries in particular and the communities in general.

M2: To strive for students' achievement and success, preparing them for life and leadership.

M3: To build quality students through complete personality development enabling them to meet the global challenges.

Program Educational Objectives (PEOs) of B.Tech. in Information Technology Programme

Graduates of the B. Tech Programme in Information Technology at Heritage Institute of Technology are expected to achieve the following objectives after 4 years of graduation:

PEO1. Establish themselves as practicing professionals in multidisciplinary projects

PEO2. Excel in academia by achieving highest degree available in the academic discipline and making significant contribution in research and development

PEO3. Adapt themselves with latest developments in the discipline to survive and excel in the dynamic world of Information Technology.

PEO4. Develop leadership skill and incorporate ethics, teamwork with effective communication & time management for workplace success

Program Outcomes (POs)

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

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

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

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

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

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

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

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

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

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

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

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

Program Specific Outcomes (PSOs) of B.Tech. in IT Programme

PSO1. Ability to analyze, design, develop and synthesize data and technical concepts and deliver efficient solutions for emerging challenges of society and industry.

PSO2. Build a sense of competence to work in teams for pursuing successful professional career.

PSO3. Explore the field of information technology and its latest trends, to pursue higher studies, research & development activities and entrepreneurship.

Credit Summary for B Tech Programme in IT with effect from 2023-2024

Sl. No.	Course Type	IT
1.	Humanities and Social Sciences including Management Courses	12
2.	Basic Science Courses	24
3.	Engineering Science Courses including Workshop, Drawing, Basics of Electrical / Mechanical / Computer, etc.	27.5
4.	Professional Core Courses	58.5
5.	Professional Elective Courses relevant to chosen Specialization / Branch	12
6.	Open Subjects – Electives from other Technical and/or Emerging Subjects	12
7.	Project Work, Seminar and Internship in industry or elsewhere	17
8.	Mandatory Courses (Non-credit) [Environmental Sciences, Induction Program, Indian Constitution, Essence of Indian Traditional Knowledge]	4 NON-CREDIT SUBJECTS
	Total	**163**

Definition of Credit (as per National Credit Framework 2022):

- Total notional learning hours = 1200 Hours/ Year
- Minimum credits to be earned = 40/ Year
- 1 Credit = 30 notional learning hours

Range of Credits (as per AICTE):

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

Curriculum

1st Year 1st Semester

A. Theory							
Sl.	Code	Subject	Contacts Periods/ Week				Credit Points
			L	T	P	Total	
1	PHY1001	Physics-I	3	0	0	3	3
2	MTH1101	Mathematics-I	3	1	0	4	4
3	ECE1001	Introduction to Electronics Devices & Circuits	3	0	0	3	3
4	HUM1002	Universal Human Values and Professional Ethics	3	0	0	3	3
Total Theory			**12**	**1**	**0**	**13**	**13**
B. Practical							
1	PHY1051	Physics-I Lab	0	0	2	2	1
2	ECE1051	Introduction to Electronics Devices & Circuits Lab	0	0	2	2	1
3	MEC1051	Workshop / Manufacturing Practices	1	0	3	4	2.5
4	MEC1052	Engineering Graphics & Design	1	0	3	4	2.5
Total Practical			**2**	**0**	**10**	**12**	**7**
Total of Semester			**14**	**1**	**10**	**25**	**20**

1st Year 2nd Semester

A. Theory							
Sl.	Code	Subject	Contacts Periods/ Week				Credit Points
			L	T	P	Total	
1	CHM1001	Chemistry-I	3	0	0	3	3
2	MTH1201	Mathematics-II	3	1	0	4	4
3	CSE1001	Programming for Problem Solving	4	0	0	4	4
4	ELE1001	Basic Electrical Engineering	3	1	0	4	4
5	HUM1001	English for Technical Writing	2	0	0	2	2
Total Theory			**15**	**2**	**0**	**17**	**17**
B. Practical							
1	CHM1051	Chemistry-I Lab	0	0	2	2	1
2	CSE1051	Programming for Problem Solving Lab	0	0	3	3	1.5
3	ELE1051	Basic Electrical Engineering Laboratory	0	0	2	2	1
4	HUM1051	English for Technical Writing Laboratory	0	0	2	2	1
Total Practical			**0**	**0**	**9**	**9**	**4.5**
Total of Semester			**15**	**2**	**9**	**26**	**21.5**

2nd Year 1st Semester

A. Theory							
Sl.	**Code**	**Subject**	**Contacts Periods/ Week**				**Credit Points**
			L	**T**	**P**	**Total**	
1	MTH2103	Discrete Mathematics	4	0	0	4	4
2	AEI2105	Microprocessor & Microcontroller	3	0	0	3	3
3	ECE2002	Digital Circuit Design	3	0	0	3	3
4	INF2101	Fundamentals of Data Structure and Algorithms	4	0	0	4	4
5	INF2102	Computer Organization and Architecture	3	0	0	3	3
6	EVS2016	Environmental Sciences	2	0	0	2	0
Total Theory			**19**	**0**	**0**	**19**	**17**
B. Practical							
1	AEI2155	Microprocessor & Microcontroller Lab	0	0	2	2	1
2	ECE2052	Digital Circuit Design Lab	0	0	2	2	1
3	INF2151	Fundamentals of Data Structure and Algorithms Laboratory	0	0	3	3	1.5
4	INF2152	Computer Organization and Architecture Laboratory	0	0	3	3	1.5
Total Practical			**0**	**0**	**10**	**10**	**5**
Total of Semester			**19**	**0**	**10**	**29**	**22**

2nd Year 2nd Semester

A. Theory							
Sl.	**Code**	**Subject**	**Contacts Periods/ Week**				**Credit Points**
			L	**T**	**P**	**Total**	
1	MTH2201	Algebraic Structures	4	0	0	4	4
2	INF2201	Object Oriented Programming	3	0	0	3	3
3	INF2202	Design and Analysis of Algorithms	4	0	0	4	4
4	INF2203	Database Management Systems	4	0	0	4	4
5	INF2204	Computer Networks	3	0	0	3	3
Total Theory			**18**	**0**	**0**	**18**	**18**
B. Practical							
1	INF2251	Object Oriented Programming Laboratory	0	0	3	3	1.5
2	INF2252	Design and Analysis of Algorithms Laboratory	0	0	3	3	1.5
3	INF2253	Database Management Systems Laboratory	0	0	3	3	1.5
4	INF2254	Computer Networks Laboratory	0	0	3	3	1.5
5	INF2255	Idea and Design Thinking Laboratory (IT)	0	0	2	2	1
Total Practical			**0**	**0**	**14**	**14**	**7**
Total of Semester			**18**	**0**	**14**	**32**	**25**

3rd Year 1st Semester

A. Theory							
Sl.	Code	Subject	Contacts Periods/ Week				Credit Points
			L	T	P	Total	
1	INF3101	Advanced Java and Web Technology	3	0	0	3	3
2	INF3102	Machine Learning	3	0	0	3	3
3	INF3103	Operating Systems	3	0	0	3	3
4	INF3104	Formal Language and Automata Theory	4	0	0	4	4
5	INF3131 - INF3133	Professional Elective-I	3	0	0	3	3
	INF3131 INF3132 INF3133	Computer Graphics Distributed Database Management Systems Cyber Security					
6	INC3106	Indian Constitution And Civil Society	2	0	0	2	0
7	AEI3122 - MTH3122	Open Elective-I	3	0	0	3	3
	AEI3122 AEI3123 ECE3123 ECE3124 ELE3121 MTH3121 MTH3122	Fundamentals of Sensors and Transducers Optical Instrumentation Error Control Coding for Secure Data Transmission Introduction To VLSI Design Network Analysis Linear Algebra Statistics and Information Theory					
		Total Theory	**21**	**0**	**0**	**21**	**19**
B. Practical							
1	INF3151	Advanced Java and Web Technology Laboratory	0	0	3	3	1.5
2	INF3152	Machine Learning Laboratory	0	0	3	3	1.5
3	INF3153	Operating Systems Laboratory	0	0	3	3	1.5
		Total Practical	**0**	**0**	**9**	**9**	**4.5**
		Total of Semester	**21**	**0**	**9**	**30**	**23.5**

3rd Year 2nd Semester

Sl.	Code	Subject	Contacts Periods/ Week				Credit Points
			L	T	P	Total	
A. Theory							
1	HUM3201	Economics for Engineers	3	0	0	3	3
2	INF3201	Software Engineering	3	0	0	3	3
3	INF3202	Cryptography and Network Security	4	0	0	4	4
4	INF3231 - INF3235	Professional Elective-II	3	0	0	3	3
	INF3231 INF3232 INF3233 INF3234 INF3235	Multimedia Technology and Applications Big Data Analytics Compiler Design Digital Image Processing Artificial Intelligence					
6	INF3241 - INF3245	Professional Elective-III	3	0	0	3	3
	INF3241 INF3242 INF3243 INF3244 INF3245	Internet Technology Distributed Computing Pattern Recognition Blockchain Technology Data Science					
7	CSE3222 - BTC3225	Open Elective-II	2	0	2	4	3
	CSE3222 BTC3223 BTC3224 BTC3225	Cloud Computing with AWS Introduction to Biology Biopolymer Computational Biology					
Total Theory			**18**	**0**	**2**	**20**	**19**
B. Practical							
1	INF3251	Software Engineering Laboratory	0	0	3	3	1.5
2	INF3252	Industry Competence Laboratory	0	0	3	3	1.5
Total Practical			**0**	**0**	**6**	**6**	**3**
C. Sessional							
1	INF3293	Term Paper and Seminar	0	0	4	4	2
Total Sessional			**0**	**0**	**4**	**4**	**2**
~~**Total of Semester**~~			~~**18**~~	~~**0**~~	~~**12**~~	~~**30**~~	~~**24**~~

4th Year 1st Semester

A. Theory							
Sl.	Code	Subject	Contacts Periods/ Week				Credit Points
			L	T	P	Total	
1	HUM4101	Principles of Management	3	0	0	3	3
2	INF4131- INF4134	Professional Elective-IV	3	0	0	3	3
	INF4131 INF4132 INF4133 INF4134	Introduction to IOT Mobile Computing Real Time Systems Quantum Computing					
3	CSE4122- ECE4124	Open Elective-III	3	0	0	3	3
	CSE4122 ECE4121 ECE4122 ECE4123 ECE4124	DevOps Principles of Radar Evolution of Mobile Communication: 1G to 5G Introduction to Software Defined Radio Ad Hoc Wireless Networks					
4	****	Open Elective-IV	3	0	0	3	3
Total Theory			**12**	**0**	**0**	**12**	**12**
B. Sessional							
1	INF4191	Industrial Training / Internship	-	-	-	-	2
2	INF4195	Project-I	0	0	8	8	4
Total Sessional			**0**	**0**	8	8	**6**
Total of Semester			**12**	**0**	**8**	**20**	**18**

4th Year 2nd Semester

Sl.	Code	Subject	Contacts Periods/ Week				Credit Points
			L	T	P	Total	
1	INF4295	Project-II	0	0	14	14	7
2	INF4297	Comprehensive Viva-voce	-	-	-	-	2
Total Sessional			**0**	**0**	**14**	**14**	**9**
Total of Semester			**0**	**0**	**14**	**14**	**9**

Open Electives to be offered by Information Technology Department for Non-Departmental Students

Sl.	Semester	Paper Code	Course Title	Contact Hours / Week				Credit Points
				L	T	P	Total	
1	6th	INF3221	Fundamentals of Cryptography	3	0	0	3	3
2	7th	INF4121	Fundamentals of Cloud Computing	3	0	0	3	3

DETAILED SYLLABUS

1st Year 1st Semester

Course Title: Physics-I					
Course Code: PHY1001					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	0	0	3	3

Course Outcomes:

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

PHY1001.1. Understanding physical systems in terms of their modelling of time evolution.

PHY1001.2. Comprehending wave interpretation of natural phenomena and implications of allied observations.

PHY1001.3. Understanding theoretical backgrounds associated to some experiments based on wave phenomena.

PHY1001.4. Grasping an analytic view of micro and macroscopic world.

PHY1001.5. Accessing the knowledge of the behaviour of a particle under the influence of different potential.

PHY1001.6. Understanding conservative systems based on their particle and wave nature.

Module I: [9 Hours]

Central Forces:

Plane-polar coordinate system---velocity and acceleration of a particle---trajectory under central force---conservation principle---Kepler's laws --- Qualitative discussion relating to effective potential.

Module II: [9 Hours]

Oscillation:

Constitutive equation of damping---conditions for large, critical (qualitative discussion) and weak damping---relaxation time, logarithmic decrement, energy decay (qualitative discussion) --- Forced oscillation --- transient and steady state --- Amplitude and velocity resonance --- quality factor (definition only) --- series LCR circuit with AC source.

Module III: [9 Hours]

Optics:

Light as an electromagnetic wave --- Principle of Superposition --- Coherent and Incoherent waves --- Interference by Division of Amplitude (thin films, Newton's rings).

Polarization – Brief quantitative description of Plane Polarized, Circularly Polarized, and Elliptically Polarized light --- Natural or Unpolarized light --- Creation of Plane polarized light from Natural light --- Malus's law --- Brewster's law --- Creation of Circular and Elliptically Polarized light using Plane Polarized light and Birefringent crystals --- Retardation Plates.

Module IV: [9 Hours]

Quantum Mechanics:

An informal discussion from Planck to de Broglie as the historical context of quantum mechanics---Quantum Mechanics of a particle—operator eigenvalue problem---commutation relations---momentum operator--- time dependent/time independent Schrodinger equation---wave function—stationary states---probability density---probability current density---normalization--- expectation value----uncertainty (qualitative)---particle in a one dimensional box.

Books

1. Theoretical Mechanics - M R Spiegel (Schaum Series) McGrow-Hill Book Company
2. Classical Mechanics - N C Rana and P S Joag Tata- McGrow-Hill Publishing Company Limited
3. Vibrations and Waves - A P French, W W Norton and Company
4. The Physics of Waves and Oscillations - N K Bajaj, Tata- McGrow-Hill Publishing Company Limited
5. Optics - A Ghatak, Tata McGraw-Hill Publishing Company Limited
6. Optics - E. Hecht, Addison Wesley
7. Fundamentals of Optics - F A Jenkins and H E White, McGrow-Hill Higher Education
8. Atomic Physics (Modern Physics) - S N Ghosal, S. Chand and Company
9. Practical Quantum Mechanics - S Flugge, Springer (Reprint of the 1994 Edition)
10. Concepts of Modern Physics - A Baiser, Tata McGraw-Hill Publishing Company Limited

Course Title: Mathematics-I					
Course Code: MTH1101					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	1	0	4	4

Course Outcome:

After successfully completing this course the students will be able to:

MTH1101.1. Apply the concept of rank of matrices to find the solution of a system of linear simultaneous equations

MTH1101.2. Develop the concept of eigen values and eigen vectors

MTH1101.3. Combine the concepts of gradient, curl, divergence, directional derivatives, line integrals, surface integrals and volume integrals

MTH1101.4. Analyze the nature of sequence and infinite series

MTH1101.5. Choose proper method for finding solution of a specific differential equation

MTH1101.6. Describe the concept of differentiation and integration for functions of several variables with their applications in vector calculus

Module I: [10L]

Matrix:

Inverse and rank of a matrix; Elementary row and column operations over a matrix; System of linear equations and its consistency; Symmetric, skew symmetric and orthogonal matrices; Determinants; Eigen values and eigen vectors; Diagonalization of matrices; Cayley Hamilton theorem; Orthogonal transformation.

Module II: [10L]

Vector Calculus:

Vector function of a scalar variable, Differentiation of a vector function, Scalar and vector point functions, Gradient of a scalar point function, divergence and curl of a vector point function, Directional derivative, Related problems on these topics.

Infinite Series:

Convergence of sequence and series; Tests for conver gence: Comparison test, Cauchy's Root test, D' Alembert's Ratio test (statements and related problems on these tests), Raabe's test; Alternating series; Leibnitz's Test (statement, definition); Absolute convergence and Conditional convergence.

Module III: [10L]

First order ordinary differential equations:

Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.

Ordinary differential equations of higher orders:

General linear ODE of order two with constant coefficients, C.F. & P.I., D-operator methods, Method of variation of parameters, Cauchy-Euler equations.

Module IV: [10L]

Calculus of functions of several variables:

Introduction to functions of several variables with examples, Knowledge of limit and continuity, Determination of partial derivatives of higher orders with examples, Homogeneous functions and Euler's theorem and related problems up to three variables.

Multiple Integration:

Concept of line integrals, Double and triple integrals. Green's Theorem, Stoke's Theorem and Gauss Divergence Theorem.

Text Books

1. Higher Engineering Mathematics- B.S. Grewal, Khanna Publishers, 2000
2. Advanced Engineering Mathematics- E. Kreyszig, John Wiley & Sons, 2006
3. Higher Engineering Mathematics- Ramana B.V., Tata McGraw Hill New Delhi, 11th Reprint, 2010

Reference Books

1. Differential Equations - G.F. Simmons and S.G. Krantz, McGraw Hill, 2007.
2. Vector Analysis (Schaum's outline series) - M. R. Spiegel, Seymour Lipschutz, Dennis Spellman (McGraw Hill Education).
3. Engineering Mathematics - S. S. Sastry (PHI).
4. Advanced Engineering Mathematics - M.C. Potter, J.L. Goldberg and E.F. Abonfadel (OUP), Indian Edition.
5. Linear Algebra (Schaum's outline series) - Seymour Lipschutz, Marc Lipson (McGraw Hill Education).
6. Mathematical Methods for Physics and Engineering - K. F. Riley, M. P. Hobson, S. J. Bence, Cambridge University Press, 23-Mar-2006.
7. Differential Equations - S. L. Ross, Wiley India, 1984.

Course Title: Introduction to Electronics Devices and Circuits					
Course Code: ECE1001					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	0	0	3	3

Course Outcome:

After successfully completing this course the students will be able to:

ECE1001.1: Categorize different semiconductor materials based on their energy bands and analyze the change in characteristics of those materials due to different types of doping.

ECE1001.2: Describe energy band of P-N Junction devices and solve problems related to P-N Junction Diode.

ECE1001.3: Design different application specific circuits using diodes.

ECE1001.4: Analyze various biasing configurations of Bipolar Junction Transistor.

ECE1001.5: Categorize different field-effect transistors and analyze their behavior.

ECE1001.6: Design and implement various practical electronic circuits.

Module I: [10L]

Basic Semiconductor Physics:

Crystalline materials, energy band theory, Conductors, Semiconductors and Insulators, Concept of Fermi energy level, intrinsic and extrinsic semiconductors, mass action law, drift and diffusion currents in semiconductor, Einstein relation.

Diodes and Diode Circuits:

Formation of p-n junction, energy band diagram, forward & reverse biased configurations, V-I characteristics, DC load line, breakdown mechanisms - Zener and avalanche breakdown, voltage regulation using Zener diode.

Rectifier circuits: half wave & full wave rectifiers: ripple factor, rectification efficiency, rectifier output without and with filters. Light emitting diode.

Module II: [8L]

Bipolar Junction Transistors (BJT):

pnp & npn BJT structures, different operating modes of BJT, current components in BJT, dc current gains in CE & CB configurations and their interrelation, input output V-I characteristics of CE & CB configurations.

Concept of Biasing: DC load line, Q-point, basic concept of amplification using BJT.

Module III: [9L]

Field Effect Transistors (FET):

Classification of FET, basic structure and operation of Junction Field Effect Transistor (n-channel) along with its V-I characteristics.

Metal Oxide Semiconductor Field Effect Transistor (MOSFET): Enhancement & depletion type MOSFETs (for both n & p channel devices), drain & transfer characteristics.

Module IV [9L]

Feedback in amplifiers:

Concept of feedback, different feedback topologies using block diagram only, effects of negative feedback (qualitative), Barkhausen criteria for sustained oscillation.

Operational Amplifier:

Usefulness of differential amplifier over single ended amplifier, ideal OPAMP characteristics, transfer characteristics of OPAMP, CMRR, slew rate, offset error voltages and current, concept of virtual ground

Basic circuits using OPAMP: Comparator, inverting and non-inverting amplifiers, voltage follower, adder, subtractor, integrator, differentiator.

Text Books

1. Electronic Devices & Circuit Theory - Boylestad & Nashelsky
2. Op Amps and Linear IC's - R.A Gayakwad, PHI
3. Electronics Fundamentals and Applications - D. Chattopadhyay, P. C Rakshit

Reference Books

1. Microelectronics Engineering - Adel S. Sedra, Kenneth Carless Smith.
2. Integrated Electronics - Millman & Halkias
3. Electronics Devices & Circuits - Salivahanan.
4. Electronic Principle - Albert Paul Malvino

Course Title: Universal Human Values and Professional Ethics					
Course Code: HUM1002					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	0	0	3	3

Course Outcome:

After successfully completing this course the students will be able to:

HUM1002.1**:** Appreciate the essential complementarily between 'values and 'skills' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.

HUM1002.2**:** Develop a Holistic perspective towards life and profession.

HUM1002.3**:** Develop a correct understanding of the Human reality and the rest of existence.

HUM1002.4**:** Appreciate the relationship of values in terms of ethical human conduct.

HUM1002.5**:** Understand the importance of trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.

HUM1002.6**:** Differentiate between the characteristics and activities of different orders and study the mutual fulfillment among them.

Module I:

Introduction to Value Education (6 hrs.)

Understanding Values: Historical perspective to the development of values and its importance for the integration and harmony of the self and body.

Understanding Human being as the Co-existence of the Self and the Body.

Exploring Harmony of Self with the Body.

Distinguishing between the Needs of the Self and the Body.

Understanding and appreciating basic human aspirations- Maslow's Hierarchy of Needs Theory.

Strategies, Methods to Fulfill the Basic Human Aspirations.

Continuous Happiness and Prosperity – the Basic Human Aspirations.

Module II:

Harmony in the Family and Society (10 hrs.)

The self as a social being starting with the family as the smallest unit—the process of socialization. Development of the self in relation to the society – Cooley's and Mead's theories of socialization. Self and Integrated personality-Morality, Courage and Integrity.

Conflict of interest at home and society and its resolution through the implementation of the Human Values.

Societal Values – Justice, Democracy and Rule of law.

Establishing harmony in the society with the help of ethical conduct based on values- Ethics of Rights and Duties, Ethics of care, Ethics justice and Fairness, Work Ethics and quality of life at work.

Value crisis- Disharmony in relationships, understanding harmony in the society. Solutions - Contribution of the individual in establishing harmony in the society. 'Trust' and 'Respect'--The Foundational Values in Relationship. Exploring the Feeling of Trust and Respect.

Module III:

Implications of the Holistic Understanding – A Look at Professional Ethics (10 hrs.)

Ethics and Ethical Values

Principles and Theories of Ethics--Consequential and non-consequential ethics, Utilitarianism, Kant's theory and other non-consequential perspectives.

Professional Ethics- Right understanding of Professional Ethics.

Canons of professional Ethics

Technology – various perspectives-its use, overuse and misuse.

Privacy, Data Security and Data Protection, Artificial Intelligence-Harmony or Disharmony, Misinformation, Deep Fake, Cyber- Crime - A Sociological Perspective.

Code of Ethics, Violation of Code of Ethics, Whistle Blowing, Institutionalising Ethics.

Vision for the Universal Human Order, Exploring Systems to fulfil Human Endeavours.

Module IV:

Harmony in the Nature/ Existence (10 hrs.)

Understanding Harmony in the Nature - Ecological Ethics.

Sustainable Development- Definition and Concept.

Strategies for Sustainable Development- Small is beautiful, Slow is Beautiful.

Sustainable Development--- The Modern Trends.

Sustainable Development Goals- Case Studies and Best Practices.

Exploring the Four Orders of Nature -Interconnectedness, Self-Regulation and Mutual Fulfilment among the Four Orders of Nature.

The Holistic Perception of Harmony in Existence.

Books

1. A Foundation Course in Human Values and Professional Ethics - R.R. Gaur, R. Asthana, G.P. Bagaria, Excel Books Pvt. Ltd. New Delhi.
2. Human Values - A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - Mohandas Karamchand Gandhi.
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews.

Course Title: Physics-I Lab					
Course Code: PHY1051					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	0	0	2	2	1

Course Outcome:

After successfully completing this course the students will be able to:

PHY1051.1**:** Applying practical knowledge using the experimental methods to correlate with the Physics theory.

PHY1051.2**:** Understanding the usage of electrical and optical systems for various measurements.

PHY1051.3**:** Applying the analytical techniques and graphical analysis to the experimental data.

PHY1051.4**:** Understanding measurement technology, usage of new instruments and real time applications in engineering studies.

PHY1051.5**:** Evaluating intellectual communication skills and discuss the basic principles of scientific concepts in a group.

Minimum of six experiments taking at least one from each of the following four groups:

Group I: Experiments in Optics

1. Determination of dispersive power of the material of a prism

2. Determination of wavelength of a monochromatic light by Newton's ring

3. Determination of wavelength of the given laser source by diffraction method

Group II: Electricity & Magnetism experiments

1. Determination of specific charge (e/m) of electron by J.J. Thompson's method.

2. Determination of dielectric constant of a given dielectric material.

3. Determination of Hall coefficient of a semiconductor by four probe method.

4. To study current voltage characteristics, load response, areal characteristic and spectral response of a photovoltaic solar cell.

5. Determination of Magnetic Field Measurement for a current carrying coil.

6. Determination of unknown resistance using Carey Foster's bridge

Group III: Experiments in Quantum Physics

1. Determination of Stefan-Boltzmann constant.

2. Determination of Planck constant using photocell.

3. Determination of Lande-g factor using Electron spin resonance spectrometer.

4. Determination of Rydberg constant by studying Hydrogen spectrum.

5. Determination of Band gap of semiconductor.

Group IV: Miscellaneous experiments

1. Determination of Young's modulus of elasticity of the material of a bar by the method of flexure

2. Determination of bending moment and shear force of a rectangular beam of uniform cross section

3. Determination of modulus of rigidity of the material of a rod by static method

4. Determination of rigidity modulus of the material of a wire by dynamic method

5. To determine the moment of inertia of a body about an axis passing through its centre of gravity and to determine the modulus of rigidity of the material of the suspended wire

6. Determination of coefficient of viscosity by Poiseulle's capillary flow method

Text Books

1. Advanced Practical Physics (Vol.1 and Vol.2) - B. Ghosh and K. G. Mazumdar.
2. Advanced Course in Practical Physics - D. Chattopadhyay and P. C. Rakshit.

Reference Books

1. Optics - Eugene Hecht, Pearson Education India Private Limited.
2. Introduction to Electrodynamics - David J. Griffiths, Pearson Education India Learning Private Limited.
3. Waves and Oscillations - N.K. Bajaj.
4. Principles of Physics - David Halliday, Robert Resnick Jearl Walker, 10ed, Wiley.
5. Electricity, Magnetism and Light - Wayne M. Saslow, Academic Press.
6. Classical Mechanics - Narayan Rana, Pramod Joag, McGraw Hill Education.
7. Introduction to Classical Mechanics - R Takwale, P Puranik, McGraw Hill Education.
8. Optics - Ghatak- McGraw Hill Education India Private Limited.
9. Refresher Course in B.Sc. Physics , Vol1 and Vol 2 - C. L. Arora.

Course Title: Introduction to Electronics Devices and Circuits Lab					
Course Code: ECE1051					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	0	0	2	2	1

Course Outcome:

After successfully completing this course the students will be able to:

ECE1051.1**:** Correlate theory with diode behavior.

ECE1051.2**:** Design and check rectifier operation with regulation etc.

ECE1051.3: Design different modes with BJT and FET and check the operations.

ECE1051.4: Design and study adder, integrator etc. with OP-AMPs.

List of Experiments

1. Familiarization with passive and active electronic components such as Resistors, Inductors, Capacitors, Diodes, Transistors (BJT) and electronic equipment like DC power supplies, multi-meters etc.
2. Familiarization with measuring and testing equipment like CRO, Signal generators etc.
3. Study of I-V characteristics of Junction diodes.
4. Study of I-V characteristics of Zener diodes.
5. Study of Half and Full wave rectifiers with Regulation and Ripple factors.
6. Study of I-V characteristics of BJTs in CB mode
7. Study of I-V characteristics of BJTs in CE mode
8. Study of I-V characteristics of Field Effect Transistors.
9. Determination of input-offset voltage, input bias current and Slew rate of OPAMPs.

10. Determination of Common-mode Rejection ratio, Bandwidth and Off-set null of OPAMPs.
11. Study of OPAMP circuits: Inverting and Non-inverting amplifiers, Adders, Integrators and Differentiators.

Books

1. Electronics Laboratory Primer - B Sasikala.

Course Title: Workshop/ Manufacturing Practices					
Course Code: MEC1051					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	1	0	3	4	2.5

Course Outcome:

After successfully completing this course the students will be able to:

MEC1051.1**:** Follow the various safety practices in workshop and personal protective elements.

MEC1051.2**:** Identify tools, work material and measuring instruments useful for fitting, carpentry and sheet metal practices.

MEC1051.3: Operate machine tools, components and processes to prepare jobs of specific shape and size.

MEC1051.4: Acquire knowledge of foundry process and casting of a product.

MEC1051.5: Perform welding, brazing and soldering processes.

MEC1051.6: Assemble a simple product.

Syllabus:

(i) Lectures & videos: (13 hours)

Detailed contents

1. Introduction on Workshop and familiarization with safety norms (**1 lecture**)
2. Carpentry and Fitting (**2 lectures**)
3. Sheet metal (**1 lecture**)
4. Metal casting (**1 lecture**)
5. Welding (arc welding & gas welding), brazing and soldering (**2 lectures**)
6. Manufacturing Methods- machining (Lathe, Shaping and Milling) **(4 lectures)**
7. Additive manufacturing **(1 lecture)**
8. Assembling of a product **(1 lecture)**

(ii) Workshop Practice: (39 hours)

1. Safety practices in workshop **(3 hours)**
2. Carpentry shop **(3 hours)**
3. Fitting shop **(6 hours)**
4. Foundry shop **(3 hours)**
5. Machine shop **(9 hours)**
6. Welding shop-Arc welding **(3 hours)**
7. Sheet metal shop and brazing **(6 hours)**
8. Soldering operation **(3 hours)**
9. Assembling of a product **(1 hours)**

Books

1. Elements of Workshop Technology - Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy. S.K.,Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
2. Manufacturing Engineering and Technology - Kalpakjian S. And Steven S. Schmid, 4th edition, Pearson Education India Edition, 2002.
3. Manufacturing Technology - I, Gowri P. Hariharan and A. Suresh Babu, Pearson Education, 2008.
4. Processes and Materials of Manufacture - Roy A. Lindberg, 4th edition, Prentice Hall India, 1998.
5. Manufacturing Technology - Rao P.N., Vol. I and Vol. II, Tata McGraw-Hill House, 2017.

Course Title: Engineering Graphics & Design					
Course Code: MEC1052					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	1	0	3	4	2.5

Course Outcome:

After successfully completing this course the students will be able to:

MEC1052.1**:** Visualize the basic concept of engineering drawing.

MEC1052.2**:** Use engineering drawing tools (conventional / modern tools).

MEC1052.3: Apply the various standards and symbols followed in engineering drawing.

MEC1052.4: Implement the concept of projections used in engineering graphics.

MEC1052.5: Relate the concept of sections to determine its true shape.

MEC1052.6: Execute the concept of isometric projections.

Syllabus:

Lecture Plan (13 L)

1. Importance and principles of engineering drawing [1 L]
2. Lettering [1 L]
3. Concepts of Scale, dimensioning and Conic sections [3 L]
4. Introduction to concept of projection (Projections of points, lines and surfaces) [3 L]
5. Definitions of different solids and their projections [1 L]
6. Section of solids and sectional view [1 L]
7. Isometric projection [1 L]
8. Introduction to CAD [1 L]
9. Viva-voce [1 L]

Detailed contents of Lab hours (39 hours)

Module I: Introduction to Engineering Drawing (3 hours)

Principles of Engineering Graphics and their significance, usage of Drawing instruments, lines, lettering & dimensioning, Conic sections like Ellipse (General method only); Involute; Scales – Plain, Diagonal.

Module II: Orthographic Projections (9 hours)

Principles of Orthographic Projections - Conventions - Projections of Points and lines inclined to both planes; Projections on Auxiliary Planes. Projection of lamina.

Module III: Projections of Regular Solids covering (6 hours)

Those axes inclined to both the Planes- Auxiliary Views.

Module IV: Sections and Sectional Views of Right Angular Solids (3 hours)

Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Sectional orthographic views of geometrical solids.

Module V: Isometric Projections (6 hours)

Principles of Isometric projection -Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions.

Module VI: **Overview of Computer Graphics (3 hours)**

Listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids.

Module VII: Customization & CAD Drawing, **(3 hours)**

Consisting of set up of the drawing page and the printer, including scale settings, setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles.

Module VIII: Annotations, layering & other functions covering, (3 hours)

Applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation.

Module IX: Demonstration of a simple team design project that illustrates (3 hours)

Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame.

Books

1. Elementary Engineering Drawing - Bhatt, N.D., Panchal V.M. & Ingle P. R. (2014), Charotan Publishing House.
2. Engineering Graphics - Narayana, K.L. and Kannaaiah, P, TMH.
3. Engineering Graphics - Lakshminarayanan, V. and Vaish Wanar, R.S, Jain Brothers.
4. Engineering Drawing and Computer Graphics - Shah, M.B. & Rana B.C. (2008), Pearson Education.
5. Engineering graphics - Agarwal B. & Agarwal C. M. (2012), TMH Publications.

1st Year 2nd Semester

Course Title: Chemistry-I					
Course Code: CHM1001					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	0	0	3	3

Course Outcome:

The subject code CHM-1001 corresponds to Chemistry Theory classes (**Chemistry-I**) for the first year B. Tech students, offered as Chemistry for Engineering and is common to all Branches of Engineering Disciplines. The course provides basic knowledge of theory and applications in the subjects like Thermodynamics, Quantum mechanics, Electrochemistry, & Energy conversion, Structure and reactivity of molecules. Spectroscopic techniques and their applications, Synthesis & use of Drug molecules.

After successfully completing this course the students will be able to:

CHM1001.1**:** Knowledge acquisition of bulk properties of materials and understanding of reaction processes using thermodynamic considerations.

CHM1001.2**:** Conception of energy conversion and its importance in clean energy scenario, the operating principles for batteries, fuel cells and the materials and reactions involved there in, their applications as sustainable energy devices, particularly in automobiles sectors to reduce environmental pollution.

CHM1001.3: Analytic view of microscopic chemistry in terms of atomic structure, molecular orbital and intermolecular forces to reinforce strong background on materials science and engineering.

CHM1001.4: Rationalize periodic trends of elements to explain various physico - chemical properties.

CHM1001.5: Understanding of the spectrum of electromagnetic radiation used for exciting different molecular energy levels in various spectroscopic techniques.

CHM1001.6: Knowledge of stereochemistry and conception of the mechanism of major chemical reactions involved in synthesis of drug molecules.

Syllabus

Module I: [9L]

Thermodynamics

The 1st and 2nd laws of thermodynamics and thermodynamic functions like free energy, work function and entropy; Carnot cycle, Joule-Thomson effect, Gibbs-Helmholtz equation; Chemical Potential, Gibbs- Duhem Equation and Clausius-Clapeyron Equation.

Electrochemical Cell

Generation of electromotive force in electrochemical cells and application of Nernst equation; Electrode potentials and the redox reactions; Cell configuration and half cell reactions; Standard Hydrogen Electrode, Reference electrode, evaluation of thermodynamic functions; Electrochemical corrosion. Electrochemical Energy Conversion: Primary & Secondary batteries, Fuel Cells.

Module II: [9L]

Molecular Structure

Molecular geometry, Hybridization, Ionic, dipolar and van Der Waals interactions; Molecular Orbital Theory and its application in diatomic molecule; Pi-molecular orbital of unsaturated system; Band structure of solids, intrinsic and extrinsic semiconductors and the role of doping on band structures.

Periodic Properties

Effective nuclear charge, penetration of orbitals; variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes; ionization energies, electron affinity and electro-negativity, polarizability, oxidation states, coordination numbers and geometries; hard-soft acid base theory.

Module III: [9L]

Atomic structure and Wave Mechanics

Brief outline of the atomic structure, wave particle duality, Heisenberg uncertainty principle; Introduction to quantum mechanics, Schrodinger wave equation for particle in one dimensional box.

Spectroscopic Techniques & Applications

Electromagnetic spectrum: Interaction of EMR with matter; Principle and applications of Fluorescence & Phosphorescence, UV-Visible, Infrared and NMR spectroscopy

Module IV: [9L]

Stereochemistry

Representations of 3- dimensional structures, structural isomers and stereo-isomers; configurations, symmetry and chirality; enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis.

Organic reactions and synthesis of drug molecules

Introduction to reaction mechanism: substitution, addition, elimination and oxidation, reduction reactions. Synthesis of commonly used drug molecules.

Text Books

1. Atkins' Physical Chemistry - P.W. Atkins (10th Edition).
2. Organic Chemistry - I. L. Finar, Vol-1 (6th Edition).
3. Engineering Chemistry - Jain & Jain (16th Edition).
4. Fundamental Concepts of Inorganic Chemistry - A. K. Das, (2nd Edition).
5. Engineering Chemistry-I - Gourkrishna Dasmohapatra, (3rd Edition).

Reference Books

1. General & Inorganic Chemistry - R. P. Sarkar.
2. Physical Chemistry - P. C. Rakshit, (7th Edition).
3. Organic Chemistry - Morrison & Boyd, (7th Edition).
4. Fundamentals of Molecular Spectroscopy - C.N. Banwell, (4th Edition).
5. Physical Chemistry - G. W. Castellan, (3rd Edition).
6. Basic Stereo chemistry of Organic Molecules - Subrata Sen Gupta, (1st Edition).

Course Title: Mathematics-II					
Course Code: MTH1201					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	1	0	4	4

Course Outcome:

After successfully completing this course the students will be able to:

MTH1201.1**:** Demonstrate the knowledge of probabilistic approaches to solve wide range of engineering problem.

MTH1201.2**:** Recognize probability distribution for discrete and continuous variables to quantify physical and engineering phenomenon.

MTH1201.3: Develop numerical techniques to obtain approximate solutions to mathematical problems where analytical solutions are not possible to evaluate.

MTH1201.4: Analyze certain physical problems that can be transformed in terms of graphs and trees and solving problems involving searching, sorting and such other algorithms.

MTH1201.5: Apply techniques of Laplace Transform and its inverse in various advanced engineering problems.

MTH1201.6: Interpret differential equations and reduce them to mere algebraic equations using Laplace Transform to solve easily.

Module I: [10L]

Basic Probability: Random experiment, Sample space and events, Classical and Axiomatic definition of probability, Addition and Multiplication law of probability, Conditional probability, Bayes' Theorem, Random variables, General discussion on discrete and continuous distributions, Expectation and Variance, Examples of special distribution: Binomial and Normal Distribution.

Module II: [10L]

Basic Numerical Methods: Solution of non-linear algebraic and transcendental equations: Bisection Method, Newton-Raphson Method, Regula-Falsi Method. Solution of linear system of equations: Gauss Elimination Method, Gauss-Seidel Method, LU Factorization Method, Matrix Inversion Method. Solution of Ordinary differential equations: Euler's Method, Modified Euler's Method, Runge-Kutta Method of 4th order.

Module III: [10L]

Basic Graph Theory: Graph, Digraph, Weighted graph, Connected and disconnected graphs, Complement of a graph, Regular graph, Complete graph, Sub-graph, Walk, Path, Circuit, Euler Graph, Cut sets and cut vertices, Matrix representation of a graph, Adjacency and incidence matrices of a graph, Graph isomorphism, Bipartite graph, Dijkstra's Algorithm for shortest path problem. Definition and properties of a Tree, Binary tree and its properties, Spanning tree of a graph, Minimal spanning tree, Determination of spanning trees using BFS and DFS algorithms, Determination of minimal spanning tree using Kruskal's and Prim's algorithms.

Module IV: [10L]

Laplace Transformation: Basic ideas of improper integrals, working knowledge of Beta and Gamma functions (convergence to be assumed) and their interrelations. Introduction to integral transformation, Functions of exponential order, Definition and existence of Laplace Transform(LT) (statement of initial and final value theorem only), LT of elementary functions, Properties of Laplace Transformations , Evaluation of sine , cosine and exponential integrals using LT, LT of periodic and step functions, Definition and properties of inverse LT, Convolution Theorem (statement only) and its application to the evaluation of inverse LT, Solution of linear ODEs with constant coefficients (initial value problem) using LT.

Text Books

1. Advanced Engineering Mathematics - E.Kreyszig, Wiley Publications.
2. Introductory methods of Numerical Analysis - S.S. Sastry, PHI learning.
3. Introduction to Graph Theory, D. B. West - Prentice-Hall of India.

Reference Books

1. Introduction to Probability and Statistics for Engineers and Scientists - S. Ross, Elsevier.
2. Engineering Mathematics, B.S. Grewal - S. Chand & Co.

Course Title: Programming for Problem Solving					
Course Code: CSE1001					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	4	0	0	4	4

Course Outcome:

After successfully completing this course the students will be able to:

CSE1001.1**:** Remember and understand the functionalities of the different hardware and software components present in a computer system, the standard representations of various types of data in a computer system.

CSE1001.2**:** Illustrate how a computer system with one way of representation can be converted to one another equivalent representation.

CSE1001.3: Construct flow charts for any arithmetic or logical problems in hand.

CSE1001.4: Remember and understand the C programming development environment, writing, compiling, debugging, linking and executing a C program using that development environment, basic syntax and semantics of C programming language and interpret the outcome of any given C program.

CSE1001.5: Use loop constructs, conditional branching, iteration, recursion to solve simple engineering problems.

CSE1001.6: Apply pointers, arrays, structures, files to formulate simple engineering problems.

Learning Objectives: Introduction to the concept of computer and computation and solving of problems using C as a programming language. Coverage of C will include basic concepts, arithmetic and logic, flow control, and data handling using arrays, structures, pointers and files.

Module I: [12L]

Fundamentals of Computer

History of Computers, Generations of Computers, Classification of Computers.

Basic Anatomy of Computer System, Primary & Secondary Memory, Processing Unit, Input & Output devices. Basic Concepts of Assembly language, High level language, Compiler and Assembler.

Binary & Allied number systems (decimal, octal and hexadecimal) with signed and unsigned numbers (using 1's and 2's complement) - their representation, conversion and arithmetic operations. Packed and unpacked BCD system, ASCII. IEEE-754 floating point representation (half- 16 bit, full- 32 bit, double- 64 bit).

Basic concepts of operating systems like MS WINDOWS, LINUX How to write algorithms & draw flow charts.

Module II: [12L]

Basic Concepts of C

C Fundamentals:

The C character set identifiers and keywords, data type & sizes, variable names, declaration, statements.

Operators & Expressions: Arithmetic operators, relational and logical operators, type, conversion, increment and decrement operators, bit wise operators, assignment operators and expressions, precedence and order of evaluation. Standard input and output, formatted output -- printf, formatted input scanf.

Flow of Control: Statement and blocks, if-else, switch-case, loops (while, for, do-while), break and continue, go to and labels.

Module III: [12L]

Program Structures in C

Basic of functions, function prototypes, functions returning values, functions not returning values. Storage classes - auto, external, static and register variables – comparison between them. Scope, longevity and visibility of variables. C preprocessor (macro, header files), command line arguments.

Arrays and Pointers: One dimensional arrays, pointers and functions – call by value and call by reference, array of arrays. Dynamic memory usage– using malloc(), calloc(), free(), realloc(). Array pointer duality.

String and character arrays; C library string functions and their use.

Module IV: [12L]

Data Handling in C

User defined data types and files:

Basic of structures; structures and functions; arrays of structures.

Files – text files only, modes of operation. File related functions – fopen(), fclose(), fscanf(), fprintf(), fgets(), fputs(), fseek(), ftell().

Text Books

1. Schaum's outline of Programming with C - Byron Gottfried.
2. Teach Yourself C - Herbert Schildt.
3. Programming in ANSI C - E Balagurusamy.

Reference Books

1. C: The Complete Reference - Herbert Schildt.
2. The C Programming Language - D. M. Ritchie, B.W. Kernighan.

Course Title: Basic Electrical Engineering					
Course Code: ELE1001					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	1	0	4	4

Course Outcome:

After successfully completing this course the students will be able to:

ELE1001.1**:** Analyse DC electrical circuits using KCL, KVL and network theorems like Superposition Theorem, Thevenin's Theorem, Norton's Theorem and Maximum Power Transfer Theorem.

ELE1001.2**:** Analyse DC Machines; Starters and speed control of DC motors.

ELE1001.3: Analyse magnetic circuits.

ELE1001.4: Analyse single and three phase AC circuits.

ELE1001.5: Analyse the operation of single-phase transformers.

ELE1001.6: Analyse the operation of three phase induction motors.

Module I: [11L]

DC Network Theorem: [6L]

Kirchhoff's law, Nodal analysis, Mesh analysis, Superposition theorem, Thevenin's theorem, Norton theorem, Maximum power transfer theorem, Star-Delta conversion.

Electromagnetism: [5L]

Review of magnetic flux, Force on current carrying conductors, Magnetic circuit analysis, Self and Mutual inductance, B-H loop, Hysteresis and Eddy current loss, Lifting power of magnet.

Module II: [10L]

AC single phase system:

Generation of alternating emf, Average value, RMS value, Form factor, Peak factor, representation of an alternating quantity by a phasor, phasor diagram, AC series, parallel and series-parallel circuits, Active power, Reactive power, Apparent power, power factor, Resonance in RLC series and parallel circuit.

Module III: [11L]

Three phase system: [4L]

Generation of three-phase AC power, Balanced three phase system, delta and star connection, relationship between line and phase quantities, phasor diagrams, power measurement by two wattmeter method.

DC Machines: [7L]

Construction, EMF equation, Principle of operation of DC generator, Open circuit characteristics, External characteristics, Principle of operation of DC motor, speed-torque characteristics of shunt and series machine, starting of DC motor, speed control of dc motor.

Module IV: [10L]

Transformer: [6L]

Construction, EMF equation, no load and on load operation and their phasor diagrams, Equivalent circuit, Regulation, losses of a transformer, Open and Short circuit tests, Efficiency and Introduction to three phase transformer.

Three-phase induction motor: [4L]

Concept of rotating magnetic field, Principle of operation, Construction, Equivalent circuit and phasor diagram, torque-speed/slip characteristics, Starting of Induction Motor.

Text Books

1. Basic Electrical engineering - D.P Kothari & I.J Nagrath, TMH, Second Edition.
2. Basic Electrical Engineering - V.N Mittle & Arvind Mittal, TMH, Second Edition.
3. Basic Electrical Engineering - Hughes.
4. Electrical Technology, Vol-I, Vol-II - Surinder Pal Bali, Pearson Publication.
5. A Text Book of Electrical Technology, Vol. I & II - B.L. Theraja, A.K. Theraja, S.Chand & Company.

Reference Books

1. Electrical Engineering Fundamentals - Vincent Del Toro, Prentice-Hall.
2. Advance Electrical Technology - H. Cotton, Reem Publication.
3. Basic Electrical Engineering - R.A. Natarajan, P.R. Babu, Sictech Publishers.
4. Basic Electrical Engineering - N.K. Mondal, Dhanpat Rai.
5. Basic Electrical Engineering - Nath & Chakraborti.
6. Fundamental of Electrical Engineering - Rajendra Prasad, PHI, Edition 2005.

Course Title: English for Technical Writing					
Course Code: HUM1001					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	2	0	0	2	2

Course Outcome:

After successfully completing this course the students will be able to:

HUM1001.1**:** Communicate effectively in an official and formal environment.

HUM1001.2**:** Use language as a tool to build bridges and develop interpersonal relations in multi-cultural environment.

HUM1001.3: Use various techniques of communication for multiple requirements of globalized workplaces

HUM1001.4: Learn to articulate opinions and views with clarity

HUM1001.5: Write business letters and reports.

HUM1001.6: Apply various communication strategies to achieve specific communication goals.

Module I: (6hrs.)

Introduction to Phonology and Morphology

- Phonetics- Vowel and Consonant Sounds (Identification & Articulation).
- Word-stress, stress in connected speech.
- Intonation (Falling and Rising Tone).
- Vocabulary Building-The concept of Word Formation.

Module II: (6hrs.)

Communication Skills

- The Basics of Business Communication- Process, types, levels.
- Barriers to Communication Common obstacles to effective communication.
- Approaches and Communication techniques for multiple needs at workplace: persuading, convincing, responding, resolving conflict, delivering bad news, making positive connections.

- Identify common audiences and design techniques for communicating with each audience.

Module III: (6hrs.)

Organizational Communication

- Business Letters.
- Organizational Communication: Agenda & minutes of a meeting, Notice, Memo, Circular.
- Organizing e-mail messages, E-mail etiquette.
- Techniques for writing precisely: Creating coherence, organizing principles –accuracy, clarity, brevity. Different styles of writing: descriptive, narrative, expository.

Module IV: (6hrs.)

Principles, techniques and skills for professional writing

- Logic in writing, thinking and problem-solving; applying deductive and inductive reasoning; Use of infographics in writing.
- Report Writing: Importance and Purpose, Types of Reports, Report Formats, Structure of Formal Reports, Writing Strategies. Interpreting data and writing reports.
- Writing proposals and Statement of purpose.

Text Books

1. Communication Skills - Kumar, S. & Lata, P., OUP, New Delhi 2011.
2. Effective Technical Communication - Rizvi, Ashraf, M. Mc Graw Hill Education (India) Pvt. Ltd. Chennai, 2018.
3. Technical Communication - Principles and Practice, Raman, M. and Sharma, S., 2nd Ed., 2011.

Reference Books

1. Professional Writing Skills - Chan, Janis Fisher and Diane Lutovich. San Anselmo, CA: Advanced Communication Designs.
2. Business English, Hauppauge - Geffner, Andrew, P., New York: Barron's Educational Series.

Course Title: Chemistry-I Lab					
Course Code: CHM1051					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	0	0	2	2	1

Course Outcome:

The subject code CHM1051 corresponds to chemistry laboratory classes for the first year B. Tech students. This course enhances the students' experience regarding handling of various chemicals along with various laboratory equipments. Hands on experiments increase the depth of knowledge that is taught in the theory classes as well as it increases research aptitude in students because they can see the direct application of theoretical knowledge in practical field.

After successfully completing this course the students will be able to:

CHM1051.1: Knowledge to estimate the hardness of water which is required to determine the usability of water used in industries.

CHM1051.2: Estimation of ions like Fe^{2+}, Cu^{2+} and Cl^{-} present in water sample to know the composition of industrial water.

CHM1051.3: Study of reaction dynamics to control the speed and yield of various manufactured goods produced in polymer, metallurgical and pharmaceutical industries.

CHM1051.4: Handling physico-chemical instruments like viscometer, stalagmometer, pH-meter, potentiometer and conductometer.

CHM1051.5: Understanding the miscibility of solutes in various solvents required in paint, emulsion, biochemical and material industries.

CHM1051.6: Knowledge of sampling water can be employed for water treatment to prepare pollution free water.

Syllabus:

Experiments

1. Estimation of iron using KMnO4 self-indicator.
2. Iodometric estimation of Cu2+.

3. Determination of Viscosity.

4. Determination of surface tension.

5. Adsorption of acetic acid by charcoal.

6. Potentiometric determination of redox potentials.

7. Determination of total hardness and amount of calcium and magnesium separately in a given water sample.

8. Determination of the rate constant for acid catalyzed hydrolysis of ethyl acetate.

9. Heterogeneous equilibrium (determination of partition coefficient of acetic acid in n-butanol and water mixture).

10. Conductometric titration for the determination of strength of a given HCl solution against a standard NaOH solution.

11. pH-metric titration for determination of strength of a given HCl solution against a standard NaOH solution.

12. Determination of chloride ion in a given water sample by Argentometric method (using chromate indicator solution).

Books

1. Vogel's Textbook of Quantitative Chemical Analysis - G. H. Jeffery, J. Bassett, J. Mendham, R. C. Denney.
2. Advanced Practical Chemistry - S. C. Das.
3. Practicals in Physical Chemistry - P. S. Sindhu.

Course Title: Programming for Problem Solving Lab					
Course Code: CSE1051					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	0	0	3	3	1.5

Course Outcome:

After successfully completing this course the students will be able to:

CSE1051.1: Write simple programs relating to arithmetic and logical problems.

CSE1051.2: Interpret, understand and debug syntax errors reported by the compiler.

CSE1051.3: Implement conditional branching, iteration (loops) and recursion.

CSE1051.4: Decompose a problem into modules (functions) and amalgamating the modules to generate a complete program.

CSE1051.5: Use arrays, pointers and structures effectively in writing programs.

CSE1051.6: Create, read from and write into simple text files.

Software to be used: GNU C Compiler (GCC) with LINUX

NB: Cygwin (Windows based) may be used in place of LINUX

Topic 1: LINUX commands and LINUX based editors

Topic 2: Basic Problem Solving

Topic 3: Control Statements (if, if-else, if-elseif-else, switch-case)

Topic 4: Loops - Part I (for, while, do-while)

Topic 5: Loops - Part II

Topic 6: One Dimensional Array

Topic 7: Array of Arrays

Topic 8: Character Arrays/ Strings

Topic 9: Basics of C Functions

Topic 10: Recursive Functions

Topic 11: Pointers

Topic 12: Structures

Topic 13: File Handling

Text Books

1. Schaum's outline of Programming with C - Byron Gottfried.
2. Teach Yourself C - Herbert Schildt.
3. Programming in ANSI C - E Balagurusamy.

Course Title: Basic Electrical Engineering Laboratory					
Course Code: ELE1051					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	0	0	2	2	1

Course Outcome:

After successfully completing this course the students will be able to:

ELE1051.1: Get an exposure to common electrical apparatus and their ratings.

ELE1051.2: Make electrical connections by wires of appropriate ratings.

ELE1051.3: Understand the application of common electrical measuring instruments.

ELE1051.4: Understand the basic characteristics of different electrical machines.

List of Experiments:

1. Characteristics of Fluorescent lamps
2. Characteristics of Tungsten and Carbon filament lamps
3. Verification of Thevenin's & Norton's theorem.
4. Verification of Superposition theorem
5. Verification of Maximum Power Transfer theorem
6. Calibration of ammeter and voltmeter.
7. Open circuit and Short circuit test of a single phase Transformer.
8. Study of R-L-C Series / Parallel circuit
9. Starting and reversing of speed of a D.C. shunt Motor
10. Speed control of DC shunt motor.
11. No load characteristics of D.C shunt Generators
12. Measurement of power in a three-phase circuit by two wattmeter method.

Books

1. A Text Book of Electrical Technology, Vol. I & II - B.L., Theraja, A.K. Theraja, S. Chand & Company.

Course Title: English for Technical Writing Laboratory					
Course Code: HUM1051					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	0	0	2	2	1

Course Outcome:

After successfully completing this course the students will be able to:

HUM1051.1: Communicate in an official and formal environment.

HUM1051.2: Effectively communicate in a group and engage in relevant discussion.

HUM1051.3: Engage in research and prepare presentations on selected topics.

HUM1051.4: Understand the dynamics of multicultural circumstances at workplace and act accordingly.

HUM1051.5: Organize content in an attempt to prepare official documents.

HUM1051.6: Appreciate the use of language to create beautiful expressions.

Module I: (6 hrs.)

The Art of Speaking

- Techniques for Effective Speaking.
- Voice Modulation: Developing correct tone.
- Using correct stress patterns: word stress, primary stress, secondary stress. Rhythm in connected speech.
- Encoding Meaning Using Nonverbal Symbols.
- How to Improve Body Language.
- Eye Communication, Facial Expression, Dress and Appearance.
- Posture and Movement, Gesture, Paralanguage.
- Encoding meaning using Verbal symbols: How words work and how to use words.
- Volume, Pace, Pitch and Pause.
- Structuring content for delivery in accordance with time, platform, and audience.

Module II: (6 hrs.)

Group Discussion

- Nature and purpose and characteristics of a successful Group Discussion.
- Group discussion Strategies: Getting the GD started, contributing systematically, moving the discussion along, promoting optimal participation, Handling conflict, Effecting closure.

Module III: (6 hrs.)

Interview

- Types of Interviews, Format for Job Interviews: One-to-one and Panel Interviews, Telephonic Interviews, Interview through video conferencing.
- Cover Letter & CV.
- Interview Preparation Techniques, Frequently Asked Questions, Answering Strategies, Dress Code, Etiquette, Questions for the Interviewer, Simulated Interviews.

Module IV: (6 hrs.)

Professional Presentation Skills

- Nature and Importance of Presentation skills.
- Planning the Presentation: Define the purpose, analyze the Audience, Analyze the occasion and choose a suitable title.
- Preparing the Presentation: The central idea, main ideas, collecting support material, plan visual aids, design the slides.
- Organizing the Presentation: Introduction-Getting audience attentions, introduce the subject, establish credibility, preview the main ideas, Body-develop the main idea, present information sequentially and logically, Conclusion-summaries, re-emphasize, focus on the purpose, and provide closure.
- Improving Delivery: Choosing Delivery methods, handling stage fright.
- Post-Presentation discussion: Handling Questions-opportunities and challenges.

Books

1. The Cambridge guide to Teaching English to Speakers of Other Languages - Carter- R. And Nunan,D. (Eds), CUP, 2001.
2. Writing and Speaking At Work: A Practical Guide for Business Communication - Edward P. Bailey,Prentice Hall, 3rd Ed., 2004.
3. Guide to Managerial Communication: Effective Business Writing and Speaking - Munter, M.,Prentice Hall, 5th Ed., 1999.
4. Job Readiness For IT & ITES- A Placement and Career Companion - R. Anand, McGraw Hill Education.2015.
5. Campus Placements, Malhotra - A., McGraw Hill Education.2015.

2nd Year 1st Semester

Course Title: Discrete Mathematics					
Course Code: MTH2103					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	4	0	0	4	4

Course Outcome:

After successfully completing this course the students will be able to:

MTH2103.1: Interpret the problems that can be formulated in terms of graphs and trees.

MTH2103.2: Explain network phenomena by using the concepts of connectivity, independent sets, cliques, matching, graph coloring etc.

MTH2103.3: Achieve the ability to think and reason abstract mathematical definitions and ideas relating to integers through concepts of well-ordering principle, division algorithm, greatest common divisors and congruence.

MTH2103.4: Apply counting techniques and the crucial concept of recurrence to comprehend the combinatorial aspects of algorithms.

MTH2103.5: Analyze the logical fundamentals of basic computational concepts.

MTH2103.6: Compare the notions of converse, contrapositive, inverse etc in order to consolidate the comprehension of the logical subtleties involved in computational mathematics.

Module I: [10L]

Graph Theory: Tree, Binary Tree, Spanning Tree. Walk, Path, Cycle, Hamiltonian Graph, The Travelling Salesman Problem, Euler Graph, The Chinese Postman Problem. Planar Graph, Euler's Formula for Planar Graph and Related Problems. Examples of Non-Planar Graphs. Kuratowski's Theorem. Matching, Hall's Marriage Theorem and Related Problems. Vertex Coloring.

Module II: [10L]

Number Theory: Well Ordering Principle, Principle of Mathematical Induction, Divisibility theory and properties of divisibility, Fundamental Theorem of Arithmetic, Euclidean Algorithm for finding greatest common divisor (GCD) and some basic properties of GCD with simple examples, Congruence and its properties, Residue classes of integer modulo $\boldsymbol{n}$ $(\mathbb{Z}_{\boldsymbol{n}})$ and its examples, Fermat's Theorem, Wilson's Theorem and Chinese Remainder Theorem.

Module III: [10L]

Combinatorics: Counting Techniques: Permutations and Combinations, Distinguishable and Indistinguishable Objects, Binomial Coefficients, Generation of Permutations and Combinations, Pigeon-hole Principle, Generalized Pigeon-Hole Principle, Principle of Inclusion and Exclusion, Generating Functions and Recurrence Relations: Solving Recurrence Relations using Generating Functions and other Methods.

Module IV: [10L]

Propositional Calculus: Propositions, Logical Connectives, Truth Tables, Conjunction, Disjunction, Negation, Implication, Converse, Contra positive, Inverse, Biconditional Statements, Logical Equivalence, Tautology, Normal Forms, CNF and DNF, Predicates, Universal and Existential Quantifiers, Bound and Free Variables, Examples of Propositions with Quantifiers.

Text Books

1. Discrete Mathematics - T. Veerarajan, McGraw Hill Education.
2. Discrete Mathematics for Computer Scientists and Mathematicians - J. L. Mott, A. Kandel and T. P. Baker, Prentice Hall.
3. Elementary Number Theory - David M. Burton, McGraw Hill Education.
4. Introduction to Graph Theory (2nd Ed) - D G West, Prentice-Hall of India, 2006.

Reference Books

1. Beginning Number Theory - Neville Robbins, Narosa Publishing House.
2. Discrete Mathematics and its Applications - Kenneth H. Rosen, Tata McGraw- Hill.
3. Elements of Discrete Mathematics: A Computer Oriented Approach - C L Liu and D P Mohapatra, Tata McGraw Hill.
4. Discrete Mathematical Structure and It's Application to Computer Science - J.P. Tremblay and R. Manohar, Tata McGraw Hill.
5. Discrete Mathematics - Norman L. Biggs, Oxford University Press.
6. Schaum's Outlines Series - Seymour Lipschutz, Marc Lipson.
7. Higher Algebra (Classical) - S.K. Mapa, Sarat Book Distributors.

Course Title: Microprocessor & Microcontroller					
Course Code: AEI2105					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcome:

After successfully completing this course the students will be able to:

AEI2105.1: Describe the architecture and fundamentals of 8085 Microprocessor and 8051 Microcontroller.

AEI2105.2: Understand and classify the instruction set of 8085 Microprocessor and 8051 Microcontroller.

AEI2105.3: Select the appropriate instructions and apply them to write the assembly level programming of 8085 Microprocessor and 8051 Microcontroller.

AEI2105.4: Understand the concept of Subroutine, Interrupts, Timer and Counters.

AEI2105.5: Interface different types of memory devices with 8085 Microprocessor.

AEI2105.6: Familiarize the architecture and operation of various Programmable Peripheral Devices, and interface with 8085 Microprocessor.

Module I: [9L]

Introduction to 8-bit microprocessor: 8085 microprocessor internal architecture, 8085 pin configuration, Software instruction set, Addressing Modes, timing diagram of the instructions.

Module II: [9L]

Interrupts and Interfacing: Stack and Subroutine, Interrupts of 8085 processor: classification of interrupts, Programming using interrupts. Counter and Time delay, Concept of Memory Interfacing, Memory mapped I/O, I/O mapped I/O.

Module III: [9L]

Introduction to Peripheral Devices and Application: Support IC chips: PPI 8255, USART 8251, DMAC 8237/57- Block diagram, pin configuration, mode of operation, control word(s) format and Interfacing with Microprocessors.

Module IV: [9L]

Introduction to microcontrollers: Intel MCS-51 family features, 8051 architecture, pin configuration, I/O ports and memory organization; Instruction set and basic assembly language programming; Interrupts, timer/counter and serial communication.

Text Books

1. Microprocessor architecture, programming and applications with 8085/8085A - Ramesh S. Gaonkar, Wiley eastern Ltd.
2. Fundamental of Microprocessor and Microcontrollers - B. Ram, Dhanpat Rai Publications.
3. Microprocessors and Microcontrollers - N. Senthil Kumar, M. Saravanan, S. Jeevanathan, Oxford Publications.
4. 8085 Microprocessor and its Applications - A. Nagoor Kani, Third Edition, TMH Education Pvt. Ltd.

Reference Books

1. The 8051 Microcontroller and Embedded. Systems. Using Assembly and C. Muhammad Ali Mazidi, Janice Gillispie Mazidi. Rolin D. McKinlay, Second Edition, Pearson Publication.
2. Design with PIC Microcontroller, John Peatman, Pearson Publication.

Course Title: Digital Circuit Design					
Course Code: ECE2002					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	0	0	3	3

Course Outcome:

After successfully completing this course the students will be able to:

ECE2002.1: Students will learn about the Binary Number system and minimization of logic expression using different methods.

ECE2002.2: Students will design different Arithmetic Combinational circuits like Adder, Subtractor.

ECE2002.3: Students will be able to design Multiplexer, De-Multiplexer, Decoder, Encoder, etc and learn about applications.

ECE2002.4: Students will be able to design Sequential Circuits such as flip flops and perform inter conversion of them.

ECE2002.5: Students will design various types of Registers and Counters Circuits using Flip-Flops (Synchronous, Asynchronous, Irregular, Cascaded, Ring, Johnson).

ECE2002.6: Students will learn basic gates using CMOS logic and analyze different memory systems including RAM, ROM, EPROM, EEROM, etc.

Module I: [8L]

Data and number systems; Binary, Octal, and Hexadecimal representation and their conversions; BCD, Gray codes and their conversions; Signed binary number representation with 1's and 2's complement methods, Binary arithmetic. Boolean algebra, De-Morgan's theorem, Various Logic gates-their truth tables and circuits; Representation in SOP and POS forms; Minimization of logic expressions by algebraic method; Karnaugh-map method, Quine-McCluskey method (3 & 4 variables).

Module II: [12L]

Arithmetic Circuits: Adder circuit – Ripple Carry and BCD Adder; Subtractor circuit.

Combinational Circuit: Encoder, Decoder, Comparator, Multiplexer, De-Multiplexer and parity Generator; Shannon's Expansion Theorem.

Module III: [10L]

Sequential Circuits- Sequential circuits design methodology; Basic memory element S-R, J-K, D, and T Flip Flops, Inter conversions of Flip-Flop; Finite State Machine Design using Sequential circuit design methodology; various types of Registers (with Parallel load, shift Registers), and Counters (Asynchronous ripple counters, Synchronous counters: BCD, Ring, Johnson).

Module IV: [8L]

Memory Systems: Concepts and basic designs of RAM, ROM, EPROM, EEROM, Programming logic devices and gate arrays (PLAs and PLDs)

MOS as digital switch, basic working principle of nMOS, pMOS, CMOS inverter and realization of combinational circuit using CMOS logic.

Text Books

1. Digital Circuit & Design - S. Salivahanan, S. Arivazhagan, Bikas Oxford.
2. Fundamental of Digital Circuits - Anand kumar, PHI.
3. Digital Technology - Virendra Kumar, New Age Publication.
4. Modern Digital Electronics, 2/e - R. P. Jain, Mc Graw Hill.

Reference Books

1. Digital Integrated Electronics - H. Taub & D. Shilling, Mc Graw Hill.
2. Moss-Digital Systems 9/e - Tocci, Widmer, Pearson.
3. Digital Principles &Application 5/e - Leach & Malvino, Mc Graw Hill.
4. Digital Fundamentals - Floyed & Jain- Pearson.

Course Title: Fundamentals of Data Structure and Algorithms					
Course Code: INF2101					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	4	0	0	4	4

Course Outcome:

After successfully completing this course the students will be able to:

INF2101.1: Develop the knowledge of basic data structures for storage and retrieval of ordered or unordered data.

INF2101.2: Design linear and non-linear data structures to be used for storing, accessing and manipulating data, and be able to choose the appropriate data structure to be used for different real life applications.

INF2101.3: Evaluate and compare the runtime and memory usage of algorithms with the help of mathematical background (Asymptotic Notation) of algorithm analysis.

INF2101.4: Apply graph-based algorithms on shortest path problems.

INF2101.5: Apply efficient algorithm for solving problems like sorting, searching, insertion and deletion of data.

INF2101.6: Analyze hash functions and collision resolution techniques for storing and retrieving data efficiently into a hash table.

Module I: [8L]

Linear Data Structure I

Introduction [2L]

Concepts of data structures: a) Data and data structure b) Abstract Data Type and Data Type. Algorithms and programs, basic idea of pseudo-code. Introduction to time and space complexity analysis of algorithm.

Array: [1L]

Different representations – row major, column major. Sparse matrix - its implementation and usage. Array representation of polynomials.

Linked List: [5L]

Singly linked list, circular linked list, doubly linked list, linked list representation of polynomial and applications.

Module II: [10L]

Linear Data Structure II

Stack: [5L]

Stack and its implementations (using array, using linked list), Principles of Recursion – Applications of stack, differences between recursion and iteration, tail recursion.

Queue: [5L]

Queue, circular queue, deque. Implementation of queue- both linear and circular (using array, using linked list), applications. Implementation of deque- with input and output restriction.

Module III: [13L]

Nonlinear Data Structures

Trees: [9L]

Basic terminologies, tree representation (using array, using linked list).

Binary trees - binary tree traversal (pre-, in-, post- order), threaded binary tree (left,right,full). Binary search tree- operations ->creation, insertion, deletion, searching).

Height balanced binary tree – AVL tree --> insertion, deletion with examples only. B- Trees – operations -->insertion, deletion with examples only.

Graphs: [4L]

Graph definitions and Basic concepts. Graph representations/storage implementations – adjacency matrix, adjacency list, Graph traversal and connectivity – Depth-first search (DFS), Breadth-first search (BFS)

Module IV: [12L]

Searching, Sorting, Hashing:

Sorting Algorithms: [8L]

Bubble sort and its optimization, insertion sort, shell sort, selection sort, merge sort, quicksort, heap sort, radix sort. Complexity analysis.

Searching: [2L]

Sequential search, binary search, Interpolation Search

Hashing: [2L]

Hashing functions, collision resolution techniques (Open and closed hashing).

Books

1. Data Structures and Program Design In C, 2/E - Robert L. Kruse, Bruce P. Leung.
2. Fundamentals of Data Structures of C - Ellis Horowitz, Sartaj Sahni, Susan Anderson-freed.
3. Data Structures in C - Aaron M. Tenenbaum.
4. Data Structures - S. Lipschutz.
5. Introduction to Algorithms - Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein.
6. Data Structures using C - Reema Thareja

Course Title: Computer Organization and Architecture					
Course Code: INF2102					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	0	0	3	3

Course Outcome:

After successfully completing this course the students will be able to:

INF2102.1: Understand the instruction formats and addressing modes in the context of computer architecture.

INF2102.2: Design the ALU for different arithmetical and logical problems and apply the knowledge of different multiplication and division algorithm.

INF2102.3: Understand the memory hierarchy (Register, Cache, Primary and Secondary).

INF2102.4: Analyze different memory technologies and related replacement techniques.

INF2102.5: Analyze the types of pipeline including instruction pipeline and arithmetic pipeline.

INF2102.6: Understand different types of Multiprocessor architectures and types of Control Units.

Module I: [8L]

Introduction to Computer and Computer Arithmetic:

Von Neumann and Harvard Architecture, Computer organization vs Computer Architecture, Instruction format, Addressing modes, Addition and subtraction with signed magnitude, Ripple carry adder, Carry Look-ahead adder, Multiplication algorithm, Division algorithm, ALU design.

Module II: [10L]

Memory Organization and I/O techniques:

Inclusion, coherence and locality properties, Memory Hierarchy, Cache memory organization, Memory replacement policies, Techniques for reducing cache misses, Virtual memory organization, Mapping and management techniques, Modes of transfer, Handshaking and DMA.

Module III: [10L]

Pipeline and ILP:

Quantitative techniques in computer design, Introduction to pipeline, Instruction pipeline, Introduction to ILP and techniques to improve ILP, Arithmetic pipeline, Types of Pipeline hazards and its countermeasures, Superscalar and VLIW architecture. Array and Vector processor.

Module IV: [8L]

Multiprocessor Architecture and Control Unit:

Taxonomy of parallel architectures, Types of Multiprocessor architectures, Multicomputer Architecture, Centralized and Distributed shared memory architecture, Cluster computer, RISC and CISC architecture. Introduction to Control unit, Hardwired CU and Micro programmed CU.

Text Books

1. Advanced Computer Architecture - Kai Hwang, TMH.
2. Computer Architecture: A Quantitative approach - Patterson and Hennessy, Morgan Kaufmann.
3. Computer Architecture - T. K. Ghosh, TMH.
4. Computer System Architecture - Morris Mano, PHI.
5. Computer Organization - Carl Hamacher, McGraw Hill.

Course Title: Environmental Sciences					
Course Code: EVS2016					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	2	0	0	2	0

Course Outcome:

The subject code EVS2016 corresponds to basic environmental chemistry for the 2nd year B. Tech students, which is offered as Environmental Sciences and is mandatory for all branches of engineering. The course provides basic knowledge of various environmental pollutions as well as its impact and ways to curb it.

After successfully completing this course the students will be able to:

EVS2016.1: Understand the natural environment and its relationships with human activities.

EVS2016.2: Characterize and analyze human impacts on the environment.

EVS2016.3: Integrate facts, concepts, and methods from multiple disciplines and apply to environmental problems.

EVS2016.4: Educate engineers who can work in a multi-disciplinary environment to anticipate and address evolving challenges of the 21st century.

EVS2016.5: Understand and implement scientific research strategies, including collection, management, evaluation, and interpretation of environmental data.

EVS2016.6: Design and evaluate strategies, technologies, and methods for sustainable management of environmental systems and for the remediation or restoration of degraded environments.

Module I: [6L]

Socio Environmental Impact

Basic ideas of environment and its component

Population growth: exponential and logistic; resources; sustainable development. **[3L]**

Concept of green chemistry, green catalyst, green solvents

Environmental disaster and social issue, environmental impact assessment, environmental audit, environmental laws and protection act of India. **[3L]**

Module II: [6L]

Air Pollution
Structures of the atmosphere, global temperature models
Green house effect, global warming; acid rain: causes, effects and control. **[3L]**

Lapse rate and atmospheric stability; pollutants and contaminants; smog; depletion of ozone layer; standards and control measures of air pollution. **[3L]**

Module III: [6L]

Water Pollution
Hydrosphere; pollutants of water: origin and effects; oxygen demanding waste; thermal pollution; pesticides; salts.

Biochemical effects of heavy metals; eutrophication: source, effect and control. **[2L]**

Water quality parameters: DO, BOD, COD.

Water treatment: surface water and waste water. **[4L]**

Module IV: [6L]

Land Pollution
Land pollution: sources and control; solid waste: classification, recovery, recycling, treatment and disposal. **[3L]**

Noise Pollution
Noise: definition and classification; noise frequency, noise pressure, noise intensity, loudness of noise, noise threshold limit value; noise pollution effects and control. **[3L]**

Text Books

1. Basic Environmental Engineering and Elementary Biology – Gour Krishna Das Mahapatra, Vikas Publishing House P. Ltd.

2. Environmental Chemistry - A. K. De, New Age International.

3. Environmental Chemistry with Green Chemistry - A. K. Das, Books and Allied P. Ltd.

Reference Books

1. Environmental Science - S. C. Santra, New Central Book Agency P. Ltd.

2. Fundamentals of Environment & Ecology - D. De, D. De, S. Chand & Company Ltd.

Course Title: Microprocessor & Microcontroller Lab					
Course Code: AEI2155					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	0	0	2	2	1

Course Outcome:

After successfully completing this course the students will be able to:

AEI2155.1: Identify and select the appropriate instructions, and develop different assembly language programs for the 8085 microprocessor.

AEI2155.2: Develop the interfacing of various input/output devices with 8085 microprocessor.

AEI2155.3: Execute assembly language program to control LEDs, switches and 7 segment displays for various applications.

AEI2155.4: Write assembly language program to control the speed and rotation of stepper motor.

AEI2155.5: Analyze the processing of analog signal using A/D converter.

AEI2155.6: Generate various analog signals (like square wave, triangular wave) using D/A converter.

List of Experiments

1. Familiarization with the 8085 training kit/simulator components and the procedure of saving and examining the contents of memory and registers.

2. Analyzing pre-written programs on 8085 trainer kit/simulator using the basic instruction set (data transfer, load/store, arithmetic and logical). Assignments based on these.

3. Programming using 8085 trainer kit/simulator for:

   a) Addition of two 8 bit BCD numbers

   b) Addition of two 16 bit unsigned numbers

   c) Multiplication of two 8 bit unsigned numbers

d) Division of two 8 bit unsigned numbers

e) Copy/Shift a block of data from one memory location to another memory location

f) Packing and unpacking of 8 bit BCD number

g) Binary to ASCII conversion

h) Sorting (Bubble) of numbers

4. Interfacing of switches and LEDs to 8085A trainer kit via 8255A PPI/8051 Microcontroller to perform the following tasks:

a) Display operation

b) Blinking operation

c) Scrolling operation

5. Interfacing of seven segment displays to 8085A trainer kit via 8255A PPI/8051 Microcontroller via 8-bit latch (e.g., 74LS373).

6. Interfacing of Analog to Digital Converter (ADC) and Digital to Analog Converter (DAC) to 8085A trainer kit via 8255A PPI/8051 Microcontroller via 8-bit latch (e.g., 74LS373).

7. Interfacing of stepper motor to 8085A trainer kit via 8255A PPI/8051 Microcontroller.

Course Title: Digital Circuit Design Lab					
Course Code: ECE2052					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	0	0	2	2	1

Course Outcome:

After successfully completing this course the students will be able to:

ECE2052.1: Define different types of logic gate ICs, verify their truth table and realize the Boolean expression using logic gates.

ECE2052.2: Design and developed code converters and simple arithmetic circuits like adder, subtractor etc.

ECE2052.3: Design and test combinational circuits.

ECE2052.4: Design and develop sequential circuits like flip-flops and counters.

List of Experiments:

1. Realization of basic gates using Universal logic gates.
2. Realization of code conversion circuits - BCD to Excess-3 and vice-versa.
3. Construction of simple arithmetic circuits - Adder, Subtractor.
4. Design of Parity Bit Generator and Checker circuits.
5. Construction of Decoder circuit using logic gates.
6. Construction of Multiplexer circuit using logic gates and realization of different combinational logic circuits using Multiplexer.
7. Design of 2-Bit Comparator Circuit.
8. Realization of RS, D and JK flip-flops using universal logic gates.
9. Realization of Asynchronous Up or Down counter.
10. Realization of Synchronous Up or Down counter.
11. Realization of Ring and Johnson's counters.

Course Title: Fundamentals of Data Structure and Algorithms Laboratory					
Course Code: INF2151					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	0	0	3	3	1.5

Course Outcome:

After successfully completing this course the students will be able to:

INF2151.1: Design and analyze the time and space efficiency of the data structure.

INF2151.2: Capable to identity the appropriate data structure for a given problem.

INF2151.3: Implement the Stack ADT using both array based and linked-list based data structures.

INF2151.4: Implement the Queue ADT using both array based circular queue and linked-list based implementations.

INF2151.5: Implement Nonlinear Data structure operations and its applications

INF2151.6: Apply Sorting and Searching algorithms on various problems and analyze run-time execution of these methods.

Syllabus:

1. Design and Implement List data structure using i) array ii) singly linked list.
2. Design and Implementation of basic operations on doubly linked list.
3. Design and Implementation of Linear Data Structure.
    a) Stack using i) array ii) singly linked list
    b) Queue using i) array ii) singly linked list
    c) Basic operations on Circular Queue
4. Design and Implementation of Conversion and Evaluation of expressions (Infix, Postfix) operations.
5. Implementation of Sorting Techniques.

6. Implementation of Searching Techniques.

7. Design and Implement Binary Search Tree (BST)- create, insert, delete, search elements. Traversal in a BST- inorder, preorder, postorder.

8. Design and Implement Graph Algorithms: Breadth First Search Techniques, Depth First Search Techniques.

Books

1. The C Programming Language, Brian W. Kernighan and Dennis M. Ritchie, Prentice Hall of India.
2. Programming in ANSI C, E. Balagurusamy, Tata McGraw-Hill.
3. Schaum's Outline of Programming with C, Byron Gottfried, McGraw-Hill.
4. Data Structures, Seymour Lipschutz, Schaum's Outlines Series, Tata McGraw-Hill.
5. Fundamentals of Data Structures in C, Ellis Horowitz, Satraj Sahniand, Susan Anderson-Freed, W. H. Freeman and Company.
6. How to Solve it by Computer, R. G. Dromey, Prentice-Hall of India.
7. Data Structures using C, Reema Thareja, Oxford University Press.

Course Title: Computer Organization and Architecture Laboratory					
Course Code: INF2152					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	0	0	3	3	1.5

Course Outcome:

After successfully completing this course the students will be able to:

INF2152.1: Analyze different types of logic gates and verify K-Maps and truth tables of logic gates.

INF2152.2: Construct adder and subtractor circuits and defend the obtained truth tables and K-maps via TBW.

INF2152.3: Design and construct Multiplexer circuits and defend the obtained truth tables and K-maps.

INF2152.4: Design and construct different converters and ALU circuits and defend the obtained truth tables and K-maps via TBW.

INF2152.5: Design and construct sequential circuit designs (Flip-flops, Counter, Register) and and defend the obtained truth tables and K-maps via TBW.

INF2152.6: Design horizontal and vertical expansion of RAM and compare their results from obtained truth tables.

Syllabus:

1. Logic gates

2. Combinational circuit designs

    i). Arithmetic:

        Adders
        Subtractors

    ii). Data Handling:

Multiplexers
DeMultiplexers
Encoders and Decoders

iii). Code Converters:

BCD to Excess-3 code and vice versa
BCD to Gray code and vice versa
Seven Segment

3. Sequential circuit designs

i) Flip-flops
ii) Counter
iii) Register

4. Arithmetic and Logic Unit

5. Horizontal and vertical expansion of RAM

Methodology (Chip based realization and Xilinx based synthesis and simulation)

Text Books

1. The Practical Xilinx Designer Lab Book: Version 1.5 - David E. Van, Den Bout, Prentice Hall.
2. Programmable Logic Fundamentals Using Xilinx ISE - Denton Dailey, Prentice Hall.
3. Programmable Logic Design Quick Start Hand Book - Karen Parnell, Nick Mehta, Xilinx Corporation.

2nd Year 2nd Semester

Course Title: Algebraic Structures					
Course Code: MTH2201					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	4	0	0	4	4

Course Outcome:

After successfully completing this course the students will be able to:

MTH2201.1: Describe the basic foundation of computer related concepts like sets, POsets, lattice and Boolean Algebra.

MTH2201.2: Analyze sets with binary operations and identify their structures of algebraic nature such as groups, rings and fields.

MTH2201.3: Identify and compare homomorphic and isomorphic structures.

MTH2201.4: Compare even permutations and odd permutations, abelian and non-abelian groups, normal and non-normal subgroups and units and zero divisors in rings.

MTH2201.5: Adapt algebraic thinking to design programming languages.

MTH2201.6: Explore the applications of finite group theory to computational problem.

Module I: [10L] Relations on Set and their Representation:

Set theory. Binary relations defined on sets, Matrix representation of relations. Mapping with classification. Equivalence relation and equivalence classes. partially ordered sets (POset). Hasse diagram. Maximal, minimal, greatest and least elements in a POset. Lattices and their properties. Distributive and complemented lattices. Principle of duality.

Module II: [10L] Group Theory – I

Cartesian product, Binary operation, Composition Table. Group, elementary theorems on groups. Permutations, Product of permutations, Group property of permutations, Cyclic permutation, Transposition, Even and Odd permutations, Proposition regarding permutations, Alternating Groups.

Module III: [10L] Group Theory – II

Order of an element of a group, Properties of the order of an element of a group. Subgroups, some basic theorems on subgroups. Cyclic group, Cosets, Lagrange's theorem, Fermat's Little Theorem (statement only). Normal subgroup, some basic theorems on normal subgroup. Quotient group.

Module IV: [10L] Morphisms, Rings and Fields

Homomorphism and Isomorphism of groups, some basic theorems, Automorphism group. Rings, some elementary properties of a ring. Ring with unity, Characteristic of a ring, Ring with zero divisors, Sub-ring, Integral domain, Field, Division Ring or Skew Field, Ideal. (Emphasis should be given on examples and elementary properties.)

Text Books

1. Discrete Mathematics and Its Applications – Kenneth H. Rosen.
2. Higher Algebra - S. K. Mapa, Sarat Book Distributors.
3. Abstract Algebra – M. K. Sen, S. Ghosh, P. Mukhopadhyay.

Reference Books

1. Discrete Mathematics – T Veerarajan.
2. Introduction to Discrete Mathematics via Logic and Proof – Calvin Jongsma.
3. Advanced Higher Algebra – J. G. Chakravorty and P. R. Ghosh.
4. A First Course in Abstract Algebra – J. B. Fraleigh.
5 Contemporary Abstract Algebra – J. A. Gallian.

Course Title: Object Oriented Programming					
Course Code: INF2201					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	0	0	3	3

Course Outcome:

After successfully completing this course the students will be able to:

INF2201.1: Understand the basic concepts and fundamentals of platform independent object oriented programming language and its specialties.

INF2201.2: Use the syntax and semantics of Java programming language and basic concepts of OOP to write programs relating to the real world in an Object Oriented paradigm.

INF2201.3: Develop reusable programs using the concepts of inheritance, polymorphism, interfaces and packages.

INF2201.4: Apply the concepts of Multithreading and Exception handling to develop efficient and error free codes.

INF2201.5: Apply the knowledge of Input Output System handling to write user interactive programs.

INF2201.6: Design event driven GUI and applets which mimic the real-world scenarios.

Module I: [10L]

Basics of OOP and Introduction to JAVA:

Properties of object oriented programming language, Comparison between object oriented programming language and Procedural Programming Language, Major and minor elements, Object, Class, relationships among objects. Aggregation, Association, Generalization, meta-class. Class, object, message passing, inheritance, encapsulation, polymorphism.

Basic concept of JAVA programming– advantages of java, byte-code & JVM, data types, operators, control statements & loops, array, creation of class, object, constructor, finalize and garbage collection.

Module II: [10L]

Class & Object proprieties:

Different types of access specifiers, method overloading, this keyword, use of objects as parameter & methods returning objects, call by value & call by reference, static variables, methods and block nested & inner classes, basic string handling concepts, concept of mutable and immutable string.

Reusability properties:

Super class & subclasses including multilevel hierarchy, process of constructor calling in inheritance, use of super and final keywords with super() method, dynamic method dispatch, abstract classes & methods, interfaces. Creation of packages, importing packages, member access for packages, CLASSPATH. Implementation of different relationships in OOPs.

Module III: [8L]

Exception handling and Multithreading:

Exception handling basics, different types of exception classes, use of try & catch with throw, throws & finally, creation of user defined exception classes.

Basics of multithreading, main thread, thread life cycle, creation of multiple threads, thread priorities, thread joining, thread synchronization, inter-thread communication, deadlocks for threads.

Module IV: [8L]

I/O and Applet & Swing Programming:

Input Output stream structure, Wrapper class, command line arguments, basics of I/O operations – keyboard input using Buffered Reader & Scanner classes, I/O class hierarchy with the use of Data Input Stream, Data Output Stream, Print Writer. File Handling.

Basics of applet programming, applet life cycle, difference between application & applet programming, parameter passing in applets. Basic of swing programming, Difference between applet and swing, AWT Event handling, message box input box, introduction to JFrame, JButton, JLabel.

Books

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

Course Title: Design and Analysis of Algorithms					
Course Code: INF2202					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	4	0	0	4	4

Course Outcome:

After successfully completing this course the students will be able to:

INF2202.1: Demonstrate how the time complexity of an algorithm is defined and analyze the asymptotic performance of algorithms.

INF2202.2: Understand basic algorithm designing techniques such as divide and conquer, greedy, dynamic programming, branch and bound, backtracking and analyze them.

INF2202.3: Explain the graph algorithms such as BFS, DFS, Ford Fulkerson Method, etc and analyze them.

INF2202.4: Synthesize efficient algorithms in common engineering design situations.

INF2202.5: Exploration of various research problems in algorithm like NP-hard and NP-complete problems.

INF2202.6: Explain what an approximation algorithm is, and the benefit of using approximation algorithms.

Module I: [9L]

Introduction: [3L]

Properties of an algorithm, Patterns in algorithm, Time and Space Complexity, Different Asymptotic notations – their mathematical significance, The Master theorem, Generating Functions.

Divide and Conquer: [2L]

Basic method, Binary Search, Merge Sort, Quick Sort and their complexity.

Matrix Manipulation Algorithm: [1L]

Strassen's matrix manipulation algorithm.

Heapsort: [2L]

Heaps, Maintaining the heap property, Building a heap, The heapsort algorithm, Priority queues.

Lower Bound Theory: [1L]

O(nlgn) bound for comparison sort. Set manipulation algorithm like UNION-FIND.

Module II: [12L]

Graph Traversal Algorithm: [5L]

Introduction of Graph, Breadth First Search (BFS), Depth First Search (DFS), Best First Search, Bidirectional Search.

Network Flow: [3L]

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

Backtracking: [4L]

Basic method, 8 queens problem, Graph coloring problem.

Module III: [12L]

Greedy Method: [4L]

Basic method, Fractional Knapsack problem, Job sequencing with deadlines, Minimum cost spanning tree by Prim's and Kruskal's algorithm, Dijkstra algorithm for single source shortest path

Dynamic Programming: [8L]

Basic method, All pair shortest paths, Single source shortest path, Matrix Chain Manipulation, Travelling salesperson problem.

Module IV: [8L]

Branch and Bound: [2L]

Basic method, 15 puzzles problem.

Notion of NP-completeness: [3L]

P class, NP class, NP hard class, NP complete class – their interrelationship, Cook's theorem (Statement only), Satisfiability problem, Clique decision problem, Non-deterministic Algorithm.

Approximation Algorithms: [3L]

Necessity of approximation scheme, Polynomial time approximation schemes, Travelling salesman problem.

Books

1. Introduction to Algorithms, T. H. Cormen - C. E. Leiserson, R. L. Rivest and C. Stein.
2. The Design and Analysis of Algorithms - A. Aho, J. Hopcroft and J. Ullman.
3. The Art of Computer Programming - D. E. Knuth.
4. Algorithm Design - Jon Kleiberg and Eva Tardos.
5. Data Structures and Algorithms - Vol. I & Vol. 2., K. Mehlhorn.
6. Computer Algorithms - S. Baase.
7. Fundamentals of Computer Algorithms - E.Horowitz and Shani.
8. Combinatorial Algorithms- Theory and Practice - E. M. Reingold, J. Nievergelt and N. Deo, Prentice Hall, 1997.

Course Title: Database Management Systems					
Course Code: INF2203					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	4	0	0	4	4

Course Outcome:

After successfully completing this course the students will be able to:

INF2203.1: Understand the need of DBMS over traditional file system and acquire the knowledge on overall database description, at three levels, and Deduce the constraints, i.e., the candidate keys, super-keys, that exists in a given real world problem

INF2203.2: Design the entity relationship diagram to graphically represent entities and their relationships to each other, typically used in computing in regard to the organization of data within databases or information systems

INF2203.3: Formulate a mathematical tool using relational algebra that operates on one or more relational tables and outputs a relational table as result, and design a normalized Database based on real-world situations, maintaining all constraints and manipulate database relations using SQL and PL/SQL.

INF2203.4: Prove whether the ordering of concurrent transactions result in inconsistency of the database system or not.

INF2203.5: Compare the number of block access required for searching a particular record, in an un indexed data file, with respect to a data file having (primary, secondary, clustering or multilevel) index structure.

INF2203.6: Create a complete Normalized Database system, maintaining all the requirement specifications for a real life problem, and creating indexed relations for efficient accessing.

Module I: [8L]

Introduction and Conceptual Modeling

Database Model, Schema and Architecture:

Concept & Overview of database and DBMS, Advantages of using DBMS approach, Database Users and Types, Database Applications. Data Models, Schema, Instances, Three Schema architecture of DBMS, Data Independence, Introduction to Big Data.

Entity-Relationship Model:

Basic concepts, Design Issues, Super Keys, Candidate keys, Concept of Composite Keys, Cardinality, Entity types, Entity sets, Attributes and Keys. Relationship types, Relationship sets, Attributes of relationship types, Weak Entity Sets , ER diagram design issues, Extended E-R modeling: generalization, specialization, aggregation. Problem Solving.

Module II: [10L]

Relational Model

Schema Design:

Mapping of ER model to Relational Model. Different Constraints: Check, Primary Key, Not Null, Referential Integrity Constraint, Unique.

Relational Algebra:

Fundamental Operations in relational algebra: select, project, rename, set difference, union, cartesian product,

Additional Operations: Natural Join, Theta Join, Division, Set Intersection, Assignment

Extended Operations: Generalized Projection, Aggregate Functions, Outer Join

Introduction to Database languages:

SQL: Concept of DDL, DML, DCL, TCL, DQL. Creation, Alteration, Dropping of Objects. Adding Constraints, Modifying Constraints, Dropping Constraints. Different Data Access Patterns, and modifications. Single Row Functions, Group Functions. Join and Sub-Query. Creating Users and adding Privileges. Top N Analyses, View

PL/SQL: Basic Structure, Control Structures, Procedures, Exceptions, Implicit and Explicit Cursor, Triggers.

Module III: [13L]

Relational Database Design

Functional Dependencies:

Basic concept of Functional Dependency, Axioms, Closure, Attribute closure, Equivalent set of FD, Cover, Canonical cover. Problem Solving.

Normalization:

Different Methods of Determining candidate keys from given FD set. Why Normalization Required. Different Anomalies in Designing a Database. First, Second and Third Normal Form, Boyce-Codd Normal Form, Dependency Preservation, Lossless Decomposition. Normalization using Multi-Valued Dependencies and Join Dependency. Designing Normalized Databases, Given a Problem.

Module IV: [13L]

Transaction Processing, Indexed Data Storage

Transaction processing concepts:

Transaction Properties and States. Serial vs. Concurrent Execution. Conflict and View Serializability, Problem Solving. Concurrency Control techniques and Recovery Management

File Organization & Index Structures:

File & Record Concept, Types of Single-Level Index (primary, secondary, clustering), Multilevel Indexes, Dynamic Multilevel Indexes using B tree and B+ tree.

Text Books

1. Database System Concepts - Henry F. Korth and Silberschatz Abraham, Mc.Graw Hill.
2. Fundamentals of Database Systems - Elmasri Ramez and Navathe Shamkant, Benjamin Cummings Publishing. Company.
3. Introduction to Database Management - C. J. date, Pearson Edition.

Reference Books

1. Database Management System - Ramakrishnan, McGraw-Hill.
2. Transaction Processing: Concepts and Techniques Gray Jim and Reuter Address - Moragan Kauffman Publishers.

Course Title: Computer Networks					
Course Code: INF2204					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	4	0	0	4	4

Course Outcome:

After successfully completing this course the students will be able to:

INF2204.1: Understand the fundamental concepts of data communication and networking, layered models, protocols, networking devices.

INF2204.2: Understand theoretical basis for data communication, multiplexing, switching, transmission media.

INF2204.3: Illustrate data link layer services, framing, error control, flow control, data link layer protocols and various channel access protocols.

INF2204.4: Examine various routing algorithms, addressing schemes and different network layer protocols.

INF2204.5: Evaluate different Internet transport protocols, techniques for congestion control and QoS provisioning.

INF2204.6: Understand different application layer protocols.

Module I: [10L]

Introduction: Data communications, Direction of data flow - Simplex, Half-duplex, Full-duplex, Topology – Bus, Ring, Mesh. Star & Hybrid, Types of Network - LAN, MAN 7 WAN, Protocols, and Reference models – OSI & TCP/IP reference model & comparative study.

Physical Layer: Transmission media - Guided & Unguided, Switching – Circuit, Packet & Message, Multiplexing, Network Devices: Repeaters, Hubs, Bridges, Switches, Router and Gateway.

Data link Layer: Types of Errors, Error Detection – Parity, CRC & Checksum, Error Correction – Hamming Code

Module II: [10L]

Data link Layer: Flow Control – Stop-n-Wait & Sliding Window Protocol, ARQ Techniques – Stop-n-Wait, Go-Back- N & Selective Repeat, Framing, Bit & Byte Oriented Protocol, HDLC, Point to Point Protocol (PPP), Token Ring, FDDI and Ethernet Protocols, Reservation, Polling, Multiple access protocols - Pure ALOHA, Slotted ALOHA, CSMA, CSMA/CD, CSMA/CA.

Module III: [10L]

Network Layer: Internet Protocol (IP), IPv4 vs IPv6, ARP & RARP, IP Addressing – Classful & Classless, Subnetting, VLSM, CIDR. Routing - Techniques, Static, Dynamic & Default Routing, Unicast Routing Protocols - RIP, OSPF, BGP

Module IV: [10L]

Transport Layer: Process to Process delivery; UDP; TCP; Congestion Control - Open Loop, Closed Loop, Quality of service, Techniques to improve QoS - Leaky bucket & Token bucket algorithm.

Application Layer Protocols: DNS, SMTP, FTP & DHCP.

Text Books

1. Computer Networks (4th Ed.) - A. S. Tanenbaum, Pearson Education/PHI.

Reference Books

1. Data Communications and Networking (3rd Ed.) - B. A. Forouzan, TMH.
2. Data and Computer Communications (5th Ed.) - W. Stallings, PHI/ Pearson Education.
3. Computer Networking -A top down approach featuring the internet - Kurose and Rose, Pearson. Education.
4. Internetworking with TCP/IP, vol. 1, 2, 3(4th Ed.) - Comer, Pearson Education/PHI.

Course Title: Object Oriented Programming Laboratory					
Course Code: INF2251					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	0	0	3	3	1.5

Course Outcome:

After successfully completing this course the students will be able to:

INF2251.1: Analyze a problem and design a solution for the problem, following an algorithmic design paradigm.

INF2251.2: Implement Object Oriented Programming Features to improve the solution designs.

INF2251.3: Apply Multithreading solutions of real-life problems.

INF2251.4: Reconstruct the solution to a problem in GUI mode.

INF2251.5: Design programs in platform independent environment.

Syllabus:

Implement all problems abiding by features of object-oriented programming (Abstraction, Encapsulation, Reusability, Data Hiding, Generalization, Specialization.)

Lab1:

Familiarization on object-oriented approach of programming: use of class, object, reference.

Lab 2:

Use of constructor, static, final, array, date, access specifiers.

Lab 3:

Familiarization with String, String Buffer, Array List and Linked List classes

Lab 4:

Inheritance and Dynamic Method Dispatch

Lab 5 & 6:

Abstract Class, Interface and Package Java Exception Handling.

Lab 7:

Familiarization on Java IO using Scanner, Buffered Reader, Print Writer. File handling in Java.

Lab 8:

Exploring Java multithreading concept.

Lab 9:

Java Applet, AWT Event Handling

Lab 10:

Exploring JOptionPane

Basics of Java Swing: Different Layouts, Event Handling

Lab 11:

Basic JDBC connection and data handling.

Books

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

Course Title: Design and Analysis of Algorithms Laboratory					
Course Code: INF2252					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	0	0	3	3	1.5

Course Outcome:

After successfully completing this course the students will be able to:

INF2252.1. Analyze a problem and design a solution for the problem, following an algorithmic design paradigm.

INF2252.2. Reconstruct the solution to a problem to achieve optimum solution in terms of time complexity.

INF2252.3. Design and implement an algorithm using the technique of divide-and-conquer and greedy method.

INF2252.4. Design and implement different Graph traversal algorithms (BFS and DFS).

INF2252.5. Solve different problem using the technique of backtracking and branch and bound algorithms.

INF2252.6. Solve different problem using the technique of dynamic programming algorithms.

Syllabus:

Programming Language used: C

Lab1: Divide and Conquer:

Implement Binary Search using Divide and Conquer approach Implement Merge Sort using Divide and Conquer approach

Lab2: Divide and Conquer:

Implement Quick Sort using Divide and Conquer approach

Find Maximum and Minimum element from a array of integer using Divide and Conquer approach

Lab3: Graph Traversal Algorithm:

Implement Breadth First Search (BFS) Implement Depth First Search (DFS)

Lab4: Greedy method:

Fractional Knapsack Problem Job sequencing with deadlines

Lab5: Greedy method (implement any two of the following problems):

Minimum Cost Spanning Tree by Prim's Algorithm

Minimum Cost Spanning Tree by Kruskal's Algorithm Single Source shortest Path for a graph (Dijkstra)

Lab6: Dynamic Programming:

Find the minimum number of scalar multiplication needed for chain of matrix

Lab7: Dynamic Programming:

Implement all pair of Shortest path for a graph (Floyed- Warshall Algorithm) Implement Traveling Salesman Problem

Lab8: Dynamic Programming:

Implement Single Source shortest Path for a graph (Bellman Ford Algorithm)

Lab9: Backtracking:

Implement 8 Queen Problem

Lab10: Backtracking:

Graph Coloring Problem

Lab11: Brunch and Bound:

Implement 15 Puzzle Problem.

Books

1. Introduction to Algorithms - T. H. Cormen, C. E. Leiserson, R. L. Rivest and C. Stein.
2. The Design and Analysis of Algorithms - A. Aho, J. Hopcroft and J. Ullman.
3. Fundamentals of Computer Algorithms - E. Horowitz and Shani.
4. Let Us C - Y. Kanetkar.
5. Programming with C - B. S. Gottfried.
6. The C Programming Language - B.W. Kernighan and D. M. Ritchie.

Course Title: Database Management Systems Laboratory					
Course Code: INF2253					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	0	0	3	3	1.5

Course Outcome:

After successfully completing this course the students will be able to:

INF2253.1: Define and understand the Oracle Server architecture and also identifying the different DDL, DML, DCL, DQL, TCL Sql statement.

INF2253.2: Construct and map an Entity Relationship model to relational tabular structure and maintaining all relationships and domain integrity, referential integrity, entity integrity constraints.

INF2253.3: Make use of SQL commands to populate and query a database.

INF2253.4: Apply and implement security and administrative aspect to a database.

INF2253.5: Experiment with implementing event-oriented programming using PL/SQL TRIGGER and CURSOR, and also implement user defined functions to solve real world problem.

INF2253.6: Develop a normalized database system maintaining all the requirement specifications with respect to real life problem.

Syllabus:

Structured Query Language

1. Introduction to server architecture

2. Creating database objects

- Creating a Table
- Specifying Relational Data Types
- Specifying Constraints
- Creating Column Aliases
- DROP, ALTER statements
- Creating an object structure from another existing structure

3. Table and Record Handling

- INSERT statement
- DELETE, UPDATE, TRUNCATE statements
- Populating data from other tables using insert and select together

4. Retrieving Data from a Database The SELECT statement

- Using the WHERE clause
- Using Logical Operators in the WHERE clause
- Using IN, BETWEEN, LIKE , ORDER BY, GROUP BY and HAVING
- Clause
- Using Aggregate Functions
- Combining Tables Using JOINS
- Subqueries

5. Database Management

- Creating Views Creating
- Database Users
- Granting and revoking Privileges (GRANT, REVOKE) Granting object privileges

Basics of Programming Language/Structured Query Language (PL/SQL)

- Conditional /Iterative Statements
- Introduction to Functions and Stored procedures
- Exception Handling
- Cursor and its application
- Triggers

Books

1. SQL, PL/SQL the Programming Language of Oracle - Ivan Bayross.
2. SQL The Complete Reference - Groff James.
3. Oracle PL/SQL Programming - Feuerstein, Steven.

Course Title: Computer Networks Laboratory					
Course Code: INF2254					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	0	0	3	3	1.5

After successfully completing this course the students will be able to:

INF2254.1: Understand the concepts of NIC installation and configuration.

INF2254.2: Demonstrate Socket programming to design client server environment.

INF2254.3: Develop an application to execute command remotely using socket programming.

INF2254.4: Develop a file transfer application using socket programming.

INF2254.5: Learn to gather network information using socket programming.

INF2254.6: Develop different ARQ techniques using socket programming.

Syllabus:

1. NIC Installation & Configuration
2. TCP/UDP Socket Programming – Introduction
3. Sockets – Operation, Socket types, Domains, Closing Sockets
4. Client/Server Models - Usage
5. Connection Based Services - Client and Server actions
6. Connectionless Services - Client and Server actions
7. Access Network Database - Host Information, Network Information, Protocol Information
8. Implement Multicasting / Broadcasting socket I/O.
9. Implement ARQ techniques.

Books

1. Unix Network Programming - Richard Stevens, Bill Fenner, and Andrew M. Rudoff, Volume1, 3rd Edition, Addison-Wesley, 2004.

Course Title: Idea and Design Thinking Laboratory (IT)					
Course Code: INF2255					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	0	0	2	2	1

Course Outcome:

After successfully completing this course the students will be able to:

INF2255.1: Identify an opportunity from a Problem.

INF2255.2: Identified a suitable data Structure for the problem.

INF2255.3: Design an algorithm for the problem and develop a prototype.

INF2255.4: Analyze the time and space efficiency of the algorithm defined and designed for the problem solution.

INF2255.5: Modify the algorithm to find an optimal solution whenever necessary.

Syllabus:

Lab 1 and Lab 2: Problem 1

The Bashemin Parking garage contains a single lane that holds up to 10 cars. There is only a single entrance/exit to the garage to the one end of the lane. If a customer arrives to pick up a car that is not nearest to the exit, all cars blocking its path are moved out, the customer's car is driven out, and the other cars are restored in the same order that they were in originally. Write a program that processes a group of input lines. Each input lines contains A for arrival and D for departure, and a license plate number. Cars are assumed to arrive and depart in the order specified by the input. The program should print a message whenever a car arrives or departs. When a car arrives, the message should specify whether or not there is room for car in the garage. If there is no room, the car leaves without entering the garage. When a car departs, the message should include the number of times that the car was moved out

Lab 3: Problem 2

Write a program to simulate a simple computer system as follows:

Each user has a unique ID and wishes to perform a number of transactions on the computer. However, only one process can be processed by the computer at any given moment. Each input line represents a single user and contains user's ID followed by a starting time and a series of integer representing the duration of each of his / her transactions. The input is stored by increasing starting time. , and all times & durations are in seconds. Assume that a user does not require time for a transaction until the previous transaction is complete and that the computer accepts transactions on a first come, first served basis. The program should simulate the system and print a message containing the user ID and the time whenever a transaction begins and ends. At the end of the simulation it should print the average waiting time for a transaction. (The waiting time is the amount of the time between the time that the transaction was requested and the time it was started)

Lab 4: Problem 3

A factory produces items according to the following process: An item must be assembled and polished. Assembly time is uniformly distributed between 100 and 300 seconds, and polishing time is normally distributed with a mean of 20 seconds and a standard deviation of 7 seconds (but values below 5 are discarded). After an item is assembled, a polishing machine must be used, and a worker cannot begin assembling the next item until the item he or she has just assembled has been polished. There are ten workers but only one polishing machine. If the machine is not available, workers who have finished assembling their items must wait for it. Compute the average waiting time per item by means of a simulation. Do the same under assumption of two and three polishing machines.

Lab 5 and Lab 6: Problem 4

A group of soldiers are surrounded by an overwhelming enemy force. There are no hopes for victory without reinforcement, but there is only a single horse available for escape. The soldiers agree to a pact (deal) to determine which of them is to escape and summon help. They form a circle and a number n is picked from a hat. One of their names is also picked up from a hat. Beginning with the soldier whose name is picked, they begin to count clockwise around the circle. When the count reaches n, that soldier is removed from the circle, and the count begins with the next soldier. The process continues so that each time the count reached n, another soldier is removed from circle. Any soldier removed is no longer counted. The last soldier remaining is to take the horse and escape. The problem is, given a number n, the ordering of the soldiers in a circle, and the

soldier from whom the count begins, to determine the order in which soldiers are eliminated from the circle and which soldier escapes.

The input to the program is the number n and a list of names, which is the clockwise ordering of the circle, beginning from the soldier from whom the count is to start. The last input line contains the string "end" indicating the end of the input. The program should print the names in the order that they are eliminated and the name of the soldier who escapes.

For example, suppose that n = 3 and that there are five soldiers named A, B, C, D and E. We count three soldiers starting from A, so that C is eliminated first. We then begin at D and count D, E and back to A, so that A is eliminated next. Then we count B, D and E, so that E is eliminated, finally B, D and B, so that B is eliminated and D is the one who escapes.

Lab 7 and Lab 8: Problem 5

A group of people stand in a circle and each chooses a positive integer. One of their names and positive integer n are chosen. Starting with the person whose name is chosen; they count around the circle clockwise and eliminate the nth person. The positive integer that the person chose is used to continue to count. Each time that a person eliminated, the number that he or she chose is used to determine the next person eliminated. For example, suppose that the 5 people are A, B, C, D and E and they choose integers 3,4,6,2 and 7 respectively, and that the integer 2 is finally chosen. Then if we start from A, the order in which people are eliminated from circle is B, A, E, C, leaving D as the last one in the circle.

Write a program that reads a group of input lines. Each input line except the first and last contains name and a positive integer chosen by that person. The order of the names in the data is the clockwise ordering of the people in the circle, and the count is to start with first name in the input. The first input line contains the number of the people in the circle. The last input line contains only a single positive integer representing the initial count. The program prints the order in which the people are eliminated from the circle.

Lab 9 and Lab 10: Problem 6

A tournament is an almost complete strictly binary in which each non-leaf contains the larger of the two elements in its two sons. Thus the contents of the tournament's leaves completely determine the contents of all its nodes. A tournament with n leaves represents a set of n elements.

a) Develop an algorithm pqinsert (t,n,elt) to add a new element elt to a tournament containing n leaves represent implicitly by an array t.

b) Develop an algorithm pqmaxdelete (t,n) to delete the maximum element from a tournament with n elements by replacing the leaf containing the maximum element with a dummy value smaller than any possible element (for example -1 in a tournament of non-negative integers) and then readjusting all values in the path from that leaf to the root.

c) Show how to simplify pdmaxdelete by maintaining a pointer to a leaf in each non-leaf info field, rather than an actual element value.

d) Write a C program to implement a selection sort using tournament. The preprocessing phase builds the initial tournament from the array x and the selection phase applies pdmaxdelete repeatedly. Such a sort is called a tournament sort.

Lab 11 and Lab 12: Problem 7

Ina mountain range, there are some areas where Army conducts operations for Terrorist Demolition. They start by setting up camps after scouting from summit to the base of mountain. In given operation named KTH (Kill Terrorism of Himalaya), army commandos are given instruction to scout and build camps in two different mountains say MP1 and MP2 to launch an attack. Relevant camps consist of respective designated officers. Starting from summit each camp should have a minimum distance of 30 meters from upper level towards base of mountain and every camp should have two base camps under its control. Each camp can consist of max. 4 personnel (2 havildars, 1 Subedar and 1 captain/Lieutenant) and 1 major for camps at same level. Create such camp design by giving height for both MP1 and MP2. According to given height give details of each camp level wise with details of army officers in it as per restriction given. Then compare and report to headquarter about camps. Report should include following:

1) Total no. of camps created in MP1 and MP2.

2) Total army personnel deployed in MP1 and MP2

3) Army cadet wise total army officers' count for each MP (Mountain Pick)

4) If base camps are storing food and beverages, then total how many such camps are needed as per given details.

5) Is MP1 or MP2 is exact subset of other? Find out.

Lab 13 and Lab 14: Problem 8

Graph related problem.

Books

1. Introduction to Algorithms - T. H. Cormen, C. E. Leiserson, R. L. Rivest and C. Stein.
2. The Design and Analysis of Algorithms - A. Aho, J. Hopcroft and J. Ullman.
3. Fundamentals of Computer Algorithms - E. Horowitz and Shani.
4. Programming with C - B. S. Gottfried.
5. The C Programming Language - Brian W. Kernighan and Dennis M. Ritchie, Prentice Hall of India.
6. Programming in ANSI C - E. Balagurusamy, Tata McGraw-Hill.
7. Schaum's Outline of Programming with C - Byron Gottfried, McGraw-Hill.
8. Data Structures - Seymour Lipschutz, Schaum's Outlines Series, Tata McGraw-Hill.
9. Fundamentals of Data Structures in C - Ellis Horowitz, Satraj Sahniand, Susan Anderson-Freed, W. H. Freeman and Company.
10. How to Solve it by Computer - R.G. Dromey, Prentice-Hall of India.
11. Data Structures using C - Reema Thareja, Oxford University Press.

3rd Year 1st Semester

Course Title: Advanced Java and Web Technology					
Course Code: INF3101					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	0	0	3	3

Course Outcome:

After successfully completing this course the students will be able to:

INF3101.1: Design static and dynamic web pages using HTML and CSS.

INF3101.2; Apply Javascript for client and server-side scripting.

INF3101.3: Understand and apply Asynchronous JavaScript.

INF3101.4: Implement server-side program using Servlet.

INF3101.5: Understand the use of JavaServer Faces framework and RESTful Web Services for Java-based web applications.

INF3101.6: Understand the concept of Enterprise Java Beans and its types.

Module I: [8L]

Static Web Pages: Web Pages - Types and issues, Tiers Architecture, WWW Basic concepts, web client and web server, http protocol (frame format), universal resource locator (URL), HTML different tags, sections, image & pictures, listings, tables, frame, frameset, form.

Dynamic Web Pages: The need of dynamic web pages; an overview of DHTML, cascading style sheet (CSS).

Module II: [10L]

Overview of JavaScript:

What is JavaScript? Brief history. Common use-cases. Runtime environments. ECMA Script standards. Basic syntax, Arrays and Objects, Functions, Document Object Model, String interpolation, let and const, Arrow functions, De-structuring assignment , Symbol, Maps and Sets, for-of , Spread operator , Classes , Module loaders, Typed Arrays.

Module III: [8L]

Javascript Context, Closures & Asynchronous JavaScript:

Object method invocation, implicit parameter variable, Event handlers and callbacks, Usage of call and apply, Binding context, new keyword. Lexical scope, Inner functions, Closure scope. Asynchronous Programming with Callbacks, Promises, async and await, Asynchronous Iteration.

Module IV: [10L]

Java Servlet: Servlet environment and role, HTML support, Servlet API, The servlet life cycle, Cookies and Sessions.

JavaServer Faces: Facelets, Resource Handling, Composite Components, Request Processing Life-Cycle Phases, HTTP GET.

RESTful Web Services: Resources, Binding HTTP Methods, Multiple Resource Representations, Binding a Request to a Resource, Entity Providers, Entity Providers.

Enterprise Java Beans: An overview of EJB, Session Beans, Entity Bean and Message Driven Bean.

Text Books

1. Web Technologies - Godbole A. S. & Kahate A., TMH.
2. Web Technology & Design - Xavier C., New Age Publication.
3. JavaScript: The Definitive Guide - David Flanagan 7th Edition, O'Reilly Media
4. Java EE Essential - Arup Gupta, O'Reilly.

Reference Books

1. Advanced Java Programming - Uttam Kumar Roy, Oxford university press.

Course Title: Machine Learning					
Course Code: INF3102					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	0	0	3	3

Course Outcome:

After successfully completing this course the students will be able to:

INF3102.1: Apply the different clustering algorithms to cluster real life datasets.

INF3102.2: Apply appropriate classification algorithm to classify an unknown dataset.

INF3102.3: Compare and contrast pros and cons of various machine learning techniques and to get an insight of when to apply a particular machine learning approach.

INF3102.4: Identify the patterns in the data using Regression techniques.

INF3102.5: Identify and design solution to overcome the limitations of the learning models.

INF3102.6: Build efficient and appropriate Machine Learning Models to analyze hidden patterns in real world data.

Module I: [10L]

Introduction to Learning: Concept of Supervised and Unsupervised Learning; Data representation; Normalizing and Standardization of Data; Outlier Concept.

Regression: Linear Regression, Non-Linear Transformation, Loss Functions, Gradient Descent

Error and Noise: Training vs Testing: From Training to Testing, Dichotomies, Growth Function, key notion: Break Points; VC Dimension, Bias-Variance Tradeoff

Overfitting: Introduction to Overfitting, Concept of Regularization, K cross validation

Module II: [12L]

Classification I: Nearest Neighbors, Logistic Regression

Neural Model Classifier: Single Perceptron Model, Multilayer Perceptron (MLP), Activation functions, Back propagation algorithm

Introduction to Deep Learning Model: Convolution Neural Network, Recurrent Neural Network

Module III: [8L]

Classification II: Decision tree algorithms: Entropy, Information Gain, Gain Ratio, Gini Index, ID3 Algorithm, Limitations of ID3, C4.5 Algorithm; Bayes Theorem, Naïve Bayes classification Model

Performance Metrics: Introduction to Metrics such as Accuracy, Precision, Recall, F-Score, Confusion Matrix

Module IV: [10L]

Unsupervised Learning:

Clustering: Hard Clustering: k-means; Soft Clustering: Fuzzy c means; Density based clustering: DBSCAN.

Hierarchical Clustering Methods: Agglomerative Approach, Divisive Approach, ROCK Clustering

Text Books

1. Introduction to Machine Learning – Ethem Alpaydin, The MIT Press.
2. Machine Learning - Tom Mitchell. First Edition, McGraw-Hill, 1997.
3. Data Mining: Concepts and Techniques, 2nd Edition - Han, J. and Kamber, M., Morgan Kaufmann, 2006.
4. Data Mining Techniques - K. Pujari, Universities Press.
5. Pattern Recognition and Machine Learning - Christopher Bishop, First Edition, Springer, 2006.
6. Foundations of Machine Learning - Mehryar Mohri, Afshin Rostamizadeh, and Ameet Talwalkar, MIT Press, Second Edition, 2018.
7. Machine Learning: An Algorithmic Perspective - Stephen Marsland, CRC Press, A Chapman & Hall Book, 2015.
8. Machine Learning: A Probabilistic Perspective - Kevin Patrick Murphy, MIT Press, 2012.

Reference Books

1. Introduction to Data Mining - P. Tan, M. Steinbach and V. Kumar, Addison Wesley, 2006.
2. Data Science for Business: What you need to know about data mining and data-analytic thinking - Foster Provost & Tom Fawcett: O'Reilley.
3. Computational Intelligence Principles, Techniques and Applications - Amit Konar, Springer, 2012.
4. Neural Networks and Learning Machines - Simon Haykin, Third Edition, PHI Learning, 2009.
5. Data Mining Introductory & Advanced Topic - Dunham, Pearson Education.

Course Title: Operating Systems					
Course Code: INF3103					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	0	0	3	3

Course Outcome:

After successfully completing this course the students will be able to:

INF3103.1: Analyze and differentiate between different types of operating systems (namely, batch, multi programmed, time-sharing, real-time, distributed, parallel processing system) based on their application domains and evolution.

INF3103.2: Illustrate how a computer system with one way of representation can be converted to one another Demonstrate and describe system operations, internal structure of computer system and operating system.

INF3103.3: Apply multiprocessing and multithreading architectures enabled with inter-process /thread communication and synchronization to improve the performance of the system.

INF3103.4: Compare the different levels of memory (Primary memory, cache, virtual memory, secondary storage) and how they are correlated to improve the performance of the system.

INF3103.5: Demonstrate the operations of IO devices and how they are governed by the operating system

INF3103.6: Discuss the activity and impact of threat, virus, worm and how the system could be protected from them.

Module I: [9L]

Introduction: [3L]

Introduction to OS. Operating system functions, evaluation of O.S., Different types of O.S.: batch, multi- programmed, timesharing, real-time, distributed, parallel.

System Structure: [3L]

Computer system operation, I/O structure, storage structure, storage hierarchy, different types of protections, operating system structure (simple, layered, virtual machine), O/S services, and system calls.

Process and Threads: [3L]

Processes: [1L]

Concept of processes, operations on processes.

Threads: [2L]

Overview, benefits of threads, user and kernel threads.

Module II: [14L]

Process Scheduling: [2L]

Process scheduling, co-operating processes, inter process communication.

CPU Scheduling: [3L]

Scheduling criteria, preemptive & non-preemptive scheduling, scheduling algorithms (FCFS, SJF, RR, priority), algorithm evaluation, multi-processor scheduling.

Process Synchronization: [5L]

Background, critical section problem, critical region, synchronization hardware, classical problems of synchronization, semaphores.

Deadlocks: [4L]

System model, deadlock characterization, methods for handling deadlocks, deadlock prevention, deadlock avoidance, deadlock detection, recovery from deadlock.

Module III: [10L]

Memory Management: [4L]

Background, logical vs. physical address space, swapping, contiguous memory allocation, paging, segmentation, segmentation with paging.

Virtual Memory: [3L]

Background, demand paging, performance, page replacement, page replacement algorithms (FCFS, LRU), allocation of frames, thrashing.

Disk Management: [3L]

Disk structure, disk scheduling (FCFS, SSTF, SCAN, C-SCAN), disk reliability, disk formatting, boot block, bad blocks.

Module IV: [12L]

File Systems: [4L]

File concept, access methods, directory structure, file system structure, allocation methods (contiguous, linked, indexed), free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency & performance.

I/O Management: [4L]

I/O hardware, polling, interrupts, DMA, application I/O interface (block and character devices, network devices, clocks and timers, blocking and non-blocking I/O), kernel I/O subsystem (scheduling, buffering, caching, spooling and device reservation, error handling), performance.

Protection & Security: [4L]

Goals of protection, domain of protection, security problem, authentication, one-time password, program threats, system threats, threat monitoring, encryption.

Text Books

1. Operating System: Concept & Design - Milenkovie M., McGraw Hill.
2. Operating System Design & Implementation - Tanenbaum A.S., Practice Hall NJ.
3. Operating System Concepts - Silbersehatz A. and Peterson J. L., Wiley.

Reference Books

1. Operating System - Dhamdhere, TMH.
2. Operating Systems - Maxwell McMillan International Editions, 1992.
3. An Introduction to Operating Systems - Dietel H. N., Addison Wesley.

Course Title: Formal Language and Automata Theory					
Course Code: INF3104					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	4	0	0	4	4

Course Outcome:

After successfully completing this course the students will be able to:

INF3104.1: Describe and Design the Finite State Machine and the concept of Automata using sequential circuits.

INF3104.2: Describe, Evaluate and express the different concepts of Finite Automata (NFA, DFA).

INF3104.3: Describe and Design the Regular Language for Finite Automata (NFA, DFA).

INF3104.4: Classify, describe and discuss different types of Grammar (Regular Grammar and Context Free Grammar).

INF3104.5: Construct Context Free Language using Context Free Grammar.

INF3104.6: Describe and Design Turing Machine and Push Down Automata for Context Free Language.

Module I: [11L]

Fundamentals:

Basic definition of sequential circuit, block diagram, mathematical representation, concept of transition table and transition diagram (Relating of Automata concept to sequential circuit concept), Design of sequence detector, Introduction to finite state mode

Finite State Machine:

Definitions, capability & state equivalent, kth- equivalent concept, Minimization of FSM, Equivalence between two FSM's, Limitations of FSM, Merger graph, Merger table, Compatibility graph, Finite memory definiteness, testing table & testing graph, Information lossless.

Module II: [13L]

Deterministic finite automaton and non-deterministic finite automaton. Transition diagrams and Language recognizers.

Finite Automata:

NFA with Î transitions - Significance, acceptance of languages.

Conversions and Equivalence:

Equivalence between NFA with and without λ-transitions. NFA to DFA conversion. Application of finite automata, Finite Automata with output- Moore & Mealy machine.

Regular Language:

Regular sets Regular expressions, identity rules. Arden's theorem state and prove Constructing finite Automata for a given regular expressions, Regular string accepted by NFA/DFA, Pumping lemma of regular sets, Closure properties of regular sets (proofs not required).

Module III: [11L]

Grammar Formalism:

Regular grammars-right linear and left linear grammars. Equivalence between regular linear grammar and FA. Inter conversion, Context free grammar. Derivation trees, sentential forms. Right most and leftmost derivation of strings (Concept only). Context Free Grammars, Ambiguity in context free grammars. Normal forms for Context Free Grammars. Chomsky normal form and Greibatch normal form. Pumping Lemma for Context Free Languages. Enumeration of properties of CFL (proofs omitted). Closure property of CFL, Ogden's lemma & its applications.

Module IV: [8L]

Push Down Automata:

Push down automata, definition. Acceptance of CFL, Acceptance by final state and acceptance by empty state and its equivalence. Equivalence of CFL and PDA, interconversion (Proofs not required). Introduction to DCFL and DPDA.

Turing Machine:

Turing Machine definition, model, Design, Computable functions, Universal Turing Machine, Halting problem (proofs not required)

Books

1. Introduction to Automata Theory Language and Computation - Hopcroft H.E. and Ullman J. D., Pearson Education.
2. Theory of Computer Science, Automata Languages and computation - Mishra and Chandrashekaran, 2nd Edition, PHI.
3. Formal Languages and Automata Theory - C. K. Nagpal, Oxford.
4. Switching & Finite Automata - ZVI Kohavi, 2nd Edn., Tata McGraw Hill.
5. Introduction to Computer Theory - Daniel I.A. Cohen, John Wiley.
6. Introduction to languages and the Theory of Computation - John C Martin, TMH.
7. Elements of Theory of Computation - Lewis H.P. & Papadimitrou C.H. Pearson, PHI.
8. An Introduction to Formal Languages and Automata - Peter Linz, Jones & Bartlett Learning.

Course Title: Computer Graphics					
Course Code: INF3131					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	0	0	3	3

Course Outcome:

After successfully completing this course the students will be able to:

INF3131.1: Demonstrate activities and applications of device dependent and independent color models, image representation techniques (raster and random graphics), activities of active and passive graphics devices and computer graphics software.

INF3131.2: Apply DDA algorithm, Bresenham's line algorithm, Circle generation algorithm; Ellipse generating algorithm; to create composite geometric figures.

INF3131.3: Compare effectiveness of scan line polygon-fill algorithm, boundary fill algorithm, flood fill algorithm, Cohen and Sutherland line clipping, Liang-Barsky line clipping method, Sutherland-Hodgeman Polygon clipping, Weiler Atherton Polygon Clipping.

INF3131.4: Employ 2D and 3D transformation techniques (translation, rotation, scaling, shearing, reflection)

INF3131.5: Demonstrate 3D object representation and projection, curve and surface representation techniques using Bezier curves, B-spline curves, and end conditions for periodic B-spline curves, rational B-spline curves algorithms.

INF3131.6: Describe hidden surface representation using Z-buffer algorithm, Back face detection, BSP tree method, the Painter's algorithm, scan-line algorithm; Hidden line elimination, wire frame methods, fractal – geometry.

Module I: [10L]

Introduction to computer graphics & graphics systems, Overview & use of computer graphics & Multimedia, Image, Image Processing, representing pictures, preparing, presenting & interacting with pictures for presentations, Visualization & image processing; Color Models, lookup table, Histogram; Image representing hardwares: Cathod Ray Tube, LCD & LED Display devices, Scanner, Digital Camera. Gamma, Interlacing, properties of display devices, different image formats.

Scan Conversion: Points & lines, Line drawing algorithms; DDA algorithm, Bresenham's line algorithm, Circle generation algorithm; Ellipse generating algorithm;

Module II: [10L]

Area Filling Algorithms: Scan line polygon-fill algorithm, Boundary fill algorithm, Flood fill algorithm.

2D transformation & viewing: Basic transformations: translation, rotation, scaling; Matrix representations & homogeneous coordinates, transformations between coordinate systems; reflection shear; Transformation of points, lines, parallel lines, intersecting lines.

Overview of 3D Transformation

Module III: [10L]

Viewing pipeline, Window to view port co-ordinate transformation, clipping operations, point clipping, line clipping, clipping circles, polygons & ellipse, Text clipping. Cohen and Sutherland line clipping, Liang-Barsky line clipping method, Sutherland-Hodgeman Polygon clipping, Weiler Atherton Polygon Clipping.

Overview of 3D Viewing

3D Display: Perspective Projection and Parallel Projection, Vanishing Points, Horizon. 3D Object Representation: Depth Cuing, Polygon Table, Plane Equation, Polygon Mesh.

Module IV: [10L]

Curves: Curve representation, surfaces, designs, Bezier curves, B-spline curves, end conditions for periodic B- spline curves, rational B-spline curves.

Hidden surfaces: Depth comparison, Z-buffer algorithm, Back face detection, BSP tree method, the Painter's algorithm, scan-line algorithm; Hidden line elimination, wire frame methods , fractal-geometry.

Color & shading models: Light & color model; interpolative shading model; Texture.

Text Books

1. Computer Graphics (C version 2nd Ed.) - Hearn, Baker, Pearson education.
2. Mathematical Elements for Computer Graphics (2nd Ed.) - D. F. Rogers, J. A. Adams, TMH.

Reference Books

1. Schaum's outlines Computer Graphics (2nd Ed.) - Z. Xiang, R. Plastock, TMH.
2. Fundamental of Computer Graphics - Peter Shirley, Michael Ashikhmin, Michael Gleicher, Stephen R. Marschner, Erik Reinhard, KelvinSung, and AK Peters, CRC Press.
3. Computer Graphics: Theory into Practice - Jeffrey McConnell, Jones and Bartlett Publishers.

Course Title: Distributed Database Management Systems					
Course Code: INF3132					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	0	0	3	3

Course Outcome:

After successfully completing this course the students will be able to:

INF3132.1: Understand the need of distributed database and understand the various architectures of DDBMS.

INF3132.2: Understand Hadoop Eco-System, and access Data on Distributed File System.

INF3132.3: Design and apply various distribution fragmentation and Allocation techniques, given a problem.

INF3132.4: Apply the different distributed transaction protocols and recovery techniques.

INF3132.5: Analyze and apply query optimization algorithms.

INF3132.6: Analyze the performance comparison of different NO-SQL Databases.

Module I: [12L]

Distributed Databases: An Overview

Definition, Features of Distributed Database, The need for Distributed Database, Centralized vs. Distributed DBMS, Distributed Database on a geographically dispersed network, Distributed Database on a local network

Levels of Distribution Transparency

Reference Architecture for Distributed Databases: Global Schema, Fragmentation Schema, Allocation Schema, Local Mapping Schema. Distribution transparency: Location Transparency, Fragmentation Transparency, Replication Transparency, Local Mapping Transparency, Replication Transparency, Applications

Data Fragmentation

Rules of Fragmentation, Horizontal Fragmentation, Vertical Fragmentation, Derived Horizontal Fragmentation, Mixed Fragmentation

Distributed Fragment Design

Objectives of Design, Design of Horizontal Fragments: Simple Predicate, Minterm Predicates, Complete and Minimal Rules, Problem Solving. Design of Vertical Fragments and Derived Horizontal Fragments. Problem Solving.

Allocation Design

Redundant and Non-Redundant Allocation, Measures of Cost and Benefits of Fragment Allocation, Problem Solving

Module II: [10L]

Query Processing

Overview of Query Processing Steps: Parsing and Translation, Optimization and Evaluation, Measures of Query Cost, Selection Operation, Sorting, Join Operation: Nested Loop Join Algorithm, Block Nested Loop Join Algorithm, Hash Join

Algorithm, Problem Solving. Evaluation of Expressions, Translation of Global Queries to Fragment Queries

Query Optimization:

Overview, Transformation of Relational Expressions: Equivalence Rules, Problem Solving, Join Ordering, Estimating Statistics of Expression, Choice of Evaluation Plans, Problem Solving

Distributed Transactions and Management:

Overview of Distributed Transactions, Applications, Atomicity in Distributed Transaction: Several Communication Failures in Distributed Transactions, Reference Models of Distributed Transactions Recovery, 2 -Phase Commitment Protocol, its behavior with Different kinds of Failures, 3 -Phase Commitment Protocol

Distributed Concurrency Control

Objectives of Distributed Concurrency Control, Concurrency Control based on Locking, Reference Model for Distributed Concurrency Control, Serializability in Distributed Database, Problem Solving

Distributed Deadlocks

Overview, Distributed and Local Wait for Graphs, Distributed Deadlock Detection Algorithms, False Deadlocks, Deadlock Prevention, Problem Solving

Module III: [8L]

Introduction to Big Data and Hadoop:

Big Data Properties, Examples of Big data.

Hadoop: History of Hadoop, Apache Hadoop, Analysing Data with Hadoop, Hadoop Streaming, Hadoop Echo System. Google file system (GFS).

HDFS (Hadoop Distributed File System) The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Dataflow.

Map Reduce Anatomy: Introduction, Mapper concept, Reducer concept, Input splits, Master Processes, Slave processes, Map Reduce Job Run, Job Scheduling, Mapping, Shuffling and Sorting, Reducing, Task Execution, Replicas, Failures, Recovery

Module IV: [10L]

NoSQL Distributed Databases:

Characteristics, Categories: Key Value, Column based, Document based, Graph based NoSQL databases

HBase: Introduction, HBase. RDBMS, HBase architecture, HBase Table design, concept of regions, Hfiles, storage in HBase, Accessing in HBase

MongoDB: Introduction, RDBMS vs. Mongo DB, Mongo DB architecture, Data Model, Database Accessing.

Books

1. Distributed Databases Principles and Systems - Stefano Ceri and Giuseppe Pelagatti, McGraw Hill Education.
2. Principles of Distributed Database Systems - Ozsu, Pearson Publication.
3. Distributed Databases - Sachin Deshpande, Dreamtech.
4. Hadoop: The Definitive Guide - Tom White, O'Reilley.
5. HBase: The Definitive Guide - Lars Georg, O'Reilley.
6. MongoDB: The Definitive Guide: Shannon Bradshaw, Eoin Brazil, Kristina Chodorow, O'Rei.

Course Title: Cyber Security					
Course Code: INF3133					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	0	0	3	3

Course Outcome:

After successfully completing this course the students will be able to:

INF3133.1: Define the concept of Cybercrime, Classify types of Cybercrime and Cybercriminals.

INF3133.2: Discuss the phases in planning cybercrime, Explain Cyber Stalking and different tools for Active attack and Passive attack.

INF3133.3: Discuss the security challenges posted by mobile devices, Compare the attacks on mobile/Cell phones and Differentiate between techniques of Credit Card fraud. Compare the attacks on Bluetooth technologies.

INF3133.4: Explain the stages of Network attack, Differentiate between Proxy Server and Anonymizer, Classify password cracking attacks, Explain types of Virus and Worms, Differentiate between Trojan Horse and Backdoor.

INF3133.5: Classify and discuss Denial of Service (DOS) attacks, Explain DDOS attack and discuss SQL injection.

INF3133.6: Explain Phishing and Identity theft and Discuss steps and tools for Digital Forensic Analysis.

Module I: [8L]

Introduction of Cybercrime:

Definition of Cybercrime, Classifications of Cybercrime, Techno-crime and Techno-vandalism, Botnet Menace, Types of Cybercriminals, Phases of Cybercrime, Tools for Active attacks and Tools for passive attacks, Cyberstalking.

Module II: [8L]

Cybercrime Mobile & Wireless devices:

Techniques of Credit Card Frauds, Security challenges posted by mobile devices, Attacks on mobile/cell phones, Attacks on Bluetooth technologies, Bluetooth hacking tools, Guidelines for implementing Mobile device Security. Stages of Network attack.

Module III: [10L]

Tools and Methods used in Cybercrime:

Proxy servers and Anonymizer, Classification of Password cracking attacks, Keyloggers and Spywares, Types of Virus, Types of Worms, Trojan Horses and Backdoors, DOS & DDOS attacks, SQL injection.

Module IV: [11L]

Phishing & Identity Theft:

Methods of Phishing, Techniques of Phishing, Spear Phishing and Whaling, Types of Phishing Scams, Countermeasures of Phishing, Types of Identity Theft, Techniques of Identity theft, Geotagging, Tools for protecting online identity.

Digital Forensic: Introduction to Digital Forensic, Steps of Forensic investigation, Tools for Digital forensic analysis and Organizational guidelines for Cell phone Forensics.

Text Books

1. Cyber Security, Nina Gobole & Sunit Belapune - Wiley India.

Course Title: Indian Constitution and Civil Society					
Course Code: INC3106					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	2	0	0	2	0

Course Outcome:

After successfully completing this course the students will be able to:

INC3106.1: Analyze the historical, political and philosophical context behind the Indian Constitution-making process

INC3106.2: Appreciate the important principles characterizing the Indian Constitution and institute comparisons with other constitutions.

INC3106.3: Understand the contemporaneity and application of the Indian Constitution in present times

INC3106.4: Critique the contexts for constitutional amendments in consonance with changing times and society.

INC3106.5: Establish the relationship between the Indian Constitution and civil society at the collective as well as the individual levels.

INC3106.6: Consciously exercise the rights and the duties emanating from the Indian Constitution to one's own life and work.

Module I: [6L]

Introduction to the Constitution of India-Historical Background,

Making of Indian Constitution -the process of framing the constitution, the constituent assembly.

Module II: [6L]

Salient Features of the Indian constitution

Comparison with the constitutions of other countries

Module III: [6L]

Relevance of the Constitution of India

Constitution and Governance

Constitution and Judiciary

Constitution and Parliament-Constitutional amendments

Module IV: [6L]

Constitution and Society- democracy, secularism, justice

Constitution and the individual citizen- Fundamental Rights, Directive Principles of state policy and Fundamental duties.

Books

1. Civil Society and Democracy - C. M. Elliot, (ed.), OUP, Oxford, 2012.
2. The Idea of the Modern State - David Held et.al (ed), Open Univ. Press, Bristol, 1993.
3. State and Civil Society - Neera Chandoke, Sage, Delhi, 1953.

Course Title: Fundamentals of Sensors and Transducers					
Course Code: AEI3122					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	0	0	3	3

Course Outcome:

After successfully completing this course the students will be able to:

AEI3122.1: Memorize the knowledge on mechanical, electromechanical, thermal and acoustic, and optical sensors.

AEI3122.2: Identify and classify the sensors based on type of measure and such as strain, force, pressure, displacement, temperature, flow, etc.

AEI3122.3: Choose the application specific Sensors and Transducers.

AEI3122.4: Relate the sensors in various industrial applications.

AEI3122.5: Design and set up the sensing systems.

AEI3122.6: Create the applications of smart sensors.

Module I: [10L]

Fundamentals: Definition, principle of sensing and transduction, classification of transducers, static and dynamic characteristics of Transducers.

Resistive Transducers: Potentiometric transducer- Theory, type, symbol, materials, error calculations due to loading effects, sensitivity, and specifications.
Strain gauge- Theory, type, symbol, materials, gauge factor, temperature compensation and dummy gauge, Strain measurement circuit- quarter, half and full bridge configuration, and specifications.

Inductive Transducers: Principle, common types, Reluctance change type, Mutual inductance change type, transformer action type. LVDT- Construction, working principle, characteristics (modulated and demodulated).

Module II: [8L]

Capacitive sensors: Parallel plate type- Variable distance, variable area, variable dielectric constant type, calculation of sensitivity, response characteristics, specifications, and applications.

Piezoelectric transducers: Piezoelectric effect, type, charge and voltage co-efficient and relationships, crystal model, materials, charge amplifier; Ultrasonic sensors- Liquid velocity and level measurements.

Module III: [10L]

Contact type Thermal Sensors:
Resistance change type:
Resistance Temperature Detector (RTD) - materials, temperature range, R-T characteristics, configurations, specifications, and applications. Thermistors- materials, temperature range, R-T characteristics, applications and specification.
Thermo-emf sensor:
Thermocouple- Thermo electric laws, types, temperature ranges, series and parallel configurations, cold junction compensation, compensating cables.
Introduction to semiconductor type temperature sensors.

Non-Contact type Thermal Sensors:
Thermal Radiation sensors- types, constructions, working, temperature ranges and comparison.

Module IV: [8L]

Radiation Sensors:
LED, LDR, photodiodes, Photovoltaic cells, photo emissive cell types, materials, construction, response, applications. Geiger counters, Scintillation detectors.
Introduction to smart sensors.

Books

1. Introduction to transducers - A. K. Ghosh, PHI, 2015.
2. Measurement Systems: Application and Design - E. A. Doebelin, Mc Graw Hill, New York.
3. Instrument Transducers - H. K. P. Neubert, Oxford University Press, London and Calcutta.
4. Transducer Engineering - S. Renganathan, Allied Publishers Limited, 2003.
5. Transducer and instrumentation - D. V. S. Murty, PHI, Second Edition, 2008.
6. Handbook of Modern Sensors: Physics, Designs and Applications, Third Edition - Jacob Fraden, Springer International, 2010.
7. Sensors and Transducers - D Patranabis, PHI, 2nd Ed.

Course Title: Optical Instrumentation					
Course Code: AEI3123					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	0	0	3	3

Course Outcome:

After successfully completing this course the students will be able to:

AEI3123.1: Study Optical Fibers and their performances.

AEI3123.2: Understand the basic concepts of LED and photo detector, properties and industrial applications.

AEI3123.3: Understand the LASER and application.

AEI3123.4: Study Fiber-optic sensor and application.

AEI3123.5: Acquire the knowledge optical fibers.

AEI3123.6: Gain the fundamentals of opto-electronics.

Module I: [9L]

Optical Fibers and their Performances: Basic concept of optics, block diagram of fiber optics communication system, different types of optical fiber (ray propagation and material), ray propagation in step index fiber (meridional and skew rays), concept of dispersion- multipath time dispersion and material dispersion, modes of fiber, attenuation in single mode fiber, construction of optical fiber cables, optical fiber connections and related losses, optical fiber connectors and splices.

Module II: [9L]

LED: Basic concept of semiconductor, density of state, injection efficiency, selection of material for LEDs, internal quantum efficiency, external quantum efficiency calculation, structure of LED and its characteristics, hetero-junction, concept of SLED and ELED.

Optical detectors: Basic principle of optoelectronics detection, optical absorption coefficient and photo current relation, responsivity, types of photodiode-p-i-n diode, avalanche photo diode, and equivalent model of optical receiver.

Module III: [9L]

LASER: Fundamental characteristics of lasers-Three level and four level lasers- Einstein relations, concept of population inversion, condition of LASER action, electrical and optical confinement, LASER modes, differential quantum efficiency and relation with loss coefficient, temperature effects on LASER, properties of semiconductor LASER, semiconductor LASER-density of state analysis in k-space, source fiber coupling, other types of bulk LASERS.

Industrial applications of LASER: LASER application-healthcare and military; in measurement-distance, length, velocity, acceleration, current, voltage and atmospheric effect; in material processing -Laser Heating, Welding, Melting and trimming of material-Removal and vaporization.

Module IV: [9L]

Optical Fiber sensors: Fiber optic sensors- classification, intensity modulated sensors, phase modulated sensors, application of optical coupler, fiber –optic Mach-Zehnder interferometric sensor, fiber optic sensor for the measurement of pressure, temperature, current, voltage, liquid level and strain, electro-optic modulators-longitudinal and transverse electro-optic modulator.

Books

1. Optical Fiber Communication, Principles and Practice - J.M. Senior, Prentice Hall of India, 1985.
2. Introduction to Opto Electronics - J. Wilson and J.F.B. Hawkes, Prentice Hall of India, 2001.
3. Fiber optics and optoelectronics - R.P Khare, Oxford.
4. Optical Fiber Communication and Sensor - M. Arumugam, Anuradha Agencies, 2002.
5. Optical Fiber Communication - G. Keiser, McGraw Hill, 1995.
6. Physics of Semiconductor Devices - S.M Zse, Wiley; Third Edition, 2008.
7. Optics - Ajay Ghatak, TMH,2012.
8. NPTEL Course on opto-electronics - M. R. Shenoy, IIT Delhi.

Course Title: Error Control Coding for Secure Data Transmission					
Course Code: ECE3123					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	0	0	3	3

Course Outcome:

After successfully completing this course the students will be able to:

ECE3123.1. Distinguish between different types of source codes.

ECE3123.2. Figure out equations for entropy, mutual information and channel capacity for all types of channels, utilizing their knowledge on the elements.

ECE3123.3. Explain and estimate the merit of various methods for generating and detecting different types of error correcting codes.

ECE3123.4. Formulate the basic equations of linear block codes, cyclic codes.

ECE3123.5. Outline the basics of convolution code, linear algebra and BCH code.

ECE3123.6. Develop overall understanding about different types of codes applied to both source and channel end during data transmission.

Module I: [10L]

Information theory, Source coding and channels

Information theory: Uncertainty and information, measure of information, Self and conditional Information, mutual information and entropy, Fixed length code, Variable length code, Prefix code, Instantaneous code, Kraft Inequality,

Source Code: Source coding theorem, Huffman codes, Shanon- Fano coding, Arithmetic code

Channels: Discrete memory less channel, Channel matrix for different channel models- Lossless channel, Deterministic channel, Noise-less channel, Deterministic channel capacity, channel coding, Information capacity theorem, The Shannon limit.

Module II: [7L]

Error Control code: Linear Block Code

Block code: Hamming codes Minimum distance, Error detecting and Error-correcting capabilities of block code.

Linear Block Code: Definition & properties of linear block codes, Matrix description of linear block codes, Encoding of linear block code, parity check matrix, decoding of a linear block code, Syndrome and Error detection.

Module III: [10L]

Cyclic and BCH code

Cyclic Code: Definition & properties of cyclic codes, Code Polynomials, Generator Polynomials, Division algorithm for polynomials, a method for generating cyclic codes, matrix description of cyclic codes, Decoding of cyclic codes.

Galois Field: Introduction to Linear Algebra, Introduction to Galois Field, Primitive elements generator polynomials in terms of minimal polynomials, Calculation of minimal polynomial.

BCH Code: Elementary concept of BCH Codes, Encoding and Decoding, Elementary concept of Reed Solomon Code.

Module IV: [9L]

Convolution Codes:

Encoding convolution code: Polynomial description of convolution codes, Distance notions for

convolution codes and the generating function.

Decoding of convolution codes: Viterbi decoder, distance and performance bounds for convolution codes.

Example of convolution code - Turbo codes, Turbo decoding.

Graphical representation of convolution code: State diagram, Tree, Trellis diagram

Text Books

1. Information theory, coding and cryptography - Ranjan Bose; TMH.
2. Introduction to Error Control Codes – S Gravano, Oxford Press.
3. Information and Coding - N Abramson; McGraw Hill.
4. Introduction to Information Theory - M Mansurpur, McGraw Hill.
5. Information Theory - R B Ash; Prentice Hall. 8. Error Control Coding - Shu Lin and D J Costello Jr; Prentice Hall

Course Title: Introduction To VLSI Design					
Course Code: ECE3124					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	0	0	3	3

Course Outcome:

After successfully completing this course the students will be able to:

ECE3124.1. Learn about VLSI Technology Growth as driven by Moore's law.

ECE3124.2. Understand Various VLSI Design Methodologies.

ECE3124.3. Design Digital Combinational logic, Circuits and Layout using CMOS Technology.

ECE3124.4. Design Digital Sequential logic and Circuits using CMOS Technology.

ECE3124.5. Learn RTL Design using Verilog Hardware Description Language.

ECE3124.6. Learn Basic Building Blocks of Analog Circuit using CMOS Technology.

Module I: [4L]

VLSI Design Methodology:

Moore's Law, Scale of Integration (SSI, MSI, LSI, VLSI, ULSI, GSI), Technology growth and process Node, VLSI Design Trend and Challenges. VLSI Design Cycle, Y-Chart, Full Custom Design, Std Cell based Semi Custom Design, Gate Array Design, PLD: PLA, PAL, FPGA

Module II: [14L]

Digital VLSI Circuits:

Unit1:

MOS Transistor Characteristics, MOS as Digital Switch, NMOS Logic Family, CMOS Logic Family, CMOS Inverter Characteristics (VTC), Inverter Delay & Noise, NAND and NOR gates, Complex Logic Circuits, Concept of Logical effort, Pass Transistor Logic & Transmission Gate, CMOS Sequential Circuits (Latch and Flip flop), Read and write operations of 1T DRAM and 6T SRAM cell.

Unit2:

CMOS Cross Section, Inverter Layout, Lambda Rule vs Micron Rule, Stick Diagram, Euler Path Algorithm

Module III: [6L]

Hardware Description Language:

Introduction to Verilog Modeling: Behavioral, Data-Flow, Structural and Mixed Mode. Frontend Design Flow using Verilog (Behavioral, RTL and Gate Level), Combinational and sequential circuits with various examples, FSM Example: Mealy Machine and Moore Machine.

Module IV: [10L]

Analog VLSI Circuits:

MOS large signal model, Transconductance gain, MOS small signal model, MOS switch, MOS Diode, MOS Resistor, CMOS Current Source/Sink, Active Load, Voltage Dividers, CMOS Current Mirror.

Text Books

1. CMOS VLSI Design - A Circuits and Systems Perspective (4th Edition), Neil Weste, David Harris. Addison-Wesley, Pearson
2. Design of Analog CMOS Integrated Circuit - B. Razavi, Mc. GrawHill.
3. Fundamentals of Digital Logic with Verilog Design - 3rd Edition, Brown and Vranesic, Mc. GrawHill.

Reference Books

1. CMOS Analog Circuit Design - Phillip E. Allen and Douglas R. Holberg, 2nd Ed., Oxford.
2. Digital Integrated Circuit, Design Perspective - M. Rabaey, Prentice-Hall.
3. CMOS Digital Integrated Circuits, Analysis and Design - Sung-Mo Kang, Yusuf Leblebici, Tata McGraw Hill (3rd Edition), 2006.

Course Title: Network Analysis					
Course Code: ELE3121					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	0	0	3	3

Course Outcome:

After successfully completing this course the students will be able to:

ELE3121.1: Develop foundational concepts of circuit analysis by employing various mathematical methods.

ELE3121.2: Utilize network theorems to solve electrical circuits that contain both dependent and independent sources.

ELE3121.3: Learn about various electrical waveforms and signals, and their applications in analyzing electrical circuits.

ELE3121.4: Apply Laplace Transform technique for solving transient problems of electrical circuits.

ELE3121.5: Analyze electrical circuits using the concept of graph theory.

ELE3121.6: Obtain the equivalent representation of electrical circuits using two-port network parameter representation.

Module I: [8L]

Network equations: Formulation of Node & Mesh equations. Loop and node variable analysis of electrical circuits.

Network Theorems: Superposition, Thevenin's, Norton's and Maximum Power Transfer theorem applied to circuits containing dependent sources.

Module II: [8L]

Laplace Transform: Concept of complex frequency. Properties of Laplace transform: linearity, differentiation, integration, initial value theorem and final value theorem. Transform of standard periodic and nonperiodic waveforms. Circuit elements and their transformed equivalents. Transient and steady state response of switching circuit containing RL, RC, LC and RLC with or without stored energy.

Module III: [8L]

Graph theory: Graph of network: Concept of path, tree, tree branch, tree link, loop, tie set and cut set. Incidence Matrix, Tie-set Matrix and f-cut set matrix and their properties. Loop currents and node-pair potentials, formulation of loop and node equilibrium equations in view of graph theory.

Module IV: [8L]

Two port networks: Open circuit Impedance & Short circuit Admittance parameter, Transmission parameters, Hybrid parameters and inverse hybrid parameters. Inter relation between parameters. Inter connection between two port networks. Driving point & transfer impedance & admittance.

Text Books

1. Networks and Systems - D. Roy Chowdhury, New Age International Publishers.
2. Network Analysis - M.E. Valkenburg, Pearson Education.
3. Circuit theory - Dr. Abhijit Chakrabarty, Dhanpat Rai & Co Pvt. Ltd.

Reference Books

1. Engineering Circuit Analysis - W.H. Hyat, J.E. Kemmerly & S.M. Durbin, The Mc Graw Hill Company.
2. Modern Network Analysis - F. M. Reza & S. Seely, McGraw Hill.

Course Title: Linear Algebra					
Course Code: MTH3121					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	0	0	3	3

Course Outcome:

After successfully completing this course the students will be able to:

MTH3121.1: Explain concepts of diagonalization, orthogonal diagonalization and Singular Value Decomposition (SVD).

MTH3121.2: Discuss basis, dimension and spanning sets.

MTH3121.3: Design Gram-Schmidt Orthogonalization Process and QR decomposition using concepts of inner product spaces.

MTH3121.4: Analyze Least squares solutions to find the closest line by understanding projections.

MTH3121.5: Define linear transformations and change of basis.

MTH3121.6: Illustrate applications of SVD such as, Image processing and EOF analysis, applications of Linear algebra in engineering with graphs and networks, Markov matrices, Fourier matrix, Fast Fourier Transform and linear programming.

Module I: [10L]

Characteristic equations, Eigen Values and Eigen vectors, Diagonalization, Applications to differential equations, Symmetric matrices, Positive definite matrices, similar matrices, Singular Value Decomposition, Generalized Inverses.

Module II: [10L]

Definition of Field, Vector Spaces, Elementary Properties in Vector Spaces, Subspaces, Linear Sum of Subspaces, Spanning Sets, Linear Dependence and Independence, Basis and Dimension. Application to matrices and system of linear equations.

Module III: [10L]

Inner Product Spaces, Concept of Norms, Orthogonality, Projections and subspaces, Orthogonal Complementary Subspaces, Orthogonal Projections, Gram-Schmidt Orthogonalization Process, Least square approximations, QR decomposition.

Module IV: [10L]

Linear Transformations, kernels and images, The Rank-Nullity Theorem. Matrix representation of a Linear Transformation, Change of Basis, Linear space of linear mappings.

Text Books

1. Linear Algebra and its Applications – Gilbert Strang.
2. Higher Algebra – S. K. Mapa.

Reference Books

1. Linear Algebra – Kenneth M. Hoffman, Ray Kunze.
2. Linear Algebra – Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence.
3. Schaum's Outline of Linear Algebra – Seymour Lipschutz and Marc Lipson.
4. Matrix Computations – Gene H. Golub, Charles F. Van Loan.
5. Linear Algebra A Geometric Approach – S. Kumaresan.

Course Title: Statistics and Information Theory					
Course Code: MTH3122					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	0	0	3	3

Course Outcome:

After successfully completing this course the students will be able to:

MTH3122.1: Solve the problems involving multiple random variables.

MTH3122.2: Compare and contrast different interpretations of probability theory selecting the preferred one in a specific context.

MTH3122.3: Formulate predictive models to tackle situations where deterministic algorithms are intractable.

MTH3122.4: Quantifies the amount of uncertainty involved in the value of a random variable or the outcome of a random process.

MTH3122.5: Understand mathematical analysis of problems in Information Theory.

MTH3122.6: Summarize data visually and numerically.

Module -I: Single and Bivariate Probability Distributions:

- Review of basic probability
- Moment generating functions
- Markov's inequality, Chebyshev's inequality and law of large numbers
- Joint distribution using joint probability mass/density function
- Finding marginal pmf/pdf from joint distribution
- Multiplicative property of joint pmf/ pdf in case of independent random variables

Module -II: Markov Chains and Statistical Methods:

- Markov Chains: Introduction
- Chapman-Kolmogorov equations
- Classification of states
- Some applications: Gambler's Ruin Problem
- Measures of Central tendency: Moments, skewness and Kurtosis

- Spearman's Rank Correlation coefficient
- Curve fitting: Straight line and parabolas

Module -III: Statistics-II:

- Population and Samples,
- The sampling distribution of mean (standard deviation known),
- The sampling distribution of mean (standard deviation unknown),
- Point and Interval estimation,
- Null Hypotheses and Tests of Hypotheses.

Module -IV: Classical Information Theory:

- Motivation with some relevant examples
- Entropy : Definition with examples
- Joint Entropy and Conditional Entropy
- Relative Entropy and Mutual Information
- Relationship Between Entropy and Mutual Information
- Chain Rules for Entropy, Relative Entropy and Mutual Information
- Jensen's Inequality and Its Consequences

Text Books

1. Elements of Information Theory - Thomas M. Cover , Joy A. Thomas, Wiley
2. Fundamentals of Mathematical Statistics - S. C. Gupta and V. K. Kapoor, Sultan Chand and Sons
3. Business Statistics - J. K. Sharma, Vikas Publishing House.

Reference Books

1. Introduction to Probability Models - S. M. Ross, Elsevier.
2. Information Theory and Reliable Communication - Robert G. Gallager, John Wiley and Sons
3. Business Statistics Problem and Solutions - J. K. Sharma, Pearson.

Course Title: Advanced Java and Web Technology Laboratory					
Course Code: INF3151					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	0	0	3	3	1.5

Course Outcome:

After successfully completing this course the students will be able to:

INF3151.1: Design static web pages using HTML.

INF3151.2: Implement CSS to design dynamic HTML pages.

INF3151.3: Implement JavaScript client and server-side scripting.

INF3151.4: Implement closure and lexical scoping concept of JavaScript.

INF3151.5: Implement Asynchronous JavaScript (Callback and Promise).

INF3151.6: Create Servlet based web application.

Syllabus:

1. HTML.

2. CSS [Inline, Internal External].

3. JavaScript Control Structure and Functions.

4. JavaScript Events.

5. JavaScript Objects and Arrays.

6. JavaScript Validation and implementation in HTML Form.

7. JavaScript closure and lexical scoping.

8. Asynchronous JavaScript (Callback and Promise).

9. Servlet

Books

1. Web Technologies - Godbole A. S. & Kahate A., TMH.
2. Web Technology & Design - Xavier C., New Age Publication.
3. JavaScript: The Definitive Guide - David Flanagan, 7th Edition, O'Reilly Media.
4. Java EE Essential - Arup Gupta, O'Reilly.

Course Title: Machine Learning Laboratory					
Course Code: INF3152					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	0	0	3	3	1.5

Course Outcome:

After successfully completing this course the students will be able to:

INF3152.1: Build core programming logics for hard and soft clustering techniques.

INF3152.2: Implement python programs to solve real world problems, and Access Databases.

INF3152.3: Performing complex numerical analysis tasks.

INF3152,4: Produce high quality 2D Data Visualizations.

INF3152.5: Analyze real world datasets and apply suitable clustering algorithms to group.

INF3152.6: Build Classifiers with real life dataset.

Syllabus:

Unit – I: Unsupervised Learning- K-Means, DBSCAN, Fuzzy C means

1. Building Efficient Programming Logics for Different Hard Clustering Techniques
2. Building Efficient Programming Logics for Different Soft Clustering Techniques
3. Performance Analyses
4. Basics of python - Introduction to Python, Decision Structures, Repetition Structures, Creating User Defined Functions and Modules, Useful Built-in Functions.

Unit – II: Familiarization with ML based Data Preprocessing, Analyses & Visualization Tools

1. Python String Handling, Regular Expressions, Lists, Tuples, Dictionaries and Sets.
2. Introduction to math library, Handling Random Numbers.

3. Understanding Data, Python Packages for Data Science.
4. NumPy: Creation of arrays, Array types and attributes, Indexing, slicing, Aggregations: max, min, sum, mean, standard deviation.
5. Matplotlib: Simple figure, Subfigures, Other data visualization libraries for Python.
6. Pandas: Creation of Data Frames, accessing columns and rows of a data frame, Summary statistics, Missing data, Converting columns from one type to another.

Unit – III: Supervised Learning – Decision Tree, Naïve Bayes, Random Forest, Neural Network Models

1. Importing and Exporting Data in Python, Creating, loading and accessing csv files
2. Introduction to sklearn library
3. Classifying Dataset: Using sklearn-Preparing Training and Test Dataset, Preparing Models using Supervised Learning Techniques, Summary Statistics
4. Performance Comparisons
5. Building Classifiers on different Real-World Problems

Unit – IV: Managing Data for Machine Learning using Sqlite3

1. Creating Database Objects
2. Insertion or loading Data
3. Different database access patterns
4. Conditional Updation, Deletions
5. Programming Constructs based Modification

Text Books

1. Python Programming, A Modular Approach - Sheetal Taneja and Naveen Kumar, Pearson.
2. The Fundamentals of Python: First Programs - 2011, Kenneth A. Lambert, Cengage Learning.
3. Python for Data Analysis - Wes McKinney, 2nd Editions, O'Reilly, 2017.
4. Think Python First Edition - Allen B. Downey, Orielly Publishing.

Reference Books

1. Introduction to Computation and Programming Using Python - John V. Guttag, The MIT Press.
2. Beginning Python using Python 2.6 and Python 3 - James Payne, Wrox Publishing.
3. Practical Programming: An Introduction to Computer Science using Python 3 - Paul Gries, The Pragmatic Bookshelf, 2nd edition (4 Oct. 2013).
4. Python Data Science Essentials, Third Edition - Alberto Boschetti and Luca Massaron, Packt Publishing, 2018.

Course Title: Operating Systems Laboratory					
Course Code: INF3153					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	0	0	3	3	1.5

Course Outcome:

After successfully completing this course the students will be able to:

INF3153.1: Develop and debug programs in UNIX environment.

INF3153.2: Develop shell scripts to manage the system memory, user, files, and devices.

INF3153.3: Develop multi-processing and multi-threading environment capable of performing multiple tasks or subtasks simultaneously.

INF3153.4: Apply system calls and signals for user defined purposes

INF3153.5: Design a synchronized multi-threaded system capable of resource sharing

INF3153.6: Develop C programs to share information between two process using concepts of IPC.

Syllabus:

1. **Shell Programming [3P]:** Shell Commands, Creating a shell script, making a script executable, shell syntax (variables, conditions, control structures).

2. **Process [4P]:** starting new process, replacing a process image, duplicating a process image, waiting for a process, zombie process.

3. **Signal [4P]:** signal handling, sending signals, signal interface, signal sets.

4. **Semaphore [6P]:** programming with semaphores (use functions sem_init, sem_wait, sem_post, sem_destroy).

5. **POSIX Threads [6P]:** programming with pthread functions (viz. pthread_create, pthread_join, pthread_exit)

6. **Inter-process communication [6P]:** pipes (use functions pipe, popen, pclose), named pipes (FIFOs, accessing FIFO), message passing & shared memory (IPC version V).

Text Books

1. UNIX and Shell Programming - Behrouz A. Forouzan, Richard F. Gilberg, Thomson, 2003.
2. The UNIX Programming Environment - Brian W. Kernighan, Rob Pike, PHI, 1996.
3. Understanding UNIX - K. Srirengan, PHI 2002.

Reference Books

1. Your UNIX- The Ultimate Guide - Sumitabha Das, TMGH, 2002.
2. UNIX Concepts and Applications - Sumitabha Das, Second Edition, TMGH, 2002.

APPENDIX – B

OFFICE OF THE CONTROLLER OF EXAMINATIONS

HERITAGE INSTITUTE OF TECHNOLOGY, KOLKATA

MANDATORY ADDITIONAL REQUIREMENTS (MAR)

Activity List w.e.f. 2023-2024 Academic Year

	Activity	Points per Activity	Permissible Points (max)
1.	*MOOCS (SWAYAM / NPTEL / SPOKEN TUTORIAL / ANY TECHNICAL, NON-TECHNICAL COURSE) (PER COURSE)*		
a)	For 12 weeks duration/40 Hours	20	40
b)	For 8 weeks duration/30 Hours	15	
c)	For 4 weeks duration/20 Hours	10	
d)	For 2 weeks duration/10 Hours	5	
2.	*TECH FEST / FEST / TEACHERS DAY / FRESHER'S WELCOME*		
a)	Organizer	5	10
b)	Participant	3	6
3.	*RURAL REPORTING*	5	10
4.	*TREE PLANTATION AND UP-KEEPING (PER TREE)*	1	10
5.	*RELIEF / CHARITABLE ACTIVITIES*		
a)	Collection of fund / materials for the Relief Camp or Charitable Trusts	5	40
b)	To be a part of the Relief Work Team	20	
6.	*PARTICIPATION IN DEBATE / GROUP DISCUSSION / WORKSHOP / TECH QUIZ / MUSIC / DANCE / DRAMA / ELOCUTION / QUIZ / SEMINAR / PAINTING / ANY PERFORMING ARTS / PHOTOGRAPHY / FILM MAKING / LIFE SKILLS*	10	20
7.	*PUBLICATION IN NEWS PAPER, MAGAZINE, WALL MAGAZINE & BLOGS*	10	20
8.	*RESEARCH PUBLICATION (PER PUBLICATION)*	15	30
9.	*INNOVATIVE PROJECTS (OTHER THAN COURSE CURRICULUM)*	30	60
10.	*BLOOD DONATION*		
a)	Individual Blood donation	8	16
b)	Blood Donation Camp Organization	10	20
11.	*SPORTS / GAMES / ADVENTURE SPORTS / TREKKING / YOGA CAMP*		
a)	Personal Level	10	20
b)	College level	5	10
c)	University Level	10	20
c)	District Level	12	24
e)	State Level	15	30
f)	National / International Level	20	20
12.	*ACTIVITIES IN A PROFESSIONAL SOCIETY / STUDENT CHAPTER*	10	20
13.	*RELEVANT INDUSTRY VISIT & REPORT / HOTEL-EVENT MANAGEMENT TRAINING & REPORT (MINIMUM 3 DAYS WITH SUBMITTED REPORT)*	10	20
14.	*COMMUNITY SERVICE & ALLIED ACTIVITIES LIKE: CARING FOR THE SENIOR CITIZENS, UNDER-PRIVILEGED / STREET CHILDREN / ANIMAL CARE ETC. / TRAINING TO DIFFERENTLY ABLE*	10	20
15.	*SELF-ENTREPRENEURSHIP PROGRAMME*		
a)	To organise entrepreneurship programmes and workshops	10	20
b)	To take part in entrepreneurship workshop and get certificate	5	10
c)	Video film making on entrepreneurship	10	20
d)	Submit business plan on any project	10	20
e)	To work for start-up/as entrepreneur	20	40

Format for Report Submission

Name :

Department :

Year/Semester :

Title of the Activity :

Date :

Name of the organization :

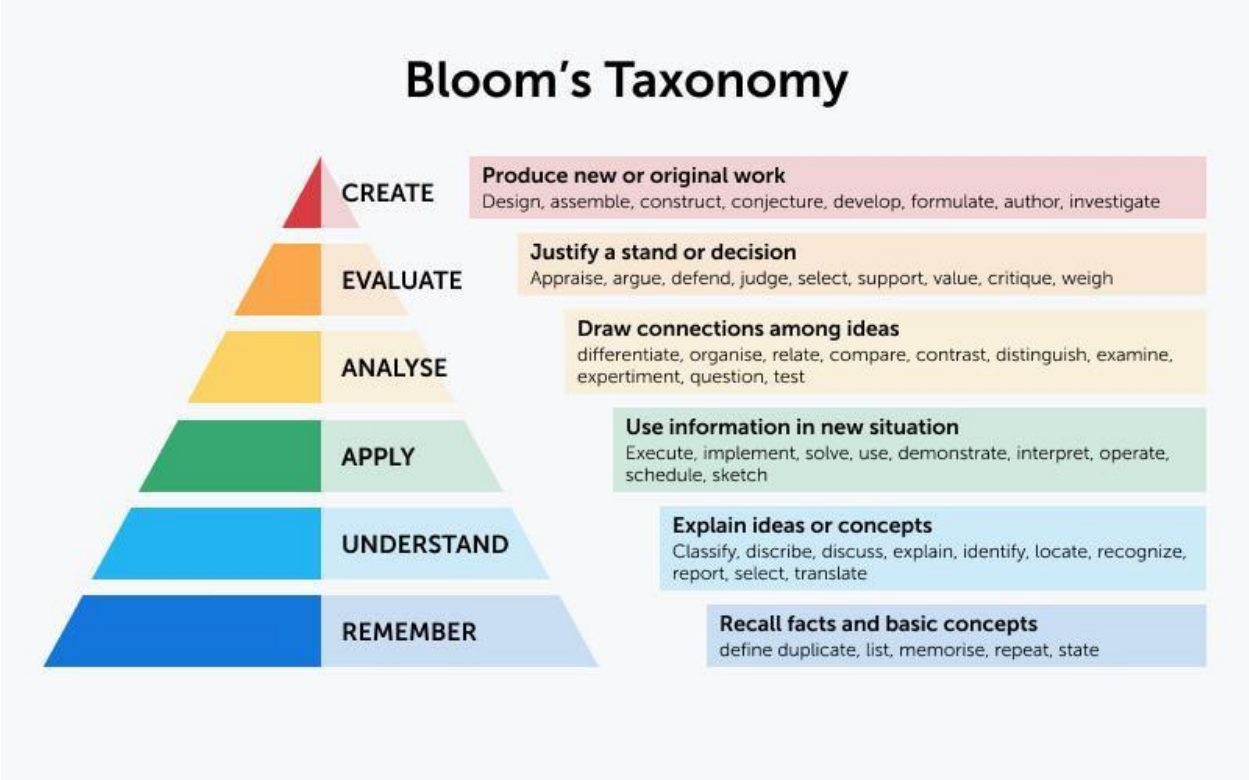
Report :

Signature
(Coordinator / Competent Authority)

Points earned:

Signature of the Mentor

APPENDIX – C


Bloom's Taxonomy
CREATE
Produce new or original work
Design, assemble, construct, conjecture, develop, formulate, author, investigate
EVALUATE
Justify a stand or decision
Appraise, argue, defend, judge, select, support, value, critique, weigh
ANALYSE
Draw connections among ideas
differentiate, organise, relate, compare, contrast, distinguish, examine, expertiment, question, test
APPLY
Use information in new situation
Execute, implement, solve, use, demonstrate, interpret, operate, schedule, sketch
UNDERSTAND
Explain ideas or concepts
Classify, discribe, discuss, explain, identify, locate, recognize, report, select, translate
REMEMBER
Recall facts and basic concepts
define duplicate, list, memorise, repeat, state