HERITAGE INSTITUTE OF TECHNOLOGY

(An Autonomous Institution affiliated to MAKAUT, West Bengal)

DEPARTMENT

OF

COMPUTER SCIENCEAND ENGINEERING

(Internet of Things and Cyber Security Including Blockchain Technology)

B.TECH. PROGRAMME

Curriculum and Detailed Syllabus

Release Version 1: JULY 2023

Release Version 2: June 2024

(Applicable from 2023 admitted batch)

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Preamble

The curriculum for the B. Tech. in Computer Science and Engineering (Internet of Things and Cyber Security including Blockchain 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 a multidisciplinary approach that satisfies the requirements of the industry, academics and the different Accreditation bodies like NBA and NAAC. Courses such as Cyber Security, Cloud Computing, Big Data and IOT, Python programming, Design Thinking & Idea Lab, Blockchain Technology, IOT Architectures and Protocols are included in the syllabus keeping in mind about the industry demand. 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 came from the office of the Controller of Examinations. In accordance with this, the curriculum and syllabi are revised in a structured manner by implementing Feedback Mechanism on Curriculum from various stakeholders, including potential employers, alumni, and parents. This syllabus has been prepared in consultation with experts from the esteemed organization titled Ernst & Young.

Institutional Vision & Mission

VISION:

To prepare dynamic and caring citizens to meet the challenges of global society while retaining the 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 meet the challenges of 21st century and become a Centre of Excellence in the field of Computer Science & Engineering.

MISSION:

M1: To impart the best educational training and facilities to prepare the students with a strong foundation in their disciplines with a penchant for life-long learning and knowledge sharing.

M2: To inculcate a spirit of entrepreneurship and hone their professional skills through developmental activities and interaction with industry.

M3: To promote a culture of research, collaboration and innovation among students and enable them to conceptualize, analyze and solve problems and projects in their fields of interest.

M4: To help students gain perspective of their gifts, talents and interests and encourage them to learn and assess the best ways to lead a venture and respond to the needs of the society.

Program Educational Objectives (PEOs)

The graduate students with the B.Tech. degree in Computer Science and Engineering (Internet of Things and Cyber Security including Blockchain Technology) from Heritage Institute of Technology, Kolkata are expected to achieve the following qualities after a few years of getting this degree.

PEO1. Students will be prepared for successful careers in the fields of IoT and cybersecurity, demonstrating proficiency in both technical and non-technical skills required for various roles in industry, government, or academia.

PEO2. Students will possess a strong foundation in IoT technologies and cybersecurity principles, enabling them to design, develop, implement, and manage secure IoT systems, networks, and applications effectively.

PEO3. Students will exhibit ethical and professional behavior, understanding the legal and ethical considerations associated with IoT deployments and cybersecurity practices. They will prioritize the protection of privacy, confidentiality, and integrity of data in all aspects of their work.

PEO4. Students will be capable of working with multidisciplinary teams and collaborating with professionals from diverse backgrounds to address complex IoT and cybersecurity challenges. They will effectively communicate technical concepts and solutions to both technical and non-technical stakeholders.

PEO5. Students will be able to lead teams and contribute to the advancement of society by applying their knowledge and skills to address societal challenges related to IoT deployment and cybersecurity.

Program Outcomes (POs)

Engineering Graduates will be able to:

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

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

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

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

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

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

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

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

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

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

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

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

Program Specific Outcomes (PSOs)

PSO1. Reflex Action: Students should be able to identify the requirements to build IoT-based applications and identify vulnerabilities in IoT systems and appropriate security measures to mitigate risks. The ability to categorize the different domains or areas of the sub-problems associated with the computational process should come to them naturally.

PSO2. Perceptual Action: Students should be able to design appropriate mathematical/logical models for the solution of the sub-problems to demonstrate a deep understanding of secure IoT technologies, communication protocols, and data processing frameworks.

PSO3. Physical Action: Based on the mathematical or logical models, students should be able to recognize the correct algorithmic approach to design efficient approaches to integrate IoT devices and systems securely into existing networks and infrastructures to solve real-world problems while maintain professional ethics.

PSO4. Skilled Action: Students should be able to implement the solutions of unique security challenges posed by IoT deployments and be capable of implementing strategies to protect sensitive data and infrastructure from cyber threats. They will gain enough expertise to choose the optimal solution by assessing the prospective results, analyzing the efficiency of algorithms.

Credit Summary for B.Tech. Programmes in CSE (IOT&CS) with effect from 2023-2024, Comparing with the Credits for B.Tech.in CSE

Sl. No.	Course Type	AICTE Suggested for CSE as per 2022	CSE (IOT&CS)
1.	Humanities and Social Sciences including Management Courses	16	12
2.	Basic Science Courses	23	16
3.	Engineering Science Courses including Workshop, Drawing, Basics of Electrical / Mechanical / Computer, etc.	29	18
4.	Professional Core Courses	59	73
5.	Professional Elective Courses relevant to chosen Specialization / Branch	12	16
6.	Open Subjects – Electives from other Technical and/or Emerging Subjects	9	12
7.	Project Work, Seminar and Internship in industry or elsewhere	15	16
8.	Mandatory Courses (Non-credit) [Environmental Sciences, Induction Program, Indian Constitution and Civil Society]	(NON-CREDIT)	(NON-CREDIT)
	Total	**163**	**163**
9	Honours Courses (MOOCS or otherwise)	20	20
	Grand Total	**183**	**183**

Definition of Credit (as per AICTE):

- 1 Hour Lecture (L) per Week = 1 Credit
- 1 Hour Tutorial (T) per Week = 1 Credit
- 1 Hour Practical (P) per Week = 0.5 Credits
- 2 Hours Practical (Lab) per Week = 1 Credit

Range of Credits (as per AICTE):

- A total of 163 credits will be necessary for a student to be eligible to get B.Tech degree.
- A student will be eligible to get B.Tech degree with Honours if he/she completes an additional 20 credits.
- These could be acquired through MOOCs.
- Any student completing any course through MOOC will have to submit an appropriate certificate to earn the corresponding credit.

For any additional information, the student may contact the concerned HODs.

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	2	1	0	3	3
Total Theory			**11**	**2**	**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 Practice	1	0	3	4	2.5
4	MEC1052	Engineering Graphics and Design	1	0	3	4	2.5
Total Practical			**2**	**0**	**10**	**12**	**7**
Total of Semester			**13**	**2**	**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 Lab	0	0	2	2	1
4	HUM1051	English for Technical Writing Lab	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	CSE2101	Data Structures and Algorithms	4	0	0	4	4
2	CSE2102	Operating Systems	3	0	0	3	3
3	IOT2101	Internet and Networking Basics	3	0	0	3	3
4	IOT2102	Introduction to Cybersecurity	3	0	0	3	3
5	IOT2103	Fundamentals of Network Security and Cryptography	4	0	0	4	4
Total Theory			**17**	**0**	**0**	**17**	**17**
B. Practical							
1	CSE2151	Data Structures and Algorithms Lab	0	0	3	3	1.5
2	CSE2152	Operating Systems Lab	0	0	3	3	1.5
3	IOT2151	Internet and Networking Basics Lab	0	0	2	2	1
4	IOT2154	Programming in Python Lab	0	0	3	3	1.5
5	IOT2155	Design Thinking and Idea Lab	0	0	2	2	1
Total Practical			**0**	**0**	**13**	**13**	**6.5**
Total of Semester			**17**	**0**	**13**	**30**	**23.5**

2nd Year 2nd Semester

A. Theory							
Sl.	**Code**	**Subject**	**Contacts Periods/ Week**				**Credit Points**
			L	**T**	**P**	**Total**	
1	IOT2201	Blockchain Technology	4	0	0	4	4
2	IOT2202	Fundamentals of Software Engineering	3	0	0	3	3
3	IOT2203	Object Oriented Programming with Java	3	0	0	3	3
4	IOT2204	IOT Architecture and Protocols	4	0	0	4	4
5	ECE2002	Digital Circuit Design	3	0	0	3	3
6	EVS2016	Environmental Sciences (Mandatory – non-credit)	2	0	0	2	0
Total Theory			**19**	**0**	**0**	**19**	**17**
B. Practical							
1	IOT2252	Fundamentals of Software Engineering Lab	0	0	3	3	1.5
2	IOT2253	Object Oriented Programming with Java Lab	0	0	3	3	1.5
3	IOT2254	IOT Lab	0	0	3	3	1.5
4	ECE2052	Digital Circuit Design Laboratory	0	0	2	2	1
Total Practical			**0**	**0**	**11**	**11**	**5.5**
Total of Semester			**19**	**0**	**11**	**30**	**22.5**

3rd Year 1st Semester

A. Theory							
Sl.	**Code**	**Subject**	**Contacts Periods/ Week**				**Credit Points**
			L	**T**	**P**	**Total**	
1	CSE3101	Database Management Systems	4	0	0	4	4
2	IOT 3101	Introduction to Computer Organization and Architecture	4	0	0	4	4
3	IOT 3102	Introduction to Offensive Security	3	0	0	3	3
4	CSE3131-CSE3140	Professional Elective-I	3	0	0	3	3
	CSE3131 CSE3132 CSE3133 IOT3131 IOT3132	Computer Graphics & Multimedia Data Mining & Knowledge Discovery Web Technologies Mobile and Web Application penetration Testing Theory of Computation					
5	IOT3141-IOT3150	Professional Elective-II	3	0	0	3	3
	IOT3141 IOT3142 IOT3143	Network Security Network Design & Management Digital Forensics					
6	*******	Open Elective-I	3	0	0	3	3
Total Theory			**20**	**0**	**0**	**20**	**20**
B. Practical							
1	CSE3151	Database Management Systems Lab	0	0	3	3	1.5
2	IOT3151	Introduction to Computer Organization and Architecture Lab	0	0	3	3	1.5
3	IOT 3152	Offensive Security Lab	0	0	3	3	1.5
4	IOT 3171 IOT 3172 IOT 3173	Network Security Lab Firewall Lab Digital Forensics Lab	0	0	2	2	1
Total Practical			**0**	**0**	**11**	**11**	**5.5**
Total of Semester			**20**	**0**	**11**	**31**	**25.5**

3rd Year 2nd Semester

Sl.	Code	Subject	Contacts Periods/ Week L	T	P	Total	Credit Points
A. Theory							
1	IOT 3201	Fundamentals of Cloud computing & Security	3	0	0	3	3
2	IOT 3202	Intrusion Detection & Prevention Systems	3	0	0	3	3
3	HUM3201	Economics for Engineers	3	0	0	3	3
4	CSE3231- CSE3240	Professional Elective-III	3	0	0	3	3
	CSE3231 CSE3233 IOT3231 CSE3238 CSE3240	Image Processing Machine Learning Big Data and IOT Enterprise Application in Java EE Real Time & Embedded System					
6	*******	Open Elective-II	3	0	0	3	3
7	INCO3016	Indian Constitution and Civil Society (Mandatory)	2	0	0	2	0
Total Theory			**17**	**0**	**0**	**17**	**15**
B. Practical							
1	IOT 3251	Fundamentals of Cloud Computing and Security Lab	0	0	3	3	1.5
2	IOT 3252	Intrusion Detection Lab	0	0	3	3	1.5
3	CSE3261- CSE3270	Professional Elective-III Lab	0	0	2	2	1
	CSE3261 CSE3263 CSE3266 CSE3268 CSE3270	Image Processing Lab Machine Learning Lab Big Data and IOT Lab Enterprise Application in Java EE Lab Real Time & Embedded System Lab					
Total Practical			**0**	**0**	**8**	**8**	**4**
C. Sessional							
1	CSE3293	Term Paper and Seminar /External Certification / ISO 27001, CEH, AZ500, AZ900 (MOOC)	0	0	4	4	2
2	CSE3295	Project-I	0	0	4	4	2
Total Sessional			**0**	**0**	**8**	**8**	**4**
Total of Semester			**17**	**0**	**16**	**33**	**23**

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	XXX4131 - XXX4140	Professional Elective-IV	3	0	0	3	3
	CSE4131 CSE4038 DSC4133 IOT4131 IOT4132	Soft Computing Mobile Computing Introduction to Deep Learning IT Systems Security & Physical Security Introduction to Identity and Access Management					
3	IOT4141-IOT4150	Professional Elective-V	3	0	0	3	3
	IOT4141 IOT4142 IOT4143	Cybersecurity Standards and Frameworks Agile methodology Software Project Management with Risk Management					
4	*******	Open Elective-III	3	0	0	3	3
5	*******	Open Elective-IV	3	0	0	3	3
Total Theory			**15**	**0**	**0**	**15**	**15**
B. Sessional							
1	IOT4191	Industrial Training / Internship	-	-	-	-	2
2	IOT4195	Project-II	0	0	6	6	3
Total Sessional			**0**	**0**	**6**	**6**	**5**
Total of Semester			**15**	**0**	**6**	**21**	**20**

4th Year 2nd Semester

Sl.	Code	Subject	Contacts Periods/ Week				Credit Points
			L	T	P	Total	
1	IOT4295	Project-III	0	0	10	10	5
2	IOT4297	Comprehensive Viva-voce	-	-	-	-	2
Total Sessional			**0**	**0**	**10**	**10**	**7**
Total of Semester			**0**	**0**	**10**	**10**	**7**

DETAILED SYLLABUS

1st Year

Course Title : Physics-I					
Course Code: PHY1001					
Contact hrs. per week:	**L**	**T**	**P**	**Total**	**Credit points**
	3	**0**	**0**	**3**	**3**

Course Outcomes:

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

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

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

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

PHY1001.4: Grasp an analytic view of micro and macroscopic world.

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

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

Module – I: [10L] Mechanics

Plane-polar coordinate system-velocity and acceleration of a particle-trajectory under central force- conservation principle-Kepler's laws -Rotating frame of reference-Five point acceleration formula- Coriolis effect-deflection of a moving particle.

Module – II: [10L] Oscillation

Constitutive equation of damping-nature of solutions for large, critical and weak damping-relaxation time, logarithmic decrement, energy decay (qualitative discussion) -Forced oscillation-transient and steady state-amplitude and velocity resonance---power transfer theorem-quality factor-series LCR circuit with AC source.

Module –III: [10L] Optics

Plane Progressive Wave-phase/wave-length/frequency-qualitative description of light as an electromagnetic wave-Huygens principle-polarization (state of polarization, general equation of ellipse, transformation of polarized lights)-interference (basic theory from superposition principle)-Division of wave front (Young's double slit experiment)-Division of amplitude (thin film, wedge, Newton's ring)-Diffraction (single slit, double slit, grating, Resolving Power).

Module – IV: [10L] 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- Unitary-Hermitian frame work-position and momentum operator-Canonical Commutation Relations (CCR)- Schrodinger equation-time dependent/time independent Schrodinger equation-wave function-stationary states-probability density-probability current density-normalization-expectation value-uncertainty-Bound state problem-particle in a one dimensional box- scattering state problem-potential step-reflection and transmission coefficients- tunnelling.

Text & Reference 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.
11. Refresher Course in B.Sc. Physics – Vol1 and Vol 2 – C.L.Arora

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

Course Outcomes:

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 convergence: 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 & Reference books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 2000.
2. E. Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 2006.
3. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
5. K. F. Riley, M. P. Hobson, S. J. Bence. Mathematical Methods for Physics and Engineering, Cambridge University Press, 23-Mar-2006.
6. S. L. Ross, Differential Equations", Wiley India, 1984.
7. G.F. Simmons and S.G. Krantz, Differential Equations, McGraw Hill, 2007.
8. Vector Analysis(Schaum's outline series): M. R. Spiegel, Seymour Lipschutz, Dennis Spellman (McGraw Hill Education)
9. Engineering Mathematics: S. S. Sastry (PHI)
10. Advanced Engineering Mathematics: M.C. Potter, J.L. Goldberg and E.F. Abonfadel (OUP),Indian Edition.
11. Linear Algebra (Schaum's outline series): Seymour Lipschutz, Marc Lipson (McGraw Hill Education)

Course Title : Introduction to Electronics Devices & Circuits					
Course Code: ECE1001					
Contact hrs. per week:	**L**	**T**	**P**	**Total**	**Credit points**
	3	**0**	**0**	**3**	**3**

Course Outcomes:

After going through 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, 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 (forboth 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, CMRR, slew rate, offset error voltages and current
Basic circuits using OPAMP: Comparator, inverting and non-inverting amplifiers, adder, subtractor, integrator, differentiator.

Text & Reference books

1. Boylestad&Nashelsky:Electronic Devices & Circuit Theory
2. R.A Gayakwad: Op Amps and Linear IC's, PHI
3. D. Chattopadhyay, P. C Rakshit : Electronics Fundamentals and Applications
4. Adel S. Sedra, Kenneth Carless Smith: Microelectronics Engineering
5. Millman & Halkias: Integrated Electronics.
6. Salivahanan: Electronics Devices & Circuits.
7. Albert Paul Malvino: Electronic Principle.

Course Name: **Universal Human Values and Professional Ethics**					
Course Code : HUM1002					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	2	1	0	3	3

Course Outcomes:

After going through this course, the students will be able to:

HUM1002.1: Aware of the value system and the importance of following such values at workplace.

HUM1002.2: Learn to apply ethical theories in the decision making process.

HUM1002.3: Follow the ethical code of conduct as formulated by institutions and organizations.

HUM1002.4: Implement the principles governing work ethics.

HUM1002.5: Develop strategies to implement the principles of sustainable model of development.

HUM1002.6: Implement ecological ethics wherever relevant and also develop eco-friendly technology.

Module I: [10L]

Human society and the Value System: Values: Definition, Importance and application. Formation of Values: The process of Socialization.

Self and the integrated personality Morality, courage, integrity

Types of Values: Social Values: Justice, Rule of Law, Democracy, Indian Constitution, Secularism Aesthetic Values: Perception and appreciation of beauty.

Organizational Values: Employee: Employer--- rights, relationships, obligations

Psychological Values: Integrated personality and mental health

Spiritual Values & their role in our everyday life

Value Spectrum for a Good Life, meaning of Good Life

Value Crisis in Contemporary Society

Value crisis at----

Individual Level Societal Level Cultural Level

Value Crisis management Strategies and Case Studies

Module II: [10L]

Ethics and Ethical Values Principles and theories of ethics

Consequential and non-consequential ethics

Egotism, Utilitarianism, Kant's theory and other non-consequential perspectives Ethics of care, justice and fairness, rights and duties

Ethics:Standardization Codification Acceptance Application

Types of Ethics- Ethics of rights and Duties
Ethics of Responsibility Ethics and Moral judgment Ethics of care
Ethics of justice and fairness
Work ethics and quality of life at work

Professional Ethics:

Ethics in Engineering Profession;
Moral issues and dilemmas, moral autonomy (types of inquiry) Kohlberg's theory, Gilligan's theory (consensus and controversy)
Code of Professional Ethics Sample Code of ethics like ASME, ASCE. IEEE Institute of Engineers, Indian Institute of materials management, Institute of Electronics and telecommunication engineers
Violation of Code of Ethics---conflict, causes and consequences
Engineering as social experimentation, engineers as responsible experimenters (computer ethics, weapons development)
Engineers as managers, consulting engineers, engineers as experts, witnesses and advisors, moral leadership Conflict between business demands and professional ideals
Social and ethical responsibilities of technologies.
Whistle Blowing: Facts, contexts, justifications and case studies

Ethics and Industrial Law

Institutionalizing Ethics: Relevance, Application, Digression and Consequences

Module III: [10L]

Science, Technology and Engineering

Science, Technology and Engineering as knowledge and profession
Definition, Nature, Social Function and Practical application of science Rapid Industrial Growth and its Consequences
Renewable and Non- renewable Resources: Definition and varieties Energy Crisis
Industry and Industrialization Man and Machine interaction
Impact of assembly line and automation Technology assessment and Impact analysis Industrial hazards and safety
Safety regulations and safety engineering Safety responsibilities and rights
Safety and risk, risk benefit analysis and reducing risk Technology Transfer: Definition and Types
The Indian Context

Module IV: [6L]

Environment and Eco- friendly Technology

Human Development and Environment Ecological Ethics/Environment ethics
Depletion of Natural Resources: Environmental degradation Pollution and Pollution Control

Eco-friendly Technology: Implementation, impact and assessment
Sustainable Development: Definition and Concept
Strategies for sustainable development Sustainable Development--- The Modern Trends
Appropriate technology movement by Schumacher and later development Reports of Club of Rome.

Text & Reference books:

1. Tripathi,A.N., Human Values, New Age International, New Delhi,2006
2. Ritzer, G., Classical Sociological Theory, The McGraw Hill Companies, New York,1996. 3)Doshi,S.L., Postmodern Perspectives on Indian Society, Rawat Publications, New Delhi,2008. 4)Bhatnagar, D.K., Sustainable Development, Cyber Tech Publications, New Delhi, 2008. 5)Kurzwell,R., The age of Spiritual Machines, Penguin Books, New Delhi,1999.
3. Weinberg, S.K., Social Problems in Modern Urban Society, Prentice Hall,Inc.,USA, 1970.
4. Giddens, Anthony 2009. Sociology. London: Polity Press (reprint 13th Edition).

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

Course Outcomes:

After going through 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 & 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 by N.K. Bajaj
4. Principles of Physics, 10ed, David Halliday, Robert ResnickJearl Walker , Wiley
5. Electricity, Magnetism, and Light, Wayne M. Saslow, Academic Press
6. Classical mechanics, Narayan Rana, PramodJoag, McGraw HillEducation
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 & Circuits Lab					
Course Code: ECE1051					
Contact hrs. per week:	**L**	**T**	**P**	**Total**	**Credit points**
	0	**0**	**2**	**2**	**1**

Course Outcomes:

After going through this course, the students will be able to:

ECE1051.1 The students will correlate theory with diode behavior.
ECE1051.2 They will design and check rectifier operation with regulation etc.
ECE1051.3 Students will design different modes with BJT and FET and check the operations.
ECE1051.4 They will 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-metersetc.
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.

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

Course Outcomes:

After going through 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: (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	**(3 hours)**

Text & Reference books:

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

Course Title : Engineering Graphics and Design					
Course Code: MEC1052					
Contact hrs. per week:	**L**	**T**	**P**	**Total**	**Credit points**
	1	**0**	**3**	**4**	**2.5**

Course Outcomes:

After going through the course, the students will be able to:

MEC1051.1: To understand the meaning of engineering drawing.
MEC1051.2: To have acquaintance with the various standards (like lines, dimensions, scale etc.) and symbols followed in engineering drawing.
MEC1051.3: To represent a 3-D object into 2-D drawing with the help of orthographic and isometric projections.
MEC1051.4: To read and understand projection drawings.
MEC1051.5: To draw the section view and true shape of a surface when a regular object is cut by a section plane.
MEC1051.6: To use engineering drawing software (CAD).

Lecture Plan (13 L)

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

Detailed contents of Lab hours (52 hrs)

Module 1: Introduction to Engineering Drawing covering,

Principles of Engineering Graphics and their significance, usage of Drawing instruments, lines, lettering & dimensioning, Conic section like Ellipse (General method only); Involute; Scales – Plain, Diagonal. (4 hrs + 4 hrs)

Module 2: Orthographic Projections covering,

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

(4 hrs+4 hrs + 4 hrs)

Module 3: Projections of Regular Solids covering,those inclined to both the Planes- Auxiliary Views.

(4 hrs + 4 hrs)

Module 4: Sections and Sectional Views of Right Angular Solids covering,

Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids.(4 hrs)

Module 5: Isometric Projections covering,

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. (4 hrs + 4 hrs)

Module 6: Overview of Computer Graphics covering,

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. (4 hrs)

Module 7: Customisation & CAD Drawing

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; (2 hrs)

Annotations, layering & other functions covering

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. (2 hrs)

Module 8: Demonstration of a simple team design project that illustrates

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

(4 hrs)

Text & Reference books:

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

Course Title : Chemistry-I					
Course Code : CHM1001					
Contact hrs. per week:	L	T	P	Total	Credit points
	3	0	0	3	3

Course outcomes:

The subject code CHM1001 corresponds to chemistry theory classes for the first year B. Tech students, which is offered as Engineering Chemistry and is common for all branches of engineering subjects. The course provides basic knowledge of theory based subjects like quantum mechanics, thermodynamics, reaction dynamics, electrochemistry, structure and reactivity of molecules. The course outcomes of the subject are

CHM1001.1: Knowledge of understanding the operating principles and reaction involved in batteries and fuel cells and their application in automobiles as well as other sectors to reduce environmental pollution.

CHM1001.2: An ability to design and conduct experiments, as well as to organize, analyzes, and interprets data.

CHM1001.3: An ability to analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces for engineering applications.

CHM1001.4: Have knowledge of synthesizing nano materials and their applications in industry, carbon nano tube technology is used in every industry now-a-days.

CHM1001.5: Understanding of bulk properties and processes using thermodynamic considerations.

CHM1001.6: Elementary knowledge of IR, UV, NMR and X-ray spectroscopy is usable in structure elucidation and characterisation of various molecules.Knowledge of electronic effect and stereochemistry for understanding mechanism of the major chemical reactions involved in synthesis of various drug molecules.

Module I:[10 L]

Atomic structure and Wave Mechanics:

Brief outline of the atomic structure, Duel character of electron, De Broglies's equation, the Heisenberg uncertainty principle, brief introduction of quantum mechanics, the Schrodinger wave equation, Hermitian operator, solution of the Schrodinger equation for particle in a one dimensional box, interpretation of the wave function Ψ, concept of atomicorbital. 3L

Thermodynamics:

Carnot cycle, 2nd law of thermodynamics, entropy, Clausius inequality, free energy and work function, ClausiusClapeyron Equation, Chemical Potential, Activity and Activity coefficient. Gibbs Duhem Relation.4L

Spectroscopic Techniques & Application

Electromagnetic spectrum: EMR interaction with matter - absorption and emission of radiation. Principle and application of UV- visible and IR spectroscopy

Principles of NMR Spectroscopy and X-ray diffraction technique. 3L

Module II: [10 L]

Chemical Bonding

Covalent bond, VSEPR Theory, hybridization, molecular geometries, Dipole moment, Intermolecular forces, V.B. and M.O. theory and its application in Homo and Heteronuclear diatomic molecules, Band theory of solids, Pi- molecular orbital of ethylene and butadiene.5L

Periodicity

Effective nuclear charge, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electro-negativity, inert pair effect.3L

Ionic Equilibria

Acid Base Equilibria, Salt Hydrolysis and Henderson Equation, Buffer solutions, pH indicator, Common ion Effect, Solubility product, Fractional Precipitation .2L

Module III: [10 L]

Conductance

Conductance of electrolytic solutions, Strong and Weak electrolytes, effect of temperature and concentration.Kohlrausch's law of independent migration of ions, transport numbers and hydration of ions.Application of conductance Acid-base and precipitation titration. 3L

Electrochemical Cell

Thermodynamic derivation of Nernst equation, Electrode potential and its application to predict redox reaction; Standard Hydrogen Electrode, Reference electrode, cell configuration, half-cell reactions, evaluation of thermodynamic functions; Reversible and Irreversible cells; Electrochemical corrosion.

Electrochemical Energy Conversion: Primary & Secondary batteries, Fuel Cells. 4L

Reaction dynamics

Rate Laws, Order &Molecularity; zero, first and second order kinetics.Pseudo-unimolecular reaction, Arrhenius equation.

Mechanism and theories of reaction rates (Transition state theory, Collison theory). Catalysis: Homogeneous catalysis (Definition, example, mechanism, kinetics). 3L

Module IV: [10]

Stereochemistry

Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis.4L

Structure and reactivity of Organic molecule

Inductive effect, resonance, hyperconjugation, electromeric effect, carbocation, carbanion, free radicals, aromaticity.3L

Organic reactions and synthesis of drug molecule

Introduction to reaction mechanisms involving substitution, addition, elimination and oxidation-reduction reactions. Synthesis of commonly used drug molecules.3L

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, GourkrishnaDasmohapatra, (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, SubrataSen 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 Outcomes:

After going through the 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.

The objective of this course is to familiarize the students with numerical techniques, integral transforms, graph theory and probability. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling various problems in the discipline.

Module I: Fundamentals of Probability [10L]

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: Numerical Methods [10L]

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 and Modified Euler's Method ,Runge-Kutta Method of 4th order.

Module III: Basic Graph Theory [10L]

Graphs: Digraphs, Weighted graph, Connected and disconnected graphs, Complement of a graph, Regular graph, Complete graph, Subgraph

Walks, Paths, Circuits, Euler Graph, Cut sets and cut vertices

Matrix representation of a graph, Adjacency and incidence matrices of a graph

Graph isomorphism

Bipartite graph

Definition and properties of a tree

Binary tree, Spanning tree of a graph, Minimal spanning tree, properties of trees

Algorithms: Dijkstra's Algorithm for shortest path problem, Determination of minimal spanning tree using DFS, BFS, Kruskal's and Prim's algorithms

Module IV: Laplace Transformation [10L]

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 & Reference books:

1. Advanced Engineering Mathematics , E.Kreyszig, Wiley Publications
2. Introduction to Probability and Statistics for Engineers and Scientists, S.Ross, Elsevier

3. Introductory methods of Numerical Analysis, S.S. Sastry, PHI learning
4. Introduction to Graph Theory, D. B. West, Prentice-Hall of India
5. 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 Outcomes:

After completion of the course, 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: [10L] 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: [10L] 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: [10L]

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: [10L]

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:

12. Schaum's outline of Programming with C – Byron Gottfried
13. Teach Yourself C- Herbert Schildt
14. 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 Outcomes:

After attending the 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: [11 L]

DC Network Theorem: Kirchhoff's laws, Nodal analysis, Mesh analysis, Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Star-Delta conversion. [6L]

Electromagnetism: 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. [5L]

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: [11 L]

Three phase system: 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. [4L]

DC Machines: 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.[7L]

Module IV:[10L]

Transformer: 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, Introduction to three phase transformer.[6L]

Three-phase induction motor: Concept of rotating magnetic field, Principle of operation, Construction, Equivalent circuit and phasor diagram, torque-speed/slip characteristics, Starting of Induction Motor.[4L]

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, DhanpatRai
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 Outcomes:

After attending the 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: [6L]
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:[6L]
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:[6L]
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:[6L]
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 Kumar,S. &Lata, P. Communication Skills, OUP, New Delhi2011
2 Rizvi,Ashraf,M. Effective Technical Communication, McGraw Hill Education(India) Pvt. Ltd..Chennai,2018
3 Raman, M. and Sharma, S., Technical Communication: Principles and Practice, 2nd Ed., 2011

Reference Books:

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

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

Course outcomes:

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 equipment. 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. The course outcomes of the subject are-

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.

List of Experiments:

1. Estimation of iron using KMnO4: self indicator.
2. Iodometric estimation of Cu^{2+}.
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 ethylacetate.
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)

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

Course Outcomes:
After completion of this course the students should 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

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 Lab					
Course Code : ELE1051					
Contact hrs. per week:	**L**	**T**	**P**	**Total**	**Credit points**
	0	**0**	**2**	**2**	**1**

Course Outcomes:
After completion of this course the students should 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.

Course Title : English for Technical Writing Lab					
Course Code : HUM1051					
Contact hrs. per week:	**L**	**T**	**P**	**Total**	**Credit points**
	0	**0**	**2**	**2**	**1**

Course Outcomes:
After completion of this course the students should 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:[6L]

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:[6L]

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:[6L]

- Interviewing
  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:[6L]

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 attention, 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.

Text & Reference Books:

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

DETAILED SYLLABUS

2nd Year

Course Name: Data Structures & Algorithms					
Course Code:CSE2101					
Contact Hours per week:	**L**	**T**	**P**	**Total**	**Credit points**
	4	**0**	**0**	**4**	**4**

Course Outcomes:

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

CSE2101.1: Understand and remember the basics of data structures and how time complexity analysis is applicable to different types of algorithms.
CSE2101.2: Understand the significance and utility of different data structures and the context of their application. (For example, the queue in front of ticket counters uses first-in-first-out paradigm in a linear data structure)
CSE2101.3: Apply different types of data structures in algorithms and understand how the data structures can be useful in those algorithms.
CSE2101.4: Analyse the behaviour of different data structures in algorithms. (For example, given an algorithm that uses a particular data structure, how to calculate its space and time complexity.)
CSE2101.5: Evaluate solutions of a problem with different data structures and thereby understand how to select suitable data structures for a solution. (For example, what are the different ways to find the second largest number from a list of integers and which solution is the best.)
CSE2101.6: Evaluate different types of solutions (e.g. sorting) to the same problem.

Module I:[8L]

Introduction: Why do we need data structure? Concepts of data structures: a) Data and data structure b) Abstract Data Type and Data Type; Algorithms and programs, basic idea of pseudo-code. Algorithm efficiency and analysis, time and space analysis of algorithms – Big O, □, □, notations.
Array: Different representations – row major, column major. Sparse matrix - its implementation and usage. Array representation of polynomials.
Linked List: Singly linked list, circular linked list, doubly linked list, linked list representation of polynomial and applications.

Module II: [8L]

Stack and Queue: Stack and its implementations (using array, using linked list), applications. 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.

Recursion: Principles of recursion – use of stack, differences between recursion and iteration, tail recursion. Applications - The Tower of Hanoi, Eight Queens Puzzle (Concept of Backtracking).

Module III:[13L]

Trees: Basic terminologies, forest, tree representation (using array, using linked list). Binary trees - binary tree traversal (pre-, in-, post- order), threaded binary tree (left, right, full) - non-recursive traversal algorithms using threaded binary tree, expression tree. 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: Graph definitions and Basic concepts (directed/undirected graph, weighted/un-weighted edges, sub-graph, degree, cut vertex/articulation point, complete graph, simple path, simple cycle). Graph representations/storage implementations – adjacency matrix, adjacency list, Graph traversal and connectivity – Depth-first search (DFS), Breadth-first search (BFS) – concepts of edges used in DFS and BFS (tree-edge, back-edge, cross-edge, forward-edge), applications.

Module IV:[11L]

Sorting Algorithms: Bubble sort and its optimizations, Cocktail Shaker Sort, Insertion sort, Selection sort, Quicksort (Average Case Analysis not required), Heap sort (concept of max heap, application – priority queue), Counting Sort, Radix sort.

Searching: Sequential search, Binary search, Interpolation search.

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

Text books:

1. Fundamentals of Data Structures of C, Ellis Horowitz, Sartaj Sahni, Susan Anderson-freed.
2. Data Structures in C,Aaron M. Tenenbaum.
3. Data Structures,S.Lipschutz.
4. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein.

Reference books:

1. Data Structures and Program Design In C, 2/E, Robert L. Kruse, Bruce P. Leung.

Course Name: Operating Systems					
Course Code:CSE2102					
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:

CSE2102.1: Develop knowledge about the importance of computer system resources and the role of operating system in their management policies and algorithms.
CSE2102.2: Understand processes and its management policies and scheduling of processes by CPU.
CSE2102.3: Acquire an understanding of the need of process synchronization, evaluate the requirement for process synchronization and coordination handled by operating system.
CSE2102.4: Analyze the memory management and its allocation policies and compare different memory management approaches.
CSE2102.5: Understand the impact and co-relation of different scheduling algorithm in secondary storage and different structure of file system and able to design the system with improved performance.
CSE2102.6: Identify the different activities and impact of threat, virus, worm and able to protect system from them.

Module I:[9L]

Introduction: Operating system functions, OS Architecture (Monolithic, Microkernel, Layered, Hybrid), Different types of O.S. (batch, multi-programmed, time-sharing, real-time, distributed, parallel), Evaluation of OS.

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

Protection & Security: Goals of protection, Domain of protection, Access matrix and its representation, Threats and system security.
Processes and Threads: 7 state process model, Process scheduling, Operations on processes, Inter-process communication, Threads overview, Benefits of threads, User and kernel threads.

Module II:[11L]

CPU Scheduling: Scheduling criteria, Preemptive & non-preemptive scheduling, Scheduling algorithms (FCFS, SJF, RR, Priority, Multi-level queue, Multi-level feedback queue), Comparative study of the algorithms, Multi-processor scheduling.

Process Synchronization: Background, Critical section problem, Software solution – Peterson and Bakery algorithm, Synchronization hardware, Semaphores, Classical problems of synchronization.

Deadlocks: System model, Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock.

Module III:[9L]

Primary Memory: Background, Physical address, Logical address, Virtual address, Contiguous memory allocation (Fixed and Variable partition), Non-contiguous memory allocation techniques (Paging, Segmentation, Segmentation with Paging), Virtual memory, Demand Paging, Performance, Page replacement algorithms (FCFS, LRU, optimal), Thrashing.

Module IV:[7L]

Secondary Storage: Disk structure, Disk performance, Disk scheduling (FCFS, SSTF, SCAN, C-SCAN), Boot block, Bad blocks.
File Systems: 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 and Performance.
I/O Management: PC Bus Structure, I/O connections, Data transfer techniques (Programmed, Interrupt driven, DMA), Bus arbitration (Daisy chain, Polling, Independent request), Blocking and non-blocking I/O, Kernel I/O subsystem (Scheduling, Buffering, Caching, Spooling and device reservation, Error handling).

Text books:
1. Operating System Concepts, 10E, Silberschatz A., Galvin P. B., Gagne G., Wiley Publications.
2. Operating Systems Internals and Design Principles, 9E, Stalling W., Pearson Education.

Reference Books
1. Operating System: Concept & Design, Milenkovie M., McGraw Hill.
2. Operating System Design & Implementation, Tanenbaum A.S., Prentice Hall NJ.
3. Operating System Concepts, Silberschatz A., Peterson J. L., WileyPublications.
4. Operating Systems A Concept Based Approach, Dhamdhere D.M., McGraw Hill.

Course Title : Internet and Networking Basics					
Course Code : IOT2101					
Contact hrs. 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:

IOT2101.1: Understand the network types and learn basic web technologies like HTML, XML, JavaScript, Cookies and Session.
IOT2101.2: Learn basic networking concepts like reference models, role of each layer, networks devices, and physical layer basics for example - signals , transmission media, and switching.
IOT2101.3: Learn framing, error detection techniques, flow control protocols, channel allocation protocols, and devices involved.
IOT2101.4: Describe the functions of Network Layer i.e. protocols, logical addressing, and routing mechanisms.
IOT2101.5: Explain the different Transport Layer functions i.e. Port addressing, connection management, congestion control mechanism with reference to the transport layer protocols.
IOT2101.6: Defend and argue the various quality of service measures to improve network throughput.

Module I:[8L]

Introduction [1L[: Overview, Network of Networks, Intranet, Extranet and Internet.
HTML Basics [2L[:, introduction to HTML, list, creating tables, linking documents, frames, graphics to HTML documents, CSS, style sheet basics, adding styles to documents.
JavaScript [3L]: Basics, Statements, comments, variable, comparison, condition, switch, loop, break. Object – string, array, Boolean, reg-ex. Function, dialog box,.
XML[2L]: Basics of XML

Module II:[8L]

Introduction [2L]: Direction of data flow (simplex, half duplex, full duplex), Network topology, categories of network (LAN, WAN)
Reference models [2L]: OSI reference model, TCP/IP reference model, overview of responsibility of each layer, comparative study of the two models
Physical Layer [3L]: Properties of Analog and Digital Signal; Multiplexing (FDM,TDM), Transmission Media and its properties;
Switching [1L]: Basic concepts of circuit Switching and packet Switching and their comparisons.

Module III:[8L]

Data link layer [3L]: Framing / Stuffing, Error detection and correction methods (Parity bit ,Hamming code and CRC, Checksum)
Flow Control Protocols [2L]: Stop-and-Wait / Go-Back-N / Selective Repeat;
MAC sub-layer [2L]: Random access protocol: ALOHA / CSMA-CD /
Controlled access: Polling, token passing, channelization: CDMA
Devices [1L]: Repeaters, Hubs, Bridges (Transparent Bridges / Backward Learning Algo/Construction of Spanning Trees), Routers and Gateway.

Module IV:[8L]

IPv4 [2L]: Classful addressing and classless addressing CIDR
Routing algorithm [3L]: Concept of static and dynamic routing, Distance Vector / Link State Algorithm;
Transport Layer protocols [3L]: Basic concepts and comparison between TCP and UDP-Congestion Control – Quality of services (QOS) – Techniques to improve QoS Leaky bucket ,Token bucket.

Text books:

1. Data Communications and Networking, Mc Graw Hill, Forouzan
2. Andrew S. Tanenbaum: Computer Networks, Pearson Education
3. Web Technology: A Developer's Perspective, N.P. Gopalan and J. Akilandeswari, PHI Learning.

Internetworking Technologies, An Engineering Perspective, Rahul Banerjee, PHI Learning.

Course Title : Introduction to Cyber security					
Course Code : IOT2102					
Contact hrs. 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:

IOT2102.1: Understand cyber security fundamentals, including key terms, threats, and vulnerability assessments.
IOT2102.2: Comprehend Indian cyber laws and the consequences of cybercrime under the IT Act.
IOT2102.3: Analyze cyber threats, actors, and attack models, such as hacking organizations and the cyber kill chain.
IOT2102.4: Master reconnaissance and scanning techniques for information gathering and analysis in cyber security.
IOT2102.5: Familiarize with essential security concepts and tools, including the CIA triad, access management.
IOT2102.6: Learn perimeter security strategies and technologies, such as proxy servers and demilitarized zones, for protecting networks from external threats.

Module I: [9L]
Introduction to Cyber security: Definition, Key Terms, Security Threats, Vulnerability Assessments, Roles in Security, Cyber security Today, Critical Thinking in Cyber security, Need for Cyber Security

Cyber Laws: The Indian IT Act, Cybercrime and Punishment.
Overview of actors and their motives: Hacking organizations, Major types of cyber-attacks, Cyber Security Model, Security services, Security Mechanisms, Threat Examples, Malware and Ransom ware, Threat Protection, Internet Security Threats, Security Threat, The Cyber Kill Chain, Social Engineering, Cyber warfare

Module II:[7L]

Overview of key security concepts: CIA Triad, Non - Repudiation - How does it apply to CIA? Access Management, Key Concepts – Incident Response, Incident Response Process, Introduction to Frameworks and Best Practices, IT Governance Process, Cyber security Compliance and Audit Overview.

Overview of k**ey security tools:** Antivirus/Antimalware

Module III:[10L]

Information Gathering and Analysis (Reconnaissance): Harvester, Whois, Netcraft, Host, Extracting Information from DNS, Extracting Information from E-mail Servers, Social Engineering Reconnaissance

Scanning: Port Scanning, Network Scanning and Vulnerability Scanning, Scanning Methodology, Ping Sweer Techniques, Nmap Command Switches, SYN, Stealth, XMAS, NULL, IDLE, FIN Scans, Banner Grabbing and OS Finger printing Techniques.

Module IV:[10L]

Overview of People, Process and Technologies: What is IT Security? Frameworks and their purpose, Roles in Security, Introduction to Process, Overview Business Process Management. Overview of Information Technology Infrastructure Library (ITIL), Key ITIL Processes, identification and AAA, Access Control Methods, Access Control - Physical and Logical, Open Web Application Security Project (OWASP)

Securing the perimeter: Perimeter Security in the Real World, Security Challenges, The Basics of Internet Security, Understanding the Environment, Hiding the Private Network, Understanding Private Networks, Protecting the Perimeter, Understanding the Perimeter, Network Appliances, Proxy Servers, Demilitarized Zones (DMZs), Honeypots.

Text books:

1. William Stallings, "Network Security Essentials: Applications and Standards", Pearson, 2016.
2. Anand Shinde, “Introduction to Cyber Security Guide to the World of Cyber Security”, Notion Press, 2021
3. Charles J. Brooks, Christopher Grow, Philip Craig, Donald Short, "Cyber Security Essentials 1/e", Sybex Wiley, 2019
4. Chwan-Hwa(John) Wu, J. David Irwin, "Introduction to Cyber Security, 1/e", CRC Press T&F Group, 2013

Refenrence books:

1. Nina Godbole and SuNone Belapure, "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, 1/e", Wiley INDIA
2. P.W. Singer, Allan Friedman, "Cybersecurity and Cyberwar: What Everyone Needs to Know", Oxford University Press, 2014.
3. Yuri Diogenes, Erdal Ozkaya, "Cyber security: Attack and Defense Strategies", O'Reilly Media, 2019.

Course Name: Fundamentals of Network Security & Cryptography					
Course Code:IOT2103					
Contact Hours per week:	**L**	**T**	**P**	**Total**	**Credit points**
	4	**0**	**0**	**4**	**4**

Course Outcomes:

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

IOT2103.1: Understand the concepts of Cryptography and Network Security including Private and Public key cryptography and various protocols to protect computing system against potential threats.

IOT2103.2: Explore Mathematical techniques for supporting the cryptographic mechanisms.

IOT2103.3: Analyze and compare various cryptographic techniques.

IOT2103.4: Evaluate security mechanisms using rigorous approaches by key ciphers, message authentication and Hash functions.

IOT2103.5: Investigate various network security applications, IPsec, Firewall, IDS, Web Security, Email Security and Malicious software etc.

IOT2103.6: Design a secure network after analyzing the vulnerabilities in any computing system.

Module I: [12L]

Introduction Need for Security, Security services (Confidentiality, Integrity, Authentication, Non-repudiation, Access control), Security Mechanisms (Encipherment, Data Integrity, Digital Signature, Authentication Exchange, Traffic Padding, Routing Control, Notarization, Access control)- Principles of Security, Types of attack, concept of virus, worm etc. Concept of plain text & Cipher text, Substitution Techniques, Transposition Techniques, Rotor Machines, Stenography, Encryption & Decryption, Symmetric & Asymmetric key Cryptography, Key Range & Key Size.

Brief Introduction of Number Theory- Integer Arithmetic, Modular Arithmetic, Algebraic structures, GF(2n) Fields, Matrices, Prime Numbers, Fermat's and Euler's Theorem, Primality testing, Factorization, Chinese Remainder Theorem, Linear and Quadratic Congruence, Discrete Logarithms.

Module II: [10L]

Symmetric Key Cryptography: Block Cipher, Stream Cipher, Feistal Cipher Structure, DES algorithm, Multiple Encryption, double and Triple DES, Block Cipher Modes of Operation, Strength of DES, Attacks on DES, AES algorithm, IDEA algorithm, Blowfish, RC5 algorithm.

concept of digital envelope.

Module III: [14L]

Public key cryptography: trapdoor, one way function, Principles Public key crypto Systems, Diffie Hellman Key Exchange algorithm, man in the middle attack, RSA algorithm, Elgamal algorithm, Key Management, Elliptic Curve Arithmetic, Elliptic Curve Cryptography.

Message authentication and hash functions: Authentication Requirement, Authentication Function, Message Authentication Code, Secure Hash Algorithm, HMAC.

Digital signature: Digital Signature, Digital signature forgery, Digital Signature Standard, RSA Digital Signature Scheme - ElGamal Signature Scheme.

Module IV: [12L]

Email Security PGP, MIME, S/MIME.

Ip security: Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations and Key Management.

Web Security Requirements, Secure Socket Layer (SSL) and Transport Layer Security (TLS), Introduction to Firewalls, Types of Firewalls - Packet Filtering, Application Gateway, Stateless and Stateful, IDS, Distributed Denial of Service attack.

Reference Books:

1. Cryptography and Network Security: Principles and Practice, 7/E, William Stallings, Pearson.
2. Cryptography and Network Security, 3rd Edition, Atul Kahate, McGraw Hill Education (India) Private Limited.
3. Cryptography and Information Security, 2nd Edition, V. K. Pachghare, PHI Learning Private Limited.

Course Name: Data Structure & Algorithms Lab					
Course Code:CSE2151					
Contact Hours per week:	**L**	**T**	**P**	**Total**	**Credit points**
	0	**0**	**3**	**3**	**1.5**

Course Outcomes:

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

CSE2151.1. To understand linear and non-linear data structures.
CSE2151.2. To understand different types of sorting and searching techniques.
CSE2151.3. To know how to create an application specific data structure.
CSE2151.4. To solve the faults / errors that may appear due to wrong choice of data structure.
CSE2151.5. To analyse reliability of different data structures in solving different problems.
CSE2151.6. To evaluate efficiency in terms of time and space complexity, when different data structures are used to solve same problem.

Day 1: Time and Space Complexity

Lab Assignment

Create three different 10; 000 10; 000 matrices matrixOne, matrixTwo and result-Matrix, using dynamic memory allocation. Initialize matrixOne and matrixTwo by using rand() or srand() function, limit the values from 0 to 9. Multiply matrixOne and matrixTwo into resultMatrix.

While execution, open another terminal and use top command to see the usage of memory by the process. Calculate the time taken for the execution of the program.

Repeat the same exercise for 100,000 x 100,000matrices.

Home Assignment

Write a program (WAP) to check whether a matrix is i) identity, ii) diagonal. WAP to reverse the elements of an array without using any other variable.

Day 2: Array

Lab Assignment

WAP to add two polynomials using array. Minimize the memory usage as much as you can.

WAP to convert a matrix into its sparse representation (triple format). Once represented in sparse format, do not revert back to the matrix format any-more. Manipulate the sparse representation to find the transpose of the matrix (which should also be in sparse representation).

Calculate and find out whether using triple format for your example is advantageous or not.

Home Assignment

WAP to multiply two polynomials. Minimize usage of memory.

WAP to add two matrices using sparse representation. Manipulation of data should be done in sparse format.

Day 3: Singly Linked List

Lab Assignment

Write a menu driven program to implement a singly linked list with the operations:

i) create the list ii) insert any element in any given position (front, end or intermediate)
iii) delete an element from any given position (front, end or intermediate) iv)display the list

Home Assignment

Write a menu driven program to implement a singly linked list with the operations:

i) count the number of nodes
ii) reverse the list

Day 4: Circular and Doubly Linked List

Lab Assignment

Write a menu driven program to implement a circular linked list with the operations:

i) create the list ii) insert any element in any given position (front, end or intermediate)
iii) delete an element from any given position (front, end or intermediate) iv)display the list

Home Assignment

Write a menu driven program to implement a doubly linked list with the operations:

i) create the list ii) insert any element in any given position (front, end or intermediate)
iii) delete an element from any given position (front, end or intermediate) iv)display the list

Day 5: Stack, Queue - with array

Lab Assignment

Write a menu driven program to implement stack, using array, with

i) push, ii) pop, iii) display, iv) exit operations.

WAP to evaluate a postfix expression.

Write a menu driven program to implement a queue, using array, with

i) insert, ii) delete, iii) display, iv) exit operations

Home Assignment

WAP to convert an infix expression to its corresponding postfix operation.

Write a menu driven program to implement a double-ended queue, using array, with the following operations:

i) insert (from front, from rear) ii) delete (from front, from rear)
iii) display iv) exit operations

Day 6: Stack, Queue - with linked list

Lab Assignment

Write a menu driven program to implement a stack, using linked list, with

i) push, ii) pop, iii) exit operations

Home Assignment

Write a menu driven program to implement a queue, using linked list, with

i) insert, ii) delete, iii) exit operations

Day 7: Circular Queue, Deque - with linked list

Lab Assignment

Write a menu driven program to implement a circular queue using linked list with

i) insert, ii) delete, iii) exit operations

Home Assignment

Write a menu driven program to implement a double-ended queue, using linked list, with the following operations:

i) insert (from front, rear), ii) delete (from front, rear), iii) exit operations

Day 8: Binary Search Tree (BST)

Lab Assignment

Write a program, which creates a binary search tree (BST). Also write the functions to insert, delete (all possible cases) and search elements from a BST.

Home Assignment

Write three functions to traverse a given BST in the following orders:

i) in-order, ii) pre-order, iii) post-order.

Display the elements while traversing.

Day 9: Searching

Lab Assignment

WAP to implement,

i) Linear Search, ii) Binary Search (iterative)

NB: As a pre-processing step, use bubble-sort to sort the elements in the search space.

WAP to generate integers from 1 to n (input parameter) in random order and guarantees that no number appears twice in the list. While the number sequence is being generated, store it in a text file.

Home Assignment

WAP to implement binary search recursively.

Day 10: Sorting

Lab Assignment

Write different functions for implementing,

i) Bubble sort,ii) Cocktail shaker sort, iii) Quick Sort.
Plot a graph of n vs. time taken, for n= 100, 1000, 10,000 and 100,000 to com-pare the performances of the sorting methods mentioned above. Use the second assignment of Day 9 to generate the data, using the given n values.

Home Assignment

Write different functions for implementing,

i) Insertion sort, ii) Merge sort.

Day 11: Graph Algorithms

Lab Assignment

Read a graph (consider it to be undirected) from an edge-list and store it in an adjacency list.

Use the adjacency list to run DFS algorithm on the graph and print the node labels. Detect and count the back-edges.

Home Assignment

WAP to implement BFS algorithm of a given graph (similarly as described for DFS, instead of back-edges count cross-edges)**.**

Text books:

1. Fundamentals of Data Structures of C, Ellis Horowitz, Sartaj Sahni, Susan Anderson-freed.
2. Data Structures in C,Aaron M. Tenenbaum.
3. Data Structures,S.Lipschutz.
4. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein.

Reference books:

1. Data Structures and Program Design In C, 2/E, Robert L. Kruse, Bruce P. Leung.

Course Name: Operating Systems Lab					
Course Code:CSE2152					
Contact Hours per week:	**L**	**T**	**P**	**Total**	**Credit points**
	0	**0**	**3**	**3**	**1.5**

Course Outcomes:

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

CSE2152.1: Understand and implement basic services and functionalities of the operating system using system calls.

CSE2152.2: Will be able to describe and create user defined processes.

CSE2152.3: Understand the benefits of thread over process and implement them.

CSE2152.4: Synchronization programs using multithreading concepts.

CSE2152.5: Use modern operating system calls and synchronization libraries in software to implement process synchronization.

CSE2152.6: Implementation of Inter-process communication using PIPE.

Detailed Syllabus

1. **Shell programming:** Creating a script, making a script executable, shell syntax (variables, Conditions, control structures, functions and commands).
2. **Process:** starting new process, replacing a process image, duplicating a process image, waiting for a process, zombie process.
3. **Signal:** signal handling, sending signals, signal interface, signal sets.
4. **Semaphore:** programming with semaphores (use functions semctl, semget, semop, set_semvalue, del_semvalue, semaphore_p, semaphore_v).
5. **POSIX Threads:** programming with pthreadfunctions(viz. pthread_create, pthread_join, pthread_exit, pthread_attr_init, pthread_cancel)
6. **Inter-process communication:** pipes (use functions pipe, popen, pclose), named pipes (FIFOs, accessing FIFO).

2. Textbooks

1. Your Unix: The Ultimate Guide, Sumitabha Das, MH

3. Reference Books

1. Beginning Linux Programming, Neil Matthew, Richard Stones, Wrox.

Course Title : Internet and Networking Basics Lab					
Course Code : IOT2151					
Contact hrs. per week:	**L**	**T**	**P**	**Total**	**Credit points**
	0	**0**	**2**	**2**	**1**

Course Outcomes:

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

IOT2151.1: Learn how to design web pages and forms using various features of HTML, fetch and store data for the same using XML and implement authentication and useful features using JavaScript.

IOT2151.2: Understand the concepts of protocols, sockets, network interfaces, and design/performance issues through programs.

IOT2151.3: Understanding the need of dividing stream of data into smaller units and implementing program to send such data units across a network.

IOT2151.4: Demonstrate various types of protocols to transfer packets of data from a source to destination machine.

IOT2151.5: Understand the need of different types of Transport Layer Protocols and implement them through socket programming.

IOT2151.6: Learn how to synthesize the learning gathered from different network layers to build useful, relevant and user friendly applications with the objective to solve real life problems.

Detailed Syllabus:

1. Design Web Page using HTML.
2. Fetch data in an HTML page from XML
3. Design HTML forms using CSS and implement authentication and other features using JavaScript.
4. Implement Simple TCP Client Server Application.
5. Implement TCP Echo Server Client Application.
6. Implement TCP Chat Server Client Application.
7. Implement a File Server Client application.
8. Implement UDP Echo Server Client Application.
9. Implement UDP Time Server Client Application.
10. Implement multithreaded chat program.
11. Implement Stop-and-Wait Protocol
12. Implement Sliding Window Protocol (Go-Back-N and Selective Repeat).
13. Implement Error detection algorithms like Parity/CRC/Checksum.
14. Experiment on cross-platform network-based communication issues.

15. Learn network diagnostic commands (ping, ipconfig, netstat, tracert etc.)

Text Books:

4. Data Communications and Networking, Mc Graw Hill, Forouzan
5. Andrew S. Tanenbaum: Computer Networks, Pearson Education
6. Web Technology: A Developer's Perspective, N.P. Gopalan and J. Akilandeswari, PHI Learning.
7. Internetworking Technologies, An Engineering Perspective, Rahul Banerjee, PHI Learning.

Course Name: Programming in Python Lab					
Course Code: IOT2154					
Contact Hours per week:	**L**	**T**	**P**	**Total**	**Credit points**
	0	**0**	**3**	**3**	**1.5**

Course Outcomes

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

IOT2154.1. Learn how to write simple programs in Python, relating to arithmetic and logical problems.

IOT2154.2. Understand how to implement conditional branching, iteration (loops), recursion and function.

IOT2154.3. Develop python codes to do input/output with files in Python and use exception handling.

IOT2154.4. Learn and understand how to manipulate strings, use regular expression, and also use Python data structures viz. Lists, Tuples, Dictionaries and Sets.

IOT2154.5. Apply NumPy Arrays in solving problems.

IOT2154.6. Design and develop codes using Pandas data structures (Series, Data Frames) and other features of Pandas.

Detailed Syllabus:

Topic 1:

(a) Finding the distance between two points whose coordinates are given
(b) Finding the impedance of a series R-L-C Circuit
(c) Finding the roots of a quadratic equation
(d) Finding the maximum and minimum out of a few numbers given
(e) Finding the value of sine of a given angle from its series expansion
(f) Finding the Time period of a pendulum, whose length varies from 100 to 120 cm in steps of 5 cm.

Topic 2:

Implement programs using functions:

a. Largest number in a list
b. Area of different shapes
c. Circulate the values of n variables
d. Distance between two points whose coordinates are given
e. Roots of a quadratic equation
f. Factorial
g. Fibonacci series
h. GCD

Topic 3:

Implement programs on File I/O and exception handling:

a. Copying a file

1. Take source file name and destination file name from the user
2. Use exception handling to report error, if any
3. Copy thesource text file to the destination.
4. Report completion status, number of characters copied etc. to the user

b. Finding word count and longest word in a file
c. Use exception handling in nested functions
d. Write a program to show positive use of exception handling

Topic 4:

(a) Write programs to use various in-built functions of Python on string manipulation (reverse, palindrome, character count, replacing characters)
(b) Write programs to show the use of regular expression
(c) Write programs using Python data structures viz. Lists, Tuples, Dictionaries and Sets

Topic 5:

Write programs using various features provided in the NumPy

Topic 6:

Write programs using Pandas data structures and various features provided in Pandas

Text Books:

1. Allen B. Downey, Think Python: How to think like a Computer Scientist, 2nd Edition, O'Reilly, 2016
2. Y. Daniel Liang, Introduction to Programming Using Python, Pearson, 2017

Reference Books:

1. Karl Beecher, Computational Thinking: A Beginners Guide to Problem Solving and Programming, 1st Edition, BCS Learning and Development Limited, 2017

Paper Name: Design Thinking and Idea Lab					
Paper Code: IOT2155					
Contact hours per week:	**L**	**T**	**P**	**Total**	**Credit Points**
	0	**0**	**2**	**2**	**1**

Course Outcomes:

After going through the course, the students will be able to:

CSE2155.1: Understand the definition, objectives, and relevance of design thinking.
CSE2155.2:Get familiarized with the stages of the design process: Empathize, Define, Ideate, Prototype, and Test.
CSE2155.3: Learn how to apply the design thinking process for developing innovative products.
CSE2155.4: Propose innovative product designsand choose appropriate frameworks, strategies, and techniques during prototype development.
CSE2155.5: Perceive individual differences in user perspectives and offer appropriate interventions towards enhanced user experience.

Detailed Syllabus (in-depth discussion of these topics is available in the text book suggested below):

1. Design thinking is a way of thinking
    a. The fundamental attitude of design thinking
    b. Think flexibly
    c. Work integrally
    d. Empathize
    e. Cooperate
    f. Imagine
    g. Experiment
2. Design thinking is a way of working
    a. The cycle of design thinking
    b. The design process
    c. Discovery phase: Loving the problem
    d. Definition phase: Defining the problem
    e. Development phase: Working on solutions
    f. Implementation phase: Towards functioning solutions in practice
    g. Using design thinking as a business strategy
3. Design thinking is a project approach
    a. Discovery phase: From cause to insight
    b. Definition phase: From insight to problem definition and solution area
    c. Development phase: From solution area to solutions
    d. Implementation phase: Putting solutions into practice
    e. Other roadmaps
4. Design thinking is a tool box

a. Assumption busting
b. Business model canvas
c. Decision matrix
d. Empathy map
e. One-hour prototype
f. Personas
g. Scenarios
h. Stakeholder map
i. Storyboard
j. User diaries
Etc.

Note: In the lab sessions, students will be working in teams to develop working prototypes using design thinking principles. A prototype can either be software or hardware based, or a combination of both. A set of slides, a document, a spreadsheet, or a user interface mockup will not qualify as a prototype.Students will need to make at least one presentation (with the idea of the prototype), and one demonstration (with the functioning prototype) during the semester. Continuous and end-semester assessment of student performance will be basedon establishedevaluation rubrics.

Text books:

1. Den Dekker Teun, "Design Thinking", Wolters-Noordhoff B.V., Dec, 2020

Reference books:

1. Prof. Karl Ulrich, U. Penn, "Design: Creation of Artifacts in Society by Change", Oct,2012
2. Tim Brown, "Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation", Kindle edition, 2009.
3. Pavan Soni , "Design Your Thinking: The Mindsets, Toolsets and Skill Sets for Creative Problem-solving" , Penguin Random House India Private Limited, 23 December 2020.

Course Title : Blockchain Technology					
Course Code : IOT2201					
Contact hrs. per week:	**L**	**T**	**P**	**Total**	**Credit points**
	4	**0**	**0**	**4**	**4**

Course Outcomes:

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

IOT2201.1: Understand emerging abstract models for Block chain Technology.
IOT2201.2: Analyse the concept of bit coin and mathematical background behind it.
IOT2201.3: Apply the tools for understanding the background of crypto currencies.
IOT2201.4: Identify major research challenges and technical gaps existing between theory and practice in crypto currency domain.
IOT2201.5: Understanding of latest advances and its applications in Block Chain Technology.

Module I: [12L] INTRODUCTION

Basic of Blockchain Architecture – Challenges – Applications – Block chain Design Principles - The Blockchain Ecosystem - The consensus problem - Asynchronous Byzantine Agreement - AAP protocol and its analysis - Nakamoto Consensus on permission-less, nameless, peer-to-peer network - Abstract Models for BLOCKCHAIN - GARAY model - RLA Model - Proof of Work (PoW) as random oracle - formal treatment of consistency, liveness and fairness - Proof of Stake (PoS) based Chains - Hybrid models (PoW + PoS).

Module II: [12L] CRYPTOGRAPHIC FUNDAMENTALS

Cryptographic basics for crypto currency - a short overview of Hashing, cryptographic algorithm – SHA 256,signature schemes, encryption schemes and elliptic curve cryptography-Introduction to Hyperledger- Hyperledger framework - Public and Private Ledgers.

Module III: [12L] BIT COIN

Bit coin - Wallet - Blocks - Merkley Tree - hardness of mining - transaction verifiability – anonymity - forks - double spending - mathematical analysis of properties of Bit coin. Bitcoin blockchain, the challenges, and solutions, proof of work, Proof of stake, alternatives to Bitcoin consensus, Bitcoin scripting language and their uses.

Module IV: [12L] ETHEREUM

Ethereum - Ethereum Virtual Machine (EVM) - Wallets for Ethereum - Solidity - Smart Contracts - some attacks on smart contracts. Ethereum and Smart Contracts- The Turing Completeness of Smart Contract Languages and verification challenges- comparing Bitcoin scripting vs. Ethereum Smart Contracts

BLOCK CHAIN-RECENT TREND Blockchain Implementation Challenges- Zero Knowledge proofs and protocols in Block chain - Succinct non interactive argument for Knowledge (SNARK) - pairing on Elliptic curves – Zcash - attacks on Blockchains – such as Sybil attacks, selfish mining, 51% attacks - -advent of algorand, and Sharding based consensus algorithms

Text Books:

1. Melanie Swan, "Block Chain: Blueprint for a New Economy", O"Reilly, first edition – 2015.

2. Daniel Drescher, "Block Chain Basics", Apress; 1stedition, 2017

3. Anshul Kaushik, "Block Chain and Crypto Currencies", Khanna Publishing House, Delhi.

4. Imran Bashir, "Mastering Block Chain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained", Packt Publishing, first edition – 2012.

Reference Books:

1. Ritesh Modi, "Solidity Programming Essentials: A Beginner"s Guide to Build Smart Contracts for Ethereum and Block Chain", Packt Publishing.

Course Name: Fundamentals of Software Engineering					
Course Code:IOT2202					
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:

IOT2202.1: Propose a software life cycle model for the given requirements and compile software requirement specifications as per IEEE guidelines.

IOT2202.2: Develop function-oriented design and/or object-oriented design for software systems using industry standard techniques.

IOT2202.3: Apply the knowledge of different coding standards and/or guidelines and propose test cases for sample software system modules in different testing methods.

IOT2202.4: Compare and contrast among different types of software maintenance and to decide on the maintenance models to be employed depending on the situation.

IOT2202.5: Apply different project management strategies for project planning such as to estimate the project size, duration and cost.

IOT2202.6: Apply the ideas of different project monitoring and control techniques such as WBS, Activity Network, PERT chart, Critical path etc. to efficiently monitor and control the project. They will be able to identify different software project risks and determine their mitigation approaches.

Module I: [12L]

Introduction to Software Engineering: Software Engineering – objectives and definitions, Software Life Cycle – different phases, Lifecycle Models - Waterfall, Relaxed Waterfall, RAD, Prototyping, Incremental, Spiral.

Modern Software Engineering practices: Agile: Values and Principles, Philosophy, Agile vs. Waterfall, Methods and Practices of Agile, Pitfalls of Agile methodology, Scrum: Roles, Workflow: Sprint, Daily Scrum, Sprint review etc., Limitations of scrum, Extreme Programming: Principles, Guidelines, Activities, Values, Practices, Introduction to DevOps and SEMAT.

Requirements Analysis and Specification Phase: Requirements Collection and Analysis, Requirement Specifications – General Structure of Software Requirement Specifications (SRS), Functional and Non-functional Requirements, Representing Requirements as Use Cases with examples.

Structured Analysis Modeling Techniques: Process Model using Context Diagrams (CD) and Data Flow Diagram (DFD) with examples, Data Dictionary, Decision Tree, Decision Table with examples, Data Model using Entity Relationship Diagram (ERD) with examples.

Module II: [12L]

Design Phase: Overview –Comparison between Requirement Analysis and Design, Attributes of Good Design, Design Approaches – Functional and Object-Oriented Design approaches, Design Aspects – Top-Down and Bottom-Up, Structured Design – Module Design (or High-Level Design), Detail Design (or Low-Level Design), Functional Decomposition – Abstraction, Structure Chart, Structured English, Design Issues – Cohesion, Coupling.

Object Oriented Analysis and Design: OOAD Basic Concepts, Unified Modeling Language (UML) – different types of diagrams for different views of system, User View – Use Case Diagram with examples, Structural Views – Class Diagram with examples, Behavioral View – Sequence, Collaboration, Activity and State Chart Diagrams with examples.

Module III: [12L]

Coding or Programming: Programming Principles and Guidelines – Structured Programming, Code Re-use, Coding Standards / Guidelines, Coding Process – Incremental Coding, Test Driven Development, Pair Programming / Extreme Programming Source Code Version Control, Build, Code Refactoring.
Review and Testing: Self Review / Peer Review, Testing Overview-- Objective, Definition, Static and Dynamic Testing, Functional vs. Non-functional Testing, Testing Artifacts – Test Cases and Test Suites, Traceability Matrix, Test Data, Stub and Driver, Testing Process – Test Case Design, Test Case Execution, Test Result, Defect Logging and Tracking, Testing Methods -- White Box Testing with Test Coverage using Control Flow Graph (CFG) and Cyclomatic Complexity, Black Box Testing with Equivalence Class Partitioning and Boundary Value Analysis,Testing Level – Unit Testing, Integration Testing, System Testing, (User) Acceptance Testing, Regression Testing, Performance Testing, Usability Testing, Non-functional Testing.

Module IV: [12L]

Software Maintenance: Types of Maintenance – Corrective, Preventive, Adaptive Change Management and Maintenance Process models, Estimation of maintenance cost.

Software Estimation: Overview of Software Estimation – Size, Effort, Duration and Cost

Size Estimation Methods – Lines of Code (LOC) and Function Points (FP) Estimation of Effort and Duration based on Size and Productivity, Constructive Cost Model (COCOMO) – Basic COCOMO, Intermediate COCOMO (COCOMO 81), Detailed COCOMO (COCOMO II).

Project Management: Project Management Overview -Planning, Staffing, Execution, Monitoring and Control Responsibilities of Project Manager, Project Scheduling – Work Breakdown Structure (WBS) and Activity network, Gantt Charts, PERT chart, Determining the Critical Path.

Configuration Management: Overview of Configuration Management, Software Configuration Management tasks: Identification, Change Control, Version Control, Auditing, Concept of Baseline, Versioning of Configurable Items (CI).

Text books:

1. Software Engineering: A Practitioners Approach, 5th Ed,R. S. Pressman, McGraw-Hill, 2001.
2. Software Engineering, 7th Ed, Sommerville, Addison-Wesley, 2005.

Reference Books:

1. Software Engineering: A Precise Approach, 3rd Edition, Pankaj Jalote, 2013.
2. Fundamentals of Software Engineering, 3rd Edition, Rajib Mall, 2013.
3. Fundamentals of Software Engineering, 2nd Ed, C. Ghezzi, M. Jazayeri and D. Mandrioli, Prentice Hall of India, 2003.

Course Name: Object Oriented Programming with Java					
Course Code:IOT2203					
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:

IOT2203.1: Understand the fundamental principles of object-oriented programming.
IOT2203.2: Implement and utilize classes, objects, inheritance, and polymorphism in Java programs.
IOT2203.3: Demonstrate proficiency in utilizing data structures and algorithms using Java standard packages and classes for various programming tasks.
IOT2203.4: Design and implement multithreaded applications in Java.
IOT2203.5: Develop graphical user interfaces (GUIs) using Swing in Java applications.
IOT2203.6: Applyobject-oriented design principles through Unified Modelling Language(UML) representations.

Module I: [10L]

Introduction to Java Programming: Overview: Difference between Object-oriented and procedural programming paradigm, structure of a Java program, Java philosophy; Java programming environment: JVM, JRE, compiler, class loader, classpath, file extensions, IDE.

Basic Programming Constructs: Basic Programming Concepts: Data Types, variables and constants Expressions, Operators, Control Statements & Loops, Functions & Parameters, Array; String Handling Concepts and related Functions, Command Line Arguments. User Input through Scanner; Methods: Function definition, main method arguments, lambda function, method overloading, parameter passing by value, objects and object references, references passed by value.

Module II: [10L]

Classes, Objects, and Inheritance: Class and Object, Access Specifier, Static Members, Constructor,Garbage Collector, Nested and Inner Class, new operator, this and statickeyword, Anonymous inner class; Inheritance, Runtime Polymorphism, Abstract Class, Overriding, shadowing, and hiding. Interfaces and notion of multiple inheritance, ,uper class and subclass,using super keyword, Final keywords, overriding andoverloading methods, Dynamic method dispatch; Exception Handling: Exception vs Error, Runtime vs Checked exceptions, try-catch-finally, nested try-catch blocks and best practices, throw, throws, Throwable.Packages, dynamic binding and polymorphism, finalize.

Module III: [10L]

Advanced Java Concepts: Multithreading: Processes vs Threads, Thread methods, Runnable interface vs Thread class, Thread methods, Creating, naming and priority of threads, Thread lifecycle, Co-operative vs preemptive threads, sleep, wait-notify-notifyall, thread synchronizations, synchronized, volatile, thread groups, inter-thread communications, deadlock; Java I/O and File handling: Stream classes, File classes, Reader and Writer classes, File InputStream, File Output Stream,InputStreamReader, OutputStreamWriter, FileReader,FileWriter, Buffered Readerserialization; GUI Programming: Swing, Event handling, parameter passing, layout and event listeners.

Module IV: [10L]

Object Oriented Design and Modeling: Object Oriented Design concepts, abstraction, encapsulation and Data hiding, association, aggregation and composition; Modeling through UML: class diagram, object diagram, sequence diagram, activity diagram, deployment diagrams, events, states, transition and conditions, state diagram, statediagram behavior, Interaction Modeling through Use case Models, sequence models, activity model, sswimlane, separation of concerns, structured programming and better software design.

Text books:

1. Java: The Complete Reference by Herbert Schildt, McGrawHill.
2. Java and Object-Oriented Programming Paradigm by D. Jana, PHI

Reference Books:

1. JAVA How to Program, Deitel and Deitel, Pearson.

Paper Name: IOT Architecture & Protocols					
Paper Code: IOT2204					
Contact hours per week:	**L**	**T**	**P**	**Total**	**Credit Points**
	4	**0**	**0**	**4**	**4**

Course Outcomes:

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

IOT2204.1 To Understand the Architectural Overview of IoT

IOT2204.2 To Understand the IoT Reference Architecture and Real World Design Constraints

IOT2204.3 To Understand the various IoT Protocols (Datalink, Network, Transport, Session, Service)

Module I: [9L] OVERVIEW

IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service(XaaS), M2M and IoT Analytics, Knowledge Management.

Module II: [9L] REFERENCE ARCHITECTURE

IoT Architecture-State of the Art – Introduction, State of the art, Reference Model and architecture, IoT reference Model - IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. Real-World Design Constraints- Introduction, Technical Design constraints-hardware is popular again, Data representation and visualization, Interaction and remotecontrol.

Module III: [9L] IoT DATA LINK LAYER & NETWORK LAYER PROTOCOL

SPHY/MAC Layer(3GPP MTC, IEEE 802.11, IEEE 802.15), WirelessHART, ZWave, Bluetooth Low Energy, Zigbee Smart Energy, DASH7 - Network Layer-IPv4, IPv6, 6LoWPAN, 6TiSCH,ND, DHCP, ICMP, RPL, CORPL, CARP

Module IV: [9L] TRANSPORT & SESSION LAYER PROTOCOLS

Transport Layer (TCP, MPTCP, UDP, DCCP, SCTP)-(TLS, DTLS) – Session Layer HTTP, CoAP, XMPP, AMQP, MQTT

SERVICE LAYER PROTOCOLS & SECURITY Service Layer -oneM2M, ETSI M2M,OMA, BBF – Security in IoT Protocols – MAC 802.15.4 , 6LoWPAN, RPL, Application Layer.

Text books:

1. Internet Of Things (IoT) Technologies Applications Challenges And Solutions by BK Tripathy and J Anuradha, Taylor & Francis first Edition, 2017.

2. Internet of Things: Architectures, Protocols and Standards,by Simone Cirani, Gianluigi Ferrari, Marco Picone, Luca Veltri, First edition 2018.

Reference books:

1. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press,2014.

2. Peter Waher, "Learning Internet of Things", PACKT publishing, BIRMINGHAM –MUMBAI, First Edition – 2015.

3. Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", ISBN 978-3-642- 19156-5 e-ISBN 978-3-642-19157-2,Springer first edition – 2011.

Paper Name: Digital Circuit Design					
Paper Code: ECE2002					
Contact hours per week:	**L**	**T**	**P**	**Total**	**Credit Points**
	4	**0**	**0**	**4**	**4**

Course Outcomes:

After completion of the course, 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.

Textbooks:

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

References:

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

Course Name: Environmental Sciences (Mandatory)					
Course Code: EVS2016					
Contact Hours per week:	**L**	**T**	**P**	**Total**	**Credit points**
	2	**0**	**0**	**2**	**0**

Course Outcomes:

After completion of the course, 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.
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.

Module II: [6L]

Air Pollution: Structures of the atmosphere, global temperature models, Greenhouse effect, global warming; acid rain: causes, effects and control. Lapse rate and atmospheric stability; pollutants and contaminants; smog; depletion of ozone layer; standards and control measures of air pollution.

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. Water quality parameters: DO, BOD, COD. Water treatment: surface water and wastewater.

Module IV: [6L]

Land Pollution: Land pollution: sources and control; solid waste: classification, recovery, recycling, treatment and disposal.
Noise Pollution: Noise: definition and classification; noise frequency, noise pressure, noise intensity, loudness of noise, noise threshold limit value; noise pollution effects and control.

Textbooks

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 Name: Fundamentals of Software Engineering Lab					
Course Code:IOT2252					
Contact Hours per week:	**L**	**T**	**P**	**Total**	**Credit points**
	0	**0**	**3**	**3**	**1.5**

Course Outcomes:

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

IOT2252.1. Prepare SRS document for sample application system as per IEEE guidelines.

IOT2252.2. Design sample software application problem using various UML diagrams (e.g. Use Case Diagram, Class Diagram, Sequence Diagram etc.) using tools like Microsoft Visio.

IOT2252.3. Design test cases for sample application module(s).

IOT2252.4. Estimate the project size, duration and cost for sample application system using industry standard method like FPA.

IOT2252.5. Prepare project schedule.

IOT2252.6. Plan the staffing for sample application system.

Detailed Syllabus

Exercises and Assignments on:

1. Preparation of Software Requirement Specification for sample application system(s) as per IEEE guidelines.
2. Designing a system using UML Diagrams for sample application problems: Use Case Diagrams, Class Diagrams and Sequence Diagrams using tools.
3. Designing Test Cases for sample application module(s).
4. Estimation of Project Size for sample application system(s) – Function Point Analysis (FPA).
5. Preparation of Project Schedule and Staffing Plan for sample software project(s).

Text books:

1. Uml: A Beginner's Guide, Jason T. Roff, McGraw-Hill, 2002.
2. Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development, 3rd Edition, Craig Larman, 2004.

Reference books:

1. The IFPUG Guide to IT and Software Measurement edited by IFPUG,CRC Press, 2012.

Course Name: Object Oriented Programming with Java Lab					
Course Code:IOT2253					
Contact Hours per week:	**L**	**T**	**P**	**Total**	**Credit points**
	0	**0**	**3**	**3**	**1.5**

Course Outcomes:

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

IOT2253.1: Implement basic Java programs involving data types, control flow, and basic algorithms.
IOT2253.2: Develop Java programs utilizing classes, objects, inheritance, and polymorphism.
IOT2253.3: Utilize Java standard packages and classes for various programming tasks.
IOT2253.4: Design and implement multithreaded applications in Java.
IOT2253.5: Design and implement GUI applications in Java using UML
IOT2253.6: Design and implement various Java based applications to understand object-oriented design and modelling through examples.

Assignments on Java:

Day 1
1. Understanding Java platform, compilation, and execution of a java program.
2. Implement class, object, constructor, methods, and other OOP features.

Day 2
1. Understanding Exception with runtime and checked exceptions.
2. Understand nested try-catch with throw, throws etc

Day 3
1. Interface and Classes through examples.

Day 4
1. Object class, practical use of abstract class.
2. Using Interface for achieving multiple inheritance, implementation of package.

Day 5
1. Exception handing fundamentals, java built-in exceptions, Use of Scanner class for console input, use of own Exception subclass.

Day 5

1. Java thread life cycle model and implementation approach, thread priority, implementation of synchronization.

Day 6

1. I/O Basics, byte stream and character streams, reading and writing files.

Day 7

1. Use of Java collection classes

Day 8

1. Exercise on standard data structure and algorithms using Java

Day9

1. Swing life cycle implementation, text processing using Java predefined String, StringBuilder and StringBuffer classes.

Day10

1. Swing event handling through anonymous inner classes, event listeners, button, textbox etc.

Day 11

1. Event handling for interactive GUI application.

Textbooks

1. Java: The Complete Reference by Herbert Schildt, McGrawHill.
2. Java and Object-Oriented Programming Paradigm by D. Jana, PHI

Reference Books

1. JAVA How to Program, Deitel and Deitel, Pearson.

Course Name: IOT Lab					
Course Code:IOT2254					
Contact Hours per week:	**L**	**T**	**P**	**Total**	**Credit points**
	0	**0**	**3**	**3**	**1.5**

1. Interface LED and Buzzer with Arduino/Raspberry Pi and write a program to ‘turn ON’ LED and Buzzer for 1 sec after every 2 seconds.
2. Interface Push button/Digital sensor (IR/LDR) with Arduino/Raspberry Pi and write a program to ‘turn ON’ LED when push button is pressed or at sensor detection.
3. Interface DHT11 sensor with Arduino/Raspberry Pi and write a program to print temperature and humidity readings. Interface OLED with Arduino/Raspberry Pi and write a program to print the temperature and humidity readings on it.
4. Interface motor using relay with Arduino/Raspberry Pi and write a program to ‘turn ON’ motor when push button is pressed.
5. Interface Bluetooth with Arduino/Raspberry Pi and write a program to turn LED ON/OFF when '1'/'0' is received from smart phone using Bluetooth.
6. Write a program on Arduino/Raspberry Pi to upload/receive temperature and humidity data to/from thingspeak cloud.
7. Install MySQL database on Raspberry Pi and perform basic SQL queries.
8. Write a program on Arduino/Raspberry Pi to publish temperature data to MQTT broker.
9. Write a program to create UDP server on Arduino/Raspberry Pi and respond with humidity data to UDP client when requested.
10. Write a program to create TCP server on Arduino/Raspberry Pi and respond with humidity data to TCP client when requested.
11. Write a program on Arduino/Raspberry Pi to subscribe to MQTT broker for temperature data and print it.
12. Design a cloud-based email notification system that generates a notification when the temperature falls under a threshold temperature.
13. Design a home automation prototype.
14. Design a velocity management system for vehicles.

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

Course Outcomes:

After completion of the course, 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.

APPENDIX – A

Point Description for Mandatory Additional Requirement (MAR)

Sl. No.	Name of the Activity	Points	Maximum Points allowed
1	MOOCS (SWAYAM/NPTEL/Spoken Tutorial) (per course)	20	40
2	Tech Fest / Teachers Day / Freshers Welcome		
	(i) Organizer	05	10
	(ii) Participants	03	06
3	Rural Reporting	05	10
4	Tree Plantation (per tree)	01	10
5	Participation in Relief Camps	20	40
6	Participation in Debate/Group Discussion/ Tech quiz	10	20
7	Publication of Wall magazine at Institutional level (magazine/article/internet)	10	20
8	Publication in News paper, Magazine & Blogs	10	20
9	Research Publication (per publication)	15	30
10	Innovative Projects (other than course curriculum)	30	60
11	Blood donation camp		
	(i) Donor	08	16
	(ii) Camp Organizer	10	20
12	Participation in Sports/Games		
	(i) College Level	05	10
	(ii) University Level	10	20
	(iii) District Level	12	24
	(iv) State Level	15	30
	(v) National / International Level	20	40
13	Cultural programme (Dance, Drama, Elocution, Music etc.)	10	20
14	Member of Professional Society	10	20
15	Student Chapter Activities / Seminars		
	(i) Participant	05	20
	(ii) Presentation	10	20
	(iii) Organizer	10	20
16	Relevant industry visit & report	10	20
17	Activities in different clubs at HIT (Photography Club, Cine Club etc.)	05	10
18	Participation in Yoga Camp	05	10
19	Self-Entrepreneurship programme	20	20
20	Adventure sports	10	20
21	Training to under privileged / Physically challenged	15	30
22	Community Service & Allied Activities	10	20
23	Hackathon (State / National Level)		
	(i) Participation in Hackathon	10	20
	(ii) Qualifier for final round (not prize winner) in Hackathon	20	40
	(iii) Prize Winners of Hackathon	30	60

Format for Report Submission

Name :

Department :

Year/Semester :

Title of the Activity :

Date :

Name of the organization :

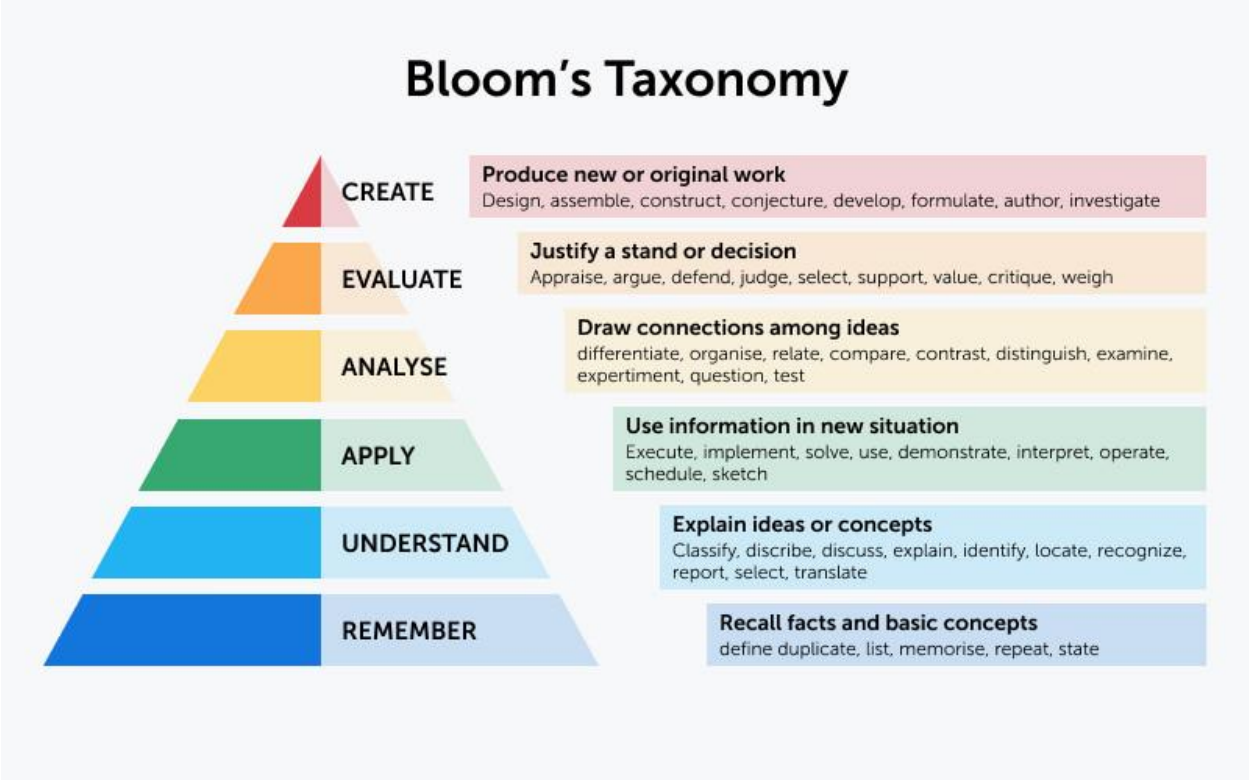
Report :

Signature
(Coordinator / Competent Authority)

Points earned:

Signature of the Mentor

APPENDIX – B


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