HERITAGE INSTITUTE OF TECHNOLOGY

(An Autonomous Institution affiliated to MAKAUT, West Bengal)

DEPARTMENT
OF
COMPUTER SCIENCE AND BUSINESS SYSTEMS

B.TECH. PROGRAMME

Curriculum and Detailed Syllabus
Release Date Version-1: JULY 2023

Release Date Version-1: JULY 2024

(Applicable from 2023 admitted batch)

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Preamble

The curriculum for the B. Tech. in Computer Science and Business Systems (CSBS) 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 industry, academics and the different Accreditation bodies like NBA and NAAC. Courses such as Artificial Intelligent, Machine Learning Business Statistic Lab, Design Thinking and Idea Lab etc. are included in the syllabus keeping in mind the industry demand, as well as the suggestions given by the NBA experts in the very recent visit. Basic mathematical courses like Algebraic structures, linear algebra, and optimization theory are included to strengthen students' mathematical skills that enables them to learn latest developments of computer science and be more innovative. Students are being motivated to select and study MOOC subjects of their choice towards attaining the degree with honors. Apart from this, the course code is now changed from 4 letters to 3 letters from the session 2023 – 2024 as per the suggestions came from the office of the controller of examinations. This will help to distinguish the new courses from the old ones. In accordance with this, the curriculum and syllabi are revised in a structured manner by implementing Feedback Mechanism on Curriculum from various stakeholders, including potential employers, alumni, and parents.

Institutional Vision & Mission

VISION:

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

MISSION:

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

Departmental Vision & Mission

VISION:

To become a recognized hub in Computer Science & Management, focusing on the development of workforce with strong foundation of technology, and an equal appreciation of humanities, management sciences and human values.

MISSION:

M1: To provide quality education through well designed curriculum designed to meet the challenging needs of the software industry.

M2: To impart essential knowledge in Basic Sciences, Computer Sciences and Management Sciences.

M3: To inculcate value-based, socially committed professionalism demonstrating high ethical and professional standards and responsible team leadership.

Program Educational Objectives (PEOs) of B.Tech. in CSBSProgramme

The graduate students with the B.Tech. degree in CSBS from Heritage Institute of Technology, Kolkata are expected to achieve the following qualities after a few years of getting this degree.

PEO 1: Apply fundamental knowledge of basic sciences, computer science, and business analytics to perform in technical and managerial roles and responsibilities.

PEO 2: Recognize proper tools and business principles for understanding contemporary technology as well as pursue life-long learning.

PEO 3: Modify acquired technical and leadership skills to deal with real-life problems and to meet the diverse needs of industry, academia, and research.

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) of B.Tech. in CSBS Programme

PSO 1: Identify appropriate cutting-edge engineering tools and business principles to develop solutions for the ever-changing needs of society.

PSO 2: Adapt diverse technological, socio-economic, and ethical aspects of various business systems.

PSO 3: Re-create customized computational algorithms for various business models as an individual or team.

Credit Summary for B Tech programmes in CSBS with effect from 2023-2024

Sl. No.	Course Type	Credit CSBS
1.	Humanities and Social Sciences including Management Courses	6
2.	Basic Science Courses	23
3.	Engineering Science Courses including Workshop, Drawing, Basics of Electrical / Mechanical / Computer, etc.	23.5
4.	Professional Core Courses	67.5
5.	Professional Elective Courses relevant to chosen Specialization / Branch	15
6.	Open Subjects – Electives from other Technical and/or Emerging Subjects	12
7.	Project Work, Seminar and Internship in industry or elsewhere	16
8.	Mandatory Courses (Non-credit) [Environmental Sciences, Induction Program, Indian Constitution, Essence of Indian Traditional Knowledge]	(NON-CREDIT)
	Total	**163**
9	Honours Courses (MOOCS or otherwise)	20
	Grand Total	**183**

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

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

Range of Credits (as per AICTE):

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

Curriculum

1st Year 1st Semester

Sl.	Code	Subject	Contacts Periods/ Week L	T	P	Total	Credit Points
A. Theory							
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

Sl.	Code	Subject	Contacts Periods/ Week L	T	P	Total	Credit Points
A. Theory							
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	CBS2101	Data Structures and Applications	4	0	0	4	4
2	CBS2102	Information Theory and Coding	3	0	0	3	3
3	CBS2103	Fundamentals of Management	2	0	0	2	2
4	MTH2103	Discrete Mathematics	4	0	0	4	4
5	ECE2002	Digital Circuit Design	3	0	0	3	3
6	EVS2016	Environmental Sciences (Mandatory)	2	0	0	2	0
Total Theory			**18**	**0**	**0**	**18**	**16**
B. Practical							
1	CBS2151	Data Structures and Applications Lab	0	0	3	3	1.5
2	CBS2153	Business Statistics Lab	0	0	2	2	1
3	ECE2052	Digital Circuit Design Lab	0	0	2	2	1
4	CBS2155	Design Thinking and Idea Lab	0	0	2	2	1
Total Practical			**0**	**0**	**9**	**9**	**4.5**
Total of Semester			**18**	**0**	**9**	**27**	**20.5**

2nd Year 2nd Semester

Sl.	Code	Subject	Contacts Periods/ Week				Credit Points
			L	T	P	Total	
A. Theory							
1	CBS2201	Design and Analysis of Algorithms	4	0	0	4	4
2	CBS2202	Computer Organization and Architecture	3	0	0	3	3
3	CBS2203	Operating System Concept	3	0	0	3	3
4	CBS2204	Object Oriented Programming	3	0	0	3	3
5	CBS2205	Managerial Economics	3	0	0	3	3
6	MTH2205	Statistics for Business System	3	0	0	3	3
Total Theory			**19**	**0**	**0**	**19**	**19**
B. Practical							
1	CBS2251	Design & Analysis of Algorithms Lab	0	0	3	3	1.5
2	CBS2252	Computer Architecture Lab	0	0	3	3	1.5
3	CBS2253	Operating System Concept Lab	0	0	3	3	1.5
4	CBS2254	Object Oriented Programming Lab	0	0	3	3	1.5
Total Practical			**0**	**0**	**12**	**12**	**6**
Total of Semester			**19**	**0**	**12**	**31**	**25**

3rd Year 1st Semester

A. Theory							
Sl.	Code	Subject	Contacts Periods/ Week				Credit Points
			L	T	P	Total	
1	CBS3101	DBMS	4	0	0	4	4
2	CBS3102	Computer Networks	4	0	0	4	4
3	CBS3103	Artificial Intelligence	4	0	0	4	4
4	CBS3104	Formal Language & Automata Theory	4	0	0	4	4
5	CBS3131 - CBS3140	Professional Elective-I	3	0	0	3	3
	CBS3131	Marketing Management					
	CBS3132	Financial Management					
	CBS3133	Operations Management					
6		Open Elective-I	3	0	0	3	3
	MTH3121	Linear Algebra					
	MEC3122	Computational Methods in Engineering					
	AEI3122	Fundamentals of Sensors & Transducers					
7	INC3016	Indian Constitution and Civil Society (Mandatory)	2	0	0	2	0
		Total Theory	**24**	**0**	**0**	**24**	**22**
B. Practical							
1	CBS3151	DBMS Lab	0	0	3	3	1.5
2	CBS3152	Network Administration Lab	0	0	3	3	1.5
3	CBS3153	Artificial Intelligence Lab	0	0	2	2	1
		Total Practical	**0**	**0**	**8**	**8**	**4**
		Total of Semester	**24**	**0**	**8**	**32**	**26**

3rd Year 2nd Semester

Sl.	Code	Subject	Contacts Periods/ Week				Credit Points
			L	T	P	Total	
A. Theory							
1	CBS3201	Software Engineering	3	0	0	3	3
2	CBS3202	Machine Learning	4	0	0	4	4
3	CBS3203	Strategic Management	3	0	0	3	3
4	CBS3231 - CBS3240	Professional Elective-II	3	0	0	3	3
	CBS3231 CBS3232 CBS3233	Compiler Design Web Technology Cyber Security					
5	CBS3241 - CBS3250	Professional Elective-III	3	0	0	3	3
	CBS3241 CBS3242 CBS3243	Business Analytics Digital Marketing Advanced Business Research					
6	****	Open Elective-II	3	0	0	3	3
Total Theory			**19**	**0**	**0**	**19**	**19**
B. Practical							
1	CBS3251	Software Engineering Lab	0	0	3	3	1.5
2	CBS3252	Machine Learning Lab	0	0	3	3	1.5
Total Practical			**0**	**0**	**6**	**6**	**3**
C. Sessional							
1	CBS3293	Term Paper and Seminar	0	0	2	2	1
2	CBS3295	Project-I	0	0	4	4	2
Total Sessional			**0**	**0**	**6**	**6**	**3**
Total of Semester			**19**	**0**	**12**	**31**	**25**

4th Year 1st Semester

Sl.	Code	Subject	Contacts Periods/ Week				Credit Points
			L	T	P	Total	
A. Theory							
1	CBS4131 - CBS4140	Professional Elective-IV	3	0	0	3	3
	CBS4131 CBS4132	Human Resource Management Industry Laws for Employees Welfare					
3	CBS4141 - CBS4150	Professional Elective-V	3	0	0	3	3
	CBS4141 CBS4142	Enterprise Resource Planning Supply Chain Management					
4	****	Open Elective-III	3	0	0	3	3
5	****	Open Elective-IV	3	0	0	3	3
Total Theory			**12**	**0**	**0**	**12**	**12**
B. Sessional							
1	CBS4191	Industrial Training / Internship	-	-	-	-	**2**
2	CBS4195	Project-II	0	0	6	6	3
Total Sessional			**0**	**0**	6	6	**5**
Total of Semester			**12**	**0**	**6**	**18**	**17**

4th Year 2nd Semester

Sl.	Code	Subject	Contacts Periods/ Week				Credit Points
			L	T	P	Total	
1	CBS4295	Project-III	0	0	12	12	6
2	CBS4297	Comprehensive Viva-voce	-	-	-	-	2
Total Sessional			**0**	**0**	**12**	**12**	**8**
Total of Semester			**0**	**0**	**12**	**12**	**8**

DETAILED SYLLABUS

1st Year

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

Course Outcomes

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

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

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

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

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

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

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

Module - I [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 asan 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 PS Joag Tata- McGraw-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- McGraw-Hill Publishing Company Ltd

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 Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	1	0	4	4

Course Outcomes

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

MTH1001.1: Apply the concept of rank of matrices to find the solution of a system of linear simultaneous equations

MTH1001.2: Develop the concept of eigen values and eigen vectors

MTH1001.3: Combine the concepts of gradient, curl, divergence, directional derivatives, line integrals, surface integrals and volume integrals

MTH1001.4: Analyze the nature of sequence and infinite series

MTH1001.5: Choose proper method for finding solution of a specific differential equation

MTH1001.6: 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 the setests), 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'stype.

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,NewDelhi, 2008.

4. Ramana B.V.,"Higher Engineering Mathematics", TataMcGrawHill NewDelhi,11th Reprint, 2010.

5. K.F. Riley, M.P. Hobson, S. J. Bence., "Mathematical Methods for Physics andEngineering", 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. M. R. Spiegel, Seymour Lipschutz, Dennis Spellman, “Vector Analysis (Schaum’soutline series)”, McGraw Hill Education.

9. S. S. Sastry, “Engineering Mathematics”, PHI.

10.M.C. Potter, J.L.Goldberg and E.F. Abonfadel (OUP), “Advanced Engineering Mathematics”, Indian Edition.

11. Seymour Lipschutz, Marc Lipson, “Linear Algebra (Schaum’s outline series)”, McGraw Hill Education.

Course Title: Introduction to Electronic Devices and Circuits					
Course Code:ECE1001					
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:

ECE1001.1 Categorize different semiconductor materials based on their energy bands and analyze the characteristics of those materials for different doping concentrations based on previous knowledge on semiconductors acquired.

ECE1001.2 Describe energy band of P-N Junction devices and solve problems related to P-N Junction Diode both from device and circuit perspectives.

ECE1001.3 Design different application specific circuits associated with diodes operating both in forward and reverse bias.

ECE1001.4 Analyze various biasing configurations of Bipolar Junction Transistor and categorize different biasing circuits based on stability.

ECE1001.5 Categorize different field-effect transistors based on their constructions, physics and working principles and solve problems associated with analog circuits based on operational amplifiers.

ECE1001.6 Design and implement various practical purpose electronic circuits and systems meant for both special purpose and general purpose and anlayze their performance depending on the type of required output and subsequently the applied input.

Module - I [10L] Basic Semiconductor

Physics

Crystalline materials, Energy band theory, Conductors, Semiconductors and Insulators, Concept of Fermi Energy level, intrinsic and extrinsic semiconductors, drift and diffusion currents in semiconductor

Diodes and Diode Circuits

Formation of p-n junction, Energy Band diagram, forward & reverse biased configurations, V-I characteristics, load line, breakdown mechanisms, Zener Diode and its Application. Rectifier circuits: half wave & full wave rectifiers: ripple factor, rectification efficiency.

Module - II [8L]

Bipolar Junction Transistors (BJT)

PNP & NPN BJT structures, current components in BJT, CE, CB, CC configurations, V-I Characteristics of CB& CE modes, regions of operation, Base width modulation & Early effect, thermal runaway, Concept of Biasing: DC load line, Q-point, basics of BJT amplifier operation, current amplification factors, different biasing circuits: fixed bias, collector to base bias, voltage divider bias.

Module - III [9L]

Field Effect Transistors (FET): n-channel Junction Field Effect Transistor (JFET) structure &V-I characteristics.

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

MOSFET as a digital switch, CMOS inverter, voltage transfer characteristic (VTC), NAND & NOR gate realization using CMOS logic.

Moore's Law, evolution of process node, state of integration (SSI, MSI, LSI, VLSI, ULSI), Classification of Integrated circuits (IC) and their applications.

Module - IV [9L]

Feedback in amplifiers: Concept of feedback, advantages of negative feedback (qualitative), Barkhausen criteria.

Operational Amplifier: Ideal OPAMP characteristics, OPAMP circuits: inverting and non-inverting amplifiers, Adder, Subtractor, Integrator, Differentiator, Basic Comparator.

Special Semiconductor Devices: Light Emitting Diode (LED), Silicon Controlled Rectifier (SCR), Photodiode: Operations, characteristics & applications.

Text / Reference books

1. Electronic Devices & Circuit Theory, Boylestad & Nashelsky.

2. Op Amps and Linear IC's, R.A Gayakwad, PHI.

3. Electronics Fundamentals and Applications, D. Chattopadhyay, P. C Rakshit.

4. Microelectronics Engineering, Adel S. Sedra, Kenneth Carless Smith.

5. Integrated Electronics, Millman & Halkias.

6. Electronics Devices & Circuits, Salivahanan.

7. Electronic Principle, Albert Paul Malvino.

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

Course Outcomes

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

HUM1001.1 Be aware of the value system and the importance of following such values at workplace.

HUM1001.2 Learn to apply ethical theories in the decision making process

HUM1001.3 Follow the ethical code of conduct as formulated by institutions and organizations

HUM1001.4 Implement the principles governing work ethics

HUM1001.5 Develop strategies to implement the principles of sustainable model of development

HUM1001.6 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, Utilatirianism, 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, Giligan'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. Human Values, Tripathi, A.N., New Age International, New Delhi, 2006.

2. Classical Sociological Theory, Ritzer, G., The McGraw Hill Companies, NewYork,1996

3. Postmodern Perspectives on Indian Society, Doshi, S.L., Rawat Publications, NewDelhi, 2008

4. Sustainable Development, Bhatnagar, D.K., Cyber Tech Publications, New Delhi,2008

5. The age of Spiritual Machines, Kurzwell, R., Penguin Books, New Delhi,1999

6. Social Problems in Modern Urban Society, Weinberg, S.K., Prentice Hall Inc.,USA,1970

7. Anthony 2009. Sociology. London, Giddens, Polity Press (reprint 13th Edition).

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

Course Outcomes

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

PHY1051.1 Gain practical knowledge by applying the experimental methods to correlatewith the Physics theory.

PHY1051.2 Learn the usage of electrical and optical systems for various measurements

PHY1051.3 Apply the analytical techniques and graphical analysis to the experimentaldata

PHY1051.4 Understand measurement technology, usage of new instruments and realtime applications in engineering studies

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

PHY1051.6

Detailed Syllabus

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

Module - I

Experiments in General Properties of matter:

1. Determination of Young's modulus by Flexure Method

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

Module - II

Experiments in Optics

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

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

3. Determination of wavelength of light by Fresnel's bi-prism method.

4. Determination of the wavelength of a given laser source by diffraction method

Module - III

Electricity & Magnetism experiments

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

2. Determination of resistance of ballistic galvanometer by half deflection methodand study of variation of logarithmic decrement with series resistance.

3.Determination of the thermo-electric power at a certain temperature of the giventhermocouple.

4. Determination of specific charge (e/m) of electron

Module - IV

Quantum Physics Experiments:

1. Determination of Planck's constant.

2. Determination of Stefan's radiation constant.

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

4. Determination of Rydberg constant by studying Hydrogen/Helium spectrum.

5. Determination of Hall co-efficient of semiconductors.

6. Determination of band gap of semiconductors.

7. To study current-voltage characteristics, load response, areal characteristics andspectral response of photovoltaic solar cells.

Textbooks

1. Advanced Practical Physics (Vol.1 and Vol.2), B. Ghosh and K.G. Mazumdar.

2. Advanced Course in Practical Physics, D.Chattopadhyayand P.C. Rakshit

Reference books

1. Optics, Eugene Hecht, Pearson Education India Private Limited.

2. Introduction to Electrodynamics, David J. Griffiths, Pearson Education IndiaLearning Private Limited

3. Waves and Oscillations, N.K. Bajaj

4. Principles of Physics, David Halliday, Robert Resnick Jearl Walker, 10ed,Wiley

5. Electricity, Magnetism and Light, Wayne M.Saslow, Academic Press

6. Classical Mechanics, Narayan Rana, Pramod Joag, McGraw Hill Education

7. Introduction to Classical Mechanics, R Takwale, P Puranik, McGraw Hill Education

8. Optics, Ghatak, McGraw Hill Education India Private Limited

9. Refresher Course in B.Sc. Physics, C.L. Arora, Vol1 and Vol2

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

Course Outcomes

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

ECE1051.1 Correlate theory with diode behavior.

ECE1051.2 Design and check rectifier operation with regulation etc

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

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

Detailed Syllabus

List of Experiments

1. Familiarization with passive and active electronic components such as Resistors, Inductors, Capacitors, Diodes, Transistors (BJT) and electronic equipment like DC power supplies, multi-meters etc.

2. Familiarization with measuring and testing equipment like CRO, Signal generators etc.

3. Study of I-V characteristics of Junction diodes.

4. Study of I-V characteristics of Zener diodes.

5. Study of Half and Full wave rectifiers with Regulation and Ripple factors.

6. Study of I-V characteristics of BJTs in CB mode

7. Study of I-V characteristics of BJTs in CE mode

8. Study of I-V characteristics of Field Effect Transistors.

9. Determination of input-offset voltage, input bias current and Slew rate of OPAMPs.

10. Determination of Common-mode Rejection ratio, Bandwidth and Off-set null of OPAMPs.

11. Study of OPAMP circuits: Inverting and Non-inverting amplifiers, Adders,I ntegrators and Differentiators.

Text/ Reference books

1. Electronics Fundamentals and Applications, D. Chattopadhyay, P. C Rakshit.

2. Electronics Laboratory Primer, B Sasikala.

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

Course Outcomes

After completion of the course, 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.

Detailed Syllabus

(i) Lectures & videos: (13 hours)

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

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

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

Course Outcomes

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

MEC1052.1 Visualize the basic concept of engineering drawing.

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

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

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

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

MEC1052.6 Execute the concept of isometric projections.

Detailed Syllabus

Lecture [13L]

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

Course Title: Chemistry I					
Course Code: CHM1001					
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:

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

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

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

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

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

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

Detailed Syllabus

Module I [9L]

Thermodynamics: [5L]

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

Electrochemical Cell: [4L]

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

ModuleII [9L]

Molecular Structure: [5L]

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

Periodic Properties: [4L]

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

Module – III [9L]

Atomic structure and Wave Mechanics: [5L]

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

Spectroscopic Techniques & Applications: [4L]

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

Module – IV [9L]

Stereochemistry: [5L]

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

Organic reactions and synthesis of drug molecules: [4L]

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

Textbooks

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

Reference books

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

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

Course Outcomes

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

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

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

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

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

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

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

Module I: [10L]

Basic Probability

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

Module II: [10L]

Basic Numerical Methods

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

ModuleIII[10L]

Basic Graph Theory

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

ModuleIV[10L]

Laplace Transformation

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

Text books

1. Advanced Engineering Mathematics, E.Kreyszig, Wiley Publications.
2. 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.

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.Cpreprocessor (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

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

Reference Books

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

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

Course Outcomes:

After completion of the course, 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.

Detailed Syllabus

Module I [11L] DC Network Theorem: [6L]

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

Electromagnetism: [5L]

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

Module II [10L]

AC single phase system:

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

Module III [11L]

Three phase system: [4L]

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

DC Machines: [7L] Construction, EMF equation, Principle of operation of DC generator, Open circuit characteristics, External characteristics, Principle of operation of DC motor, speed-torque characteristics of shunt and series machine, starting of DC motor, speed control of DC motor.

ModuleIV[10L]

Transformer: [6L]

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

3-phase induction motor: [4L]

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

Textbooks

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 Comp

Reference books

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

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

Course Outcomes

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

HUM1001.1 Acquire competence in using English language to communicate.
HUM1001.2 Be aware of the four essential skills of language usage-listening, speaking, reading and writing.
HUM1001.3 Be adept at using various modes of written communication at work.
HUM1001.4 Attain the skills to face formal interview sessions.
HUM1001.5 Write reports according to various specifications.
HUM1001.6 Acquire the skill to express with brevity and clarity

Module I [6L]

Grammar (Identifying Common Errors in Writing)
Subject-verb agreement
Noun-pronoun agreement
Misplaced Modifiers
Articles
Prepositions
Redundancies

Module II [6L]

Basic Writing Strategies Sentence Structures
Use of phrases and clauses in sentences
Creating coherence
Organizing principles –accuracy, clarity, brevity
Techniques for writing precisely
Different styles of writing: descriptive, narrative, expository
Importance of proper punctuation

ModuleIII[8L]

Business Communication- Scope & Importance

Writing Formal Business Letters:

Form and Structure-Parts of a Business letter, Business Letter Formats, Style and Tone, Writing strategies

Organizational Communication:

Agenda & minutes of a meeting, Notice, Memo, Circular Organizing e-mail messages, E-mail etiquette

Job Application Letter:

Responding to Advertisements and Forced Applications, Qualities of well-written Application Letters: The You-Attitude, Length, Knowledge of Job Requirement, Reader-Benefit Information, Organization, Style, Mechanics – Letter Plan: Opening Section, Middle Section, Closing Section

Resume and CV:

Difference, Content of the Resume – Formulating Career Plans: Self Analysis, Career Analysis, Job Analysis, Matching Personal Needs with Job Profile – Planning your Resume – Structuring the Resume: Chronological Resume, The Functional Resume, Combination of Chronological and Functional Resume, Content of the Resume: Heading, Career Goal or Objectives, Education, Work Experience, Summary of Job Skills/Key Qualifications, Activities, Honors and Achievements, Personal Profile, Special Interests, References

Module IV [6L]

Writing skills

Comprehension:

Identifying the central idea, inferring the lexical and contextual meaning, comprehension passage - practice

Paragraph Writing:

Structure of a paragraph, Construction of a paragraph, Features of a paragraph, Writing techniques/developing a paragraph.

Précis:

The Art of Condensation-some working principles and strategies. Practice sessions of writing précis of given passages.

Essay Writing:

Characteristic features of an Essay, Stages in Essay writing, Components comprising an Essay, Types of Essays-Argumentative Essay, Analytical Essay, Descriptive Essays, Expository Essays, Reflective Essays

Text / Reference books

1.Theories of Communication: A Short Introduction, Armand Matterlart and Michele Matterlart, Sage Publications Ltd.

2.Professional Writing Skills, Chan, Janis Fisher and Diane Lutovich. San Anselmo, CA: Advanced Communication Designs.

3.Business English, Hauppauge, Geffner, Andrew P. New York: Barron's Educational Series.
4.Business Communication, Kalia, S. &Agarwal, S.,Wiley India Pvt. Ltd., New Delhi, 2015
5.Business Communication- Connecting at work., Mukherjee, H.S., Oxford University Press.2nd Edition.2015
6.Technical Communication: Principles and Practice, 2nd Ed., Raman, M. and Sharma, S., 2011

Course Title :Chemistry I Laboratory					
Course Code: CHM1051					
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:

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 Fe2+, Cu2+ 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

Detailed Syllabus
1. Estimation of iron using KmnO4 self indicator.
2. Iodometric estimation of Cu2+.
3. Determination of Viscosity.
4. Determination of surface tension.
5. Adsorption of acetic acid by charcoal.
6. Potentiometric determination of redox potentials.
7. Determination of total hardness and amount of calcium and magnesium separately in a given water sample.
8. Determination of the rate constant for acid catalyzed hydrolysis of ethyl acetate.
9. Heterogeneous equilibrium (determination of partition coefficient of acetic acid in n-butanol and water mixture).
10. Conductometric titration for the determination of strength of a given HCl solution against a standard NaOH solution.

11. pH-metric titration for determination of strength of a given HCl solution against a standard NaOH solution.
12. Determination of chloride ion in a given water sample by Argen to metric method (using chromate indicator solution)

Text / Reference books

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

Course Title : Programming for Problem Solving Laboratory					
Course Code: CSE1051					
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:

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
Detailed Syllabus

Topic 1: LINUX commands and LINUX based editors
Topic 2: Basic Problem Solving
Topic 3: Control Statements (if, if-else, if-elseif-else, switch-case)
Topic 4: Loops - Part I (for, while, do-while)
Topic 5: Loops - Part II
Topic 6: One Dimensional Array
Topic 7: Array of Arrays
Topic 8: Character Arrays/ Strings
Topic 9: Basics of C Functions
Topic 10: Recursive Functions
Topic 11: Pointers
Topic 12: Structures
Topic 13: File Handling

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

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

Course Outcomes

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

ELE1051.1 Get an exposure to common electrical apparatus and their ratings.
ELE1051.2 Make electrical connections by wires of appropriate ratings.
ELE1051.3 Apply various network theorems in Electrical Circuits
ELE1051.4 Understand the application of common electrical measuring instruments.
ELE1051.5 Understand the basic characteristics of different electrical machines.
ELE1051.6 Know the measurement technique various electrical parameters.

Detailed Syllabus

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.

Text / Reference books

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

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

Course Outcomes

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

HUM1051.1 Acquire the techniques to become an effective listener.
HUM1051.2 Acquire the skill to become an effortless speaker.
HUM1051.3 Organize and present information for specific audience.
HUM1051.4 Communicate to make a positive impact in professional and personal environment.
HUM1051.5 Engage in research and prepare authentic, formal, official documents.
HUM1051.6 Acquire reading skills for specific purpose

Module I [4 HRS]

Listening Skills

• Principles of Listening: Characteristics, Stages.

• Types of Listening: Passive listening, Marginal or superficiallistening, Projective Listening, Sensitive or Empathetic Listening, Active or Attentive listening.

• Guidelines for Effective Listening

• Barriers to Effective Listening

• Listening Comprehension

Module II [8 HRS]

• Interviewing

Types of Interviews, Format for Job Interviews: One-to-one and Panel Interviews, Telephonic Interviews, Interview through video conferencing.

• Interview Preparation Techniques, Frequently Asked Questions, Answering Strategies, Dress Code, Etiquette, Questions for the Interviewer, Simulated Interviews

Module III [6 HRS]

• Public Speaking: The Speech Process: The Message, The Audience, The Speech Style, Encoding, Feedback.

• Characteristics of a good speech : content and delivery, structure of a speech

• Modes of delivery in public speaking: Impromptu, Extemporaneous, Prepared or Memorized, Manuscript.

• Conversation: Types of conversation: formal and informal, Strategies for effective conversation, Improving fluency.
• Situational conversation practice: Greetings and making introductions, Asking for information and giving instructions, agreeing and disagreeing.
• Conversational skills in the business scenario: One-to-one and Group communication, Gender and Culture Sensitivity, Etiquette, Sample Business Conversation, Telephonic Conversation

Module IV [8 HRS]
Presentation Skills
Speaking from a Manuscript, Speaking from Memory, Impromptu Delivery, Extemporaneous Delivery, Analyzing the Audience, Nonverbal Dimensions of Presentation
Organizing the Presentation: The Message Statement, Organizing the Presentation: Organizing the Speech to Inform, The Conclusion, Supporting Your Ideas – Visual Aids: Designing and Presenting Visual Aids, Selecting the Right Medium.
Project Team/Group Presentations

Text / Reference books
1.Business and Administrative Communication Locker, Kitty O The Cambridge guide to Teaching English to Speakers of Other Languages, Carter, R. And Nunan, D. (Eds), CUP, 2001.
2.Writing and Speaking At Work: A Practical Guide for Business Communication, Edward P. Bailey, Prentice Hall, 3rd Ed., 2004.
3.Guide to Managerial Communication: Effective Business Writing and Speaking, Munter, M., Prentice Hall, 5th Ed., 1999
4.Communication and Language Skills, Sen, S.,Mahendra, A Patnaik,P.,Cambridge University Press, 2015
5.McGraw-Hill/ Irwin
6.Intercultural Business Communication. Chaney, L.andMartin, J., Prentice Hall

DETAILED SYLLABUS

2nd Year

Course Title : Data Structures and Basic Algorithms					
Course Code: CBS2101					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	4	0	0	0	4

Course Outcome

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

CSBS2101.1. Demonstrate the standard data structures covered in this course, in relevant applications.

CSBS2101.2. Identify the application of ordered and unordered lists in relevant problems of data structures.

CSBS2101.3. Apply stack and queue data structure to solve mathematical and real-life problems.

CSBS2101.4. Explore tree and graph approaches, mentioned in this course, to solve a given problem definition.

CSBS2101.5. Analyse algorithms related to sorting, searching and hashing covered in this course, in related applications.

CSBS2101.6. Compare the performance of alternative approaches built using different data structures covered in this course, with respect to their efficiency.

MODULE-I [8L]

Linear Data Structure I

Introduction

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

Array:

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

Linked List:

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

MODULE-II [10L]

Linear Data Structure II

Stack:

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

Queue:

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

MODULE-III [13L]

Nonlinear Data structures

Trees:

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

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

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

B- Trees – operations -->insertion, deletion with examples only.

Graphs:

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

MODULE-IV [12L]

Searching, Sorting, Hashing

Sorting Algorithms:

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

Searching:

Sequential search, binary search, Interpolation Search

Hashing:

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

Text Books:

1. Reema Thareja, “Data Structures using C”, Oxford University Press.

2.Narasimha Karumanchi, “Data structures and algorithms made easy”,Career Monk Plublications

Reference Books:

1. NarasimhaKarumanchi,“Data Structures and Algorithms Made Easy-Data Structures and AlgorithmicPuzzles”, CareerMonkPlublications

2. S. Lipschutz, “Data Structures”, Schaums Outlines.

3. Ellis Horowitz, SartajSahni, Susan Anderson, “Fundamentals of Data Structures of C”, Freed.
4. Aaron M. Tenenbaum, “Data Structures in C”.
5. D. Samanta, “Classic Data Structures”, PHI
6. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, “Introduction to Algorithms”,The MIT Press.

Course Title : Information Theory and Coding					
Course Code: CBS2102					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	0	0	3	3

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

CSBS2101.1. Derive equations for entropy, mutual information and channel capacity for all types of channels.
CSBS2101.2. Compare among different types of error correcting codes.
CSBS2101.3. Evaluate the channel performance using Information theory.
CSBS2101.4. Formulate the basic equations of linear block codes.
CSBS2101.5. Apply convolution codes for performance analysis .
CSBS2101.6. Design BCH code for Channel performance improvement.

Detailed Syllabus:

Module I: [10 L]

Entropy and Mutual Information: Entropy, Joint and Conditional Entropy, Relative Entropy and Mutual Information.
Source coding: Huffman coding, Kraft Inequality, Shannon-Fano Coding, Shannon-Fano-Elias Coding, Arithmetic Coding and Run length coding.
Channel Capacity: Channel models, Discrete memoryless channels, Shannon's noisy coding theorem, The Shannon limit.

Module II: [14 L]

Linear Block Codes: Design of linear block codes, introduction of linear block codes, Matrix description of linear block codes, parity check matrix, syndrome and error detection, minimum distance of a block code, error detecting and error correcting capability of a block code, design of encoder and syndrome decoder for linear block codes. Hamming codes.
Cyclic Codes: Polynomials, division algorithm for polynomials, a method for generating cyclic codes, matrix description of cyclic codes, generator and parity check polynomials, syndrome and error detection.

Module III : [8 L]

BCH Codes: Primitive elements, minimal polynomials, generator polynomials in terms of minimal polynomials, Error Syndrome, Error location polynomial, examples of BCH codes.

Module IV : [8 L]
Convolutional Codes: Tree codes, trellis codes, polynomial description of convolutional codes, distance notions for convolutional codes, the generating function, matrix representation of convolutional codes, decoding of convolutional codes – Viterbi Algorithm, distance and performance bounds for convolutional codes.

Text / Reference Books:

1. Information theory, coding and cryptography - Ranjan Bose; TMH.
2. Information and Coding - N Abramson; McGraw Hill.
3. Elements of Information Theory - T. M. Cover and J. A. Thomas, John Wiley, New York.
4. Information Theory - R B Ash; Prentice Hall.

Course Title : Fundamentals of Management					
Course Code: CBS2103					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	2	0	0	2	2

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

CBS2103.1. Study the evolution of Management.
CBS2103.2. Understand various management functions and have some basic knowledge on different aspects of management.
CBS2103.3. Understand the planning process in an organization.
CBS2103.4. Understand the concept of organizational structure.
CBS2103.5. Demonstrate the ability to direct, lead and communicate effectively.
CBS2103.6. Analyze and isolate issues and formulate best Business Strategy.

Module – I [7L]
Introduction to Management: Definition, Nature and Scope, Functions, Managerial Roles, Levels of Management, Managerial Skills, Challenges of Management.

Planning: General Framework for Planning - Planning Process, Types of Plans, Analyzing Business Environment, SWOT Analysis, Porter's Industry analysis and other analytical tools for analysis of the micro and macro business environment.

Module – II [6L]

Decision Making and Forecasting: Forecasting of the business environment using different tools. Decision making and Problem Solving - Programmed and Non Programmed Decisions, Steps in Problem Solving and Decision Making; Decision Tree analysis.

Business Strategy Formation: Development of Business Strategy. BCG Matrix and its application related to SBU strategy

Module – III[7L]

Organizing and Staffing

Organizing: Principles of Organization: Organizational Design & Organizational Structures; Departmentalization, Delegation; Empowerment, Centralization, Decentralization, Recentralization; Organizational Culture; Organizational Climate and Organizational Change.

Human Resource Management: Talent Management, Human Resource Planning; Recruitment and Selection; Training and Development; Performance Appraisal.

Module – IV[6L]

Controlling: Feedforward and Feedback controlling.Different quantitative techniques of controlling. Budgetary Control. Strategy for correcting the deviation.

Text / Reference Books

1. Stephen P. Robbins and Mary Coulter, “Management”, Pearson Education, 2017, 13th edition.
2. Koontz H. and Weihrich H., "Essentials of Management", Mcgraw Hill Int. Ed., 2015,10th edition.
3. Bhat and Kumar A. “Management: Principles, Processes & Practices”, Oxford University Press, 2016, 2nd edition.
4. Robbins, Coulter, and DeCenzo, “Fundamentals of Management”, Pearson Education, 2016, 9th edition.
5. Richard L. Daft, "Management", Cengage Learning, 10th edition.

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

Course Outcomes:

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

MTH 2103.1. Interpret the problems that can be formulated in terms of graphs and trees.
MTH 2103.2. Explain network phenomena by using the concepts of connectivity, independent sets, cliques, matching, graph coloring etc.
MTH 2103.3. Achieve the ability to think and reason abstract mathematical definitions and ideas relating to integers through concepts of well-ordering principle, division algorithm, greatest common divisors and congruence.
MTH 2103.4. Apply counting techniques and the crucial concept of recurrence to comprehend the combinatorial aspects of algorithms.
MTH 2103.5. Analyze the logical fundamentals of basic computational concepts.
MTH 2103.6. Compare the notions of converse, contra positive, inverse etc. in order to consolidate the comprehension of the logical subtleties involved in computational mathematics.

Detailed Syllabus:

Module I:[10L]

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

Module II:[10L]

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

Module III:[10L]

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

Module IV:[10L]

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

Text Books

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

Reference Books

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

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

Course outcomes:

ECE2102.1. Students will learn about the Binary Number system and minimization of logic expression using different methods.

ECE2102.2. Students will design different Arithmetic Combinational circuits like Adder, Subtractor.

ECE2102.3. Students will be able to design Multiplexer, De-Multiplexer, Decoder,Encoder, etc and learn about applications

ECE2102.4. Students will be able to design Sequential Circuits such as flip flops and perform inter conversion of them.

ECE2102.5. Students will design various types of Registers and Counters Circuits using Flip-Flops (Synchronous, Asynchronous,Irregular, Cascaded, Ring, Johnson).

ECE2102.6. Students will learn basic gates using CMOS logic and analyze different memory systems including RAM, ROM, EPROM,EEROM, etc.

Module-1[8 L]

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-2: [12 L]

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-3: [10 L]

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-4: [8 L]

Memory Systems: Concepts and basic designs of RAM, ROM, EPROM, EEROM, Programming logicdevices 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.

Total: 36 hours

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

Course Outcome

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

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

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

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

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

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

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

MODULE-I [6L]

Socio Environmental Impact

Basic ideas of environment and its component

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

Concept of green chemistry, green catalyst, green solvents

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

MODULE-II [6L]

Air Pollution

Structures of the atmosphere, global temperature models

Green house effect, global warming; acid rain: causes, effects and control. [3L]

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

MODULE-III [6L]

Water Pollution

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

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

Water quality parameters: DO, BOD, COD.

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

MODULE-IV [6L]

Land Pollution

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

Noise Pollution

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

Text Books

1. Gour Krishna Das Mahapatra, “Basic Environmental Engineering and Elementary Biology”, VikasPublishing House P. Ltd.

2. A. K. De, “Environmental Chemistry”, New Age International.

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

Reference Books

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

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

Course Title : Data Structures and Basic Algorithms Lab					
Course Code: CBS2151					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	0	0	3	3	1.5

Course Outcome:

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

CSBS2151.1. Demonstrate the concept of memory mapping for different data structures.

CSBS2151.2. Analyze the linear data structures for solving the real life problems.

CSBS2151.3. Solve the different problems applying appropriate non-linear data structures.

CSBS2151.4. Compute the data structure in a sorted order using appropriate sorting algorithms.

CSBS2151.5. Examine the data structure to search a data pattern by applying suitable searching algorithms.

CSBS2151.6. Identity the appropriate data structure for a given problem.

Detailed Syllabus:

1. Matrix manipulations and Sparse matrix

2. Polynomial representation and operations

3. Implement List data structure using i) array ii) singly linked list.

4. Implementation of basic operations on doubly linked list.

5. Implementation of Linear Data Structure :

a. Stack using i)array ii) singly linked list

b. Queue using i)array ii) singly linked list

c. Basic operations on Circular Queue

6. Conversion and evaluation of expressions (Infix, Prefix, Postfix operations).

7. Implementation of Sorting Techniques.

8. Implementation of Searching Techniques.

9. Implement Binary Search Tree (BST) with its operations

10. Implement Graph Algorithms (BFS, DFS)

Text/Reference Books

1. Brian W. Kernighan and Dennis M. Ritchie, “The C Programming Language”, PHI.

2. Byron Gottfried, “Schaum's Outline of Programming with C”, McGraw-Hill.

3. ReemaThareja, “Data Structures using C”, Oxford University Press.

4.NarasimhaKarumanchi,“Data Structures and Algorithms Made Easy-Data Structures and AlgorithmicPuzzles”, CareerMonkPlublications

5. Ellis Horowitz, Satraj Sahni and Susan Anderson-Freed,“Fundamentals of Data Structures in “C”,W.H.Freemanand Company.

Course Title : Business Statistics Lab					
Course Code: CBS2153					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	0	0	2	2	1

Course Outcome:

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

CBS2153.1. Explain the importance of statistics and statistical analysis for applicability to business scenarios.

CBS2153.2. Apply the elements of descriptive statistics to solve problems and understand datasets.

CBS2153.3. Create graphs and visual representations of data, and interpret information presented in graphs.

CBS2153.4. Explain the properties of various data distributions, and calculate the metrics from those distributions.

CBS2153.5. Apply the concept of a random variable, including differentiating the population from a sample.

CBS2153.6. Examine datasets to answer pertinent business questions using statistical models.

Statistical Representation of Data: (a) Diagrammatic representation of data (b) Frequency distribution (c) Graphical representation of Frequency Distribution – Histogram, Frequency Polygon Curve, Ogive, Pie-chart

Measures of Central Tendency and Dispersion: (a) Mean, Median, Mode, Mean Deviation (b) Range, Quartiles and Quartile Deviation (c) Standard Deviation (d) Co-efficient of Variation (e) Karl Pearson and Bowley's Coefficient of Skewness

Correlation and Regression: (a) Scatter diagram (b) Karl Pearson's Coefficient of Correlation (c) Regression lines, Regression equations, Regression coefficients, Introduction to Multiple Regression

Probability: Special type of distributions: Binomial, Poisson, Exponential, Normal distribution, Central limit theorem.

Text / reference books:

1. Dhingra IC & MP Gupta, Lectures In Business Statistics, Sultan chand and Sons, New Delhi 2009
2. Gupta SP and Archana Agarwal, Business Statistics (Statistical Methods) Sultan chand and Sons, New Delhi, 9th Edition 2013
3. Gupta SC, Fundamentals of Statistics, Himalaya Publishing House
4. Richard Levin and David Rubin, Statistics for Management, Prentice Hall Of India, New Delhi, 2011,7th Edition
5. Sharma J K,Fundamentals of Business Statistics, Second Edition, Vikas Publishing House Private Limited,2013
6. Siegel, Andrew, Practical Business Statistics, Irwin Mcgraw Hill International

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

Course Outcome

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

ECE2052.1 Use the concept of Boolean algebra to minimize logic expressions by the algebraic method, K-map method etc.

ECE2052.2 Construct different Combinational circuits like Adder, Subtractor, Multiplexer, De-Multiplexer, Decoder, Encoder, etc.

ECE2052.3 Design various types of Registers and Counters Circuits using Flip-Flops (Synchronous, Asynchronous, Irregular, Cascaded, Ring, Johnson).

ECE2052.4 Realize different logic circuits using ICs built with various logic families

Detailed Syllabus

Choose any ten experiments out of the twelve suggested next:

1. Realization of basic gates using Universal logic gates.
2. Four-bit parity generator and comparator circuits.
3. Code conversion circuits BCD to Excess-3 & vice-versa.
4. Construction of simple 3-to-8 Decoder circuit by 2-to-4 Decoders using logic gates.
5. Design a 4-to-1 Multiplexer using logic gates and use it as a Universal logic module.
6. Realization of SR (Set Reset), JK, and D flip-flops using Universal logic gates.
7. Construction of simple arithmetic logic circuits-Adder, Subtractor.
8. Realization of Asynchronous Up/Down Counter (Count up to 7) using logic gates.
9. Realization of Synchronous Up/Down Counter (Count up to 7) using logic gates.
10. Realization of Shift Registers using logic gates (Serial in Serial out and Parallel in Serial out).
11. Construction of Serial adder circuit using a D Flip-Flop and a Full adder.
12. Design a combinational circuit for BCD to Decimal conversion to drive 7-Segment display using logic gates.

Course Title : Design Thinking and Idea Lab					
Course Code: CBS2155					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	0	0	2	2	1

Course Outcome

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

CBS2155.1. Understand a set of tools and methods for product design and development.
CBS2155.2. Create framework for developing a new product.
CBS2155.3. Make themselves aware of the role of multiple functions in creating a new product (i.e. marketing, finance, industrial design, engineering, production etc).
CBS2155.4. Work effectively as a part of a group as well as nurture a leader amongst themselves as and when required.
CBS2155.5. Communicate effectively with group members and stakeholders while materializing the design into working prototype.

List of Experiments:

1. Problem Statement (Clearly mention the problem your group would like to solve)

    a) Mission Statement (Why is it important to solve this problem? Who will be the beneficiaries? What is the market opportunity?)

    b) Value Proposition (Clearly state the redefined problem with specific issues the team would like to solve)

2. Assumptions (What are the current/existing considerations/limitations regarding the problem your team would like to address?)

    a. Stakeholders (List all the stakeholder groups that can influence or can be influenced by a change. Which stakeholder group(s) will be benefitted? Which stakeholder group(s) has your team interacted with? – Identify which user group you would like to target the solution - Mainstream, Extreme or Latent users)

3. Empathy Tool Used (What/How/Why, Empathy Map, AEIOU method, Beginner's mindset, Story/Share capture, etc.)

4. Data Collection (Research, Questionnaires, Interviews, Surveys, Stakeholder groups, Statistics, etc.)

5. Insights (Document all points from data collection stage to form insights about the problem)

6. Ideation Method Used (Mind Map, Brainstorming, SIT method, SCAMPER, Three-Box Thinking)

TEXT / Referance BOOK:

1. Ulrich, Karl, and Steven Eppinger. Product Design and Development. 3rd ed. New York, NY: McGraw-Hill, 2004. ISBN: 9780072471465.

Course Title : Design and Analysis of Algorithms					
Course Code: CBS2201					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	4	0	0	4	4

Course Outcome

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

CBS2201.1. Analyze the time and space complexity of an algorithm using asymptotic notations.

CBS2201.2. Distinguish the algorithms to solve optimization problems.

CBS2201.3. Illustrate the suitable algorithmic technique to find out a solution of decision making problems.

CBS2201.4. Apply the appropriate algorithmic techniques to solve the mathematical puzzles.

CBS2201.5. Describe different NP-hard and NP-complete problems and necessity of approximation algorithms.

CBS2201.6. Develop algorithms to solve common engineering problems

MODULE – I [9L]

Introduction [3L]

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

Divide and Conquer [2L]:

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

Matrix Multiplication Algorithm [1L]:

Strassen's matrix multiplication algorithm.

Heapsort [2L]:

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

Lower Bound Theory [1L]:

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

MODULE – II [9L]

Graph Traversal Algorithm [5L]

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

Greedy Method [4L]:

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

MODULE – III [11L]

Dynamic Programming [8L]

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

Network Flow [3L]:

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

MODULE – IV [12L]

Backtracking [4L]

Basic method, 8 queens problem, Graph coloring problem.

Branch and Bound [2L]:

Basic method, 15 puzzles problem.

Notion of NP-completeness [3L]:

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

Approximation Algorithms [3L]:

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

Text Books

1. T. H. Cormen, C. E. Leiserson, R. L. Rivest and C. Stein, "Introduction to Algorithms".

2. E.Horowitz and Shani, "Fundamentals of Computer Algorithms".

Reference Books

1. Aho, J.Hopcroft and J.Ullman, "The Design and Analysis of Algorithms".

2. D.E.Knuth, "The Art of Computer Programming".

3. Jon Kleiberg and Eva Tardos, "Algorithm Design".

4. K.Mehlhorn, "Data Structures and Algorithms" - Vol. I & Vol. 2.

5. S.Baase, "Computer Algorithms".

6.E.M.Reingold, J.Nievergelt and N.Deo, "Combinatorial Algorithms- Theory and Practice", PrenticeHall, 1997

Course Title : Computer Organization and Architecture					
Course Code: CBS2202					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	0	0	3	3

Course Outcome

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

CBS2202.1. Categorize the types of instructions and addressing modes and their impact on processor design.

CBS2202.2. Demonstrate the design of the arithmetic and logical units of a digital computer system.

CBS2202.3. Analyze performance and techniques to improve the performance of cache memory organization to reduce the access time.

CBS2202.4. Illustrate the concepts of paging, segmentation, segmentation with paging, and page replacement strategies in the paradigm of virtual memory to create the illusion of a large memory of a computer system.

CBS2202.5. Explain the pipeline techniques for consistent execution of instructions with minimum hazards.

CBS2202.6. Understand the concepts of parallel processing, multiprocessor architectures and control unit design.

MODULE–I [11L]

Introduction to Computer and Computer Arithmetic:

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

MODULE–II [10L]

Memory Organization and I/O techniques:

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

MODULE–III [10L]

Pipeline and ILP:

Introduction to pipeline, Instruction pipeline, Arithmetic pipeline, processor pipeline, Super-pipeline, Superscalar and VLIW architecture. Introduction to ILP and techniques to improve ILP, Array and Vector processor.

MODULE–IV [11L]

Types of Pipeline hazards and its counter measures, Dataflow architecture, RISC and CISC architecture. Introduction to Control unit, Hardwired CU and Microprogrammed CU.

Books:

1. Kai Hwang, “Advanced Computer Architecture”.

2. Patterson and Hennessy, “Computer Architecture: A Quantitative approach”.

3. Hwang and Briggs, “Computer Architecture and Parallel processing”.

4. T. K. Ghosh, “Computer Architecture”.

5. Mano, M.M, “Computer System Architecture”, PHI.

6. Hamacher, “Computer Organisation”, McGraw Hill

Course Title: Operating System Concept					
Course Code: CBS2203					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	0	0	3	3

Course Outcome

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

CBS2203.1. Differentiate different types of operating systems (namely, batch, multi programmed, time sharing, real-time, distributed, parallel processing system) based on their application domains and evolution.

CBS2203.2. Describe system operations, internal structure of computer system and operating system.

CBS2203.3. Illustrate multiprocessing and multithreading environments based on inter-process/thread communication and synchronization.

CBS2203.4. Compare the different level of memory (Primary memory, cache, virtual memory, secondary storage) and how they are correlated to improve the performance of the system.

CBS2203.5. Describe the operations of IO devices and how they are governed by the operating system

CBS2203.6. Define the activity and impact of threat, virus, worm and how the system could be protected from them.

MODULE – I [9L]

Introduction [2L]: Introduction to OS. Operating system functions, evaluation of O.S., Different types of O.S.: batch, multi-programmed, timesharing, real-time, distributed, parallel.

System Structure [2L]: Computer system operation, I/O structure, storage structure, storage hierarchy, different types of protections, operating system structure (simple, layered, virtual machine), O/S services, and system calls.

Process and Threads [5L]

Processes [3L]: Concept of processes, operations on processes (creation, maintenance, termination scheduling, communication).

Threads [2L]: Overview, benefits of threads, user and kernel threads, multithreading models and their use.

MODULE – II [14L]

Process Scheduling [2L]: Process scheduling, co-operating processes, inter process communication.

CPU Scheduling [4L]: Scheduling criteria, preemptive & non-preemptive scheduling, scheduling algorithms(FCFS, SJF, RR, priority), multilevel queue and feedback queue algorithms, algorithm evaluation, multiprocessor scheduling.

Process Synchronization [5L]: Background, critical section problem, algorithms to address critical section problem (two process and multi-process solutions), synchronization hardware, semaphores, classical problems of synchronization and their solutions, deadlock during synchronization, monitor.

Deadlocks [3L]: System model, deadlock characterization, methods for handling deadlocks, deadlock prevention, deadlock avoidance, deadlock detection, recovery from deadlock.

MODULE-III [10L]

Memory Management [4L]: Background, logical vs. physical address space, swapping, contiguous memory allocation, paging, segmentation, segmentation with paging.

Virtual Memory [3L]: Background, demand paging, performance, page replacement, page replacement algorithms (FCFS, LRU, Optimal, MRU, MFU, LFU), allocation of frames, thrashing.

Disk Management [3L]: Disk structure, disk scheduling (FCFS, SSTF, SCAN,C-SCAN) , disk reliability, disk formatting, boot block, bad blocks, Concepts of RAID.

MODULE-IV [12L]

File Systems [4L]: File concept, access methods, directory structure, file system structure, allocation methods (contiguous, linked, indexed), free-space management (bit vector, linked list, grouping, counting), directory implementation (linear list, hash table), efficiency & performance.

I/O Management [4L]: I/O hardware, polling, interrupts, DMA, application I/O interface (block and character devices, network devices, clocks and timers, blocking and non blocking I/O), kernel I/O subsystem (scheduling, buffering, caching, spooling and device reservation, error handling), performance.

Protection & Security [4L]: Goals of protection, domain of protection, security problem, authentication, onetime password, program threats, system threats, threat monitoring, encryption.

Text Books

1. Silbersehatz A. and Peterson J. L., "Operating System Concepts", Wiley.

2. Tanenbaum A.S., "Operating System Design & Implementation", Practice Hall NJ.

3. Milenkovie M., "Operating System: Concept & Design", McGraw Hill.

Reference Books

1. Dhamdhere, "Operating System", TMH.

2. Maxwell, "Operating Systems", McMillan International Editions, 1992.

3. Dietel H. N., "An Introduction to Operating Systems", Addison Wesley.

Course Title: Object Oriented Programming					
Course Code: CBS2204					
Contact Hours 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:

CBS2204.1. Recall the knowledge of procedural language and map it to paradigm of object oriented concept.

CBS2204.2. Relate the real world problem with object oriented approach.

CBS2204.3. Describe and illustrate the features of object-oriented programming.

CSBS3102.4. Analyze any real world problem with object oriented approach and formulate a solution for the same.

CBS2204.5. Manage the complexity of procedural language by using the concept polymorphism, inheritance, abstraction, and encapsulation.

CBS2204.6. Create and explain some GUI and thread-based applications.

MODULE-I [10L]

Basics of OOP and Introduction to JAVA:

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

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

MODULE-II [10L]

Class & Object proprieties:

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

Reusability properties:

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

MODULE-III [8L]

Exception handling and I/O:

Exception handling basics, different types of exception classes, use of try & catch with throw, throws & finally, creation of user-defined exception classes. Input Output stream structure, Wrapper class, command line arguments, basics of I/O operations – keyboard input using Buffered Reader& Scanner classes. File copy programming using command line arguments.

MODULE-IV [10L]

Multithreading and Applet & Swing Programming:

Basics of multithreading, main thread, thread life cycle, creation of multiple threads, thread priorities, thread synchronization, inter-thread communication, deadlocks for threads, suspending & resuming threads. Basics of applet programming, applet life cycle, difference between application & applet programming, parameter passing in applets. Basic swing programming, Difference between applet and swing, AWT Event handling, message box input box, introduction toJFrame, JButton, JLabel.

Text Books

1. The complete reference-Java2, Patrick Naughton, Herbert Schildt, TMH

2. Object Oriented Modelling and Design, Rumbaugh, James Michael, Blaha, PHI.

Reference Books

1. Object-Oriented System Development Ali Bahrami, McGraw Hill.

2. Core Java for Beginners, R. K Das, VIKAS PUBLISHING.

3. Java How to Program, Deitel and Deitel, 6th Ed. – Pearson.

4. Beginning Java 2 SDK, Ivor Horton's, Wrox.

5. Programming with Java: A Primer, E. Balagurusamy, 3rd Ed., TMH.

Course Title: Managerial Economics					
Course Code: CBS2205					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	0	0	3	3

Course Outcome

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

CBS2205.1. Appreciate the foundational concepts of managerial economics.

CBS2205.2. Develop a microeconomic approach to business decisions.

CBS2205.3. Arrive at decisions by applying concepts of microeconomics.

CBS2205.4. Apply the tools of managerial economics and find solutions to the complex problems of production processes.

CBS2205.5. Co-relate concepts and theories of microeconomics and macroeconomics.

CBS2205.6. Decide and choose options aimed at furthering the goals of the organization.

MODULE-I [9L]

● Managerial Economics: Fundamental Concepts

● Objectives of the Firm; Environment of Business; Economic and Non-Economic Elements and their Interactions

● Decision Making Consumer Behaviour: Utility Analysis; Equi-marginal Utility; Indifference Curve;Consumer Equilibrium

● Demand Decision: Meaning & Types of Demand; Determinants of Demand; Demand Function

● Demand Elasticity Demand Estimation: Methods of Demand Estimation; Demand Forecasting; Types of Demand Forecasting

MODULE-II [10L]

● Production Decisions: Firm's behaviour in short & long run

● Cost Concepts; Cost-Output Relations

● Production Function; Elementary Description, Pricing Decisions: Determinants of Price; Pricing under different market conditions

● Objectives of Pricing under different market structures

● Perfect Competition; Monopoly; Oligopoly; Monopolistic Competition

MODULE-III [10L]

● Monetary Policy: Different Components of Money Supply

● Monetary Theory and Policy in Practice; Interest Rate Policy

● Role of RBI in Monetary Management; Credit Policy

● Financial Institutions Fiscal Policy: Fiscal Imbalance

● Government Expenditure; Plan and Non-Plan Expenditure; Tax Policy and Reforms; Government Borrowings: Domestic and External Commercial Policy

MODULE-IV [9L]

● Foreign Trade Policy; Foreign Exchange Management Act (FEMA)

● External Sector: Balance of Payment and Balance of Trade; Current Account and Capital Account;Trends in Exports and Imports

● 2nd generation Economic Reforms: Liberalisation; Privatisation and Globalisation; Assessment of New Economic Reforms

Text/Reference Books

1. Ahluwalia, I J, “India's economic reforms and development, essays for Manmohan Singh”, New Delhi: OUP,1998.
2. Ahluwalia, Montek S.“Macroeconomics and Monetary Policy”, New Delhi: Oxford University Press, 2002.
3. Ahluwalia, Montek S., “Macroeconomics and Monetary Policy: Issues for a reforming economy”, NewDelhi: Oxford University Press, 2003.
4. Ahuja, H. L., “Advanced Economic Theory: Microeconomic Theory”, Ed 13, New Delhi S.Chand & Co,2003
5. Bhatia, H. L., “Public Finance”, Ed 25th, New Delhi: Vikas Publishing House, 2006.

Course Name: Statistics for Business Systems					
Course Code:MTH2205					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

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

MTH2205.1: Compare and contrast different interpretations of probability theory selecting the preferred one in a specific context.
MTH2205.2: Learn how to assess the model's "fit", test model assumptions through regression analysis
MTH2205.3: Formulate predictive models to tackle situations where deterministic algorithms are intractable.
MTH2205.4 Summarize data visually and numerically.
MTH2205.5: Estimate meanand variance of population.
MTH2205.6: Apply ANOVA one way and two way to real life applications.

MODULE-I: Single and Bivariate Probability Distributions:

- Review of basic probability
- Moment generating functions
- Markov's inequality, Chebyshev's inequality and law of large numbers
- Joint distribution using joint probability mass/density function
- Finding marginal pmf/pdf from joint distribution
- Multiplicative property of joint pmf/pdf in case of independent random variables

MODULE-II: Regression Analysis:

- CorrelationAnalysis
- Regression Analysis
- Multiple Linear Regression
- Estimation of Parameters
- Standard Error of Estimate for Multiple Regression
- Multiple Correlation Analysis
- Partial Correlation Analysis

MODULE-III: Statistics-I:

- Population and Samples,
- The sampling distribution of mean (standard deviation known),
- The sampling distribution of mean (standard deviation unknown),
- Point and Interval estimation,
- Null Hypotheses and Tests of Hypotheses.

MODULE-IV: Statistics-II:

- Two sample tests means
- Two sample tests variance
- Chi-Square test for Goodness-of-Fit
- Chi-Square test for Population Variance
- ANOVA
- Testing Equality of Population (Treatment) Means:One-Way Classification
- Testing Equality of Population (Treatment) Means: Two-Way Classification

Text Books

1. Introduction to Probability Models, S.M.Ross, Elsevier.
2. Business Statistics, J. K. Sharma, Vikas Publishing House

Reference Books

1. An Introduction to Probability theory and its applications Vol-I, W. Feller, John Wiley and Sons
2. Fundamentals of Mathematical Statistics, S.C.Gupta and V.K.Kapoor, Sultan Chand and Sons

Course Title : Design and Analysis of Algorithms Lab					
Course Code: CBS2251					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	0	0	4	4	2

Course Outcome

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

CBS2251.1. Analyze the technique of divide-and-conquer to find out a solution

CBS2251.2. Apply greedy methods to obtain the optimal solution.

CBS2251.3. Examine different Graph traversal algorithms (BFS and DFS).

CBS2251.4. Solve different problem using the technique of backtracking, branch and bound algorithms.

CBS2251.5. Demonstrate the technique of dynamic programming to solve different problems.

CBS2251.6. Develop appropriate algorithm to solve common engineering problems.

Detailed Syllabus:

Programming Language used: C

Lab1: Divide and Conquer:

Implement Binary Search using Divide and Conquer approach

Implement Merge Sort using Divide and Conquer approach

Lab2: Divide and Conquer:

Implement Quick Sort using Divide and Conquer approach

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

Lab 3: Graph Traversal Algorithm:

Implement Breadth First Search (BFS)

Implement Depth First Search (DFS)

Lab4: Greedy method:

Knapsack Problem

Job sequencing with deadlines

Lab 5: Greedy method:

Minimum Cost Spanning Tree by Prim's Algorithm

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

Lab 6: Dynamic Programming:

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

Lab 7: Dynamic Programming:

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

Implement Traveling Salesman Problem

Lab8: Dynamic Programming:

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

Lab9: Backtracking:

Implement 8 Queen Problem

Lab 10: Backtracking:

Graph Coloring Problem

Lab 11: Brunch and Bound:

Implement 15 Puzzle Problem

Books

1. T. H. Cormen, C. E. Leiserson, R. L. Rivest and C. Stein, “Introduction to Algorithms”.

2. A. Aho, J.Hopcroft and J.Ullman “The Design and Analysis of Algorithms”.

3. E.Horowitz and Shani, “Fundamentals of Computer Algorithms”.

4. Y. Kanetkar, “Let Us C”.

5. B. S. Gottfried, “Programming with C”.

6. B.W. Kernighan and D. M. Ritchie, “The C Programming Language”.

Course Title : Computer Architecture Lab					
Course Code: CBS2252					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	0	0	3	3	1.5

Course Outcome:

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

CBS2252.1 Analyze different types of logic gates and verify K-Maps and truth tables of logic gates.
CBS2252.2 Construct adder and subtractor circuits and defend the obtained truth tables and K-maps via TBW.
CBS2252.3 Design and construct Multiplexer circuits and defend the obtained truth tables and K-maps.
CBS2252.4 Design and construct different converters and ALU circuits and defend the obtained truth tables and K-maps via TBW.
CBS2252.5 Design horizontal and vertical expansion of RAM and compare their results from obtained truth tables.
CBS2252.6 Design seven segment displays and defend the obtained truth tables.

Detailed Syllabus:

1. Logic gates
2. Adders: Half-Adder, Full Adder
3. Subtractors: Half Substractor, Full Substractor
4. Horizontal and vertical expansion of RAM
5. Combinational circuit designs

a. Multiplexers: 4:1 and 8:1, 8:1 using 4:1 and 2:1
b. Code Converters: 4-bit binary to gray, 4-bit gray to binary
c. 7-segment display
d. ALU

Books

1. David E. Van, Den Bout, “The Practical Xilinx Designer Lab Book”, Prentice Hall.

2. Denton Dailey, “Programmable Logic Fundamentals Using Xilinx ISE”, Prentice Hall.

3. Karen Parnell, Nick Mehta, “Programmable Logic Design Quick Start Hand Book”, Xilinx Corporation.

Course Title: Operating System Concept Lab					
Course Code: CBS2253					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	0	0	3	3	1.5

Course Outcome:
After successfully completing this course the students will be able to:
CBS2253.1 Develop and debug programs in UNIX environment.
CBS2253.2 Develop shell scripts to manage the system memory, user, files, and devices.
CBS2253.3 Develop multi-processing and multi-threading environment capable of performing multiple tasks or sub-tasks simultaneously.
CBS2253.4 Apply system calls and signals for user defined purposes
CBS2253.5 Design a synchronized multi-threaded system capable of resource sharing
CBS2253.6 Develop C programs to share information between two process using concepts of IPC.
Detailed Syllabus:
1. Managing Unix/Linux Operating System [9P]: Familiarization with LINUX OS and shell commands(commands and filters), Creating a bash shell script, making a script executable, shell syntax (variables,conditions, control structures, functions, commands).
2. Process [6P]: starting new process, replacing a process image, duplicating a process image, waiting for aprocess, zombie process.
3. Signal [3P]: signal handling, sending signals, signal interface, signal sets, user defined signals.
4. Semaphore [6P]: Programming with semaphores to solve critical section problems (e.g. producer consumerproblem)
5. POSIX Threads [6P]: Programming with pthread functions (viz. pthread_create, pthread_join, pthread_exit,pthread_attr_init, pthread_cancel)
6. Inter-process communication [6P]: Pipes (use functions pipe, popen, pclose), named pipes(FIFOs,accessing FIFO), message passing & shared memory(IPC version V).

Text Books
1. Behrouz A. Forouzan, Richard F. Gilberg, “UNIX and Shell Programming”, Thomson, 2003.
2. Brian W. Kernighan, Rob Pike, “The UNIX Programming Environment”, PHI, 1996.
3. K. Srirengan, “Understanding UNIX”, PHI 2002.
Reference Books
1. Sumitabha Das, “Your UNIX- The Ultimate Guide”, TMGH, 2002.
2. Sumitabha Das, “UNIX Concepts and Applications”, Second Edition, TMGH, 2002.

Course Title: Object Oriented Programming Lab					
Course Code: CBS2254					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	0	0	3	3	1.5

Course Outcomes

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

CBS2254.1. Analyze a problem and design a solution for the problem, following an algorithmic design paradigm.

CBS2254.2. Implement Object Oriented Programming Features to improve the solution designs.

CBS2254.3. Apply Multithreading solutions of real life problems.

CBS2254.4. Reconstruct the solution to a problem in GUI mode.

CBS2254.5. Design programs in platform independent environment.

Syllabus:

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

Lab1:
Familiarization on object oriented approach of programming: use of class, object, reference.
Lab 2:
Use of constructor, static, final, array, date, access specifiers.
Lab 3:
Familiarization with String, StringBuffer, ArrayList and LinkedList classes
Lab 4:
Inheritance and Dynamic Method Dispatch
Lab 5 & 6:
Abstract Class, Interface and Package Java Exception Handling.
Lab 7:
Familiarization on Java IO using Scanner, BufferedReader, PrintWriter. File handling in Java.
Lab 8:
Exploring Java multithreading concept.
Lab 9:
Java Applet, AWT Event Handling
Lab 10:
Exploring JOptionPane
Basics of Java Swing: Different Layouts, Event Handling
Lab 11:
Basic JDBC connection and data handling

Text Books

1. The complete reference-Java2, Patrick Naughton, Herbert Schildt, TMH
2. Object Oriented Modelling and Design, Rumbaugh, James Michael, Blaha, PHI.

Reference Books

1. Object-Oriented System Development Ali Bahrami, McGraw Hill.
2. Core Java for Beginners, R. K Das, VIKAS PUBLISHING.
3. Java How to Program, Deitel and Deitel, 6th Ed. – Pearson.
4. Beginning Java 2 SDK, Ivor Horton's, Wrox.
5. Programming with Java: A Primer, E. Balagurusamy, 3rd Ed., TMH.

DETAILED SYLLABUS

3rd Year

Course Title: DBMS					
Course Code: CBS3101					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	4	0	0	4	4

Course Outcomes

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

CBS3101.1. Demonstrate the concepts of various data model and schemas used in database design.

CBS3101.2. Design relational database schemas using the conceptual modelling tools like ER diagrams.

CBS3101.3. Analyze the functional dependencies and normalize the relational database design.

CBS3101.4. Apply the query language to manipulate the relational databases.

CBS3101.5. Describe the concept of transaction, basic database storage structures, and indexing.

CBS3101.6. Construct database schema for various real life problems.

MODULE -I [10L]

Introduction to DBMS: Introduction to Database and DBMS, Importance of Database Design, Problems with File System Data Management, Database Systems, Three-Level Architecture, Instances and Schemas, Database Administrator, Database Users, Advantages and Disadvantages of DBMS.

Data Model: Data Modeling and Data Models, Importance of Data Models, Data Model Basic Building Blocks.

Entity-Relationship Modeling:- Entity and Entity Instances, Attributes, Entity Relationships, Cardinality of Relationships, Strong and Weak Entity, Generalization, Specialization, Aggregation, Developing an ER Diagram, Entity Integrity and Primary Key, Translating ER Model into Relational Model.

Relational Algebra: Operators- Selection, Projection, Union, Intersection, Set difference, Cross product,Rename, Assignment, Various types of joins, Division.

MODULE -II [10L]

Relational Data Model: A Logical View of Data, Keys, Integrity Rules, Relational Set Operators, Data Dictionary and the System Catalog, Relationships within the Relational Database, Data Redundancy Revisited, Indexes, Codd's Relational Database Rules.

Relational Database Design: Functional Dependency (FD) – Definition, Trivial and Non- Trivial FD, Closure of Set of FD, Closure Of Attribute Sets, Irreducible Set of FD, Canonical Cover, Normalization – 1NF, 2NF, 3NF,BCNF, Decomposition using FD, Lossless Decomposition, Dependency Preservation. Normalization using multi-valued dependencies and 4NF, Join dependency and 5NF, Domain key normal form (DKNF).

MODULE -III [10L]

Structured Query Language (SQL): Introduction to SQL, DDL, DML, DCL, Basic Structure, Basic Queries, Set operations, Aggregate Functions, Null Values, Domain Constraints, Referential Integrity Constraints, Assertions, Views, Joining Database Tables, Commit and Rollback. Sub queries and Correlated Queries, SQL Built in Functions - Numeric, Date, String Functions, Updatable Views.

MODULE -IV [12L]

Introduction to Procedural Language/Structured Query Language (PL/SQL):
PL/SQL block structure, Variables, Control Structure and iteration, Implicit and Explicit Cursors, Stored procedures and functions, PL/SQL packages, Triggers, Locks.
Concepts of Transaction and Concurrency Control:
Transaction Concept and State. Executions, Serializability, Recoverability. Concurrency Control Techniques: Lock based Protocols.
Storage structure & Indexing: Sequential and indexed file organization, Primary, Secondary & Multi Level indexing

Textbooks

1. Database System Concepts - Korth, Silberschatz, S. Sudarshan, TMH.
2. Fundamentals of Database Systems - Elmsari and Navathe, Addison-Wesley.

Reference Books

1. An Introduction to Database Systems - Date C. J, Addison-Wesley.
2. SQL-PL/SQL - Ivan Bayross, BPB.

Course Title: Computer Networks					
Course Code: CBS3102					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	4	0	0	4	4

Course Outcomes:

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

CSBS3102.1. Describe the fundamental concepts of data communication and networking, layered models, protocols, networking devices.

CSBS3102.2. Describe theoretical basis for data communication, digital and analog transmission, multiplexing, switching, transmission media.

CSBS3102.3. Illustrate data link layer services, framing, error control, flow control, data link layer protocols and various channel access protocols.

CSBS3102.4. Examine various routing algorithms, addressing schemes and different network layer protocols.

CSBS3102.5. Analyze different transport layer protocols, techniques for congestion control and QoS provisioning.

CSBS3102.6. Define different application layer protocols.

Detailed Syllabus:

MODULE – I [10L]

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

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

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

MODULE – II [10L]

Data link Layer: Flow Control – Stop-n-Wait & Sliding Window Protocol, ARQ Techniques – Stop-n-Wait,Go-Back- N & Selective Repeat, Framing, Bit & Byte Oriented Protocol, HDLC, Point to Point Protocol (PPP),

Token Ring, FDDI and Ethernet Protocols, Reservation, Polling, Multiple access protocols - Pure ALOHA,Slotted ALOHA, CSMA, CSMA/CD, CSMA/CA

MODULE – III [10L]

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

MODULE – IV [10L]

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

Text Books

1. Data Communications and Networking – B. A. Forouzan –TMH

Reference Books

1. Computer Networks – A. S. Tanenbaum –Pearson Education/PHI

2. Data and Computer Communications – W. Stallings –PHI/ Pearson Education

3. Computer Networking -A top down approach featuring the internet– Kurose and Rose – Pearson Education

4. Internetworking with TCP/IP, vol. 1, 2, 3 – Comer –Pearson Education/PHI

Course Title: Artificial Intelligence					
Course Code: CBS3103					
Contact Hours 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:

CBS3103.1. Apply the basic principles of state-space to formulate classical AI problems.

CBS3103.2. Demonstrate the uninformed and informed search techniques to solve the searching problems

CBS3103.3. Illustrate adversarial searching algorithms and constraint satisfaction problems as and when required.

CBS3103.4. Interpret the basic principles of knowledge representation and propositional logic.

CBS3103.5. Investigate the knowledge using first-order predicate logic to solve various AI problems based on the human behavior.

CBS3103.6. Construct AI models to solve real world problems using learning techniques and probabilistic models.

MODULE - I [8L]

Introduction: Definition of AI, typical AI problems, practical impact of AI, approaches to AI, limits of AI today, AI history.

Intelligent Agents: Definitions of a rational agent, reflex, model-based, goal-based, and utility-based agents, agent environment.

Problem Solving using Search -(Single agent):Introduction to State-space search, state-space search notation, search problem, Formulation of some classical AI problems as a state space search problem, Explicit Vs Implicit State space.

Uninformed Search: Search strategies, search tree, Breadth First Search, Uniform-cost search, Depth First Search, Depth Limited Search, Bidirectional Search

MODULE - II [8L]

Informed Search Methods: Basic Principles, Heuristics, A* Search and its properties, Admissible & Consistent heuristic, Iterative deepening A* (IDA*) and AO* search, Local Search Techniques – Hill climbing &Simulated Annealing

Problem Solving using Search-(Multi agents):Adversarial Search – Game Tree, MINIMAX Algorithm, Alpha-Beta Pruning, Performance Analysis.

Constraint satisfaction problems (CSP): Definition of CSP, Representation of CSP, Formulation of Various popular problems as CSP, Solution methods of CSP

MODULE - III [9L]

Knowledge Representation: Knowledge representation issues, Approaches to knowledge representation

Propositional Logic: Its syntax & semantics, Inference rules, Resolution for propositions, Limitation of Propositional Logic.

First Order Predicate Logic: Syntax & Semantics of FOPL, Representation of facts using FOPL, Clauses, Resolution, Unification methods of inference, Default & Non-Monotonic reasoning.

Rule based Systems: Introduction, Horn clauses, Procedural vs. declarative knowledge, forward & backward reasoning.

MODULE - IV [9L]

Planning: Introduction to planning, Problem solving vs. planning, logic based planning, Planning algorithm -planning as search, Total-order vs. partial order planning.

Learning: Overview, various learning models, learning rules, Naïve Bayes classifier and Decision tree based learning.

Bayesian Networks: Syntax & Semantics of Bayesian networks, learning of Bayesian Network parameters, inference in Bayesian Networks.

Text Books

1. Artificial Intelligence - A Modern Approach,S. Russell and P. Norvig, Pearson Education.

2. Introduction to Artificial Intelligence and Expert Systems - Dan W. Patterson, PHI.

Reference Books:

1. Artificial Intelligence and Soft Computing Behavioral and Cognitive Modeling of the Human Brain -Amit Konar,CRC Press.

2. Artificial Intelligence - Elaine Rich and Kelvin Knight, TMH.

Course Title: Formal Language & Automata Theory					
Course Code: CBS3104					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	4	0	0	4	4

Course Outcomes

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

CSBS3104.1. Demonstrate basic concepts of finite automata

CSBS3104.2. Design the Finite State Machine using Moore & Mealy machine

CSBS3104.3. Design the Regular Language for Finite Automata (NFA, DFA)

CSBS3104.4. Construct context free grammar for various languages

CSBS3104.5. Design push down automata as a recognizer of languages

CSBS3104.6. Interpret Turing machines as a language acceptor

MODULE - I [10L]

Basic concepts: Propositions, Connectives, Well-formed Formulas, Disjunctive Normal Form. Finite Automata: Definition, Transition Functions, Deterministic finite automaton (DFA) and non- deterministic finite automaton (NFA). Transition diagrams, Application of finite automata, NFA with ϵ transitions -Significance, acceptance of languages. Design of DFA/ NFA for given languages. Equivalence between NFA with and without ϵ transitions. NFA to DFA conversion.

MODULE - II [10L]

Finite state machine: Definitions, Moore & Mealy machine and their conversion, Minimization of FSM, Equivalence between two FSM's, Limitations of FSM.

Formal Language and Grammars: Chomsky Classification of grammar, Right and Left Linear Grammar, Regular Grammar, Regular Expression, Regular Language, Closure property of Regular Languages, Regular string accepted by NFA/DFA, Pumping Lemma, Properties of

Regular expressions. Identifying non regular languages, reduction of number of states, equivalence between regular language and regular grammars.

MODULE - III [12L]

Context free Language and Grammar: Context free Language, Context free Grammar, and derivation tree, left most and right most derivation, Parsing and ambiguity, Chomsky and Greibach Normal Form, Pumping Lemma, Properties of CFL including closure property. Ogden's lemma & its applications.

MODULE - IV [8 L]

Pushdown Automata (PDA): PDA, Acceptance by PDA, PDA and CFL, Parsing and PDA, NPDA as recognizer of CFL.

Turing machine: Introduction to Turing Machine, Definition, Model. Design of TM for different languages, TM as language accepter. TM as transducers. Computable functions. Languages accepted by a TM, Non Deterministic Turing Machine, Universal Turing Machine

Undecidable Problems: Halting Problem of TM, Post correspondence problem, undecidable problems of CFL, Post Systems.

Text Books:

1. P. Linz, "An Introduction to formal Languages and Automata", Norasa

2. Mishra, Chandrashekharan, "Theory of Computer Science", PHI

Reference Books:

1. J. E. Hopcroft, J. D. Ulman, "Introduction of automata Theory, Languages and Computation", Student Edition, Norasa,

2. ZVI Kohavi, Switching & Finite Automata, Tata McGraw Hill.

3. John C Martin, "Introduction to Theory of formal Languages and Automata", McGraw Hill

4. S. P. Eigere Xavier, "Theory of Automata, Formal Languages and Computation, New Age Publishers.

Course Title: Marketing Management					
Course Code: CBS3131					
Contact Hours 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:

CBS3131.1 Identify the scope and significance of Marketing in the actual business environment.

CBS3131.2 Practice marketing communication skills relevant to the corporate world.

CBS3131.3 Coordinate the various marketing environment variables and interpret them for designing marketing strategy for business firms

CBS3131.4 Illustrate market research skills for designing innovative marketing strategies for business firms.

Module I [6L]

Introduction: Definitions of marketing; Core Concept of Marketing – need, want, demand, offering and branding, value and satisfaction, Evolution of marketing concepts (orientations); Marketing Mix – 4Ps and 4Cs Market Segmentation, Targeting and Positioning (STP): Concepts of market segmentation: Various bases for segmentation: Geographic, Demographic, Psychographic (VALS-II) and Behavioural; Targeting: Mass marketing, Segment, Marketing, Niche Marketing, Micro Marketing and Customization; Concept of Differentiation and Positioning

Module II [4L]

Consumer Behaviour and Marketing Research: A framework of consumer decision making process, overview of major factors influencing consumer behavior; marketing research: Role in decision making, Steps and process of Marketing Research, B2B Marketing.

Module III [10L]

Product: Product Classification, Service – characteristics and expanded service mix elements; Product Levels, Product Mix, Product Line Management, Product Life Cycle: concept and types and strategies across the phases, New Product Development. Branding and Packaging: Purpose of branding; Brand equity; Branding strategies; Purpose of Packaging; Types of Packaging – primary, secondary, shipping packages.

Module IV [10L]

Pricing: Procedure for price setting; Pricing objectives; Cost and Demand consideration; Pricing Methods, Pricing Strategies Promotion: Elements of Promotion Mix (Advertising, Sales Promotion, Personal Selling, Direct Marketing, Publicity & PR), Concept of Digital Marketing, Distribution Channel and physical distribution process.

Text Books

1. Ramaswamy & Namakumari - Marketing Management; McMillan

2. Kotler, P., Keller, K., Koshy, A. & Jha, M. - Marketing Management; Pearson

Reference Books

1. Saxena, R. - Marketing Management; TMH

2. Kotler, P., Keller, K., Koshy, A. & Jha, M. - Marketing Management; Pearson

3. Kurtz, David L, Boone , Louis E - Principles of Marketing; Thomson

4. Keith Blois – Text Book of Marketing; Oxford University Press

5. Etzel, M.J., Walker, B.W. & W.J. Stanton - Marketing; TMH

Course Title: Financial Management					
Course Code: CBS3132					
Contact Hours 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:

CBS3132.1. Understand the basic concept of financial management.

CBS3132.2. Apply the tools from financial management this would facilitate the decision making i.e. Capital Budgeting.

CBS3132.3. Develop analytical skills this would facilitate the decision making in business situations.

CBS3132.4. Explain and use of financial analysis techniques i.e. Fund Flow, Cash Flow.

CBS3132.5. Estimate working capital requirement of Business concern

CBS3132.6. Explain the Factors affecting the capital structure and significance of capital structure.

Module I [5L]

Introduction: Introduction to Financial Management - Goals of the firm – Financial Environments. Time Value of Money: Simple and Compound Interest Rates, Amortization, Computing more that once a year, Annuity Factor.

Valuation of Securities: Bond Valuation, Preferred Stock Valuation, Common Stock Valuation, Concept of Yield and YTM.

Module II [7L]

Risk & Return: Defining Risk and Return, Using Probability Distributions to Measure Risk, Attitudes Toward Risk, Risk and Return in a Portfolio Context, Diversification, The Capital Asset Pricing Model (CAPM)

Cost of Capital: Concept, Computation of Specific Cost of Capital for Equity, Preference-Debt, Weighted Average Cost of Capital-Factors affecting Cost of Capital

Module III [10L]

Working Capital Management: Overview, Working Capital Issues, Financing Current Assets (Short Term and Long Term- Mix), Combining Liability Structures and Current Asset Decisions, Estimation of Working Capital Cash Management: Motives for holding cash, Speeding up Cash Receipts, Slowing Down Cash Payouts, Electronic Commerce, Outsourcing, Cash Balances to maintain, Factoring

Module IV [8L]

Capital Budgeting: The Capital Budgeting Concept & Process - An Overview, Generating Investment Project Proposals, Estimating Project, After Tax Incremental Operating Cash Flows, Capital Budgeting Techniques, Project Evaluation and Selection- Alternative Methods

Text Books

1. Chandra, Prasanna - Financial Management - Theory & Practice, Tata McGraw Hill.

Reference Books

1. Brigham - Financial Mgmt, 10th Ed, Thomson Learning

2. Srivastava, Misra: Financial Management, OUP

3. Van Horne and Wachowicz : Fundamentals of Financial Management, Prentice Hall.

Course Title: Operations Management					
Course Code: CBS3132					
Contact Hours 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:

CBS3132.1. Enhance the analytical skills of the students and take them better decisions.

CBS3132.2. Understand the strategic importance of operations management in terms of providing competitive advantage in the workplace.

CBS3132.3. Understand the relationship between operations and other business functions.

CBS3132.4. Understand techniques of location and facility planning; line balancing; job scheduling in operations management.

CBS3132.5. Understand the Materials Management function starting from Demand Management through Inventory Management and classification of materials in stock.

Module I [6L]

Introduction to Production and Operations Management: Difference between Manufacturing and Service Operations; Product Process Matrix capacity planning-Responsibilities of Production Manager; Production as a Coordination Function; Production Cycle, Production Planning & Control Concept.

Characteristics of Manufacturing Systems: Classification of Manufacturing Systems with Examples; Differences between Intermittent and Continuous Production

Module II [8L]

Plant Location: Need for a Good Plant Location; Factors influencing Plant Location–Tangible and Intangible Factors; Economic Survey of Site Selection Plant Layout: Need for a Good Plant Layout; Characteristics of a Good Layout; Costs associated with Plant Layout; Process Layout vs. Product Layout; Optimization in a Process Layout and Product Layout; Designing Product

and Process Layout; Assembly Line Balancing – Concept and Problems; Cellular Manufacturing Concept

Module III [8L]

Purchase Management: Purchasing Procedure; Value Analysis; Vendor Selection; Negotiation; Make or Buy decision Inventory Management: Classification of inventory items – ABC, FSN, VED classification; Introduction to EOQ and EBQ; MRP – Concept, inputs and outputs, benefits, examples; Deterministic demand model–EOQ-Continuous and Periodic review Inventory models; Master Production Schedule and MRP; Concepts of MRP II,JIT and ERP

Module IV [8L]

Maintenance Management: Types of Maintenance – Breakdown and Preventive Maintenance; Total Productive Maintenance (TPM)Work Study: Definition and its Importance; Basic Procedure in Performing a Work Study; Method Study –Objectives and Procedure; Work Measurement–Objectives and Procedure; Concepts of Performance Rating, Basic Time, Allowances and Standard Time

Text Books

1. Chary, S.N. – Production and Operations Management; TMH

Reference Books

1. Panneerselvam, R. – Production and Operations Management, PHI

2. Bedi, K. – Production and Operations Management; Oxford University Press Chase,

3. Jacobs, Aquilano and Agarwal – Operations Management for Competitive Advantage; TMH

4. Buffa, E. S. and Sarin, R.K. – Modern Production / Operations Management; John Wiley

5. Collier, Evans and Ganguly – Operations Management; Cengage Learning

Course Title: Linear Algebra					
Course Code: MTH3121					
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:

MTH3121.1. Explain concepts of diagonalization, orthogonal diagonalization and Singular Value Decomposition (SVD).

MTH3121.2. Discuss basis, dimension and spanning sets.

MTH3121.3. Design Gram-Schmidt Orthogonalization Process and QR decomposition using concepts of inner product spaces.

MTH3121.4. Analyze Least squares solutions to find the closest line by understanding projections.

MTH3121.5. Define linear transformations and change of basis.

MTH3121.6. Illustrate applications of SVD such as, Image processing and EOF analysis, applications of Linear algebra in engineering with graphs and networks, Markov matrices, Fourier matrix, Fast Fourier Transform and linear programming.

Module I: [10L]

Characteristic equations, Eigen Values and Eigen vectors, Diagonalization, Applications to differential equations, Symmetric matrices, Positive definite matrices, similar matrices, Singular Value Decomposition, Generalized Inverses.

Module II: [10L]

Definition of Field, Vector Spaces, Elementary Properties in Vector Spaces, Subspaces, Linear Sum of Subspaces, Spanning Sets, Linear Dependence and Independence, Basis and Dimension. Application to matrices and system of linear equations.

Module III: [10L]

Inner Product Spaces, Concept of Norms, Orthogonality, Projections and subspaces, Orthogonal Complementary Subspaces, Orthogonal Projections, Gram-Schmidt Orthogonalization Process, Least square approximations, QR decomposition.

Module IV: [10L]

Linear Transformations, kernels and images, The Rank-Nullity Theorem. Matrix representation of a Linear Transformation, Change of Basis, Linear space of linear mappings.

Text Books

1. Linear Algebra and its Applications –Gilbert Strang.
2. Higher Algebra – S. K. Mapa.

Reference Books

1. Linear Algebra – Kenneth M. Hoffman, Ray Kunze.
2. Linear Algebra –Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence.
3. Schaum's Outline of Linear Algebra – Seymour Lipschutz and Marc Lipson.
4. Matrix Computations – Gene H. Golub, Charles F. Van Loan.
5. Linear Algebra A Geometric Approach – S. Kumaresan.

Course Title: Computational Methods In Engineering					
Course Code: MEC3122					
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:

MEC3122.1: Apply different mathematical models to obtain numerical solutions and classify different types of error.

MEC3122.2: Analyze and solve a system of linear algebraic equations by different methods and find out the roots.

MEC3122.3: Implement the regression and interpolation methods for curve fitting and apply different types of optimization techniques to solution of problems.

MEC3122.4: Use different numerical integration methods for practical problems.

MEC3122.5: Classify Initial-value and Boundary-value problems in order to formulate their solutions, implement different methods for their solutions, and solve Eigenvalue problems applied to physical systems.

MEC3122.6: Classify linear, second-order partial differential equations (PDEs) as elliptic, parabolic, or hyperbolic, and apply the Finite Difference Method to formulate the solutions of different classes of PDEs.

Module I: [10L]

Simple Mathematical model of engineering problem,
Approximations– Significant figures, Accuracy, Precision & Error; definition and formulations. Round-off and truncation errors, error propagation, total numerical error.
Formulation and solution of linear algebraic equations, Gauss elimination, LU decomposition. Solution of linear algebraic equations through iteration methods
Roots of Equation: Newton Raphson method, Secant Method, roots of polynomial: Muller's method, Bairstow's method.

Module II: [10L]

Linear and polynomial regression, multiple linear regression, general linear least squares.

Interpolation methods: Newton's divided difference interpolation of polynomials, Lagrange interpolation of polynomials.
Optimization: one dimensional unconstrained problem, Golden-section search, multi dimension unconstrained problem, Gradient method.

Module III: [9L]

NumericalIntegration: The Trapezoidal rule, Simpson's rule, Gauss quadrature two points and three points.
Boundary Value Problems in Ordinary Differential Equations, Initial and Boundary Value Problems in Partial Differential Equations.
Eigen value problems applied to a physical system.

Module IV: [10L]

Basics of Finite Difference Method-Forward Differences, Backward Differences, Central Differences, Symbolic Relations and Separation of Symbols.
Numerical Solution of Ordinary Differential Equations-Solution by Taylor's series, Picard's Method, Euler's Method, Second-order and Fourth-order Runge-Kutta Methods
Adams-Bashforth-Moulton Predictor-Corrector Method, Cubic Spline Method, Finite Difference solution of Boundary-value Problems.
Numerical Solution of Partial Differential Equations-Classification of PDEs, Elliptic equations (Laplace equation), Parabolic equations (Transient Diffusion equation), Hyperbolic equations (Wave equation).
Numerical Solution of Two-dimensional Laplace equation-Nodal network in two dimensions, Finite Difference form, Solution procedure for Finite Difference equations.

Text Books

1. Numerical Methods for engineers, Steven C Chapra& Raymond P. Canale, McGraw- Hill.

2. Numerical Analysis, P Sivaramakrishna Das and C Vijaykumari, Pearson Education.

3. Computational Methods in Engineering, S.P. Venkateshan and PrasannaSwaminathan, Academic Press.

Reference Books:

1. Numerical Methods for engineers, Steven C Chapra& Raymond P. Canale, McGraw-Hill.
2. Numerical Analysis, P Sivaramakrishna Das and C Vijaykumari, Pearson Education.

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

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

AEI3122.1 Memorize the knowledge on mechanical, electromechanical, thermal and acoustic, and optical sensors.
AEI3122.2 Identify and classify the sensors based on type of measure and such as strain, force, pressure, displacement, temperature, flow, etc.
AEI3122.3 Choose the application specific Sensors and Transducers.
AEI3122.4 Relate the sensors in various industrial applications.
AEI3122.5 Design and set up the sensing systems.
AEI3122.6 Create the applications of smart sensors

Module I – [10L]
Fundamentals: Definition, principle of sensing and transduction, classification of transducers, static and dynamic characteristics of Transducers.
Resistive Transducers: Potentiometric transducer- Theory, type, symbol, materials, error calculations due to loading effects, sensitivity, and specifications.
Strain gauge- Theory, type, symbol, materials, gauge factor, temperature compensation and dummy gauge, Strain measurement circuit- quarter, half and full bridge configuration, and specifications.
Inductive Transducers: Principle, common types, Reluctance change type, Mutual inductance change type, transformer action type. LVDT- Construction, working principle, characteristics (modulated and demodulated).

Module II - [8L]
Capacitive sensors: Parallel plate type- Variable distance, variable area, variable dielectric constant type, calculation of sensitivity, response characteristics, specifications, and applications.
Piezoelectric transducers: Piezoelectric effect, type, charge and voltage co-efficient and relationships, crystal model, materials, charge amplifier; Ultrasonic sensors- Liquid velocity and level measurements.

Module III-[10L]
Contact type Thermal Sensors:
Resistance change type:
Resistance Temperature Detector (RTD) - materials, temperature range, R-T characteristics, configurations, specifications, and applications. Thermistors- materials, temperature range, R-T characteristics, applications and specification.
Thermo-emf sensor:

Thermocouple- Thermo electric laws, types, temperature ranges, series and parallel configurations, cold junction compensation, compensating cables.
Introduction to semiconductor type temperature sensors.

Non-Contact type Thermal Sensors:

Thermal Radiation sensors- types, constructions, working, temperature ranges and comparison.

Module IV- [8L]

Radiation Sensors:

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

Text / Reference Books:

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

Course Title: Indian Constitution and Civil Society (Mandatory)					
Course Code: INC3016					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	2	0	0	2	2

Course Outcomes

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

INC3016.1. Analyze the historical, political and philosophical context behind the Indian Constitution-making process

INC30166.2. Appreciate the important principles characterizing the Indian Constitution and institute comparisons with other constitutions.

INC3016.3. Understand the contemporaneity and application of the Indian Constitution in present times

INC3016.4. Critique the contexts for constitutional amendments in consonance with changing times and society.

INC3016.5. Establish the relationship between the Indian Constitution and civil society at the collective as well as the individual levels.

INC3016.6. Consciously exercise the rights and the duties emanating from the Indian Constitution to one's own life and work.

MODULE – I [6L]

Introduction to the Constitution of India-Historical Background

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

MODULE – II [6L]

Salient Features of the Indian constitution

Comparison with the constitutions of other countries

MODULE – III [6L]

Relevance of the Constitution of India

Constitution and Governance

Constitution and Judiciary

Constitution and Parliament-Constitutional amendments

MODULE – IV [6L]

Constitution and Society- democracy, secularism, justice

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

Text Books

1. Civil Society and Democracy, C.M.Elliot, (ed.), OUP, Oxford, 20012.

Reference Books

1. The Idea of the Modern State, David Held et.al (ed), Open Univ. Press, Bristol, 1993

2. Neera Chandoke, State and Civil Society, Sage, Delhi, 19953

Course Title: DBMS Lab					
Course Code: CBS3151					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	0	0	3	3	1.5

Course Outcomes:

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

CBS3151.1. Construct database and tables using RDBMS

CBS3151.2. Manage data within the RDBMS by performing various operations.

CBS3151.3. Determine the output fetched from table/s through various complex query processing.

CBS3151.4. Modify the database access control using various query processing.

CBS3151.5. Investigate the data using PL/SQL

CBS3151.6. Construct various data control to handle the data transactions.

Problems related to the following topics:

Topic 1: Database Creation

- Creating a Database
- Creating a Table
- Specifying Relational Data Types
- Specifying Constraints
- Creating Indexes

Topic 2: Table and Record Handling

- INSERT statement
- Using SELECT and INSERT together

 DELETE, UPDATE, TRUNCATE statements

 DROP, ALTER statements

Topic 3: Retrieving Data from a Database

 The SELECT statement

 Using the WHERE clause

 Using Logical Operators in the WHERE clause

 Using IN, BETWEEN, LIKE , ORDER BY, GROUP BY and HAVING

Topic 4: Clause

 Using Aggregate Functions

 Combining Tables Using JOINS

 Subqueries

Topic 5: Database Management

 Creating Views

 Creating Column Aliases

 Creating Database Users

 Using GRANT and REVOK

Topic 6: PL/SQL overview Structure of PL/SQL block.

 Using PL/SQL variables, taking user input and displaying the output.

 PL/SQL Control structures(Conditional control, Iterative control, Sequential control)

 Built-in PL/SQL functions

 PL/SQL composite datatype (Tables, ROWTYPE)

 Subprograms

- Procedures

- Functions
- Cursor Management
- Implicit Cursor
- Explicit Cursor
- Cursor for-loop
- Database Triggers
- Error Handling
- Packages

Topic 7: Transaction management

 Transaction with COMMIT, ROLLBACK, SAVEPOINT

 Locking with pair of user

 Locking with multiuser

Books

1. Database System Concepts - Korth, Silberschatz, S. Sudarshan, TMH.

2. SQL-PL/SQL - Ivan Bayross, BPB

Course Title: Network Administration Lab					
Course Code: CBS3152					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	0	0	3	3	1.5

Course Outcomes

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

CBS3152.1. Describe the concepts of socket programming.
CBS3152.2. Demonstrate Socket programming to design client server environment.
CBS3152.3. Develop an application to execute command remotely using socket programming.
CBS3152.4. Develop a file transfer application using socket programming.
CBS3152.5. Learn to gather network information using socket programming.
CBS3152.6. Implement and configure various servers and firewall protocols.
Syllabus:
1. TCP/UDP Socket Programming – Introduction

2. Sockets – Operation, Socket types, Domains, Closing Sockets

3. Client/Server Models - Usage

4. Connection Based Services - Client and Server actions

5. Connectionless Services - Client and Server actions

6. Access Network Database - Host Information, Network Information, Protocol Information

7. Implement Multicasting / Broadcasting socket I/O.

8. Configure FTP, DNS and DHCP server.

9. Configure firewall and packet monitoring software.

Books

1. Unix Network Programming, Richard Stevens, Bill Fenner, and Andrew M. Rudoff, Vo1 & 2 Addison Wesley, 2004.

Course Title: Artificial Intelligence Lab					
Course Code: CBS3153					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	0	0	2	2	1

Course Outcomes

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

CBS3153.1. Apply various AI search algorithms.
CBS3153.2. Apply AI techniques and technologies to solve real world business problems.
CBS3153.3. Explore the methods of implementing algorithms using artificial intelligence techniques.
CBS3153.4. Develop intelligent agents to solve real life problems.
CBS3153.5. Develop and analyze game-playing algorithms.
CBS3153.6. Demonstrate practical application and implementation skills through a mini AI-based project, integrating concepts learned throughout the course into a real-world or simulated scenario.

Syllabus:

1. Search Algorithms: Breadth First Search, Depth First Search
2. Hill Climbing Algorithm
3. A* Algorithm
4. Tic-Tac-Toe game
5. 8-Puzzle problem
6. Water-Jug problem
7. Travelling Salesman Problem
8. Tower of Hanoi
9. 4-Queens Problem
10. Mini AI based Project

Text / Reference Books

1. “Artificial Intelligence For Dummies (2nd Edition)”, Luca Massaron, John Mueller
2. “Python: Beginner's Guide to Artificial Intelligence”, Denis Rothman, Matthew Lamons, Rahul Kumar

APPENDIX – A

Point Description for Mandatory Additional Requirement (MAR)

OFFICE OF THE CONTROLLER OF EXAMINATIONS

HERITAGE INSTITUTE OF TECHNOLOGY, KOLKATA

MANDATORY ADDITIONAL REQUIREMENTS (MAR)

Activity List w.e.f. 2023-2024 Academic Year

	Activity	Points per Activity	Permissible Points (max)
1.	MOOCS (SWAYAM / NPTEL / SPOKEN TUTORIAL / ANY TECHNICAL, NON-TECHNICAL COURSE) (PER COURSE)		
a)	For 12 weeks duration/40 Hours	20	40
b)	For 8 weeks duration/30 Hours	15	
c)	For 4 weeks duration/20 Hours	10	
d)	For 2 weeks duration/10 Hours	5	
2.	TECH FEST / FEST / TEACHERS DAY / FRESHER'S WELCOME		
a)	Organizer	5	10
b)	Participant	3	6
3.	RURAL REPORTING	5	10
4.	TREE PLANTATION AND UP-KEEPING (PER TREE)	1	10
5.	RELIEF / CHARITABLE ACTIVITIES		
a)	Collection of fund / materials for the Relief Camp or Charitable Trusts	5	40
b)	To be a part of the Relief Work Team	20	
6.	PARTICIPATION IN DEBATE / GROUP DISCUSSION / WORKSHOP / TECH QUIZ / MUSIC / DANCE / DRAMA / ELOCUTION / QUIZ / SEMINAR / PAINTING / ANY PERFORMING ARTS / PHOTOGRAPHY / FILM MAKING / LIFE SKILLS	10	20
7.	PUBLICATION IN NEWS PAPER, MAGAZINE, WALL MAGAZINE & BLOGS	10	20
8.	RESEARCH PUBLICATION (PER PUBLICATION)	15	30
9.	INNOVATIVE PROJECTS (OTHER THAN COURSE CURRICULUM)	30	60
10.	BLOOD DONATION		
a)	Individual Blood donation	8	16
b)	Blood Donation Camp Organization	10	20
11.	SPORTS / GAMES / ADVENTURE SPORTS / TREKKING / YOGA CAMP		
a)	Personal Level	10	20
b)	College level	5	10
c)	University Level	10	20
c)	District Level	12	24
e)	State Level	15	30
f)	National / International Level	20	20
12.	ACTIVITIES IN A PROFESSIONAL SOCIETY / STUDENT CHAPTER	10	20
13.	RELEVANT INDUSTRY VISIT & REPORT / HOTEL-EVENT MANAGEMENT TRAINING & REPORT (MINIMUM 3 DAYS WITH SUBMITTED REPORT)	10	20
14.	COMMUNITY SERVICE & ALLIED ACTIVITIES LIKE: CARING FOR THE SENIOR CITIZENS, UNDER-PRIVILEGED / STREET CHILDREN / ANIMAL CARE ETC. / TRAINING TO DIFFERENTLY ABLE	10	20
15.	SELF-ENTREPRENEURSHIP PROGRAMME		
a)	To organise entrepreneurship programmes and workshops	10	20
b)	To take part in entrepreneurship workshop and get certificate	5	10
c)	Video film making on entrepreneurship	10	20
d)	Submit business plan on any project	10	20
e)	To work for start-up/as entrepreneur	20	40

Format for Report Submission

Name :

Department :

Year/Semester :

Title of the Activity :

Date :

Name of the organization :

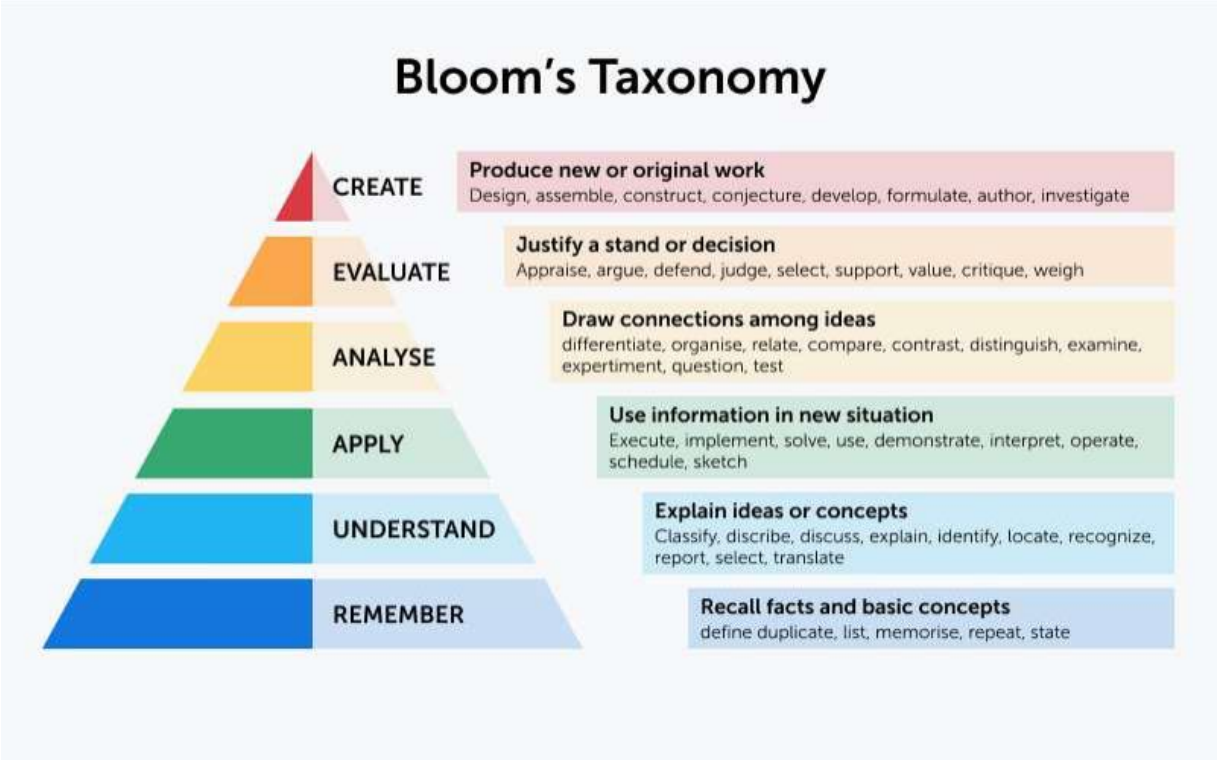
Report :

Signature
(Coordinator / Competent Authority)

Points earned:

Signature of the Mentor

APPENDIX – C


Bloom's Taxonomy
CREATE
Produce new or original work
Design, assemble, construct, conjecture, develop, formulate, author, investigate
EVALUATE
Justify a stand or decision
Appraise, argue, defend, judge, select, support, value, critique, weigh
ANALYSE
Draw connections among ideas
differentiate, organise, relate, compare, contrast, distinguish, examine, expertiment, question, test
APPLY
Use information in new situation
Execute, implement, solve, use, demonstrate, interpret, operate, schedule, sketch
UNDERSTAND
Explain ideas or concepts
Classify, discribe, discuss, explain, identify, locate, recognize, report, select, translate
REMEMBER
Recall facts and basic concepts
define duplicate, list, memorise, repeat, state