CURRICULUM

FOR

B. TECH DEGREE PROGRAMME

IN

COMPUTER SCIENCE AND ENGINEERING

2020 SCHEME (Revised in 2022)

(AUTONOMOUS)

MAR BASELIOS COLLEGE OF ENGINEERING AND TECHNOLOGY
(Approved by AICTE, Autonomous Institution Affiliated to APJ Abdul Kalam Technological University)
MAR IVANIOS VIDYANAGAR, NALANCHIRA, THIRUVANANTHAPURAM – 695015, KERALA.
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MAR BASELIOS COLLEGE OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

B.TECH DEGREE PROGRAMME

IN

COMPUTER SCIENCE AND ENGINEERING

CURRICULUM AND DETAILED SYLLABI

2020 SCHEME

Items	Board of Studies(BOS)	Academic Council(AC)
Date of Approval	20.11.2020	30.12.2020
	03.02.2021	17.02.2021
	24.11.2021	22.04.2022
	16.08.2022	---

Head of the Department **Principal**

Chairman, Board of Studies **Chairman, Academic Council**

CURRICULUM AND DETAILED SYLLABI

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MAR BASELIOS COLLEGE OF ENGINEERING AND TECHNOLOGY

Vision and Mission of the Institution

Vision:
To be an Institution moulding globally competent professionals as epitomes of Noble Values.

Mission:
To transform the Youth as technically competent, ethically sound and socially committed professionals, by providing a vibrant learning ambience for the welfare of humanity.

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Vision and Mission of the Department

Vision:
To be a Centre of Excellence in Computer Science and Engineering providing quality education and research for the betterment of the society.

Mission:
To impart sound knowledge in theoretical and applied foundations of Computer Science and Engineering, and to train the students to solve real life issues to effectively define and shape life.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

1. Graduates will be successful professionals in Industries of core or interdisciplinary nature or entrepreneurs, demonstrating effective leadership and excellent team work.
2. Graduates will expand the horizon of knowledge through higher education orresearch, leading to self-directed professional development.
3. Graduates will demonstrate professional attitude and ethics while providing solutions in societal and environmental contexts.

PROGRAMME OUTCOMES (POs)

Engineering graduates will be able to:

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **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.
3. **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.
4. **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.
5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6. **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.
7. **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.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **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.
11. **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.
12. **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.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

Engineering Graduates will have the ability to:

1. Apply Algorithmic Principles, Programming Skills and Software Engineering Principles to design, develop and evaluate Software Systems of varying complexities.
2. Apply knowledge of System Integration to design and implement computer-based systems.
3. Solve real world and socially relevant problems with the knowledge in recent and advanced Computing Technologies.

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

For the students admitted from 2022-23

Scheduling of Courses

i) Knowledge Segments and Credits

Every course of B. Tech Programme is placed in one of the nine categories as listed in the following table.No semester shall have more than six lecture-based courses and two laboratory courses, and/ordrawing/seminar/project courses in the curriculum.

Sl. No.	Category	Category Code	Total credits
1	Humanities and Social Sciences including Management Courses	HSC	5
2	Basic Science Courses	BSC	26
3	Engineering Science Courses	ESC	22
4	Programme Core Courses, Comprehensive Course Work and Viva Voce	PCC	79
5	Programme Elective Courses	PEC	15
6	Open Elective Courses	OEC	3
7	Project Work and Seminar	PWS	10
8	Mandatory Non-credit Courses (P/F) with Grade	MNC	---
9	Mandatory Student Activities (P/F)	MSA	2
Total Mandatory Credits			**162**
	Value Added Courses (Optional) – Honours/Minor	VAC	20

ii) Semester-wise Credit Distribution

Semester	**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	***Total Credits***
Credits for Courses	17	21	22	22	23	23	15	17	**160**
Activity Points (Min.)	40				60				**100**
Credits for Activities	2								**2**
Total Credits									**162**
Value Added Courses (Optional) – Honours / Minor									**20**
Total Credits									**182**

SEMESTER I						
Slot	**Category Code**	**Course Number**	**Courses**	**L-T-P**	**Hours**	**Credit**
A	BSC	MA0U10A	Linear Algebra and Calculus	3-1-0	4	4
B 1/2	BSC	PH0U10A	Engineering Physics-A	3-1-0	4	4
		CY0U10A	Engineering Chemistry-A	3-1-0	4	4
C 1/2	ESC	ES0U10A	Engineering Mechanics	2-1-0	3	3
		ES0U10B	Engineering Graphics	2-0-2	4	3
D 1/2	ESC	ES0U10C	Basics of Civil and Mechanical Engineering	4-0-0	4	4
		ES0U10D	Basics of Electrical and Electronics Engineering	4-0-0	4	4
E	HSC	HS0U10A	Life Skills	2-0-2	4	---
S 1/2	BSC	PH0U18A	Engineering Physics Lab	0-0-2	2	1
		CY0U18A	Engineering Chemistry Lab	0-0-2	2	1
T 1/2	ESC	ES0U18A	Civil and Mechanical Workshop	0-0-2	2	1
		ES0U18B	Electrical and Electronics Workshop	0-0-2	2	1
TOTAL					**23/24**	**17**

SEMESTER II						
Slot	**Category Code**	**Course Number**	**Courses**	**L-T-P**	**Hours**	**Credit**
A	BSC	MA0U10B	Vector Calculus, Differential Equations and Transforms	3-1-0	4	4
B 1/2	BSC	PH0U10A	Engineering Physics-A	3-1-0	4	4
		CY0U10A	Engineering Chemistry-A	3-1-0	4	4
C 1/2	ESC	ES0U10A	Engineering Mechanics	2-1-0	3	3
		ES0U10B	Engineering Graphics	2-0-2	4	3
D 1/2	ESC	ES0U10C	Basics of Civil and Mechanical Engineering	4-0-0	4	4
		ES0U10D	Basics of Electrical and Electronics Engineering	4-0-0	4	4
E	HSC	HS0U10B	Professional Communication	2-0-2	4	---
F	ESC	ES0U10F	Introduction to Computer Programming	2-1-2	5	4
S 1/2	BSC	PH0U18A	Engineering Physics Lab	0-0-2	2	1
		CY0U18A	Engineering Chemistry Lab	0-0-2	2	1
T 1/2	ESC	ES0U18A	Civil and Mechanical Workshop	0-0-2	2	1
		ES0U18B	Electrical and Electronics Workshop	0-0-2	2	1
TOTAL					**28/29**	**21**

SEMESTER III						
Slot	**Category Code**	**Course Number**	**Courses**	**L-T-P**	**Hours**	**Credit**
A	BSC	MA0U20G	Discrete Mathematical Structures	3-1-0	4	4
B	PCC	CS1U20A	Data Structures	3-1-0	4	4
C	PCC	CS1U20B	Logic System Design	3-1-0	4	4
D	PCC	CS1U20C	Object Oriented Programming using Java	3-1-0	4	4
E 1/2	ESC	ES0U20A	Design and Engineering	2-0-0	2	2
	HSC	HS0U20A	Professional Ethics	2-0-0	2	2
F	MNC	NC0U20A	Sustainable Engineering	2-0-0	2	---
S	PCC	CS1U28A	Data Structures Lab	0-0-3	3	2
T	PCC	CS1U28B	Object Oriented Programming Lab (in Java)	0-0-3	3	2
R/M	VAC		Remedial/Minor Course	3-1-0	4	4
TOTAL					**26/30**	**22/26**

SEMESTER IV						
Slot	**Category Code**	**Course Number**	**Courses**	**L-T-P**	**Hours**	**Credit**
A	BSC	MA0U20D	Probability Statistics and Numerical Methods	3-1-0	4	4
B	PCC	CS1U20D	Computer Organization and Architecture	3-1-0	4	4
C	PCC	CS1U20E	Database Management Systems	3-1-0	4	4
D	PCC	CS1U20G	Formal Languages and Automata Theory	3-1-0	4	4
E 1/2	ESC	ES0U20A	Design and Engineering	2-0-0	2	2
	HSC	HS0U20A	Professional Ethics	2-0-0	2	2
F	MNC	NC0U20B	Constitution of India	2-0-0	2	---
S	PCC	CS1U28C	Digital Lab	0-0-3	3	2
T	PCC	CS1U28E	Database Management Systems Lab	0-0-3	3	2
R/M /H	VAC		Remedial/Minor/Honours Course	3-1-0	4	4
TOTAL					**26/30**	**22/26**

SEMESTER V						
Slot	**Category Code**	**Course Number**	**Courses**	**L-T-P**	**Hours**	**Credit**
A	PCC	CS1U30J	Algorithm Analysis and Design	3-1-0	4	4
B	PCC	CS1U30C	System Software	3-1-0	4	4
C	PCC	CS1U30K	Operating Systems	3-1-0	4	4
D	PCC	CS1U30D	Microprocessors and Microcontrollers	3-1-0	4	4
E	PCC	CS1U30E	Management of Software Systems	3-0-0	3	3
F	MNC	NC0U30A	Disaster Management	2-0-0	2	---
S	PCC	CS1U38A	System Software and Microprocessors Lab	0-0-4	4	2
T	PCC	CS1U38D	Operating Systems Lab	0-0-4	4	2
R/M/H	VAC		Remedial/Minor/Honours Course	3-1-0	4	4
TOTAL					**29/33**	**23/27**

SEMESTER VI						
Slot	**Category Code**	**Course Number**	**Courses**	**L-T-P**	**Hours**	**Credit**
A	PCC	CS1U30F	Compiler Design	3-1-0	4	4
B	PCC	CS1U30G	Computer Graphics and Image Processing	3-1-0	4	4
C	PCC	CS1U30B	Computer Networks	3-1-0	4	4
D	PEC	CS1UXXX	Programme Elective I	2-1-0	3	3
E	HSC	HS0U30A	Industrial Economics and Foreign Trade	3-0-0	3	3
F	PCC	CS1U30I	Comprehensive Course Work	1-0-0	1	1
S	PCC	CS1U38C	Networking Lab	0-0-3	3	2
T	PWS	CS1U39A	Mini Project	0-0-3	3	2
R/M/H	VAC		Remedial/Minor/Honours Course	3-1-0	4	4
TOTAL					**25/29**	**23/27**

PROGRAMME ELECTIVE I

Slot	Category Code	Course Number	Courses	L-T-P	Hours	Credit
D	PEC	CS1U31A	Foundations of Machine Learning	2-1-0	3	3
		CS1U31B	Data Analytics	2-1-0	3	3
		CS1U31C	Foundations of Security in Computing	2-1-0	3	3
		CS1U31D	Automated Verification	2-1-0	3	3
		CS1U31E	Programming in Python	2-1-0	3	3
		CS1U31G	Introduction to IA32 Architecture	2-1-0	3	3
		CS1U31F	Advanced Data Communication	2-1-0	3	3

SEMESTER VII						
Slot	**Category Code**	**Course Number**	**Courses**	**L-T-P**	**Hours**	**Credit**
A	PCC	CS1U40A	Artificial Intelligence	2-1-0	3	3
B	PEC	CS1UXXX	Programme Elective II	2-1-0	3	3
C	OEC	CS0UXXX	Open Elective	2-1-0	3	3
D	MNC	NC0U40A	Industrial Safety Engineering	2-1-0	3	---
E	PCC	CS1U48A	Compiler Design Lab	0-0-3	3	2
T	PWS	CS1U49A	Seminar	0-0-3	3	2
U	PWS	CS1U49B	Project Phase I	0-0-6	6	2
R/M/H	VAC		Remedial/Minor/Honours Course	0-1-6/ 3-1-0	7/4	4
TOTAL					**24 (31/28)**	**15/19**

PROGRAMME ELECTIVE II

Slot	Category Code	Course Number	Course	L-T-P	Hours	Credit
B	PEC	CS1U41A	Machine Learning	2-1-0	3	3
		CS1U41B	Cloud Computing	2-1-0	3	3
		CS1U41C	Security in Computing	2-1-0	3	3
		CS1U41D	Model Based Software Development	2-1-0	3	3
		CS1U41E	Web Programming	2-1-0	3	3
		CS1U41F	Natural Language Processing	2-1-0	3	3
		CS1U41G	Advanced Topics in IA32 Architecture	2-1-0	3	3

OPEN ELECTIVE I

Slot	Category Code	Course Number	Courses	L-T-P	Hours	Credit
C	OEC	CS0U41A	Introduction to Mobile Computing	2-1-0	3	3
		CS0U41B	Introduction to Deep Learning	2-1-0	3	3
		CS0U41C	Computer Graphics	2-1-0	3	3
		CS0U41D	Python for Engineers	2-1-0	3	3
		CS0U41E	Object Oriented Concepts	2-1-0	3	3

SEMESTER VIII						
Slot	**Category Code**	**Course Number**	**Courses**	**L-T-P**	**Hours**	**Credit**
A	PCC	CS1U40B	Distributed Computing	2-1-0	3	3
B	PEC	CS1UXXX	Programme Elective III	2-1-0	3	3
C	PEC	CS1UXXX	Programme Elective IV	2-1-0	3	3
D	PEC	CS1UXXX	Programme Elective V	2-1-0	3	3
T	PCC	CS1U40C	Comprehensive Viva Voce	1-0-0	1	1
U	PWS	CS1U49C	Project Phase II	0-0-12	12	4
R/M/H	VAC		Remedial/Minor/Honours Course	0-1-6	7	4
TOTAL					**25/32**	**17/21**

PROGRAMME ELECTIVE III

Slot	**Category Code**	**Course Number**	**Courses**	**L-T-P**	**Hours**	**Credit**
B	PEC	CS1U42A	Deep Learning	2-1-0	3	3
		CS1U42B	Programming Paradigms	2-1-0	3	3
		CS1U42C	Cryptography	2-1-0	3	3
		CS1U42D	Soft Computing	2-1-0	3	3
		CS1U42E	Fuzzy Set Theory and Application	2-1-0	3	3
		CS1U42F	Embedded Systems	2-1-0	3	3
		CS1U42G	Computer Vision	2-1-0	3	3

PROGRAMME ELECTIVE IV

Slot	Category Code	Course Number	Courses	L-T-P	Hours	Credit
C	PEC	CS1U43A	Formal Methods and Tools in Software Engineering	2-1-0	3	3
		CS1U43B	Client Server Architecture	2-1-0	3	3
		CS1U43C	Parallel Computing	2-1-0	3	3
		CS1U43D	Data Compression Techniques	2-1-0	3	3
		CS1U43E	Unified Extended Firmware Interface	2-1-0	3	3
		CS1U43F	Data Mining	2-1-0	3	3
		CS1U43G	Mobile Computing	2-1-0	3	3

PROGRAMME ELECTIVE V

Slot	Category Code	Course Number	Courses	L-T-P	Hours	Credit
D	PEC	CS1U44A	High Performance Computing	2-1-0	3	3
		CS1U44B	Blockchain Technologies	2-1-0	3	3
		CS1U44C	Image Processing Technique	2-1-0	3	3
		CS1U44D	Internet of Things	2-1-0	3	3
		CS1U44E	Software Testing	2-1-0	3	3
		CS1U44F	Bioinformatics	2-1-0	3	3
		CS1U44G	Computational Linguistics	2-1-0	3	3

MINOR

Semester	BUCKET I Specialization: SOFTWARE ENGINEERING				BUCKET II Specialization: MACHINE LEARNING				BUCKET III Specialization: NETWORKING			
	Course Number	Course	L-T-P	Credit	Course Number	Course	L-T-P	Credit	Course Number	Course	L-T-P	Credit
S3	CS0M 20A	Object Oriented Programming	3-1-0	4	CS0M 20B	Python for Machine Learning	3-1-0	4	CS0M 20C	Data Communication	3-1-0	4
S4	CS0M 20D	Programming Methodologies	3-1-0	4	CS0M 20E	Mathematics for Machine Learning	3-1-0	4	CS0M 20F	Introduction to Computer Networks	3-1-0	4
S5	CS0M 30A	Concepts in Software Engineering	3-1-0	4	CS0M 30B	Concepts in Machine Learning	3-1-0	4	CS0M 30C	Client Server Systems	3-1-0	4
S6	CS0M 30D	Introduction to Software Testing	3-1-0	4	CS0M 30E	Concepts in Deep Learning	3-1-0	4	CS0M 30F	Wireless Networks and IoT Applications	3-1-0	4
S7	CS0M 49A	Mini Project	0-1-6	4	CS0M 49A	Mini Project	0-1-6	4	CS0M 49A	Mini Project	0-1-6	4
S8	CS0M 49B	Mini Project	0-1-6	4	CS0M 49B	Mini Project	0-1-6	4	CS0M 49B	Mini Project	0-1-6	4

HONOURS

Semester	BUCKET I Specialization: SECURITY IN COMPUTING				BUCKET II Specialization: MACHINE LEARNING				BUCKET III Specialization: FORMAL METHODS			
	Course Number	Course	L-T-P	Credit	Course Number	Course	L-T-P	Credit	Course Number	Course	L-T-P	Credit
S4	CS1H 20A	Number Theory	3-1-0	4	CS1H 20B	Computational Fundamentals of Machine Learning	3-1-0	4	CS1H 20C	Principles of Program Analysis and Verification	3-1-0	4
S5	CS1H 30A	Cryptographic Algorithms	3-1-0	4	CS1H 30B	Neural Networks and Deep Learning	3-1-0	4	CS1H 30C	Principles of Model Checking	3-1-0	4
S6	CS1H 30D	Network Security	3-1-0	4	CS1H 30E	Advanced Topics in Machine Learning	3-1-0	4	CS1H 30F	Theory of Computability and Complexity	3-1-0	4
S7	CS1H 40A	Cyber Forensics	3-1-0	4	CS1H 40B	Advanced Topics in Artificial Intelligence	3-1-0	4	CS1H 40C	Logic for Computer Science	3-1-0	4
S8	CS1H 49A	Mini Project	0-1-6	4	CS1H 49A	Mini Project	0-1-6	4	CS1H 49A	Mini Project	0-1-6	4

SEMESTER - I

Course Code	Course Name	Category	L	T	P	Credit	Year of Introduction
MA0U10A	LINEAR ALGEBRA AND CALCULUS	BSC	3	1	0	4	2020

COURSE OVERVIEW:

This course introduces students to some basic mathematical ideas and tools which are at the core of any engineering course. A brief course in Linear Algebra familiarises students with some basic techniques in matrix theory which are essential for analysing linear systems. The calculus of functions of one or more variables taught in this course are useful in modelling and analysing physical phenomena involving continuous change of variables or parameters and have applications across all branches of engineering.

COURSE OUTCOMES

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

CO 1	Solve systems of linear equations.	Apply
CO 2	Compute maxima and minima using partial derivatives.	Apply
CO 3	Compute areas and volumes of geometrical shapes using multiple integrals.	Apply
CO 4	Identify the convergence or divergence of an infinite series.	Apply
CO 5	Determine the Taylor and Fourier series expansion of functions and learn their applications.	Apply

SYLLABUS

Basics of Linear Algebra – Solution of systems of linear equations, rowechelonform, rank, eigenvaluesandeigenvectors,diagonalizationofmatrices,orthogonaltransformation,quadraticforms.
Partial Differentiation and Applications – Limit and continuity of functions of two or more variables, partial derivatives, chainrule,total derivatives, maxima and minima.

Multiple Integrals – Double and triple integrals, double integrals over rectangular and non-rectangular regions, changing the order of integration, finding areas and volume, mass and centre of gravity.

Infinite series - Convergence and divergence of Infinite series, geometric series and p-series, test of convergence, Alternating series, absolute and conditional convergence

Taylor series, Binomial series and series representation of exponential, trigonometric, logarithmic functions-Fourier Series- Euler's formulas, Fourier sine and cosine series, Half range expansions

TEXT BOOKS

1) H. Anton, I. Biven, S. Davis, *Calculus*, Wiley, 10th Edition, 2015.

2) ErwinKreyszig,*Advanced Engineering Mathematics,*John Wiley &Sons, 10th Edition, 2016.

REFERENCES

1) J.Stewart,*Essential Calculus*,Cengage,2nd Edition,2017.
2) G.B.Thomas and R.L.Finney,Calculus and Analyticgeometry,9th Edition,Pearson, Reprint,2002.
3) Peter V. O'Neil, *Advanced Engineering Mathematics*, Cengage, 7th Edition 2012.

COURSE PLAN

Module	Contents	No. of hours
I	Linear Algebra: Systems of linear equations, Solution by Gauss elimination, row echelon form and rank of a matrix, fundamental theorem for linear systems (homogeneous and non-homogeneous, without proof), Eigen values and Eigen vectors. Diagonalization of matrices, orthogonal transformation, quadratic forms and their canonical forms.	12
II	Multivariable calculus-Differentiation: Concept of limit and continuity of functions of two variables, partial derivatives, Differentials, Local Linear approximations, chain rule, total derivative, Relative maxima and minima, Absolute maxima and minima on closed and bounded set.	12
III	Multivariable Calculus-Integration: Double integrals (Cartesian), reversing the order of integration, change of coordinates (Cartesian to polar), finding areas and volume using double integrals, mass and centre of gravity of inhomogeneous laminas using double integral. Triple integrals, volume calculated as triple integral, triple integral in cylindrical and spherical coordinates (computations involving spheres, cylinders).	12
IV	Sequences and Series: Convergence of sequences and series, convergence of geometric series and p-series(without proof), test of convergence (comparison, ratio and root tests without proof); Alternating series and Leibnitz test, absolute and conditional convergence.	12
V	Series representation of functions: Taylor series (without proof, assuming the possibility of power series expansion in appropriate domains), Binomial series and series representation of exponential, trigonometric, logarithmic functions (without proofs of convergence); Fourier series, Euler formulas, Convergence of Fourier series (without proof), half range sine and cosine series, Perceval's theorem (without proof).	12
	Total hours	60

MARK DISTRIBUTION

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 Hours

CONTINOUS INTERNAL EVALUATION PATTERN

Attendance	:	10 marks
Continuous Assessment Tests	:	25 marks
Assignment/Project/Case study etc.	:	15 marks

Course Code	Course Name	Category	L	T	P	Credit	Year of Introduction
PH0U10A	ENGINEERING PHYSICS-A (FOR CIRCUIT BRANCHES)	BSC	3	1	0	4	2022

COURSE OVERVIEW:

The aim of the course is to develop scientific attitude in students and offer them an understanding of physical concepts behind various engineering applications. It creates an urge in students to think creatively in emerging areas of Physics.

COURSE OUTCOMES

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

CO 1	Describe the characteristics of different types of oscillations and waves.	Understand
CO 2	Explain natural physical processes and related technological advances using principles of optics	Understand
CO 3	Generalize the principles of quantum mechanics to explain the behaviour of matter in the atomic and subatomic level	Understand
CO 4	Relate the fundamental ideas of magnetism and vector calculus to arrive at Maxwell's equations	Understand
CO 5	Describe the principles behind various superconducting applications, solid-state lighting devices and fibre optic communication system.	Understand

SYLLABUS

Oscillations and Waves: Damped oscillations, Forced oscillations, One dimensional and three-dimensional wave equations, Transverse vibrations along a stretched string

Wave Optics: Interference of light- Air wedge, Newton's rings, Antireflection coating, Diffraction-Fraunhofer diffraction at a single slit, Grating equation, Rayleigh's criterion

Quantum Mechanics & Nano technology: Wave function, Time dependent and time independent Schrodinger wave equations, One-dimensional potential well, Introduction to nanoscience and technology, Quantum confinement, Properties of nanomaterials

Magnetism & Electro Magnetic Theory: Magnetic field and Magnetic flux density, fundamental laws, magnetic permeability and susceptibility, classification of magnetic materials, fundamentals of vector calculus and theorems, equation of continuity, Maxwell's equations in vacuum, velocity of electromagnetic waves in freespace.

Superconductivity & Photonics: Super conductivity- Meissner effect, Type I &II superconductors, applications of superconductors, Introduction to photonics-photonic devices-Light Emitting Diode, Photo detectors -Junction and PIN photodiodes, Solar cells-I-V characteristics, Optical fibre - Principle, Numerical aperture, Types of fibres, Applications

TEXT BOOKS

1) M.N. Avadhanulu, P.G. Kshirsagar, T.V. S Arun Murthy, *A Text book of Engineering Physics*, S.Chand&Co., Revised Edition, 2014

2) H.K. Malik, A.K. Singh, *Engineering Physics,* McGraw Hill Education, 2nd Edition, 2017

REFERENCES

1) Arthur Beiser, *Concepts of Modern Physics*, Tata McGraw Hill Publications, 6thEdition, 2003.
2) Aruldhas G., *Engineering Physics*, Prentice Hall of IndiaPvt. Ltd., 2015
3) AjoyGhatak, *Optics*, Mc Graw Hill Education, 6th Edition, 2017
4) David J. Griffiths, *Introduction to Electrodynamics*, Pearson, 4thEdition, 2013.
5) Premlet B., *Advanced Engineering Physics*, Phasor Books,10thEdition,2017.

COURSE PLAN

Module	Contents	No. of hours
I	Oscillations and Waves: Harmonic oscillations, damped harmonic motion-derivation of differential equation and its solution, over damped, critically damped and under damped cases, Quality factor-expression, forced oscillations-differential equation-derivation of expressions for amplitude and phase of forced oscillations, amplitude resonance-expression for resonant frequency, Quality factor and sharpness of resonance, electrical analogy of mechanical oscillators Wave motion- derivation of one-dimensional wave equation and its solution, three-dimensional wave equation and its solution (no derivation), distinction between transverse and longitudinal waves, transverse vibration in a stretched string, statement of laws of vibration	**12**
II	Wave Optics: Interference of light-principle of superposition of waves, theory of thin films - cosine law (Reflected system), derivation of the conditions of constructive and destructive interference, interference due to wedge shaped films -determination of thickness and test for optical planeness, Newton's rings- measurement of wavelength and refractive index, antireflection coatings. Diffraction of light, Fresnel and Fraunhofer classes of diffraction, diffraction grating-Grating equation, Rayleigh criterion for limit of resolution, resolving and dispersive power of a grating with expression (no derivation)	**12**
III	Quantum Mechanics & Nanotechnology: Introduction for the need of Quantum mechanics, wave nature of Particles, uncertainty principle, Applications-absence of electrons inside a nucleus and natural line broadening mechanism, formulation of time dependent and independent Schrodinger wave equations-physical meaning of wave function, Particle in a one dimensional box-derivation for normalised wave function and energy eigen values, Quantum mechanical tunnelling (qualitative). Introduction to nanoscience and technology, increase in surface to volume ratio for nanomaterials, quantum confinement in one dimension, two	**12**

	dimension and three dimension-nano sheets, nano wires and quantum dots, properties of nanomaterials-mechanical, electrical and optical, applications of nanotechnology (qualitative ideas)	
IV	Magnetism and Electromagnetic theory:Magnetic field and Magnetic flux density, Gauss's law for Magnetic flux density, Ampere's Circuital law, Faraday's law in terms of emf produced by changing magnetic flux, Magnetic permeability and susceptibility, classification of magnetic materials-para, dia and ferromagnetic materials Fundamentals of vector calculus, concept of divergence, gradient and curl along with physical significance, line, surface and volume integrals, Gauss divergence theorem & Stokes' theorem, equation of continuity, derivation of Maxwell's equations in vacuum, comparison of displacement current with conduction current, electromagnetic waves, velocity of electromagnetic waves in free space, flow of energy and Poynting's vector (no derivation)	**12**
V	Superconductivity & Photonics: Superconducting phenomena, Meissner effect and perfect diamagnetism, types of superconductors-Type I and Type II, BCS Theory (Qualitative), high temperature superconductors-applications of super conductivity Introduction to photonics-photonic devices-Light Emitting Diode, Photo detectors -Junction and PIN photodiodes, Solar cells-I-V characteristics, Optic fibre-principle of propagation of light, types of fibres-step index and graded index fibres, numerical aperture –derivation, fibre optic communication system (block diagram), industrial, medical and technological applications of optical fibre, fibre optic sensors-intensity modulated and phase modulated sensors.	**12**
	Total hours	**60**

MARK DISTRIBUTION

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

CONTINOUS INTERNAL EVALUATION PATTERN

Attendance	:	10 marks
Continuous Assessment Tests	:	25 marks
Assignment	:	15 marks

Course Code	Course Name	Category	L	T	P	Credit	Year of Introduction
ES0U10A	ENGINEERING MECHANICS	ESC	2	1	0	3	2020

COURSE OVERVIEW

Goal of this course is to expose the students to the fundamental concepts of mechanics and enhance their problem-solving skills. It introduces students to the influence of applied force system and the geometrical properties of the rigid bodies while stationary or in motion. After this course students will be able to recognize similar problems in real-world situations and respond accordingly.

COURSE OUTCOMES

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

CO 1	Explain the principles and theorems related to rigid body mechanics.	Understand
CO 2	Describe the components of system of forces acting on the rigid body.	Understand
CO 3	Apply the properties of distributed areas and masses for solving problems involving rigid bodies.	Apply
CO 4	Apply the conditions of equilibrium to various practical problems involving different force systems.	Apply
CO 5	Apply appropriate principles to solve problems in rigid body mechanics.	Apply

SYLLABUS

Statics of rigid bodies: Classification of force systems, Composition and resolution of forces, Resultant and equilibrium equations, Methods of projections, Varignon's Theorem of moments.

Friction: Analysis of single and connected bodies. Parallel coplanar forces, couple. Beam reactions.

Properties of surfaces: Centroid of composite areas, Moment of inertia of areas, Polar moment of inertia, Theorem of Pappus-Guldinus, Forces in space.

Dynamics: D'Alembert's principle, Motion on horizontal and inclined surfaces, Motion of connected bodies. Impulse momentum and work energy relation. Curvilinear translation.

Rotation: Kinematics of rotation. Plane motion of rigid body: Instantaneous centre. Simple harmonic motion: Mechanical vibrations.

TEXTBOOKS

1) Timoshenko, S., Young, D. H., Rao, J. V. and Pati, S., *Engineering Mechanics*, Mc-Graw Hill Publishers, 2017.
2) Beer, F. P. and Johnston, R., *Vector Mechanics for Engineers: Statics and Dynamics*, Tata Mc-Graw Hill Publishing Company Limited, New Delhi, 12thEdition, 2005.
3) Bansal, R. K., *A Textbook of Engineering Mechanics*, Laxmi Publications, 8thEdition, 2016.

4) Sharma, D. P., Hibbeler, R. C. and Shames, I. H., *Engineering Mechanics*, Pearson Publishers, 2011.

REFERENCES

1) Bhavikkatti, S. S., *Engineering Mechanics*, New Age International Publishers, 2016.
2) Merriam, J. L. and Kraige, L. G., *Engineering Mechanics* - Vols. 1 and 2, John Wiley, 7thEdition, 2006.
3) Hibbeler, R. C. and Gupta, A., *Engineering Mechanics*, Vol. I Statics, Vol II Dynamics, Pearson Education, 2009.
4) Shames, I. H., *Engineering Mechanics - Statics and Dynamics*, Prentice Hall of India,4th Edition 2005.

COURSE PLAN

Module	Contents	No. of hours
I	Introduction to engineering mechanics - Introduction on statics and dynamics - Basic principles of statics - Parallelogram law, Equilibrium law - Superposition and transmissibility, Law of action and reaction. Free body diagrams - Degree of Freedom-Types of supports and nature of reactions -Exercises for free body diagram preparation - Composition and resolution of forces, Resultant and equilibrium equations. Concurrent coplanar forces - Analysis of concurrent forces - Methods of projections - Methods of moment - Varignon's Theorem of Moments.	9
II	Friction - Sliding friction - Coulomb's laws of friction - Analysis of single bodies - Analysis of connected bodies. Parallel coplanar forces - Couple - Resultant of parallel forces - Centre of parallel forces - Equilibrium of parallel forces - Simple beam subject to concentrated vertical loads. General coplanar force system - Resultant and equilibrium equations.	9
III	Centroid of regular geometrical shapes - Centroid of Composite areas. Moment of inertia- Parallel axis theorem - Perpendicular axis theorem -Polar moment of inertia, Radius of gyration. Mass moment of inertia of ring, cylinder and uniform disc. Theorem of PappusGuldinus. Introduction to forces in space -Vectorial representation of forces, moments and couples - Resultant and equilibrium equations for concurrent forces in space - Concurrent forces in space.	9
IV	Introduction to dynamics - Rectilinear translation - Equations of kinematics. Introduction to kinetics - Equation of motion - D'Alembert's principle - Motion on horizontal and inclined surfaces - Motion of connected bodies. Curvilinear translation - Projectile motion - Introduction to kinetics - equation of motion. Impulse momentum equation and work energy equation. Moment of momentum and work energy equation (Curvilinear translation).	9

V	Rotation - Kinematics of rotation- Equation of motion for a rigid body rotating about a fixed axis - Rotation under a constant moment. Plane motion of rigid body- Instantaneous Centre of rotation (concept only). Introduction to harmonic oscillation - Free vibrations - Simple harmonic motion – Differential equation and solution. Degree of freedom - Examples of single degree of freedom (SDOF) systems -Idealisation of mechanical systems as spring-mass systems (concept only). SDOF spring mass system - Equation of motion –Undamped free vibration response - Concept of natural frequency. Effect of damping on free vibration response (concept only).	9
	Total hours	45

MARK DISTRIBUTION

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

CONTINOUS INTERNAL EVALUATION PATTERN

Attendance	:	10 marks
Continuous Assessment Tests	:	25 marks
Assignment/Quiz/Course project	:	15 marks

Course Code	Course Name	Category	L	T	P	Credit	Year of Introduction
ES0U10C	BASICS OF CIVIL AND MECHANICAL ENGINEERING	ESC	4	0	0	4	2020

COURSE OVERVIEW

The goal of this course is to provide an insight on the essentials of Civil and Mechanical Engineering discipline to the students of all branches of Engineering and to provide the students an illustration of the significance of the Civil and Mechanical Engineering Profession in satisfying the societal needs.

COURSE OUTCOMES

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

CO 1	Explain different types of buildings, their components, materials, construction techniques and basic infrastructure services.	Understand
CO 2	Describe the importance, objectives and principles of surveying.	Understand
CO 3	Apply the principles of levelling to find the level difference between points.	Apply
CO 4	Summarize the different materials and systems in the context of green buildings.	Understand
CO 5	Analyse thermodynamic cycles and Illustrate the working and features of IC Engines	Apply
CO 6	Explain the basic principles of Refrigeration and Air Conditioning and working of hydraulic machines	Understand
CO 7	Explain the working of power transmission elements, basic manufacturing, metal joining and machining processes	Understand

SYLLABUS

Introduction to Civil Engineering: Relevance and major disciplines of Civil Engineering, Introduction to buildings: Types and different components of buildings, building rules and regulations, Building area.

Introduction to surveying: Objectives, Principle, Classification, Levelling, Introduction to modern surveying instrument- Total Station.

Construction materials: Bricks, Stones, Sand, Timber, Cement, Cement mortar, Concrete, Steel, Modern construction materials.

Building construction: Foundations, Brick masonry, Roofs and floors, Basic infrastructure services, Green buildings.

Basics of Mechanical Engineering: Fundamental of thermodynamics. Analysis of thermodynamic cycles and working of internal combustion engines. CRDI, MPFI and concept of hybrid vehicles.

Refrigeration and power transmission systems - Analysis of reversed Carnot cycle and vapour compression cycle. Introduction to psychometric. Layout of unit and central air conditioner.

Description and basic analysis of hydraulic pump and turbine. Working of different power transmission devices.

Manufacturing methods and machine tools - Description of various manufacturing, metal joining process and basic machining operations.

Working of different machines tools and CNC machine. Introduction to CAD/CAM, additive and rapid manufacturing.

TEXT BOOKS

1) Mamlouk, M. S., and Zaniewski, J. P., *Materials for Civil and Construction Engineering*, Pearson Publishers, 4th Edition, 2017.
2) Rangwala, S. C., *Essentials of Civil Engineering*, Charotar Publishing House, 1st Edition, 2012.
3) Clifford, M., Simmons, K. and Shipway, P., *An Introduction to Mechanical Engineering Part I* - CRC Press, 2009.
4) Kumar, P., *Basic Mechanical Engineering*, Pearson India, 2013.

REFERENCES

1) Chen W. F. and Liew J. Y. R. (Eds), *The Civil Engineering Handbook*, CRC Press (Taylor and Francis), 2ndEdition, 2002
2) Punmia B. C., Ashok, K. J. and Arun K. J., *Surveying*, Vol. I, Laxmi Publications (P) ltd., New Delhi, 17thEdition, 2016
3) *Kerala Municipal Building Rules*, LSGD, Govt. of Kerala, 2019
4) SP 7: 2016*, National Building Code of India*, BIS, New Delhi, 2016.
5) Wylen G. J. V., Sonntag, R. and Borgnakke C., *Fundamentals of Classical Thermodynamics*, John Wiley & Sons,2012.
6) Sawhney G. S., *Fundamentals of Mechanical Engineering*, PHI Learning; 3rd Revised Edition, 2015.

COURSE PLAN

Module	Contents	No. of hours
I	**General Introduction to Civil Engineering:** Relevance of Civil Engineering in the overall infrastructure development of the Country. Responsibility of an engineer in ensuring the safety of built environment. Brief introduction to major disciplines of Civil Engineering like Structural Engineering, Transportation Engineering, Geotechnical Engineering, Water Resources Engineering and Environmental Engineering. **Introduction to buildings:** Types of buildings, selection of site for buildings, components of a residential building and their functions. **Building rules and regulations:** Relevance of NBC, KBR & CRZ norms (brief discussion only). **Building area:** Plinth area, built up area, floor area, carpet area and floor area ratio for a building as per KBR. **Surveying:** Importance, classification, objectives and principles, instruments used. Levelling- principles, dumpy level, simple levelling, differential levelling-problems. Introduction to modern surveying instruments-Total Station.	10
II	**Construction materials:** Conventional construction materials: types, properties and uses of building materials: bricks, stones, cement, sand and timber.	10

	Cement Mortar: Materials and properties. **Cement concrete:** Constituent materials, properties and types. **Steel:** Steel sections and steel reinforcements, types and uses. **Modern construction materials:** Architectural glass, ceramics, plastics, composite materials, thermal and acoustic insulating materials, decorative panels, waterproofing materials. Modern uses of gypsum, pre-fabricated building components (brief discussion only).	
III	**Building Construction: Foundations:** Bearing capacity of soil (definition only), functions of foundations, types – shallow and deep (brief discussion only). Load bearing and framed structures (concept only). **Brick masonry:** Header and stretcher bond, English bond and Flemish bond. **Roofs and floors:** Functions, types; flooring materials (brief discussion only). **Basic infrastructure services:** MEP, HVAC, elevators, escalators and ramps (Civil Engineering aspects only), fire safety for buildings. **Green buildings:** Materials, energy systems and water management and environment for green buildings (brief discussion only).	10
IV	**Fundamentals of thermodynamics**: Review of basics of thermodynamics-system, surroundings, process, cycle- quasistatic process, laws of thermodynamics. Analysis of thermodynamic cycles: Carnot, Otto, Diesel cycles, Derivation of efficiency of these cycles, Problems to calculate heat added, heat rejected, net-work and efficiency. **IC Engines**: CI, SI, 2- Stroke, 4-Stroke engines. Listing the parts of different types of IC Engines. Efficiencies of IC Engines (Definitions only), Air, Fuel, cooling and lubricating systems in SI and CI Engines, CRDI, MPFI. Concept of hybrid engines.	10
V	**Refrigeration**: Unit of refrigeration, reversed Carnot cycle, COP, vapour compression cycle (only description and no problems); Definitions of dry, wet & dew point temperatures, specific humidity and relative humidity, Cooling and dehumidification, Layout of unit and central air conditioners. **Hydraulic machines**: Working principle of Reciprocating pump, Centrifugal pump, Pelton turbine, Francis turbine and Kaplan turbine. Overall efficiency, Problems on calculation of input and output power of pumps and turbines (No velocity triangles) **Power Transmission Devices**: Belt and Chain drives, Gear and Gear trains, Single plate clutches.	10
VI	**Manufacturing Process**: Basic description of the manufacturing processes – Sand Casting, Forging, Rolling, Extrusion and their applications. Metal Joining Processes: List types of welding, Description with sketches of Arc Welding, Soldering and Brazing and their applications. **Basic Machining Operations**: Turning, Drilling, Milling and Grinding. Lathe, drilling machine, Milling machine. **Computer Aided Machining**: CNC Machine. Principle of CAD/CAM, Rapid and Additive manufacturing.	10
	Total hours	60

MARK DISTRIBUTION

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

CONTINOUS INTERNAL EVALUATION PATTERN

Attendance	:	10 marks
Continuous Assessment Tests	:	25 marks
Assignment/Quiz/Course project	:	15 marks

Course Code	Course Name	Category	L	T	P	Credit	Year of Introduction
HS0U10A	LIFE SKILLS	HSC	2	0	2	-	2020

COURSE OVERVIEW:

This course is designed to enhance the employability and maximize the potential of the students by introducing them to the principles that underlay personal and professional success, and help them acquire the skills needed to apply these principles in their lives and careers.

COURSE OUTCOMES

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

CO 1	Identify different skills required in personal and professional life.	Understand
CO 2	Apply well defined techniques to cope with emotions and stress and to provide an awareness of the self.	Apply
CO 3	Apply appropriate thinking tools and techniques for creative problem solving.	Apply
CO 4	Explain the importance of teamwork, team performance and team conflicts.	Understand
CO 5	Explain the basic mechanics of effective communication and demonstrate these through presentations.	Understand

SYLLABUS

Overview of Life Skills: Meaning and significance of life skills, Life skills identified by WHO, Life skills for professionals,personality development, IQ, EQ, and SQ

Self-awareness & Stress Management: Definition and need for self-awareness;Tools and techniques of SA, Stress, reasons and effects, the four A's of stress management, Techniques and Approaches, PATH method and relaxation techniques

Critical Thinking & Problem Solving: Creativity, Lateral thinking, Critical thinking, Multiple Intelligence, Problem Solving, Six thinking hats, Mind Mapping & Analytical Thinking.

Teamwork: Groups, Teams, Group Vs Teams, Team formation process, Stages of Group, Group Dynamics, Managing Team Performance & Team Conflicts.

Leadership Skills: Leadership, Levels of Leadership, Making of a leader, Types of leadership, Transactions Vs Transformational Leadership, VUCA Leaders, Leadership Grid & leadership Formulation**.**

TEXT BOOKS

1. Remesh.S., VishnuR.G., *LifeSkillsforEngineers*,RidhimaPublications,1st Edition,2016.
2. *Life Skills for Engineers*, Complied by ICT Academy of Kerala, McGraw Hill Education (India) Private Ltd., 2016.

REFERENCES

1. Shiv Khera, *You CanWin*, Macmillan Books, NewYork,2003.
2. Barun.K. Mitra, *Personality Development &Soft Skills*, Oxford Publishers, Thirdimpression, 2017.
3. Caruso, D. R. and Salovey P, *The Emotionally Intelligent Manager: Howto Develop and Use the Four Key Emotional Skills of Leadership*, John Wiley & Sons,2004.
4. Larry James, *The First Book of Life Skills*; Embassy Books, 1st Edition,2016.

COURSE PLAN

Module	Contents	No. of hours
I	**Overview of Life Skills**: Meaning and significance of life skills **Life skills identified by WHO**: Self- awareness, Empathy, Critical thinking, Creative thinking, Decision making, problem solving, Effective communication, interpersonal relationship, coping with stress, coping with emotion. **Life skills for professionals:** positive thinking, right attitude, attention to detail, having the big picture, learning skills, research skills, perseverance, setting goals and achieving them, helping others, leadership, motivation, self-motivation, and motivating others, personality development, IQ, EQ, and SQ	**6**
II	**Self-awareness**: Definition, need for self-awareness; Coping With Stress and Emotions, Human Values, tools and techniques of SA: questionnaires, journaling, reflective questions, meditation, mindfulness, psychometric tests, feedback. **Stress Management**: Stress, reasons and effects, identifying stress, stress diaries, the four A's of stress management, techniques, Approaches: action-oriented, emotion-oriented, acceptance- oriented, resilience, Gratitude Training, Coping with emotions: Identifying and managing emotions, harmful ways of dealing with emotions, PATH method and relaxation techniques. **Morals, Values and Ethics**: Integrity, Civic Virtue, Respect for Others, Living Peacefully. Caring, Sharing, Honesty, Courage, Valuing Time, Time management, Co operation, Commitment, Empathy, Self-Confidence, Character, Spirituality, Avoiding Procrastination, Sense of Engineering Ethics.	6
III	**21st century skills**: Creativity, Critical Thinking, Collaboration, Problem Solving, Decision Making, Need for Creativity in the 21st century, Imagination, Intuition, Experience, Sources of Creativity, Lateral Thinking, Myths of creativity, Critical thinking Vs Creative thinking, Functions of Left Brain & Right brain, Convergent & Divergent Thinking, Critical reading & Multiple Intelligence. **Steps in problem solving**: Problem Solving Techniques, Six Thinking Hats, Mind Mapping, Forced Connections. Analytical Thinking, Numeric, symbolic, and graphic reasoning. Scientific temperament and Logical thinking Thinking Hats, Mind Map.	6
IV	**Group and Team Dynamics**: Introduction to Groups: Composition, formation,	6

	Cycle, thinking, Clarifying expectations, Problem Solving, Consensus, Dynamics techniques, Group vs Team, Team Dynamics, Virtual Teams. Managing team performance and managing conflicts, Intrapreneurship.	
V	**Leadership**: Leadership framework, entrepreneurial and moral leadership, vision, cultural dimensions. Growing as a leader, turnaround leadership, managing diverse stakeholders, crisis management. Types of Leadership, Traits, Styles, VUCA Leadership, Levels of Leadership, Transactional vs Transformational Leaders, Leadership Grid, Effective Leaders.	6
	Total hours	30

Life skills- Practical part

1. Activities based on Creative thinking tools- 3 hours
2. Case studies on Morals and Ethics- 3hours
3. Problem solving using Mind map/Six Thinking Hats- 3 hours
4. Group Discussion: Differences between group discussion and debate; Ensuring success in group discussions- 3 hours
5. Oral presentation and public speaking skills; business presentations- 3 hours

MARK DISTRIBUTION

Total Marks	CIE	ESE	ESE Duration
150	50	50	2 hours

CONTINOUS INTERNAL EVALUATION PATTERN

Attendance	:	10 marks
Regular assessment	:	15 marks
Series test (one test only, should include first three modules)	:	25 marks

Course Code	Course Name	Category	L	T	P	Credit	Year of Introduction
PH0U18A	ENGINEERING PHYSICS LAB	BSC	0	0	2	1	2022

COURSE OVERVIEW:

The aim of this course is to enable the students to gain practical knowledge in Physics to correlate with the theoretical studies. It equips the students to utilize the acquired skills in an appropriate way to explore the prospects of modern technology. It brings more confidence in students and develop the ability to fabricate engineering and technical tools.

COURSE OUTCOMES

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

CO 1	Apply the theory of stretched string to determine the frequency of tuning fork using a Melde's string apparatus.	Apply
CO 2	Identify different wave patterns using CRO to determine the wave parameters.	Apply
CO 3	Determine the wavelength of a monochromatic beam of light and thickness of thin wire using principle of interference	Apply
CO 4	Make use of the ideas of diffraction to determine the wavelengths of a light using plane transmission grating.	Apply
CO 5	Experiment with non ohmic devices to draw the I-V characteristics	Apply

LIST OF EXPERIMENTS

1. Melde's string apparatus- Measurement of frequency in the transverse mode.
2. Wavelength measurement of a monochromatic source of light using Newton's Rings method.
3. Determination of diameter of a thin wire or thickness of a thin strip of paper using air wedge method.
4. Measurement of wavelength of a source of light using grating.
5. Determination of dispersive power and resolving power of a plane transmission grating.
6. Determination of the wavelength of any standard laser using diffraction grating
7. I-V characteristics of solar cell.
8. CRO-Measurement of frequency and amplitude of wave forms.

REFERENCES

1) S.L. Gupta and V. Kumar, *Practical physics with viva voce*, Pragati Prakashan Publishers, Revised Edition, 2009.
2) M.N. Avadhanulu, A.A. Dani and Pokely P.M., *Experiments in Engineering Physics*, S. Chand &Co, 2008.
3) S. K. Gupta, *Engineering Physics practicals*, Krishna Prakashan Pvt. Ltd., 2014
4) P. R. Sasikumar, *Practical Physics*, PHI Ltd., 2011.

MARK DISTRIBUTION

Total Marks	CIE	ESE	ESE Duration
100	70	30	1 hours

CONTINOUS INTERNAL EVALUATION PATTERN

Attendance : 20 marks

Class work/ Assessment /Viva-voce : 50 marks

Course Code	Course Name	Category	L	T	P	Credit	Year of Introduction
ES0U18A	CIVIL AND MECHANICAL WORKSHOP	ESC	0	0	2	1	2020

COURSE OVERVIEW

The course is designed to train the students to identify and manage the tools, materials and methods required to execute basic Civil and Mechanical Engineering activities. Students will be introduced to a team working environment where they develop the necessary skills for planning, preparing and executing a basic Engineering activity. It also enables the student to familiarize various tools, measuring devices, practices and different methods of manufacturing processes employed in industry for fabricating components.

COURSE OUTCOMES

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

CO 1	Name different devices and tools used for Civil Engineering measurements.	Remember
CO 2	Explain the use of various techniques and devices used in Civil Engineering measurements.	Understand
CO 3	Choose materials and methods required for basic Civil Engineering activities like field measurements, masonry work and plumbing.	Apply
CO 4	Demonstrate the steps involved in basic Civil Engineering activities like plot measurement, setting out operation, evaluating the natural profile of land, plumbing and undertaking simple construction work.	Apply
CO 5	Identify the tools and equipment used in fitting, carpentry, sheet metal, foundry, welding and smithy and various machine tools.	Remember
CO 6	Prepare simple models in fitting, carpentry, sheet metal, foundry, welding and smithy trades.	Apply
CO 7	Apply general safety precautions in different mechanical workshop trades.	Understand

LIST OF EXPERIMENTS

PART I

CIVIL WORKSHOP

1) Set out a one room building of given plan using tape only method and using tape and cross staff.
2) a) Use screw gauge and Vernier calliper to measure the diameter of a steel rod and thickness of a flat bar.
   b) Calculate the area of a built-up space and a small piece of land- Use standard measuring tape and digital distance measuring devices.

3) a) Construct a wall using currently used building blocks such as bricks (1 ½ thick brick wall using English bond), hollow blocks, solid blocks, etc. Use spirit level to assess the tilt of walls.
   b) Estimate the number of different types of building blocks required to construct a wall of given dimensions.
   c) Transfer the level from one point to another point using a water level.
4) Find the level difference between any two points using dumpy level (differential levelling).
5) a) Introduce the students to plumbing tools, different types of pipes, types of connections, traps, valves, fixtures and sanitary fittings.
   b) Study of installation of rain water harvesting system in an educational campus.
6) Introduce students to the principle and working of Total Station.
7) Demonstration of a simple construction work using concrete.

PART II
MECHANICAL WORKSHOP

1) General: Introduction to workshop practice, Safety precautions, Shop floor ethics, Basic First Aid knowledge, Study of mechanical tools
2) Carpentry: Understanding of carpentry tools and making minimum one model.
3) Foundry: Understanding of foundry tools and making minimum one model.
4) Sheet metal: Understanding of sheet metal working and making minimum one model.
5) Fitting: Understanding of fitting tools and making minimum one model.
6) Welding: Understanding of fitting tools and making minimum one model.
7) Smithy: Understanding of smithy tools and making minimum one model.
8) Machine Tools: Demonstration of various machines like shaping and slotting machine, milling machine, Grinding Machine, Lathe, Drilling Machine, CNC Machines, Power Tools. Demonstration of 3D Printer.

REFERENCES

1) Khanna, P. N., *Indian Practical Civil Engineering Handbook*, Engineers Publishers, 2012.
2) Purnima, B. C., Ashok, K. J. and Arun, K.J., *Surveying*, Vol. I, Laxmi Publications (P) ltd., New Delhi, 17th Edition, 2016.
3) Arora, S. P. and Bindra, S. P., *Building Construction*, DhanpatRai Publications,43rd Edition,2019.
4) Rangwala, S. C., *Engineering Materials*, Charotar Publishing House, Anand, 43rdEdition, 2019.
5) Sawhney, G.S., *Mechanical Experiments and Workshop Practice*, Dreamtech Press, 2019.
6) Varun, B., *Engineering Workshop: Civil and Mechanical Engineering Practice*, Notion Press, 1stEdition, 2020.

MARK DISTRIBUTION

Total Marks	CIE	ESE	ESE Duration
100	70	30	1 hour

Assessment Procedure: Total marks allotted for the course is 100 marks. CIE shall be conducted for70 marks and ESE for 30 marks. CIE should be done for the work done by the student and alsoviva voce based on the work done on each practical session. ESE shall be evaluated by writtenexamination of onehour duration conducted internally by the institute.

CONTINOUS INTERNAL EVALUATION PATTERN

Attendance	:	20 marks
Class work/ Assessment /Viva-voce	:	50 marks
End semester examination (Internally by college)	:	30 marks

SEMESTER II

Course Code	Course Name	Category	L	T	P	Credit	Year of Introduction
MA0U10B	VECTOR CALCULUS, DIFFERENTIAL EQUATIONS AND TRANSFORMS	BSC	3	1	0	4	2020

COURSE OVERVIEW:

The objective of this course is to familiarize the prospective engineers with some advanced concepts and methods in Mathematics which include the Calculus of vector valued functions, ordinary differential equations and basic transforms such as Laplace and Fourier Transforms which are invaluable for any engineer's mathematical tool box. The topics treated in this course have applications in all branches of engineering.

COURSE OUTCOMES

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

CO 1	Compute the derivatives and line integrals of vector functions and learn their applications.	Apply
CO 2	Evaluate surface and volume integrals and learn their inter-relations and applications.	Apply
CO 3	Solve linear ordinary differential equations.	Apply
CO 4	Apply Laplace transform to solve ODEs arising in engineering.	Apply
CO 5	Apply Fourier transforms of functions to solve problems arising in engineering.	Apply

SYLLABUS

Vector Calculus – Derivative of vector function, Gradient, Divergence, Curl, Line integral, conservative fields, Green's theorem, surface integral, Gauss divergence theorem, Stokes' theorem.

Ordinary Differential Equations- Homogeneous and Non-Homogeneous linear differential Equations, Euler-Cauchy equations. Method of undetermined coefficients and Method of variation of parameters.

Laplace transforms: Laplace Transform and its inverse, shifting theorems, Laplace transform of derivatives and integrals, solution of differential equations using Laplace transform, Unit step function. Dirac delta function, Convolution theorem and its applications.

Fourier Transforms: Fourier integral representation, Fourier sine and cosine integrals. Fourier transform and inverse Fourier transform. Fourier sine and cosine transforms, inverse sine and cosine transform, Convolution theorem.

TEXT BOOKS

1) H. Anton, I. BivenS.Davis, *Calculus*, Wiley, 10th Edition, 2015.

2) ErwinKreyszig, *Advanced Engineering Mathematics*, JohnWiley&Sons, 10th Edition, 2016.

REFERENCES

1) George F Simmons*: Differential Equation with Applications and its historical Notes*, McGraw Hill Education India, 2nd Edition, 2002.
2) HemenDutta, *Mathematical Methods for Science and Engineering*, CengageLearning,1stEdition, 2020.
3) B.S. Grewal, *Higher Engineering Mathematics*, Khanna Publishers, 44th Edition, 2018.

COURSE PLAN

Module	Contents	No. of hours
I	Calculus of vector functions: Vector valued function of single variable, derivative of vector function and geometrical interpretation, motion along a curve-velocity, speed and acceleration. Concept of scalar and vector fields, Gradient and its properties, directional derivative, divergence and curl, Line integrals of vector fields, work as line integral, Conservative vector fields, independence of path and potential function (results without proof).	12
II	Vector integral theorems: Green's theorem (for simply connected domains, without proof) and applications to evaluating line integrals and finding areas. Surface integrals over surfaces of the form z = g(x, y), y = g(x, z) or x = g(y, z) , Flux integrals over surfaces of the form z = g(x, y), y = g(x, z) or x = g(y, z), divergence theorem (without proof) and its applications to finding flux integrals, Stokes' theorem (without proof) and its applications to finding line integrals of vector fields and work done.	12
III	Ordinary differential equations: Homogenous linear differential equation of second order, superposition principle, general solution, homogenous linear ODEs with constant coefficients-general solution. Solution of Euler-Cauchy equations (second order only). Existence and uniqueness (without proof). Non homogenous linear ODEs-general solution, solution by the method of undetermined coefficients (for the right-hand side of the form xn, e^{kx}, $sinax$, $cosax$, $e^{kx}sinax$, $e^{kx}cosax$ and their linear combinations), methods of variation of parameters. Solution of higher order equations-homogeneous and non-homogeneous with constant coefficient using method of undetermined coefficient.	12
IV	Laplace transforms: Laplace Transform and its inverse, Existence theorem (without proof), linearity, Laplace transform of basic functions, first shifting theorem, Laplace transform of derivatives and integrals, solution of differential equations using Laplace transform, Unit step function, Second shifting theorems. Dirac delta function and its Laplace transform, Solution of ordinary differential equation involving unit step function and Dirac delta functions. Convolution theorem (without proof) and its application to finding inverse Laplace transform of products of functions.	12
V	Fourier Transforms: Fourier integral representation, Fourier sine and cosine integrals. Fourier sine and cosine transforms, inverse sine and cosine transform. Fourier transform and inverse Fourier transform, basic properties. The Fourier transform of derivatives. Convolution theorem (without proof).	12
	Total hours	60

MARK DISTRIBUTION

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

CONTINOUS INTERNAL EVALUATION PATTERN

Attendance	:	10 marks
Class work/ Assessment /Viva-voce	:	25 marks
Continuous Assessment Tests	:	15 marks

Course Code	Course Name	Category	L	T	P	Credit	Year of Introduction
CY0U10A	ENGINEERING CHEMISTRY-A	BSC	3	1	0	4	2022

COURSE OVERVIEW:

The aim of the engineering chemistry program is to expose the students to basic concepts of chemistry and its industrial as well as engineering applications. It also let the students to familiarize with different topics such as new-generation engineering materials, storage-devices, different instrumental methods etc.

COURSE OUTCOMES

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

CO 1	Solve various engineering problems by applying the basic concepts of Electrochemistry.	Apply
CO 2	Analyze organic compounds by applying the basic concepts of UV-Visible, IR and NMR spectroscopic techniques.	Apply
CO 3	Select relevant techniques for identification and separation of a given chemical mixture including nanomaterials.	Understand
CO 4	Select relevant polymers by applying the concept of conducting polymers, isomerism and advanced polymers.	Understand
CO 5	Examine the various types of hardness in water and their elimination.	Apply

SYLLABUS

Electrochemistry – Cell prototypes, Nernst equation and its uses, different types of cells and applications of electrochemical series. Fundamentals of corrosion and its prevention.

Basics of Spectroscopy – Principles and applications of UV-Vis, IR and NMR spectroscopy, instrumentation of UV-Vis spectroscope, colorimetry, MRI technique.

Instrumental methods in chemistry and Engineering materials – TGA, DTA, and chromatography techniques; Basics of polymer chemistry, BS, ABS and Kevlar and conducting polymers, Classifications of nanomaterials, synthesis, SEM, CNT, graphene.

Stereochemistry and polymer chemistry– Different types of isomers with examples; Notations; Conformational analysis, Types of polymers, ABS, Kevlar and applications. Polyaniline and Polypyrrole - preparation properties and applications, OLED.

WaterTechnology–Types of hardwater and its elimination, DO, BOD and COD and its significance, disinfection of water, reverse osmosis, sewage water treatment.

TEXT BOOKS

1) D. Harvey, N. Rutledge, *Industrial Chemistry*, ETP,1st Edition, 2018. ISBN: 9781788820554
2) P. W. Atkins, J de Paula, *Atkins' Physical Chemistry*, Oxford University Press, 11th Edition 2014. ISBN: 9780199697403
3) M. Arif, A. Fernandez, K. P. Nair, *Engineering Chemistry*, Owl Books, 1st Edition, 2015.
4) S. Chawla, *A text book of Engineering Chemistry*, DhanpatRai& Co., 2nd Edition, 2013.

REFERENCES

1) C. N. Banwell, E. M. Mc Cash, *Fundamentals of Molecular Spectroscopy*, McGraw-Hill, 4th edition, 2001. ISBN: 9780074620250

2) H. H. Willard, L. L. Merritt,*Instrumental Methods of Analysis*, CBS Publishers, 7th edition, 2005. ISBN: 9788123909431

3) A. J. Peacock, A. Calhoun, C. Hanser*, Polymer Chemistry: Properties and Application*, Verlag GmbH & Company KG, 2012. ISBN: 9783446433434

4) C. Binns*, Introduction to Nanoscience and Nanotechnology*, Wiley, 2010. ISBN:9780471776475

COURSE PLAN

Module	Contents	No. of hours
I	**Electrochemistry and corrosion:** Introduction - Differences between electrolytic and electrochemical cells- Daniel cell - redox reactions - cell representation. Different types of electrodes (brief) - Reference electrodes- SHE - Calomel electrode - Glass Electrode – Construction and Working. Single electrode potential – definition - Helmholtz electrical double layer - Determination of E^0 using calomel electrode. Determination of pH using glass electrode. Electrochemical series and its applications. Free energy and EMF -Nernst Equation – Derivation - single electrode and cell (Numericals) –Application - Variation of EMF with temperature. Potentiometric titration - Introduction -Redox titration only. Lithium ion cell - construction and working. Conductivity- Measurement of conductivity of a solution (Numericals). Corrosion-Electrochemical corrosion – mechanism. Galvanic series- cathodic protection - electroless plating –Copper and Nickel plating.	12
II	**Spectroscopic Techniques and applications:** Introduction- Types of spectrum - electromagnetic spectrum - molecular energy levels - Beer Lambert's law (Numericals). UV-Visible Spectroscopy – Principle - Types of electronic transitions – Energy level diagram of ethane, butadiene, benzene and hexatriene. Instrumentation of UV-Visible spectrometer and applications. IR-Spectroscopy – Principle - Number of vibrational modes -Vibrational energy states of a diatomic molecule and -Determination of force constant of diatomic molecule (Numericals) –Applications. 1H NMR spectroscopy – Principle - Relation between field strength and frequency- chemical shift - spin-spin splitting (spectral problems) - coupling constant (definition) - applications of NMR- including MRI	**12**

	(brief).	
III	**Instrumental Methods and Nanomaterials:** Thermal analysis –TGA-Principle, instrumentation (block diagram) and applications – TGA of CaC2O4.H2O and polymers. DTA-Principle, instrumentation (block diagram) and applications - DTA of CaC2O4.H2O. Chromatographic methods - Basic principles and applications of column and TLC- Retention factor. GC and HPLC-Principle, instrumentation (block diagram) - retention time and applications. Nanomaterials - Definition - Classification - Chemical methods of preparation -Hydrolysis and Reduction - Applications of nanomaterials – Surface characterisation -SEM – Principle and instrumentation (block diagram).	**12**
IV	**Stereochemistry and Polymer Chemistry**: Isomerism-Structural, chain, position, functional, tautomerism and matamerism - Definition with examples - Representation of 3D structures-Newman, Sawhorse, Wedge and Fischer projection of substituted methane and ethane. Stereoisomerism - Geometrical isomerism in double bonds and cycloalkanes (cis-trans and E-Z notations). R-S Notation – Rules and examples - Optical isomerism, Chirality, Enantiomers and Diastereoisomers-Definition with examples. Conformational analysis of ethane, butane, cyclohexane, mono and di methyl substituted cyclohexane. Copolymers - Definition - Types - Random, Alternating, Block and Graft copolymers - ABS - preparation, properties and applications. Kevlar-preparation, properties and applications. Conducting polymers - Doping -Polyaniline and Polypyrrole - preparation properties and applications. OLED - Principle, construction and advantages.	**12**
V	**Water Chemistry and Sewage Water Treatment:** Water characteristics - Hardness - Types of hardness- Temporary and Permanent- Disadvantages of hard water -Units of hardness- ppm and mg/L -Degree of hardness (Numericals) - Estimation of hardness-EDTA method (Numericals). Water softening methods-Ion exchange process-Principle, procedure and advantages. Reverse osmosis – principle, process and advantages. Municipal water treatment (brief) - Disinfection methods - chlorination, ozone and UV irradiation.	**12**

	Dissolved oxygen (DO) -Estimation (only brief procedure-Winkler's method), BOD and COD-definition, estimation (only brief procedure) and significance (Numericals). Sewage water treatment - Primary, Secondary and Tertiary - Flow diagram -Trickling filter and UASB process.	
	Total hours (Approx.)	**60**

MARK DISTRIBUTION

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

CONTINOUS INTERNAL EVALUATION PATTERN

Attendance	:	10 marks
Continuous Assessment Tests	:	25 marks
Assignment	:	15 marks

Course Code	Course Name	Category	L	T	P	Credit	Year of Introduction
ES0U10B	ENGINEERING GRAPHICS	ESC	2	0	2	3	2020

COURSE OVERVIEW:

Aim of the course is to enable the student to effectively perform technical communication through graphical representation as per global standards. The student will be able to apply the principles of projection and will be introduced to the fundamentals of Computer Aided Drawing (CAD).

COURSE OUTCOMES

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

CO 1	Construct the orthographic projection of points and lines located in different quadrants.	Apply
CO 2	Prepare multi view orthographic projection of solids by visualizing them in different positions.	Apply
CO 3	Construct sectional views and develop surfaces of a given solid.	Apply
CO 4	Prepare pictorial drawings using the principles of isometric and perspective projection to visualize objects in three dimensions.	Apply
CO 5	Convert pictorial views into orthographic views.	Apply
CO 6	Prepare multi view projection and solid models of objects using CAD tools.	Apply

SYLLABUS

Introduction - Relevance of technical drawing in engineering field, BIS code of practice for technical drawing.

Orthographic projection - Projection of points and lines in different quadrants, traces of line. Projection of solids in simple position, axis inclined to one reference plane and axis inclined to both reference planes.

Sections of Solids - Sections of solids cut by different section planes, true shape of the sections

Development of Surfaces - Development of surfaces of solids and solids cut by different section planes.

Isometric Projection - Isometric view and projection of solids and their combinations.

Perspective Projection - Perspective projection of solids with axis perpendicular to the ground plane and axis perpendicular to picture plane.

Conversion of Pictorial Views - Conversion of pictorial views into orthographic views.

Introduction to Computer Aided Drawing - Creating 2D drawing and 3D models of various components using suitable modelling software.

TEXT BOOKS

1) Bhatt N.D, *Engineering Drawing*, Charotar Publishing House Pvt. Ltd, 53rd Edition, 2019.
2) John K.C., *Engineering Graphics*, Prentice Hall India Publishers, 1st Edition, 2009.
3) C. M.Agrawal, BasantAgrawal, *Engineering Graphics*, Tata McGraw-Hill, 1stEdition, 2012.

REFERENCES

1) G. S. Phull, H. S.Sandhu, *Engineering Graphics*, John Wiley & Sons IncPvt. Ltd, 1st Edition, 2014.
2) P. I.Varghese, *Engineering Graphics*, V.I.P. Publishers,21st Edition, 2010.
3) Anil Kumar K.N., *Engineering Graphics*, Adhyuth Narayan Publishers, 4th Edition, 2009.

COURSE PLAN

Module	Contents	No. of hours
I	Introduction: Relevance of technical drawing in engineering field. Types of lines, dimensioning, BIS code of practice for technical drawing. Orthographic projection of points and lines: Projection of points in different quadrants, projection of straight lines inclined to one plane and inclined to both planes. Trace of line, inclination of lines with reference planes, true length of line inclined to both the reference planes.	8
II	Orthographic projection of solids: Projection of simple solids such as triangular, rectangle, square, pentagonal and hexagonal prisms, pyramids, cone and cylinder. Projection of solids in simple position including profile view. Projection of solids with axis inclined to one of the reference planes and with axis inclined to both reference planes.	9
III	Sections of Solids: Sections of prisms, pyramids, cone, cylinder with axis in vertical position and cut by different section planes. True shape of the sections. Locating the section plane when the true shape of the section is given. Development of surfaces: Development of surfaces of the above solids and solids cut by different section planes. Finding the shortest distance between two points on the surface.	9
IV	Isometric projection: Isometric view and projection of prisms, pyramids, cone, cylinder, frustum of pyramid, frustum of cone, sphere, hemisphere and their combinations.	6
V	Perspective projection: Perspective projection of prisms and pyramids with axis perpendicular to the ground plane, axis perpendicular to picture plane. Conversion of pictorial view: Conversion of pictorial view into orthographic views.	5
SECTION B *(To be conducted in CAD Lab)*		
	Introduction to Computer Aided Drawing: Role of CAD in design and development of new products, advantages of CAD. Creating two-dimensional drawing with dimensions using suitable software. (Minimum 2 exercises mandatory) Introduction to Solid Modelling: Creating 3D models of various components using suitable modelling software. (Minimum 2 exercises mandatory)	8
	Total hours	45

MARK DISTRIBUTION

Total Marks	CIE	ESE	ESE Duration
100	50	100	3 hours

CONTINOUS INTERNAL EVALUATION PATTERN

Attendance	:	10 marks
CIA for section A carries	:	25 marks(15 marks for 1 test and Class work 10 marks)
CIA for section B carries	:	15 marks(10 marks for 1 test and Class work 5 marks)

Course Code	Course Name	Category	L	T	P	Credit	Year of Introduction
ES0U10D	BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING	ESC	4	0	0	4	2020

COURSE OVERVIEW

This course aims to equip the students with an understanding of the fundamental principles of electrical, electronics and communication engineering.

COURSE OUTCOMES

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

CO 1	Apply fundamental circuit laws and principles of electromagnetism to solve simple DC electric circuits and magnetic circuits respectively.	Apply
CO 2	Describe the fundamentals of AC generation to perform simple AC circuit analysis.	Understand
CO 3	Describe the principles of passive components, semiconductor devices and its characteristics.	Understand
CO 4	Explain the working of electronic circuits, instrumentation, radio and cellular communication systems.	Understand

SYLLABUS

Basic concepts of DC circuits: Ohm's Law and Kirchhoff's laws, Star-delta conversion, Analysis of DC circuits, Mesh analysis, Node analysis.

Magnetic Circuits: Basic Terminology, Simple Magnetic circuits, Electromagnetic Induction, Faraday's laws, Lenz's law, Self-inductance and mutual inductance.

Alternating Current fundamentals: Basic definitions, Average, RMS values, AC Circuits, Phasor representation, Analysis of simple AC circuits (R, L, C, RL, RC, RLC Series circuits) Three phase AC systems, Generation of three phase voltages, star and delta connections.

Introduction to Semiconductor devices: Evolution of electronics, Resistors, Capacitors, Inductors PN Junction diodes and Bipolar Junction Transistors.

Basic electronic circuits and instrumentation: DC power supply, Full wave bridge rectifier, Capacitor filter, Simple Zener voltage regulator, Amplifiers, Public Address system and ElectronicEquipments.

Introduction to Communication Systems: Evolution of communication systems, Radio communication, Principle of antenna and Mobile communication.

TEXT BOOKS

1) William H. Hayt., Jr., Jack E. Kemmerly, Steven M. Durbin., *Engineering Circuit Analysis*, McGraw-Hill, 8th Edition, 2012.
2) Kothari D. P. and Nagrath I. J., *Basic Electrical Engineering*, Tata McGraw Hill, 2010.
3) Fitzgerald A.E., David Higginbotham E., Arvin Grabel, *Basic Electrical Engineering*, Tata McGraw Hill, 5th Edition,2009.

4) Boylested, R. L. and Nashelsky, L., *Electronic Devices and Circuit Theory*, Pearson Education, 10th Edition, 2009.
5) Wayne Tomasi and Neil Storey, *A Textbook on Basic Communication and Information Engineering*, Pearson, 5th Edition, 2010.

REFERENCES

1) Paul Breeze, *Power Generation Technologies,* Newnes,3rd Edition, 2019.
2) Allan HambleyR., *Electrical Engineering: Principles & Applications*, Pearson Education,7th Edition, 2018.
3) Mittle V. N. and Arvind Mittal, *Basic Electrical Engineering*, McGraw Hill,2nd Edition, 2006.
4) N.N. Bhargava , D.C. Kulshreshtha , S.C. Gupta, *Basic Electronics and Linear Circuits*, Tata McGraw - Hill Education, New Delhi, 2nd Edition, 2014.

COURSE PLAN

Module	Contents	No. of hours
I	**DC circuits:** Review of Elementary concepts of DC circuits, Current and Voltage Division Rules, Star-delta conversion (resistive networks only-derivation not required), Numerical problems.	9
	Analysis of DC circuits: Mesh current method, Node voltage method. Solution of network equations by matrix method, Numerical problems.	
	Magnetic Circuits: Review of Magnetic Circuits, Series magnetic circuits with composite materials, Numerical problems.	
II	**Electromagnetic Induction:** Faraday's laws, Lenz's law, statically induced and dynamically induced emfs, Self-inductance and mutual inductance, coefficient of coupling (derivation not required), Numerical Problems.	9
	Alternating Current fundamentals: Generation of alternating voltages, Basic definitions, Average and RMS values of sinusoidal waveforms, Numerical Problems.	
	Power Generating Stations: Solar, Wind, Hydro-electric and Nuclear power stations, Basic concepts with block diagrams only.	
III	**Analysis of AC Circuits:** Transient Analysis of RL circuit, Steady state Analysis of RL circuit, Phasor representation of sinusoidal quantities, Complex forms. **Analysis of simple AC circuits:** Purely resistive, inductive and capacitive circuits; Analysis of RL, RC and RLC series circuits, active, reactive and apparent power. Illustrations using simple example.	12

	Three phase AC systems: Generation of three phase voltages, advantages of three phase systems, star and delta connections (balanced only), relation between line and phase voltages, line and phase currents, Power in three phase circuit, Numerical problems.	
IV	Introduction to Semiconductor devices	
	Evolution of electronics – Vacuum tubes to nano electronics (In evolutional perspective only)	1
	Resistors, Capacitors and Inductors: types, specifications, standard values, colour coding (No constructional features)	2
	PN Junction diode: Principle of operation, V-I characteristics, principle of avalanche breakdown and Zener breakdown	2
	Bipolar Junction Transistors: PNP and NPN structures, principle of operation, relation between current gains in CE, CB and CC Configurations, input and output characteristics of common emitter configuration.	5
V	**Basic electronic circuits and instrumentation**	
	Rectifiers and Power supplies: Block diagram description of a dc power supply, working of a full wave bridge rectifier, capacitor filter (no analysis), working of simple Zener voltage regulator	3
	Amplifiers: Concept of voltage divider biasing, circuit diagram and working of common emitter (RC coupled) amplifier with its frequency response, block diagram of Public Address system.	5
	Electronic Instrumentation: Block diagram of an electronic instrumentation system, functions of various equipments (multimeter, DSO and function generator)	2
VI	**Introduction to Communication Systems**	
	Evolution of communication systems: Telegraphy to 5G	1
	Radio communication: Principle of AM & FM, frequency bands used for various communication systems, block diagram of super heterodyne receiver. **Principle of antenna:** Radiation from accelerated charge	5
	Mobile communication: Basic principles of cellular communications, principle and block diagram of GSM.	4
	Total hours	60

Suggested Simulation Assignments for Basic Electronics Engineering

(1) Plot V-I characteristics of Si and Ge diodes on a simulator.
(2) Plot Input and Output characteristics of BJT on a simulator.
(3) Implementation of half wave and full wave rectifiers.

(4) Simulation of RC coupled amplifier with the design supplied.
(5) Generation of AM signal.

Note: The simulations can be done on open tools such as Proteus, QUCS, KiCad, GNURadio or similar software to augment the understanding.

MARK DISTRIBUTION

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

CONTINOUS INTERNAL EVALUATION PATTERN

Attendance	:	10 marks
Continuous Assessment Tests	:	25 marks
Assignment/Quiz/Course Project	:	15 marks

Course Code	Course Name	Category	L	T	P	Credit	Year of Introduction
HS0U10B	PROFESSIONAL COMMUNICATION	HSC	2	0	2	--	2020

COURSE OVERVIEW:

The objective of this course is to equip students with the necessary skills to listen, read, write, and speak so as to comprehend and successfully convey any idea, technical or otherwise, as well as give them the necessary polish to become persuasive communicators. The course aims to enhance the employability and career Skills of students and orient the students towards grooming as a professional.

COURSE OUTCOMES

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

CO 1	Develop effective language skills relevant to Engineering as a profession and demonstrate these through writing and making presentations.	Create
CO 2	Analyze, interpret and effectively summarize a variety of textual and audio content for specific needs.	Analyze
CO 3	Apply appropriate thinking and problem solving techniques to solve new case studies.	Apply
CO 4	Present and analyses a given technical/non-technical topic in a group setting and arrive at generalizations/consensus.	Analyze
CO 5	Create professional and technical documents that are clear and adhering to all thenecessary conventions.	Create
CO 6	Manage and apply interviewing skills.	Apply

SYLLABUS

Communication Skills: Introducing yourself and others professionally, elevator pitch, recommendation letter, e-mails, netiquettes, telephone etiquettes, demi-official letters.

Business Communication and Technical writing: Product description, narrating an incident, report writing, agenda and minutes, memo, asking for information and giving information, explaining processes and products, giving instructions, planning a course of action.

Creative Thinking, Critical Thinking Skills and problem solving: Expressing opinion, GD, Arguing, reading critical texts (general and academic) and summarizing, listening and responding, Negotiation strategies and decision making skills.

Presentation Skills: OralPresentation Skills (Proposal presentation), Power point presentation (Projects).

Interviews: CVs and Resumes, Job application, Types of interviews, successful interviews, interview etiquette, dress code, body language, telephone/online (Skype) interviews, one-to-one interview & panel interview, FAQs related to job interviews.

TEXT BOOKS

1. Meenakshi Raman and Sangeetha Sharma (2018). *Professional Communication*, Oxford University Press, 3rdEdition, 2018.
2. Meenakshi Raman and Sangeetha Sharma*, Technical Communication: Principles and Practice*, Oxford University Press, 2nd Edition, 2011.

3. Ashraf RizviM., *Effective Technical Communication*. New Delhi: Tata McGraw Hill Publications, 2007.

REFERENCES

1. *English for Engineers and Technologists* (Combined edition, Vol. 1 and 2, Orient Blackswan, 2010.
2. Stephen E. Lucas, *The Art of Public Speaking*, 10th Edition; McGraw Hill Education, 2012.
3. William Strunk Jr. & E.B. White, *The Elements of Style*, 4thEdition, Pearson, 1999.
4. David F. Beer and David*, Guide to writing as an Engineer*, John Willey. New York, 2004.
5. Goodheart-Willcox, *Professional Communication*, 1stEdition, 2017.
6. *Training in Interpersonal Skills: Tips for Managing People at Work,* Pearson Education, India, 6th Edition,2015.
7. *The Ace of Soft Skills: Attitude, Communication and Etiquette for Success*, Pearson Education; 1st Edition, 2013.
8. AnandGanguly, *Success in Interview*, RPH, 5thEdition, 2016.
9. Raman Sharma, *Technical Communications*, Oxford Publication, London, 2004.

COURSE PLAN

Module	Contents	No. of hours
I	Use of language in communication: Significance of technical communication VocabularyDevelopment: technical vocabulary, vocabulary used in formal letters/emails and reports, sequencewords, misspelled words, compound words, finding suitable synonyms, paraphrasing, verbal analogies. Language Development: subject-verb agreement, personal passive voice, numericaladjectives, embedded sentences, clauses, conditionals, reported speech, active/passive voice. Technology-based communication: Effective email messages, slide presentations, editing skills using software. Modern day research and study skills: search engines, repositories, forums such as GitHub, Stack Exchange, OSS communities (MOOC, SWAYAM, NPTEL), and Quora; Plagiarism	**6**
II	Reading, Comprehension, and Summarizing: Reading styles, speed, valuation, critical reading,reading and comprehending shorter and longer technical articles from journals, newspapers,identifying the various transitions in a text, SQ3R method, PQRST method, speed reading. Comprehension: techniques, understanding textbooks, marking and underlining, Note-taking:recognizing non-verbal cues.	**6**
III	Oral Presentation: Voice modulation, tone, describing a process, Presentation	**6**

	Skills: Oralpresentation and public speaking skills, business presentations, Preparation: organizing the material, self-introduction, introducing the topic, answering questions, individual presentation practice, presenting visuals effectively. Debate and Group Discussions: introduction to Group Discussion (GD), differences between GD anddebate; participating GD, understanding GD, brainstorming the topic, questioning and clarifying, GDstrategies, activities to improve GD skills.	
IV	Listening and Interview Skills Listening: Active and Passive listening, listening: for general content, to fill up information, intensive listening, for specific information, to answer, and to understand. Developing effective listening skills, barriers to effective listening, listening to longer technical talks, listening to classroom lectures, talks on engineering /technology, listening to documentaries and making notes, TED talks. Interview Skills: types of interviews, successful interviews, interview etiquette, dress code, body language, telephone/online (skype) interviews, one-to-one interview & panel interview, FAQs related to job interviews.	**6**
V	Formal writing: Technical Writing: differences between technical and literary style. Letter Writing (formal, informal and semi-formal), Job applications, Minute preparation, CV preparation (differences between Bio-Data, CV and Resume), and Reports. Elements of style, Common Errors in Writing: describing a process, use of sequence words, Statements of Purpose, Instructions, Checklists. Analytical and issue-based Essays and Report Writing: basics of report writing; Referencing Style (IEEE Format), structure of a report; types of reports, references, bibliography	**6**
	Total Hours	**30**

Lab Activities

Written: Letter writing, CV writing, Attending a meeting and Minute Preparation, Vocabulary Building
Spoken: Phonetics, MMFS (Multimedia Feedback System), Mirroring, Elevator Pitch, telephone etiquette, qualities of a good presentation with emphasis on body language and use of visual aids.
Listening: Exercises based on audio materials like radio and podcasts. Listening to Song practiceand exercises.
Reading: Speed Reading, reading with the help of Audio Visual Aids, Reading Comprehension Skills
Mock interview and Debate/Group Discussion: concepts, types, Do's and don'ts- intensive practice.

MARK DISTRIBUTION

Total Marks	CIE	ESE	ESE Duration
100	50	50	2 hours

CONTINOUS INTERNAL EVALUATION PATTERN

Attendance	:	10 marks
Class work/ Assessment /Viva-voce	:	25 marks
Continuous Assessment Tests	:	15 marks

Course Code	Course Name	Category	L	T	P	Credit	Revised in 2022
ES0U10F	INTRODUCTION TO COMPUTER PROGRAMMING	ESC	2	1	2	4	

COURSE OVERVIEW:

This course aims to introduce the concepts of structured programming. It covers basic concepts of C programming language including arrays, functions, pointers and files. This course involves a lab component which equips the learner to solve computational problems through programming.

COURSE OUTCOMES

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

CO 1	Explain the fundamentals of computer architecture and types of software.	Understand
CO 2	Develop a solution using algorithm/flowchart to a computational problem.	Apply
CO 3	Construct programs with control statements and arrays.	Apply
CO4	Make use of user defined data types or functions to solve computational problems.	Apply
CO5	Develop programs using files and pointers.	Apply

SYLLABUS

Computer architecture & Programming Languages – Basics of Computer architecture, Types of Programming Languages, System Software, Application Software, Introduction to structured programming, Algorithms, Flowcharts and Pseudo-codes

C Programming Language – Data Types, variables, keywords, Constants, Operators and Expressions, Control Flow Statements- Conditional statements, Iterative statements, programs

Arrays and Strings– Multidimensional arrays and matrices, String processing, searching and sorting in 1D array.

Functions – Scope of variable, Pass by reference and value methods, Recursive functions. Structures and union, Storage Classes

Pointers and Files- File Operations, Sequential access and random access, programs covering pointers and files.

TEXT BOOKS

1) Byron Gottfried, *Programming with C* (Schaum's Outlines Series), Mcgraw Hill Education, 3rd Edition, 2017.
2) H. M. Deitel, P. J. Deitel, *C: How to program*, 7th Edition, Pearson Education, 2010.
3) Anita Goel, Computer Fundamentals, Pearson, 1st Edition, 2010.
4) Ellis Horowits, SartajSahini, Susan Anderson Freed, *Fundamentals of Data Structures in C*, 2ndEdition, 2008.

REFERENCES

1) Brian W. Kernighan and Dennis M. Ritchie, *C Programming Language*, Pearson, 2nd Edition, 2015.
2) Rajaraman V, PHI, *Computer Basics and Programming in C*, 1st Edition, 2007.
3) Anita Goel and Ajay Mittal, *Computer fundamentals and Programming in C*, 1st Edition, 2013.

COURSE PLAN

Module	Contents	No. of hours
I	Basics of Computer architecture. -Von-Neumann Architecture- Processor, Memory, Input and Output devices. Types of Programming Languages, System Software, Application Software: Compilers, Interpreters, high level and low levellanguages Introduction to structured programming, Algorithm, flowcharts and Pseudo-code -Examples	**14**
II	Basic structure of C program: Character set, Identifiers, Variables and Data Types, Constants, Console IO Operations,Operators and Expressions, Operators Precedence. Control Flow Statements: If Statement, Switch Statement, Unconditional Branching using goto statement, While Loop, Do..While Loop, For Loop, Break and Continue statements.	**15**
III	Arrays, Multidimensional arrays and matrices. Linear search and Bubble Sort in array. String processing: String handling functions Simple programs covering arrays and strings	**15**
IV	Functions: The prototype declaration, Function definition. Function call: Passing arguments to a function, by value, by reference. Scope of variable names. Recursive function calls. Storage Classes. Structures in C : Motivation, declaration and use. Operations on structures, Array of structures, Passing arrays and structures as function arguments.	**15**
V	Pointers: Pointer variables. Declaring and dereferencing pointer variables. Accessing arrays through pointers. Dynamic memory allocation- malloc(), realloc(), calloc(), free() - self referential structure. File Operations: open, close, read, write, append Sequential access and random access to files: In built file handling functions (rewind (), fseek (), ftell(), feof (), fread (), fwrite()), simple programs covering pointers and files.	**16**
	Total hours	**75**

C PROGRAMMING LAB(Practical Part of ES0U10F)

1. Familiarization of console I/O and operators in C
   i) Display “Hello World”
   ii) Read two numbers, add them and display their sum
   iii) Read the radius of a circle, calculate its area and display it
   iv) Area of triangle after reading its sides
2. Read 3 integer values and find largest of three numbers.

3. Check whether given year is leap year.
4. Display the grade of a student after reading his mark for a subject. (Use switch)
5. Read a Natural Number and check whether the number is prime or not
6. Read a Natural Number and check whether the number is Armstrong or not

7. Display second largest number after reading n numbers from user. (Without array).
8. Read n integers, store them in an array and find their sum and average
9. Read n integers, store them in an array and search for an element in the array using an algorithm for Linear Search
10. Read n integers, store them in an array and sort the elements in the array using Bubble Sort algorithm
11. Write a menu driven program for performing matrix addition, multiplication and finding the transpose. Use functions to (i) read a matrix, (ii) find the sum of two matrices, (iii) find the product of two matrices, (i) find the transpose of a matrix and (v) display a matrix.
12. Display sum of diagonal elements of a matrix
13. Read a string (word), store it in an array and check whether it is a palindrome word or not.
14. Read a string (ending with a $ symbol), store it in an array and count the number of vowels, consonants and spaces in it.
15. Display first n prime numbers using Function.
16. Program to find the sum of digits of a number using recursion
17. Using structure, read and print data of n employees (Name, Employee Id and Salary)
18. Read the marks of three subjects for n students of a class and display their names in the order of rank. (Use array of structure)
19. Input and Print the sum of elements of an array using pointers
20. Create a file and perform the following
    - **i)** Write data to the file
    - **ii)** Read the data in a given file & display the file content on console
    - **iii)** append new data and display on console
21. Open a text input file and count number of characters, words and lines in it; and store the results in an output file.

MARK DISTRIBUTION

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

CONTINOUS INTERNAL EVALUATION PATTERN

Attendance	:	10 marks
Continuous Assessment Test 1 (for theory, for 2 hrs)	:	20 marks
Continuous Assessment Test 2 (for lab, internal examination, for 2 hrs)	:	20 marks

Course Code	Course Name	Category	L	T	P	Credit	Year of Introduction
CY0U18A	ENGINEERING CHEMISTRY LAB	BSC	0	0	2	1	2022

COURSE OVERVIEW:

This course is designed to familiarize with the basic experiments in industrial chemistry and to accustom the students with the handling and analyzing chemicals and standard laboratory equipments.

COURSE OUTCOMES

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

CO 1	Use volumetric titration techniques for quantitative analysis of water.	Apply
CO 2	Use spectroscopic techniques for analyzing and interpreting the IR spectra and NMR spectra of some organic compounds.	Apply
CO 3	Use instrumental techniques for quantitative chemical analysis.	Apply
CO 4	Organize scientific experiments as a team to analyze the results of such experiments.	Analyze
CO 5	Interpret experimental data by themselves to apply them to real world problems.	Analyze

LIST OF EXPERIMENTS

1. Estimation of total hardness of water by EDTA method.
2. Analysis of IR and 1H NMR spectra of organic compounds.
3. Determination of wavelength of absorption maximum and colorimetric estimation of Fe3+ in solution.
4. Determination of molar absorptivity of a compound.
5. Estimation of chloride in water by argentometric method.
6. Calibration of pH meter and determination of pH of a solution.
7. Potentiometric titration: Acid – base titration
8. Estimation of dissolved oxygen in water by Winkler's method.

REFERENCES

1) R. K. Mohapatra, *Engineering Chemistry with Laboratory Experiments*, 2015, First edition, PHI Learning, New Delhi.
2) S. C. George, R. Jose, Lab *Manual of Engineering Chemistry*, 2019, First edition, S. Chand & Company Pvt Ltd, New Delhi.
3) E. Slowinski, W. C. Wolsey, *Chemical Principles in the Laboratory*, 2008, Cengage Learning, 11th edition, New Delhi.

MARK DISTRIBUTION

Total Marks	CIE	ESE	ESE Duration
100	70	30	1 hour

CONTINOUS INTERNAL EVALUATION PATTERN

Attendance : 20 marks

Class work/ Assessment /Viva-voce : 50 marks

Course Code	Course Name	Category	L	T	P	Credit	Year of Introduction
ES0U18B	ELECTRICAL AND ELECTRONICS WORKSHOP	ESC	0	0	2	1	2020

COURSE OVERVIEW:

- To expose the students to the commonly used accessories and components in electrical installations and to provide hands on experience of wiring of electrical circuits.
- To enable the students to familiarize, identify, construct, and debug the electronic components, devices and circuits. It also enables the student's engineering skills by soldering practices of electronic circuits.

COURSE OUTCOMES

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

CO 1	Identify electrical accessories, protective elements and their standard symbols and the tools used for electrical wiring.	Remember
CO 2	Develop the connection diagram, identify the suitable accessories and materials necessary for wiring simple lighting circuits for domestic buildings.	Apply
CO 3	Identify different types of batteries and different types of earthing.	Remember
CO 4	Explain the working and purpose of fuse, MCB, ELCB etc. and solar powered circuit.	Understand
CO 5	Identify and test various electronic components.	Understand
CO 6	Draw circuit schematics with EDA tools.	Apply
CO 7	Assemble and test electronic circuits on boards.	Apply

LIST OF EXPERIMENTS

PART I
ELECTRICAL WORKSHOP

1. Familiarization/Identification of electrical components with specification (Functionality, type, size, colour coding, symbol, cost etc. of Wires, Cables, Connectors, Fuses, MCB, ELCB, Switches and other electrical installation equipments with ratings).
2. Wiring of one lamp controlled by one SPST switch and a plug socket (PVC conduit wiring).
3. Wiring of light/fan circuit controlled by two SPDT switches (Staircase wiring).
4. Wiring of a light circuit and a power circuit for domestic applications.
5. Wiring of simple solar chargeable circuit and determination of its characteristics.
6. Demonstration of power distribution arrangement using single phase MCB distribution board with ELCB, main switch and Energy meter.
7. Understand the safety precautions to be observed in the workshop and learn about safety procedures of first aid in case of electrical hazards.
8. Video demonstration of Pipe and Plate Earthing Schemes.

PART II
ELECTRONICS WORKSHOP

1 Familiarization/Identification of electronic components with specification (Functionality, type, size, colour coding, package, symbol, cost etc. (Active, Passive, Electrical, Electronic, Electro-mechanical, Wires, Cables, Connectors, Fuses, Switches, Relays, Crystals, Displays, Fasteners, Heat sink etc.))

2 Drawing of electronic circuit diagrams using standard symbols and introduction to EDA tools, Interpret data sheets of discrete components and IC's, Estimation and costing.

3 Familiarization/Application of testing instruments and commonly used tools. [Multimeter, Function generator, Power supply, DSO etc.] [Soldering iron, Desoldering pump, Pliers, Cutters, Wire strippers, Screw drivers, Tweezers, Crimping tool, Hot air soldering and de-soldering station etc.]

4 Testing of electronic components [Resistor, Capacitor, Diode, Transistor and JFET using multimeter]

5 Inter-connection methods and soldering practice. [Bread board, Wrapping, Crimping, Soldering - types - selection of materials and safety precautions, soldering practice in connectors and general-purpose PCB, Crimping.]

6 Printed circuit boards (PCB) [Types, Single sided, Double sided, PTH, Processing methods, Design (using Proteus) and fabrication of a single sided PCB for a simple circuit with manual etching (Ferric chloride) and drilling.]

7 Assembling of electronic circuit/system on general purpose PCB, test and show the functioning

   a. Fixed voltage power supply with transformer, rectifier diode, capacitor filter, Zener/IC regulator
   b. Square wave generation using IC 555 timer in IC base.

REFERENCES

1) Singh R. P., *Electrical Workshop: Safety, Commissioning, Maintenance & Testing of Electrical Equipment*, Dream tech Press, 3rd Edition, 2019.
2) John H. Watt, *Terrell Croft American Electricians' Handbook: A Reference Book for the Practical Electrical Manual*, McGraw-Hill, 9th Edition, 2002.
3) NavasK A, *Electronics Lab Manual*, Volume 1, PHI Learning Private Limited, 5th Edition, 2015.

MARK DISTRIBUTION

Total Marks	CIE	ESE	ESE Duration
100	70	30	1 Hour

CONTINOUS INTERNAL EVALUATION PATTERN

Attendance : 20 marks

Class work/ Assessment /Viva-voce : 50 marks

Semester III

Course Code	Course Name	Category	L	T	P	Credit	Year of Introduction
MA0U20G	Discrete Mathematical Structures	BSC	3	1	0	4	2022

COURSE OVERVIEW:

The purpose of this course is to create awareness in students about the basic terminologies used in advanced courses in Computer Science and develop rigorous logical thinking for solving different kinds of problems in Computer Science. This course helps the learner to apply the theory and applications of elementary Counting Principles, Propositional Logic, Predicate Logic, Lattices, Generating Functions, Recurrence Relations and Algebraic Structures and fundamental concepts in Graph Theory eventually in practical applications.

COURSE OUTCOMES

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

CO 1	Use the truth tables, deductive reasoning and inference theory on Propositional Logic check the validity of predicates in Propositional and Quantified Propositional Logic.	Apply
CO 2	Classify binary relations into various types and Illustrate an application for Partially Ordered Sets and Complete Lattices.	Apply
CO 3	Describe the fundamentals of abstract algebraic systems - Semigroups, Monoids, Groups, Homomorphism and Isomorphism of Monoids and Groups.	Understand
CO 4	Explain vertices and their properties, types of paths, classification of graphs, trees, Planar graphs & their properties.	Apply
CO 5	Explain the Vertex Color problem in graphs and illustrate an example application for vertex coloring.	Apply

SYLLABUS

Mathematical logic - Tautology, Contradiction. Logical Equivalence - The Laws of Logic, The Principle of duality, Logical Implication - Rules of Inference, The use of Quantifiers–Logical equivalences and implications for quantified statement, Implications, Negation.

Linear recurrence relations with constant coefficients – homogeneous, non-homogeneous Solution. Principles of counting.

Binary Relation and Functions. - Relations, Equivalence Relations and partitions. Partial Order relations, partially ordered Set - Lattice, Properties of Lattice.

Algebraic Systems-Semi group and monoid-cyclic monoid, Homomorphism and Isomorphism. Group-subgroup, symmetric group, The direct product of two groups, Group Homomorphism-Cyclic Group-Right cosets and Lagrange's Theorem.

Introduction to Graphs, Definition, incidence and degree, sub graphs walks, paths, circuits, Isomorphism, Connectedness, Eulerian and Hamiltonian graphs, Travelling salesman problem, Fleury's algorithm

Matrix representation of graphs, Trees, basic properties of trees, Binary trees, Spanning and Minimal spanning tree, Dijkstra, prims and Kruskal algorithms

Connectivity, Cut set and Cut vertices, Fundamental circuits, Planar graphs and their properties, Planarity of graphs, Kurtowski's two graphs, Euler's formula, Coloring- Chromatic number, Chromatic polynomial, Matchings, Coverings, Four color problem and Five color problem. Greedy colouring algorithm

TEXT BOOKS

1. Discrete and Combinatorial Mathematics (An Applied Introduction), Ralph P Grimaldi, B V Ramana , 5th Edition, Pearson
2. NarsinghDeo, Graph theory, PHI,1979

REFERENCES

1. Kenneth H. Rosen, Discrete Mathematics and Its Applications with Combinatorics and Graph Theory, Seventh Edition, MGH, 2011
2. Trembly J.P and Manohar R, "Discrete Mathematical Structures with Applications to Computer Science", Tata Mc Graw Hill Pub. Co. Ltd., New Delhi, 2003.
3. Bernard Kolman, Robert C. Busby, Sharan Cutler Ross, "Discrete Mathematical Structures", Pearson Education Pvt Ltd., New Delhi, 2003
4. Douglas B. West, Introduction to Graph Theory, Prentice Hall India Ltd.,2001
5. J.A. Bondy and U.S.R. Murty. Graph theory with Applications
6. Robin J. Wilson, Introduction to Graph Theory, Longman Group Ltd.,2010

COURSE PLAN

Module	Contents	No. of hours
I	**Mathematical logic**, Basic Connectives and Truth Table Statements, Tautology, Contradiction Logical Equivalence, The Laws of Logic, The Principle of duality, Substitution Rules, The implication, The Contrapositive, the Converse , the Inverse. Logical Implication, Rules of Inference,The use of Quantifiers, Open Statement, Quantifier, Negation **Linear Recurrence Relations** with Constant Coefficients of order one and two-Homogeneous Solution Non homogeneous Solution. Pigeonhole principle, Principle of inclusion and exclusion, derangements.	**12**

II	**Binary Relation**-Reflexive Relations, Symmetric Relations, Transitive relations, Antisymmetric Relations-Partial Order relations Equivalence Relation, Equivalence Classes Partitions, Irreflexive Relations. Partially ordered Set, Hasse Diagram Maximal-Minimal Element, Least Upper bound, Greatest Lower Bound, **Lattice**- Dual Lattice, sub lattice , Properties of glb and lub Properties of Lattice , Special Lattice , Complete Lattice,Bounded Lattice, Complemented Lattice, Distributive Lattice	**12**
III	**Algebraic Systems**-Binary operations on a set and its properties Semi group , Monoid, Sub semigroup and sub monoid Cyclic monoid Homomorphism and Isomorphism of Semigroup, Monoids and Groups, Elementary Properties, Subgroup, Symmetric group on three Symbols .The direct Product of two Groups-Group Homomorphism, Isomorphism, Cyclic group, Right coset, Left coset ,Lagrange's Theorem.	**12**
IV	**Concepts of Graphs and Trees**: Definition, incidence and degree, sub graphs walks, paths, circuits, Isomorphism, Connectedness, Eulerian and Hamiltonian graphs, Travelling salesman problem, Fleury's algorithm Matrix representation of graphs, adjacency and incidence matrix Trees, basic properties of trees, Binary trees Spanning and Minimal spanning tree Graph theoretical algorithms: Dijkstra, prims and Kruskal	**12**
V	**Connectivity and Planar Graphs** Vertex Connectivity, Edge Connectivity, Cut set and Cut vertices, Fundamental circuits, Planar graphs and their properties: Planarity of graphs, Kurtowski's two graphs, Euler's formula, **Coloring**- Chromatic number, Chromatic polynomial, Matchings, Coverings, Four color problem and Five color problem. Greedy colouring algorithm.	**12**
	Total hours	60

MARK DISTRIBUTION

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 Hours

CONTINOUS INTERNAL EVALUATION PATTERN

Attendance	:	10 marks
Continuous Assessment Tests	:	25 marks
Assignment/Project/Case study etc.	:	15 marks

Course Code	Course Name	Category	L	T	P	Credit	Year of Introduction
CS1U20A	Data Structures	PCC	3	1	0	4	2020

PRE-REQUISITE: ES0U10F Introduction to Computer Programming

COURSE OVERVIEW:

This course aims to introduce the various data structures, their organization and operations. It covers abstract concepts for data organization and manipulation using data structures such as stacks, queues, linked lists, binary trees, heaps and graphs. It helps the learner to apply appropriate data structures and associated algorithms for solving real world problems efficiently.

COURSE OUTCOMES

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

CO 1	Design an algorithm for a computational task and calculate the time/space complexities.	Apply
CO 2	Identify suitable data structure (array or linked list) to represent a data item required to be processed to solve a given computational problem and write an algorithm to find the solution of the computational problem.	Apply
CO 3	Design an algorithm to find the solution of a computational problem by selecting an appropriate data structure (binary tree/graph) to represent a data item to be processed.	Apply
CO 4	Apply appropriate Hash Function to store a given dataset and enable efficient access of data in the given set.	Apply
CO 5	Make use of appropriate sorting algorithms based on specific circumstances.	Apply

SYLLABUS

Introduction: Basic Concepts of Data Structures, Algorithms, Performance Analysis, Asymptotic Notation, Complexity Calculation of Simple Algorithms.

Arrays and Searching: Sparse matrix, Stacks and Queues, Linear Search and Binary Search.

Linked List and Memory Management: Operations on Linked List, Types of Linked Lists, Stacks and Queues, Memory allocation and deallocation -First-fit, Best-fit and Worst-fit.

Trees and Graphs: Binary Trees, Binary Search Trees, Graph Representations, Depth First Search and Breadth First Search, Applications of Graphs.

Sorting and Hashing: Selection Sort, Insertion Sort, Quick Sort, Merge Sort and Heap Sort, Hashing Techniques, Collision Resolution, Overflow handling, Hashing functions.

TEXT BOOKS

1) Ellis Horowitz, SartajSahni and Susan Anderson-Freed, Universities Press, Fundamentals of Data Structures in C.

REFERENCES

1) Samanta D., Classic Data Structures, Prentice Hall India.
2) Richard F. Gilberg, Behrouz A. Forouzan, Data Structures: A Pseudocode Approach with C, 2/e, Cengage Learning.
3) Aho A. V., J. E. Hopcroft and J. D. Ullman, Data Structures and Algorithms, Pearson Publication.
4) Tremblay J. P. and P. G. Sorenson, Introduction to Data Structures with Applications, Tata McGraw Hill.

COURSE PLAN

Module	Contents	No. of hours
I	Introduction: Basic Concepts of Data Structures, System Life Cycle, Algorithms, Performance Analysis, Space Complexity, Time Complexity, Asymptotic Notation, Complexity Calculation of Simple Algorithms	8
II	Arrays and Searching: Polynomial representation using Arrays, Sparse matrix, Stacks, Queues-Circular Queues, Priority Queues, Double Ended Queues, Evaluation of Expressions, Linear Search and Binary Search	14
III	Linked List and Memory Management: Self-Referential Structures, Dynamic Memory Allocation, Operations on Linked List-Singly Linked List, Doubly Linked List, Circular Linked List. Stacks and Queues using Linked List, Polynomial representation using Linked List, Memory allocation and deallocation-First-fit, Best-fit and Worst-fit allocation schemes	14
IV	Trees and Graphs: Trees, Binary Trees-Tree Operations, Binary Tree Representation, Tree Traversals, Binary Search Trees- Binary Search Tree Operations, Graphs, Representation of Graphs, Depth First Search and Breadth First Search on Graphs, Applications of Graphs	14
V	Sorting and Hashing: Sorting Techniques – Selection Sort, Insertion Sort, Quick Sort, Merge Sort and Heap Sort, Hashing- Hashing Techniques, Collision Resolution, Overflow handling, Hashing functions – Mid square, Division, Folding, Digit Analysis	10
	Total hours	60

MARK DISTRIBUTION

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 Hours

CONTINOUS INTERNAL EVALUATION PATTERN

Attendance	:	10 marks
Continuous Assessment Tests	:	25 marks
Assignment/Project/Case study etc.	:	15 marks

Course Code	Course Name	Category	L	T	P	Credit	Year of Introduction
CS1U20B	Logic System Design	PCC	3	1	0	4	2020

PRE-REQUISITE: NIL

COURSE OVERVIEW: The goal of this course is to impart an understanding of the basic concepts of Boolean algebra and digital systems. This course covers the design and implementation of different types of practically used combinational and sequential circuits. This course helps the learners to develop application level digital logic circuits to solve real life problems.

COURSE OUTCOMES

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

CO 1	Illustrate decimal, binary, octal, hexadecimal and BCD number systems, perform conversions among them and do the operations - complementation, addition, subtraction, multiplication and division on binary numbers .	Understand
CO 2	Simplify a given Boolean Function and design a combinational circuit to implement the simplified function using Digital Logic Gates.	Apply
CO 3	Design combinational circuits - Adders, Code Converters, Decoders, Magnitude Comparators, Parity Generator/Checker and design the Programmable Logic Devices -ROM and PLA.	Apply
CO 4	Design sequential circuits - Registers, Counters and Shift Registers.	Apply
CO 5	Illustrate algorithms to perform addition and subtraction on binary, BCD and floating point numbers.	Understand

SYLLABUS

Number systems, Operations & Codes: Various Number systems - its arithmetic operation - Number Base Conversions- Representation of negative numbers-BCD Arithmetic-Binary codes- character coding schemes.

Boolean Algebra: Postulates- Basic theorems and properties of Boolean Algebra-Boolean Functions-Simplification of Boolean Functions-Don't care Conditions-Digital Logic Gates

Combinational Logic circuits: Design procedure & Implementation of Binary Adders and Subtractors-BCD Adder-Code Converter-Comparator-Decoder/Encoder-Demux /Mux-Parity Generator/Checker.

Sequential logic circuits: Flip-flops- Triggering of flip-flops- Master Slave flip- flops - Excitation table and Characteristic Equation-Counter Design: Asynchronous & Synchronous Counters.

Shift registers: Shift register, Ring Counter- Johnson Counter
Arithmetic algorithms: Algorithms for arithmetic operations on Negative Numbers-BCD-Floating Point Numbers-Programmable Logic Devices: ROM-Implementation of PLA.

TEXT BOOKS

1) M. Morris Mano, Digital Logic & Computer Design, 4/e, Pearson Education, 2013
2) Thomas L Floyd, Digital Fundamentals, 10/e, Pearson Education, 2009.
3) M. Morris Mano, Computer System Architecture, 3/e, Pearson Education, 2007.

REFERENCES

1) M. Morris Mano, Michael D Ciletti , Digital Design With An Introduction to the Verilog HDL, 5/e, Pearson Education, 2013.
2)Donald D Givone, Digital Principles and Design, Tata McGraw Hill, 2003.

COURSE PLAN

Module	Contents	No. of hours
I	**Number systems, Operations & Codes** Decimal, Binary, Octal and Hexadecimal Number Systems- Number Base Conversions. Addition, Subtraction, Multiplication and Division of binary numbers. Representation of negative numbers- Complements, Subtraction with complements. Addition and subtraction of BCD, Octal and Hexadecimal numbers. Binary codes- Decimal codes, Error detection codes, Reflected code, Character coding schemes – ASCII, EBCDIC.	12
II	**Boolean Algebra** Postulates of Boolean Algebra. Basic theorems and Properties of Boolean Algebra. Boolean Functions - Canonical and Standard forms. Simplification of Boolean Functions- Using Karnaugh- Map Method (upto five variables), Don't care conditions, Product of sums simplification, Tabulation Method. Digital Logic Gates- Implementation of Boolean functions using basic and universal gates.	12
III	**Combinational Logic Circuits** Design Procedure & Implementation of combinational logic circuits- Binary adders and subtractors, Binary Parallel adder, Carry look ahead adder, BCD adder, Code converter, Magnitude comparator, Decoder, DE multiplexer, Encoder, Multiplexer, Parity generator/ Checker	12
IV	**Sequential logic circuits** Flip-flops- SR, JK, T and D. Triggering of flip-flops- Master slave flip-flops, Edge- triggered flip- flops. Excitation table and characteristic equation. Registers- register with parallel load. Counter design: Asynchronous counters- Binary and BCD counters, timing sequences and state diagrams. Synchronous counters- Binary Up- down counter, BCD counter.	12
V	**Shift registers** Shift registers – Serial In Serial Out, Serial In Parallel Out, Bidirectional	12

	Shift Register with Parallel load. Ring counter. Johnson counter- timing sequences and state diagrams. **Arithmetic algorithms** Algorithms for addition and subtraction of binary numbers in signed magnitude and 2's complement representations. Algorithm for addition and subtraction of BCD numbers. Representation of floating point numbers, Algorithm for addition and subtraction of floating point numbers. **Programmable Logic devices** ROM. Programmable Logic Array(PLA)- Implementation of simple circuits using PLA.	
	Total hours	60

MARK DISTRIBUTION

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 Hours

CONTINOUS INTERNAL EVALUATION PATTERN

Attendance	:	10 marks
Continuous Assessment Tests	:	25 marks
Assignment/Project/Case study etc.	:	15 marks

Course Code	Course Name	Category	L	T	P	Credit	Year of Introduction
CS1U20C	Object Oriented Programming using java	PCC	3	1	0	4	2020

PRE-REQUISITE: ES0U10F Introduction to Computer Programming

COURSE OVERVIEW:

Aim of the course is to introduce Object oriented concepts in programming. The course covers Object Oriented Principles, Object Oriented Programming in Java, Inheritance, Exception handling, Event handling, multithreaded programming and working with window-based graphics. The course will enable learners to solve problems by breaking it down to object level while designing software and to implement it using Java.

COURSE OUTCOMES

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

CO 1	Summarize the Basic features and architecture of Java.	Understand
CO 2	Construct Object Oriented Design using Unified Modelling Language (UML).	Apply
CO 3	Apply the object-oriented concepts - classes, objects, constructors, data hiding, inheritance, and polymorphism to write java programs.	Apply
CO 4	Utilize packages & interfaces, input/output streams, files and exception-handling mechanism to develop programs.	Apply
CO 5	Utilize multithreading and database connectivity to develop java applications.	Apply
CO 6	Apply event handling features and swing to develop Graphical User Interface based java application programs.	Apply

SYLLABUS

Approaches to Software Design - Functional Oriented Design, Object Oriented Design, Object Modeling Using Unified Modeling Language (UML) – Use case model, Class diagram, Interaction diagram, Activity diagram, State chart diagram. Introduction to Java - Java programming Environment and Runtime

Environment, Java Virtual Machine (JVM), Java compiler, Bytecode.

Core Java Fundamentals: Data types, Operators, Control Statements, Object Oriented Programming in Java - Class Fundamentals, Constructors, Method Overloading, Access Control, Command Line Arguments, Inheritance - Method Overriding, Abstract Classes and Methods.

Packages and Interfaces, Interfaces, Exception Handling, Input/ Output - Reading Console Input, Writing Console Output, Object Streams and Serialization, Working with Files.

Java Library, String Handling, Comparison of String Buffer and String, Collections framework, Collections Class, Event handling - Delegation Event Model, Multithreaded Programming.

Swings fundamentals - Model View Controller (MVC), Event Handling in Swings, Exploring Swings, Java Database Connectivity (JDBC).

TEXT BOOKS

1) Herbert Schildt, Java: The Complete Reference, 8/e, Tata McGraw Hill, 2011.
2) Bahrami A., Object Oriented Systems Development using the Unified Modeling Language, McGraw Hill, 1999.
3) Paul Deitel, Harvey Deitel, Java How to Program, Early Objects 11th Edition, Pearson, 2018.

REFERENCES

1) Y. Daniel Liang, Introduction to Java Programming, 7/e, Pearson, 2013.
2) Nageswararao R., Core Java: An Integrated Approach, Dreamtech Press, 2008.
3) Balaguruswamy E., Programming JAVA a Primer, 5/e, McGraw Hill, 2014.

COURSE PLAN

Module	Contents	No. of hours
I	Approaches to Software Design - Functional Oriented Design, Object Oriented Design, Case Study of Automated Fire Alarm System. Object Modeling Using Unified Modeling Language (UML) – Basic Object Oriented concepts, UML diagrams, Use case model, Class diagram, Interaction diagram, Activity diagram, State chart diagram. Introduction to Java - Java programming Environment and Runtime Environment, Development Platforms -Standard, Enterprise. Java Virtual Machine (JVM), Java compiler, Bytecode, Java applet, Java Buzzwords, Java program structure, Comments, Garbage Collection, Lexical Issues.	10

II	Core Java Fundamentals: Primitive Data types - Integers, Floating Point Types, Characters, Boolean. Literals, Type Conversion and Casting, Variables, Arrays, Strings, Vector class. Operators - Arithmetic Operators, Bitwise Operators, Relational Operators, Boolean Logical Operators, Assignment Operator, Conditional (Ternary) Operator, Operator Precedence. Control Statements - Selection Statements, Iteration Statements and Jump Statements. Object Oriented Programming in Java - Class Fundamentals, Declaring Objects, Object Reference, Introduction to Methods, Constructors, this Keyword, Method Overloading, Using Objects as Parameters, Returning Objects, Recursion, Access Control, Static Members, Final Variables, Inner Classes, Command Line Arguments, Variable Length Arguments. Inheritance - Super Class, Sub Class, The Keyword super, protected Members, Calling Order of Constructors, Method Overriding, the Object class, Abstract Classes and Methods, using final with Inheritance.	14
III	More features of Java: Packages and Interfaces - Defining Package, CLASSPATH, Access Protection, Importing Packages, Interfaces. Exception Handling - Checked Exceptions, Unchecked Exceptions, try Block and catch Clause, Multiple catch Clauses, Nested try Statements, throw, throws and finally. Input/ Output - I/O Basics, Reading Console Input, Writing Console Output, PrintWriter Class, Object Streams and Serialization, Working with Files.	12
IV	Advanced features of Java: Java Library - String Handling – String Constructors, String Length, Special String Operations - Character Extraction, String Comparison, Searching Strings, Modifying Strings, using value Of(), Comparison of String Buffer and String. Collections framework - Collections overview, Collections Interfaces- Collection Interface, List Interface. Collections Class – Array List class. Accessing a Collection via an Iterator. Event handling - Event Handling Mechanisms, Delegation Event Model, Event Classes, Sources of Events, Event Listener Interfaces, Using the Delegation Model. Multithreaded Programming - The Java Thread Model, The Main Thread, Creating Thread, Creating Multiple Threads, Synchronization, Suspending, Resuming and Stopping Threads.	12

V	Graphical User Interface and Database support of Java: Swings fundamentals - Swing Key Features, Model View Controller (MVC), Swing Controls, Components and Containers, Swing Packages, Event Handling in Swings, Swing Layout Managers, Exploring Swings –JFrame, JLabel, The Swing Buttons, JTextField. Java Database Connectivity (JDBC) - JDBC overview, Creating and Executing Queries – create table, delete, insert, select.	12
	Total hours	60

MARK DISTRIBUTION

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 Hours

CONTINOUS INTERNAL EVALUATION PATTERN

Attendance	:	10 marks
Continuous Assessment Tests	:	25 marks
Assignment/Project/Case study etc.	:	15 marks

Course Code	Course Name	Category	L	T	P	Credit	Year of Introduction
ES0U20A	DESIGN AND ENGINEERING	ESC	2	0	0	2	2020

PRE-REQUISITE: Nil

COURSE OVERVIEW:

Goal of this course is to expose the students to the fundamental principles of design engineering. Students are expected to apply design thinking in learning, which is very important and relevant for today. The course also focuses on familiarizing the students with the aesthetics, ergonomics and sustainability factors in designs and practice professional ethics while designing.

COURSE OUTCOMES

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

CO 1	Demonstrate the different stages involved in design engineering process	Understand
CO 2	Compose a problem statement with design objectives taking into account the customer requirements, design constraints and functionality.	Create
CO 3	Develop innovative solutions to the Design problem through brainstorming and ideation.	Apply
CO 4	Identify the concepts of Biomimicry, Aesthetics and Ergonomic factors in designs to add more value to it.	Apply
CO 5	Apply the Design communication tools to model an idea.	Apply
CO6	Incorporate different segments of knowledge in engineering in order to develop innovative, reliable, sustainable and economically viable designs.	Apply

SYLLABUS

Introduction to engineering design. Generate a design through the Design Process stages.

Design Thinking Approach, Design Thinking Process Stages: Empathize, Define, Ideate, Prototype and Test. Design Thinking as Divergent-Convergent Questioning.

Ideation in Design Thinking - Brainstorming sessions. Design Engineering Concepts. Application of Biomimicry, Aesthetics and Ergonomics in Design. Design for X – Quality, Reliability and Sustainability

Design Communication, Data Representation, Communicating Designs Orally, Graphically and in Writing. Modelling, Prototyping and Proof of Concept.

Value Engineering, Concurrent and Reverse Engineering. Expediency, Economics and Environment in Design Engineering. Design Rights. Ethics in Design.

TEXT BOOKS

1) Yousef Haik, SangarappillaiSivaloganathan, Tamer M. Shahin, *Engineering Design Process*, Third Edition, Cengage Learning, (1 January 2017)
2) Linda C. Schmidt , George Dieter, *Engineering Design*, McGraw Hill Education; Fourth edition (1 July 2017)
3) PavanSoni, *Design Your Thinking: The Mindsets, Toolsets and Skill Sets for Creative Problem-Solving,* Penguin Random House India Private Limited, 2020
4) Voland, G., *Engineering by Design*, Pearson India 2014, Second Edition, ISBN 9332535051

REFERENCES

6) Clive L Dym, *Engineering Design: A Project Based Introduction*, Fourth Edition, John Wiley & Sons, New York 2009.
7) Tim Brown, *Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation*, Harper Business; Revised, Updated ed. edition (5 March 2019)
8) Don Norman , *The Design of Everyday Things*, Basic Books; 2 edition (5 November 2013)
9) Dominique Forest , *Art of Things: Product Design Since 1945*, Abbeville Press Inc.,U.S.; Special edition (16 October 2014)
10) Javier Abarca, Al Bedard, et al, *Introductory Engineering Design – A Projects-Based Approach*, 3rded, Regents of the University of Colorado, 2000.
11) Nigel Cross, Design Thinking: *Understanding How Designers Think and Work*, Berg Publishers 2011, First Edition, ISBN: 978-1847886361
5) Pahl, G., Beitz, W., Feldhusen, J., Grote, K.-H., *Engineering Design: A Systematic Approach*, Springer 2007, Third Edition, ISBN 978-1-84628-319-2.
6) George Dieter , *Engineering Design: A Materials and Processing Approach*, McGraw-Hill Education / Asia; 3 edition (16 February 2000)

COURSE PLAN

Module	Contents	No. of hours
I	Design Process: - Defining a Design Process-: Detailing Customer Requirements, Setting Design Objectives, Identifying Constraints, Establishing Functions, Generating Design Alternatives and Choosing a Design.	3
	Practical Exercise: Need Identification. How to define a Problem Statement. Present an idea using the stages of Design Process.	3
II	Design Thinking Approach: -Introduction to Design Thinking, Iterative Design Thinking Process Stages: Empathize, Define, Ideate, Prototype and Test. Design Thinking as Divergent-Convergent Questioning. Empathize – User Persona, Day in the Life Technique, identify customer requirements using Morphological Chart and set design objectives. Define - Identifying and formulating a Problem Statement -Fish Bone Diagram	4
	Practical Exercise: User Persona Chart. Morphological Chart	2

III	Ideate - Brainstorming sessions, and ideation using Random word technique, SCAMPER. Design Engineering Concepts: Modular Design and Life Cycle Design Approaches. Application of Biomimicry, Aesthetics and Ergonomics in Design. Design for X – Quality, Reliability and Sustainability.	4
	Practical Exercise: Brainstorming, 6-3-5 technique, Random Word Technique	2
IV	Design Communication: - Data Representation, Communicating Designs Orally, Graphically and in Writing. Modelling, Prototyping and Proof of Concept. Awareness of Basic tools of Design like – Autodesk, CATIA, MATLAB	3
	Practical Exercise: Communicating Designs Graphically.	4
V	Value Engineering, Concurrent Engineering, and Reverse Engineering in Design. Expediency, Economics and Environment in Design Engineering: -Design for Production, Use, and Sustainability. Engineering Economics in Design. Design Rights. Ethics in Design	3
	Practical Exercise: Case Studies	2
	Total hours	30

Course Code	Course Name	Category	L	T	P	Credit	Year of Introduction
HS0U20A	Professional Ethics	HSC	2	0	0	2	2020

COURSE OVERVIEW:

To enable students to create awareness on ethics and human values.

COURSE OUTCOMES

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

CO 1	Infer the core values that shape the ethical behaviour of a professional.	Understand
CO 2	Apply philosophical concepts discussed in the course to personal and contemporary issues.	Apply
CO 3	Explain the role and responsibility of engineer in technological development without compromising personal ethics and legal ethics.	Understand
CO 4	Solve moral and ethical problems through exploration and assessment by established experiments.	Apply
CO 5	Demonstrate the concept of Corporate Social Responsibility, and explore its relevance to ethical business activity.	Understand
CO 6	Apply the knowledge of human values and social values to contemporary ethical values andglobal issues.	Apply

SYLLABUS

Morals, values and Ethics – Integrity- Academic Integrity-Work Ethics- Service Learning- Civic Virtue- Respect for others- Living peacefully- Caring and Sharing- Honestly- Courage-Cooperation commitment- Empathy-Self Confidence -Social Expectations.

Senses of Engineering Ethics - Variety of moral issues- Types of inquiry- Moral dilemmas –Moral Autonomy – Kohlberg's theory- Gilligan's theory- Consensus and Controversy-Profession and Professionalism- Models of professional Roles-Theories about right action –Self-Interest-Customs and Religion- Uses of Ethical Theories.

Engineering as Experimentation – Engineers as responsible Experimenters- Codes of Ethics- Plagiarism- A balanced outlook on law - Challenges case study- Bhopal gas tragedy.

Collegiality and loyalty – Managing conflict- Respect for authority- Collective bargaining- Confidentiality- Role of confidentiality in moral Integrity-Conflicts of interest- Occupational crime- Professional rights- Employee right- IPR Discrimination.

Multinational Corporations- Environmental Ethics- Business Ethics- Computer Ethics -Role in Technological Development-Engineers as Managers- Consulting Engineers- Engineers as Expert witnesses and Advisors-Moral leadership.

TEXT BOOKS

1. M Govindarajan, S Natarajan and V S Senthil Kumar, Engineering Ethics, PHI Learning Private Ltd, NewDelhi, 2012.
2. RSNaagarazan,Atextbookonprofessionalethicsandhumanvalues,Newageinternational (P) limited, New Delhi, 2006.

REFERENCES

1. Mike W Martin and Roland Schinzinger, Ethics in Engineering,4th edition, Tata McGraw Hill Publishing Company Pvt Ltd, NewDelhi,2014.
2. Charles D Fleddermann, Engineering Ethics, Pearson Education/ Prentice Hall of India, New Jersey,2004.
3. Charles E Harris, Michael S Protchard and Michael J Rabins, Engineering Ethics- Concepts and cases, Wadsworth Thompson Learning, United states,2005.
4. http://www.slideword.org/slidestag.aspx/human-values-and-Professional-ethics.

COURSE PLAN

Module	Contents	No. of hours
I	Morals, values and Ethics, Integrity, Academic Integrity, Work Ethics Service Learning, Civic Virtue, Respect for others, Living peacefully Caring and Sharing, Honesty, Courage, Co-operation commitment Empathy, Self Confidence, Social Expectations	6
II	Senses of Engineering Ethics, Variety of moral issues, Types of Inquiry-Moral dilemmas, Moral Autonomy, Kohlberg's theory, Gilligan's theory, Consensus and Controversy, Profession& Professionalism, Models of professional roles, Theories about right action-Self-interest-Customs and Religion, Uses of Ethical Theories	6
III	Engineering as Experimentation, Engineers as responsible Experimenters-Codes of Ethics, Plagiarism, A balanced outlook on law-Challenger case study, Bhopal gas tragedy	6
IV	Collegiality and loyalty, Managing conflict, Respect for authority Collective bargaining, Confidentiality, Role of confidentiality in moral integrity, Conflicts of interest-Occupational crime, Professional rights, Employee right, IPR, Discrimination	6
V	Multinational Corporations, Environmental Ethics, Business Ethics, Computer Ethics-Role in Technological Development, Moral leadership-Engineers as Managers, Consulting Engineers, Engineers as Expert witnesses and advisors	6
		30

Course Code	Course Name	Category	L	T	P	Credit	Year of Introduction
NC0U20A	SUSTAINABLE ENGINEERING	MNC	2	0	0	NIL	2020

COURSE OVERVIEW

The objective of this course is to expose the students to the concept of sustainability, the global initiatives towards attaining sustainable development goals and the various sustainable practices. The students should realize the potential of technology in addressing environmental issues and bringing in sustainable solutions.

COURSE OUTCOMES

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

CO 1	Explain the relevance and the concept of sustainability and the global initiatives towards attaining sustainable development.	Understand
CO 2	Identify sustainable solutions for different types of environmental pollution problems	Apply
CO 3	Discuss the environmental regulations and standards, various tools for environmental management and clean development mechanism.	Apply
CO 4	Explain the concept of circular economy, bio-mimicking and the sustainable framework developed in industrial ecology and industrial symbiosis.	Apply
CO 5	Choose the best practice of nonconventional and sustainable energy depending on the available resources and its utilization.	Apply
CO6	Demonstrate the broad perspective of sustainable practices applicable for energy efficient buildings, green engineering, sustainable cities, sustainable urbanization, and sustainable transport.	Apply

SYLLABUS

Sustainability- need and concept, Technology and Sustainable Development, Sustainable Development Goals.
Environmental Pollution: Natural resources and their pollution, Carbon credits, Zero waste concept and 3 R concepts, Clean Development Mechanism: Carbon Trading and Carbon foot print, legal provisions for environmental protection.
Environmental management standards: ISO 14001:2015 frame work, Life Cycle Analysis, Circular economy, Bio-mimicking, Environment Impact Assessment (EIA), Industrial ecology and industrial symbiosis.

Resources and its utilization: Basic concepts of Conventional and non-conventional energy.

Sustainability practices: Sustainable habitat, Green buildings, green materials, Sustainable urbanization.

TEXTBOOKS

1) Bradley, A.S., Adebayo A.O., Maria, P., *Engineering applications in sustainable design and development*, Cengage learning, 1st Edition, 2015.
2) Allen, D. T. and Shonnard, D. R., *Sustainability Engineering: Concepts, Design and Case Studies*, Prentice Hall, 1st Edition, 2011
3) Purohit, S.S., *Green Technology: An Approach for Sustainable Environment*, Agrobios (India), 1st Edition, 2021.
4) Janine, M.B., *Biomimicry: Innovation Inspired by Nature,* William Morrow Paperbacks, 2002

REFERENCES

1) Environment Impact Assessment Guidelines, Notification of Government of India, 2006.
2) ECBC Code 2007, Bureau of Energy Efficiency, New Delhi Bureau of Energy Efficiency Publications-Rating System, TERI Publications - GRIHA Rating System.

COURSE PLAN

Module	Contents	No. of hours
I	Sustainability: Introduction, concept, evolution of the concept; Social, environmental and economic sustainability concepts; Sustainable development, Nexus between Technology and Sustainable development; Millennium Development Goals (MDGs) and Sustainable Development Goals (SDGs).	6
II	Environmental Pollution: Air Pollution and its effects, Water pollution and its sources, Zero waste concept and 3 R concepts in solid waste management; Greenhouse effect, Global warming, Climate change, Ozone layer depletion, Clean Development Mechanism (CDM):Carbon credits, carbon trading and carbon foot print, legal provisions for environmental protection.	6
III	Environmental management standards: ISO 14001:2015 frame work and benefits, Scope and goal of Life Cycle Analysis (LCA), Circular economy, Bio-mimicking, Environment Impact Assessment (EIA), Industrial ecology and industrial symbiosis.	6
IV	Resources and its utilisation: Basic concepts of Conventional and non-conventional energy, General idea about solar energy, Fuel cells, Wind energy, Small hydro plants, bio-fuels, Energy derived from oceans and Geothermal energy.	6
V	Sustainability practices: Basic concept of sustainable habitat, Methods for increasing energy efficiency in buildings, Green Engineering, Sustainable Urbanization, Sustainable cities, Sustainable transport.	6
	Total hours	30

Course Code	Course Name	Category	L	T	P	Credit	Year of Introduction
CS1U28A	Data Structures Lab	PCC	0	0	3	2	2020

PRE-REQUISITE: ES0U10F Introduction to Computer Programming

COURSE OVERVIEW:

The aim of this course is to give hands-on experience in creating and using different Data Structures. It also covers various applications of linear and nonlinear Data Structures. This course helps the learners to select appropriate data structures to solve computational problems.

COURSE OUTCOMES

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

CO 1	Implement different data structures like stacks, queues, linked lists, trees and graphs efficiently.	Apply
CO 2	Apply appropriate data structures to solve problems efficiently.	Apply
CO 3	Design an efficient program to search/sort a list of records.	Apply
CO 4	Implement different hashing techniques.	Apply

SYLLABUS

Searching techniques. Stack, queue and their applications. Linked lists and its applications.

Trees and its applications, Graph traversals, Different sorting techniques, Different Hashing

Techniques.

REFERENCE BOOKS

1) Ellis Horowitz, SartajSahni and Susan Anderson-Freed, Universities Press, Fundamentals of Data Structures in C
2) Samanta D., Classic Data Structures, Prentice Hall India.
3) Richard F. Gilberg, Behrouz A. Forouzan, Data Structures: A Pseudocode Approach with C, 2/e, Cengage Learning.
4) Aho A. V., J. E. Hopcroft and J. D. Ullman, Data Structures and Algorithms, Pearson Publication.
5) Tremblay J. P. and P. G. Sorenson, Introduction to Data Structures with Applications, Tata McGraw Hill.

COURSE PLAN

Experiment No.	List of Exercises	No. of hours
I	Implementation of different searching techniques.	**3**
II	Implementation of stack, queue and their applications.	**9**
III	Implementation of linked lists and its applications.	**9**
IV	Implementation of trees and its applications.	**9**
V	Implementation of graph traversals.	**3**
VI	Implementation of different sorting techniques.	**6**
VII	Implementing different hashing techniques.	**6**
	Total hours	**45**

Course Code	Course Name	Category	L	T	P	Credit	Year of Introduction
CS1U28B	Object Oriented Programming lab (in Java)	PCC	0	0	3	2	2020

PRE-REQUISITE: ES0U10F Introduction to Computer Programming

COURSE OVERVIEW:

The aim of the course is to provide hands-on experience to the learners on various object oriented concepts in Java Programming. The course covers implementation of object oriented concepts, packages, exception handling, multithreading, GUI based application development and database connectivity. This course helps the learners to enhance the capability to design and implement various Java applications for real world problems.

COURSE OUTCOMES

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

CO 1	Implement the Object Oriented concepts - constructors, inheritance, method overloading & overriding and polymorphism in Java.	Apply
CO 2	Implement programs in Java which use data types, operators, control statements, built in packages & interfaces, Input /Output streams and Files.	Apply
CO 3	Implement robust application programs in Java using exception handling.	Apply
CO 4	Implement application programs in Java using multithreading and database connectivity.	Apply
CO 5	Implement Graphical User Interface based application programs by utilizing event handling features and Swing in Java.	Analyze

SYLLABUS

Classes-Objects, Constructors, Data Types, Operators, Control statements,Polymorphism, Interfaces, I/O,File operations, Multithreading, Exception Handling,GUI based application programs-Swing, Database Connectivity, Searching, Sorting

REFERENCE BOOKS

1) Herbert Schildt, Java: The Complete Reference, 8/e, Tata McGraw Hill, 2011.

2) Nageswararao R., Core Java: An Integrated Approach, Dreamtech Press, 2008.
3) Flanagan D., Java in A Nutshell, 5/e, O'Reilly, 2005.
4) Balagurusamy E., Programming JAVA a Primer, 5/e, McGraw Hill, 2014.

COURSE PLAN

Sl .No.	Topics	No. of hours
I	Basic programs using datatypes, operators, and control statements in Java.	7
II	Object Oriented Programming Concepts: Problem on the use of constructors, inheritance, method overloading & overriding, polymorphism	7
III	File Handling: Problems on performing I/O operations using streams and files	8
IV	Exception handling and multi-threading applications	7
V	Graphics Programming and database connectivity	9
VI	Standard Searching and Sorting Algorithms using data structures and algorithms	7
	Total hours	**45**

SEMESTER IV

Course Code	Course Name	Category	L	T	P	Credit	Year of Introduction
MA0U20D	Probability, Statistics and Numerical Methods	BSC	3	1	0	4	2022

i) COURSE OVERVIEW:

This course introduces students to the modern theory of probability and statistics, covering important models of random variables and techniques of parameter estimation and hypothesis testing. A brief course in numerical methods familiarises students with some basic numerical techniques for finding roots of equations, evaluating definite integrals ,solving systems of linear equations, and solving ordinary differential equations which are especially useful when analytical solutions are hard to find.

ii) COURSE OUTCOMES

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

CO 1	Identify the different discrete random experiments and find the probabilities of their occurrence	Apply
CO 2	Identify the different continuous random experiments and find the probabilities of their occurrence	Apply
CO 3	Use statistical inference to draw conclusions concerning characteristics of a population based on attributes of samples drawn from the population	Apply
CO 4	Find roots of equations, definite integrals and interpolating polynomial on given numerical data using standard numerical techniques	Apply
CO 5	Apply standard numerical techniques for solving systems of equations, ordinary differential equations and for fitting curves on given numerical data	Apply

iii) SYLLABUS

Discrete random variables and their probability distributions, Binomial distribution, Poisson distribution, Discrete bivariate distributions, Expectation -multiple random variables.

Continuous random variables and their probability distributions-Uniform, exponential and normal distributions, Continuous bivariate distributions, Expectation-multiple random variables, i.i.d random variables and Central limit theorem.

Population and samples, Sampling distribution of the mean and proportion . Test of hypotheses Concerning mean and proportion. Confidence interval.
Roots of equations- Newton-Raphson, regulafalsi methods. Interpolation-finite differences,

Newton’s forward and backward formula, Newton’s divided difference method, Lagrange’s method. Numerical integration.

Solution of linear Systems-Gauss-Siedal and Jacobi iteration methods. Curve fitting-method of least squares, Solution of ordinary differential equations-Euler and Classical Runge-Kutta method of second and fourth order, Adams- Moulton predictor-correction method

iv) TEXT BOOKS

1. Jay L. Devore, Probability and Statistics for Engineering and the Sciences, 8th edition, Cengage, 2012

2. Erwin Kreyszig, Advanced Engineering Mathematics, 10 th Edition, John Wiley & Sons, 2016.

OTHER REFERENCES

1. Hossein Pishro-Nik, Introduction to Probability, Statistics and Random Processes, Kappa Research, 2014 (Also available online at www.probabilitycourse.com)
2. Sheldon M. Ross, Introduction to probability and statistics for engineers and scientists, 4th edition, Elsevier, 2009.
3. T. VeeraRajan, Probability, Statistics and Random processes, Tata McGraw-Hill, 2008
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36 Edition, 2010.

(v) COURSE PLAN

Module	Contents	No. of hours
I	Discrete random variables and probability distributions, expected value, mean and variance (discrete)Binomial distribution-mean, variance, Poisson distribution-mean, variance, Poisson approximation to binomial-Discrete bivariate distributions, marginal distributions, Independence of random variables (discrete), Expected values	12
II	Continuous random variables and probability distributions,expected value, mean and variance (continuous)-Uniform, exponential and normal distributions, mean and variance of these distributionsContinuous bivariate distributions, marginal distributions, Independent random variables, Expected values, Central limit theorem.	12
III	Population and samples, Sampling distribution of single mean and single proportion(large samples)Confidence interval for single mean and single proportions (large samples)Hypothesis testing basics, large sample test for single mean and single proportion Large sample test for equality of means and equality ofproportions of two populations-t-distribution and small sample t-test for single mean and pooled t-test for equality of means	12
IV	Errors in numerical computation-round-off, truncation and relative error, Solution of equations – Newton-Raphson method and Regula-Falsi method. Interpolation-finite differences- Numerical Integration-Trapezoidal rule and Simpson's 1/3rd rule with proof. (derivation of other methods/ formulae not required in this module)	12
V	Solution of linear systems-Gauss-Siedal method, Jacobi iteration methodCurve-fitting-fitting straight lines and parabolas to pairs of datapoints using method of least squares-linear correlation- Basic ideas of Multiple	

	regression. Solution of ODE-Euler ,Modified Euler and Classical Runge - Kutta methods ofsecond and fourth order ,Adams-Moulton predictor-corrector methods	12
	Total hours	60

MARK DISTRIBUTION

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 Hours

CONTINOUS INTERNAL EVALUATION PATTERN

Attendance	:	10 marks
Continuous Assessment Tests	:	25 marks
Assignment/Project/Case study etc.	:	15 marks

Course Code	Course Name	Category	L	T	P	Credit	Year of Introduction
CS1U20D	Computer Organization and Architecture	PCC	3	1	0	4	2020

PRE-REQUISITE: CS1U20B Logic System Design

COURSE OVERVIEW:

The aim of this course is to enable students to understand the fundamental architecture of a digital computer. Study of Computer Organization and Architecture is essential to understand the hardware behind the code and its execution at physical level by interacting with existing memory and I/O structure. It helps the learners to understand the fundamentals about computer system design so that they can extend the features of computer organization to detect and solve problems occurring in computer architecture.

COURSE OUTCOMES

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

CO 1	Recognize and express the relevance of basic components, I/O organization and pipelining schemes in a digital computer.	Understand
CO 2	Explain the types of memory systems and mapping functions used in memory systems.	Understand
CO 3	Demonstrate the control signals required for the execution of a given instruction.	Understand
CO 4	Illustrate the design of Arithmetic Logic Unit and explain the usage of registers in it.	Apply
CO 5	Explain the implementation aspects of arithmetic algorithms in a digital computer.	Apply
CO 6	Develop the control logic for a given arithmetic problem.	Apply

SYLLABUS

Fundamental building blocks and functional units of a computer. Memory locations and addresses. Execution phases of an instruction.

Register transfer logic: inter register transfer – arithmetic, logic and shift micro operations. Processor logic design: - Design of arithmetic circuit, logic circuit, arithmetic logic unit, shifter, accumulator.

Arithmetic Algorithms. Pipelining: Basic principles, classification of pipeline processors, instruction and arithmetic pipelines, hazard detection and resolution.

Design of the processing unit – how arithmetic and logic operations are performed. Design of the control unit – hardwired and microprogrammed control.

I/O organisation – interrupts, DMA, different interface standards. Memory Subsystem – different types. Virtual Lab using simulation software

TEXT BOOKS

1. Hamacher C., Z. Vranesic and S. Zaky, Computer Organization ,5/e, McGraw Hill, 2011
2. M. Morris Mano, Digital Logic & Computer Design, 4/e, Pearson Education, 2013
3. M. Morris Mano, Computer System Architecture, 3/e, Pearson Education, 2007.

REFERENCES

1. Patterson D.A. and J. L. Hennessy, Computer Organization and Design, 5/e, Morgan Kaufmann Publishers, 2013.
2. William Stallings, Computer Organization and Architecture: Designing for Performance, Pearson, 9/e, 2013.

COURSE PLAN

Module	Contents	No. of hours
I	Basic Structure of computers – functional units - basic operational concepts - bus structures. Memory locations and addresses - memory operations, Instructions and instruction sequencing, addressing modes. Basic processing unit – fundamental concepts – instruction cycle – execution of a complete instruction - single bus and multiple bus organization	12
II	Register transfer logic: inter register transfer – arithmetic, logic and shift micro operations. Processor logic design: - processor organization – Arithmetic logic unit - design of arithmetic circuit - design of logic circuit - Design of arithmetic logic unit - status register – design of shifter - processor unit – design of accumulator.	12
III	Arithmetic algorithms: Algorithms for multiplication and division (restoring method) of binary numbers. Array multiplier, Booth's multiplication algorithm. Pipelining: Basic principles, classification of pipeline processors, instruction and arithmetic pipelines (Design examples not required), hazard detection and resolution.	12
IV	Control Logic Design: Control organization – Hardwired control-microprogram control –control of processor unit - Microprogram sequencer, micro programmed CPU organization -horizontal and vertical micro instructions.	11

V	I/O organization: accessing of I/O devices – interrupts, interrupt hardware - Direct memory access. Memory system: basic concepts – semiconductor RAMs. memory system considerations –ROMs, Content addressable memory, cache memories - mapping functions. Virtual Lab using simulation software: Design of ALU, Memory,CPU	13
	Total hours	**60**

MARK DISTRIBUTION

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 Hours

CONTINOUS INTERNAL EVALUATION PATTERN

Attendance	:	10 marks
Continuous Assessment Tests	:	25 marks
Assignment/Project/Case study etc.	:	15 marks

Course Code	Course Name	Category	L	T	P	Credit	Year of Introduction
CS1U20E	Database Management Systems	PCC	3	1	0	4	2020

PRE-REQUISITE: MA0U20G Discrete Mathematical Structures

COURSE OVERVIEW:

This course provides a clear understanding of fundamental principles of Database Management Systems with special focus on relational databases to the learners. The topics covered in this course are basic concepts of DBMS in Entity Relationship (ER) model, Relational Database principles, Transaction Processing Concepts and also gives a glimpse of the alternative data management model, NoSQL. This course helps the learners to manage data efficiently by identifying suitable structures to maintain data assets of organizations and to develop applications that utilize database technologies.

COURSE OUTCOMES

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

CO 1	Summarize and exemplify fundamental nature and characteristics of database systems.	Understand
CO 2	Model real world scenarios given as informal descriptions, using Entity Relationship diagrams.	Apply
CO 3	Model and design solutions for efficiently representing and querying data using relational model.	Apply
CO 4	Demonstrate the features of indexing and hashing in database applications.	Understand
CO 5	Discuss and compare the aspects of Concurrency Control and Recovery in Database systems.	Understand
CO 6	Explain various types of NoSQL databases.	Understand

SYLLABUS

Types of data, database and DBMS, Languages and users. Software Architecture, E-R Modelling, Relational Model – concepts and languages, relational algebra SQL, views, assertions and triggers, relational database design, Functional Dependency and normal forms, Secondary storage organization, Hashing, indexing, query optimization, concurrent transaction processing and recovery principles, Introduction to NoSQL.

TEXT BOOKS

1. Elmasri R. and S. Navathe, Database Systems: Models, Languages, Design and Application Programming, Pearson Education, 2013.
2. Sliberschatz A., H. F. Korth and S. Sudarshan, Database System Concepts, 6/e, McGraw Hill, 2011.

REFERENCES

1. Adam Fowler, NoSQL for Dummies, John Wiley & Sons, 2015.
2. NoSQL Data Models: Trends and Challenges (Computer Engineering: Databases and Big Data), Wiley, 2018.
3. Web Resource: https://www.w3resource.com/redis/
4. Web Resource: https://www.w3schools.in/category/mongodb/
5. WebResource: https://www.tutorialspoint.com/cassandra/cassandra_introduction.htm
6. Web Resource: https://www.tutorialspoint.com/arangodb/index.htm

COURSE PLAN

Module	Contents	No. of hours
I	**Introduction to Database and Entity Relationship (ER) Model** Concept & Overview of Database Management Systems (DBMS) - Characteristics of Database system, Database Users, structured, semi-structured and unstructured data. Data Models and Schema - Three Schema architecture. Database Languages, Database architectures and classification. ER model - Basic concepts, entity set & attributes, notations, Relationships and constraints, cardinality, participation, notations, weak entities, relationships of degree 3.	12

II	**Relational Model** Structure of Relational Databases - Integrity Constraints, Synthesizing ER diagram to relational schema Introduction to Relational Algebra - select, project, Cartesian product operations, join-Equi-join, natural join. query examples, introduction to Structured Query Language (SQL), Data Definition Language (DDL), Table definitions and operations – CREATE, DROP, ALTER, INSERT, DELETE, UPDATE.	12
III	**SQL and Physical Data Organization** SQL DML (Data Manipulation Language) - SQL queries on single and multiple tables, Nested queries (correlated and non-correlated), Aggregation and grouping, Views, assertions, Triggers, SQL data types. Physical Data Organization - Review of terms: physical and logical records, blocking factor, pinned and unpinned organization. Heap files, Indexing, Single level indices, numerical examples, Multi-level-indices, numerical examples, B-Trees & B+-Trees (structure only, algorithms not required), Extendible Hashing, Indexing on multiple keys – grid files.	12
IV	**Normalization** Different anomalies in designing a database, The idea of normalization, Functional dependency, Armstrong's Axioms (proofs not required), Closures and their computation, Equivalence of Functional Dependencies (FD), Minimal Cover (proofs not required). First Normal Form (1NF), Second Normal Form (2NF), Third Normal Form (3NF), Boyce Code Normal Form (BCNF), Lossless join and dependency preserving decomposition, Algorithms for checking Lossless Join (LJ) and Dependency Preserving (DP) properties.	12

V	**Transactions, Concurrency Control, Recovery and Recent Topics** Transaction Processing Concepts - overview of concurrency control, Transaction Model, Significance of concurrency Control & Recovery, Transaction States, System Log, Desirable Properties of transactions. Serial schedules, Concurrent and Serializable Schedules, Conflict equivalence and conflict serializability, Recoverable and cascadeless schedules, Locking, Two-phase locking and its variations. Log-based recovery, Deferred database modification, check-pointing. Introduction to NoSQL Databases, Main characteristics of Key-value DB (examples from: Redis), Document DB (examples from: MongoDB) , Main characteristics of Column - Family DB (examples from: Cassandra) and Graph DB (examples from : ArangoDB)	12
	Total hours	60

MARK DISTRIBUTION

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 Hours

CONTINOUS INTERNAL EVALUATION PATTERN

Attendance	:	10 marks
Continuous Assessment Tests	:	25 marks
Assignment/Project/Case study etc.	:	15 marks

Course Code	Course Name	Category	L	T	P	Credit	Year of Introduction
CS1U20G	FORMAL LANGUAGES AND AUTOMATA THEORY	PCC	3	1	0	4	2020

PRE-REQUISITE: Nil

COURSE OVERVIEW: This is a core course in theoretical computer science. It covers automata and grammar representations for languages in Chomsky Hierarchy. For regular languages, it also covers representations using regular expression and Myhill-Nerode Relation. The topics covered in this course have applications in various domains including compiler design, decidability and complexity theory, software testing, formal modelling and verification of hardware and software.

COURSE OUTCOMES: After the completion of the course the student will be able to

CO1	Classify a given formal language into Regular, Context-Free, Context Sensitive, Recursive or Recursively Enumerable. **[Cognitive knowledge level: Understand]**
CO2	Explain a formal representation of a given regular language as a finite state automaton, regular grammar, regular expression and Myhill-Nerode relation. [**Cognitive knowledge level: Understand**]
CO3	Design a Pushdown Automaton and a Context-Free Grammar for a given context-free language. [**Cognitive knowledge level** : **Apply**]
CO4	Design Turing machines as language acceptors or transducers. [**Cognitive knowledge level: Apply]**
CO5	Explain the notion of decidability. [**Cognitive knowledge level: Understand]**

SYLLABUS

Introduction to Automata Theory, Structure of an automaton, classification of automata, grammar and automata for generating each class of formal languages in the Chomsky Hierarchy, decidability and Halting problem.

TEXT BOOKS

1. Dexter C. Kozen, Automata and Computability, Springer (1999).

REFERENCE MATERIALS

1) John E Hopcroft, Rajeev Motwani and Jeffrey D Ullman, Introduction to Automata Theory, Languages and Computation, 3/e Pearson Education, 2007.
2) Michael Sipser, Introduction to Theory of Computation, Cengage Publishers, 2013.

COURSE PLAN

Module	Contents	No. of hours
I	Introduction to formal language theory– Alphabets, Strings, Concatenation of strings, Languages. Regular Languages - Deterministic Finite State Automata (DFA) (Proof of correctness of construction not required), Nondeterministic Finite State Automata (NFA), Equivalence of DFA and NFA**,** Regular Grammar (RG), Equivalence of RGs and DFA.	13
II	More on Regular Languages Regular Expression (RE), Equivalence of REs and DFA, Homomorphisms, Necessary conditions for regular languages, Closure Properties of Regular Languages, DFA state minimization (No proof required)	12
III	Myhill-Nerode Relations and Context Free Grammars Myhill-Nerode Relations (MNR)- MNR for regular languages, Myhill-Nerode Theorem (MNT) (No proof required), Applications of MNT.Context Free Grammar (CFG)- CFG representation of Context Free Languages (proof of correctness is required), derivation trees and ambiguity, Normal forms for CFGs.	11
IV	More on Context-Free Languages Nondeterministic Pushdown Automata (PDA), Deterministic Pushdown Automata (DPDA), Equivalence of PDAs and CFGs (Proof not required), Pumping Lemma for Context-Free Languages (Proof not required), Closure Properties of Context Free Languages.	12
V	Context Sensitive Languages, Turing Machines Context Sensitive Languages - Context Sensitive Grammar (CSG), Linear Bounded Automata.Turing Machines - Standard Turing Machine, Robustness of Turing Machine, Universal Turing Machine, Halting Problem, Recursive and Recursively Enumerable Languages. Chomsky classification of formal languages.	12
	Total hours	**60**

MARK DISTRIBUTION

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 Hours

CONTINOUS INTERNAL EVALUATION PATTERN

Attendance	:	10 marks
Continuous Assessment Tests	:	25 marks
Assignment/Project/Case study etc.	:	15 marks

Course Code	Course Name	Category	L	T	P	Credit	Year of Introduction
ES0U20A	DESIGN AND ENGINEERING	ESC	2	0	0	2	2020

PRE-REQUISITE: Nil. Its generic to all engineering disciplines.

COURSE OVERVIEW:

Goal of this course is to expose the students to the fundamental principles of design engineering. Students are expected to apply design thinking in learning, which is very important and relevant for today. The course also focuses on familiarizing the students with the aesthetics, ergonomics and sustainability factors in designs and practice professional ethics while designing.

COURSE OUTCOMES

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

CO 1	Demonstrate the different stages involved in design engineering process	Understand
CO 2	Compose a problem statement with design objectives taking into account the customer requirements, design constraints and functionality.	Create
CO 3	Develop innovative solutions to the Design problem through brainstorming and ideation.	Apply
CO 4	Identify the concepts of Biomimicry, Aesthetics and Ergonomic factors in designs to add more value to it.	Apply
CO 5	Apply the Design communication tools to model an idea.	Apply
CO6	Incorporate different segments of knowledge in engineering in order to develop innovative, reliable, sustainable and economically viable designs.	Apply

SYLLABUS

Introduction to engineering design. Generate a design through the Design Process stages.

Design Thinking Approach, Design Thinking Process Stages: Empathize, Define, Ideate, Prototype and Test. Design Thinking as Divergent-Convergent Questioning.

Ideation in Design Thinking - Brainstorming sessions. Design Engineering Concepts. Application of Biomimicry, Aesthetics and Ergonomics in Design. Design for X – Quality, Reliability and Sustainability

Design Communication, Data Representation, Communicating Designs Orally, Graphically and in Writing. Modelling, Prototyping and Proof of Concept.

Value Engineering, Concurrent and Reverse Engineering. Expediency, Economics and Environment in Design Engineering. Design Rights. Ethics in Design.

TEXT BOOKS

1. Yousef Haik, SangarappillaiSivaloganathan, Tamer M. Shahin, *Engineering Design Process*, Third Edition, Cengage Learning, (1 January 2017)

2. Linda C. Schmidt , George Dieter, *Engineering Design*, McGraw Hill Education; Fourth edition (1 July 2017)

3. PavanSoni, *Design Your Thinking: The Mindsets, Toolsets and Skill Sets for Creative Problem-Solving,* Penguin Random House India Private Limited, 2020

4.Voland, G., *Engineering by Design*, Pearson India 2014, Second Edition, ISBN 9332535051

REFERENCES

1. Clive L Dym, *Engineering Design: A Project Based Introduction*, Fourth Edition, John Wiley & Sons, New York 2009.
2. Tim Brown, *Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation*, Harper Business; Revised, Updated ed. edition (5 March 2019)
3. Don Norman , *The Design of Everyday Things*, Basic Books; 2 edition (5 November 2013)
4. Dominique Forest , *Art of Things: Product Design Since 1945*, Abbeville Press Inc.,U.S.; Special edition (16 October 2014)
5. Javier Abarca, Al Bedard, et al, *Introductory Engineering Design – A Projects-Based Approach*, 3rd ed, Regents of the University of Colorado, 2000.
6. Nigel Cross, Design Thinking: *Understanding How Designers Think and Work*, Berg Publishers 2011, First Edition, ISBN: 978-1847886361
7. Pahl, G., Beitz, W., Feldhusen, J., Grote, K.-H., *Engineering Design: A Systematic Approach*, Springer 2007, Third Edition, ISBN 978-1-84628-319-2.
8. George Dieter , *Engineering Design: A Materials and Processing Approach*, McGraw-Hill Education / Asia; 3 edition (16 February 2000)

COURSE PLAN

Module	Contents	No. of hours
I	Design Process: - Defining a Design Process-: Detailing Customer Requirements, Setting Design Objectives, Identifying Constraints, Establishing Functions, Generating Design Alternatives and Choosing a Design.	3
	Practical Exercise: Need Identification. How to define a Problem Statement. Present an idea using the stages of Design Process.	3
II	Design Thinking Approach: -Introduction to Design Thinking, Iterative Design Thinking Process Stages: Empathize, Define, Ideate, Prototype and Test. Design Thinking as Divergent-Convergent Questioning. Empathize – User Persona, Day in the Life Technique, identify customer requirements using Morphological Chart and set design objectives. Define - Identifying and formulating a Problem Statement -Fish Bone Diagram	4
	Practical Exercise: User Persona Chart. Morphological Chart	2
III	Ideate - Brainstorming sessions, and ideation using Random word technique,	4

	SCAMPER. Design Engineering Concepts: Modular Design and Life Cycle Design Approaches. Application of Biomimicry, Aesthetics and Ergonomics in Design. Design for X – Quality, Reliability and Sustainability.	
	Practical Exercise: Brainstorming, 6-3-5 technique, Random Word Technique	2
IV	Design Communication: - Data Representation, Communicating Designs Orally, Graphically and in Writing. Modelling, Prototyping and Proof of Concept. Awareness of Basic tools of Design like – Autodesk, CATIA, MATLAB	3
	Practical Exercise: Communicating Designs Graphically.	4
V	Value Engineering, Concurrent Engineering, and Reverse Engineering in Design. Expediency, Economics and Environment in Design Engineering: -Design for Production, Use, and Sustainability. Engineering Economics in Design. Design Rights. Ethics in Design	3
	Practical Exercise: Case Studies	2
	Total hours	30

Course Code	Course Name	Category	L	T	P	Credit	Year of Introduction
HS0U20A	Professional Ethics	HSC	2	0	0	2	2020

COURSE OVERVIEW:

To enable students to create awareness on ethics and human values.

COURSE OUTCOMES

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

CO 1	Infer the core values that shape the ethical behaviour of a professional.	Understand
CO 2	Apply philosophical concepts discussed in the course to personal and contemporary issues.	Apply
CO 3	Explain the role and responsibility of engineer in technological development without compromising personal ethics and legal ethics.	Understand
CO 4	Solve moral and ethical problems through exploration and assessment by established experiments.	Apply
CO 5	Demonstrate the concept of Corporate Social Responsibility, and explore its relevance to ethical business activity.	Understand
CO 6	Apply the knowledge of human values and social values to contemporary ethical values andglobal issues.	Apply

SYLLABUS

Morals, values and Ethics – Integrity- Academic Integrity-Work Ethics- Service Learning- Civic Virtue- Respect for others- Living peacefully- Caring and Sharing- Honestly- Courage-Cooperation commitment- Empathy-Self Confidence -Social Expectations.

Senses of Engineering Ethics - Variety of moral issues- Types of inquiry- Moral dilemmas –Moral Autonomy – Kohlberg's theory- Gilligan's theory- Consensus and Controversy-Profession and Professionalism- Models of professional Roles-Theories about right action –Self-Interest-Customs and Religion- Uses of Ethical Theories.

Engineering as Experimentation – Engineers as responsible Experimenters- Codes of Ethics- Plagiarism- A balanced outlook on law - Challenges case study- Bhopal gas tragedy.

Collegiality and loyalty – Managing conflict- Respect for authority- Collective bargaining- Confidentiality- Role of confidentiality in moral Integrity-Conflicts of interest- Occupational crime- Professional rights- Employee right- IPR Discrimination.

Multinational Corporations- Environmental Ethics- Business Ethics- Computer Ethics -Role in Technological Development-Engineers as Managers- Consulting Engineers- Engineers as Expert witnesses and Advisors-Moral leadership.

TEXT BOOKS

3. M Govindarajan, S Natarajan and V S Senthil Kumar, Engineering Ethics, PHI Learning Private Ltd, NewDelhi, 2012.
4. RSNaagarazan,Atextbookonprofessionalethicsandhumanvalues,Newageinternational (P) limited, New Delhi, 2006.

REFERENCES

5. Mike W Martin and Roland Schinzinger, Ethics in Engineering,4th edition, Tata McGraw Hill Publishing Company Pvt Ltd, NewDelhi,2014.
6. Charles D Fleddermann, Engineering Ethics, Pearson Education/ Prentice Hall of India, New Jersey,2004.
7. Charles E Harris, Michael S Protchard and Michael J Rabins, Engineering Ethics- Concepts and cases, Wadsworth Thompson Learning, United states,2005.
8. http://www.slideword.org/slidestag.aspx/human-values-and-Professional-ethics.

COURSE PLAN

Module	Contents	No. of hours
I	Morals, values and Ethics, Integrity, Academic Integrity, Work Ethics Service Learning, Civic Virtue, Respect for others, Living peacefully Caring and Sharing, Honesty, Courage, Co-operation commitment Empathy, Self Confidence, Social Expectations	6
II	Senses of Engineering Ethics, Variety of moral issues, Types of Inquiry-Moral dilemmas, Moral Autonomy, Kohlberg's theory Gilligan's theory, Consensus and Controversy, Profession& Professionalism, Models of professional roles, Theories about right action-Self-interest-Customs and Religion, Uses of Ethical Theories	6
III	Engineering as Experimentation, Engineers as responsible Experimenters-Codes of Ethics, Plagiarism, A balanced outlook on law-Challenger case study, Bhopal gas tragedy	6
IV	Collegiality and loyalty, Managing conflict, Respect for authority Collective bargaining, Confidentiality, Role of confidentiality in moral integrity, Conflicts of interest-Occupational crime, Professional rights, Employee right, IPR, Discrimination	6
V	Multinational Corporations, Environmental Ethics, Business Ethics, Computer Ethics-Role in Technological Development, Moral leadership-Engineers as Managers, Consulting Engineers, Engineers as Expert witnesses and advisors	6
		30

Course Code	Course Name	Category	L	T	P	Credit	Year of Introduction
NC0U20B	CONSTITUTION OF INDIA	MNC	2	0	0	---	2020

PREAMBLE:

The study of the Constitution of India enables the students to

1) Understand the fundamental rights & duties and directive principles
2) Understand the functions of Executive, Legislature and Judiciary of the Union and the States
3) Understand the relation between the Union and the States
4) Provides the student the knowledge and strength to face the society and people.

PREREQUISITE: Nil

COURSE OUTCOMES:

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

CO 1	Explain the historic background of the constitution of India and its features.	Understand
CO 2	Describe the fundamental rights, duties and directive principles of state policy.	Understand
CO 3	Discuss the machinery of executive, legislature and judiciary of the Union and the States.	Understand
CO4	Explain the relation between the Union and the States.	Understand
CO 5	Demonstrate national and patriotic spirit as responsible citizens of the country.	Apply

SYLLABUS

Constitution of India: Definition, historical background, features, preamble, territory, citizenship. State, fundamental rights, directive Principles, fundamental duties. The machinery of the union government, machinery of the state governments. Statutory institutions, miscellaneous provisions, amendments to constitution.

TEXT BOOKS

1. M. Laxmikanth, Indian Polity, McGraw Hill Education India, 6/e, 2019.
2. D. D. Basu, Introduction to the Constitution of India, Lexis Nexis, New Delhi, 24/e, 2019.
3. P. M. Bhakshi, The Constitution of India, Universal Law, 14/e, 2017.

REFERENCES

1. Ministry of Law and Justice, The Constitution of India, Govt. of India, New Delhi, 2019.
2. J. N. Pandey, The Constitutional Law of India, Central Law agency, Allahabad, 51/e, 2019.
3. M. V.Pylee, India's Constitution, S. Chand and Company, New Delhi, 16/e, 2016.

COURSE PLAN

Module	Contents	No. of hours
I	Definition of constitution, historical back ground, salient features of the constitution. Preamble of the constitution, union and its territory. Meaning of citizenship, types, termination of citizenship.	4
II	Definition of state, fundamental rights, general nature, classification, right to equality, right to freedom, right against exploitation. Right to freedom of religion, cultural and educational rights, right to constitutional remedies. Protection in respect of conviction for offences. Directive principles of state policy, classification of directives, fundamental duties.	7
III	The Union Executive, the President, the Vice President, the Council of Ministers, the Prime Minister, Attorney-General, functions. The parliament, composition, Rajyasabha, Loksabha, qualification and disqualification of membership, functions of parliament. Union judiciary, the supreme court, jurisdiction, appeal by special leave.	7
IV	The State executive, the Governor, the council of ministers, the Chief minister, advocate general, union Territories. The State Legislature, composition, qualification and disqualification of membership, functions. The state judiciary, the high court, jurisdiction, writs jurisdiction.	6
V	Relations between the Union and the States, legislative relation, administrative relation, financial Relations, Inter State council, finance commission. Emergency provision, freedom of trade commerce and inter course, comptroller and auditor general of India, public Services, public service commission, administrative Tribunals. Official language, elections, special provisions relating to certain classes, amendments to constitution.	6
	Total hours	30

Course Code	Course Name	Category	L	T	P	Credit	Year of Introduction
CS1U28C	Digital Lab	PCC	0	0	3	2	2020

PRE-REQUISITE: CS1U20B Logic System Design

COURSE OVERVIEW: This course aims to familiarize students with the Digital Logic Design. This course covers the implementation of logic circuits using ICs of basic logic gates and flip flops and HDL based Digital Design Flow. This course helps the learners to develop a digital logic and apply it to solve real life problems.

COURSE OUTCOMES

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

CO 1	Design and implement combinational logic circuits using logic gates	Apply
CO 2	Design and implement sequential logic circuits using Integrated Circuits	Apply
CO 3	Design and implement digital circuits using an industry compatible hardware description language	Apply

LIST OF EXPERIMENTS

Part-A

- A two-hour session should be spent to make the students comfortable with the use of trainer kit/breadboard and ICs.
- The following experiments can be conducted on breadboard or trainer kits.

1. Realization of functions using basic and universal gates (SOP and POS forms).
2. Design and realization of half adder, full adder, half subtractor and full subtractor using:
   a) basic gates (b) universal gates.
3. Design and implement 4-bit adder/subtractor circuit and BCD adder using IC7483.
4. Implementation of Flip Flops: SR, D, T, JK and Master Slave JK Flip Flops using basic gates.
5. Asynchronous Counter: Realization of Mod N counters (At least one up counter and one down counter to be implemented).
6. Synchronous Counter: Realization of Mod-N counters and sequence generators. (At least one mod N counter and one sequence generator to be implemented)
7. Realization of Shift Register (Serial input left/right shift register), Ring counter and Johnson Counter using flip flops.
8. Realization of Multiplexers and DE multiplexers using gates.

9. Realization of combinational circuits using MUX & DEMUX ICs (74150, 74154).

Part-B

- The following experiments aim at training the students in digital circuit design with Verilog. The experiments will lay a foundation for digital design with Hardware Description Languages.
- A 3-hour introductory session shall be spent to make the students aware of the fundamentals of development using Verilog.

Experiment 1. Realization of Logic Gates and Familiarization of Verilog

(a) Familiarization of the basic syntax of Verilog
(b) Development of Verilog modules for basic gates and to verify truth tables.
(c) Design and simulate the HDL code to realize three and four variable Boolean functions

Experiment 2: Half adder and full adder

(a) Development of Verilog modules for half adder in 3 modeling styles (dataflow/ structural/behavioural).
(b) Development of Verilog modules for full adder in structural modeling using half adder.

Experiment 3: Design of code converters

Design and simulate the HDL code for
(a) 4- bit binary to gray code converter
(b) 4- bit gray to binary code converter

Experiment 4: Mux and Demux in Verilog

(a) Development of Verilog modules for a 4x1 MUX.
(b) Development of Verilog modules for a 1x4 DEMUX.

Experiment 5: Flip Flops and shift registers

(a) Development of Verilog modules for SR, JK, T and D flip flops.
(b) Development of Verilog modules for a Johnson/Ring counter.

Experiment 6: Counters

(a) Development of Verilog modules for an asynchronous decade counter.
(b) Development of Verilog modules for a 3-bit synchronous up-down counter.

REFERENCE BOOKS

1) M. M. Mano and M. D. Ciletti, *Digital Design: With an Introduction to the Verilog HDL,* Pearson Education, 2013.
2) T. L. Floyd, *Digital Fundamentals*, 11/e, Pearson Education, 2018.
3) S. Brownand Z. Vranesic, *Fundamentals of Digital Logic with Verilog Design*, McGraw-Hill Higher Education, 2nd edition, 2007.

COURSE PLAN

Experiment No.	List of exercises/experiments	No. of hours
1	Realization of functions using basic and universal gates (SOP and POS forms).	3
2	Design and realization of half adder, full adder, half subtractor and full subtractor using basic gates and universal gates.	3
3	Design and implement 4-bit adder/subtractor circuit and BCD adder using IC7483.	3
4	Implementation of Flip Flops: SR, D, T, JK and Master Slave JK Flip Flops using basic gates.	3
5	Asynchronous Counter: Realization of Mod N counters (At least one up counter and one down counter to be implemented).	3
6	Synchronous Counter: Realization of Mod-N counters and sequence generators. (At least one mod N counter and one sequence generator to be implemented)	3
7	Realization of Shift Register (Serial input left/right shift register), Ring counter and Johnson Counter using flip flops.	3
8	Realization of Multiplexers and DE multiplexers using gates.	3
9	Realization of combinational circuits using MUX & DEMUX ICs (74150, 74154).	3
10	(a) Familiarization of the basic syntax of Verilog. (b) Development of Verilog modules for basic gates and to verify truth tables. (c) Design and simulate the HDL code to realize three and four variable Boolean functions.	3
11	(a) Development of Verilog modules for half adder in 3 modeling styles (dataflow/ structural/behavioural). (b) Development of Verilog modules for full adder in structural modeling using half adder.	3
12	Design and simulate the HDL code for (a) 4- bit binary to gray code converter (b) 4- bit gray to binary code converter	3

13	(a) Development of Verilog modules for a 4x1 MUX. (b) Development of Verilog modules for a 1x4 DEMUX.	3
14	(a) Development of Verilog modules for SR, JK, T and D flip flops. (b) Development of Verilog modules for a Johnson/Ring counter.	3
15	(a) Development of Verilog modules for an asynchronous decade counter. (b) Development of Verilog modules for a 3-bit synchronous up-down counter.	3

Course Code	Course Name	Category	L	T	P	Credits	Year of introduction
CS1U28E	DATABASE MANAGEMENT SYSTEMS LAB	PCC	0	0	3	2	2020

PRE-REQUISITE: CS1U20E Database Management Systems

COURSE OVERVIEW: The Database Management Systems course is intended to impart the elementary concepts of a database management system to students and equip them to design and implement a database application based on those concepts. This course helps the learners to get practical exposure on database creation, SQL queries creation, transaction processing and NoSQL & MongoDB based operations. The course enables the students to create, manage and administer the databases, develop necessary tools for the design and development of the databases, and to understand emerging technologies to handle Big Data.

COURSE OUTCOMES: After the completion of the course the student will be able to

CO1	Design database schema for a given real world problem-domain using standard design and modeling approaches. **(Cognitive Knowledge Level: Apply)**
CO2	Construct queries using SQL for database creation, interaction, modification, and updation. **(Cognitive Knowledge Level: Apply)**
C03	Design and implement triggers and cursors. (Cognitive Knowledge Level: **Apply**)
C04	Implement procedures, functions, and control structures using PL/SQL**. (Cognitive Knowledge Level: Apply)**
CO5	Perform CRUD operations in NoSQL Databases. **(Cognitive Knowledge Level: Apply)**
C06	Develop database applications using front-end tools and back-end DBMS. **(Cognitive Knowledge Level: Create)**

SYLLABUS

1. Design a database schema for an application with ER diagram from a problem description**.
2. Creation, modification, configuration, and deletion of databases using UI and SQL Commands **.
3. Creation of database schema - DDL (create tables, set constraints, enforce relationships, create indices, delete and modify tables). Export ER diagram from the database and verify relationships** (with the ER diagram designed in step 1).
4. Database initialization - Data insert, Data import to a database (bulk import using UI and SQL Commands) **.
5. Practice SQL commands for DML (insertion, updating, altering, deletion of data, and viewing/querying records based on condition in databases) **.
6. Implementation of built-in functions in RDBMS**.
7. Implementation of various aggregate functions in SQL**.
8. Implementation of Order By, Group By & Having clause **.
9. Implementation of set operators nested queries, and join queries **.
10. Implementation of queries using temp tables.
11. Practice of SQL TCL commands like Rollback, Commit, Savepoint **.
12. Practice of SQL DCL commands for granting and revoking user privileges **.
13. Practice of SQL commands for creation of views and assertions ** .
14. Implementation of various control structures like IF-THEN, IF-THEN-ELSE, IF-THEN-ELSIF, CASE, WHILE using PL/SQL **.
15. Creation of Procedures, Triggers and Functions**.
16. Creation of Packages **.
17. Creation of Cursors **.
18. Creation of PL/SQL blocks for exception handling **.
19. Database backup and restore using commands.
20. Query analysis using Query Plan/Show Plan.
21. Familiarization of NoSQL Databases and CRUD operations**.
22. Design a database application using any front end tool for any problem selected. The application constructed should have five or more tables**.

** mandatory

TEXT BOOKS

1. Elmasri R. and S. Navathe, Database Systems: Models, Languages, Design and

Application Programming, Pearson Education, 2013.
2. Sliberschatz A., H. F. Korth and S. Sudarshan, Database System Concepts, 6/e, McGraw Hill, 2011.

REFERENCE MATERIALS

1. Adam Fowler, NoSQL for Dummies, John Wiley & Sons, 2015.
NoSQL Data Models: Trends and Challenges (Computer Engineering: Databases and Big Data), Wiley, 2018.

B.Tech (MINOR)

Minor Basket I: Software Engineering

Course Code	Course Name	Category	L	T	P	Credit	Year of Introduction
CS0M 20A	Object Oriented Programming	Minor	3	1	0	4	2020

PRE-REQUISITE: Nil

COURSE OVERVIEW:

The purpose of this course is to enable learners to solve problems by breaking it down to object level while designing software and to implement it using Java. This course covers Object Oriented Principles, Object Oriented Programming in Java, Inheritance, Exception handling, Event handling, multithreaded programming and working with window-based graphics. This course helps the learners to develop Mobile applications, Enterprise Applications, Scientific Applications and Web based Applications.

COURSE OUTCOMES

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

CO 1	Write Java programs using the object oriented concepts – classes, objects, constructors, data hiding, inheritance and polymorphism	Apply
CO 2	Utilize datatypes, operators, control statements, built in packages & interfaces, Input/ Output Streams and Files in Java to develop programs	Apply
CO 3	Illustrate how robust programs can be written in Java using exception handling mechanism	Understand
CO 4	Write application programs in Java using multithreading	Apply
CO 5	Write Graphical User Interface based application programs by utilising event handling features and Swing in Java	Apply

SYLLABUS

Introduction - Approaches to Software Design, Object Modeling using UML, Introduction to Java - JVM, Java Compiler, Bytecode.

Core Java Fundamentals – Primitive Data types, Operators, Control Statements, Object Oriented Programming in Java - Class and Object fundamentals, Constructors, Access Control, Command-line Arguments.

More features of Java – Inheritance, Packages and Interfaces, Abstract Classes and Methods, Exception Handling.

Advanced Features of Java – Input/ Output, Java Library, String Handling, Collections Framework.

GUI Programming, Event Handling and Multithreaded Programming – Swing Fundamentals, Event Handling, Multithreaded Programming.

TEXT BOOKS

1) Herbert Schildt, *Java: The Complete Reference*, 8/e, Tata McGraw Hill,2011.
2) Rajib Mall, *Fundamentals of Software Engineering*, 4th edition, PHI,2014.
3) Paul Deitel, Harvey Deitel, *Java How to Program*, Early Objects 11th Edition, Pearson, 2018.

REFERENCES

1) Y. Daniel Liang, *Introduction to Java Programming*, 7/e, Pearson,2013.
2) Nageswararao R., *Core Java: An Integrated Approach*, Dreamtech Press,2008.
3) Flanagan D., *Java in A Nutshell*, 5/e, O'Reilly,2005.
4) Barclay K., J. Savage, *Object Oriented Design with UML and Java*, Elsevier,2004.
5) Sierra K., *Head First Java*, 2/e, O'Reilly,2005.
6) Balagurusamy E., *Programming JAVA a Primer*, 5/e, McGraw Hill,2014.

COURSE PLAN

Module	Contents	No. of hours
I	Introduction - Approaches to Software Design- Functional Oriented Design, Object-Oriented Design, Case Study of Automated Fire Alarm System. Object Modeling Using UML – Basic object oriented concepts. Basic object oriented concepts. UML diagrams, Use case model. Class diagram, Interaction diagram. Activity diagram, State chart diagram. Java programming Environment and Runtime Environment, Development Platforms -Standard, Enterprise. JVM, Java compiler, Bytecode. Java applet, Java Buzzwords, Java program structure, Comments, Garbage Collection, Lexical Issues.	12
II	Primitive Data types - Integers, Floating Point Types, Characters, Boolean. Literals, Type Conversion and Casting, Variables, Arrays, Strings, Vector class. Operators - Arithmetic Operators, Bitwise Operators, Relational Operators, Boolean Logical Operators, Assignment Operator, Conditional (Ternary) Operator, Operator Precedence. Control Statements - Selection Statements, Iteration Statements and Jump Statements. Object Oriented Programming in Java - Class Fundamentals, Declaring Objects. Object Reference, Introduction to Methods. Constructors, ***this*** Keyword. Method Overloading, Using Objects as Parameters. Returning Objects,	12

	Recursion. Access Control, static Members. Final Variables, Inner Classes. Command-Line Arguments, Variable Length Arguments.	
III	Inheritance - Super class, Sub class, the keyword super, protected Members, Calling Order of Constructors, Method Overriding, the Object class, Abstract Classes and Methods, Using final with Inheritance. Packages and Interfaces - Defining Package, CLASSPATH, Access Protection, Importing Packages. Interfaces. Exception Handling - Checked Exceptions, Unchecked Exceptions, ***try*** Block and ***catch*** Clause, Multiple ***catch*** Clauses, Nested ***try*** Statements, ***throw***, ***throws*** and ***finally.***	12
IV	Input/output - I/O Basics, Reading Console Input. Writing Console Output, PrintWriter Class. Object Streams and Serialization, Serialization, Working with Files. Working with Files. Java Library - String Handling – String Constructors, String Length, Special String Operations, Character Extraction, String Comparison, Searching Strings, Modifying Strings Using valueOf( ), Comparison of string Buffer and String. Collections framework – Collections overview, Collections Class – Array List. Accessing Collections via an Iterator.	12
V	Swings fundamentals, Swing Key Features. MVC, Swing Controls, Components and Containers. Exploring Swing –JFrame, JLabel, JButton, JTextField. Event handling - Event Handling Mechanisms, Delegation Event Model, Delegation Event Model, Event Classes, Sources of Events, Event Listener Interfaces, Using the Delegation Model. Multithreaded Programming- The Java Thread Model, The Main Thread, Creating Thread, Creating Multiple Threads, Suspending, Resuming and Stopping Threads.	12
	Total hours	60

MARK DISTRIBUTION

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 Hours

CONTINOUS INTERNAL EVALUATION PATTERN

Attendance	:	10 marks
Continuous Assessment Tests	:	25 marks
Assignment/Project/Case study etc.	:	15 marks

Course Code	Course Name	Category	L	T	P	Credit	Year of Introduction
CS0M20D	Programming Methodologies	Minor	3	1	0	4	2020

PRE-REQUISITE: Nil

COURSE OVERVIEW:

The course deals with the various systems of ideas that have been used to guide the design of programming languages. It covers data types, variables, control flow structures, computational problems, characteristics of object oriented programming languages and concurrency constructs in different programming languages. The course provides the learners a clear understanding of the main constructs of contemporary programming languages.

COURSE OUTCOMES

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

CO 1	Explain the criteria for evaluating programming languages and compare Imperative, Functional and Logic programming languages.	Understand
CO2	Explain the characteristics of data types and variables.	Understand
CO3	Illustrate how control flow structures and subprograms help in developing the structure of a program to solve a computational problem.	Apply
CO 4	Explain the characteristics of Object Oriented Programming Languages.	Understand
CO 5	Compare concurrency constructs in different programming languages.	Understand

SYLLABUS

Names, Bindings & Scope – Names, Variables, Concept of Binding, Scope and Lifetime, Referencing Environments

Data Type Checking, Strong Typing, Type Equivalence. Expressions – Arithmetic Expressions, Overloaded Operators, Type Conversions, Relational and Boolean Expressions, Short-Circuit Evaluation. Assignment - Assignment Statements, Mixed-mode Assignment.

Statement-Level Control Structures, Subprograms – Design Issues of Subprograms, Local Referencing Environments, Parameter Passing Methods, Closures, Co-routines.

Support for Object Oriented Programming, Exception Handling – Basic Concepts, Design Issues. Event Handling - Introduction to Event Handling

Concurrency –– Introduction to LISP and Scheme, Comparison of Functional and Imperative Languages. Logic Programming Languages – Basic Elements of Prolog, Applications of Logic Programming.

TEXT BOOKS

1) Robert W. Sebesta, Concepts of Programming Languages, 10th Edition, Pearson.
2) Scott M. L., Programming Language Pragmatics, 3rd Edn., Morgan Kaufmann Publishers.

REFERENCES

1) Kenneth C. Louden, Programming Languages: Principles and Practice, 2nd Edn., Cengage Learning.
2) Tucker A. B. and R. E. Noonan, Programming Languages: Principles and Paradigms, 2nd Edn. –TMH.
3) Ravi Sethi, Programming Languages: Concepts & Constructs, 2nd Edn., Pearson Education.
4) David A. Watt, Programming Language Design Concepts, Wiley Dreamtech.

COURSE PLAN

Module	Contents	No. of hours
I	Introduction – Role of Programming Languages, Programming Domains, Language Evaluation Criteria, Influence on Language Design, Language Design Trade-offs, Implementation Methods. Names, Bindings & Scope – Names, Variables, Concept of Binding, Scope and Lifetime, Referencing Environments.	11
II	Data Types- Primitive Data Types, Character String Types, User-Defined Ordinal Types, Array Types, Record Types, List Types, Pointer & Reference Types, Type Checking, Strong Typing, Type Equivalence. Expressions-Arithmetic Expressions, Overloaded Operators, Type Conversions, Relational and Boolean Expressions, Short-Circuit Evaluation. Assignment-Assignment Statements, Mixed-mode Assignment.	14
III	Statement-Level Control Structures – Selection Statements, Iterative Statements, Unconditional Branching, Guarded Commands. Subprograms – Design Issues of Subprograms, Local Referencing Environments, Parameter Passing Methods, Subprograms as Parameters, Overloaded Subprograms, Closures, Co-routines.	11

IV	Support for Object Oriented Programming – Inheritance, Dynamic Binding, Design Issues for Object Oriented Languages, Support for Object Oriented Programming in C++, Implementation of Object Oriented Constructs. Exception Handling – Basic Concepts, Design Issues. Event Handling - Introduction to Event Handling.	13
V	Concurrency – Subprogram Level Concurrency, Semaphores, Monitors, Message Passing. Functional Programming Languages – Introduction to LISP and Scheme, Comparison of Functional and Imperative Languages. Logic Programming Languages – Basic Elements of Prolog, Applications of Logic Programming.	11
	Total hours	**60**

MARK DISTRIBUTION

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 Hours

CONTINOUS INTERNAL EVALUATION PATTERN

Attendance	:	10 marks
Continuous Assessment Tests	:	25 marks
Assignment/Project/Case study etc.	:	15 marks

Minor Basket 2: Machine Learning

Course Code	Course Name	Category	L	T	P	Credit	Year of Introduction
CS0M20B	Python for Machine Learning	Minor	3	1	0	4	2020

PRE-REQUISITE: NIL

COURSE OVERVIEW:

The objective of the course is to introduce Python programming and develop programming skills to manage the development of software systems. It covers Object Oriented Programming, data processing in Python and introduces to Machine Learning and Artificial Intelligence-based applications and tools, Data Science and Data Visualization applications. This course enables the learner to develop python programs and lays the foundation to develop Machine Learning and Artificial Intelligence-based applications.

COURSE OUTCOMES

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

CO 1	Write, test and debug Python programs	Apply
CO 2	Illustrate uses of conditional (if, if-else, if-else if-else and switch-case) and iterative (while and for) statements in Python programs	Apply
CO 3	Develop programs by utilizing the modules Lists, Tuples, Sets and Dictionaries in Python	Apply
CO 4	Implement Object Oriented programs with exception handling	Apply
CO 5	Write programs in Python to process data stored in files by utilizing the modules Numpy, Matplotlib, and Pandas	Apply

SYLLABUS

Introduction to Python and Functions-keywords, identifiers, operators, data types, statement and expression, Type conversion, reading Input, output formatting Control Flow Statements, functions and strings- conditional and Iterative statements, break and continue statements, functions and recursive functions, string methods. Data Structures in Python- list, dictionary, tuple, set Object Oriented Programming, exception handling in Python-inheritance and polymorphism, handle a single exception, handle multiple exceptions Data Processing, visualization modules in python -numpy, matplotlib, pandas.

TEXT BOOKS

1) Kenneth A Lambert., Fundamentals of Python : First Programs, 2/e, Cengage Publishing, 2016
2) Wes McKinney, Python for Data Analysis, 2/e, Shroff / O'Reilly Publishers,2017

REFERENCES

1) Allen B. Downey, Think Python: How to Think Like a Computer Scientist, 2/e, Schroff, 2016
2) Michael Urban and Joel Murach, Python Programming, Shroff/Murach,2016
3) David M.Baezly, Python Essential Reference. Addison-Wesley Professional; 4/e,2009.
4) Charles Severance. Python for Informatics: Exploring Information,
5) http://swcarpentry.github.io/python-novice-gapminder/

COURSE PLAN

Module	Contents	No. of hours
I	Basic coding skills - Working with data types, Numeric data types and Character sets, Keywords, Variables and Assignment statement, Operators, Expressions, Working with numeric data, Type conversions, Comments in the program. Input, Processing, and Output. Formatting output. Detecting and correcting syntax errors. Using built in functions and modules in math module	10
II	Control statements - Selection structure (if-else, switch-case), Iteration structure (for, while), Testing the control statements, Lazy evaluation. Functions - Hiding redundancy and complexity, Arguments and return values, Variable scopes and parameter passing, Named arguments, Main function, Working with recursion, Lambda functions. Strings and number systems - String function, Handling numbers in various formats.	13
III	Lists - Basic list Operations and functions, List of lists, Slicing, Searching and sorting list, List comprehension. Work with tuples. Sets. Work with dates and times. Dictionaries – Dictionary functions, dictionary literals, adding and removing keys, accessing and replacing values, traversing dictionaries.	12
IV	Design with classes - Objects and Classes, Methods, Instance	11

	Variables, Constructor, Accessors and Mutators. Structuring classes with Inheritance and Polymorphism. Abstract Classes. Exceptions - Handle a single exception, handle multiple exceptions.	
V	The os and sysmodules. NumPy - Basics, creating arrays, Arithmetic, Slicing, Matrix Operations, Random numbers. Plotting and visualization using Matplotlib - Basic plot, Ticks, Labels, and Legends. Working with CSV files with Pandas - Reading, Manipulating, and Processing Data.	14
	Total hours (Approx.)	**60**

MARK DISTRIBUTION

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 Hours

CONTINOUS INTERNAL EVALUATION PATTERN

Attendance	:	10 marks
Continuous Assessment Tests	:	25 marks
Assignment/Project/Case study etc.	:	15 marks

Course Code	Course Name	Category	L	T	P	Credit	Year of Introduction
CS0M20E	Mathematics for Machine Learning	Minor	3	1	0	4	2020

COURSE OVERVIEW: This is the foundational course for awarding B. Tech. Minor in Computer Science and Engineering with specialization in Machine Learning. The purpose of this course is to introduce mathematical foundations of basic Machine Learning concepts among learners, on which Machine Learning systems are built. This course covers Linear Algebra, Vector Calculus, Probability and Distributions, Optimization and Machine Learning problems. Concepts in this course help the learners to understand the mathematical principles in Machine Learning and aid in the creation of new Machine Learning solutions, understand & debug existing ones, and learn about the inherent assumptions & limitations of the current methodologies.

Prerequisite: CS0M20B Python for Machine Learning

COURSE OUTCOMES

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

CO 1	Make use of the concepts, rules and results about linear equations, matrix algebra, vector spaces, eigenvalues & eigenvectors and orthogonality & diagonalization to solve computational problems	Apply
CO 2	Perform calculus operations on functions of several variables and matrices, including partial derivatives and gradients	Apply
CO 3	Utilize the concepts, rules and results about probability, random variables, additive & multiplicative rules, conditional probability, probability distributions and Bayes' theorem to find solutions of computational problems	Apply
CO 4	Train Machine Learning Models using unconstrained and constrained optimization methods	Apply

SYLLABUS

Linear Algebra: Systems of Linear Equations, Matrices**, ANALYTIC GEOMETRY, MATRIX DECOMPOSITIONS:** Norms, Eigen decomposition and Diagonalization, **Vector Calculus:** differentiation of Univariate Functions, Useful Identities for Computing Gradients**, Probability and Distributions:** Data and Learning Model Empirical Risk Minimization**,** Summary Statistics and Independence, **Optimization**: Optimization Using Gradient Descent, Constrained Optimization and Lagrange Multipliers.

TEXT BOOKS

1) Mathematics for Machine Learning by Marc Peter Deisenroth, A. Aldo Faisal, and Cheng Soon Ong published by Cambridge University Press (freely available at https://mml - book.github.io)

REFERENCES

1) Linear Algebra and Its Applications, 4th Edition by Gilbert Strang
2) Linear Algebra Done Right by Axler, Sheldon, 2015 published by Springer
3) Introduction to Applied Linear Algebra by Stephen Boyd and LievenVandenberghe, 2018 published by Cambridge University Press

COURSE PLAN

Module	Contents	No. of hours
I	**LINEAR ALGEBRA:** Systems of Linear Equations – Matrices, Solving Systems of Linear Equations. Vector Spaces –Vector Spaces, Linear Independence, Basis and Rank. Linear Mappings – Matrix Representation of Linear Mappings, Basis Change, Image and Kernel.	14
II	**ANALYTIC GEOMETRY, MATRIX DECOMPOSITIONS:** Norms, Inner Products, Lengths and Distances, Angles and Orthogonality, Orthonormal Basis, Orthogonal Complement, Orthogonal Projections – Projection into One Dimensional Subspaces, Projection onto General Subspaces, Gram-Schmidt Orthogonalization. Determinant and Trace, Eigenvalues and Eigenvectors, Cholesky Decomposition, Eigen decomposition and Diagonalization, Singular Value Decomposition, Matrix Approximation.	14
III	**VECTOR CALCULUS:**Differentiation of Univariate Functions - Partial Differentiation and Gradients, Gradients of Vector Valued Functions, Gradients of Matrices, Useful Identities for Computing Gradients. Back propagation and Automatic Differentiation – Gradients in Deep Network, Automatic Differentiation.Higher Order DerivativesLinearization and Multivariate TaylorSeries.	10
IV	**Probability and Distributions:**Construction of a Probability Space - Discrete and Continuous Probabilities, Sum Rule, Product Rule, and Bayes' Theorem. Summary Statistics and Independence – Gaussian Distribution - Conjugacy and the Exponential Family - Change of Variables/Inverse	12

	Transform.	
V	**Optimization:**Optimization Using Gradient Descent - Gradient Descent with Momentum, Stochastic Gradient Descent. Constrained Optimization and Lagrange Multipliers - Convex Optimization - Linear Programming - Quadratic Programming	10
Total hours		60

MARK DISTRIBUTION

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 Hours

CONTINOUS INTERNAL EVALUATION PATTERN

Attendance	:	10 marks
Continuous Assessment Tests	:	25 marks
Assignment/Project/Case study etc.	:	15 marks

Minor Basket 3: Networking

Course Code	Course Name	Category	L	T	P	Credit	Year of Introduction
CS0M20C	Data Communication	MINOR	3	1	0	4	2020

PRE-REQUISITE: NIL

COURSE OVERVIEW: The purpose of this course is to prepare learners to understand the communication entities and the associated issues in the field of Computer Science. This course covers fundamental concepts of data transmission &media, digital &analog transmissions, multiplexing & spread spectrum, error detection &correction and switching. Concepts in data communication help the learner to understand the concepts in networking and mobile communication.

COURSE OUTCOMES

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

CO 1	Describe the characteristics of signals used for Analog and Digital Transmissions	Understand
CO 2	Discuss the features and issues in data transmission	Understand
CO 3	Select transmission media based on characteristics and propagation modes	Apply
CO 4	Apply appropriate signal encoding techniques for a given scenario	Apply
CO 5	Illustrate multiplexing and spread spectrum technologies	Understand
CO 6	Explain error detection & correction techniques and switching techniques used in data communication	Understand

SYLLABUS

Data Transmission Basics - Communication model - Periodic Analog signals - Analog & digital data and signals - Transmission Impairments-Data rate limits - Noiseless channel, Nyquist bandwidth, Noisy channel, Shannon's capacity formula.

Transmission Media - Guided Transmission Media - Unguided media -Wireless Propagation - Ground wave propagation, Sky Wave propagation, Line-of-Sight (LoS) Propagation.

Digital Transmission and Analog Transmission - Digital data to Digital signal - Analog data to Digital signal - Digital data to Analog signal - Analog data to Analog signal.

Multiplexing and Spread Spectrum - Multiplexing - FDM, WDM,TDM, Synchronous TDM, Statistical TDM. Spread Spectrum Techniques - DSSS, FHSS, CDM, CDMA.

Error Detection, Correction and Switching - Digital data communication techniques - Asynchronous transmission, Synchronous transmission. Detecting and correcting errors - Types of Errors- Detection Methods - Basic principles of Switching - Circuit Switching, Packet Switching, Message Switching.

TEXT BOOKS

1) Forouzan B. A., Data Communications and Networking, 5/e, McGraw Hill, 2013.
2) William Stallings, Data and Computer Communication 9/e, Pearson Education, Inc.

REFERENCES

1) Schiller J., Mobile Communications, 2/e, Pearson Education, 2009.
2) Curt M. White, Fundamentals of Networking and Communication 7/e, Cengage learning.

COURSE PLAN

Module	Contents	No. of hours
I	**Data Transmission Basics** Communication model - Simplex, Half duplex, Full duplex transmission. Periodic Analog signals - Sine wave, Amplitude, Phase, Wavelength, Time and frequency domain, Bandwidth. Analog & digital data and signals. Transmission impairments - Attenuation, Delay distortion, Noise. Data rate limits - Noiseless channel, Nyquist bandwidth, Noisy channel, Shannon's capacity formula.	12
II	Transmission Media Guided Transmission Media - Twisted pair, Coaxial cable, Optical fiber. Unguided media - Radio waves, Terrestrial microwave, Satellite microwave, Infrared. Wireless Propagation - Ground wave propagation, Sky Wave propagation, Line-of-Sight (LoS) Propagation.	12
III	Digital Transmission and Analog Transmission Digital data to Digital signal – Non-Return-to-Zero (NRZ), Return-to-Zero (RZ), Multilevel binary, Biphase. Analog data to Digital signal - Sampling theorem, Pulse Code Modulation (PCM), Delta Modulation (DM). Digital data to Analog signal: Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK), Phase Shift Keying (PSK). Analog data to Analog signal: Amplitude Modulation (AM),	12

	Frequency Modulation (FM), Phase Modulation (PM).	
IV	Multiplexing and Spread Spectrum Multiplexing - Frequency Division Multiplexing (FDM), Wave length Division Multiplexing (WDM), Time Division Multiplexing (TDM), Characteristics, Synchronous TDM, Statistical TDM. Spread Spectrum Techniques - Direct Sequence Spread Spectrum (DSSS), Frequency Hopping Spread Spectrum (FHSS), Code Division Multiplexing, Code Division Multiple Access (CDMA).	12
V	Error Detection, Correction and Switching Digital data communication techniques - Asynchronous transmission, Synchronous transmission. Detecting and correcting errors - Types of Errors, Parity check, Checksum, Cyclic Redundancy Check (CRC), Forward Error Correction (FEC), Hamming Distance, Hamming Code. Basic principles of Switching - Circuit Switching, Packet Switching, Message Switching.	12
	Total Hours	**60**

MARK DISTRIBUTION

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 Hours

CONTINOUS INTERNAL EVALUATION PATTERN

Attendance	:	10 marks
Continuous Assessment Tests	:	25 marks
Assignment/Project/Case study etc.	:	15 marks

Course Code	Course Name	Category	L	T	P	Credit	Year of Introduction
CS0M20F	Introduction to Computer Networks	Minor	3	1	0	4	2020

PRE-REQUISITE: NIL

COURSE OVERVIEW: The aim of this course is to build an understanding of the fundamental concepts of computer networking. The course covers the main features of computer networks, various protocols, routing algorithms and its functions. The learner will be able to familiarize the basic protocols of computer networks, and how they can be used to assist in computer design and implementation.

COURSE OUTCOMES

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

CO 1	Explain the features of computer networks, protocols and network design models	Understand
CO 2	Summarize the design issues of data link layer, data link layer protocols, bridges and switches	Understand
CO 3	Illustrate wired LAN protocols (IEEE 802.3/4/5) and wireless LAN protocols (IEEE 802.11a/b/g/n, 802.15)	Understand
CO 4	Choose appropriate routing algorithms, congestion control techniques and Quality of Service parameters for a network	Apply
CO 5	Illustrate the functions and protocols of network, transport and application layer in inter-networking	Understand

SYLLABUS

Introduction-Uses of Computer Networks, Network Hardware, Network Software, Reference Models.

The Data Link Layer - Data Link layer Design Issues, Error Detection and Correction, Elementary Data Link Protocols. The Medium Access Control (MAC) Sub layer - Ethernet, Wireless LANs - 802.11 a/b/g/n, Bridges & Switches.

Network Layer Design Issues. Routing Algorithms, Routing for Mobile Hosts, Congestion Control Algorithms, Quality of Service (QoS).

Network Layer in Internet-ICMP, IP, ARP, RARP, BOOTP, DHCP, OSPF, IPV6.

Transport Layer – The Transport Service – Services Provided to the Upper Layers, Transport Service Primitives, The User Datagram Protocol (UDP), Transmission Control Protocol (TCP), Application Layer protocols.

TEXT BOOKS

1) Andrew S. Tanenbaum, Computer Networks, 4/e, PHI (Prentice Hall India).

REFERENCES

1) Behrouz A Forouzan, Data Communication and Networking, 4/e, Tata McGraw Hill .
2) William Stallings, Computer Networking with Internet Protocols, Prentice-Hall, 2004.
3) James F. Kurose, Keith W. Ross, Computer Networking: A Top-Down Approach, 6/e.

COURSE PLAN

Module	Contents	No. of hours
I	Introduction – Uses of Computer Networks, Network Hardware, Network Software, Reference Models – The OSI Reference Model, The TCP/IP Reference Model, Comparison of OSI and TCP/IP Reference models.	12
II	The Data Link Layer - Data Link layer Design Issues, Error Detection and Correction, Elementary Data Link Protocols, Sliding Window Protocols, HDLC (High-Level Data Link Control) Protocol. The Medium Access Control (MAC) Sub layer – The Channel Allocation Problem, Multiple Access Protocols, Ethernet, Wireless LANs - 802.11 a/b/g/n, Bridges & Switches.	13
III	Network Layer Design Issues. Routing Algorithms - The Optimality Principle, Shortest path routing, Flooding, Distance Vector Routing, Link State Routing, Multicast Routing, Routing for Mobile Hosts. Congestion Control Algorithms, Quality of Service (QoS) - Requirements, Techniques for Achieving Good QoS	11
IV	Network Layer in Internet – The IP Protocol, IP Addresses, Internet Control Message Protocol (ICMP), Address Resolution Protocol (ARP), Reverse Address Resolution Protocol (RARP), Bootstrap Protocol (BOOTP), Dynamic Host Configuration Protocol (DHCP). Open Shortest Path First (OSPF) Protocol, Border Gateway Protocol (BGP), Internet Multicasting, IPv6, ICMPv6.	12

V	Transport Layer – The Transport Service – Services Provided to the Upper Layers, Transport Service Primitives. The User Datagram Protocol (UDP), Transmission Control Protocol (TCP) – Overview of TCP, TCP Segment Header, Connection Establishment & Release, Connection Management Modeling, TCP Retransmission Policy, TCP Congestion Control. Application Layer – File Transfer Protocol (FTP), Domain Name System (DNS), Electronic mail, MIME, Simple Network Management Protocol (SNMP), Dynamic Host Configuration Protocol (DHCP), World Wide Web – Architectural Overview.	12
	Total Hours	**60**

MARK DISTRIBUTION

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 Hours

CONTINOUS INTERNAL EVALUATION PATTERN

Attendance	:	10 marks
Continuous Assessment Tests	:	25 marks
Assignment/Project/Case study etc.	:	15 marks

B.Tech (HONOURS)

Honour Bucket 1: Security in Computing

Course Code	Course Name	Category	L	T	P	Credit	Year of Introduction
CS1H20A	NUMBER THEORY	Honours	3	1	0	4	2020

PRE-REQUISITE:NIL

COURSE OVERVIEW: The aim of this course is to create awareness among learners about the important areas of number theory used in computer science. The course covers modular arithmetic operations, methods to verify correctness of mathematical assertions, theorems for ensuring security in computing systems and applications of arithmetic functions. The goal of the course is to help the learners to apply the concepts in practical applications of Computer organization and Security, Coding and Cryptography, Random number generation, Hash functions and Graphics.

COURSE OUTCOMES

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

CO 1	Illustrate modular arithmetic operations, methods and techniques	Understand
CO 2	Use the methods - Induction, Contraposition or Contradiction to verify the correctness of mathematical assertions	Apply
CO 3	Utilize theorems and results about prime numbers, congruences, quadratic residues and integer factorization for ensuring security in computing systems.	Analyse
CO 4	Illustrate uses of Chinese Remainder Theorem & Euclidean algorithm in Cryptography and Security	Apply
CO 5	Explain applications of arithmetic functions in Computer Science	Understand
CO 6	Implement Number Theoretic Algorithms using a programming language	Apply

SYLLABUS

Divisibility and Modular Arithmetic, Finite Fields, Divisibility and Division Algorithms, Modular Arithmetic- Properties, Euclid's algorithm for the greatest common divisor, Extended Euclid's Algorithm, LCM.

Primes and Congruence, Methods to find prime numbers, Primality testing and factorization, Congruence, Chinese Remainder Theorem, Fermat's little theorem, Wilson's theorem.

Congruences with a Prime-Power Modulus, Pseudo-primes and Carmichael numbers, Euler's Function, Euler's Totient function, Applications of Euler's Totient function, The Group of units- The group U_n, primitive roots.

Quadratic Residues, Quadratic Congruences, Legendre symbol, Jacobi Symbol, Quadratic reciprocity. Arithmetic Functions, Arithmetic Functions, Perfect numbers, Mobius function. The Dirichlet Products.

Sum of Squares, The Gaussian Integers, Continued Fractions -Finite continued fractions, Infinite continued fractions, Pell's Equation, Solution of Pell's equation by continued fractions.

TEXT BOOKS

1) G.A. Jones & J.M. Jones, Elementary Number Theory, Springer UTM, 2007.

2) Joseph Silverman, A Friendly introduction to Number Theory, Pearson Ed. 2009.

REFERENCES

1) William Stallings, Cryptography and Network Security Principles and Practice, Pearson Ed.

2) Tom M.Apostol, 'Introduction to Analytic Number Theory', Narosa Publishing House Pvt. Ltd, New Delhi, (1996).

3) Neal Koblitz, A course in Number Theory and Cryptography, 2nd Edition, Springer ,2004.

COURSE PLAN

Module	Contents	No. of hours
I	**Divisibility and Modular Arithmetic:** Finite Fields – Groups, Rings and Fields. Divisibility - Divisibility and Division Algorithms, Well ordering Principle, Bezout's Identity. Modular Arithmetic- Properties, Euclid's algorithm for the greatest common divisor, Extended Euclid's Algorithm, Least Common multiple, Solving Linear Diophantine Equations, Modular Division.	12
II	**Primes and Congruence:** Prime Numbers-Prime Numbers and prime – power factorization, Fermat and Mersenneprimes, Primality testing and factorization. Congruences- Linear congruences, Simultaneous linear congruences, Chinese Remainder Theorem, Fermat's little theorem, Wilson's theorem.	12
III	**Congruences with a Prime-Power Modulus & Euler's Function:** Congruences with a Prime-Power Modulus-Arithmetic modulo p, Pseudo-primes and Carmichael numbers, Solving congruences modulo prime powers. Euler's Function-Euler's Totient function, Applications of Euler's Totient function, Traditional Cryptosystem, Limitations. The Group of units- The group U_n, primitive roots, Existence of primitive roots, Applications of primitive roots.	12
IV	**Quadratic Residues & Arithmetic Functions:** Quadratic Residues- Quadratic Congruences, The group of Quadratic residues, Legendre symbol, Jacobi Symbol, Quadratic reciprocity. Arithmetic Functions- Definition and examples, Perfect numbers, Mobius function and its properties, Mobius inversion formula, The Dirichlet Products.	12
V	**Sum of Squares and Continued Fractions:** Sum of Squares- Sum of two squares, The Gaussian Integers, Sum of three squares, Sum of four squares. Continued Fractions -Finite continued fractions, Infinite continued fractions, Pell's Equation, Solution of Pell's equation by continued fractions.	12

	Total hours	**60**

MARK DISTRIBUTION

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 Hours

CONTINOUS INTERNAL EVALUATION PATTERN

Attendance	:	10 marks
Continuous Assessment Tests	:	25 marks
Assignment/Project/Case study etc.	:	15 marks

Honour Bucket 2: Machine Learning

Course Code	Course Name	Category	L	T	P	Credit	Year of Introduction
CS1H20B	Computational Fundamentals of Machine Learning	Honour	3	1	0	4	2020

PRE-REQUISITE: Nil

COURSE OVERVIEW: This is the foundational course for awarding B. Tech. Honours in Computer Science and Engineering with specialization in Machine Learning. The purpose of this course is to introduce mathematical foundations of basic Machine Learning concepts among learners, on which Machine Learning systems are built. This course covers Linear Algebra, Vector Calculus, Probability and Distributions, Optimization and Machine Learning problems. Concepts in this course help the learners to understand the mathematical principles in Machine Learning and aid in the creation of new Machine Learning solutions, understand & debug existing ones, and learn about the inherent assumptions & limitations of the current methodologies.

COURSE OUTCOMES

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

CO 1	Make use of the concepts, rules and results about linear equations, matrix algebra, vector spaces, eigenvalues & eigenvectors and orthogonality & diagonalization to solve computational problems	Apply
CO 2	Perform calculus operations on functions of several variables and matrices, including partial derivatives and gradients	Apply
CO 3	Utilize the concepts, rules and results about probability, random variables, additive & multiplicative rules, conditional probability, probability distributions and Bayes' theorem to find solutions of computational problems	Apply
CO 4	Train Machine Learning Models using unconstrained and constrained optimization methods	Apply

SYLLABUS

Linear Algebra: Systems of Linear Equations, Matrices**, ANALYTIC GEOMETRY, MATRIX DECOMPOSITIONS:** Norms, Eigen decomposition and Diagonalization, **Vector Calculus:** differentiation of Univariate Functions, Useful Identities for Computing Gradients**, Probability and Distributions:** Data and Learning Model Empirical Risk Minimization**,** Summary Statistics and Independence, **Optimization**: Optimization Using Gradient Descent, Constrained Optimization and Lagrange Multipliers.

TEXT BOOKS

1) Mathematics for Machine Learning by Marc Peter Deisenroth, A. Aldo Faisal, and Cheng Soon Ong published by Cambridge University Press (freely available at https://mml - book.github.io)

REFERENCES

1) Linear Algebra and Its Applications, 4th Edition by Gilbert Strang
2) Linear Algebra Done Right by Axler, Sheldon, 2015 published by Springer
3) Introduction to Applied Linear Algebra by Stephen Boyd and LievenVandenberghe, 2018 published by Cambridge University Press

COURSE PLAN

Module	Contents	No. of hours
I	**LINEAR ALGEBRA:** Systems of Linear Equations – Matrices, Solving Systems of Linear Equations. Vector Spaces –Vector Spaces, Linear Independence, Basis and Rank. Linear Mappings – Matrix Representation of Linear Mappings, Basis Change, Image and Kernel.	14
II	**ANALYTIC GEOMETRY, MATRIX DECOMPOSITIONS:** Norms, Inner Products, Lengths and Distances, Angles and Orthogonality, Orthonormal Basis, Orthogonal Complement, Orthogonal Projections – Projection into One Dimensional Subspaces, Projection onto General Subspaces, Gram-Schmidt Orthogonalization. Determinant and Trace, Eigenvalues and Eigenvectors, Cholesky Decomposition, Eigen decomposition and Diagonalization, Singular Value Decomposition, Matrix Approximation.	14
III	**VECTOR CALCULUS:**Differentiation of Univariate Functions - Partial Differentiation and Gradients, Gradients of Vector Valued Functions, Gradients of Matrices, Useful Identities for Computing Gradients. Back propagation and Automatic Differentiation – Gradients in Deep Network, Automatic Differentiation. Higher Order Derivatives Linearization and	10

	Multivariate Taylor Series.	
IV	**Probability and Distributions:**Construction of a Probability Space - Discrete and Continuous Probabilities, Sum Rule, Product Rule, and Bayes' Theorem. Summary Statistics and Independence – Gaussian Distribution - Conjugacy and the Exponential Family - Change of Variables/Inverse Transform.	12
V	**Optimization:**Optimization Using Gradient Descent - Gradient Descent With Momentum, Stochastic Gradient Descent. Constrained Optimization and Lagrange Multipliers - Convex Optimization - Linear Programming - Quadratic Programming	10
Total hours		60

MARK DISTRIBUTION

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 Hours

CONTINOUS INTERNAL EVALUATION PATTERN

Attendance	:	10 marks
Continuous Assessment Tests	:	25 marks
Assignment/Project/Case study etc.	:	15 marks