SCHEME OF EXAMINATION

&

SYLLABI

for

Bachelor of Technology / Master of Technology (Dual Degree Programmes)

Scheme and Syllabus

for

a. **Computer Science and Engineering Major Discipline**
b. **Information Technology Major Discipline**
c. **Electronics and Communication Engineering Major Discipline**

1st Year Common Scheme and Syllabus, 2nd year Scheme and Syllabus and Scheme of Studies framework for higher semesters)

Offered by

University School of Information, Communication & Technology at the GGSIPU University Campus, Dwarka

GURU GOBIND SINGH
INDRAPRASTHA
UNIVERSITY

GuruGobindSinghIndraprasthaUniversity
Sector 16C, Dwarka, Delhi – 110 078 [INDIA]
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Applicable from Batch Admitted in Academic Session 2021-22 Onwards

Approval History:

1. **First year Scheme and Syllabus approved by BoS 31/10/2021.**
2. **First year Scheme and Syllabus approved by AC Subcommittee on 22/11/2021.**
3. **First year Scheme and Syllabus approved by Academic Council on 22/02/2022 vide agenda item AC 52.11.**
4. **2nd year Scheme and Syllabus approved by BoS 10/09/2022**
5. **Minor Modification inBS113 and BS108 approved by BoS on 10/09/2022 w.e.f. Academic Session 2022-23. And, the same approved in AC subcommittee on dt. 14.09.2022.**
6. **Inclusion of Basic Engineering Chemistry I and Basic Engineering Chemistry II papers in lieu of Engineering Chemistry I and Engineering Chemistry II for admitted students in the 1st year, for students who did not study chemistry at 10+2 level, approved by BoS on 10 /09/2022,w.e.f academic session 2022-23. And, the same approved in AC subcommittee on dt. 14.09.2022.**
7. **Inclusion of lateral entry guidelines and bridge course with effect from lateral entry admissions in the year 2022-23 (regular batch 2021-22) approved by BoS on 10/09/2022. And, the same approved in AC subcommittee on dt. 14.09.2022.**
8. **Correction in the marking scheme of BS110 approved by the BoS on 10/09/2022 with retrospective effect from Academic Session 2021-22. And, the same approved in AC subcommittee on dt. 14.09.2022.**

Vision of the School

Create high-qualityengineering professionals

Mission of the School

To serve humanity by creatingprofessionally competent, socially sensitiveengineers with high ethical values who canwork as individuals or in groups inmulticultural global environments.

Introduction

This document describes the curriculum of the Bachelor of Technology part of the Dual Degree (Bachelor Technology / Master of Technology) Programmes that are offered at the University School of Information, Communication and Technology in its own campus (not at the affiliated institution of the University). In the event of any difficulty of implementation, and / or interpretation of any clause of the document, the same may be brought to the notice of Dean of the University School of Information Communication and Technology. The decision of the Dean, University School of Information Communication and Technology shall be final and implemented to resolve the issue. The same shall be put up in the subsequent meeting of the Board of Studies of the University School of Information Communication and Technology for its approval. If the decision of the Board of Studies of the University School of Information Communication and Technology is at variance with the decision taken earlier by the Dean of the School, the decision of the Board shall be effective from the date of the approval by the Board of Studies. In the interim period (between the approval of the Dean, of the School and the Board of Studies approval), the decision already taken by the Dean of the school shall stand.

Programme Outcomes

1. ***Engineering Knowledge*** (**PO01**): Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. ***Problem Analysis*** (**PO02**): Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
3. ***Design/Development of Solutions*** (**PO03**): 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*** (**PO04**): 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 for complex problems:
    a. that cannot be solved by straightforward application of knowledge, theories and techniques applicable to the engineering discipline as against problems given at the end of chapters in a typical text book that can be solved using simple engineering theories and techniques;
    b. that may not have a unique solution. For example, a design problem can be solved in many ways and lead to multiple possible solutions;
    c. that require consideration of appropriate constraints / requirements not explicitly given in the problem statement such as cost, power requirement, durability, product life, etc.;
    d. which need to be defined (modelled) within appropriate mathematical framework; and
    e. that often require use of modern computational concepts and tools, for example, in the design of an antenna or a DSP filter.
5. ***Modern Tool Usage*** (**PO05**): Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding ofthe limitations.
6. ***The Engineer and Society*** (**PO06**): 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*** (**PO07**): 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*** (**PO08**): Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. ***Individual and Team Work*** (**PO09**): Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. ***Communication*** (**PO10**): Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. ***Project Management and Finance*** (**PO11**): Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. ***Life-long Learning*** (**PO12**): Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context oftechnological change.

Course / Paper Group Codes:
BS: Basic Science
HS: Humanities, social science, management
ES: Engineering Science
MC: Mandatory courses
PC: Programme Core, that is course / paper offered in the discipline of the programme as a compulsory paper.
PCE: Programme Core Elective, that is elective course / paper offered in the discipline of the programme.
EAE: Emerging Area Elective offered by school
OAE: Open area elective offered by other school or open / emerging area elective offered by the school. This allows the student to have two minor specializations also.
Note: The papers offered by USICT as open elective shall only be offered in the Dwarka Campus of the University. Students studying at the Dwarka Campus of the University only are eligible for these papers, subject to the rules of the USICT.

Definitions:
Batch: The batch of the student shall mean the year of the first time enrolment of the students in the programme of study in the first semester. Lateral entry students admitted in the 3rd semester / 2nd year shall be designated as students admitted in the previous batch as they are admitted one year later. A student re-admitted in a programme of study in a lower / later batch shall be considered as the student of the original batch for the purpose calculation of duration of study.

Programme of study shall mean Bachelor of Technology.

Major specialization shall mean the discipline in which the student is admitted / upgraded or transferred.

Minor specialization shall mean the specializations earned through the EAE or OAE route subject to fulfilment of requirements specified in the scheme of study for the concerned minor specialization.

Paper / Course shall be treated as synonyms. A paper is one unit of curriculum taught, in general, in one particular semester, having upto 4 credits (for papers with

Acronyms:
APC: Academic programme committee comprising of all faculty of the school and as defined in the implementation rules.
BoS: Board of Study of the school, USICT.
USICT: University School of Information, Communication and Technology.
L: Number of Lecture hours per week
T/P: Number of Tutorial / Practical Hours per week
C: Number of credits assigned to a course / paper
COE: Controller of Examinations of the Examinations Division of the University.
SGPA/CGPA: Semester/Cumulative Grade Point Average.
NUES: No term end examination shall be held. The evaluation shall be conducted as per the scheme of examinations as described in the scheme of study.

NOTE: THE CURRENT DOCUMENT DEFINES THE SCHEME OF THE FIRST 4 YEARS (8 SEMESTER) CORRESPONDING TO THE BACHELOR OF TECHNOLOGY PART OF THE BACHELOR OF TECHNOLOGY / MASTER OF TECHNOLOGY PART OF THE DUAL DEGREE PROGRAMMES OFFERED BY USICT AT THE DWARKA CAMPUS OF THE UNIVERSITY. THE CURRENT DOCUMENT DEFINES THE SCHEME AND SYLLABUS FOR THE FIRST AND SECOND YEAR ONLY.

FIRST YEAR

Common Scheme and Syllabus for

Bachelor of Technology / Master of Technology
(Dual Degree Programmes)
In

a. **Computer Science and Engineering - Major Discipline**
b. **Information Technology - Major Discipline**
c. **Electronics and Communication Engineering - Major Discipline**

In light of the eligibility condition specified in the **AICTE Process Handbook 2022-23** (Page Nos 89 and 90), the **BasicEngineeringChemistry - I(BS-117)**shall be offered in lieu of **Engineering Chemistry – I (BS109)** and **Basic Engineering Chemistry – II (BS116)** shallbe offered in lieu of **Engineering Chemistry – II (BS104),** to students admitted from Academic Session 2022-23 (in the 1st Semester).This shall be offered only to students who have not studied Chemistry at 10+2 Level and are admitted to the following disciplines only:

1) Computer Science and Engineering (CSE)
2) Information Technology (IT)
3) Electronics and Communications Engineering (ECE)

Note: The corresponding practical paper codes shall be unchanged.
(Addition from Academic Session 2022-23)

First Semester					
Group	**Code**	**Paper**	**L**	**P**	**Credits**
Theory Papers					
ES	ICT101	Programming for Problem Solving	3	-	3
ES	ICT103	Electrical Science	3	-	3
ES	ICT105	Engineering Mechanics	3	-	3
HS	HS107	Communication Skills-I	3	-	3
BS	BS109[#] Or BS117	Engineering Chemistry – I Basic Engineering Chemistry – I	3	-	3
BS	BS111	Engineering Mathematics – I	4	-	4
BS	BS113	Engineering Physics – I	3	-	3
HS/MC	LLB115*****	Indian Constitution	2	-	2
Practical/Viva Voce					
ES	ICT151	Programming for Problem Solving Lab.	-	2	1
ES	ICT153	Engineering Graphics-I	-	2	1
ES	ICT155	Electrical Science Lab.	-	2	1
BS	BS157	Engineering Chemistry-I Lab	-	2	1
BS	BS159	Engineering Physics - I Lab	-	2	1
Total			**24**	**10**	**29**

***NUES : Comprehensive evaluation by the teacher concerned out of 100.**

#The students who have not studied Chemistry at 10+2 level shall be offered BS-117 in lieu of BS-109, as applicable in applicable disciplines. (Addition from the Academic Session 2022-23)

Group	Code	Paper	L	P	Credits
HS/MS	HS-352	NSS / NCC / Cultural Clubs / Technical Society / Technical Club*			2

***NUES:** Comprehensive evaluation of the students by the concerned coordinator of NCC / NSS / Cultural Clubs / Technical Society / Technical Clubs, out of 100 as per the evaluation schemes worked out by these activity societies, organizations; the co-ordinators shall be responsible for the evaluation of the same. These activities shall start from the 1st semester and the evaluation shall be conducted at the end of the 6th semester for students admitted in the first semester. Students admitted in the 2nd year (3rd semester) as lateral entry shall undergo training or participate in the activities for the period of 3rd semester to 6th semester only

Second Semester					
Group	**Paper Code**	**Paper**	**L**	**P**	**Credits**
Theory Papers					
ES		School Specific Engineering Science Paper**			3
HS	HS102	Communication Skills – II	3	-	3
BS	BS104[%] Or BS116	Engineering Chemistry – II Basic Engineering Chemistry – II	3	-	3
BS	BS106	Engineering Mathematics - II	4	-	4
BS	BS108	Engineering Physics-II	3	-	3
BS	BS110	Probability and Statistics for Engineers ***	3	2	4
HS/MC	ICT114*	Human Values and Ethics	1	-	1
BS/MC	EMES112	Environmental Studies	4	-	4
Practical/Viva Voce					
ES	ICT152	Engineering Graphics-II Lab.	-	2	1
BS	BS156	Engineering Chemistry – II Lab	-	2	1
BS	BS158	Engineering Physics –II Lab	-	2	1
One paper from the following#:					
ES	ICT154	Workshop Technology		2	1
ES	ICT160	Programming in Python		2	
Total			**24**	**10**	**29**

*NUES: Comprehensive evaluation by the teacher out of 100, no term end examination shall be held.

%The students who have not studied Chemistry at 10+2 level shall be offered BS-116 in lieu of BS-104, as applicable in applicable disciplines. (Addition from the Academic Session 2022-23)

Either Workshop practice or Programming in Python paper shall be offered to the students by the school. If Workshop Technology paper is offered it shall be considered as a Theory paper otherwise Workshop practice shall be considered as practical paper

** School Specific Engineering Science Paper in this semester shall be one of the papers from the list below or any paper (approved by the Board of Studies of the School) decided by the Academic Programme Committee of the School to be offered in the first year/second semester.

Second Semester Open Elective from the School					
Group	**Paper Code**	**Paper**	**L**	**P**	**Credits**
	Open Elective Papers				
ES	ICT116	Introduction to Manufacturing Process	3	-	3
ES	BS118	Industrial Chemistry	3	-	3
ES	BT120	Introduction to Biotechnology	3	-	3

*** The Teachers' Continuous Evaluation Component shall be 25, Term end theory examinations of 50 marks and term end practical marks shall be of 25 marks maximum. The marks obtained in each component by the student shall be reflected in the marksheet**as internal marks out of 25 and external marks out of 75 (50 theory and 25 practicals)** (amended in 2022 for batch of 2021 onwards).

SYLLABUS OF FIRST YEAR

for

a. Computer Science and Engineering Major Discipline
b. Information Technology Major Discipline
c. Electronics and Communication Engineering Major Discipline

Offered by

University School of Information, Communication & Technology at the GGSIPU University Campus, Dwarka

PaperCode: ICT101	Paper: Programming for Problem Solving	L	T/P	C
PaperID: 164101		3	-	3

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end Theory Examinations: 75 marks

Instruction for paper setter:

1. There should be 9 questions in the term end examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus.This question should be objective, single line answers or short answer type question of total 15 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15.
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

Course Objectives:

1:	To impart basic knowledge about simple algorithms for arithmetic and logical problems so that students can understand how to write a program, syntax and logical errors in 'C'.
2:	To impart knowledge about how to implement conditional branching, iteration and recursion in 'C'.
3:	To impart knowledge about using arrays, pointers, files, union and structures to develop algorithms and programs in 'C'.
4:	To impart knowledge about how to approach for dividing a problem into sub-problems and solve the problem in 'C'.

Course Outcomes (CO):

CO1:	Ability to develop simple algorithms for arithmetic and logical problems and implement them in 'C'.
CO2:	Ability to implement conditional branching, iteration and recursion and functions in 'C'
CO3:	Ability to use arrays, pointers, union and structures to develop algorithms and programs in 'C'.
CO4:	Ability to decompose a problem into functions and synthesize a complete program using divide and conquer approach in 'C'.

Course Outcomes (CO) to Programme Outcomes (PO) Mapping (scale 1: low, 2: Medium, 3: High)

CO/PO	*PO01*	*PO02*	*PO03*	*PO04*	*PO05*	*PO06*	*PO07*	*PO08*	*PO09*	*PO10*	*PO11*	*PO12*
CO1	3	3	2	1	1	-	-	-	2	1	1	3
CO2	3	3	2	1	1	-	-	-	2	1	1	3
CO3	3	3	3	1	1	-	-	-	2	1	1	3
CO4	3	3	3	1	1	-	-	-	2	1	1	3

Unit I

Introduction to Programming: Computer system, components of a computer system, computing environments, computer languages, creating and running programs, Preprocessor, Compilation process, role of linker, idea of invocation and execution of a programme. Algorithms: Representation using flowcharts, pseudocode.

Introduction to C language: History of C, basic structure of C programs, process of compiling and running a C program, C tokens, keywords, identifiers, constants, strings, special symbols, variables, data types, I/O statements. Interconversion of variables.

Operators and expressions: Operators, arithmetic, relational and logical, assignment operators, increment and decrement operators, bitwise and conditional operators, special operators, operator precedence and associativity, evaluation of expressions, type conversions in expressions. [10Hrs]

Unit II

Control structures: Decision statements; if and switch statement; Loop control statements: while, for and do while loops, jump statements, break, continue, goto statements.

Arrays: Concepts, One dimensional array, declaration and initialization of one dimensional arrays, two dimensional arrays, initialization and accessing, multi dimensional arrays.

Functions: User defined and built-in Functions, storage classes, Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference, Recursion.

Strings: Arrays of characters, variable length character strings, inputting character strings, character library functions, string handling functions. [10Hrs]

Unit III

Pointers: Pointer basics, pointer arithmetic, pointers to pointers, generic pointers, array of pointers, functions returning pointers, Dynamic memory allocation. Pointers to functions. Pointers and Strings

Structures and unions: Structure definition, initialization, accessing structures, nested structures, arrays of structures, structures and functions, self referential structures, unions, typedef, enumerations.

File handling: command line arguments, File modes, basic file operations read, write and append.
Scope and life of variables, multi-file programming.
C99 extensions. 'C' Standard Libraries: stdio.h, stdlib.h, assert.h, math.h, time.h, ctype.h, setjmp.h, string.h, stdarg.h, unistd.h [10Hrs]

Unit IV

Basic Algorithms: Finding Factorial, Fibonacci series, Searching, Basic Sorting Algorithms- Bubble sort, Insertion sort and Selection sort. Find the square root of a number, array order reversal, reversal of a string, two-way merge sort, stacks, queues, single –link linked list, Binary search tree. [10Hrs]

Textbooks:

1. *How to solve it by Computer* by R. G. Dromey, Prentice-Hall India EEE Series, 1982.
2. *The C programming language* by B W Kernighan and D M Ritchie, Pearson Education, 1988.

References:

1. *Programming Logic & Design* by Tony Gaddis, Pearson, 2nd Ed. 2016.
2. *Programming Logic and Design* by Joyce Farrell, Cengage Learning, 2015.
3. *Engineering Problem Solving With C* by Delores M. Etter, Pearson, 2013.
4. *Problem Solving and Program Design in C* by Jeri R. Hanly and Elliot B. Koffman, Pearson, 2016.
5. *Structure and Interpretation of Computer Programs* by Harold Abelson and Gerald Sussman with Julie Sussman, MIT Press, 1985.
6. *How to Design Programs* by Matthias Felleisen, Robert Bruce Findler, Matthew Flatt, and Shriram Krishnamurthi, MIT Press, 2018.
7. *ANSI/ISO 9899-1990, American National Standard for Programming Languages 'C'* by American National Standards Institute, Information Technology Industry Council, 1990 (C89).
8. *ISO/IEC 9899:1999. International Standard for Programming Languages – C (ISO/IEC 9899)* by American National Standards Institute, Information Technology Industry Council, 2000 (C99).
9. *INCITS/ISO/IEC 9899-2011.American National Standard for Programming Languages 'C'*by American National Standards Institute, Information Technology Industry Council, 2012 (C11).

PaperCode: ICT103	Paper: Electrical Science	L	T/P	C
PaperID: 164103		3	-	3

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end Theory Examinations: 75 marks

Instruction for paper setter:

1. There should be 9 questions in the term end examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus.This question should be objective, single line answers or short answer type question of total 15 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15.
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

Course Objectives:

1:	To impart knowledge of the basics electrical engineering.
2:	To impart knowledge of the working of RLC circuits.
3:	To impart basic knowledge about filters and magnetic circuits.
4:	To impart basic knowledge about electrical machines.

Course Outcomes (CO):

CO1:	Ability to understand and use Kirchpff's Laws to solve resistive circuit problems.
CO2:	Ability to analyse resistive, inductive and capacitive circuits for transient and steady state sinusoidal solutions.
CO3:	Understand the first order filters and magnetic circuits.
CO4:	Understand the design of electrical machines.

Course Outcomes (CO to Programme Outcomes (PO) Mapping (scale 1: low, 2: Medium, 3: High

CO/PO	*PO01*	*PO02*	*PO03*	*PO04*	*PO05*	*PO06*	*PO07*	*PO08*	*PO09*	*PO10*	*PO11*	*PO12*
CO1	3	3	3	3	3	-	-	-	1	1	1	2
CO2	3	3	3	3	3	-	-	-	1	1	1	2
CO3	3	3	3	3	3	-	-	-	1	1	1	2
CO4	3	3	3	3	3	-	-	-	1	1	1	2

Unit - I

DC Circuits: Passive circuit components, Basic laws of Electrical Engineering, Temperature Resistance Coefficients. voltage and current sources, Series and parallel circuits, power and energy, Kirchhoff's Laws, Nodal & Mesh Analysis, delta-star transformation, superposition theorem, Thevenin's theorem, Norton's theorem, maximum power transfer theorem. Time domain analysis of first Order RC & LC circuits.[10Hrs]

Unit – II

AC Circuits: Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three phase balanced circuits, voltage and current relations in star and delta connections. [10Hrs]

Unit - III

D. C. Generators & Motors: Principle of operation of Generators & Motors, Speed Control of shunt motors, Flux control, Rheostatic control, voltage control, Speed control of series motors.

A. C. Generators & Motors: Principle of operation, Revolving Magnetic field, Squirrel cage and phase wound rotor, Starting of Induction motors, Direct on line and Star Delta starters, Synchronous machines. [10Hrs]

Unit - IV:

Transformers: Construction and principle of operation, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

Measuring Instruments: Electromagnetism, Different Torques in Indicating instruments, Moving Iron Instruments: Construction & Principle, Attraction and Repulsion type; Moving Coil instruments: Permanent Magnet type; Dynamometer type Instruments. [10Hrs]

Textbooks:

1. *Electrical Engineering Fundamentals* by Vincent Del Toro, PHI (India), 1989

References:

1. *An Introduction to Electrical Science* by Adrian Waygood, Routledge, 2nd Ed. 2019.
2. *Electrical Circuit Theory and Technology* by John Bird, Elsevier, 2007.
3. *Principles and Applications of Electrical Engineering* by Giorgio Rizzoni, MacGraw-Hill, 2007.

4. *Electrical Engineering* by Allan R. Hambley, Prentice-Hall, 2011.
5. *Hughes Electical & Electronic Technology* by Edward Hughes revised by Hohn Wiley, Keith Brown and Ian McKenzie Smith, Pearson, 2016.
6. *Electrical and Electronics Technology* by E. Hughes, Pearson, 2010.
7. Basic Electrical Engineering by D.C. Kulshrestha, McGraw-Hill, 2009.
8. Basic Electrical Engineering by D. P. Kothai and I.J. Nagrath, McGraw-Hill, 2010.

PaperCode: ICT105	Paper: Engineering Mechanics	L		T/P	C
PaperID: 164105		3		-	3

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end Theory Examinations: 75 marks

Instruction for paper setter:

1. There should be 9 questions in the term end examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus.This question should be objective, single line answers or short answer type question of total 15 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15.
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

Course Objectives:

1:		To impart knowledge to solve problems pertaining to force systems, equilibrium and distributed systems.
2:		To impart knowledge to solve problems of friction and engineering trusses.
3:		To impart knowledge to deal with the problems of kinematics and kinetics of particle
4:		To impart knowledge to deal with the problems of kinematics and kinetics of rigid bodies.

Course Outcomes (CO):

CO1:		Ability to solve problems pertaining to force systems, equilibrium and distributed systems.
CO2:		Ability to solve problems of friction and engineering trusses.
CO3:		Ability to deal with the problems of kinematics and kinetics of particle
CO4:		Ability to deal with the problems of kinematics and kinetics of rigid bodies.

Course Outcomes (CO) to Programme Outcomes (PO) Mapping (scale 1: low, 2: Medium, 3: High)

CO/PO	*PO01*	*PO02*	*PO03*	*PO04*	*PO05*	*PO06*	*PO07*	*PO08*	*PO09*	*PO10*		*PO11*	*PO12*
CO1	3	3	3	3	2	-	-	-	1	1		1	2
CO2	3	3	3	3	2	-	-	-	1	1		1	2
CO3	3	3	3	3	2	-	-	-	1	1		1	2
CO4	3	3	3	3	2	-	-	-	1	1		1	2

Unit I

Force System: Introduction, force, principle of transmissibility of force, resultant of a force system, resolution of a force, moment of force about a line, Varigon's theorem, couple, resolution of force into force and a couple, properties of couple and their application to engineering problems.

Equilibrium: Force body diagram, equations of equilibrium and their applications to engineering problems, equilibrium of two force and three force members.

Distributed Forces: Determination of center of gravity, center of mass and centroid by direct integration and by the method of composite bodies, mass moment of inertia and area moment of inertia by direct integration and composite bodies method, radius of gyration, parallel axis theorem, polar moment of inertial.[10Hrs]

Unit II

Structure: Plane truss, perfect and imperfect truss, assumption in the truss analysis, analysis of perfect plane trusses by the method of joints, method of section and graphical method.

Friction: Static and Kinetic friction, laws of dry friction, co-efficient of friction, angle of friction, angle of repose, cone of friction, frictional lock, friction in flat pivot and collar bearing, friction in flat belts. [10Hrs]

Unit III

Kinematics of Particles: Rectilinear motion, plane curvilinear motion, rectangular coordinates, normal and tangential coordinates.

Kinetics of Particles: Equation of motion, rectilinear motion and curvilinear motion, work-energy equation, conservation of energy, concept of impulse and momentum, conservation of momentum, impact of bodies, co-efficient of restitution, loss of energy during impact. [10Hrs]

Unit IV

Kinematics of Rigid Bodies: Concept of rigid body, types of rigid body motion, absolute motion, introduction to relative velocity, relative acceleration (Corioli's component excluded) and instantaneous center of zero velocity, Velocity and acceleration.

Kinetics of Rigid Bodies: Equation of motion, translatory motion and fixed axis rotation, application of work energy principles to rigid bodies conservation of energy.

Beam: Introduction, types of loading, methods for the reactions of a beam, space diagram, types of end supports, beams subjected to couple. [10Hrs]

Textbooks:

1.*Engineering Mechanics* by A.K.Tayal, Umesh Publications.

References:

1. *'Engineering Mechanics' by K. L. Kumar, Tata Mc-Graw Hill*
2. 'Engineering Mechanics' by S. Timoshenko, D. H. Young, J. V. Rao, Tata Mc-Graw Hill
3. 'Engineering Mechanics-Statics and Dynamics' by Irwing H. Shames, PHI.
4. 'Engineering Mechanics' by Basudev Bhattacharya, Oxford Higher Education.

PaperCode: HS107	Paper: Communication Skills - I	L	T/P	C
PaperID: 99107		3	-	3

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end Theory Examinations: 75 marks

Instruction for paper setter:

1. There should be 9 questions in the term-end examinations question paper.
2. The first unit will be compulsory and cover the entire syllabus. This question will have Five sub-parts, and the students will be required to answer any THREE parts of 5 marks each. This unit will have a total weightage of 15 marks.
3. Apart from unit 1 which is compulsory, the rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain up to 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15.
4. The questions are to be framed keeping in view the learning outcomes of the course/paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.

Course Objectives:

1:	To help them understand the structures of language, and build up the vocabulary.
2:	To enhance language proficiency and communication competence.
3:	To understand basic principles of written communication.
4:	To develop the efficiency of using language for Specific Purposes with clarity.
5:	To be able to critically appreciate the written texts and audio-visual inputs effectively.
6:	To develop the theoretical understanding of interpersonal communication effectively.

Course Outcomes (CO):

CO1:	Ability to understand the basic structure of language
CO2:	Ability to communicate effectively in writing.
CO3:	Ability to present their ideas effectively in professional and demanding situations.
CO4:	Ability to interpret texts and comprehend the extended discourse.

Course Outcomes (CO to Programme Outcomes (PO) Mapping (scale 1: low, 2: Medium, 3: High

CO/PO	*PO01*	*PO02*	*PO03*	*PO04*	*PO05*	*PO06*	*PO07*	*PO08*	*PO09*	*PO10*	*PO11*	*PO12*
CO1	-	-	-	-	-	-	-	-	3	3	-	3
CO2	-	-	-	-	-	-	-	-	3	3	-	3
CO3	-	-	-	-	-	-	-	-	3	3	-	3
CO4	-	-	-	-	-	-	-	-	3	3	-	3

Unit I

Basic Language Efficiency 1: Parts of Speech, Sentence Structure, Subject-Verb Agreement, Vocabulary, Common Errors, [8Hrs]

Unit II

Basic Language Efficiency 2: Writing Skills: Types of Writing, Paragraph writing,Paraphrasing, Summarizing, Précis Writing [8Hrs]

Unit III

Formal Written Communication: Meetings – Agenda and Minutes,Press release, Letter writing, Notice, Memorandum, E-mails [8Hrs]

Unit IV

Appreciating written Texts for comprehension ability:

1. Steven Spielberg's Speech at Harvard Commencement 2016(https://www.youtube.com/watch?v=TYtoDunfu00)
2. Lecture by Johan Rockstrom: Let the Environment Guide our Development http://www.ted.com/talks/johan_rockstrom_let_the_environment_guide_our_development

[8Hrs]

Textbooks:

1. *High English Grammar and Composition* by Wren, P.C. & Martin H., S.Chand & Company Ltd, New Delhi.
2. *Technical Communication: Principles & Practice* by Meenakshi Raman, New Delhi: Oxford University Press

References:

1. *Be Grammar Ready: The Ultimate Guide to English Grammar* by John Eastwood, New Delhi, Oxford University Press, 2020.
2. *Communication Skills: A Workbook* by Sanjay Kumar & Pushp Lata, New Delhi, Oxford University Press, 2018.
3. *Basic Technical Communication* by Kavita Tyagi & Padma Mishra, New Delhi, PHI Learning, 2012.
4. *Advanced Technical Communication* by Kavita Tyagi & Padma Mishra, New Delhi, PHI Learning, 2011.

PaperCode: BS109	Paper: Engineering Chemistry - I	L	T/P	C
PaperID: 99109		3	-	3

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end Theory Examinations: 75 marks

Instruction for paper setter:

1. There should be 9 questions in the term-end examinations question paper.
2. The first unit will be compulsory and cover the entire syllabus. This question will have Five sub-parts, and the students will be required to answer any THREE parts of 5 marks each. This unit will have a total weightage of 15 marks.
3. Apart from unit 1 which is compulsory, the rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain up to 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15.
4. The questions are to be framed keeping in view the learning outcomes of the course/paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

Course Objectives:

1:	To impart knowledge about understanding and modeling atomic structure and chemical bonding.
2:	To impart knowledge about understanding and modeling Thermochemistry and Reaction Kinetics.
3:	To impart knowledge about understanding and modeling organic compound structure and reactions.
4:	To impart knowledge about understanding and modeling Stereochemistry.

Course Outcomes (CO):

CO1:	Ability to understand and model atomic structure and chemical bonding.
CO2:	Ability to understand and model Thermochemistry and Reaction Kinetics.
CO3:	Ability to understand and model organic compound structure and reactions.
CO4:	Ability to understand and model Stereochemistry.

Course Outcomes (CO to Programme Outcomes (PO) Mapping (scale 1: low, 2: Medium, 3: High

CO/PO	*PO01*	*PO02*	*PO03*	*PO04*	*PO05*	*PO06*	*PO07*	*PO08*	*PO09*	*PO10*	*PO11*	*PO12*
CO1	2	2	3	3	2	-	-	-	1	1	-	1
CO2	2	2	3	3	2	-	-	-	1	1	-	1
CO3	2	2	3	3	2	-	-	-	1	1	-	1
CO4	2	2	3	3	2	-	-	-	1	1	-	1

Unit I

Atomic Structure: Introduction to wave mechanics, the Schrödinger equation as applied to hydrogen atom, origin of quantum numbers, Long form of periodic table on the basis of Electronic configuration s, p, d, f block elements periodic trends, Ionization potential, atomic and ionic radii electron affinity & electro-negativity.

Chemical Bonding: Ionic bond, energy changes, lattice energy Born Haber Cycle, Covalent bond-energy changes, Potential energy curve for H2 molecule, characteristics of covalent compound, co-ordinate bond-Werner's Theory, effective atomic numbers, A hybridization and resonance, Valence Shell Electron Repulsion theory (VSEPR), Discussion of structures of H2O, NH3, BrF3, SiF4, Molecular orbital theory, Linear combination of atomic orbitals (LCAO) method. Structure of simple homo nuclear diatomic molecule like H2, N2, O2, F2.

[12Hrs]

Unit II

Thermochemistry: Hess's Law, heat of reaction, effect of temperature on heat of reaction at constant pressure (Kirchhoff's Equation) heat to dilution, heat of hydration, heat of neutralization and heat of combustion, Flame temperature. Reaction Kinetics: Significance of rate law and rate equations, order and molecularity, Determinations of order of simple reactions-experimental method, Equilibrium constant and reaction rates -Lindermann, collision and activated complex theories, complex reactions of 1st order characteristics of consecutive, reversible and parallel reactions-Steady state and non-steady state approach. [10 Hrs]

Unit III

Basic concepts of Organics: Inductive, electromeric, mesomeric and hyperconjugative effects. Stability of reaction intermediates. Electrophiles and nucleophiles, concepts of acids and bases. Arrhenius, Lowry-Bronsted and Lewis theory of acids and bases (HSAB), Carbon acids (active methylene groups), super acids. Bonds weaker than covalent bond: Hydrogen bonding - nature, types, stability and effects. IUPAC Nomenclature. [8Hrs]

Unit IV

Stereochemistry: Classification of stereoisomers, diastereomers, Separation of enantiomers. Absolute configuration (R and S), Projection formulae. Stereochemistry of compounds containing two asymmetric C-atoms. Elements of symmetry -

center, plane and axis of symmetry, Conformations: Conformations around a C-C bond in acyclic and cyclic compounds.
[10Hrs]

Textbooks / References:

1. Engineering Chemistry (16th Edition) Jain, Jain, Dhanpat Rai Publishing Company, 2013.
2.Textbook of Engineering Chemistry by Jaya Shree Anireddy, Wiley, 2017
3.Engineering Chemistry by E.R. Nagarajan and S. Ramalingam, Wiley, 2017.

Paper Code:	**Paper: Basic Engineering Chemistry- I**	**L**	**T/P**	**C**
PaperID:	w.e.f. Academic session 2022-23	**3**	**-**	**3**

TO BE OFFERED TO STUDENTS WHO HAVE NOT STUDIED CHEMISTRY AT 10+2 LEVEL IN LIEU OF BS109

Marking Scheme:

1.Teachers Continuous Evaluation: 25 marks

2.Term and Theory Examinations: 75 marks

Instruction for paper setter:

1. There should be 9 questions in the term-end examination question paper.
2. The first question will be compulsory and cover the entire syllabus. This question will have five sub-parts, and the students will be required to answer any THREE parts of 5 marks each. This question will have a total weightage of 15 marks.
3. Apart from question 1 which is compulsory, the rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain up to 5 sub-parts/sub-questions. Each Unit shall have a marks weightage of 15.
4. The questions are to be framed keeping in view the learning outcomes of the course/paper. The standard/level of the questions to be asked should be at the level of the prescribed textbook.
5. The requirement of (scientific) calculators/ log-tables / data-tables may be specified if required.

Course Objectives:

1.	To impart knowledge about atomic structure, periodicity and chemical bonding.
2.	To impart understanding about thermodynamics and reaction kinetics.
3.	To understand the basic concepts of organic chemistry.
4.	To impart basic understanding about biomolecules.

Course Outcomes (CO):

CO1:	Students will be able to understand microscopic chemistry in terms of atomic orbitals and chemical bonding
CO2:	Ability to understand thermodynamics and reaction kinetics
CO3:	Ability to understand organic compound structure and reactions
CO4:	Students will be able to understand the basic structure and functions of biomolecules.

Course Outcomes (CO to Programme Outcomes (PO) Mapping (scale 1: low, 2: Medium, 3: High

CO/PO	PO01	PO02	PO03	PO04	P005	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO1	2	2	3	3	2	-	-	-	1	1	-	1
CO2	2	2	3	3	2	-	-	-	1	1	-	1
CO3	2	2	3	3	2	-	-	-	1	1	-	1
CO4	2	2	3	3	2	-	-	-	1	1	-	1

Unit I

Atomic Structure: Atomic models; Rutherford, Bohr's model (with drawbacks), Plank's quantum theory, quantum mechanical model of the atom: dual behaviour of atom, Heisenberg's uncertainty principle, basic idea of Schrödinger equation, orbitals and quantum numbers.

Periodic Table and properties: long form of periodic table on the basis of electronic configuration, s, p, d, f block elements, periodic trends: Ionisation potential, atomic and ionic radii, electron affinity and electronegativity.

Chemical Bonding: Lewis symbols, Octet rule, ionic bond (bond parameters), covalent bond, hybridisation and resonance, valence shell electron repulsion (VSEPR) theory, structures of H_2O, NH_3, BrF_3, SiF_4. Elementary idea of Valence bond theory, Molecular orbital theory.

Unit II

Thermodynamics: Basic thermodynamic terms, types of thermodynamic processes, concept of internal energy and enthalpy, Hess's law, heat of reaction, heat of dilution, heat of hydration, heat of neutralization, heat of combustion, concept of spontaneity and entropy, Gibb's energy change and equilibrium.

Kinetics: Rate of chemical reaction, factors influencing rate of reaction, order, molecularity of reaction, zero order, first order reactions, temperature dependence of reaction rate, effect of catalyst on rate of reaction.

Unit III:

Basic Concepts of Organic Chemistry: Inductive, electromeric, mesomeric and hyperconjugative effects. Stability of reaction intermediates. Electrophiles and nucleophiles, concept of acids and bases. Arrhenius, Lowry-Bronsted and Lewis theory of acids and bases (HSAB), Carbon acids (active methylene groups), super acids, Bonds weaker than covalent bond: Hydrogen bonding-nature, types, stability and effects. IUPAC Nomenclature.

Unit IV

Biomolecules:

Carbohydrates: Classification (aldoses and ketoses), monosaccharide (glucose and fructose), D-L configuration, oligosaccharides (sucrose, lactose, maltose), polysaccharides (starch, cellulose, glycogen): importance. Proteins: Elementary idea of a - amino acids, peptide bond, polypeptides, proteins, primary structure, secondary structure, tertiary structure and quaternary structure (qualitative idea only), denaturation of proteins; enzymes. Vitamins: Classification and functions. Nucleic Acids: DNA and RNA.

PaperCode: BS111	Paper: Engineering Mathematics – I	L	T/P	C
PaperID: 99111		4	-	4

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end Theory Examinations: 75 marks

Instruction for paper setter:

1. There should be 9 questions in the term end examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus.This question should be objective, single line answers or short answer type question of total 15 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15.
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

Course Objectives:

1:	To understand use series, differential and integral methods to solve formulated engineering problems.
2:	To understand use Ordinary Differential Equations to solve formulated engineering problems.
3:	To understand use linear algebrato solve formulated engineering problems.
4:	To understand use vector calculusto solve formulated engineering problems.

Course Outcomes (CO):

CO1:	Ability to use series, differential and integral methods to solve formulated engineering problems.
CO2:	Ability to use Ordinary Differential Equations to solve formulated engineering problems.
CO3:	Ability to use linear algebra to solve formulated engineering problems.
CO4:	Ability to use vector calculusto solve formulated engineering problems.

Course Outcomes (CO to Programme Outcomes (PO) Mapping (scale 1: low, 2: Medium, 3: High

CO/PO	*PO01*	*PO02*	*PO03*	*PO04*	*PO05*	*PO06*	*PO07*	*PO08*	*PO09*	*PO10*	*PO11*	*PO12*
CO1	2	3	3	3	1	-	-	-	-	-	1	2
CO2	2	3	3	3	1	-	-	-	-	-	2	2
CO3	2	3	3	3	1	-	-	-	-	-	2	2
CO4	2	3	3	3	1	-	-	-	-	-	2	2

Unit I

Partial derivatives, Chain rule, Differentiation of Implicit functions, Exact differentials.Maxima, Minima and saddle points, Method of Lagrange multipliers. Differentiation underIntegral sign, Jacobians and transformations of coordinates.[8Hrs]

Unit II

Ordinary Differential Equations (ODEs): Basic Concepts. Geometric Meaning of y'= f(x, y). Direction Fields, Euler's Method, Separable ODEs. Exact ODEs. Integrating Factors, Linear ODEs. Bernoulli Equation. Population Dynamics, Orthogonal Trajectories. Homogeneous Linear ODEs with Constant Coefficients. Differential Operators. Modeling of Free Oscillations of a Mass–Spring System, Euler–Cauchy Equations. Wronskian, Nonhomogeneous ODEs, Solution by Variation of Parameters. Power Series Method for solution of ODEs: Legendre's Equation. Legendre Polynomials, Bessel's Equation, Bessels's functions Jn(x) and Yn(x). Gamma Function [12Hrs]

Unit III

Linear Algebra: Matrices and Determinants, Gauss Elimination, Linear Independence. Rank of a Matrix. Vector Space. Solutions of Linear Systems and concept of Existence, Uniqueness, Determinants. Cramer's Rule, Gauss–Jordan Elimination. The Matrix Eigenvalue Problem.

Determining Eigenvalues and Eigenvectors, Symmetric, Skew-Symmetric, and Orthogonal Matrices.Eigenbases. Diagonalization. Quadratic Forms.Cayley – Hamilton Theorem (without proof) [10Hrs]

Unit IV

Vector Calculus: Vector and Scalar Functions and Their Fields. Derivatives, Curves. Arc Length. Curvature. Torsion, Gradient of a Scalar Field. Directional Derivative, Divergence of a Vector Field, Curl of a Vector Field, Line Integrals, Path Independence of Line Integrals, Double Integrals, Green's Theorem in the Plane, Surfaces for Surface Integrals, Surface Integrals, Triple Integrals, Stokes Theorem. Divergence Theorem of Gauss. [10Hrs]

Textbooks:

1. *Advanced Engineering Mathematics* by Erwin Kreyszig, John Wiley, 10th Ed., 2011.
2. *Mathematical Methods for Physics and Engineering*, by K. F. Riley, M. P. Hobson and S. J. Bence, CUP, 2013. (for Unit I)

References:

1. *Engineering Mathematics* by K.A. Stroud withDexter J. Booth, Macmillan, 2020.

2. *Advanced Engineering Mathematics* by Larry Turyn, Taylor and Francis, 2014.
3. *Advanced Engineering Mathematics* by Dennis G. Zill, Jones & Bartlett Learning, 2018.
4. *Advanced Engineering Mathematics with MATLAB* by Dean G. Duffy, Taylor and Francis, 2017.
5. *Advanced Engineering Mathematics* by Merle C. Potter, Jack L. Lessing, and Edward F. Aboufadel, Springer (Switzerland), 2019.

PaperCode: BS113	**Paper: Engineering Physics – I**	**L**	**T/P**	**C**
PaperID: 99113		**3**	**-**	**3**

Applicable w.e.f. Academic Session 2022-23

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end Theory Examinations: 75 marks

Instruction for paper setter:

1. There should be 9 questions in the term end examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus.This question should be objective, single line answers or short answer type question of total 15 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15.
4. The questions are to be framed keeping in view the learning outcomes of the course / paper.The standard / level of the questions to be asked should be at the level of the prescribed textbook.
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

Course Objectives:

1:	To understand thermodynamic principles.
2:	To understand and model oscillations and waves.
3:	To understand and model interference, diffraction and polarization phenomenon.
4:	To understand and appreciate relativistic systems and Lasers.

Course Outcomes (CO):

CO1:	Ability to apply thermodynamic principles to solution of engineering problems.
CO2:	Ability to understand and model oscillations and waves.
CO3:	Ability to understand and model interference, diffraction and polarization phenomenon.
CO4:	Ability to understand and appreciate relativistic systems and Lasers.

Course Outcomes (CO to Programme Outcomes (PO) Mapping (scale 1: low, 2: Medium, 3: High

CO/PO	***PO01***	***PO02***	***PO03***	***PO04***	***PO05***	***PO06***	***PO07***	***PO08***	***PO09***	***PO10***	***PO11***	***PO12***
CO1	2	2	3	3	2	-	-	-	1	1	-	2
CO2	2	2	3	3	2	-	-	-	1	1	-	2
CO3	2	2	3	3	2	-	-	-	1	1	-	2
CO4	2	2	3	3	2	-	-	-	1	1	-	2

Unit I

Introduction to Thermodynamics: Fundamental Ideas of Thermodynamics, The Continuum Model, The Concept of a "System'", "State", "Equilibrium", "Process'". Equations of state, Heat, Zeroth Law of Thermodynamics, Work, first and second laws of thermodynamics, entropy [8Hrs]

Unit II

Waves and Oscillations: Wave motion, simple harmonic motion, wave equation, superposition principle. Introduction to Electromagnetic Theory: Maxwell's equations. work done by the electromagnetic field, Poynting's theorem, Momentum, Angular momentum in electromagnetic fields, Electromagnetic waves: the wave equation, plane electromagnetic waves, energy carried by electromagnetic waves [8Hrs]

Unit III

Interference: Interference by division of wave front (Young's double slit experiment, Fresnel's biprism), interference by division of amplitude (thin films, Newton's rings, Michelson's interferometer), Coherence and coherent sources

Diffraction: Fraunhofer and Fresnel diffraction; Fraunhofer diffraction for Single slit, double slit, and N-slit (diffraction grating), Fraunhofer diffraction from a circular aperture, resolving power and dispersive power of a grating, Rayleigh criterion, resolving power of optical instruments

Polarization: Introduction to polarization, Brewster's law, Malu's law, Nicol prism, double refraction, quarter-wave and half-wave plates, optical activity, specific rotation, Laurent half shade polarimeter. [12Hrs]

Unit IV

Theory of relativity: The Michelson-Morley Experiment and the speed of light; Absolute and Inertial frames of reference, Galilean transformations, the postulates of the special theory of relativity, Lorentz transformations, time dilation, length contraction, velocity addition, mass energy equivalence.

Introduction to Laser Physics: Introduction, coherence, Einstein A and B coefficients, population inversion, basic principle and operation of a laser, the He-Ne laser and the Ruby laser [12Hrs]

Textbooks:

1. *Concepts of Modern Physics (SIE)*by Arthur Beiser, Shobhit Mahajan, and S. Rai Choudhury,McGraw-Hill, 2017.
2. *Physics for Scientists and Engineers* by Raymond A. Serway and John W. Jewett, 9th Edition , Cengage, 2017

References:

1. *Modern Physics* by Kenneth S. Krane, Wiley, 2020.
2. *Principles of Physics* by Robert Resnick, Jearl Walker and David Halliday, Wiley, 2015.
3. *Optics* by Ajoy Ghatak, McGraw Hill, 2020.

PaperCode: BS113	Paper: Engineering Physics – I	L	T/P	C
PaperID: 99113		3	-	3

Applicable only to batch admitted in 2021-22

Marking Scheme:

3. Teachers Continuous Evaluation: 25 marks

4. Term end Theory Examinations: 75 marks

Instruction for paper setter:

1. There should be 9 questions in the term end examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus.This question should be objective, single line answers or short answer type question of total 15 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15.
4. The questions are to be framed keeping in view the learning outcomes of the course / paper.The standard / level of the questions to be asked should be at the level of the prescribed textbook.
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

Course Objectives:

1:	To understand thermodynamic principles.
2:	To understand and model oscillations and waves.
3:	To understand and model interference, diffraction and polarization phenomenon.
4:	To understand and appreciate relativistic systems and Lasers.

Course Outcomes (CO):

CO1:	Ability to apply thermodynamic principles to solution of engineering problems.
CO2:	Ability to understand and model oscillations and waves.
CO3:	Ability to understand and model interference, diffraction and polarization phenomenon.
CO4:	Ability to understand and appreciate relativistic systems and Lasers.

Course Outcomes (CO to Programme Outcomes (PO) Mapping (scale 1: low, 2: Medium, 3: High

CO/PO	*PO01*	*PO02*	*PO03*	*PO04*	*PO05*	*PO06*	*PO07*	*PO08*	*PO09*	*PO10*	*PO11*	*PO12*
CO1	2	2	3	3	2	-	-	-	1	1	-	2
CO2	2	2	3	3	2	-	-	-	1	1	-	2
CO3	2	2	3	3	2	-	-	-	1	1	-	2
CO4	2	2	3	3	2	-	-	-	1	1	-	2

Unit I

Introduction to Thermodynamics: Fundamental Ideas of Thermodynamics, The Continuum Model, The Concept of a "System'", "State", "Equilibrium", "Process'". Equations of state, Heat, Zeroth Law of Thermodynamics, Work, first and second laws of thermodynamics, entropy [8Hrs]

Unit II

Waves and Oscillations: Wave motion, simple harmonic motion, wave equation, superposition principle. Introduction to Electromagnetic Theory: Maxwell's equations. work done by the electromagnetic field, Poynting's theorem, Momentum, Angular momentum in electromagnetic fields, Electromagnetic waves: the wave equation, plane electromagnetic waves, energy carried by electromagnetic waves [8Hrs]

Unit III

Interference: Interference by division of wave front (Young's double slit experiment, Fresnel's biprism), interference by division of amplitude (thin films, Newton's rings, Michelson's interferometer), Coherence and coherent sources

Diffraction: Fraunhofer and Fresnel diffraction; Fraunhofer diffraction for Single slit, double slit, and N-slit (diffraction grating), Fraunhofer diffraction from a circular aperture, resolving power and dispersive power of a grating, Rayleigh criterion, resolving power of optical instruments

Polarization: Introduction to polarization, Brewster's law, Malu's law, Nicol prism, double refraction, quarter-wave and half-wave plates, optical activity, specific rotation, Laurent half shade polarimeter. [12Hrs]

Unit IV

Theory of relativity: The Michelson-Morley Experiment and the speed of light; Absolute and Inertial frames of reference, Galilean transformations, the postulates of the special theory of relativity, Lorentz transformations, time dilation, length contraction, velocity addition, mass energy equivalence. Invariance of Maxwell's equations under Lorentz Transformation.

Introduction to Laser Physics: Introduction, coherence, Einstein A and B coefficients, population inversion, basic principle and operation of a laser, the He-Ne laser and the Ruby laser [12Hrs]

Textbooks:

3. *Concepts of Modern Physics (SIE)*by Arthur Beiser, Shobhit Mahajan, and S. Rai Choudhury,McGraw-Hill, 2017.
4. *Physics for Scientists and Engineers* by Raymond A. Serway and John W. Jewett, 9th Edition , Cengage, 2017

References:

4. *Modern Physics* by Kenneth S. Krane, Wiley, 2020.
5. *Principles of Physics* by Robert Resnick, Jearl Walker and David Halliday, Wiley, 2015.
6. *Optics* by Ajoy Ghatak, McGraw Hill, 2020.

PaperCode: LLB115	Paper: Indian Constitution	L	T/P	C
PaperID: 99115		2	-	2

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end Theory Examinations: 75 marks
3. This is an NUES paper, hence all examinations to be conducted by the concerned teacher.

Instruction for paper setter (Maximum Marks for Term End Examinations: 75):

1. There should be 9 questions in the term end examinations question paper.
2. The first (1^{st}) question should be compulsory and cover the entire syllabus.This question should be objective, single line answers or short answer type question of total 15 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15.
4. The questions are to be framed keeping in view the learning outcomes of the course / paper.

Course Objectives:

1:	To create awareness among students about the Indian Constitution
2:	To create consciousness among students about democratic principles and enshrined in the Constitution of India

Course Outcomes (CO):

CO1:	To understand institutional mechanism and fundamental values enshrined in the Constitution of India
CO2:	To understand the inter-relation between Centre and State Government
CO3:	To understand Fundamental Rights and Duties
CO4:	To understand the structure and functions of judicial systems in the country.

Course Outcomes (CO to Programme Outcomes (PO) Mapping (scale 1: low, 2: Medium, 3: High

CO/PO	*PO01*	*PO02*	*PO03*	*PO04*	*PO05*	*PO06*	*PO07*	*PO08*	*PO09*	*PO10*	*PO11*	*PO12*
CO1	-	-	-	-	-	3	-	2	-	-	-	1
CO2	-	-	-	-	-	3	-	2	-	-	-	1
CO3	-	-	-	-	-	3	-	2	-	-	-	1
CO4	-	-	-	-	-	3	-	2	-	-	-	1

Unit I

Introduction to Constitution of India: Definition, Source and Framing of the Constitution of India.Salient Features of the Indian Constitution. Preamble of the Constitution. [6Hrs]

Unit II

Fundamental Rights and Duties: Rights To Equality (Article 14-18).Rights to Freedom (Article 19-22).Right against Exploitation (Article 23-24).Rights to Religion and Cultural and Educational Rights of Minorities(Article 25- 30). The Directive Principles of State Policy – Its significance and application. Fundamental Duties – Necessary obligations and its nature, legal status and significance [6Hrs]

Unit III

Executives and Judiciary: Office of President, Vice President and Governor: Power and Functions, Parliament, Emergency Provisions-, President Rule; Union Judiciary: Appointment of Judges, Jurisdiction of the Supreme Court, State Judiciary: Power and functions, Writ Jurisdiction [6Hrs]

Unit IV

Centre- States Relation: Is Indian Constitution Federal in Nature, Legislative relations between Union and States, Administrative Relations between Union and States, Financial Relations between Union and States [6Hrs]

Textbooks:

1. *Constitutional Law of India* by J.N Pandey, Central Law Publication, 2018.
2. *Introduction to the Indian Constitution of India*by D.D. Basu, PHI, New Delhi, 2021
3. *The Constitution of India* by P.M. Bakshi, Universal Law Publishing Co., 2020.

References:

1. *Indian Constitutional Law* by M.P. Jain, Lexis Nexis, 2013
2.*Constitution of India* byV.N. Shukla, Eastern Book Agency, 2014

PaperCode: ICT151	Paper: Programming for Problem Solving Lab.		L	P	C
PaperID: 164151			-	2	1
Teachers Continuous Evaluation:	40 marks	Term End Examinations:	60 Marks		

Instructions:

1. The course objectives and course outcomes are identical to that of ICT101 (Programming for Problem Solving) as this is the practical component of the corresponding theory paper.
2. The practical list shall be notified by the teacher in the first week of the class commencement.

PaperCode: ICT153	**Paper: Engineering Graphics-I**	**L**	**P**	**C**
PaperID: 164153		**-**	**2**	**1**

Marking Scheme:

1. Teachers Continuous Evaluation: 40 marks
2. Term end Theory Examinations: 60 marks

Course Objectives:

1:	The students will learn the introduction of Engineering graphics, various equipment used, various scales, dimensions and BIS codes used while making drawings for various streams of engineering disciplines.
2:	The students will learn theory of projections and projection of points.
3:	The students will learn projection of lines and projection of planes.
4:	The students will learn the projection of solid and development of surfaces

Course Outcomes (CO):

CO1:	To understand the theory of projections and projection of points.
CO2:	Ability to do line projections.
CO3:	Ability to do plane projections.
CO4:	Ability to do solid projections and development of surfaces

Course Outcomes (CO to Programme Outcomes (PO) Mapping (scale 1: low, 2: Medium, 3: High

CO/PO	***PO01***	***PO02***	***PO03***	***PO04***	***PO05***	***PO06***	***PO07***	***PO08***	***PO09***	***PO10***	***PO11***	***PO12***
CO1	3	3	3	3	2	-	-	-	1	2	1	2
CO2	3	3	3	3	2	-	-	-	1	2	1	2
CO3	3	3	3	3	2	-	-	-	1	2	1	2
CO4	3	3	3	3	2	-	-	-	1	2	1	2

Unit I

Introduction: Engineering Graphics/Technical Drawing, Introduction to drawing equipments and use of instruments, Conventions in drawing practice. Types of lines and their uses, BIS codes for lines, technical lettering as per BIS codes, Introduction to dimensioning, Types, Concepts of scale drawing, Types of scales

Theory of Projections: Theory of projections, Perspective, Orthographic, System of orthographic projection: in reference to quadrants, Projection of Points, Projection in different quadrants, Projection of point on auxiliary planes. Distance between two points, Illustration through simple problems.

Unit II

Projection of Lines: Line Parallel to both H.P. and V.P., Parallel to one and inclined to other, Other typical cases: three view projection of straight lines, true length and angle orientation of straight line: rotation method, Trapezoidal method and auxiliary plane method, traces of line.

Unit III

Projection of Planes: Projection of Planes Parallel to one and perpendicular to other, Perpendicular to one and inclined to other, Inclined to both reference planes, Plane oblique to reference planes, traces of planes.

Planes Other than the Reference Planes: Introduction of other planes (perpendicular and oblique), their traces, inclinations etc., projections of points and lines lying in the planes, conversion of oblique plane into auxiliary plane and solution of related problems.

Unit IV

Projection of Solids: Projection of solids in first or third quadrant, Axis parallel to one and perpendicular to other, Axis parallel to one inclined to other, Axis inclined to both the principal plane, Axis perpendicular to profile plane and parallel to both H.P. and V.P., Visible and invisible details in the projection, Use of rotation and auxiliary plane method.

Development of Surface: Purpose of development, Parallel line, radial line and triangulation method, Development of prism, cylinder, cone and pyramid surface for both right angled and oblique solids, Development of surface.

Note: The sheets to be created shall be notified by the concerned teacher in the first week of teaching.

Textbooks:

1. *Engineering Drawing* by N.D. Bhatt, 53rd Ed., Charotar Publishing House Pvt. Ltd., Gujarat,2017.

References:

1. *Engineering Drawing*by P.S. Gill, S.K Kataria & Sons, New Delhi, 2013.
2. *Technical Drawing with Engineering Graphics* by Frederick E. Giesecke, Shawna Lockhart, Marla Goodman, and Cindy M. Johnson, 15th Ed., Prentice Hall, USA, 2016
3. *Engineering Drawing*by M.B. Shah and B.C. Rana, 3rd Ed., Pearson Education, New Delhi, 2009.

PaperCode: ICT155	Paper: Electrical Science Lab.		L	P	C
PaperID: 164155			-	2	1
Teachers Continuous Evaluation:	40 marks	Term End Examinations:	60 Marks		

Instructions:

1. The course objectives and course outcomes are identical to that of ICT103 (Electrical Science) as this is the practical component of the corresponding theory paper.
2. The practical list shall be notified by the teacher in the first week of the class commencement.

PaperCode: BS157	Paper: Engineering Chemistry - I Lab.		L	P	C
PaperID: 99157			-	2	1
Teachers Continuous Evaluation:	40 marks	Term End Examinations:	60 Marks		

Instructions:

1. The course objectives and course outcomes are identical to that of BA109 (Engineering Chemistry - I) as this is the practical component of the corresponding theory paper.
2. The practical list shall be notified by the teacher in the first week of the class commencement under intimation to the office of the school in which the paper is being offered.

PaperCode: BS159	Paper: Engineering Physics - I Lab.		L	P	C
PaperID: 99159			-	2	1
Teachers Continuous Evaluation:	40 marks	Term End Examinations:	60 Marks		

Instructions:

1. The course objectives and course outcomes are identical to that of BA113 (Engineering Physics - I) as this is the practical component of the corresponding theory paper.
2. The practical list shall be notified by the teacher in the first week of the class commencement under intimation to the office of the school in which the paper is being offered.

PaperCode: HS102	Paper: Communication Skills - II	L	T/P	C
PaperID: 99102		3	-	3

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end Theory Examinations: 75 marks

Instruction for paper setter:

1. There should be 9 questions in the term-end examinations question paper.
2. The first unit will be compulsory and cover the entire syllabus. This question will have Five sub-parts, and the students will be required to answer any THREE parts of 5 marks each. This unit will have a total weightage of 15 marks.
3. Apart from unit 1 which is compulsory, the rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain up to 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15.
4. The questions are to be framed keeping in view the learning outcomes of the course/paper.

Course Objectives:

1:	To develop the theoretical framework of communication to understand the professional interaction.
2:	To develop confidence in all aspects of communication whether verbal or non-verbal.
3:	To be able to create error-free and well-formatted formal documents for professional records.
4:	To be able to overcome the barriers to effective communication.
5:	To inculcate the capacity to organize ideas and systematically present them through various media.
6:	To be able to critically appreciate the written texts and audio-visual inputs effectively.

Course Outcomes (CO):

CO1:	Ability to understand basic concepts regarding communication and develop a clear understanding of the flow of thoughts.
CO2:	Ability to apply verbal and non-verbal communication skills in real-life situations.
CO3:	Ability to write and document the information in the appropriate formats.
CO4:	Ability to effectively communicate in interpersonal and intercultural situations without being misunderstood.

Course Outcomes (CO to Programme Outcomes (PO) Mapping (scale 1: low, 2: Medium, 3: High

CO/PO	*PO01*	*PO02*	*PO03*	*PO04*	*PO05*	*PO06*	*PO07*	*PO08*	*PO09*	*PO10*	*PO11*	*PO12*
CO1	-	-	-	-	-	-	-	-	3	3	-	3
CO2	-	-	-	-	-	-	-	-	3	3	-	3
CO3	-	-	-	-	-	-	-	-	3	3	-	3
CO4	-	-	-	-	-	-	-	-	3	3	-	3

Unit I

Communication as Process: Concept of Communication, Communication as a Process, Formal, Informal and Intercultural communication, Barriers to Effective Communication and remedies, Characteristics of Effective Communication[8Hrs]

Unit II

Communication Efficiency: Concept of Non-verbal Communication, Elements of Non-verbal Communication – Gestures, Postures, Facial-expressions, Gaze, Eye contact, and Space, Presentation skills – Interviews, Group Discussion, Making presentations with Audio-visual aids, Electronic Communication – Internet and Social media. [8Hrs]

Unit III

Technical Documents: Definition, Types, Structure, Significant Features of: Resume Writing, Report Writing, Proposal Writing, Dissertation, and Research Papers [8Hrs]

Unit IV

Communication in Society and Workplace:

Text 1 – Gender-inclusive Language

Background, Purpose, and Guidelines

United Nations Gender-inclusive Language

https://www.un.org/en/gender-inclusive-language/index.shtml

Text 2 – Cultural Diversity in India

India: Unity in Cultural Diversity Introduction (P. xii – xviii)

https://dsel.education.gov.in/sites/default/files/book_unity_in_diversity.pdf

Text 3 – The Matrix (1999)

Genre: Movie (Science Fiction)

Dir. The Wachowski Brothers

[8Hrs]

Textbooks:

1. *High English Grammar and Composition* by Wren, P.C. & Martin H., S. Chand & Company Ltd, New Delhi.
2. *Technical Communication: Principles & Practice* by Meenakshi Raman, New Delhi: Oxford University Press

References:

1. *Be Grammar Ready: The Ultimate Guide to English Grammar* by John Eastwood, New Delhi, Oxford University Press, 2020.
2. *Communication Skills: A Workbook* by Sanjay Kumar & Pushp Lata, New Delhi, Oxford University Press, 2018.
3. *Basic Technical Communication* by Kavita Tyagi & Padma Mishra, New Delhi, PHI Learning, 2012.
4. *Advanced Technical Communication* by Kavita Tyagi & Padma Mishra, New Delhi, PHI Learning, 2011.

PaperCode: BS104	Paper: Engineering Chemistry - II	L	T/P	C
PaperID: 99104		3	-	3

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end Theory Examinations: 75 marks

Instruction for paper setter:

1. There should be 9 questions in the term-end examinations question paper.
2. The first unit will be compulsory and cover the entire syllabus. This question will have Five sub-parts, and the students will be required to answer any THREE parts of 5 marks each. This unit will have a total weightage of 15 marks.
3. Apart from unit 1 which is compulsory, the rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain up to 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15.
4. The questions are to be framed keeping in view the learning outcomes of the course/paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

Course Objectives:

1:	To understand methods to make pure water and use fuels.
2:	To understand the use of techniques used to characterize engineering materials.
3:	To understand the properties and industrial applications of polymers.
4:	To understand the basics of nano-technology and bio chemistry

Course Outcomes (CO):

CO1:	Ability to make pure water and use fuels and perform energy conversion calculations
CO2:	Ability to use techniques used to characterize engineering materials.
CO3:	Understand the properties and industrial applications of polymers.
CO4:	Understand the basics of nano-technology and bio chemistry

Course Outcomes (CO to Programme Outcomes (PO) Mapping (scale 1: low, 2: Medium, 3: High

CO/PO	*PO01*	*PO02*	*PO03*	*PO04*	*PO05*	*PO06*	*PO07*	*PO08*	*PO09*	*PO10*	*PO11*	*PO12*
CO1	2	2	3	3	2	-	-	-	1	1	-	1
CO2	2	2	3	3	2	-	-	-	1	1	-	1
CO3	2	2	3	3	2	-	-	-	1	1	-	1
CO4	2	2	3	3	2	-	-	-	1	1	-	1

Unit I

Water treatment: Introduction, Hardness of water, Disadvantages of hard water, Water-softening-Lime-Soda process, Ion-exchanger polished water, Boiled-feed water, boiler problems-scale, sludge priming and foaming, caustic embrittlement and corrosion.

Fuels: Classification of fuels, Calorific values, Comparison between solid, liquid and gaseous fuels, Bomb calorimeter, Calorific value of gaseous fuel, Theoretical calculation of calorific value of a fuel, Wood, Coal, Analysis of coal, Natural Gas, Producer gas, water gas, Non-Conventional sources of energy. [10Hrs]

Unit II

Spectroscopic Techniques: Basic principles of spectroscopic methods. The use The use of various spectroscopic techniques for the determination of structure of simple compounds. XRD, SEM and TEM. [10Hrs]

Unit III

Polymers: Basic concepts & Terminology, such as monomers, Polymers, functionality, Thermoplastics, Thermosets, Linear, Branched, cross linked polymers etc. Different definitions of molecular weight's viz. Mw, Mn, Mv and then determinations, Industrial applications of polymers. General methods of synthesis of organics and their applications. [10Hrs]

Unit IV

Nano Technology: Introduction, Properties, Synthesis and characterization of Nanomaterials, Material self-assembly, Nanoscale materials and their applications.

Biochemistry: Molecular basis of life, study of macro molecules: Carbohydrates, Proteins, Lipids, Nucleic acid. Metabolism, basic concepts and design, Glycolysis citric acid cycle oxidative phosphorylation pentose phosphate pathway.[10Hrs]

Textbooks/References:

1. *Engineering Chemistry (16th Edition) by Jain, Jain, Dhanpat Rai Publishing Company, 2013.*
2. *Textbook of Engineering Chemistry by Jaya Shree Anireddy, Wiley, 2017.*
3. *Engineering Chemistry* byE.R. Nagarajan and S. Ramalingam, Wiley, 2017.
4. *Biochemistry* by Lubert Stryer, Jeremy Berg, John Tymoczko, Gregory Gatto 9th Edition 2019. W H Freeman & Co.

Paper Code: BS 116	**Paper: Basic Engineering Chemistry-II**	**L**	**T/P**	**C**
PaperID:	w.e.f. Academic Session 2022-23	**3**	**-**	**3**

TO BE OFFERED TO STUDENTS WHO HAVE NOT STUDIED CHEMISTRY AT 10+2 LEVEL IN LIEU OF BS109

Marking Scheme:

1.Teachers Continuous Evaluation: 25 marks

2.Term and Theory Examinations: 75 marks

Instruction for paper setter:

6. There should be 9 questions in the term-end examination question paper.
7. The first question will be compulsory and cover the entire syllabus. This question will have five sub-parts, and the students will be required to answer any THREE parts of 5 marks each. This question will have a total weightage of 15 marks.
8. Apart from question 1 which is compulsory, the rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain up to 5 sub-parts/sub-questions. Each Unit shall have a marks weightage of 15.
9. The questions are to be framed keeping in view the learning outcomes of the course/paper. Thestandard/level of the questions to be asked should be at the level of the prescribed textbook.
10. The requirement of (scientific) calculators/ log-tables / data-tables may be specified if required.

Course Objectives:

1.	To understand methods to make pure water and use fuels.
2.	To understand corrosion and the methods used to prevent it.
3.	To understand the properties and industrial applications of some important engineering materials.
4.	To understand the basics and applications of nano- technology.

Course Outcomes (CO):

CO1:	Ability to make pure water and use fuels and perform energy conversion calculations.
CO2:	Understand the causes and remedies of Corrosion.
CO3:	Students will be able to understand the important applications of cement, glass and polymers.
CO4:	Understand the potential applications of nanomaterials.

Course Outcomes (CO to Programme Outcomes (PO) Mapping (scale 1: low, 2: Medium, 3: High

CO/PO	PO01	PO02	PO03	PO04	P005	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO1	2	2	3	3	2	-	-	-	1	1	-	1
CO2	2	2	3	3	2	-	-	-	1	1	-	1
CO3	2	2	3	3	2	-	-	-	1	1	-	1
CO4	2	2	3	3	2	-	-	-	1	1	-	1

Unit I

Water treatment: Introduction, Hardness of water, Disadvantages of hard water, Water softening techniques- Lime-Soda process, Ion Exchange Method, Boiler feed water, Boiler problems- scale and sludge formation, priming and foaming, caustic embrittlement and corrosion.

Fuels: Classification of fuels, Calorific values, Comparison between solid, liquid and gaseous fuels, Bomb calorimeter, calorific value of gaseous fuels, Theoretical calculation of calorific value of a fuel, Wood, Coal, Analysis of coal, Natural gas, Producer gas, Water gas, non-Conventional sources of energy.

Unit II

Corrosion and its Control: Definition, effects, theory (mechanisms): dry/chemical, wet/electrochemical corrosion, Pilling-Bedworth ratio; Types of corrosion: Galvanic corrosion, Soil corrosion, Pitting corrosion, Concentration cell or Differential Aeration corrosion, Stress corrosion; Mechanism of rusting of iron, Passivity. Factors influencing corrosion; protective measures: galvanization, tinning, cathodic protection, sacrificial anodic protection; electroplating and prevention of corrosion through material selection and design.

Unit III:

Engineering Materials: Portland Cement: manufacturing by Rotary Kiln, role of gypsum, chemistry of setting and hardening of cement. **Glass:** manufacturing by tank furnace, significance of annealing, types and properties of soft glass, hard glass, borosilicate glass. **Polymers:**Basic concepts & terminology, classification and functionality of polymers, Properties and applications of (excluding synthesis): polyethylene, polymethacrylate, nylon, bakelite, polycarbonate, conducting polymers, liquid crystalline polymers, biodegradable polymers.

Unit IV

Nano chemistry: Nanoscience & Nanotechnology; Top-down and bottom-up approaches for nanomaterial synthesis, properties of nanomaterials, synthesis: mechanical grinding, Sol-gel process, chemical vapour

condensation; surface characterization techniques: BET and TEM; properties and applications of nanoscale materials: Carbon nanotubes, fullerenes, quantum dots, nanowires, nanocrystals, nanocones. Practical applications of nanomaterials in different areas.

Textbooks:

1. *Engineering Chemistry: Fundamentals and Applications (Second Edition) Shikha Agarwal, Cambridge University Press, 2019.*
2. *Engineering Chemistry (Seventeenth Edition) Jain& Jain, Dhanpat Rai Publication Company, 2021.*

PaperCode: BS106	Paper: Engineering Mathematics – II	L	T/P	C
PaperID: 99106		4	-	4

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end Theory Examinations: 75 marks

Instruction for paper setter:

1. There should be 9 questions in the term end examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus.This question should be objective, single line answers or short answer type question of total 15 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15.
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

Course Objectives:

1:	To understand Complex series methods.
2:	To understand Complex analysis
3:	To understand Fourier and Laplace methods
4:	To understand how to solve specific formulated engineering problems using PDE methods.

Course Outcomes (CO):

CO1:	Ability to use Complex series methods.
CO2:	Ability to use Complex analysis to solve formulated engineering problems
CO3:	Ability to use Fourier and Laplace methods to solve formulated engineering problems
CO4:	Ability to solve specific formulated engineering problems using PDE methods.

Course Outcomes (CO to Programme Outcomes (PO) Mapping (scale 1: low, 2: Medium, 3: High

CO/PO	*PO01*	*PO02*	*PO03*	*PO04*	*PO05*	*PO06*	*PO07*	*PO08*	*PO09*	*PO10*	*PO11*	*PO12*
CO1	2	3	3	3	1	-	-	-	-	-	1	2
CO2	2	3	3	3	1	-	-	-	-	-	2	2
CO3	2	3	3	3	1	-	-	-	-	-	2	2
CO4	2	3	3	3	1	-	-	-	-	-	2	2

Unit I

Complex Analysis – I : Complex Numbers and Their Geometric Representation, Polar Form of Complex Numbers. Powers and Roots, Derivative. Analytic Function, Cauchy–Riemann Equations. Laplace's Equation, Exponential Function, Trigonometric and Hyperbolic Functions. Euler's Formula, de'Moivre's theorem (without proof), Logarithm. General Power. Principal Value**.**Singularities and Zeros. Infinity,

Line Integral in the Complex Plane, Cauchy's Integral Theorem, Cauchy's Integral Formula, Derivatives of Analytic Functions, Taylor and Maclaurin Series. [10Hrs]

Unit II

Complex Analysis – II: Laurent Series, Residue Integration Method. Residue Integration of Real Integrals,

Geometry of Analytic Functions: Conformal Mapping, Linear Fractional Transformations (Möbius Transformations), Special Linear Fractional Transformations, Conformal Mapping by Other Functions, Applications: Electrostatic Fields, Use of Conformal Mapping. Modeling, Heat Problems, Fluid Flow. Poisson's Integral Formula for Potentials [10Hrs]

Unit III

Laplace Transforms: Definitions and existence (without proof), properties, First Shifting Theorem (s-Shifting), Transforms of Derivatives and Integrals and ODEs, Unit Step Function (Heaviside Function).Second Shifting Theorem (t-Shifting), Short Impulses. Dirac's Delta Function. Partial Fractions, Convolution. Integral Equations, Differentiation and Integration of Transforms. Solution of ODEs with Variable Coefficients, Solution of

Systems of ODEs. Inverse Laplace transform and its properties.

Fourier Analysis: Fourier Series, Arbitrary Period. Even and Odd Functions. Half-Range Expansions, Sturm–Liouville Problems. Fourier Integral, Fourier Cosine and Sine Transforms, Fourier Transform. Usage of fourier analysis for solution of ODEs. Inverse Fourier transform and its properties. [10Hrs]

Unit IV

Partial Differential Equations (PDEs): Basic Concepts of PDEs. Modeling: Vibrating String, Wave Equation. Solution by Separating Variables. Use of Fourier Series. D'Alembert's Solution of the Wave Equation. Characteristics. Modeling: Heat Flow from a Body in Space. Heat Equation:Solution by Fourier Series.Steady Two-Dimensional Heat Problems. Dirichlet Problem. Heat Equation: Modeling Very Long Bars.Solution by Fourier Integrals and Transforms. Modeling: Membrane, Two-Dimensional Wave Equation. Rectangular Membrane. Laplacian in Polar Coordinates. Circular Membrane. Laplace's Equation in Cylindrical and Spherical Coordinates. Potential. Solution of PDEs by Laplace Transforms. [10Hrs]

Textbooks:

1. *Advanced Engineering Mathematics* by Erwin Kreyszig, John Wiley, 10th Ed., 2011.

References:

1. *Engineering Mathematics* by K.A. Stroud withDexter J. Booth, Macmillan, 2020.
2. *Advanced Engineering Mathematics* by Larry Turyn, Taylor and Francis, 2014.
3. *Advanced Engineering Mathematics* by Dennis G. Zill, Jones & Bartlett Learning, 2018.
4. *Advanced Engineering Mathematics with MATLAB* by Dean G. Duffy, Taylor and Francis, 2017.
5. *Advanced Engineering Mathematics* by Merle C. Potter, Jack L. Lessing, and Edward F. Aboufadel, Springer (Switzerland), 2019.
6. *Mathematical Methods for Physics and Engineering*, by K. F. Riley, M. P. Hobson and S. J. Bence, CUP, 2013.

PaperCode: BS108	Paper: Engineering Physics - II	L	T/P	C
PaperID: 99108	w.e.f. 2022-23	3	-	3

Applicable only to the batch admitted in academic session 2021-22

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end Theory Examinations: 75 marks

Instruction for paper setter:

1. There should be 9 questions in the term-end examinations question paper.
2. The first unit will be compulsory and cover the entire syllabus. This question will have Five sub-parts, and the students will be required to answer any THREE parts of 5 marks each. This unit will have a total weightage of 15 marks.
3. Apart from unit 1 which is compulsory, the rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain up to 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15.
4. The questions are to be framed keeping in view the learning outcomes of the course/paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

Course Objectives:

1:	To learn about the quantum nature of reality.
2:	To learn about quantum statistics and its significance.
3:	To learn about the band theory of solids and properties and characteristics of diodes.
4:	To understand the basics of physical basis of biology.

Course Outcomes (CO):

CO1:	Understand and appreciate the quantum nature of reality.
CO2:	Understand quantum statistics and its significance.
CO3:	Understand the band theory of solids and properties and characteristics of diodes.
CO4:	To have an understanding of the physical basis of Biology.

Course Outcomes (CO to Programme Outcomes (PO) Mapping (scale 1: low, 2: Medium, 3: High

CO/PO	*PO01*	*PO02*	*PO03*	*PO04*	*PO05*	*PO06*	*PO07*	*PO08*	*PO09*	*PO10*	*PO11*	*PO12*
CO1	2	2	3	3	2	-	-	-	1	1	-	1
CO2	2	2	3	3	2	-	-	-	1	1	-	1
CO3	2	2	3	3	2	-	-	-	1	1	-	1
CO4	2	2	3	3	2	-	-	-	1	1	-	1

Unit I

Quantum Mechanics: Introduction: Wave particle duality, de Broglie waves, the experiment of Davisson and Germer, electron diffraction, physical interpretation of the wave function, properties, the wave packet, group and phase velocity, the uncertainty principle . The Schrödinger wave equation (1D), Eigen values and Eigen functions, expectation values, simple Eigen value problems – solutions of the Schrödinger's equations for the free particle, the infinite well, the finite well, tunneling effect, the scanning electron microscope, the quantum simple harmonic oscillator (qualitative), zero point energy.

Unit II

Quantum Statistics: The need for statistics , statistical distributions: Maxwell Boltzmann, Bose-Einstein and Fermi-Dirac statistics, their comparisons, Fermions and Bosons, Applications of quantum statistics: 1. Molecular speed and energies in an ideal gas; 2. The Black body spectrum, the failure of classical statistics to give the correct explanations – Bose-Einstein statistics applied to the Black Body radiation spectrum; Fermi-Dirac distribution, free electron theory, electronic specific heats, Fermi energy and average energy; Dying stars.

Unit III

Band Theory of Solids: Origin of energy bands in solids, motion of electrons in a periodic potential – the Kronig–Penny model (Qualitative). Brillouin zones, effective mass, metals, semi-conductors and insulators and their energy band structures. Extrinsic and Intrinsic semiconductors, doping – Fermi energy for doped and undoped semiconductors, the p-n junction (energy band diagrams with Fermi energy), the unbiased diode, forward and reverse biased diodes – tunnel diodes, zener diode, photo diode its characteristics, LED

Unit IV

The DNA double helix - molecules to life (qualitative)X – ray diffraction and crystallography as a technique to determine structure: Basic principles and methodology.

Textbooks:

1. *Concepts of Modern Physics (SIE)*by Arthur Beiser, Shobhit Mahajan, and S. Rai Choudhury,McGraw – Hill, 2017.
2. *Modern Physics* by Kenneth S. Krane, Wiley, 2020.

References:

1. *Physics for Scientists and Engineers* by Raymond A. Serway and John W. Jewett, 9th Edition , Cengage, 2017
2. *Principles of Physics* by Robert Resnick, Jearl Walker and David Halliday, Wiley, 2015.
3. *Solid State Electronic Devices ,by* Streetman and Ben G Prentice Hall India Learning Private Limited; 2006
4. https://drive.google.com/file/d/169AQBvIzHzbRjZU6M8oe260ZUWp7iUm1/view [part of NPTEL Lectures https://nptel.ac.in/courses/115/101/115101121/#

PaperCode: BS108	Paper: Engineering Physics - II	L	T/P	C
PaperID: 99108		3	-	3

Applicable only to the batch admitted in academic session 2021-22

Marking Scheme:

3. Teachers Continuous Evaluation: 25 marks

4. Term end Theory Examinations: 75 marks

Instruction for paper setter:

1. There should be 9 questions in the term-end examinations question paper.
2. The first unit will be compulsory and cover the entire syllabus. This question will have Five sub-parts, and the students will be required to answer any THREE parts of 5 marks each. This unit will have a total weightage of 15 marks.
3. Apart from unit 1 which is compulsory, the rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain up to 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15.
4. The questions are to be framed keeping in view the learning outcomes of the course/paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

Course Objectives:

1:	To learn about the quantum nature of reality.
2:	To learn about quantum statistics and its significance.
3:	To learn about the band theory of solids and properties and characteristics of diodes.
4:	To understand the basics of physical basis of biology.

Course Outcomes (CO):

CO1:	Understand and appreciate the quantum nature of reality.
CO2:	Understand quantum statistics and its significance.
CO3:	Understand the band theory of solids and properties and characteristics of diodes.
CO4:	To have an understanding of the physical basis of Biology.

Course Outcomes (CO to Programme Outcomes (PO) Mapping (scale 1: low, 2: Medium, 3: High

CO/PO	*PO01*	*PO02*	*PO03*	*PO04*	*PO05*	*PO06*	*PO07*	*PO08*	*PO09*	*PO10*	*PO11*	*PO12*
CO1	2	2	3	3	2	-	-	-	1	1	-	1
CO2	2	2	3	3	2	-	-	-	1	1	-	1
CO3	2	2	3	3	2	-	-	-	1	1	-	1
CO4	2	2	3	3	2	-	-	-	1	1	-	1

Unit I

Quantum Mechanics: Introduction: Wave particle duality, de Broglie waves, the experiment of Davisson and Germer, electron diffraction, physical interpretation of the wave function, properties, the wave packet, group and phase velocity, the uncertainty principle . The Schrödinger wave equation (1D), Eigen values and Eigen functions, expectation values, simple Eigen value problems – solutions of the Schrödinger's equations for the free particle, the infinite well, the finite well, tunneling effect, the scanning electron microscope, the quantum simple harmonic oscillator (qualitative), zero point energy. [12Hrs]

Unit II

Quantum Statistics: The need for statistics , statistical distributions: Maxwell Boltzmann, Bose-Einstein and Fermi-Dirac statistics, their comparisons, Fermions and Bosons, Applications of quantum statistics: 1. Molecular speed and energies in an ideal gas; 2. The Black body spectrum, the failure of classical statistics to give the correct explanations – Bose-Einstein statistics applied to the Black Body radiation spectrum; Fermi-Dirac distribution, free electron theory, electronic specific heats, Fermi energy and average energy; Dying stars.

[12Hrs]

Unit III

Band Theory of Solids: Origin of energy bands in solids, motion of electrons in a periodic potential – the Kronig–Penny model (Qualitative). Brillouin zones, effective mass, metals, semi-conductors and insulators and their energy band structures. Extrinsic and Intrinsic semiconductors, doping – Fermi energy for doped and undoped semiconductors, the p-n junction (energy band diagrams with Fermi energy), the unbiased diode, forward and reverse biased diodes – tunnel diodes, zener diode, photo diode its characteristics, LED [12Hrs]

Unit IV

Introduction to Physics in Biology: Overview : from molecules to life - the building blocks of biology, DNA Packing and Structure, The relationship between shape and function of biomolecules, Numbers and Sizes, System Variability and Spatial Scales, Timescales in Biological Systems [4Hrs]

Textbooks:

3. *Concepts of Modern Physics (SIE)*by Arthur Beiser, Shobhit Mahajan, and S. Rai Choudhury,McGraw – Hill, 2017.

4. *Modern Physics* by Kenneth S. Krane, Wiley, 2020.

References:

5. *Physics for Scientists and Engineers* by Raymond A. Serway and John W. Jewett, 9th Edition , Cengage, 2017
6. *Principles of Physics* by Robert Resnick, Jearl Walker and David Halliday, Wiley, 2015.
7. *Solid State Electronic Devices ,by* Streetman and Ben G Prentice Hall India Learning Private Limited; 2006
8. https://drive.google.com/file/d/169AQBvIzHzbRjZU6M8oe260ZUWp7iUm1/view [part of NPTEL Lectures https://nptel.ac.in/courses/115/101/115101121/#

PaperCode: BS110	Paper: Probability and Statistics for Engineers	L	P	C
PaperID: 99110		3	2	4

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end Theory Examinations: 50 marks
3. Term end Practical Examinations: 25 marks

The marksheet shall reflect the teachers continuous evaluation as internal (out of 25) and the term end examination (out of 75, 25 for practical term end and 50 for theory term end examination) as external.

Instruction for paper setter (Term end Theory Examinations):

1. There should be 9 questions in the term end examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus.This question should be objective, single line answers or short answer type question of total 15 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15.
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

Course Objectives:

1:	To understand probability and probability distributions.
2:	To understand methods of summarization of data.
3:	To understand and use test for hypothesis.
4:	To understand methods for design experiments and analysis.

Course Outcomes (CO):

CO1:	Ability to solve probability problems and describe probability distributions.
CO2:	Ability to describe and summarize data.
CO3:	Ability to use test for hypothesis.
CO4:	Ability to design experiments and analyse using ANOVA.

Course Outcomes (CO to Programme Outcomes (PO) Mapping (scale 1: low, 2: Medium, 3: High

CO/PO	*PO01*	*PO02*	*PO03*	*PO04*	*PO05*	*PO06*	*PO07*	*PO08*	*PO09*	*PO10*	*PO11*	*PO12*
CO1	-	3	1	1	1	-	-	-	-	-	1	2
CO2	-	3	1	1	1	-	-	-	-	-	1	2
CO3	-	3	2	2	1	-	-	-	-	-	2	2
CO4	-	3	3	3	1	-	-	-	-	-	2	2

Unit I

Basics: Probability and Statistical models, Sample Spaces and Events, Counting Techniques, Interpretations and Axioms of Probability, Unions of Events and Addition Rules, Conditional Probability, Intersections of Events and Multiplicationand Total Probability Rules, Independence, Bayes' Theorem, Random Variables.

Discrete and Continuous Random Variables andDistributions: Probability Distributions and Probability Mass / density Functions, Cumulative Distribution Functions, Mean and Variance of a RandomVariable, Discrete and continuous Uniform Distribution, Binomial Distribution, Geometric and Negative BinomialDistributions, Hypergeometric Distribution, Poisson Distribution. Normal Distribution, Normal Approximation to the Binomial, and Poisson Distributions; Exponential Distribution, Erlang and Gamma Distributions, Weibull Distribution, Lognormal Distribution, Beta Distribution.

[10Hrs]

Unit II

Joint Probability Distributions for Two RandomVariables, Conditional Probability Distributionsand Independence, Joint Probability Distributions for Two Random Variables, Covariance and Correlation, Common Joint Distributions, Linear Functions of RandomVariables, General Functions of Random Variables, Moment-Generating Functions.

Numerical Summaries of Data, Stem-and-Leaf Diagrams, Frequency Distributions and Histograms, Box Plots, Time Sequence Plots, Scatter Diagrams, Probability Plots. Point Estimation, Sampling Distributions and the Central LimitTheorem without proof, General Concepts of Point Estimation, Methods of Point Estimation, Statistical Intervals for a SingleSample.

[10Hrs]

Unit III

Hypotheses Testing for a SingleSample: Tests on the Mean of a Normal Distribution with Variance Known / Unknown, Tests on the Variance and Standard Deviationof a Normal Distribution, Tests on a Population Proportion, Testing for Goodness of Fit, Nonparametric tests (Signed, Wilcoxon), Similarly Statistical Inference forTwo Samples.

Regression and Correlation: Linear Regression, Least Squares Estimators, Hypotheses testing for simple linear regression, Confidence Intervals, Adequacy of model, Correlation, Transformed Variables, Logistic Regression. Similarly, for multiple linear regression including aspects of MLR. [10Hrs]

Unit IV

ANOVA and Design of experiments: Designing Engineering Experiments, Completely Randomized Single-Factor Experiment, The Random Effects Model, Randomized complete block design, Concept of Factorial Experiments, Two Factor Factorial Experiments, General Factorial Experiments, 2^k Factorial Designs, Response Surface Methods and Designs. SQC: Quality improvement and Statistics, Control Charts including $\overline{X}$ and R or S charts, P and U charts, time weighted charts. [10Hrs]

Note: Atleast two laboratory practicals in each unit to be conducted. The list of practicals to be notified by the concerned teacher to the school where the students are admitted at the start of the teaching in the semester.

Textbooks:

1.*Applied Statistics and Probability for Engineers* by Douglas G. Montgomery and Runger, Wiley, 2018

References:

1. *Miller and Freund's Probability and Statistics for Engineers* by Richard A. Johnson, Pearson, 10th Ed., 2018.
2. *Probability & Statistics for Engineers & Scientists* by Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers and Keying Ye, Pearson, 2016.
3. *Statistics and probability with applications for engineers and scientists using Minitab, R and JMP*, C. Gupta, Irwin Guttman, and Kalanka P. Jayalath, Wiley, 2020.
4. *Probability and Statistics for Engineering and the Sciences*, Jay Devore, Cengage Learning, 2014.
5. *Probability and Statistics in Emgineering*, William W. Hines, Douglas C. Montgomery, David M. Goldman, and Connie M. Borror, Wiley, 2003.

PaperCode: ICT114	Paper: Human Values and Ethics	L	P	C
PaperID: 164114		1	-	1

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end Theory Examinations: 75 marks
3. This is an NUES paper, the examinations are to be conducted by the concerned teacher.

Instruction for paper setter:

1. There should be 9 questions in the term end examinations question paper.
2. The first (1^{st}) question should be compulsory and cover the entire syllabus.This question should be objective, single line answers or short answer type question of total 15 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15.
4. The questions are to be framed keeping in view the learning outcomes of the course / paper.

Course Objectives:

1:	To help students regulate their behavior in a professional environment as employees
2:	To make students aware of the impact of taking non-ethical engineering decisions.
3:	To understand that mind and desire control is needed for being ethical.
4:	To understand organizational culture and to adapt to varying cultures withoutcompromising ethical values

Course Outcomes (CO):

CO1:	Realize the importance of human values.
CO2:	Understand that excessive desires of the mind make a person unethical and restless,while fewer desires lead to peace and professional progress
CO3:	Assess different types of risks involved in unethical practices. Know various means ofprotesting against unethical practices.
CO4:	Assess the benefits of restraining from unethical practices like bribery, extortion,nepotism, nexus between politicians and industrialists.

Course Outcomes (CO to Programme Outcomes (PO) Mapping (scale 1: low, 2: Medium, 3: High

CO/PO	*PO01*	*PO02*	*PO03*	*PO04*	*PO05*	*PO06*	*PO07*	*PO08*	*PO09*	*PO10*	*PO11*	*PO12*
CO1	-	-	-	-	-	3	-	3	1	1	-	1
CO2	-	-	-	-	-	3	-	3	1	1	-	1
CO3	-	-	-	-	-	3	-	3	1	1	-	1
CO4	-	-	-	-	-	3	-	3	1	1	-	1

Unit I

Human Values: Morals, Values, Ethics, Integrity, Work ethics, Service learning, Virtues, Respect for others, Living peacefully, Caring, Sharing, Honesty, Courage,Valuing time, Cooperation, Commitment, Empathy, Self-confidence, Challenges in the work place, Spirituality [3Hrs]

Unit II

Engineering Ethics: Senses of engineering ethics, Variety of moral issues, Types of inquiries, Moral dilemma, Moral autonomy, Moral development (theories), Consensus and controversy, Profession, Models of professional roles, Responsibility, Theories about right action (Ethical theories), Self-control, Self-interest, Customs, Religion, Self-respect, Case study: Choice of the theory

Engineering as experimentation, Engineers as responsible experimenters, Codes of ethics, Industrial standards, A balanced outlook on law, Case study: The challenger [3Hrs]

UnitIII

Safety definition, Safety and risk, Risk analysis, Assessment of safety and risk, Safe exit, Risk-benefit analysis
Sefety lessons from 'the challenger', Case study: Power plants,Collegiality and loyalty, Collective bargaining, Confidentiality, Conflict of interests, Occupational crime, Human rights, Employee rights, Whistle blowing, Intellectual property rights. [4Hrs]

UnitIV

Globalization, Multinational corporations, Environmental ethics, Computer ethics, Weapons development, Engineers as managers, Consulting engineers, Engineers as expert witness, Engineers as advisors in planning and policy making, Moral leadership, Codes of ethics, Engineering council of India, Codes of ethics in Business Organizations [3Hrs]

Textbooks:

1. *A Textbook on Professional Ethics and Human Values*, by R. S. Naagarazan, New Age Publishers, 2006.

References:

1. *Professional Ethics and Human Values* by D. R. Kiran, McGraw-Hill, 2014.

2. *Engineering Ethics, by Charles E Harris and Micheal J Rabins, Cengage Learning Pub., 2012.*
3. *Ethics in Engineering, Mike Martin and Roland Schinzinger, McGraw Hill Pub., 2017.*
4. *Unwritten laws of Ethics and Change in Engineeringby The America Society of Mechanical Engineers, 2015.*
5. *Engineering Ethics by Charles B. Fleddermann, Pearson, 2014.*
6. *Introduction to Engineering Ethics* by Mike W. Martin and Roland Schinzinger, McGraw-Hill, 2010.
7. *Engineering Ethics: Concept and Cases* by Charles E. Harris, Michael S. Pritchard and Michael J.Rabins, Cengage, 2009.
8. *Ethics in Engineering Practiceand Research* by Caroline Whitbeck, Cambridge University Press, 2007.

PaperCode: EMES112	Paper: Environmental Studies	L	P	C
PaperID: 99112		4	-	4

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end Theory Examinations: 75 marks

Instruction for paper setter:

1. There should be 9 questions in the term end examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus.This question should be objective, single line answers or short answer type question of total 15 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15.
4. The questions are to be framed keeping in view the learning outcomes of the course / paper.
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

Course Objectives:

1:	The course is designed to impart basic knowledge of the environment and its components.
2:	The course deals in creating awareness about the energy resources and current environmental problems faced by the world.
3:	To understand and learn about environment pollution, related case studies and measures taken for control to pollution.
4:	To understand and explore different approaches of conserving and protecting environment for the benefit of society.

Course Outcomes (CO):

CO1:	Environmental Studies course will provide necessary information and knowledge about the various aspects of environment, ecosystems and related biodiversity.
CO2:	Students will be able to learn and understand about the availability and sustainable use of resources, environmental problems and their short term and long term impacts to humans.
CO3:	Course will help them to learn about environmental policies and protocols, social issues and role of human in conservation and protection of environment.
CO4:	Overall, course will help students to develop skills and ability of understanding environment- human relationship.

Course Outcomes (CO to Programme Outcomes (PO)) Mapping (scale 1: low, 2: Medium, 3: High)

CO/PO	*PO01*	*PO02*	*PO03*	*PO04*	*PO05*	*PO06*	*PO07*	*PO08*	*PO09*	*PO10*	*PO11*	*PO12*
CO1	-	1	1	-	-	2	3	2	1	1	1	1
CO2	-	1	1	-	-	2	3	2	1	1	1	1
CO3	-	1	1	-	-	2	3	2	1	1	1	1
CO4	-	1	1	-	-	2	3	2	1	1	1	1

Unit I

Fundamentals:The Multidisciplinary nature of environmental studies: Definition, components, scope and importance, need for public awareness;

Ecosystems: Concept, Structure and function of an ecosystem, energy flow in ecosystems, food chain, food web, ecological pyramids, ecological succession; Introduction to types, characteristics features, structure and function of different ecosystems including forest, grassland, desert and aquatic ecosystem;

Biodiversity: Introduction to biodiversity-definition, genetics, species, ecosystem diversity, biogeographical classification of India, value of biodiversity-consumptive uses, productive, social, ethical, aesthetic and option values, biodiversity at global, national and local level, India as a mega diversity nation, endangered and endemic species of India, hot spots of biodiversity, threats to biodiversity – habitat loss, poaching of wild life, man wildlife conflicts and conservation of biodiversity- in-situ and ex-situ conservation. [16Hrs]

Unit II

Renewable and Non-renewable Resources:Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources-green fuel.

Water Resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems

Forest resources: Use and over-exploitation, deforestation, Timber extraction, mining, dams and their effects on forest and tribal people, case studies

Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies

Food resources: World food problems, changes caused by agriculture and over-grazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies

Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

Role of individual in conservation of natural resources, Resource Management-Sustainable development. [8Hrs]

Unit III

Environmental Pollution: (a) Air Pollution: Types of pollutants, source, effects, sink & control of primary pollutants– CO, NOX, HC, SOx and particulates, effect of pollutants on man & environment: photochemical smog, acid rain and global warming, CO2 Sequestration. (b) Water Pollution: Classification of Pollutants, their sources, waste water treatment (domestic and industrial). (c) Soil Pollution: Composition of soil, classification and effects of solid pollutants and their control. (d) Solid Waste Management: Classification, waste treatment and disposal methods; compositing, sanitary land filling, thermal processes, recycling and reuse methods. (e) Hazardous wastes - Classification, radioactive, biomedical & chemical, treatment and disposal- Physical, chemical and biological processes. (f) Marine Pollution: Causes, effects and control of marine pollution, coastal zone management (g) Thermal pollution: Causes, effects and control of marine pollution, coastal zone management.

Disaster Management: Floods, earth quake, cyclone and landslides [8Hrs]

Unit IV

Environmental Policies, Human Population and Environment

Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents, case studies; Some important Environmental laws, issues involved in enforcement of environment legislations, Green bench; carbon footprint, Montreal and Kyoto Protocol, conservation of Biological Diversity, The Chemical Weapons Convention, Environment Impact Assessment; population growth and variation among nations, Impacts on environment and human health, human right, Tribal people and rights, Human and wildlife conflicts in Indian context, Environmental ethics; Role of government and non government organizations in public awareness and environment improvement. [13Hrs]

Field work (equal to 5 hours) : visit to local areas to document environmental assets, study of simple ecosystems, study and identification of common plants, birds and insects.

Suggested Readings and References:

1. A textbook of environmental studies, R. Gadi, S. Rattan, S. Mohaptra, Kataria Publication, 2014.
2. Elements of environmental sciences & engineering, P. Meenakshi, PHI Learning Pvt Ltd, 2014.
3. Basics of Environment and Ecology, A. kaushik & C.P. Kaushik, New Age International Publishers, 2010.
4. Fundamental concepts in environmental studies, D.D. Mishra, S Chand & Co. Ltd., 2008.
5. Textbook of environmental studies, E. Barucha, UGC, 2005.
6. Environmental studies, B. Joseph, Tata McGraw-Hill Publishing Company Ltd., 2005.

PaperCode: ICT152	Paper: Engineering Graphics-II	L	P	C
PaperID: 164152		-	2	1

Marking Scheme:

1. Teachers Continuous Evaluation: 40 marks
2. Term end Theory Examinations: 60 marks

Course Objectives:

1:	The students will learn sectioning of solid figures.
2:	The students will understand 3D projections. They will have understanding of isometric and oblique projections.
3:	The students will have understanding of perspective projections,
4:	The students will learn computer aided drafting.

Course Outcomes (CO):

CO1:	Ability to draw sectional diagrams of solids
CO2:	Ability to draw 3S projections (isometric and oblique).
CO3:	Ability to draw perspective projections.
CO4:	Understand and use a CAD tool (AutoCAD).

Course Outcomes (CO to Programme Outcomes (PO) Mapping (scale 1: low, 2: Medium, 3: High

CO/PO	*PO01*	*PO02*	*PO03*	*PO04*	*PO05*	*PO06*	*PO07*	*PO08*	*PO09*	*PO10*	*PO11*	*PO12*
CO1	3	3	3	3	2	-	-	-	1	2	1	2
CO2	3	3	3	3	2	-	-	-	1	2	1	2
CO3	3	3	3	3	2	-	-	-	1	2	1	2
CO4	3	3	3	3	2	-	-	-	1	2	1	2

Unit I

Section of Solids: Definition of Sectioning and its purpose, Procedure of Sectioning, Illustration through examples, Types of sectional planes-application to few examples.

Unit II

Isometric Projection: Classification of pictorial views, Basic Principle of Isometric projection, Difference between isometric projection and drawing, Isometric projection of solids such as cube, prism, pyramid and cylinder.

Oblique Projection: Principle of oblique projection, difference between oblique projection and isometric projection, receding lines and receding angles, oblique drawing of circle, cylinder, prism and pyramid.

Unit III

Perspective Projection: Principle of perspective projection, definitions of perspective elements, visual ray method, vanishing point method.

Conversion of 3D to 2D figures.

Unit IV

Introduction to CADD: Interfacing and Introduction to CAD Software, Coordinate System, 2D drafting: lines, circles, arc, polygon, etc., Dimensioning, 2-D Modelling, Use of CAD Software for engineering drawing practices.

Note: The sheets to be created shall be notified by the concerned teacher in the first week of teaching.

Textbooks:

1. *Engineering Drawing* by N.D. Bhatt, 53rd Ed., Charotar Publishing House Pvt. Ltd., Gujarat,2017.

References:

1. *Engineering Drawing*by P.S. Gill, S.K Kataria & Sons, New Delhi, 2013.
2. *Technical Drawing with Engineering Graphics* by Frederick E. Giesecke, Shawna Lockhart, Marla Goodman, and Cindy M. Johnson, 15th Ed., Prentice Hall, USA, 2016
3. *Engineering Drawing*by M.B. Shah and B.C. Rana, 3rd Ed., Pearson Education, New Delhi, 2009.
4. *AutoCAD 2017 for Engineers & Designers*by Sham Tickoo,, Dreamtech Press 2016.

PaperCode: BS156	Paper: Engineering Chemistry - II Lab.		L	P	C
PaperID: 99156			-	2	1
Teachers Continuous Evaluation:	40 marks	Term End Examinations:	60 Marks		

Instructions:

1. The course objectives and course outcomes are identical to that of BA104 (Engineering Chemistry - II) as this is the practical component of the corresponding theory paper.
2. The practical list shall be notified by the teacher in the first week of the class commencement under intimation to the office of the school in which the paper is being offered.

PaperCode: BS158	Paper: Engineering Physics - II Lab.		L	P	C
PaperID: 99158			-	2	1
Teachers Continuous Evaluation:	40 marks	Term End Examinations:	60 Marks		

Instructions:

1. The course objectives and course outcomes are identical to that of BA108 (Engineering physics - II) as this is the practical component of the corresponding theory paper.
2. The practical list shall be notified by the teacher in the first week of the class commencement under intimation to the office of the school in which the paper is being offered.

PaperCode: ICT154	Paper: Workshop Technology	L	P	C
PaperID: 164154		-	2	1

Marking Scheme:

1. Teachers Continuous Evaluation: 40 marks
2. Term end Theory Examinations: 60 marks

Instructions:

1. The practical list shall be notified by the teacher in the first week of the class commencement under intimation to the office of the school in which the paper is being offered.

Course Objectives:

1:	The students will learn basics of safety precautions to be taken in lab. / workshop
2:	The students will have an overview of different machines used in workshop and the operations performed on these machines.
3:	The students will have understanding of various welding processes.
4:	The students will have understanding of sheet metals hop and fitting shop

Course Outcomes (CO):

CO1:	Ability to safely work in a Lab./workshop.
CO2:	Ability to use machines (lathe, mill, shaper, planer, grinder, drill).
CO3:	Ability to weld.
CO4:	Ability to use sheet metal tools and fitting shop tools.

Course Outcomes (CO) to Programme Outcomes (PO) Mapping (scale 1: low, 2: Medium, 3: High)

CO/PO	*PO01*	*PO02*	*PO03*	*PO04*	*PO05*	*PO06*	*PO07*	*PO08*	*PO09*	*PO10*	*PO11*	*PO12*
CO1	2	1	2	2	3	3	-	-	-	-	-	2
CO2	2	1	2	2	3	1	-	-	-	-	-	2
CO3	2	1	2	2	3	1	-	-	-	-	-	2
CO4	2	1	2	2	3	1	-	-	-	-	-	2

Unit I

Safety, precautions and maintenance: Safety in shop, safety devices, safety and precautions - moving machine and equipment parts, electrical parts and connections, fire, various driving systems like chain, belt and ropes, electrical accidents, an overview of predictive, preventive and scheduled maintenance, standard guidelines to be followed in shop.

Unit II

Introduction to machine shop: Introduction to Lathe, Milling, shaper, Planer, grinder, drilling and overview of operations performed on these machines by making some jobs.

Unit III

Introduction to welding shop: Welding, types of welding, tools and applications, gas welding and arc welding, edge preparation, various joints formation by gas welding and electric arc welding.

Unit IV

Introduction to sheet metal shop: Sheet metal tools and operations, formation of a box using sheet.
Introduction to fitting shop: Introduction to fitting, tools and applications, some jobs in fitting shop.

Textbooks:

1. *Workshop Technology Vol. 1 and Vol. 2*, Hajra Choudhary and Roy, Media Promoters and Publishers, 2018.

References:

1. *A course in Workshop Technology Vol.1 and Vol. 2*, B. S. Raghuvanshi, Dhanpat Rai and Compnay, 2015.
2. *Workshop Technology (Manufacturing Processes)*, Khurmi and Gupta, S. Chand Publication, 2010.

PaperCode: ICT160	**Paper: Programming in Python**	**L**	**P**	**C**
PaperID: 164160			**2**	**1**

Marking Scheme:

1. Teachers Continuous Evaluation: 40 marks
2. Term end Theory Examinations: 60 marks

Instructions:

1. The practical list shall be notified by the teacher in the first week of the class commencement under intimation to the office of the school in which the paper is being offered.

Course Objectives:

1:	The students will learn the Programming in the Python Language
2:	The students will learn usage of language implemented data structures.
3:	The students shall learn the object oriented features of the Python Language.
4:	The students will learn usage of the Numpy, Panda and Matplotlib

Course Outcomes (CO):

CO1:	Ability to write procedural programmes in Python.
CO2:	Ability to write programs using standard data structures.
CO3:	Ability to use object oriented paradigm to write program in Python.
CO4:	Ability to use Numpy, Panda and Matplotlib modules to write programs.

Course Outcomes (CO) to Programme Outcomes (PO) Mapping (scale 1: low, 2: Medium, 3: High)

CO/PO	***PO01***	***PO02***	***PO03***	***PO04***	***PO05***	***PO06***	***PO07***	***PO08***	***PO09***	***PO10***	***PO11***	***PO12***
CO1	-	1	2	1	3	-	-	-	1	1	1	1
CO2	-	1	2	1	3	-	-	-	1	1	1	1
CO3	-	1	2	1	3	-	-	-	1	1	1	1
CO4	-	1	2	1	3	-	-	-	1	1	1	1

Unit I

Identifiers, keywords, statements & expressions, variables, operators, precedence & associativity, data types, indention, comments, console I/O, type conversion. Control flow statements (if family; while & for loops; continue & break statements), exception handling. Functions, command line arguments.

Unit II

String management & usage, Lists, Dictionaries, Tuples & Sets. The operations on these data structures. Filter, Map and Reduce Function,

Unit III

Object Oriented Programming: Properties / attributes, methods, inheritance, class variables & functions, static methods, delegation, abstract base classes, Generic function.
File Handling.

Unit IV

Numpy: Dtypes, Multidimensional Arrays, Slicing,Numpy Array & Memory, Array element-wise operations, Numpy Data I/O, floating point numbers, Advanced Numpy dtypes.
Pandas: Using series and Dataframes, Indexing &Reindexing, Deleting and merging items, Common operations, Memory usage and dtypes, Pipes, Displying dataframes, Rolling & Filling operations.
Matplotlib: Setting defaults, Legends, Subplots, Sharing Axes, 3D surfaces.

Note: Atleast two laboratory practicals in each unit to be conducted. The list of practicals to be notified by the concerned teacher at the start of the teaching in the semester.

Textbooks:

1. *Introduction to Python Programming*, Gowrishankar S. and Veena A., CRC Press, 2019.
2. *Python Programming for Data Analysis*, Jose Unpingco, Springer Nature, 2021.

References:

1. *Python: An Introduction to Programming*, James R. Parker, 2nd Ed., Mercury Learning And Information, 2021.
2. *Introduction to Computation and Programming Using Python*, John V. Guttag, The MIT Press, 2021.
3. *Python Programming: A Practical Approach*, Vijay Kumar Sharma, Vimal Kumar, Swati Pathak, and Shashwat Pathak, CRC Press, 2021.

PaperCode: ICT116	Paper: Introduction to Manufacturing Process	L	T/P	C
PaperID: 164116		3	-	3

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end Theory Examinations: 75 marks

Instruction for paper setter:

1. There should be 9 questions in the term end examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus.This question should be objective, single line answers or short answer type question of total 15 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15.
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

Course Objectives:

1:	The students will have basic understanding of various manufacturing processes. The students will have knowledge about casting process.
2:	The students will have understanding of joining processes.
3:	The students will have understanding of forging and sheet metal works.
4:	The students will have basic idea of powder metallurgy and manufacturing of plastic components.

Course Outcomes (CO):

CO1:	Understand casting process.
CO2:	Understand joining process.
CO3:	Understand forging and sheet metal work.
CO4:	Basic understanding of powder metallurgy and manufacturing of plastic components.

Course Outcomes (CO) to Programme Outcomes (PO) Mapping (scale 1: low, 2: Medium, 3: High)

CO/PO	*PO01*	*PO02*	*PO03*	*PO04*	*PO05*	*PO06*	*PO07*	*PO08*	*PO09*	*PO10*	*PO11*	*PO12*
CO1	2	1	1	1	2	-	-	-	-	-	1	1
CO2	2	1	1	1	2	-	-	-	-	-	1	1
CO3	2	1	1	1	2	-	-	-	-	-	1	1
CO4	2	1	1	1	2	-	-	-	-	-	1	1

Unit I

Definition of manufacturing, Importance of manufacturing towards technological and social economic development, Classification of manufacturing processes, Properties of materials.

Metal Casting Processes: Sand casting, Sand moulds, Type of patterns, Pattern materials, Pattern allowances, Types of Moulding sand and their Properties, Core making, Elements of gating system. Description and operation of cupola.

Working principle of Special casting processes - Shell casting, Pressure die casting, Centrifugal casting. Casting defects.

[10Hrs]

Unit II

Joining Processes: Welding principles, classification of welding processes, Fusion welding, Gas welding, Equipments used, Filler and Flux materials. Electric arc welding, Gas metal arc welding, Submerged arc welding, Electro slag welding, TIG and MIG welding process, resistance welding, welding defects. [10Hrs]

Unit III

Deformation Processes: Hot working and cold working of metals, Forging processes, Open and closed die forging process. Typical forging operations, Rolling of metals, Principle of rod and wire drawing, Tube drawing. Principle of Extrusion, Types of Extrusion, Hot and Cold extrusion.

Sheet metal characteristics -Typical shearing operations, bending and drawing operations, Stretch forming operations, Metal spinning. [10Hrs]

Unit IV

Powder Metallurgy: Introduction of powder metallurgy process, powder production, blending, compaction, sintering

Manufacturing Of Plastic Components: Types of plastics, Characteristics of the forming and shaping processes, Moulding of Thermoplastics, Injection moulding, Blow moulding, Rotational moulding, Film blowing, Extrusion, Thermoforming. Moulding of thermosets- Compression moulding, Transfer moulding, Bonding of Thermoplastics.

[10Hrs]

Textbooks:

1. *Manufacturing Technology: Foundry, Forming and WeldingVolume 1*, P. N Rao, , McGrawHill, 5e, 2018.
2.*Elements of Workshop TechnologyVol. 1 and 2*by Hajra Choudhury, Media Promoters Pvt Ltd.,2008.

References:

1. *Manufacturing Processes for Engineering Materials*, by Serope Kalpajian and Steven R.Schmid, Pearson Education, 5e, 2014.
2. *Fundamentals of Modern Manufacturing: Materials, Processes, and Systems* by Mikell P. Groover, John Wiley and Sons, 4e, 2010 .
3. *Production Technology* byR.K.Jain and S.C. Gupta, Khanna Publishers. 16th Edition, 2001.

PaperCode: BS118	Paper: Industrial Chemistry	L	T/P	C
PaperID: 99118		3	-	3

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end Theory Examinations: 75 marks

Instruction for paper setter:

1. There should be 9 questions in the term end examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus.This question should be objective, single line answers or short answer type question of total 15 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15.
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

Course Objectives:

1:	Learn about the functioning of drugs and dyes.
2:	Learn about the most important ways of preventing corrosion.
3:	Learn about the properties of heterocycles
4:	Learn about techniques of synthesis.

Course Outcomes (CO):

CO1:	Understand the functioning of drugs and dyes.
CO2:	Understand the most important ways of preventing corrosion.
CO3:	Understand the properties of heterocycles
CO4:	Understand techniques of synthesis.

Course Outcomes (CO) to Programme Outcomes (PO) Mapping (scale 1: low, 2: Medium, 3: High)

CO/PO	*PO01*	*PO02*	*PO03*	*PO04*	*PO05*	*PO06*	*PO07*	*PO08*	*PO09*	*PO10*	*PO11*	*PO12*
CO1	3	2	3	3	1	1	1	-	-	-	-	1
CO2	3	2	3	3	1	1	2	-	-	-	-	1
CO3	3	2	3	3	1	-	-	-	-	-	-	1
CO4	3	2	3	3	1	-	-	-	-	-	-	1

Unit I

Polymerization technology, dyes and drugs: classification of polymers, plastics, fibres, elastomers. Dyes: Requirements of a dye, chemical nature, classification, chemistry of representative important dyes. Pharmaceuticals: sulfa drugs, antipyretics and analgesics, antibiotics, antimalarials. Caustic soda & Chlorine. Hydrochloric acid. Sulphur & sulphuric Acid. [10Hrs]

Unit II

Corrosion: Corrosion and its economic aspects, Thermodynamics of corrosion, Immunity, corrosivity and passivation. Mechanism and kinetics of Corrosion. Electrochemical methods for corrosion testing.

Corrosion Prevention Techniques: Metallic coatings, organic paints, varnishes, corrosion inhibitors, cathodic and anodic protection. Corrosion Prevention Techniques: Metallic coatings, organic paints, varnishes, corrosion inhibitors, cathodic and anodic protection. [10Hrs]

Unit III

Chemistry of Heterocyclic Compounds: Introduction, nomenclature, structures, and reactivities of heterocyclic compounds. Chemistry and reactivity of five and six membered heterocyclic compounds with one hetero atoms. Chemistry of selected industrially important heterocyclic compounds. [8Hrs]

Unit IV

Synthetic Methods: Introduction to synthesis, strategy of synthesis. Designing of green synthesis: choice of starting materials, reagents, catalysts and solvents. Basic principles of green chemistry and synthesis of organic compounds involving basic principles of green chemistry methodology of synthesis. New methods in organic synthesis: microwave technique, use of phase transfer catalyst in organic synthesis. [12Hrs]

Textbooks and References:

1. J.P. Mukhlyonov: Fundamentals of Chemical Technology.
2.M.G. Rao, M.Sittig: Dryden's out line of Chemicals Technology.
3.Emil Raymond Riegel: Industrial Chemistry.
4. Frank Hall Thorp: Outlines of Industrial Chemistry.
5.M.G. Fontana: Corrosion Engineering, McGraw Hill International Book Co. London.
6.L.L. Shreir: Corrosion, Vol I and Vol II, Newness Butterworths, Edward Arnold Ltd, London.
7.J.C. Scully: Fundamental of Corrosion, Pargmon Press Inc. New York, USA
8.J.A. Joule, K. Mills and G.F. Smith: Heterocyclic chemistry, III Ed., East West Press vt Ltd, ND.

9.A.R. Katrizky and J.A. Boulton: Advances in Heterocyclic chemistry, Vol 1-27, Academic Press, NY.
10.R.M. Achesion: An Introduction to the Chemistry of Heterocyclic Compounds, II Ed, NY.

PaperCode: BT120	Paper: Introduction to Biotechnology	L	T/P	C
PaperID: 160120		3	-	3

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end Theory Examinations: 75 marks

Instruction for paper setter:

1. There should be 9 questions in the term end examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus.This question should be objective, single line answers or short answer type question of total 15 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15.
4. The questions are to be framed keeping in view the learning outcomes of the course / paper.
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

Course Objectives:

1:	To introduce different areas in Biotechnology to students, laying a foundation for future courses within our biotechnology programme.
2:	To provide a historical perspective of the growth and development of biotechnology, as well as its scope and importance.
3:	To help students understand the interdisciplinary nature of biotechnology, involving integration of several disciplines to generate knowledge and technology impacting society and environment.
4:	To sensitize students towards IPR, safety and ethical concerns in biotechnology research and applications.

Course Outcomes (CO):

CO1:	Understand the history, scope, interdisciplinary nature and significance of biotechnology.
CO2:	Understand the basics of recombinant DNA technology, protein structure and engineering, bioinformatics and principle(s) underlying basic biotechnological techniques.
CO3:	Describe the basics of culturing microbes, animal cells and plant cells in laboratory, and their respective applications in Biotechnology.
CO4:	Have an awareness about the IPR, safety and ethical issues involved in use of biotechnology.

Course Outcomes (CO) to Programme Outcomes (PO) Mapping (scale 1: low, 2: Medium, 3: High)

CO/PO	*PO01*	*PO02*	*PO03*	*PO04*	*PO05*	*PO06*	*PO07*	*PO08*	*PO09*	*PO10*	*PO11*	*PO12*
CO1	3	2	3	3	1	1	1	-	-	-	-	1
CO2	3	2	3	3	1	1	2	-	-	-	-	1
CO3	3	2	3	3	1	-	-	-	-	-	-	1
CO4	3	2	3	3	1	-	-	-	-	-	-	1

Unit I

Introduction: Historical perspective, Definition of Biotechnology; Areas of biotechnology; Scope; Importance and Commercial potential; Interdisciplinary nature;

Solutions and Buffers: Introduction to Solutions and Buffers; Modes of expressing concentration of a solution, Making solutions, Concept of pH and buffers, Henderson-Hasselbach equation, Criteria for selection of buffers; [8Hrs]

Unit II

Recombinant DNA Technology: Tools of rDNA Technology; Making recombinant DNA; Introduction of recombinant DNA into host cells; Introduction to selection and screening techniques for identification of recombinants; Agarose Gel Electrophoresis; Principle, Steps and Applications of Polymerase Chain Reaction;

Protein Structure and Engineering: Introduction to the world of Proteins, Amino acids as building blocks, Non-covalent interactions, Structure of proteins, Structure Function relationship in Proteins, Recombinant proteins of high value, Introduction to Protein Engineering and Design, Introduction to Proteomics.

Introduction to basic techniques in Biotechnology: Beer-Lambert's Law, Spectrophotometer, Agarose Gel Electrophoresis, SDS-PAGE, Gel-Filtration Chromatography, Ion Exchange Chromatography, Affinity chromatography.

Introduction to Bioinformatics: Concept of Primary and Secondary databases, Nucleic acid and Protein databases, Introduction to sequence alignment, Applications of bioinformatics. [12Hrs]

Unit III

Microbial Biotechnology: Microbial Culture Techniques; Measurement and Kinetics of Microbial Growth; Scale up of microbial process; Isolation of microbial products; Strain Isolation; Improvement and Preservation;

Plant Biotechnology: History of plant tissue culture; Plant cell and tissue culture techniques; Transgenic plants with beneficial traits;

Animal Biotechnology: History of animal tissue culture; Animal Cell culture techniques; Finite and Continuous cell lines; Characterization of cell lines; Scale-up of animal cell culture; Applications of microbial, plant and animal biotechnology. [12Hrs]

Unit IV

Biotechnology and Society: Introduction to Patenting; Criterion for patents; Reading a patent; National and International Patent Laws; Safety and Ethical issues in Biotechnology; Biotechnology in India and global trends; Product safety and marketing. [8Hrs]

Text / Reference Books:

1. *Introduction to Biotechnology*, W.J. Thieman and M.A. Palladino, Pearson, 2019.
2. *Biotechnology Foundations*, J.O. Grady, 2019.
3. *Gene cloning and DNA Analysis. An introduction*. T. A Brown, Wiley-Blackwell Science, 2016.
4. *Concepts in Biotechnology: History, Science and Business*, K.Buchholz and J. Collins, Wiley-VCH, 2011.
5. *Biotechnology*, H.K. Das, 2010, Wiley Publishers.
6. *Biotechnology*, Smith, 2009, Cambridge Press.
7. *Principles and Techniques of Biochemistry and Molecular Biology* by Wilson & Walker, Cambridge Press, 2008.

BRIDGE COURSES FOR THE B.TECH LATERAL ENTRY STUDENTS

All the Lateral Entry students of B.Tech., who are directly admitted in the 2nd Year / 3rd Semester of the Progarmme of Study, have to pass the following bridge courses.

Paper Code	Paper Name	L/P
BC-121	Bridge Course in Mathematics	3
BC-123	Bridge Course in Programming in C	3

Implementation Rules for Bridge Courses:

1. The classes for the above bridge courses in the 3rd Semester shall be conducted alongwith the classes of the other courses.
2. These papers have to be qualified by the students.
3. For these papers examination shall be conducted by the concerned subject teacher as NUES, the same shall be transferred to Examination Division of the University.
4. The degree to be awarded to the student only subject to the acquiring qualifying grade/marks in the bridge courses and the minimum credits in the regular courses of the scheme of study as prescribed.
5. These Courses shall be qualifying in nature; they shall not be included for calculation of CGPA. The qualifying marks shall be 40 marks in each paper.
6. A separate marksheet will be issued by the Examination Division of the University for the Bridge Course.

Paper Code(s): BC-121	**L / P**
Paper: Bridge Course in Mathematics	**3**

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end Theory Examinations: 75 marks
3. This is NUES, non-credit and qualifying Paper. All examinations to be conducted by the concerned teacher.

Instructions for paper setter:

1. There should be 9 questions in the term end examinations question paper.
2. The first (1^{st}) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 15 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15.
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

Course Objectives:

1:	To understand the limits, differentiation and integration.
2:	To understand differential equations.
3:	To understand the concepts of matrices.
4:	To understand the concept of vectors and to find out Eigen values.

Course Outcomes (CO):

CO1	Ability to understand the use of limits, differentiation and integration.
CO2	Ability to understand and apply the ordinary differential equations.
CO3	Ability to use matrices to solve linear equations.
CO4	Ability to understand linear independence and dependence of vectors.

Course Outcomes (CO) to Programme Outcomes (PO) Mapping (scale 1: low, 2: Medium, 3: High)

CO/PO	*PO01*	*PO02*	*PO03*	*PO04*	*PO05*	*PO06*	*PO07*	*PO08*	*PO09*	*PO10*	*PO11*	*PO12*
CO1	3	3	2	1	1	-	-	-	2	1	1	3
CO2	3	3	2	1	1	-	-	-	2	1	1	3
CO3	3	3	3	1	1	-	-	-	2	1	1	3
CO4	3	3	3	1	1	-	-	-	2	1	1	3

Unit I

Differentiation: Limits, Definition, Formulas, Differentiation Rules, Real life applications of Differentiation
Integration: Definition, Indefinite Integral, Integration formulas, Definite Integral and its properties,
Real life applications of Integration

Unit II

Ordinary Differential Equations: Definition, Solution of ordinary differential equation, linear differential equation of first order, initial value problem, linear differential equation of higher order with constant coefficients

Unit III

Matrices-I: Definition of Matrix and Determinant, Type of Matrices, Properties of Determinants, Transpose of a matrix, Inverse of a matrix, Solution of system of linear equations using the inverse of a matrix, Rank of a matrix.

Unit IV

Matrices-II: Vectors, Linear independence and dependence of vectors; Eigen values and Eigen vectors or matrix.

Textbooks:

1. *Higher Engineering Mathematics* by B S Grewal, Khanna Publishing.

References:

1. Advanced Engineering Mathematics by Erwin Kreyszig, John Wiley, 10th Ed., 2011.

Paper Code(s): BC-123	**L / P**
Paper: Bridge Course in Programming in C	**3**

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end Theory Examinations: 75 marks
3. This is NUES, non-credit and qualifying Paper. All examinations to be conducted by the concerned teacher.

Instructions for paper setter:

1. There should be 9 questions in the term end examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 15 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15.
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

Course Objectives:

1:	To impart basic knowledge about simple algorithms for arithmetic and logical problems so that students can understand how to write a program, syntax and logical errors in 'C'.
2:	To impart knowledge about how to implement conditional branching, iteration and recursion in 'C'.
3:	To impart knowledge about using arrays, pointers and structures to develop programs in 'C'.
4:	To impart knowledge about using structures, unions and strings to develop programs in 'C'.

Course Outcomes (CO):

CO1	Ability to write simple programs in in 'C'.
CO2	Ability to implement conditional branching, iteration and arrays in 'C'
CO3	Ability to implement functions and pointers in 'C'
CO4	Ability to use structures, unions and strings in the programs in 'C'.

Course Outcomes (CO) to Programme Outcomes (PO) Mapping (scale 1: low, 2: Medium, 3: High)

CO/PO	***PO01***	***PO02***	***PO03***	***PO04***	***PO05***	***PO06***	***PO07***	***PO08***	***PO09***	***PO10***	***PO11***	***PO12***
CO1	3	3	2	1	1	-	-	-	2	1	1	3
CO2	3	3	2	1	1	-	-	-	2	1	1	3
CO3	3	3	3	1	1	-	-	-	2	1	1	3
CO4	3	3	3	1	1	-	-	-	2	1	1	3

Unit I

Introduction to Programming: Creating and running programs, Preprocessor, Compilation process, role of linker, idea of invocation and execution of a programme.

Introduction to C language: Basic structure of C programs, C tokens, variables, data types, I/O statements. Inter-conversion of variables.

Operators and expressions: Operators, arithmetic, relational and logical, assignment operators, increment and decrement operators operator precedence and associativity, evaluation of expressions, type conversions in expressions.

Unit II

Control structures: Decision statements; if and switch statement; Loop control statements: while, for and do while loops, jump statements, break, continue, goto statements.

Arrays: Concepts, One dimensional array, declaration and initialization of one dimensional arrays, two dimensional arrays, initialization and accessing, multi-dimensional arrays.

Unit III

Functions: User defined and built-in Functions, storage classes, Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference, Recursion.

Pointers: Pointer basics, pointer arithmetic, functions returning pointers, Dynamic memory allocation. Pointers and Strings.

Unit IV

Structures and unions: Structure definition, initialization, accessing structures, structures and functions, self-referential structures, unions, typedef.

Strings: Arrays of characters, variable length character strings, inputting character strings, character library function.

Textbooks:

1. *The C programming language* by B W Kernighan and D M Ritchie, Pearson Education, 1988.

References:

1. *Engineering Problem Solving With C* by Delores M. Etter, Pearson, 2013.
2. *Problem Solving and Program Design in C* by Jeri R. Hanly and Elliot B. Koffman, Pearson, 2016.
3. *ANSI/ISO 9899-1990, American National Standard for Programming Languages 'C'* by American National Standards Institute, Information Technology Industry Council, 1990 (C89).

THE SCHEME OF EXAMINATIONS OF 2nd to 4thYEAR

for

Dual degree Programs (B.Tech./M.Tech.)

a. Computer Science and Engineering Major Discipline
b. Information Technology Major Discipline
c. Electronics and Communication Engineering Major Discipline

Offered by

University School of Information, Communication & Technology at the GGSIPU University Campus, Dwarka

Primary Discipline:
COMPUTER SCIENCE AND ENGINEERING

Programme Education Objectives (PEO)

PEO 1: Our students will apply their knowledge and skills to succeed in their careers and/or obtain advanced degrees.

PEO 2: Our students will behave ethically and responsibly, and will remain informed and involved as full participants in their profession and society.

PEO 3: Our students will creatively solve problems, communicate effectively, and successfully function in diverse and inclusive multi-disciplinary teams.

PEO4 4: Our students will apply principles and practices of computing grounded in mathematics and science to successfully complete hardware and/or software-related engineering projects to meet customer business objectives and/or productively engage in research.

Programme Specific Outcomes (PSO)

On completion of the programme of study, the students will have the ability to:

PSO 1: Identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.

PSO 2: Apply engineering analysis &design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.

PSO 3: Communicate effectively with a range of audiences.

PSO 4: Recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.

PSO 5: Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.

PSO 6: Develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.

PSO 7: Acquire and apply new knowledge as needed, using appropriate learning strategies.

PEO to PO Mapping

PEO/PO	*PO01*	*PO02*	*PO03*	*PO04*	*PO05*	*PO06*	*PO07*	*PO08*	*PO09*	*PO10*	*PO11*	*PO12*
PEO 1	3	1	1	1	1	1	1	1	1	1	1	3
PEO 2	1	-	-	-	-	3	3	3	-	-	-	3
PEO 3	3	3	3	3	3	2	2	1	1	3	3	-
PEO 4	3	3	3	3	3	-	-	-	1	1	3	-

(scale 1: low, 2: Medium, 3: High)

PSO to PO Mapping

PSO/PO	*PO01*	*PO02*	*PO03*	*PO04*	*PO05*	*PO06*	*PO07*	*PO08*	*PO09*	*PO10*	*PO11*	*PO12*
PSO 1	3	-	-	-	-	-	-	-	-	-	-	3
PSO 2	-	3	3	3	3	3	3	-	-	-	-	-
PSO 3	-	-	-	-	-	3	-	-	3	3		-
PSO 4	-	-	-	-	-	3	3	3	1	-	-	-
PSO 5	-	-	-	-	-	-	-	1	3	1	3	-
PSO 6	1	2	2	3	3	1	1	1	-	-	-	3
PSO 7	-	-	-	-	-	-	-	-	-	-	-	3

(scale 1: low, 2: Medium, 3: High)

Third Semester					
Group	**Paper Code**	**Paper**	**L**	**P**	**Credits**
Theory Papers					
PC	ICT201	Foundations of Computer Science	4	-	4
PC	ICT203	Operating Systems	3	-	3
PC	ICT205	Digital Logic & Computer Design	4	-	4
PC	ICT207	Database Management Systems	4	-	4
PC	ICT209	Object Oriented Programming using C++	4	-	4
PC	ICT211	Data Structures	4	-	4
HS/MS	ECO213	Engineering Economics*	2	-	2
Practical/Viva Voce					
PC	ICT251	Database Management Systems Lab.	-	2	1
PC	ICT253	Object Oriented Programming Using C++ Lab.	-	2	1
PC	ICT255	Data Structures Lab.	-	2	1
PC	ICT257	Operating Systems Lab.	-	2	1
Total			**25**	**8**	**29**

***NUES:** Comprehensive evaluation by the concerned teacher, out of 100, as per detailed syllabus.

Fourth Semester					
Group	**Paper Code**	**Paper**	**L**	**P**	**Credits**
Theory Papers					
PC	ICT202	Computer Graphics	3	-	4
PC	ICT204	Computational Methods	4	-	4
PC	ICT206	Design and Analysis of Algorithms	4	-	4
PC	ICT208	Theory of Computation	4	-	4
PC	ICT210	Software Engineering	3	-	3
PC	ICT212	Computer Networks	4	-	4
HS/MS	MS214	Accountancy for Engineers*	2	-	2
Practical/Viva Voce					
PC	ICT252	Computer Networks Lab.	-	2	1
PC	ICT254	Design and Analysis of Algorithms Lab.	-	2	1
PC	ICT256	Computational Methods Lab.	-	2	1
PC	ICT258	Computer Graphics Lab.	-	2	1
PC	ICT260	Software Engineering Lab	-	2	1
Total			**24**	**10**	**29**

***NUES:** Comprehensive evaluation by the concerned teacher, out of 100, as per detailed syllabus.

Fifth Semester					
Code	**Paper Code**	**Paper**	**L**	**P**	**Credits**
Theory Papers					
PC	ICT301	Digital Signal Processing	4	-	4
PC	ICT303	Compiler Design	3	-	4
PCE		Core area Elective - 1			4
EAE		Elective in Emerging Areas 1 (Students to choose one group)			4
OAE		Elective from other schools or emerging area / open elective offered by the school - 1.			4
HS	HS305	Elements of Indian History for Engineers**	2		2
MS	MS307	Entrepreneurship Mindset	2		2
Practical/Viva Voce					
PC	ICT391	Digital Signal Processing Lab.		2	1
PC	ICT395	Compiler Design Lab.		2	1
PC	ICT393	Summer Training (after 4th semester) Report *			1
Total					**26**

*****NUES : Comprehensive evaluation by the a committee of teachers, constituted by the Academic Programme Committee, out of 100. The training shall be of 4 to 6 weeks duration. The training can be under the mentorship of a teacher of the school,

***NUES:** Comprehensive evaluation by the concerned teacher, out of 100, as per detailed syllabus.

Sixth Semester					
Group	**Paper Code**	**Paper**	**L**	**P**	**Credits**
Theory Papers					
PCE		Core area Elective – 2			4
PCE		Core area Elective – 3			4
EAE		Elective in Emerging Areas -2 (Students to choose one group)			4
EAE		Elective in Emerging Areas – 3 (Students to choose one group)			4
OAE		Elective from other schools or emerging area / open elective offered by the school – 2			4
OAE		Elective from other schools or emerging area / open elective offered by the school - 3			4
HS/MS	HS302	Technical Writing**	2		2
Practical/Viva Voce					
HS/MC	ICT392*	NSS / NCC / Cultural clubs / Technical Society / Technical club*			2
Total					**28**

***NUES:** Comprehensive evaluation by the concerned teacher, out of 100, as per detailed syllabus.
*NUES : Comprehensive evaluation of the students by the concerned coordinator of NCC / NSS / Cultural Clubs / Technical Society / Technical Clubs, out of 100 as per the evaluation schemes worked out by these activity societies, organizations; the co-ordinators shall be responsible for the evaluation of the same. These activities shall start from the 1st semester and the evaluation shall be conducted at the end of the 6th semester.

Seventh Semester					
Group	**Paper Code**	**Paper**	**L**	**T/P**	**Credits**
Theory Papers					
PCE		Core area Elective – 4			4
PCE		Core area Elective – 5			4
EAE		Elective in Emerging Areas -4 (Students to choose one group)			4
EAE		Elective in Emerging Areas - 5(Students to choose one group)			4
OAE		Elective from other schools or emerging area / open elective offered by the school – 4			4
OAE		Elective from other schools or emerging area / open elective offered by the school – 5			4
Practical/Viva Voce					
PC	ICT497	Minor Project**			4
PC	ICT499	Summer Training (after 6th semester) Report *			1
Total					**29**

***NUES : Comprehensive evaluation by the a committee of teachers, constituted by the Academic Programme Committee, out of 100.**

** The student shall be allocated a supervisor / guide for project work at the end of 6th semester by the School, the project shall continue into the 8th semester. In the 7th semester evaluation, the criteria for evaluation shall be conceptualization of the project work, the back-ground study / literature survey and identification of objectives and methodology to be followed for project. 40 marks evaluation for the Teachers' Continuous Evaluation / Internal Assessment shall be done by the concerned supervisor while the term end examinations of 60 marks shall be conducted by the supervisor concerned and the external examiner deputed by the Examinations Division. In the absence of the supervisor, the Dean of the school can assign the responsibility of the supervisor (for purpose of examinations) to any faculty of the school.

Eighth Semester					
Group	**Paper Code**	**Paper**	**L**	**T/P**	**Credits**
Practical/Viva Voce/Internship[%]					
PC / Project	ICT452	Major Project – Dissertation[**,#]			15
	ICT454	Major Project Viva Voce[#]			4
	ICT456	Project Progress Evaluation*			2
PC / Internship	ICT458	Internship Report**[,#]			15
	ICT460	Internship Viva Voce[#]			4
	ICT462	Internship Progress Evaluation[*]			2
Total					**21**

***NUES : Comprehensive evaluation by the a committee of teachers, constituted by the Academic Programme Committee, out of 100.**

% By default every student shall do the project work (ICT452, ICT454, and ICT456). A student shall either be allowed to do a project work (ICT452, ICT454, and ICT456) or an internship (ICT458, ICT460, and ICT462). The student must apply for approval to do internship before the commencement of the 8th semester to the school, and only after approval of Dean of the school through Training and Placement Officer of the School, shall proceed for internship.

** The student offered project work shall be allocated a supervisor / guide for project work at the end of 6th semester by the School, the project shall continue into the 8th semester.

Students may be allowed to do internship in this semester in lieu of Major project. The students allowed to proceed for internship shall be required to maintain a log-book of activities performed during internship. The same has to be countersigned by the mentor at the organization where internship is completed.

ICT452: Evaluation shall be conducted of 40 marks (Teachers' continuous evaluation / internal assessment) by the supervisor. And, 60 marks by an external examiner deputed by examinations division (COE), for a total of 100 marks.

ICT454: Evaluation shall be conducted of 40 marks (Teachers' continuous evaluation / internal assessment) by the supervisor. And, 60 marks by a bench of the supervisor and the external examiner deputed by examinations division (COE), for a total of 100 marks.

ICT456/ICT462: Comprehensive evaluation by the committee of teachers, constituted by the Academic Programme Committee, out of 100.

ICT458/ICT460: Evaluation shall be conducted of 40 marks (Teachers' continuous evaluation / internal assessment) by the training and placement officer of the School on the basis of the report submitted by the student. And, 60 marks by a bench of the Training and Placement Officer of the School and the external examiner deputed by examinations division (COE), for a total of 100 marks.

In the absence of the supervisor or the Training and placement officer (as the case may be), the Dean of the school can assign the responsibility of the supervisor or the Training and Placement officer (for purpose of examinations) to any faculty of the school.

Note on Elective Papers: The elective papers shall be allowed to be taken / studied by the students, by the APC of the School, keeping in view that two papers studied by the student should not have a substantial overlap. All papers studied by the student should be substantially distinct in content.

PROGRAMME CORE ELECTIVE PAPERS (PCE)

Paper	Paper Code	Paper Name	T	P	Credits
Semester 5: Choose any one paper					
311	ICT311T	Artificial Intelligence	3	-	3
	ICT311P	Artificial Intelligence Lab.	-	2	1
313	ICT313T	Microprocessors and Interfacing	3	-	3
	ICT313P	Microprocessors and Interfacing Lab	-	2	1
315	ICT315T	Engineering Optimization	3	-	3
	ICT315P	Engineering Optimization Lab.	-	2	1
317	ICT317T	Social Network Analysis and Sentiment Analysis	3	-	3
	ICT317P	Social Network Analysis and Sentiment Analysis Lab.	-	2	1
319	ICT319T	Software Requirements and Estimation	3	-	3
	ICT319P	Software Requirements and Estimation Lab.	-	2	1
321	ICT321	Graph Theory for Computer Science	4	-	4
Semester 6: Choose any Two Paper					
312	ICT312T	Java Programming	3	-	3
	ICT312P	Java Programming Lab.	-	2	1
314	ICT314T	Systems Programming	3	-	3
	ICT314P	Systems Programming Lab.	-	2	1
316	ICT316T	Introduction to Robotics Engineering	3	-	3
	ICT316P	Introduction to Robotics Engineering Lab.	-	2	1
318	ICT318T	Network Security and Cryptography	3	-	3
	ICT318P	Network Security and Cryptography Lab.	-	2	1
320	ICT320T	Visual Basic.Net Programming	3	-	3
	ICT320P	Visual Basic.Net Programming Lab.	-	2	1
322	ICT322T	Quantum Computing	3	-	3
	ICT322P	Quantum Computing Lab.	-	2	1
324	ICT324T	Natural Language Processing	3	-	3
	ICT324P	Natural Language Processing Lab.	-	2	1
326	ICT326T	Object Technology and UML	3	-	3
	ICT326P	Object Technology and UML Lab.	-	2	1
328	ICT328T	Design Patterns	3	-	3
	ICT328P	Design Patterns Lab.	-	2	1
330	ICT330T	Data Warehousing and Data Mining	3	-	3
	ICT330P	Data Warehousing and Data Mining Lab.	-	2	1
332	ICT332T	Computational Geometry	3	-	3
	ICT332P	Computational Geometry Lab.	-	2	1
334	ICT334T	Introduction to Mobile Ad Hoc Networks	3	-	3
	ICT334P	Introduction to Mobile Ad Hoc Networks Lab.	-	2	1
Semester 7: Choose any Two Papers					
401	ICT401T	Advanced Java Programming	3	-	3
	ICT401P	Advanced Java Programming Lab.	-	2	1
403	ICT403T	Blockchain Technology	3	-	3
	ICT403P	Blockchain Technology Lab.	-	2	1
405	ICT405T	Semantic Web	3	-	3
	ICT405P	Semantic Web Lab.	-	2	1
407	ICT407T	C#.net Programming	3	-	3
	ICT407P	C#.net Programming Lab.	-	2	1
409	ICT409T	Cyber Security and Forensics	3	-	3
	ICT409P	Cyber Security and Forensics Lab.	-	2	1
411	ICT411T	Software Testing	3	-	3
	ICT411P	Software Testing Lab.	-	2	1
413	ICT413	Cloud Computing	4	-	4
415	ICT415T	Introduction to IoT	3	-	3
	ICT415P	Introduction to IoT Lab.	-	2	1
417	ICT417	Complexity Theory	4	-	4
419	ICT419T	Human Computer Interface	3	-	3
	ICT419P	Human Computer Interface Lab.	-	2	1
421	ICT421T	Software Project Management	3	-	3
	ICT421P	Software Project Management Lab.	-	2	1

Paper	Paper Code	Paper Name	T	P	Credits
423	ICT423T	Next Generation Web	3	-	3
	ICT423P	Next Generation Web Lab.	-	2	1
425	ICT425T	Web Mining	3	-	3
	ICT425P	Web Mining Lab.	-	2	1

Note:

1. Each paper to be studied as elective is of 4 credits. In most of the papers, there are two components, a 3 credit theory component to be evaluated as a (pure) theory paper (25 marks teacher's continuous evaluation and 75 marks term end examination) and a (pure) laboratory / practical paper of 1 credit (40 marks teacher's continuous evaluation and 60 marks term end examination).If the paper is of 4 credits with only one component, then it is equivalent to a theory paper (25 marks teacher's continuous evaluation and 75 marks term end examination).

2. An elective shall be offered to the student based on the availability of resources and faculty at the institution and at least one third of the batch or at least 20 students must be willing to take the elective.

3. Each PCE slot is of 4 credits, if in a particular slot, the paper has no practical component, then it is of 4 credits (a pure theory paper), otherwise for purpose of examination and conduct of classes, the course is split in two papers, namely a theory paper of 3 credits and a practical paper of 1 credit. The student has to study for 4 credits per slot of PCE group. This is reflected by suffixing the paper code by T (for Theory component) and P (for Practical component), if required.

Implementation Rules:

1. The examinations, attendance criteria to appear in examinations, promotion and award of the degree shall be governed by the Ordinance 11 of the University. The term "major discipline" / "primary discipline" in this document refers to the discipline in which student is admitted / studies from 3rd semester onwards. However credits of courses / paper for OAE / EAE groups shall not be considered for the purpose of promotion from one year of study to the subsequent year of study.

2. Minimum duration of the Bachelor of Technology part of the Bachelor / Master of Technology (Dual Degree) programme shall be 4 years (N=4 years) (8 semesters) for the students admitted in the 1st year and 1st semester of the degree programme. Lateral entry students shall be admitted in the 2nd year and 3rd semester of the degree programme (effectively in the batch admitted in the first year in the previous academic session and shall be deemed to have been exempted from the courses / papers of the first year of the degree programme. No exemption certificate shall be issued in any case.

A specific lateral entry students' minimum duration shall be the same as the minimum duration for the batch in which he/she is admitted as a lateral entry student in the 2nd year.

3. Maximum duration of the Bachelor of Technology part of the Bachelor / Master of Technology (Dual Degree) programme shall be 6 years (N+2 years). After completion of N+2 years of study, if the student has appeared in the papers of all the semesters upto 8th semester, then a maximum extension of 1 year may be given to the student for completing the requirements of the degree if and only if the number of credits already earned by the student is atleast 165 from the (non-honours components). Otherwise, the admission of the student shall stand cancelled. After the period of allowed study, the admission of the student shall be cancelled.

A specific lateral entry students' maximum duration shall be the same as the minimum duration for the batch in which he/she is admitted as a lateral entry student in the 2nd year.

4. Only after qualifying for the award of the degree of Bachelor of Technology, the student may be allowed to proceed for the Master in Technology part of the Bachelor / Master of Technology (Dual Degree).The degree shall be awarded only after the fulfilment of all requirements of the Scheme and Syllabus of Examinations and the applicable Ordinance.

5. The scheme and syllabi of the Master of Technology part of the Bachelor / Master of Technology (Dual Degree) shall be notified separately. This document pertains to the Bachelor of Technology part of the Bachelor / Master of Technology (Dual Degree) programme only.

6. (a) The students shall undergo the following group of Courses / Papers as enumerated in the scheme (for students admitted in the 1st year / 1st semester).

Group	Semester (Credits)								Total Credits	Mandatory Credits
	I	II	III	IV	V	VI	VII	VIII		
BS	12	20							**32**	**16**
HS	5	4	2	2	4	4			**21**	**10**
ES	12	5							**17**	**17**
PC			27	27	10		5	21	**90**	**90**
PCE					4	8	8		**20**	**16**
EAE					4	8	8		**20**	**16**
OAE / EAE					4	8	8		**20**	**10**
Total	**29**	**29**	**29**	**29**	**26**	**28**	**29**	**21**	**220**	**175**

TABLE 1: Distribution of Credits. (Project / internship credits are 27 out of the 90 credits for Programme Core (PC) credits, while extra-curricular activities credits are 2 out of 21 credits for humanities / management / social science group (HS)). This table is for students admitted in the 1st year and 1st semester of the degree programme.

(b) The students admitted as lateral entry student in the second year / 3rd semester of the degree programme shall have to undergo the following group of Courses / Papers as enumerated in the scheme (From the year 2022-23 lateral entry admissions):

Group	Semester (Credits)						Total Credits	Mandatory Credits
	III	IV	V	VI	VII	VIII		
HS	2	2	4	4			**12**	**6**
PC	27	27	10		5	21	**90**	**90**
PCE			4	8	8		**20**	**16**
EAE			4	8	8		**20**	**16**
OAE / EAE			4	8	8		**20**	**10**
Total	**29**	**29**	**26**	**28**	**29**	**21**	**162**	**138**

TABLE 2: Distribution of Credits. (Project / internship credits are 27 out of the 90 credits for Programme Core (PC) credits, while extra-curricular activities credits are 2 out of 21 credits for humanities / management / social science group (HS)). This table is for students admitted as lateral entry students in the 2nd year and 3rdsemester of the degree programme.

7. Mandatory Credits value is 175, and specify the number of credits from each subject group to be mandatorily acquired by the student for the award of the degree (Table 1),for students admitted as students in the 1st year and 1st semester of the degree programme.While for students admitted as lateral entry in the 2nd year and 3rd semester the Mandatory Credits value is 138, and specify the number of credits from each subject group to be mandatorily acquired by the student for the award of the degree (Table 2). See clause 12 and 13 also

8. Some of the papers are droppable in the sense that the student may qualify for the award of the degree even when the student has not cleared / passed some of the papers of these group. However, the student has to earn the minimum credits for the programme of study as specified. See clause 12 and 13 also.

9. The open electives of the OAE group of courses may be taken through SWAYAM / NPTEL MOOCs platform. The student desirous of doing a MOOC based course among the OAE group must seek approval of the APC of the school for the same before the commencement of the semester. The APC shall allow the MOOC based OAE option to the student if and only if the MOOC subject / course being considered for the student is being offered in line with the Academic Calendar applicable. The student shall submit the successful completion certificate with marks to the School for onwards transfer to the Examination Division. The Examinations Divisions shall take these marks on record for incorporation in the result of the appropriate semester. These marks / grades of these courses shall be used for calculation of the SGPA/CGPA of the student concerned by the examination division of the University. If a student takes even one OAE paper through MOOCs, then the student shall not be eligible for two minor specialization. The degree to the student on fulfilment of other requirements for such cases shall be through clause 13.b. or 13.c or 13.d.

These MOOC courses taken by the students, if allowed by the APC of the school shall be of 4 credits or more collectively to be againstor for one paper slot in the scheme, through MOOCs, though the marks shall be shown individually. That is in one paper slot in the scheme wherever a MOOC course is allowed, the student may register for more than one paper to aggregate 4 credits or more. If the credits of these MOOC Courses, allowed to a student is more than 4, then the maximum credit for the programme shall be amended accordingly for the particular student. Also, in a particular semester, a student may take more than one MOOC course with the approval of the APC to meet the credit requirements of OAE for the semester. The cost of taking the MOOC course is to be borne by the concerned student. The results of the MOOC courses shall be declared separately by the examination division from the result for the papers conducted by the examination division of the University.

However, if the student opts for emerging area electives in this group also, the same shall be allowed subject to other conditions specified in the rules / scheme.

10. To earn an Honours degree, the student may enrol for 20 credits or more through SWAYAM / NPTEL MOOCs platform. This point has to be read together with other points specially point 13 and 14, The acquisition of the credits should be completed before the 15th of the July of the admission year plus 4 years. That is, if a student is admitted in the year X, then these credits must be acquired through MOOCs by 15th July of the year (X+4), no extra duration or time shall be allocated.

Honours in the degree shall be awarded if and only if at least 20 credits are acquired through MOOCs. To obtain Honours in the programme, the student must apply to the School about the same before the commencement of the 5th semester. The specific courses through MOOCs shall be registered by the student only after approval by the Academic Programme

Committee (APC) of the School. The APC shall approve the course if it is not already studied by the student or the student shall not study it in future and adds value to the major area of specialization (which is the degree). The papers for which the student desires to appear for Honours through MOOCs, all papers results shall be submitted by the student to the school for onwards transfer to Examination Division of the University, to be taken on record of the University. The results of these papers shall be a part of the records of the examinations of the students. The records shall be submitted by the student to the school, then transferred to the Examinations division, shall be notified by the examinations division of the University, and a separate marksheet shall be issued by the Examinations divisions. The cost of taking the MOOC course is to be borne by the concerned student. Such courses shall be reflected as additional courses / papers for the student.

If a student acquires less than 20 credits through MOOCs, following the mechanism specified, then also the results of these papers shall be taken on record as specified above, though no Honours degree shall be awarded.

The papers through MOOCs for Honours degree shall not be a part of the set of the papers over which the SGPA / CGPA of the student shall be calculated.

The papers through MOOCs for Honours degree shall be additional papers studied by the students and are to be taken into account only for award of Honours in the degree programme, if 20 credits are earned through MOOCs as approved by APC, by a student. See Clause 14 also.

11. Maximum Credits is at least 220 (Table 1) for students admitted in the 1st year and 1st semester, these are the credits for which the student shall have to study for the non-Honours component of the curriculum. And, for lateral entry students admitted in the 2nd year and 3rd semester of the degree programme, the maximum credit required to be studied is at least 162 (Table 2). See clause 9 also.

The student has to appear in the examinations for these credits in all components of evaluation as specified in the scheme of studies.

12. Minimum Credits required to be earnedis atleast 200 (out of the 220 non Honours papers credits, see clause 11 also) for students admitted in the 1st year and 1st semester. And, for lateral entry students admitted in the 2nd year and 3rd semester of the degree programme, the minimum credit required to be earned is at least 148(out of the 162 non Honours papers credits, see clause 11 also). See clause 7 also.

13. The following degree route can be taken by a student (also refer point 14):

a. The students shall be awarded two minor specializations, one from EAE and one from OAE / EAE route under the following conditions:
   i. The student has earned The student has earned the mandatory credits as defined in Table 1 or Table 2 (as applicable) and clause 7.
   ii. The student earns 20 credits from one group of EAE courses offered as a minor specialization by USICT.
   iii. The student earns 20 credits from one group of OAE courses offered as a minor specialization by USICT or any other school. Papers taken through MOOCs for OAE shall not entitle the student to a minor specialization.
   iv. In addition, the total credits (including the above specified credits) earned by the student is atleast as specified in clause 12.

   The degree nomenclature of the degree shall be as: "***Bachelor of Technology (Primary Discipline) with minor specializations in <concerned EAE discipline> and <concerned OAE discipline>)***"; if criteria / point 10 is not satisfied for Honours. Otherwise, if criteria / point 10 is met, then the degrees shall be an Honours degree and the nomenclature shall be as: "***Bachelor of Technology (Primary Discipline) with minor specializations in <concerned EAE discipline> and <concerned OAE / EAE specialization>) (Honours)"***, if in addition to point 13.a.i, 13.a.ii, 13.a.iii, and 13.a.iv, the student fulfils the criteria for Honours as specified at point 10.

b. The students shall be awarded one minor specialization from EAE route under the following conditions:
   i. The student has earned The student has earned the mandatory credits as defined in Table 1 or Table 2 (as applicable) and clause 7.
   ii. The student earns 20 credits from one group of EAE courses offered as a minor specialization by USICT.
   iii. In addition, the total credits (including the above specified credits) earned by the student is atleast as specified in clause 12.

   The degree nomenclature of the degree shall be as: "***Bachelor of Technology (Primary Discipline) with minor specialization in <concerned EAE specialization>)***"; if criteria / point 10 is not satisfied for Honours. Otherwise, if criteria / point 10 is met, then the degrees shall be an Honours degree and the nomenclature shall be as: "***Bachelor of Technology (Primary Discipline) with minor specialization in***

<concerned EAE specialization>) (Honours)", if in addition to point 13.b.i, 13.b.ii, and 13.b.iii, the student fulfils the criteria for Honours as specified at point 10.

c. The students shall be awarded one minor specialization from OAE / EAE route under the following conditions:

i. The student has earned the student has earned the mandatory credits as defined in Table 1 or Table 2 (as applicable) and clause 7.
ii. The student earns 20 credits from one group of OAE courses offered as a minor specialization by USICT or any other school. Papers taken through MOOCs for OAE shall not entitle the student to a minor specialization.
iii. In addition, the total credits (including the above specified credits) earned by the student is atleast as specified in clause 12.

The degree nomenclature of the degree shall be as: "***Bachelor of Technology (Primary Discipline) with minor specialization in <concerned OAE / EAE specialization>)***"; if criteria / point 10 is not satisfied for Honours. Otherwise, if criteria / point 10 is met, then the degrees shall be an Honours degree and the nomenclature shall be as: "***Bachelor of Technology (Primary Discipline) with minor specialization in <concerned OEA / EAE specialization>) (Honours)***", if in addition to point 13.c.i, 13.c.ii, and 13.c.iii, the student fulfils the criteria for Honours as specified at point 10.

d. The students shall be awarded the degree without any minor specialization under the following conditions:

i. The student has earned The student has earned the mandatory credits as defined in Table 1 or Table 2 (as applicable) and clause 7.
ii. In addition, the total credits (including the above specified credits) earned by the student is atleast as specified in clause 12.

The degree nomenclature of the degree shall be as: "***Bachelor of Technology (Major Discipline)";*** if criteria / point 6 is not satisfied for Honours. Otherwise, if criteria / point 10 is met, then the degrees shall be an Honours degree and the nomenclature shall be as: "***Bachelor of Technology (Major Discipline) (Honours)***", if in addition to point 13.d.i and 13.d.ii, the student fulfils the criteria for Honours as specified at point 10.

e. If the student does not fulfil any of the above criterions (point 13.a, 13.b, 13.c or 13.d), if the student earns atleast the minimum credits specified in clause 12 (disregarding the mandatory credits clause of Table 1 or 2 and Clause 7), then the student shall be award the degree as ***Bachelor of Technology (Major Discipline).*** Such students shall not be eligible for the award of an Honours degree. Though if credits are accumulated through MOOCs as per clause 10, the same shall be reflected in the marksheets of the students.

14. The Honours degree shall only be awarded if the CGPA of the student is above or equal to 7.5 in addition to fulfilment of criteria / point 10 and 13 above and the degree is awarded after the immediate completion of the 4^{th} of the batch from the year of admission. No Honours shall be conferred if the degree requirements are not completed in the minimum duration.

15. Pass marks in every paper shall be 40.

16. Grading System shall be as per Ordinance 11 of the University.

17. The programme core electives (PCE) shall be specific to a major discipline, minor specializations and papers for EAE shall be defined by the school and minor specializations and papers for OAE shall be defined by the concerned school. The school shall offer atleast two emerging area elective groups for students of each major discipline, and atleast two open area elective groups for students of each major discipline of the school. In addition, the school shall offer minor specialization groups as OAE to other school students. The emerging area / open electives can also be offered as standalone papers not forming a part of any elective groups also. The prerequisites for a specific paper, offered by the school, shall be defined in the detailed scheme and syllabus document of the school. The school shall decide the group(s) and/or individual papers to be offered as electives based on the availability of infrastructure and faculty. From the groups / papers offered by the school, an elective paper / group shall be taught if and only if the number of students in a paper is at-least 20 or at-least 1/3 of the students of a major discipline for which the paper / group is to be offered. The APC of the school may define a maximum number of students allowed to register for a paper as an elective (EAE / OAE).

18. The students desirous to continue to the Master of Technology part of the dual degree programme, must first complete the requirements for the award of the Bachelor of Technology degree, before being allowed to proceed for the Master of Technology part.

19. Teachers of other Schools, as and when deputed by their school, for teaching the students enrolled in programmes offered by the University School of Information, Communication and Technology (USICT) shall be a part of the Academic Programme Committee of the school. Such teachers, for all academic matters, including teaching, teachers' continuous evaluation, term end examinations etc. shall be governed by the decisions of the APC of USICT. Similarly, the guest faculty, the visiting faculty and the contract / Ad Hoc faculty as and when deputed to teach students of USICT shall form a part of APC of USICT.

20. The medium of instructions shall be English.

Primary Discipline:
INFORMATION TECHNOLOGY

Programme Education Objectives (PEO)

PEO 1: Our students will apply their knowledge and skills to succeed in their careers and/or obtain an advanced degree.

PEO 2: Our students will behave ethically and responsibly, and will remain informed and involved as full participants in their profession and society.

PEO 3: Our students will creatively solve problems, communicate effectively, and successfully function in diverse and inclusive multi-disciplinary teams.

PEO 4: Our students will apply principles and practices of information technology to identify, implement, and enable effective technologies and apply fundamental computing knowledge to solve information technology problems and be capable of doing research.

Programme Specifc Outcomes (PSO)

On completion of the programme of study, the students will have the ability to:

PSO 1: Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions.

PSO 2: Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline.

PSO 3: Communicate effectively in a variety of professional contexts.

PSO 4: Recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles.

PSO 5: Function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline.

PSO 6: Identify and analyze user needs and to take them into account in the selection, creation, integration, evaluation, and administration of computing-based systems.

PEO to PO Mapping

PEO/PO	*PO01*	*PO02*	*PO03*	*PO04*	*PO05*	*PO06*	*PO07*	*PO08*	*PO09*	*PO10*	*PO11*	*PO12*
PEO 1	3	1	1	1	1	1	1	1	1	1	1	3
PEO 2	1	-	-	-	-	3	3	3	-	-	-	3
PEO 3	3	3	3	3	3	2	2	1	1	3	3	-
PEO 4	3	3	3	3	3	-	-	-	1	1	3	-

(scale 1: low, 2: Medium, 3: High)

PSO to PO Mapping

PSO/PO	*PO01*	*PO02*	*PO03*	*PO04*	*PO05*	*PO06*	*PO07*	*PO08*	*PO09*	*PO10*	*PO11*	*PO12*
PSO 1	3	3	-	3	-	-	-	-	-	-	-	3
PSO 2	-	3	3	3	3	1	1	-	-	-	-	3
PSO 3	-	-	-	-	-	3	-	-	3	3	3	-
PSO 4	-	-	-	-	-	3	3	3	1	-	-	-
PSO 5	-	-	-	-	-	-	-	1	3	1	3	-
PSO 6	1	3	3	3	3	1	1	1	-	-	-	3

(scale 1: low, 2: Medium, 3: High)

Third Semester					
Group	**Paper Code**	**Paper**	**L**	**P**	**Credits**
Theory Papers					
PC	ICT201	Foundations of Computer Science	4	-	4
PC	ICT203	Operating Systems	3	-	3
PC	ICT205	Digital Logic & Computer Design	4	-	4
PC	ICT207	Database Management Systems	4	-	4
PC	ICT209	Object Oriented Programming using C++	4	-	4
PC	ICT211	Data Structures	4	-	4
HS/MS	ECO213	Engineering Economics*	2	-	2
Practical/Viva Voce					
PC	ICT251	Database Management Systems Lab.	-	2	1
PC	ICT253	Object Oriented Programming using C++ Lab.	-	2	1
PC	ICT255	Data Structures Lab.	-	2	1
PC	ICT257	Operating System Lab.	-	2	1
Total			**25**	**8**	**29**

***NUES:** Comprehensive evaluation by the concerned teacher, out of 100, as per detailed syllabus.

Fourth Semester					
Group	**Paper Code**	**Paper**	**L**	**P**	**Credits**
Theory Papers					
PC	ICT202	Computer Graphics	3	-	3
PC	ICT204	Computational Methods	4	-	4
PC	ICT206	Design and Analysis of Algorithms	4	-	4
PC	ICT208	Theory of Computation	4	-	4
PC	ICT210	Software Engineering	3	-	3
PC	ICT212	Computer Networks	4	-	4
HS/MS	MS214	Accountancy for Engineers*	2	-	2
Practical/Viva Voce					
PC	ICT252	Computer Networks Lab.	-	2	1
PC	ICT254	Design and Analysis of Algorithms Lab.	-	2	1
PC	ICT256	Computational Methods Lab.	-	2	1
PC	ICT258	Computer Graphics Lab.	-	2	1
PC	ICT260	Software Engineering Lab.	-	2	1
Total			**24**	**10**	**29**

***NUES:** Comprehensive evaluation by the concerned teacher, out of 100, as per detailed syllabus.

Fifth Semester					
Code	**Paper Code**	**Paper**	**L**	**P**	**Credits**
Theory Papers					
PC	ICT301	Digital Signal Processing	4	-	4
PC	ICT303	Compiler Design	3	-	3
PCE		Core area Elective - 1			4
EAE		Elective in Emerging Areas 1 (Students to choose one group)			4
OAE		Elective from other schools or emerging area / open elective offered by the school - 1.			4
HS	HS305	Elements of Indian History for Engineers**	2		2
MS	MS307	Entrepreneurship Mindset	2		2
Practical/Viva Voce					
PC	ICT391	Digital Signal Processing Lab.		2	1
PC	ICT395	Compiler Design Lab.		2	1
PC	ICT393	Summer Training (after 4th semester) Report *			1
Total				**2**	**26**

*****NUES : Comprehensive evaluation by the a committee of teachers, constituted by the Academic Programme Committee, out of 100. The training shall be of 4 to 6 weeks duration. The training can be under the mentorship of a teacher of the school

****NUES:** Comprehensive evaluation by the concerned teacher, out of 100, as per detailed syllabus.

Sixth Semester					
Group	**Paper Code**	**Paper**	**L**	**P**	**Credits**
Theory Papers					
PCE		Core area Elective – 2			4
PCE		Core area Elective – 3			4
EAE		Elective in Emerging Areas -2 (Students to choose one group)			4
EAE		Elective in Emerging Areas – 3 (Students to choose one group)			4
OAE		Elective from other schools or emerging area / open elective offered by the school - 2			4
OAE		Elective from other schools or emerging area / open elective offered by the school - 3			4
HS/MS	HS302	Technical Writing**	2		2
Practical/Viva Voce					
HS/MC	ICT392*	NSS / NCC / Cultural clubs / Technical Society / Technical club*			2
Total					**28**

*NUES : Comprehensive evaluation of the students by the concerned coordinator of NCC / NSS / Cultural Clubs / Technical Society / Technical Clubs, out of 100 as per the evaluation schemes worked out by these activity societies, organizations; the co-ordinators shall be responsible for the evaluation of the same. These activities shall start from the 1st semester and the evaluation shall be conducted at the end of the 6th semester.

****NUES:** Comprehensive evaluation by the concerned teacher, out of 100, as per detailed syllabus.

Seventh Semester					
Group	**Paper Code**	**Paper**	**L**	**T/P**	**Credits**
Theory Papers					
PCE		Core area Elective – 4			4
PCE		Core area Elective – 5			4
EAE		Elective in Emerging Areas -4 (Students to choose one group)			4
EAE		Elective in Emerging Areas - 5(Students to choose one group)			4
OAE		Elective from other schools or emerging area / open elective offered by the school – 4			4
OAE		Elective from other schools or emerging area / open elective offered by the school – 5			4
Practical/Viva Voce					
PC	ICT497	Minor Project**			4
PC	ICT499	Summer Training (after 6th semester) Report *			1
Total					**29**

***NUES : Comprehensive evaluation by the a committee of teachers, constituted by the Academic Programme Committee, out of 100.**

** The student shall be allocated a supervisor / guide for project work at the end of 6th semester by the School, the project shall continue into the 8th semester. In the 7th semester evaluation, the criteria for evaluation shall be conceptualization of the project work, the back-ground study / literature survey and identification of objectives and methodology to be followed for project. 40 marks evaluation for the Teachers' Continuous Evaluation / Internal Assessment shall be done by the concerned supervisor while the term end examinations of 60 marks shall be conducted by the supervisor concerned and the external examiner deputed by the Examinations Division. In the absence of the supervisor, the Dean of the school can assign the responsibility of the supervisor (for purpose of examinations) to any faculty of the school.

Eighth Semester					
Group	**Paper Code**	**Paper**	**L**	**T/P**	**Credits**
Practical/Viva Voce/Internship[%]					
PC / Project	ICT452	Major Project – Dissertation[**,#]			15
	ICT454	Major Project Viva Voce[#]			4
	ICT456	Project Progress Evaluation*			2
PC / Internship	ICT458	Internship Report**[,#]			15
	ICT460	Internship Viva Voce[#]			4
	ICT462	Internship Progress Evaluation[*]			2
Total					**21**

***NUES : Comprehensive evaluation by the a committee of teachers, constituted by the Academic Programme Committee, out of 100.**

% By default every student shall do the project work (ICT452, ICT454, and ICT456). A student shall either be allowed to do a project work (ICT452, ICT454, and ICT456) or an internship (ICT458, ICT460, and ICT462). The student must apply for approval to do internship before the commencement of the 8th semester to the school, and only after approval of Dean of the school through Training and Placement Officer of the School shall proceed for internship.
** The student offered project work shall be allocated a supervisor / guide for project work at the end of 6th semester by the School, the project shall continue into the 8th semester.
# Students may be allowed to do internship in this semester in lieu of Major project. The students allowed to proceed for internship shall be required to maintain a log-book of activities performed during internship. The same has to be countersigned by the mentor at the organization where internship is completed.
ICT452: Evaluation shall be conducted of 40 marks (Teachers' continuous evaluation / internal assessment) by the supervisor. And, 60 marks by an external examiner deputed by examinations division (COE), for a total of 100 marks.
ICT454: Evaluation shall be conducted of 40 marks (Teachers' continuous evaluation / internal assessment) by the supervisor. And, 60 marks by a bench of the supervisor and the external examiner deputed by examinations division (COE), for a total of 100 marks.
ICT456/ICT462: Comprehensive evaluation by the committee of teachers, constituted by the Academic Programme Committee, out of 100.
ICT458/ICT460: Evaluation shall be conducted of 40 marks (Teachers' continuous evaluation / internal assessment) by the training and placement officer of the School on the basis of the report submitted by the student. And, 60 marks by a bench of the Training and Placement Officer of the School and the external examiner deputed by examinations division (COE), for a total of 100 marks.

In the absence of the supervisor or the Training and placement officer (as the case may be), the Dean of the school can assign the responsibility of the supervisor or the Training and Placement officer (for purpose of examinations) to any faculty of the school.

Note on Elective Papers: The elective papers shall be allowed to be taken / studied by the students, by the APC of the School, keeping in view that two papers studied by the student should not have a substantial overlap. All papers studied by the student should be substantially distinct in content.

PROGRAMME CORE ELECTIVE PAPERS

Paper	Paper Code	Paper Name	T	P	Credits
Semester 5: Choose any one paper					
311	ICT311T	Artificial Intelligence	3	-	3
	ICT311P	Artificial Intelligence Lab.	-	2	1
313	ICT313T	Microprocessors and Interfacing	3	-	3
	ICT313P	Microprocessors and Interfacing Lab.	-	2	1
315	ICT315T	Engineering Optimization	3	-	3
	ICT315P	Engineering Optimization	-	2	1
317	ICT317T	Social Network Analysis and Sentiment Analysis	3	-	3
	ICT317P	Social Network Analysis and Sentiment Analysis	-	2	1
323	ICT323T	VHDL Programming	3	-	3
	ICT323P	VHDL Programming	-	2	1
325	ICT325T	Multimedia Technologies	3	-	3
	ICT325P	Multimedia Technologies	-	2	1
Semester 6: Choose any Two Paper					
312	ICT312T	Java Programming	3	-	3
	ICT312P	Java Programming	-	2	1
314	ICT314T	Systems Programming	3	-	3
	ICT314P	Systems Programming	-	2	1
316	ICT316T	Introduction to Robotics Engineering	3	-	3
	ICT316P	Introduction to Robotics Engineering	-	2	1
318	ICT318T	Network Security and Cryptography	3	-	3
	ICT318P	Network Security and Cryptography	-	2	1
320	ICT320T	Visual Basic.Net Programming	3	-	3
	ICT320P	Visual Basic.Net Programming	-	2	1
322	ICT322T	Quantum Computing	3	-	3
	ICT322P	Quantum Computing	-	2	1
324	ICT324T	Natural Language Processing	3	-	3
	ICT324P	Natural Language Processing	-	2	1
336	ICT336T	Introduction to Information and Communication Theory	3	-	3
	ICT336P	Introduction to Information and Communication Theory	-	2	1
338	ICT338T	Database Modelling and Design	3	-	3
	ICT338P	Database Modelling and Design	-	2	1
340	ICT340T	Analog and Digital Communication	3	-	3
	ICT340P	Analog and Digital Communication	-	2	1
326	ICT326T	IT Project Management	3	-	3
	ICT326P	IT Project Management	-	2	1
Semester 7: Choose any Two Papers					
401	ICT401T	Advanced Java Programming	3	-	3
	ICT401P	Advanced Java Programming Lab.	-	2	1
403	ICT403T	Blockchain Technology	3	-	3
	ICT403P	Blockchain Technology Lab.	-	2	1
405	ICT405T	Semantic Web	3	-	3
	ICT405P	Semantic Web Lab.	-	2	1
407	ICT407T	C#.net Programming	3	-	3
	ICT407P	C#.net Programming Lab.	-	2	1
409	ICT409	Cyber Security and Forensic	4	-	4
411	ICT411T	Software Testing	3	-	3
	ICT411P	Software Testing Lab.	-	2	1
413	ICT413	Cloud Computing	4	-	4
415	ICT415T	Introduction to IoT	3	-	3
	ICT415P	Introduction to IoT Lab.	-	2	1
427	ICT427	Middleware Technologies	4	-	4
429	ICT429	Mobile Computing	4	-	4
431	ICT431	E-Commerce	4	-	4
435	ICT435T	Network Programming on Linux	3	-	3
	ICT435P	Network Programming on Linux Lab.	-	2	1
333	ICT433T	Wireless Communications and Networks	3	-	3
	ICT433P	Wireless Communications and Networks Lab.	-	2	1

Note:

1. Each paper to be studied as elective is of 4 credits. In most of the papers, there are two components, a 3 credit theory component to be evaluated as a (pure) theory paper (25 marks teacher's continuous evaluation and 75 marks term end examination) and a (pure) laboratory / practical paper of 1 credit (40 marks teacher's continuous evaluation and 60 marks term end examination).If the paper is of 4 credits with only one component, then it is equivalent to a theory paper (25 marks teacher's continuous evaluation and 75 marks term end examination).

2. An elective shall be offered to the student based on the availability of resources and faculty at the institution and at least one third of the batch or at least 20 students must be willing to take the elective.

3. Each PCE slot is of 4 credits, if in a particular slot, the paper has no practical component, then it is of 4 credits (a pure theory paper), otherwise for purpose of examination and conduct of classes, the course is split in two papers, namely a theory paper of 3 credits and a practical paper of 1 credit. The student has to study for 4 credits per slot of PCE group. This is reflected by suffixing the paper code by T (for Theory component) and P (for Practical component), if required.

Implementation Rules:

1. The examinations, attendance criteria to appear in examinations, promotion and award of the degree shall be governed by the Ordinance 11 of the University. The term "major discipline" / "primary discipline" in this document refers to the discipline in which student is admitted / studies from 3rd semester onwards. However credits of courses / paper for OAE / EAE groups shall not be considered for the purpose of promotion from one year of study to the subsequent year of study.

2. Minimum duration of the Bachelor of Technology part of the Bachelor / Master of Technology (Dual Degree) programme shall be 4 years (N=4 years) (8 semesters).

3. Maximum duration of the Bachelor of Technology part of the Bachelor / Master of Technology (Dual Degree) programme shall be 6 years (N+2 years). After completion of N+2 years of study, if the student has appeared in the papers of all the semesters upto 8th semester, then a maximum extension of 1 year may be given to the student for completing the requirements of the degree if and only if the number of credits already earned by the student is atleast 165 from the (non-honours components). Otherwise, the admission of the student shall stand cancelled. After the period of allowed study, the admission of the student shall be cancelled.

4. Only after qualifying for the award of the degree of Bachelor of Technology, the student may be allowed to proceed for the Master in Technology part of the Bachelor / Master of Technology (Dual Degree).

5. The scheme and syllabi of the Master of Technology part of the Bachelor / Master of Technology (Dual Degree) shall be notified separately. This document pertains to the Bachelor of Technology part of the Bachelor / Master of Technology (Dual Degree) programme only.

6. The students shall undergo the following group of Courses / Papers as enumerated in the scheme.

Group	Semester (Credits)								Total Credits	Mandatory Credits
	I	II	III	IV	V	VI	VII	VIII		
BS	12	20							**32**	**16**
HS	5	4	2	2	4	4			**21**	**10**
ES	12	5							**17**	**17**
PC			27	27	10		5	21	**90**	**90**
PCE					4	8	8		**20**	**16**
EAE					4	8	8		**20**	**16**
OAE / EAE					4	8	8		**20**	**10**
Total	**29**	**29**	**27**	**29**	**26**	**28**	**29**	**21**	**220**	**175**

TABLE 1: Distribution of Credits. (Project / internship credits are 27 out of the 90 credits for Programme Core (PC) credits, while extra-curricular activities credits are 2 out of 21 credits for humanities / management / social science group (HS)).

7. Mandatory Credits (175) specify the number of credits from each subject group to be mandatorily acquired by the student for the award of the degree. See clause 12 and 13 also.

8. Some of the papers are droppable in the sense that the student may qualify for the award of the degree even when the student has not cleared / passed some of the papers of these group. However, the student has to earn the minimum credits for the programme of study as specified. See clause 12 and 13 also.

9. The open electives of the OAE group of courses may be taken through SWAYAM / NPTEL MOOCs platform. The student desirous of doing a MOOC based course among the OAE group must seek approval of the APC of the school for the same before the commencement of the semester. The APC shall allow the MOOC based OAE option to the student if and only if the MOOC subject / course being considered for the student is being offered in line with the Academic Calendar applicable. The student shall submit the successful completion certificate with marks to the School for onwards transfer to the Examination Division. The Examinations Divisions shall take these marks on record for incorporation in the result of the appropriate semester. These marks / grades of these courses shall be used for calculation of the SGPA/CGPA of the student concerned by the examination division of the University. If a student takes even one OAE paper through MOOCs, then the

student shall not be eligible for two minor specialization. The degree to the student on fulfilment of other requirements for such cases shall be through clause 13.b. or 13.c or 13.d.

These MOOC courses taken by the students, if allowed by the APC of the school shall be of 4 credits or more collectively to be against or for one paper slot in the scheme, through MOOCs, though the marks shall be shown individually. That is in one paper slot in the scheme wherever a MOOC course is allowed, the student may register for more than one paper to aggregate 4 credits or more. If the credits of these MOOC Courses, allowed to a student is more than 4, then the maximum credit for the programme shall be amended accordingly for the particular student. Also, in a particular semester, a student may take more than one MOOC course with the approval of the APC to meet the credit requirements of OAE for the semester. The cost of taking the MOOC course is to be borne by the concerned student. The results of the MOOC courses shall be declared separately by the examination division from the result for the papers conducted by the examination division of the University.

However, if the student opts for emerging area electives in this group also, the same shall be allowed subject to other conditions specified in the rules / scheme.

10. To earn an Honours degree, the student may enrol for 20 credits or more through SWAYAM / NPTEL MOOCs platform. This point has to be read together with other points specially point 13 and 14, The acquisition of the credits should be completed before the 15th of the July of the admission year plus 4 years. That is, if a student is admitted in the year X, then these credits must be acquired through MOOCs by 15th July of the year (X+4), no extra duration or time shall be allocated.

Honours in the degree shall be awarded if and only if at least 20 credits are acquired through MOOCs. To obtain Honours in the programme, the student must apply to the School about the same before the commencement of the 5th semester. The specific courses through MOOCs shall be registered by the student only after approval by the Academic Programme Committee (APC) of the School. The APC shall approve the course if it is not already studied by the student or the student shall not study it in future and adds value to the major area of specialization (which is the degree). The papers for which the student desires to appear for Honours through MOOCs, all papers results shall be submitted by the student to the school for onwards transfer to Examination Division of the University, to be taken on record of the University. The results of these papers shall be a part of the records of the examinations of the students. The records shall be submitted by the student to the school, then transferred to the Examinations division, shall be notified by the examinations division of the University, and a separate marksheet shall be issued by the Examinations divisions. The cost of taking the MOOC course is to be borne by the concerned student. Such courses shall be reflected as additional courses / papers for the student.

If a student acquires less than 20 credits through MOOCs, following the mechanism specified, then also the results of these papers shall be taken on record as specified above, though no Honours degree shall be awarded.

The papers through MOOCs for Honours degree shall not be a part of the set of the papers over which the SGPA / CGPA of the student shall be calculated.

The papers through MOOCs for Honours degree shall be additional papers studied by the students and are to be taken into account only for award of Honours in the degree programme, if 20 credits are earned through MOOCs as approved by APC, by a student. See Clause 14 also.

11. Maximum Credits: at least 220 (Table 1), these are the credits for which the student shall have to study for the non-Honours component of the curriculum. The student has to appear in the examinations for these credits.

12. Minimum Credits: atleast 200 (out of the 220 non Honours papers credits). See clause 7 also.

13. The following degree route can be taken by a student (also refer point 14):

a. The students shall be awarded two minor specializations, one from EAE and one from OAE / EAE route under the following conditions:
   i. The student has earned The student has earned the mandatory credits as defined in Table 1 and clause 7.
   ii. The student earns 20 credits from one group of EAE courses offered as a minor specialization by USICT.
   iii. The student earns 20 credits from one group of OAE courses offered as a minor specialization by USICT or any other school. Papers taken through MOOCs for OAE shall not entitle the student to a minor specialization.
   iv. In addition, the total credits (including the above specified credits) earned by the student is atleast 200 credits.

   The degree nomenclature of the degree shall be as: "***Bachelor of Technology (Primary Discipline) with minor specializations in <concerned EAE discipline> and <concerned OAE discipline>)***"; if criteria / point 10 is not satisfied for Honours. Otherwise, if criteria / point 10 is met, then the degrees shall be an Honours degree and the nomenclature shall be as: "***Bachelor of Technology (Primary Discipline) with***

minor specializations in <concerned EAE discipline> and <concerned OAE / EAE specialization>) (Honours)", if in addition to point 13.a.i, 13.a.ii, 13.a.iii, and 13.a.iv, the student fulfils the criteria for Honours as specified at point 10.

b. The students shall be awarded one minor specialization from EAE route under the following conditions:

   i. The student has earned The student has earned the mandatory credits as defined in Table 1 and clause 7.
   ii. The student earns 20 credits from one group of EAE courses offered as a minor specialization by USICT.
   iii. In addition, the total credits (including the above specified credits) earned by the student is atleast 200 credits.

   The degree nomenclature of the degree shall be as: "***Bachelor of Technology (Primary Discipline) with minor specialization in <concerned EAE specialization>)***"; if criteria / point 10 is not satisfied for Honours. Otherwise, if criteria / point 10 is met, then the degrees shall be an Honours degree and the nomenclature shall be as: "***Bachelor of Technology (Primary Discipline) with minor specialization in <concerned EAE specialization>) (Honours)***", if in addition to point 13.b.i, 13.b.ii, and 13.b.iii, the student fulfils the criteria for Honours as specified at point 10.

c. The students shall be awarded one minor specialization from OAE / EAE route under the following conditions:

   i. The student has earned The student has earned the mandatory credits as defined in Table 1 and clause 7.
   ii. The student earns 20 credits from one group of OAE courses offered as a minor specialization by USICT or any other school. Papers taken through MOOCs for OAE shall not entitle the student to a minor specialization.
   iii. In addition, the total credits (including the above specified credits) earned by the student is atleast 200 credits.

   The degree nomenclature of the degree shall be as: "***Bachelor of Technology (Primary Discipline) with minor specialization in <concerned OAE / EAE specialization>)***"; if criteria / point 10 is not satisfied for Honours. Otherwise, if criteria / point 10 is met, then the degrees shall be an Honours degree and the nomenclature shall be as: "***Bachelor of Technology (Primary Discipline) with minor specialization in <concerned OEA / EAE specialization>) (Honours)***", if in addition to point 13.c.i, 13.c.ii, and 13.c.iii, the student fulfils the criteria for Honours as specified at point 10.

d. The students shall be awarded the degree without any minor specialization under the following conditions:

   i. The student has earned The student has earned the mandatory credits as defined in Table 1 and clause 7.
   ii. In addition, the total credits (including the above specified credits) earned by the student is atleast 200 credits.

   The degree nomenclature of the degree shall be as: "***Bachelor of Technology (Major Discipline)";*** if criteria / point 6 is not satisfied for Honours. Otherwise, if criteria / point 10 is met, then the degrees shall be an Honours degree and the nomenclature shall be as: "***Bachelor of Technology (Major Discipline) (Honours)***", if in addition to point 13.d.i and 13.d.ii, the student fulfils the criteria for Honours as specified at point 10.

e. If the student does not fulfil any of the above criterions (point 13.a, 13.b, 13.c or 13.d), if the student earns atleast 200 credits out of 216 credits as enumerated in Table 1 (disregarding the mandatory credits clause of Table 1 and Clause 7), then the student shall be award the degree as ***Bachelor of Technology (Major Discipline).*** Such students shall not be eligible for the award of an Honours degree. Though if credits are accumulated through MOOCs as per clause 10, the same shall be reflected in the marksheets of the students.

14. The Honours degree shall only be awarded if the CGPA of the student is above or equal to 7.5 in addition to fulfilment of criteria / point 10 and 13 above and the degree is awarded after the immediate completion of the 4th of the batch from the year of admission. No Honours shall be conferred if the degree requirements are not completed in the minimum duration.

15. The scheme of examinations for the B.Tech. Programmes at the affiliated institutions shall be notified separately.

16. Pass marks in every paper shall be 40.

17. Grading System shall be as per Ordinance 11 of the University.

18. The programme core electives (PCE) shall be specific to a major discipline, minor specializations and papers for EAE shall be defined by the school and minor specializations and papers for OAE shall be defined by the concerned school. The school shall offer atleast two emerging area elective groups for students of each major discipline, and atleast two open area elective groups for students of each major discipline of the school. In addition, the school shall offer minor specialization groups as OAE to other school students. The emerging area / open electives can also be offered as standalone papers not forming a part of any elective groups also. The prerequisites for a specific paper, offered by the school, shall be defined in the detailed scheme and syllabus document of the school. The school shall decide the group(s) and/or individual papers to be offered as electives based on the availability of infrastructure and faculty. From the groups / papers offered by the school, an elective paper / group shall be taught if and only if the number of students in a paper is at-least 20 or at-least 1/3 of the students of a major discipline for which the paper / group is to be offered. The APC of the school may define a maximum number of students allowed to register for a paper as an elective (EAE / OAE).

19. The students desirous to continue to the Master of Technology part of the dual degree programme, must first complete the requirements for the award of the Bachelor of Technology degree, before being allowed to proceed for the Master of Technology part.

20. Teachers of other Schools, as and when deputed by their school, for teaching the students enrolled in programmes offered by the University School of Information, Communication and Technology (USICT) shall be a part of the Academic Programme Committee of the school. Such teachers, for all academic matters, including teaching, teachers' continuous evaluation, term end examinations etc. shall be governed by the decisions of the APC of USICT. Similarly, the guest faculty, the visiting faculty and the contract / Ad Hoc faculty as and when deputed to teach students of USICT shall form a part of APC of USICT.

21. The medium of instructions shall be English.

Primary Discipline:

ELECTRONICS AND COMMUNICATIONS ENGINEERING

Programme Education Objectives (PEO)

PEO 1: To be well acquainted with fundamentals of Electronics & Communication Engineering for leading a successful career in industry or as an entrepreneur or pursuing higher education.

PEO 2: To inculcate rational approach towards constantly evolving technologies with ethical responsibilities.

PEO 3: To foster technical skills for innovative solutions in Electronics & Communication Engineering or related areas.

PEO 4: To participate in life-long learning in the relevant domain for addressing global societal needs.

Programme Specifc Outcomes (PSO)

On completion of the programme of study, the students will have the ability to:

PSO 1: To understand and analyse the principles and working of different electronic systems.

PSO 2: To utilize their knowledge, skills and resources to demonstrate and implement technology-based systems as per the requirement.

PSO 3: To offer real time and efficient solutions problems that are directly or indirectly related to Electronics and Communication Engineering areas and will contribute towards the development of society.

PSO 4: Ability to collaborate different fields of science and technology with right blend of attitude and aptitude for placements and higher education or to become a successful Entrepreneur and a worthy global citizen.

PEO to PO Mapping

PEO/PO	*PO01*	*PO02*	*PO03*	*PO04*	*PO05*	*PO06*	*PO07*	*PO08*	*PO09*	*PO10*	*PO11*	*PO12*
PEO 1	3	1	1	1	1	1	1	1	1	1	1	3
PEO 2	3	1	1	-	1	3	3	3	-	-	-	3
PEO 3	3	3	3	3	3	2	2	1	1	1	1	3
PEO 4	1	-	-	-	-	3	1	-	-	-	-	3

(scale 1: low, 2: Medium, 3: High)

PSO to PO Mapping

PSO/PO	*PO01*	*PO02*	*PO03*	*PO04*	*PO05*	*PO06*	*PO07*	*PO08*	*PO09*	*PO10*	*PO11*	*PO12*
PSO 1	3	3	-	-	3	-	-	-	-	-	-	1
PSO 2	2	3	3	3	3	1	1	-	-	-	-	1
PSO 3	2	3	3	3	3	3	3	3	1	3	3	3-
PSO 4	1	1	1	1	1	-	-	1	1	3	-	3

(scale 1: low, 2: Medium, 3: High)

Third Semester					
Group	**Paper Code**	**Paper**	**L**	**P**	**Credits**
Theory Papers					
PC	ICT215	Signal and Systems	3	-	3
PC	ICT217	Computational Methods	4	-	4
PC	ICT219	Digital Electronics	4	-	4
PC	ICT221	Analog Electronics – I	4	-	4
PC	ICT223	Analog Communications	3	-	3
PC	ICT225	Engineering Electromagnetics	4	-	4
HS/MS	ECO213	Engineering Economics*	2	-	2
Practical/Viva Voce					
PC	ICT263	Computational Methods Lab.	-	2	1
PC	ICT259	Digital Electronics Lab.	-	2	1
PC	ICT261	Analog Electronics – I Lab.	-	2	1
PC	ICT265	Signal and Systems Lab.	-	2	1
PC	ICT267	Analog Communications Lab.	-	2	1
Total			**24**	**10**	**29**

***NUES:** Comprehensive evaluation by the concerned teacher, out of 100, as per detailed syllabus.

Fourth Semester					
Group	**Paper Code**	**Paper**	**L**	**P**	**Credits**
Theory Papers					
PC	ICT216	Network Analysis and Synthesis	4	-	4
PC	ICT218	Control Systems	3	-	3
PC	ICT220	Analog Electronics – II	4	-	4
PC	ICT222	Digital Communications	3	-	3
PC	ICT224	Microprocessors	4	-	4
PC	ICT212	Computer Networks	4	-	4
HS/MS	MS214	Accountancy for Engineers*	2	-	2
Practical/Viva Voce					
PC	ICT252	Computer Networks Lab.	-	2	1
PC	ICT262	Analog Electronics – II Lab.	-	2	1
PC	ICT264	Microprocessors Lab.	-	2	1
PC	ICT266	Digital Communications	-	2	1
PC	ICT268	Control Systems Lab	-	2	1
Total			**24**	**10**	**29**

***NUES:** Comprehensive evaluation by the concerned teacher, out of 100, as per detailed syllabus.

Fifth Semester					
Code	**Paper Code**	**Paper**	**L**	**P**	**Credits**
Theory Papers					
PC	ICT301	Digital Signal Processing	4	-	4
PC	ICT305	Microelectronics	3	-	3
PCE		Core area Elective - 1			4
EAE		Elective in Emerging Areas 1 (Students to choose one group)			4
OAE		Elective from other schools or open elective offered by the school - 1.			4
HS	HS307	Elements of Indian History for Engineers**	2		2
MS	MS309	Entrepreneurship Mindset	2		2
Practical/Viva Voce					
PC	ICT391	Digital Signal Processing Lab.		2	1
PC	ICT397	Microelectronics Lab.		2	1
PC	ICT393	Summer Training (after 4th semester) Report *			1
Total				**2**	**26**

*****NUES : Comprehensive evaluation by the a committee of teachers, constituted by the Academic Programme Committee, out of 100. The training shall be of 4 to 6 weeks duration. The training can be under the mentorship of a teacher of the school

****NUES:** Comprehensive evaluation by the concerned teacher, out of 100, as per detailed syllabus.

Sixth Semester					
Group	**Paper Code**	**Paper**	**L**	**P**	**Credits**
Theory Papers					
PCE		Core area Elective – 2			4
PCE		Core area Elective – 3			4
EAE		Elective in Emerging Areas -2 (Students to choose one group)			4
EAE		Elective in Emerging Areas – 3 (Students to choose one group)			4
OAE		Elective from other schools or open elective offered by the school - 2			4
OAE		Elective from other schools or open elective offered by the school - 3			4
HS/MS	HS302	Technical Writing**	2		2
Practical/Viva Voce					
HS/MC	ICT392*	NSS / NCC / Cultural clubs / Technical Society / Technical club*			2
Total					**28**

*NUES : Comprehensive evaluation of the students by the concerned coordinator of NCC / NSS / Cultural Clubs / Technical Society / Technical Clubs, out of 100 as per the evaluation schemes worked out by these activity societies, organizations; the co-ordinators shall be responsible for the evaluation of the same. These activities shall start from the 1st semester and the evaluation shall be conducted at the end of the 6th semester.

****NUES:** Comprehensive evaluation by the concerned teacher, out of 100, as per detailed syllabus.

Seventh Semester					
Group	**Paper Code**	**Paper**	**L**	**T/P**	**Credits**
Theory Papers					
PCE		Core area Elective – 4			4
PCE		Core area Elective – 5			4
EAE		Elective in Emerging Areas -4 (Students to choose one group)			4
EAE		Elective in Emerging Areas - 5(Students to choose one group)			4
OAE		Elective from other schools or open elective offered by the school – 4			4
OAE		Elective from other schools or open elective offered by the school – 5			4
Practical/Viva Voce					
PC	ICT497	Minor Project**			4
PC	ICT499	Summer Training (after 6th semester) Report *			1
Total					**29**

***NUES : Comprehensive evaluation by the a committee of teachers, constituted by the Academic Programme Committee, out of 100.**

** The student shall be allocated a supervisor / guide for project work at the end of 6th semester by the School, the project shall continue into the 8th semester. In the 7th semester evaluation, the criteria for evaluation shall be conceptualization of the project work, the back-ground study / literature survey and identification of objectives and methodology to be followed for project. 40 marks evaluation for the Teachers' Continuous Evaluation / Internal Assessment shall be done by the concerned supervisor while the term end examinations of 60 marks shall be conducted by the supervisor concerned and the external examiner deputed by the Examinations Division. In the absence of the supervisor, the Dean of the school can assign the responsibility of the supervisor (for purpose of examinations) to any faculty of the school.

Eight Semester					
Group	**Paper Code**	**Paper**	**L**	**T/P**	**Credits**
Practical/Viva Voce/Internship[%]					
PC / Project	ICT452	Major Project – Dissertation[**,#]			15
	ICT454	Major Project Viva Voce[@]			4
	ICT456	Project Progress Evaluation*			2
PC / Internship	ICT458	Internship Report[#]			15
	ICT460	Internship Viva Voce[#]			4
	ICT462	Internship Progress Evaluation[*,#]			2
Total					**21**

***NUES : Comprehensive evaluation by the a committee of teachers, constituted by the Academic Programme Committee, out of 100.**

% By default every student shall do the project work (ICT452, ICT454, and ICT456). A student shall either be allowed to do a project work (ICT452, ICT454, and ICT456) or an internship (ICT458, ICT460, and ICT462). The student must apply for approval to do internship before the commencement of the 8th semester to the school, and only after approval of Dean of the school through Training and Placement Officer of the School, shall proceed for internship.
** The student offered project work shall be allocated a supervisor / guide for project work at the end of 6th semester by the School, the project shall continue into the 8th semester.
# Students may be allowed to do internship in this semester in lieu of Major project. The students allowed to proceed for internship shall be required to maintain a log-book of activities performed during internship. The same has to be countersigned by the mentor at the organization where internship is completed.
ICT452: Evaluation shall be conducted of 40 marks (Teachers' continuous evaluation / internal assessment) by the supervisor. And, 60 marks by an external examiner deputed by examinations division (COE), for a total of 100 marks.
ICT454: Evaluation shall be conducted of 40 marks (Teachers' continuous evaluation / internal assessment) by the supervisor. And, 60 marks by a bench of the supervisor and the external examiner deputed by examinations division (COE), for a total of 100 marks.
ICT456/ICT462: Comprehensive evaluation by the committee of teachers, constituted by the Academic Programme Committee, out of 100.
ICT458/ICT460: Evaluation shall be conducted of 40 marks (Teachers' continuous evaluation / internal assessment) by the training and placement officer of the School on the basis of the report submitted by the student. And, 60 marks by a bench of the Training and Placement Officer of the School and the external examiner deputed by examinations division (COE), for a total of 100 marks.

In the absence of the supervisor or the Training and placement officer (as the case may be), the Dean of the school can assign the responsibility of the supervisor or the Training and Placement officer (for purpose of examinations) to any faculty of the school.

Note on Elective Papers: The elective papers shall be allowed to be taken / studied by the students, by the APC of the School, keeping in view that two papers studied by the student should not have a substantial overlap. All papers studied by the student should be substantially distinct in content.

PROGRAMME CORE ELECTIVE PAPERS

Paper	Paper Code	Paper	T	P	Credits
Semester 5: Choose any one paper					
311	ICT311T	Artificial Intelligence	3	-	3
	ICT311P	Artificial Intelligence Lab.	-	2	1
313	ICT313T	Microprocessors and Interfacing	3	-	3
	ICT313P	Microprocessors and Interfacing Lab.	-	2	1
323	ICT323T	VHDL Programming	3	-	3
	ICT323P	VHDL Programming Lab.	-	2	1
327	ICT327T	Telecommunication Switching and Networks	3	-	3
	ICT327P	Telecommunication Switching and Networks Lab.	-	2	1
329	ICT329	Optoelectronic Devices	4	-	4
Semester 6: Choose any Two Paper					
316	ICT316T	Introduction to Robotics Engineering	3	-	3
	ICT316P	Introduction to Robotics Engineering Lab.	-	2	1
318	ICT318T	Network Security and Cryptography	3	-	3
	ICT318P	Network Security and Cryptography Lab.	-	2	1
336	ICT336	Introduction to Information and Communication Theory	4	-	4
344	ICT344	Random Processes and Stochastic Systems	4	-	4
346	ICT346T	Antenna Design and Radiating Systems	3	-	3
	ICT346P	Antenna Design and Radiating Systems Lab.	-	2	1
348	ICT348T	Optical Communication Systems and Networks	3	-	3
	ICT348P	Optical Communication Systems and Networks Lab.	-	2	1
350	ICT350T	Embedded Systems	3	-	3
	ICT350P	Embedded Systems Lab.	-	2	1
352	ICT352T	RF Components and Circuit Design	3	-	3
	ICT352P	RF Components and Circuit Design Lab.	-	2	1
354	ICT354T	Multimedia Communications	4	-	4
356	ICT356T	Mobile Communication	3	-	3
	ICT356P	Mobile Communication Lab.	-	2	1
Semester 7: Choose any Two Papers					
409	ICT409T	Cyber Security and Forensic	4	-	4
415	ICT415T	Introduction to IoT	3	-	3
	ICT415P	Introduction to IoT Lab.	-	2	1
429	ICT429T	Mobile Computing	3	-	3
	ICT429P	Mobile Computing Lab.	-	2	1
441	ICT441	Advanced Computer Architecture	4	-	4
443	ICT443	Smart Antennas	4	-	4
445	ICT445	Fabrication Technology	4	-	4
447	ICT447	Power Electronics	4	-	4
449	ICT449	Electronic Measurements	4	-	4
451	ICT451T	MEMS and Sensors	4	-	4
453	ICT453T	Radar and Satellite Communication	3	-	3
	ICT453P	Radar and Satellite Communication Lab.	-	2	1
457	ICT457T	Engineering Optimization	3	-	3
	ICT457P	Engineering Optimization Lab.	-	2	1
459	ICT459T	Radio and Television Engineering	3	-	3
	ICT459P	Radio and Television Engineering Lab.	-	2	1
461	ICT461T	RF andMicrowave Engineering	3	-	3
	ICT461P	RF andMicrowave Engineering Lab.	-	2	1

Note:

1. Each paper to be studied as elective is of 4 credits. In most of the papers, there are two components, a 3 credit theory component to be evaluated as a (pure) theory paper (25 marks teacher's continuous evaluation and 75 marks term end examination) and a (pure) laboratory / practical paper of 1 credit (40 marks teacher's continuous evaluation and 60 marks term end examination).If the paper is of 4 credits with only one component, then it is equivalent to a theory paper (25 marks teacher's continuous evaluation and 75 marks term end examination).

2. An elective shall be offered to the student based on the availability of resources and faculty at the institution and at least one third of the batch or at least 20 students must be willing to take the elective.

3. Each PCE slot is of 4 credits, if in a particular slot, the paper has no practical component, then it is of 4 credits (a pure theory paper), otherwise for purpose of examination and conduct of classes, the course is split in two papers, namely a theory paper of 3 credits and a practical paper of 1 credit. The student has to study for 4 credits per slot of PCE group. This is reflected by suffixing the paper code by T (for Theory component) and P (for Practical component), if required.

Implementation Rules:

1. The examinations, attendance criteria to appear in examinations, promotion and award of the degree shall be governed by the Ordinance 11 of the University. The term "major discipline" / "primary discipline" in this document refers to the discipline in which student is admitted / studies from 3rd semester onwards. However credits of courses / paper for OAE / EAE groups shall not be considered for the purpose of promotion from one year of study to the subsequent year of study.

2. Minimum duration of the Bachelor of Technology part of the Bachelor / Master of Technology (Dual Degree) programme shall be 4 years (N=4 years) (8 semesters).

3. Maximum duration of the Bachelor of Technology part of the Bachelor / Master of Technology (Dual Degree) programme shall be 6 years (N+2 years). After completion of N+2 years of study, if the student has appeared in the papers of all the semesters upto 8th semester, then a maximum extension of 1 year may be given to the student for completing the requirements of the degree if and only if the number of credits already earned by the student is atleast 165 from the (non-honours components). Otherwise, the admission of the student shall stand cancelled. After the period of allowed study, the admission of the student shall be cancelled.

4. Only after qualifying for the award of the degree of Bachelor of Technology, the student may be allowed to proceed for the Master in Technology part of the Bachelor / Master of Technology (Dual Degree).

5. The scheme and syllabi of the Master of Technology part of the Bachelor / Master of Technology (Dual Degree) shall be notified separately. This document pertains to the Bachelor of Technology part of the Bachelor / Master of Technology (Dual Degree) programme only.

6. The students shall undergo the following group of Courses / Papers as enumerated in the scheme.

Group	Semester (Credits)								Total Credits	Mandatory Credits
	I	II	III	IV	V	VI	VII	VIII		
BS	12	20							**32**	**16**
HS	5	4	2	2	4	4			**21**	**10**
ES	12	5							**17**	**17**
PC			27	27	10		5	21	**90**	**90**
PCE					4	8	8		**20**	**16**
EAE					4	8	8		**20**	**16**
OAE / EAE					4	8	8		**20**	**10**
Total	**29**	**29**	**27**	**29**	**26**	**28**	**29**	**21**	**220**	**175**

TABLE 1: Distribution of Credits. (Project / internship credits are 27 out of the 90 credits for Programme Core (PC) credits, while extra-curricular activities credits are 2 out of 21 credits for humanities / management / social science group (HS)).

7. Mandatory Credits (175) specify the number of credits from each subject group to be mandatorily acquired by the student for the award of the degree. See clause 12 and 13 also.

8. Some of the papers are droppable in the sense that the student may qualify for the award of the degree even when the student has not cleared / passed some of the papers of these group. However, the student has to earn the minimum credits for the programme of study as specified. See clause 12 and 13 also.

9. The open electives of the OAE group of courses may be taken through SWAYAM / NPTEL MOOCs platform. The student desirous of doing a MOOC based course among the OAE group must seek approval of the APC of the school for the same before the commencement of the semester. The APC shall allow the MOOC based OAE option to the student if and only if the MOOC subject / course being considered for the student is being offered in line with the Academic Calendar applicable. The student shall submit the successful completion certificate with marks to the School for onwards transfer to the Examination Division. The Examinations Divisions shall take these marks on record for incorporation in the result of the appropriate semester. These marks / grades of these courses shall be used for calculation of the SGPA/CGPA of the student concerned by the examination division of the University. If a student takes even one OAE paper through MOOCs, then the

student shall not be eligible for two minor specialization. The degree to the student on fulfilment of other requirements for such cases shall be through clause 13.b. or 13.c or 13.d.

These MOOC courses taken by the students, if allowed by the APC of the school shall be of 4 credits or more collectively to be against or for one paper slot in the scheme, through MOOCs, though the marks shall be shown individually. That is in one paper slot in the scheme wherever a MOOC course is allowed, the student may register for more than one paper to aggregate 4 credits or more. If the credits of these MOOC Courses, allowed to a student is more than 4, then the maximum credit for the programme shall be amended accordingly for the particular student. Also, in a particular semester, a student may take more than one MOOC course with the approval of the APC to meet the credit requirements of OAE for the semester. The cost of taking the MOOC course is to be borne by the concerned student. The results of the MOOC courses shall be declared separately by the examination division from the result for the papers conducted by the examination division of the University.

However, if the student opts for emerging area electives in this group also, the same shall be allowed subject to other conditions specified in the rules / scheme.

10. To earn an Honours degree, the student may enrol for 20 credits or more through SWAYAM / NPTEL MOOCs platform. This point has to be read together with other points specially point 13 and 14, The acquisition of the credits should be completed before the 15th of the July of the admission year plus 4 years. That is, if a student is admitted in the year X, then these credits must be acquired through MOOCs by 15th July of the year (X+4), no extra duration or time shall be allocated.

Honours in the degree shall be awarded if and only if at least 20 credits are acquired through MOOCs. To obtain Honours in the programme, the student must apply to the School about the same before the commencement of the 5th semester. The specific courses through MOOCs shall be registered by the student only after approval by the Academic Programme Committee (APC) of the School. The APC shall approve the course if it is not already studied by the student or the student shall not study it in future and adds value to the major area of specialization (which is the degree). The papers for which the student desires to appear for Honours through MOOCs, all papers results shall be submitted by the student to the school for onwards transfer to Examination Division of the University, to be taken on record of the University. The results of these papers shall be a part of the records of the examinations of the students. The records shall be submitted by the student to the school, then transferred to the Examinations division, shall be notified by the examinations division of the University, and a separate marksheet shall be issued by the Examinations divisions. The cost of taking the MOOC course is to be borne by the concerned student. Such courses shall be reflected as additional courses / papers for the student.

If a student acquires less than 20 credits through MOOCs, following the mechanism specified, then also the results of these papers shall be taken on record as specified above, though no Honours degree shall be awarded.

The papers through MOOCs for Honours degree shall not be a part of the set of the papers over which the SGPA / CGPA of the student shall be calculated.

The papers through MOOCs for Honours degree shall be additional papers studied by the students and are to be taken into account only for award of Honours in the degree programme, if 20 credits are earned through MOOCs as approved by APC, by a student. See Clause 14 also.

11. Maximum Credits: at least 220 (Table 1), these are the credits for which the student shall have to study for the non-Honours component of the curriculum. The student has to appear in the examinations for these credits.

12. Minimum Credits: atleast 200 (out of the 220 non Honours papers credits). See clause 7 also.

13. The following degree route can be taken by a student (also refer point 14):

a. The students shall be awarded two minor specializations, one from EAE and one from OAE / EAE route under the following conditions:
   i. The student has earned The student has earned the mandatory credits as defined in Table 1 and clause 7.
   ii. The student earns 20 credits from one group of EAE courses offered as a minor specialization by USICT.
   iii. The student earns 20 credits from one group of OAE courses offered as a minor specialization by USICT or any other school. Papers taken through MOOCs for OAE shall not entitle the student to a minor specialization.
   iv. In addition, the total credits (including the above specified credits) earned by the student is atleast 200 credits.

   The degree nomenclature of the degree shall be as: "***Bachelor of Technology (Primary Discipline) with minor specializations in <concerned EAE discipline> and <concerned OAE discipline>)***"; if criteria / point 10 is not satisfied for Honours. Otherwise, if criteria / point 10 is met, then the degrees shall be an Honours degree and the nomenclature shall be as: "***Bachelor of Technology (Primary Discipline) with***

minor specializations in <concerned EAE discipline> and <concerned OAE / EAE specialization>) (Honours)", if in addition to point 13.a.i, 13.a.ii, 13.a.iii, and 13.a.iv, the student fulfils the criteria for Honours as specified at point 10.

b. The students shall be awarded one minor specialization from EAE route under the following conditions:

   i. The student has earned The student has earned the mandatory credits as defined in Table 1 and clause 7.
   ii. The student earns 20 credits from one group of EAE courses offered as a minor specialization by USICT.
   iii. In addition, the total credits (including the above specified credits) earned by the student is atleast 200 credits.

   The degree nomenclature of the degree shall be as: "***Bachelor of Technology (Primary Discipline) with minor specialization in <concerned EAE specialization>)***"; if criteria / point 10 is not satisfied for Honours. Otherwise, if criteria / point 10 is met, then the degrees shall be an Honours degree and the nomenclature shall be as: "***Bachelor of Technology (Primary Discipline) with minor specialization in <concerned EAE specialization>) (Honours)***", if in addition to point 13.b.i, 13.b.ii, and 13.b.iii, the student fulfils the criteria for Honours as specified at point 10.

c. The students shall be awarded one minor specialization from OAE / EAE route under the following conditions:

   i. The student has earned The student has earned the mandatory credits as defined in Table 1 and clause 7.
   ii. The student earns 20 credits from one group of OAE courses offered as a minor specialization by USICT or any other school. Papers taken through MOOCs for OAE shall not entitle the student to a minor specialization.
   iii. In addition, the total credits (including the above specified credits) earned by the student is atleast 200 credits.

   The degree nomenclature of the degree shall be as: "***Bachelor of Technology (Primary Discipline) with minor specialization in <concerned OAE / EAE specialization>)***"; if criteria / point 10 is not satisfied for Honours. Otherwise, if criteria / point 10 is met, then the degrees shall be an Honours degree and the nomenclature shall be as: "***Bachelor of Technology (Primary Discipline) with minor specialization in <concerned OEA / EAE specialization>) (Honours)***", if in addition to point 13.c.i, 13.c.ii, and 13.c.iii, the student fulfils the criteria for Honours as specified at point 10.

d. The students shall be awarded the degree without any minor specialization under the following conditions:

   i. The student has earned The student has earned the mandatory credits as defined in Table 1 and clause 7.
   ii. In addition, the total credits (including the above specified credits) earned by the student is atleast 200 credits.

   The degree nomenclature of the degree shall be as: "***Bachelor of Technology (Major Discipline)";*** if criteria / point 6 is not satisfied for Honours. Otherwise, if criteria / point 10 is met, then the degrees shall be an Honours degree and the nomenclature shall be as: "***Bachelor of Technology (Major Discipline) (Honours)***", if in addition to point 13.d.i and 13.d.ii, the student fulfils the criteria for Honours as specified at point 10.

e. If the student does not fulfil any of the above criterions (point 13.a, 13.b, 13.c or 13.d), if the student earns atleast 200 credits out of 216 credits as enumerated in Table 1 (disregarding the mandatory credits clause of Table 1 and Clause 7), then the student shall be award the degree as ***Bachelor of Technology (Major Discipline).*** Such students shall not be eligible for the award of an Honours degree. Though if credits are accumulated through MOOCs as per clause 10, the same shall be reflected in the marksheets of the students.

14. The Honours degree shall only be awarded if the CGPA of the student is above or equal to 7.5 in addition to fulfilment of criteria / point 10 and 13 above and the degree is awarded after the immediate completion of the 4th of the batch from the year of admission. No Honours shall be conferred if the degree requirements are not completed in the minimum duration.

15. The scheme of examinations for the B.Tech. Programmes at the affiliated institutions shall be notified separately.

16. Pass marks in every paper shall be 40.

17. Grading System shall be as per Ordinance 11 of the University.

18. The programme core electives (PCE) shall be specific to a major discipline, minor specializations and papers for EAE shall be defined by the school and minor specializations and papers for OAE shall be defined by the concerned school. The school shall offer atleast two emerging area elective groups for students of each major discipline, and atleast two open area elective groups for students of each major discipline of the school. In addition, the school shall offer minor specialization groups as OAE to other school students. The emerging area / open electives can also be offered as standalone papers not forming a part of any elective groups also. The prerequisites for a specific paper, offered by the school, shall be defined in the detailed scheme and syllabus document of the school. The school shall decide the group(s) and/or individual papers to be offered as electives based on the availability of infrastructure and faculty. From the groups / papers offered by the school, an elective paper / group shall be taught if and only if the number of students in a paper is at-least 20 or at-least 1/3 of the students of a major discipline for which the paper / group is to be offered. The APC of the school may define a maximum number of students allowed to register for a paper as an elective (EAE / OAE).

19. The students desirous to continue to the Master of Technology part of the dual degree programme, must first complete the requirements for the award of the Bachelor of Technology degree, before being allowed to proceed for the Master of Technology part.

20. Teachers of other Schools, as and when deputed by their school, for teaching the students enrolled in programmes offered by the University School of Information, Communication and Technology (USICT) shall be a part of the Academic Programme Committee of the school. Such teachers, for all academic matters, including teaching, teachers' continuous evaluation, term end examinations etc. shall be governed by the decisions of the APC of USICT. Similarly, the guest faculty, the visiting faculty and the contract / Ad Hoc faculty as and when deputed to teach students of USICT shall form a part of APC of USICT.

21. The medium of instructions shall be English.

MINOR SPECIALIZATION STREAMS

(EMERGING AREA ELECTIVE GROUPS)

These papers / streams shall be offered as per the prerequisite specified. The papers are to be offered to at the undergraduate level to the students of B.Tech. programmes.

Emerging Area: Minor Specialization in Machine Learning& Data Analytics

Prerequisite: First Year Engineering Mathematics (3 papers), Programming in C at the level of the B.Tech. papers for these topics in the Curriculum of B.Tech. part of the USICT programmes of studies offered at the USICT campus). (Any Engineering Discipline).

Code	Paper	L	P	Credits	Semester
ITE301	Statistics, Statistical Modelling & Data Analytics	3	2	4	5th
ITE302	Machine Learning	3	2	4	6th
ITE304	Supervised and Deep Learning	3	2	4	6th
ITE401	Unsupervised Learning	3	2	4	7th
ITE403	Machine Learning and Data Analytics Case Studies	3	2	4	7th
	OR				
ITE405	Machine Learning and Data Analytics Frameworks	3	2	4	

Note: For papers with practical component, the teacher's continuous evaluation component shall be 25 marks, term end examination theory component shall be 50 marks and term end practical examination component shall be 25 marks for a total of 100 marks. The marksheet shall reflect all three components and the total marks obtained

Emerging Area: Minor Specialization in Soft Computing

Prerequisite: First Year Engineering Mathematics (3 papers), Programming in C at the level of the B.Tech. papers for these topics in the Curriculum of B.Tech. part of the USICT programmes of studies offered at the USICT campus). (Any Engineering Discipline).

Code	Paper	L	P	Credits	Semester
ITE303	Statistics, Statistical Modelling & Data Analytics	3	2	4	5th
ITE306	Artificial Neural Networks and Deep Learning	3	2	4	6th
ITE308	Fuzzy logic and Systems	3	2	4	6th
ITE407	Global Optimization Methods	3	2	4	7th
ITE409	Soft Computing and Expert Systems	3	2	4	7th

Note: For papers with practical component, the teacher's continuous evaluation component shall be 25 marks, term end examination theory component shall be 50 marks and term end practical examination component shall be 25 marks for a total of 100 marks. The marksheet shall reflect all three components and the total marks obtained.

Emerging Area: Minor Specialization in Internet of Things

Prerequisite: Only to be offered to students of B.Tech. / M.Tech. (Dual degree) in CSE / IT / ECE (B.Tech. Part)

Code	Paper	L	P	Credits	Semester
ITE305	Introduction to Internet of Things	3	2	4	5th
ITE310	Wireless and Sensor Networks	3	2	4	6th
ITE312	IoT with Arduino, ESP, and Raspberry Pi	3	2	4	6th
ITE411	Design of smart systems	3	2	4	7th
ITE413	Privacy and Security issues in IoT	4	-	4	7th

Note: For papers with practical component, the teacher's continuous evaluation component shall be 25 marks, term end examination theory component shall be 50 marks and term end practical examination component shall be 25 marks for a total of 100 marks. The marksheet shall reflect all three components and the total marks obtained.

Emerging Area: Minor Specialization in Embedded Systems

Prerequisite: Only to be offered to students of B.Tech. / M.Tech. (Dual degree) in CSE / IT / ECE (B.Tech. Part)

Code	Paper	L	P	C	Semester
	One of the following (Depending on subjects already studied):				5th
ITE307	Microprocessors and Interfacing	3	2	4	
ITE309	Real time operating systems	4	-	4	
ITE314	Embedded System Architecture and Design	3	2	4	6th
	One of the following (Depending on subjects already studied):				6th
ITE316	VHDL Programming	3	2	4	
ITE318	Programming in C for Embedded Systems	3	2	4	
ITE415	Real Time Embedded System Programming	3	2	4	7th
	One of the following:				7th
ITE417	Logic Design and Analysis Using Verilog	3	2	4	
ITE419	Embedded Linux	3	2	4	
ITE421	Sensors and Actuators	3	2	4	

Note: For papers with practical component, the teacher's continuous evaluation component shall be 25 marks, term end examination theory component shall be 50 marks and term end practical examination component shall be 25 marks for a total of 100 marks. The marksheet shall reflect all three components and the total marks obtained.

Emerging Area: Minor Specialization in Software Engineering

Prerequisite: Only to be offered to students of B.Tech. / M.Tech. (Dual degree) in CSE / IT (B.Tech. Part)

Code	Paper	L	P	Credits	Semester
ITE311	Software Measurements, Metrics, and Modelling	3	2	4	5th
	One of the following (Depending on subjects already studied): Software Project Management				6th
ITE320	Service Oriented Architecture	3	2	4	
ITE322		3	2	4	
ITE324	Mining Software Repositories and Predictive Modelling	3	2	4	6th
	One of the following (Depending on subjects already studied): Software Verification, Validation and Testing				7th
ITE423	Software Security	3	2	4	
ITE425		4	-	4	
ITE427	Software Engineering Standards	4	-	4	7th

Emerging Area: Minor Specialization in VLSI Design

Prerequisite: Only to be offered to students of B.Tech. / M.Tech. (Dual degree) in ECE (B.Tech. Part)

Code	Paper	L	P	Credits	Semester
ITE313	Semiconductor devices and Modelling	3	2	4	5th
ITE326	VLSI Technology and Design	3	2	4	6th
ITE328	CMOS Analog Integrated Circuit Design	3	2	4	6th
ITE429	CMOS Digital Circuits Design	3	2	4	7th
	One of the following:				7th
ITE431	CMOS Mixed Signal Circuit Design	4	-	4	
ITE433	Low Power VLSI Design	3	2	4	
ITE435	VLSI Testing	4	-	4	

Emerging Area: Minor Specialization in Wireless andMobileCommunications

Prerequisite: Only to be offered to students of B.Tech. / M.Tech. (Dual degree) in CSE / IT / ECE (B.Tech. Part)

Code	Paper	L	P	Credits	Semester
ITE315	Wireless Communication Systems	3	2	4	5th
ITE330	Cellular and Mobile communication	3	2	4	6th
ITE332	Ad hoc and Sensor Networks	3	2	4	6th
ITE437	Cognitive Radio& Networks	4	-	4	7th
ITE439	Privacy and Security in Wireless Networks	4	-	4	7th

Emerging Area: Minor Specialization in Image Processing & Computer Vision

Prerequisite: Only to be offered to students of B.Tech. / M.Tech. (Dual degree) in CSE / IT / ECE (B.Tech. Part)

Code	Paper	L	P	Credits	Semester
ITE317	Digital Image Processing	3	2	4	5th
ITE334	Pattern Recognition	3	2	4	6th
ITE336	Computer Vision	3	2	4	6th
	One of the following:				7th
ITE441	Remote Sensing Image Analysis and Classification	3	2	4	
ITE443	Medical Image Processing, Analysis and Reconstruction	3	2	4	
ITE445	Biometrics	3	2	4	
	One of the Following:				7th
ITE447	Machine Learning for Image and Vision Analysis	3	2	4	
ITE449	Deep Learning for Image Processing and Computer Vision	3	2	4	

MINOR SPECIALIZATION STREAMS

(OPEN ELECTIVE GROUPS)

OPEN ELECTIVE GROUPS

1. One open elective stream shall be offered from CSE/IT discipline to be called "minor specialization in Computer Science and Engineering". This stream shall be offered to the B.Tech. part of the B.Tech. / M.Tech. (Dual degree) in Electronics and Communication Engineering and other engineering branches of the University campus (other schools) as (This shall not be offered to Students of B.Tech. part of the B.Tech. / M.Tech. (Dual degree) in CSE / IT):

Minor Specialization in Computer Engineering					
Paper Code.	**Minor Specialization in Computer Science and Engineering Paper**	**Offered in Semester**	**T**	**P**	**C**
	One of the following (Depending on subjects already studied):	5th Semester (odd semester)			
ITE319	Digital Logic and Computer Design		4	-	4
ITE321	Object Oriented Programming using C++		3	2	4
ITE338	Data Structures and Algorithms	6th Semester (even semester)	3	2	4
ITE340	Database Management Systems	6th Semester (even semester)	3	2	4
ITE451	Operating Systems	7th Semester (odd semester)	3	2	4
	One of the following (Depending on subjects already studied):	7th Semester (odd semester)			
ITE453	Computer Networks		3	2	4
ITE455	Software Engineering		3	2	4

Note: For papers with practical component, the teacher's continuous evaluation component shall be 25 marks, term end examination theory component shall be 50 marks and term end practical examination component shall be 25 marks for a total of 100 marks. The marksheet shall reflect all three components and the total marks obtained.

2. One open elective stream shall be offered from ECE discipline to be called "minor specialization in Electronics and Communications Engineering". This stream shall be offered to the B.Tech. part of the B.Tech. / M.Tech. (Dual degree) in CSE / IT and other engineering branches of the University campus (other schools) as (This shall not be offered to Students of B.Tech. part of the B.Tech. / M.Tech. (Dual degree) in ECE):

Minor Specialization in Electronics and Communications Engineering					
Paper Code	**Minor Specialization in Electronics and Communications Engineering Paper**	**Offered in Semester**	**T**	**P**	**C**
ITE323	Circuits and Systems	5th Semester (odd semester)	4	-	4
ITE342	Electronic Devices and Circuits	6th Semester (even semester)	3	2	4
	One of the following (Depending on subjects already studied):	6th Semester (even semester)			
ITE344	Digital Logic and Computer Design		4	-	4
ITE346	Microprocessors & Interfacing		3	2	4
	One of the following (Depending on subjects already studied):	7th Semester (odd semester)			
ITE457	Analog and Digital Communications		3	2	4
ITE459	Wireless and Sensor Networks		3	2	4
	One of the following (Depending on subjects already studied):	7th Semester (odd semester)			
ITE461	Computer Networks		3	2	4
ITE463	Control Systems		4	-	4

Note: For papers with practical component, the teacher's continuous evaluation component shall be 25 marks, term end examination theory component shall be 50 marks and term end practical examination component shall be 25 marks for a total of 100 marks. The marksheet shall reflect all three components and the total marks obtained

3. One open area elective stream from Computer Applications shall be offered to all engineering branches of the University and shall be called "minor specialization in Software Development". This stream shall be offered to the B.Tech. part of the B.Tech. / M.Tech. (Dual degree) engineering branches of the University campus:

Minor Specialization in Software Development					
Paper Code	**Minor Specialization in Software Development**	**Offered in Semester**	**T**	**P**	**C**
	One of the following (Depending on subjects already studied):	5th Semester (odd semester)			
ITE325	DBMS		3	2	4
ITE327	Software Engineering		3	2	4
ITE329	System Analysis and Design		4	-	4
	Any one of the following(Depending on subjects already studied):	6th Semester (even semester)			
ITE348	Web Development – I		3	2	4
ITE350	Object Oriented Programming using C++		3	2	4
	Any one of the following(Depending on subjects already studied):	6th Semester (even semester)			
ITE352	Programming in the Windows Environment		3	2	4
ITE354	Project Management		3	2	4
ITE356	Programming in Java		3	2	4
	Any one of the following(Depending on subjects already studied):	7th Semester (odd semester)			
ITE465	Web Development – II		3	2	4
ITE467	Programming in the Linux Environment		3	2	4
	Any one of the following(Depending on subjects already studied):	7th Semester (odd semester)			
ITE469	Android Development		3	2	4
ITE471	Advanced Java Programming		3	2	4

Note: For papers with practical component, the teacher's continuous evaluation component shall be 25 marks, term end examination theory component shall be 50 marks and term end practical examination component shall be 25 marks for a total of 100 marks. The marksheet shall reflect all three components and the total marks obtained

OPEN ELECTIVE PAPERS (LIST OF PAPERS THAT CAN BE OFFERED AS STAND ALONE PAPERS BY THE SCHOOL TO ANY ENGINEERING STUDENT OF THE UNIVERSITY CAMPUS.

1. Any paper that is a programme core paper (PC) (3rd Semester onwards offered by USICT through this document) can be offered as an open elective to other branches of engineering provided the prerequisite of the paper is satisfied by the student and the same paper is not a core / elective paper for the student.The students may be allowed to study such subject with the approval of the APC of USICT, subject to the conditionthat the paper is offered in the particular semester by the school.
2. Any paper that is a programme core elective paper (5rd Semester onwards, offered by USICT through this document) can be offered as an open elective to other branches of engineering provided the prerequisite of the paper is satisfied by the student and the same paper is not a core / elective paper for the student. The students may be allowed to study such subject with the approval of the APC of USICT, subject to the conditionthat the paper is offered in the particular semester by the school.
3. Any paper that is a emerging area elective paper (5rd Semester onwardsoffered by USICT through this document) can be offered as an open elective to other branches of engineering provided the prerequisite of the paper is satisfied by the student and the same paper is not a core / elective paper for the student. The students may be allowed to study such subject with the approval of the APC of USICT, subject to the condition that the paper is offered in the particular semester by the school.
4. Any paper that is a open elective group paper (5thSemester onwards) can be offered as an open elective to other branches of engineering provided the prerequisite of the paper is satisfied by the student and the same paper is not a core / elective paper for the student. The students may be allowed to study such subject with the approval of the APC of USICT, subject to the conditionthat the paper is offered in the particular semester by the school.
5. The Board of School of University School of Information, Communication and Technology may approve inclusion of papers with detailed syllabus for undergraduate programmes of studies in the university campus (other school students) as open electives. The same shall become a part of the scheme and syllabi of examinations for the concerned student once approved by the APC of the school.
6. The above shall apply in consonance with other rules specified in this document.

Assessment of Outcomes Achieved in a Course / Paper. That is, Learning Outcome Assessment Alignment Grid.

Learning Outcome	Course/Project	How Learning Will Be Assessed	Resources	Attainment Level

To complete the alignment grid, start by listing one learning outcome per row beneath the “Learning Outcome” column. Make sure that each learning outcome can be assessed by a single method.

Next, beneath the "Course/ Project" column, list the course(s) or project(s) or assignments or tests that students will complete in order to achieve the learning outcome.

In the "How Learning Will Be Assessed" column, list the assessment(s) tool that will be used for that particular learning outcome. It is fine for there to be more than one assessment used for a particular outcome, so long as each assessment captures the outcome in its entirety. Likewise, it is fine for a single assessment to be used for multiple outcomes.

In the column entitled "Resources", list any additional materials, technologies, or resources needed for students to meet the learning outcome.

In the column entitled "Attainment Level", list in a quantifiable manner the average attainment level.

Every teacher must make this sheet for every paper taught. Be that a paper with only theory component, only practical component or with both theory and practical component.

LIST OF COURSES / PAPERS WITH DETAILED SYLLABUS

(2nd Year)

Paper Code: ICT 201	**Paper: Foundations of Computer Science**	**L**	**T/P**	**C**
Paper ID:		**4**	**0**	**4**

Prerequisite Papers: None

Marking Scheme :

1. Teacher's Continuous Evaluation : 25 marks
2. Term and Theory Examinations : 75 marks

Instructions for paper setter

1. There should be 9 questions in the term end examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type questions of total 15 marks.
3. Apart from question one which is compulsory, rest of the paper shall consists of four units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain up to 5 sub-parts/sub-questions. Each unit shall have a marks weightage of 15.
4. The questions are to be framed keeping in view the learning objectives of course/paper. The standard /level of the questions to be asked should be at the level of the prescribed text books.
5. The requirement of (scientific) calculators/log tables/data-tables may be specified if required**.**

Course Objectives :

1.	To introduce the concept of Mathematical Logic, concepts of sets, relation and functions
2.	To introduce the concept of Algorithm and number theory
3.	To understand Group theory and related examples
4.	To use Graph theory for solving problems

Course Outcomes (CO)

CO1:	Ability for constructing mathematical logic to solve problems
CO2:	Ability to Analyze/ quantify the efficiency of a developed solution (algorithm) of a computational problem
CO3:	Ability to Understand mathematical preliminaries to be used in the subsequent courses of the curriculum. This includes Boolean algebra, number theory, group theory, and combinatorics.
CO4:	Ability to Understand diverse relevant topics in discrete mathematics and computation theory with an emphasis on their applicability as mathematical tools in computer science.

Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High)

	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO 1	3	3	3	2	2	-	-	-	2	2	3	3
CO 2	3	3	3	2	2	-	-	-	2	2	3	3
CO 3	3	3	3	3	2	-	-	-	2	2	3	3
CO 4	3	3	3	3	2	-	-	-	2	2	3	3

UNIT – I

Sets, Logic, and Relation: Sets, Subsets, powerset, operations on sets, Propositional Logic, Rules of inferences in propositional logic, Quantifiers, Predicates and validity, Predicate Logic, normal forms. Proof Techniques- Direct Proof, Proof by Contraposition, and proof by contradiction. Principle of inclusion and exclusion, pigeonhole principle, permutation and combination. Principle of Well Ordering, principle of mathematical induction, principle of complete induction. Relation, properties of binary relation, equivalence relation and class, closures (symmetric, reflexive, and transitive).

UNIT - II

Functions, Order relations and Boolean Algebra: Functions, Growth of functions, Permutation functions, Partially ordered sets, lattices, Boolean algebra, Minimization of Boolean Expressions. GCD, LCM, prime numbers.

Recurrence relations, solution methods for linear, first-order recurrence relations with constant coefficients, generating functions, Analysis of Algorithms involving recurrence relations, solution method for a divide-and-conquer recurrence relation. Masters theorem (with proof).

UNIT - III

Group theory: Semi-group, Monoid, Groups, Group identity and uniqueness, inverse and its uniqueness, isomorphism and homomorphism, subgroups, Cosets and Lagrange's theorem, Permutation group and Cayley's theorem (without proof), Normal subgroup and quotient groups. Groups and Coding.

UNIT - IV

Graph theory: Graph Terminology, Planar graphs, Euler's formula (proof), Euler and Hamiltonian path/circuit. Chromatic number of a graph, five color theorem (proof), Shortest path and minimal spanning trees and algorithms, Depth-first and breadth first search, trees associated with DFS & BFS, Connected components. Complexity Analysis of the graph MST.

Textbook(s):

1. B. Kolman, R. C. Busby & S.C. Ross "Discrete Mathematical Structures", 6th edition, PHI/Pearson, 2009.
2. R. L. Graham, D. E. Knuth & O. Patashnik, "Concrete Mathematics", Pearson Education, 2000.

References:

1. Neal Koblitz, "A course in number theory and cryptography", Springer – Verlag, 1994.
2. J.P. Tremblay & R. Manohar, "Discrete Mathematical Structure with Application to Computer Science," TMH, New Delhi (2000).
3. Norman L. Biggs, "Discrete Mathematics", Second edition, Oxford University Press, New Delhi (2002).
4. T .H . Cormen, C . E . Leiserson, R .L . Rivest "Introduction to Algorithms", 3rd edition, PHI/Pearson.
5. Anne Benoit, Yves Robert, Frédéric Vivien "A Guide to Algorithm Design: Paradigms, Methods, and Complexity Analysis", CRC Press, 2013.

Paper Code: ICT203	**Paper: Operating Systems**	**L**	**T/P**	**C**
Paper ID:		**3**		**3**

PrerequisitePaper: None

Marking Scheme :

1. Teacher's Continuous Evaluation : 25 marks
2. Term and Theory Examinations : 75 marks

Instructions for paper setter :

1. There should be 9 questions in the term end examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type questions of total 15 marks.
3. Apart from question one which is compulsory, rest of the paper shall consists of four units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain up to 5 sub-parts/sub-questions. Each unit shall have a marks weightage of 15.
4. The questions are to be framed keeping in view the learning objectives of course/paper. The standard /level of the questions to be asked should be at the level of the prescribed text book.

Course Objectives :

1.	To introduce fundamentals of services provided by and the design of an operating system
2.	To introduce Processor scheduling and synchronization techniques
3.	To introduce Primary and Secondary memory management techniques
4.	To introduce the structure and organization of the file system

Course Outcomes (CO) :

CO 1	Ability to understand OS types, and process management techniques.
CO 2	Ability to understand CPU scheduling and process synchronization techniques.
CO 3	Ability to understand memory management techniques like paging, segmentation and demand paging etc.
CO 4	Ability to understand techniques for file system management and system security and protection

Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High)

	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO 1	3	2	2	2	2	-	-	-	2	2	2	3
CO 2	3	3	2	2	2	-	-	-	2	2	2	3
CO 3	3	3	2	3	2	-	-	-	2	2	2	3
CO 4	3	3	2	3	2	-	-	-	2	2	2	3

UNIT – I

Computer System Organization, Architecture, Operations, Resource Management, Kernel Data Structures, OS Services, OS Types, OS Booting.

Process Management: Concept Scheduling, Operations, IPC, Client – Server Architecture. Multicore Programming, Multithreading models, Thread Libraries, Implicit threading, Threading Issues

UNIT – II

CPU Scheduling: Concepts, Criteria, Algorithms, thread scheduling, multi-processor scheduling.

Process Synchronization: Critical Section, Petersen's solution, Mutex locks, semaphores, monitors, POSIX synchronization, Deadlocks and characterization; deadlock detection, prevention, avoidance,; recovery from deadlocks.

UNIT – III

Memory Management: Main Memory: contiguous allocation, paging, page table, swapping. Virtual Memory: Demand paging, copy on write, page replacement, frame allocation, thrashing, memory compression, kernel memory allocation.

Storage Management: HDD scheduling, NVM scheduling, error detection and correction, storage device management, swap space management, RAID. I/O hardware, application I/O interface, kernel I/O subsystem, STREAMS.

UNIT - IV

File System: Concept, access methods, directory structure, protection, memory mapped files. File system: structure, operations, directory implementation, space allocation and management, recovery; file system

mounting, partitions, file sharing, virtual file systems, remote file systems.
Security and protection: program, system and network threats, cryptography as security tool, user authentication, system protection techniques: goals, principles, domain, access matrix, role based access control. (As a case study Linux and Windows OS to be used)

Note: The practical list shall be notified by the teacher in the first week of the class commencement.

Textbook(s):

1. A. Silberschatz, P. B. Galvin and G. Gagne, Operating system concepts, Wiley, 10 ed., 2018.

References:

1. W. Stallings, Operating systems – Internals and design principles,Pearson, 9th ed. 2018.
2. A. S. Tanenbaum and H. Bos, Modern Operating Systems, Pearson, 4th ed., 2015.
3. M. Milenkovic, Operating System : Concepts and Design, Tata Mcgraw-Hill, 2000.
4. N. Chauhan, Principles of Operating Systems, Oxford University Press, 2014.
5 F, Mchoes, Understanding Operating System, Thomson Press, Third Edition, 2003.

Paper Code: ICT 205	**Paper: Digital Logic and Computer Design**	**L**	**T/P**	**C**
Paper ID:		**4**	**0**	**4**

Prerequisite Paper: None

Marking Scheme :

1. Teacher's Continuous Evaluation : 25 marks
2. Term and Theory Examinations : 75 marks

Instructions for paper setter

1. There should be 9 questions in the term end examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type questions of total 15 marks.
3. Apart from question one which is compulsory, rest of the paper shall consists of four units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain up to 5 sub-parts/sub-questions. Each unit shall have a marks weightage of 15.
4. The questions are to be framed keeping in view the learning objectives of course/paper. The standard /level of the questions to be asked should be at the level of the prescribed text book.

Course Objectives :

1.	To introduce basic concepts of Boolean Algebra and Combinational Logic
2.	To introduce various sequential circuits, designing with examples
3.	To relate combination circuit design and sequential circuit design with respect to the design of a computer system
4.	To introduce machine learning, computer arithmetic, modes of data transfer with respect to I/O and Memory organization of a computer

Course Outcomes (CO) :

CO 1	Ability to understand Boolean Algebra and Design Combinational Circuits .
CO 2	Ability to understand and Design Sequential Circuits.
CO 3	Ability to understand Design of a basic computer.
CO 4	Ability to understand Input-Output and Memory Organization of a Computer.

Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High)

	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO 1	3	2	3	2	2	-	-	-	3	2	2	3
CO 2	3	2	3	2	2	-	-	-	3	2	2	3
CO 3	3	2	3	3	2	-	-	-	3	2	2	3
CO 4	3	3	3	3	3	-	-	-	3	2	2	3

UNIT – I

Boolean Algebra and Combinational Logic: Review of number systems , signed, unsigned, fixed point, floating point numbers, Binary Codes, Boolean algebra – basic postulates, theorems , Simplification of Boolean function using Karnaugh map and Quine-McCluskey method – Implementations of combinational logic functions using gates, Adders, Subtractors, Magnitude comparator, encoder and decoders, multiplexers, code converters , parity generator/checker, implementation of combinational circuits using multiplexers.

UNIT – II

Sequential Circuits: General model of sequential circuits, Flip-flops, latches , level triggering, edge triggering, master slave configuration , concept of state diagram , state table, state reduction procedures , Design of synchronous sequential circuits , up/down and modulus counters , shift registers, Ring counter , Johnson counter , timing diagram , serial adder , sequence detector, Programmable Logic Array (PLA), Programmable Array Logic (PAL), Memory Unit, Random Access Memory

UNIT – III

Basic Computer organization: Stored Program, Organization, Computer registers, bus system, instruction set completeness, instruction cycle, Register Transfer Language, Arithmetic, Logic and Shift Micro-operations, Instruction Codes, Design of a simple computer, Design of Arithmetic Logic unit, shifter, Design of a simple hardwired control unit, Programming the basic computer, Machine language instructions,

assembly language, Microprogrammed control, Horizontal and Vertical Microprogramming, Central Processing Unit, instruction sets and formats, addressing modes, data paths, RISC and CISC characteristics.

UNIT - IV

Computer Arithmetic, addition, subtraction, multiplication and division algorithms, Input-Output Organization, Modes of data transfer, Interrupt cycle, direct memory access, Input-Output processor, Memory Organization, Memory Hierarchy, Associative Memory, Cache Memory, Internal and external Memory, Virtual Memory.

Text Book(s)

1. M. Morris Mano, "Digital Logic and Computer Design", Pearson Education, 2016
2. M. Morris Mano, Rajib Mall "Computer System Architecture", 3rd Edition Pearson Education, 2017

References:

1. Leach, D. P., Albert P. Malvino, "Digital Principles and Applications", McGraw Hill Education, 8th Edition , 2014
2. Jain, R.P. ,"Modern Digital Electronics", McGraw Hill Education, 4th Edition , 2010
3. Floyd, Thomas L. , "Digital Fundamentals" Pearson Education, 11th Edition, 2017
4. M. Rafiquzzaman, "Fundamentals of Digital Logic and Microcomputer Design", Wiley, 5th Ed., 2005.

Paper Code: ICT 207	**Paper : Database Management System**	**L**	**T/P**	**C**
Paper ID:		**4**	**0**	**4**

Prerequisite Papers: None

Marking Scheme :

1. Teacher's Continuous Evaluation : 25 marks
2. Term and Theory Examinations : 75 marks

Instructions for paper setter

1. There should be 9 questions in the term end examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type questions of total 15 marks.
3. Apart from question one which is compulsory, rest of the paper shall consists of four units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain up to 5 sub-parts/sub-questions. Each unit shall have a marks weightage of 15.
4. The questions are to be framed keeping in view the learning objectives of course/paper. The standard /level of the questions to be asked should be at the level of the prescribed text book.

Course Objectives :

1.	To introduce basic concepts, architecture and characteristics of database systems
2.	To introduce relational model concepts and PL/SQL programming
3.	To introduce relational database design and Normal forms based on functional dependencies
4.	To introduce concepts of object oriented & distributed databases

Course Outcomes (CO) :

CO 1	Ability to understand advantages of database systems
CO 2	Ability to use SQL as DDL, DCL and DML
CO 3	Ability to design database and manage transaction processing
CO 4	Understand object oriented & distributed databases systems and use them

Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High)

	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO 1	3	3	2	2	2	-	-	-	3	2	2	3
CO 2	3	3	2	2	2	-	-	-	3	2	2	3
CO 3	3	3	2	3	3	-	-	-	3	2	2	3
CO 4	3	3	2	3	3	-	-	-	3	2	2	3

UNIT – I

Basic concepts: database & database users, characteristics of the database systems, concepts and architecture, date models, schemas & instances, DBMS architecture & data independence, database languages & interfaces, data modelling using the entity-relationship approach. Enhanced ER concepts - Specialization/Generalization, Aggregation, Mapping of ER model to Relational Model. Relational data base design: functional dependencies & normalization for relational databases, normal forms based on functional dependencies, (1NF, 2NF, 3NF & BCNF), lossless join and dependency preserving decomposition, normal forms based on multivalued & join dependencies (4NF & 5NF) & domain key normal form

UNIT - II:

Relational model concepts, relational model constraints, relational algebra, relational calculus, SQL – DDL, DCL & DML views and indexes in SQL. Basics of SQL, DDL, DML,DCL, structure – creation, alteration, defining constraints – Primary key, foreign key, unique, not null, check, IN operator, Functions - aggregate functions, Built-in functions – numeric, date, string functions, set operations, sub-queries, correlated sub-queries, Use of group by, having, order by, join and its types, Exist, Any, All , view and its types. Transaction control commands – Commit, Rollback, Save point, stored procedures,Triggers (with emphasis on mySQL and postgreSQL).

UNIT - III

Properties of Transaction, Transaction states, Transaction Schedule, Serializability, Concurrency control techniques, locking techniques, time stamp ordering, Recoverable schedules, granularity of data items, Deadlock detection and Recovery, recovery techniques: recovery concepts, database backup and recovery from catastrophic failures.

UNIT - IV

File Structures and Indexing: Secondary Storage Devices, Operations on Files, Heap Files, Sorted Files, Hashing, Single level indexes, Multi-level indexes, B and B+ tree indexes.

Concepts of Object Oriented Database Management systems & Distributed Database Management Systems

Textbooks:

1. R. Elmsari and S. B. Navathe, "Fundamentals of database systems", Pearson Education, 7th Edition, 2018
2. V. M. Grippa and S. Kumichev, "Learning MySQL", O'Reilly, 2021.
3. Luca Ferrari and Enrico Pirozzi, Learn PostgreSQL: Build and manage high-performance database solutions using PostgreSQL 12 and 13"", Packt Publishing, 2020.

References:

1. A. Silberschatz, H. F. Korth and S. Sudershan, "Database System Concept", McGraw Hill, 6th Edition,2013.
2. Date, C. J., "An introduction to database systems", 8th Edition, Pearson Education, 2008.
3. P. Rob & C. Coronel, "Database Systems: Design Implementation & Management", Thomson Learning, 6th Edition, 2004
4. Desai, B., "An introduction to database concepts", Galgotia publications, 2010
5. H. Garcia-Molina, J. D. Ullman, J. Widom, "Database System: The Complete Book", PH.
6. Joel Murach, Murach's Mysql"", 3rd Edition-Mike Murach and Associates, Incorporated, 2019.
7. MySQL and PostgreSQL manuals.

Paper Code: ICT 209	**Paper: Object Oriented Programming Using C++**	**L**	**T/P**	**C**
Paper ID:		**4**	**0**	**4**

Prerequisite Papers: None

Marking Scheme :

1. Teacher's Continuous Evaluation : 25 marks
2. Term and Theory Examinations : 75 marks

Instructions for paper setter :

1. There should be 9 questions in the term end examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type questions of total 15 marks.
3. Apart from question one which is compulsory, rest of the paper shall consists of four units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain up to 5 sub-parts/sub-questions. Each unit shall have a marks weightage of 15.
4. The questions are to be framed keeping in view the learning objectives of course/paper. The standard /level of the questions to be asked should be at the level of the prescribed text book.

Course Objectives :

1.	To introduce the basic Concepts of Object Oriented Programming (data types, operators and functions) using C++
2.	To introduce concepts of Classes and Objects with the examples of C++ programming
3.	To understand object oriented features such as Inheritance and Polymorphism
4.	To use various object oriented concepts (exceptional handling) to solve different problems

Course Outcomes (CO)

CO 1	Ability to have an in-depth knowledge of object oriented programming paradigm
CO 2	To be able to develop basic C++ programming skills
CO 3	To be able to apply various object oriented features using C++
CO 4	Ability to have an understanding of generic programming & standard templates

Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High)

	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO 1	3	2	2	2	3	-	-	-	3	2	2	3
CO 2	3	2	2	2	3	-	-	-	3	2	2	3
CO 3	3	2	2	2	3	-	-	-	3	2	2	3
CO 4	3	2	2	2	3	-	-	-	3	2	2	3

UNIT – I

Object Oriented Programming Paradigm, Basic Concepts of Object Oriented Programming, Benefits of Object Oriented Programming, Object Oriented Languages, Applications of Object Oriented Programming, C++ Programming Language, Tokens, Keywords, Identifiers and Constants, Data Types, Type Compatibility, Variables, Operators in C++, Implicit Type Conversions, Operator Precedence, The Main Function, Function Prototyping, Call by Reference, Return by Reference, Inline Functions, Function Overloading, Friend Functions, default parameter value.

UNIT - II

Specifying a class, Member Functions, Encapsulation, information hiding, abstract data types, objects & classes, Static Member Functions, Arrays of Objects, Constructors & Destructors, Parameterized Constructors, Copy Constructors, Dynamic Constructors, Destructors, identity and behaviour of an object, C++ garbage collection, dynamic memory allocation, Explicit Type Conversions, Operator Overloading.

UNIT - III

Inheritance, inheritance methods, Class hierarchy, derivation – public, private & protected, aggregation, Inheritance Constructors, composition vs. classification hierarchies, Containership, Initialization List, Polymorphism, categorization of polymorphic techniques, polymorphism by parameter, parametric polymorphism, generic function – template function, function overriding, run time polymorphism, virtual functions.

UNIT - IV

Standard C++ classes, using multiple inheritance, persistant objects, streams and files, namespaces,

exception handling, generic classes, standard template library: Library organization and containers, standard containers, algorithm and Function objects, iterators and allocators, strings, streams, manipulators, user defined manipulators, vectors.

Textbook(s):

1. Stanley B. Lippman, Josée Lajoie, Barbara E. Moo, "C++ Primer", Addison-Wesley Professional, 2012.
2. Ivor Horton, "Using the C++ Standard Template Libraries", Apress, 2015.
3. R. Lafore, "Object Oriented Programming using C++", Galgotia.

References:

1. A.R.Venugopal, Rajkumar, T. Ravishanker "Mastering C++", TMH
2. Bjarne Stroustrup, "Programming: principles and practice using C++", Addison-Wesley, 2015.
3. Bjarne Stroustrup, "A Tour of C++", Addison-Wesley Professional, 2018.
4. Bjarne Stroustrup, "The C++ Programming Language", 4th Edition, Addison-Wesley Professional, 2013.
5. Peter Van Weert and Marc Gregoire, "C++17 Standard Library Quick Reference: A Pocket Guide to Data Structures, Algorithms, and Functions", Apress (2019)
6. Rumbaugh et. al. " Object Oriented Modelling & Design", Prentice Hall
7. G . Booch "Object Oriented Design & Applications", Benjamin,Cummings.
8. E.Balaguruswamy, "Objected Oriented Programming with C++", TMH
9. Steven C. Lawlor, "The Art of Programming Computer Science with C++", Vikas Publication.
10. Slobodan Dmitrović, Modern C++ for Absolute Beginners":A Friendly Introduction to C++ Programming Language and C++11 to C++20 Standards", Apress, 2020.

Paper Code: ICT 211	**Paper: Data Structures**	**L**	**T/P**	**C**
Paper ID:		**4**	**0**	**4**

Prerequisite Paper: ICT101

Marking Scheme :

1. Teacher's Continuous Evaluation : 25 marks
2. Term and Theory Examinations : 75 marks

Instructions for paper setter

1. There should be 9 questions in the term end examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type questions of total 15 marks.
3. Apart from question one which is compulsory, rest of the paper shall consists of four units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain up to 5 sub-parts/sub-questions. Each unit shall have a marks weightage of 15.
4. The questions are to be framed keeping in view the learning objectives of course/paper. The standard /level of the questions to be asked should be at the level of the prescribed text book.

Course Objectives :

1.	To introduce basics of Data structures (Arrays, strings, linked list etc.)
2.	To understand the concepts of Stacks, Queues and Trees, related operations and their implementation
3.	To understand sets, heaps and graphs
4.	To introduce various Sorting and searching Algorithms

Course Outcomes (CO)

CO 1	To be able to understand difference between structured data and data structure
CO 2	To be able to create common basic data structures and trees
CO 3	To have a knowledge of sets, heaps and graphs
CO 4	To have basic knowledge of sorting and searching algorithms

Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High)

	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO 1	3	2	2	2	3	-	-	-	2	2	2	3
CO 2	3	2	2	2	3	-	-	-	2	2	2	3
CO 3	3	2	2	2	3	-	-	-	2	2	2	3
CO 4	3	2	2	2	3	-	-	-	2	2	2	3

UNIT – I

Overview of data structure, Basics of Algorithm Analysis including Running Time Calculations, Abstract Data Types, Arrays, Arrays and Pointers, Multidimensional Array, String processing, General Lists and List ADT, List manipulations, Single, double and circular lists. Stacks and Stack ADT, Stack Manipulation, Prefix, infix and postfix expressions, recursion. Queues and Queue ADT, Queue manipulation.

UNIT - II

Sparse Matrix Representation (Array and Link List representation) and arithmetic (addition, subtraction and multiplication), polynomials and polynomial arithmetic.

Trees, Properties of Trees, Binary trees, Binary Tree traversal, Tree manipulation algorithms, Expression trees and their usage, binary search trees, AVL Trees, Heaps and their implementation, Priority Queues, B-Trees, B* Tree, B+ Tree

UNIT - III

Sorting concept, order, stability, Selection sorts (straight, heap), insertion sort (Straight Insertion, Shell sort), Exchange Sort (Bubble, quicksort), Merge sort (External Sorting) (Natural merge, balanced merge and polyphase merge). Searching – List search, sequential search, binary search, hashing methods, collision resolution in hashing.

UNIT - IV

Disjoint sets representation, union find algorithm, Graphs, Graph representation, Graph Traversals and their implementations (BFS and DFS). Minimum Spanning Tree algorithms, Shortest Path Algorithms

Textbook(s):

1. Richard Gilberg , Behrouz A. Forouzan, "Data Structures: A Pseudocode Approach with C, 2nd Edition, Cengage Learning, Oct 2004
2. E. Horowitz, S. Sahni, S. Anderson-Freed, "Fundamentals of Data Structures in C", 2nd Edition, Silicon Press (US), 2007.

References:

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson, September, 1996
2. Robert Kruse, "Data Structures and Program Design in C", 2nd Edition, Pearson, November, 1990
3. Seymour Lipschutz, "Data Structures with C (Schaum's Outline Series)", McGrawhill, 2017
4. A. M. Tenenbaum, "Data structures using C". Pearson Education, India, 1st Edition 2003.
5. Weiss M.A., "Data structures and algorithm analysis in C++", Pearson Education, 2014.

Paper Code: ECO 213	**Paper: Engineering Economics**	**L**	**T/P**	**C**
Paper ID:		**2**	**0**	**2**

Prerequisite Paper: None

Marking Scheme :

1. Teacher's Continuous Evaluation : 25 marks
2. Term and Theory Examinations : 75 marks to be conducted by the concerned teacher as the paper is in the NUES mode.

Instructions for paper setter

1. There should be 9 questions in the term end examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type questions of total 15 marks.
3. Apart from question one which is compulsory, rest of the paper shall consists of four units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain up to 5 sub-parts/sub-questions. Each unit shall have a marks weightage of 15.
4. The questions are to be framed keeping in view the learning objectives of course/paper. The standard / level of the questions to be asked should be at the level of the prescribed text book.

Course Objectives :

1.	Introduce economic theory and value analysis.
2.	Understand cash flow.
3.	Learn about sampling and replacement maintenance.
4.	Learn about depreciation and inflation.

Course Outcomes (CO)

CO 1	Ability to do understand economic analysis.
CO 2	Ability to understand and use cash flow method.
CO 3	Ability to determine economic life of an asset and replacement method.
CO 4	Ability to do depreciation analysis and inflation adjustment.

Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High)

	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO 1	-	1	-	-	1	2	3	-	-	-	3	1
CO 2	-	1	-	-	1	2	3	-	-	-	3	1
CO 3	-	1	-	-	1	2	3	-	-	-	3	1
CO 4	-	1	-	-	1	2	3	-	-	-	3	1

UNIT I

Introduction, Flow in an economy, Law of Supply and Demand, Concept of Engineering Economics, Elements of Cost, Break-Even Analysis, P/V ratio, examples of simple economic analysis, Interest Formulas and Their Applications.

UNIT II

Present Worth Method of Comparison: Introduction, Revenue Dominated Cash Flow Diagram, Cost-Dominated Cash Flow Diagram

Future Worth Method: Introduction, Revenue Dominated Cash Flow Diagram, Cost-Dominated Cash Flow Diagram

Annual Equivalent Method: Introduction, Revenue Dominated Cash Flow Diagram, Cost-Dominated Cash Flow Diagram, Alternate approach.

Rate of Return Method.

UNIT III

Replacement and Maintenance Analysis: Introduction, Types, Determination of economic life of an asset, replacement method.

Depreciation: Introduction and methods of depreciation (Straight line, Declining Balance, Sum of the Years Digit method, Sinking fund method, Service output method). Evaluation of public alternative.

UNIT IV

Inflation Adjustment: Introduction, Procedure to adjust Inflation, Inflation Adjusted Economic Life of Machines. Inventory Control and Methods, Make or buy decision, Project Management: Introduction, Phases, CPM, Gantt/Time Chart, PERT. Value Analysis / Value Engineering

Textbook:

1. R. Paneerselvam, "Engineering Economics", PHI Learning, New Delhi, 2012.

References:

1. David L. Whitman, Ronald E. Terry, Fundamentals of Engineering Economics and Decision Analysis, Morgan & Claypool Publishers (2012).
2. John A. White, Kellie Grasman, Fundamentals of Engineering Economic Analysis, Wiley (2013).
3. Leland Blank, Antony Tarquin, Engineering Economy, McGraw Hill, 2002.
4. K. L. Sharma, An Introduction to Engineering Economics, Momentum Press, 2015.
5. Chan S. Park, Fundamentals of Engineering Economics, Global Edition-Pearson, (2019).
6. Zahid A. Khan, Arshad N. Siddiquee, Brajesh Kumar, Mustufa H. Abidi, Principles of Engineering Economics with Applications, Cambridge University Press (2018).

Paper Code: ICT215	**Paper: Signal and Systems**	**L**	**T/P**	**C**
Paper ID:		**3**	**-**	**3**

Prerequisite Paper: None

Marking Scheme:

1. Teacher's Continuous Evaluation: 25 Marks
2. Term End Theory Examination: 75 Marks

Instruction for paper setter:

1. There should be 9 questions in the term end examinations question paper.
2. The first(1^{st}) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 15 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto five sub-parts/sub-questions. Each unit will have a marks weightage of 15.
4. The questions are to be framed keeping in view the learning outcomes of the course/paper. The standard/level of questions to asked should be at the level of the prescribed textbook.
5. The requirements of (scientific) calculators/ log-tables/ data- tables may be specified if required.

Course Objectives:

1.	To impart understanding about various types of signals and systems, their classifications, analysis and operations.
2.	To impart knowledge of use of transforms in analysis of signals and system.
3.	To impart skill to carry out simulation on signals and systems for observing effects of applying various properties and operations.
4.	To impart strong foundation of communication and signal processing to be studied in the subsequent semester

Course Outcome (CO):

CO 1	Ability to understand about various types of signals and systems, classify them, analyze them, and perform various operations on them.
CO 2	Ability to understand use of transforms in analysis of signals and system.
CO 3	Ability to carry out simulation on signals and systems for observing effects of applying various properties and operations.
CO 4	Ability to create strong foundation of communication and signal processing to be studied in the subsequently.

Course Outcomes (CO) to Programme Outcomes (PO) Mapping (Scale - 1: Low, 2: medium, 3: High)

CO/PO	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO 1	3	3	3	3	2	-	-	-	1	1	1	1
CO 2	3	3	3	3	2	-	-	-	1	1	1	1
CO 3	3	3	3	3	2	-	-	-	1	1	1	1
CO 4	3	3	3	3	2	-	-	-	1	1	1	1

Unit I

Continuous and discrete time signals: Classification of Signals – Periodic aperiodic even – odd – energy and power signals – Deterministic and random signals – complex exponential and sinusoidal signals – periodicity – properties of discrete time complex exponential unit impulse – unit step impulse functions – Transformation in independent variable of signals: time scaling, time shifting. Determination of Fourier series representation of continuous time and discrete time periodic signals – Explanation of properties of continuous time and discrete time Fourier series. Representation of continuous time signals by its sample - Sampling theorem – Reconstruction of a Signal from its samples, aliasing – discrete time processing of continuous time signals, sampling of band pass signals.

Unit II

Continuous time Fourier Transform and Laplace Transform analysis with examples – properties of the Continuous-time Fourier Transform and Laplace Transform basic properties, Parseval's relation, and convolution in time and frequency domains.

Basic properties of continuous time systems: Linearity, Causality, time invariance, stability, magnitude and Phase representations of frequency response of LTI systems -Analysis and characterization of LTI systems using Differential Equations and Continuous time LTI systems. Laplace transform: Computation of impulse response and transfer function using Laplace transform.

Unit III

Discrete time system analysis using Difference equations, Discrete Time Fourier Transform, Discrete Fourier Transform, FFT and their property and usage in the analysis of Discrete time systems.

Unit IV

Basic principles of z-transform - z-transform definition – region of convergence – properties of ROC – Properties of z-transform – Poles and Zeros – inverse z-transform using Contour integration - Residue Theorem, Power Series expansion and Partial fraction expansion, Relationship between z-transform and Fourier transform. Properties of convolution and the interconnection of LTI Systems – Causality and stability of LTI Systems. Computation of Impulse & response & Transfer function using Z Transform.

Note: The practical list shall be notified by the teacher in the first week of the class commencement.

Textbook(s):

1. Alan V. Oppenheim, Alan S. Willsky with S. Hamid Nawab, “Signals & Systems”, 2nd ed., Pearson Education, 1997.
2. Simon Haykin and Barry Van Veen, “Signals and Systems”, John Wiley, 1999

References:

1. M. J. Roberts, “Signals and Systems Analysis using Transform method and MATLAB”, TMH 2003.
2. K. Lindner, “Signals and Systems”, McGraw Hill International, 1999.
3. Moman .H. Hays,” Digital Signal Processing “, Schaum’s outlines, Tata McGraw-Hill Co Ltd., 2004.
4. B. P. Lathi, “Signal Processing and Linear System”, Berkeley Cambridge Press, 1998.
5. H. P. Hsu, “Schaum’s Outlines of The Theory and Problems of Signals and Systems”, McGraw-Hill, 1995.
6. John G.Proakis and Dimitris G.Manolakis, “Digital Signal Processing, Principles, Algorithms and Applications, 3rd edn., PHI, 2000.

Paper Code: ICT 204 / ICT 217	**Paper: Computational Methods**	**L**	**T/P**	**C**
Paper ID:		**4**	**0**	**4**

Prerequisite Paper: ICT

Marking Scheme :

1. Teacher's Continuous Evaluation : 25 marks
2. Term and Theory Examinations : 75 marks

Instructions for paper setter

1. There should be 9 questions in the term end examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type questions of total 15 marks.
3. Apart from question one which is compulsory, rest of the paper shall consists of four units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain up to 5 sub-parts/sub-questions. Each unit shall have a marks weightage of 15.
4. The questions are to be framed keeping in view the learning objectives of course/paper. The standard /level of the questions to be asked should be at the level of the prescribed text box.
5. The requirement of (scientific) calculators/log tables/data-tables may be specified if required**.**

Course Objectives :

1.	To understand numerical methods to find roots of functions and first order unconstrained minimization of functions.
2.	To introduce concept of interpolation methods and numerical integration.
3.	To understand numerical methods to solve systems of algebraic equations and curve fitting by splines.
4.	To understand numerical methods for the solution of Ordinary and partial differential equations.

Course Outcomes (CO)

CO 1	Ability to develop mathematical models of low level engineering problems
CO 2	Ability to apply interpolation methods and numerical integration.
CO 3	Ability to solve simultaneous linear equations and curve fitting by splines
CO 4	Ability to numerically solve ordinary differential equations that are initial value or boundary value problems

Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High)

	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO 1	3	2	2	2	2	-	-	-	2	2	2	3
CO 2	3	2	2	2	2	-	-	-	2	2	2	3
CO 3	3	3	3	3	2	-	-	-	2	2	2	3
CO 4	3	3	3	3	2	-	-	-	2	2	2	3

UNIT-I

Review of Taylor Series, Rolle 's Theorem and Mean Value Theorem, Approximations and Errors in numerical computations, Data representation and computer arithmetic , Loss of significance in computation Location of roots of equation: Bisection method (convergence analysis and implementation), Newton Method (convergence analysis and implementation), Secant Method (convergence analysis and implementation). Unconstrained one variable function minimization by Fibonacci search, Golden Section Search and Newton's method. Multivariate function minimization by the method of steepest descent, Nelder- Mead Algorithm.

UNIT-II

Interpolation: Assumptions for interpolation, errors in polynomial interpolation, Finite differences, Gregory-Newton's Forward Interpolation, Gregory-Newton's backward Interpolation , Lagrange's Interpolation, Newton's divided difference interpolation

Numerical Integration: Definite Integral, Newton-Cote's Quadrature formula, Trapezoidal Rule, Simpson's one-third rule, simpson's three-eight rule, Errors in quadrature formulae, Romberg's Algorithm, Gaussian Quadrature formula.

UNIT-III

System of Linear Algebraic Equations: Existence of solution, Gauss elimination method and its computational effort, concept of Pivoting, Gauss Jordan method and its computational effort, Triangular

Matrix factorization methods: Dolittle algorithm, Crout's Algorithm, Cholesky method, Eigen value problem: Power method
Approximation by Spline Function: First-Degree and second degree Splines, Natural Cubic Splines, B Splines, Interpolation and Approximation

UNIT - IV
Numerical solution of ordinary Differential Equations: Picard's method, Taylor series method, Euler's and Runge-Kutta's methods, Predictor-corrector methods: Euler's method, Adams-Bashforth method, Milne's method.
Numerical Solution of Partial Differential equations: Parabolic, Hyperbolic, and elliptic equations
Implementation to be done in C/C++

Textbook(s):
1. E. Ward Cheney & David R. Kincaid , "Numerical Mathematics and Computing" Cengage; 7th ed (2013).

References:
1. R. L. Burden and J. D. Faires, "Numerical Analysis", CENGAGE Learning Custom Publishing; 10th Edition (2015).
2. S. D. Conte and C. de Boor, "Elementary Numerical Analysis: An Algorithmic Approach", McGraw Hill, 3rd ed. (2005).
3. H. M. Antia, "Numerical Methods for Scientists & Engineers", Hindustan Book Agency, (2002).
4. 2. E Balagurusamy "Numerical Methods" McGraw Hill Education (2017).

Paper Code: ICT219	**Paper: Digital Electronics**	**L**	**T/P**	**C**
Paper ID:		**4**	**0**	**4**

Prerequisite Paper: None

Marking Scheme:

1. Teacher's Continuous Evaluation: 25 Marks
2. Term End Theory Examination: 75 Marks

Instruction for paper setter:

1.There should be 9 questions in the term end examinations question paper.
2.The first question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type questions of total 15 marks.
3.Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto five sub-parts/sub-questions. Each unit will have a marks weightage of 15.
4.The questions are to be framed keeping in view the learning outcomes of the course/paper. The standard/level of questions to asked should be at the level of the prescribed textbook.
5.The requirements of (scientific) calculators/ log-tables/ data- tables may be specified if required.

Course Objectives:

1.	To impart understanding of principles of Boolean Algebra and minimization of logic functions.
2.	To impart skill of design and implementation of Combinational and Sequential logic circuits.
3.	To impart knowledge about Analog to Digital conversion and Digital to Analog conversion.
4.	To impart understanding of Digital logic families, PLDs, PLA, PAL and FPGA.

Course Outcome (CO):

CO 1	To understand principles of Boolean Algebra and minimization of logic functions.
CO 2	To design and implement Combinational and Sequential logic circuits.
CO 3	To understand Analog to Digital conversion and Digital to Analog conversion.
CO 4	To understand Digital logic families, PLDs, PLA, PAL and FPGA.

Course Outcomes (CO) to Programme Outcomes (PO) Mapping (Scale - 1: Low, 2: medium, 3: High)

CO/PO	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO 1	3	3	3	3	2	1	1	-	2	1	-	2
CO 2	3	3	3	3	2	1	1	-	2	1	-	2
CO 3	3	3	3	3	2	1	1	-	2	1	-	2
CO 4	3	3	3	3	2	1	1	-	2	1	-	2

Unit I

Fundamentals of Digital Systems: Analog and Digital signals, digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations, Examples of IC gates, Boolean Algebra.
Standard representation for logic functions, K-map representation, and simplification of logic functions using K-map, Don't care conditions, XOR and XNOR simplification of K-maps, minimization of logic functions using Quine-McCluskey's algorithm.

Unit II

Combinational Digital Circuits: Multiplexer, De-Multiplexer, Decoders, Encoder, Binary Adders and Subtractors, Binary multiplier, Digital comparator, parity checker/generator, code converters, priority encoders, decoders/drivers for display devices.
Sequential circuits and systems: S-R, J- K, T and D flip flops, race around condition, Level and Edge triggering mechanism, Master-slave flip flop, Excitation and characteristics tables of flip-flops, realization of flip-flops using other flip-flops, shift registers, applications of shift registers, Ripple (Asynchronous) counters, Synchronous counters, design of counters, special counter IC's: Ring counter and Johnson counter.

Unit III

Mealy and Moore machine, state diagram, state table, Design of sequence detector.
A/D and D/A Converters:D/A converters: weighted resistor/converter, R-2R Ladder D/A converter, specifications for D/A converters, examples of D/A converter ICs, Sample and hold circuit, Analog to Digital converters: quantization and encoding, A/D converter: Parallel A/D converter, successive approximation A/D converter, counting A/D converter, dual slope A/D converter, specifications of A/D converters, example of A/D converter ICs.

Unit IV

Logic families: Characteristics of Digital ICs, Digital logic families: TTL, ECL and CMOS logic.

Semiconductor memories and Programmable logic devices: Memory organization and operation, expanding memory size, classification and characteristics of memories, sequential memory, read only memory (ROM), read and write memory (RAM), content addressable memory (CAM). ROM as a PLD, Programmable logic array (PLA), Programmable array logic (PAL), Field Programmable Gate Array (FPGA).

Textbook(s):

1. Donald P. Leach, A. P. Malvino, and Gautam Saha, “Digital principles and applications”, TMH, 2011.
2. R. J. Tocci, “Digital Systems”, PHI, 2000.

References:

1. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.
2. I. J. Nagrath, “Electronics, Analog & Digital”, PHI, 1999.
3. J. M. Yarbrough, “Digital Logic-Application and Design”, PWS Publishing.
4. B. S. Nai, “ Digital Electronics and Logic Design”, PHI.
5. Balabanian and Carlson, “Digital Logic Design Principles”, Wiley Pub.
6. Morris Mano, "Digital logic and Computer design", Pearson Education India, 2016.

Paper Code: ICT221	**Paper: Analog Electronics-I**	**L**	**T/P**	**C**
Paper ID:		**4**	**0**	**4**

Prerequisite Paper: None

Marking Scheme:

1. Teacher's Continuous Evaluation: 25 Marks
2. Term End Theory Examination: 75 Marks

Instruction for paper setter:

1.There should be 9 questions in the term end examinations question paper.
2.The first question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type questions of total 15 marks.
3.Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto five sub-parts/sub-questions. Each unit will have a marks weightage of 15.
4.The questions are to be framed keeping in view the learning outcomes of the course/paper. The standard/level of questions to asked should be at the level of the prescribed textbook.
5.The requirements of (scientific) calculators/ log-tables/ data- tables may be specified if required.

Course Objectives:

1.	To develop understanding of operation, characteristics, parameters and applications of p-n junction diode
2.	To develop understanding about BJT and FET in terms of structure, operation, configurations and characteristics. Also analyse stability and amplifier circuit using small signal models
3.	To impart knowledge of cascade amplifiers, coupling schemes, power amplifiers and their analysis
4.	To impart knowledge of Feedback amplifiers and oscillators

Course Outcome (CO):

CO 1	Ability to understand of operation, characteristics, parameters and applications of p-n junction diode
CO 2	Ability to understand about BJT and FET in terms of structure, operation, configurations and characteristics and able to analyse stability and amplifier circuit using small signal models
CO 3	Ability to understand and analyse cascade amplifiers, coupling schemes in amplifiers and power amplifiers
CO 4	Ability to understand feedback amplifiers and oscillators

Course Outcomes (CO) to Programme Outcomes (PO) Mapping (Scale - 1: Low, 2: medium, 3: High)

CO/PO	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO1	3	3	3	3	2	1	1	-	2	1	-	2
CO2	3	3	3	3	2	1	1	-	2	1	-	2
CO3	3	3	3	3	2	1	1	-	2	1	-	2
CO4	3	3	3	3	2	1	1	-	2	1	-	2

UNIT - I

Open circuit P-N junction diode, Forward and reverse biased diode, I-V characteristics of diode, Diode Equation, Temperature dependence of diode. Breakdown phenomena, diffusion and transition capacitance of diode. Diode equivalent circuit, Ideal diode. Solar cell.
Diode circuits: half-wave and full-wave rectifiers with capacitor filter, clamping and clipping circuits. Zener diodes as voltage regulator.

UNIT - II

Bipolar Junction transistor (BJT): Structure, modes of operation, Configurations, I-V characteristics, early effect, junction voltages; Transistor Biasing: Need of biasing, load line concept, fixed bias, self-bias, collector to base bias, stability factors, Current Mirrors; hybrid model of BJT amplifier, small signal analysis of CE BJT amplifier using h parameter
JFET: Physical structure, I-V characteristics; MOSFET: Depletion and enhancement types, Physical structure and I-V characteristics; FET small-signal model (low & high frequency); MOSFET as resistance and switch,

UNIT – III

Cascade amplifiers: Analysis of cascade amplifier (voltage gain, current gain, input and output impedances); Darlington pair, Cascode amplifier; Types of coupling: DC, RC and Transformer; RC coupled Amplifier and its frequency response; Differential Amplifier: differential and Common mode operation, CMRR.

Power Amplifiers: Classification of output stages (Class A, B, C & AB), Class A Amplifier, Transformer coupled class A amplifier, Push pull amplifiers: Class A and Class B, Harmonic distortion, efficiency, crossover distortion, class AB operation, Class C amplifier.

UNIT - IV

Feedback Amplifiers: classification, Feedback concept, basic feedback topologies, Characteristics of Negative Feedback, Feedback and stability, gain margin, Noise margin,

Sinusoidal Oscillator, Barkhausen criterion, RC phase shift, LC (Colpitt's, Hartley, Clapp), Crystal Oscillator.

Textbook(s):

1. J. Millman, C.C. Halkias and Satyabrata Jit, "Electronic Devices and Circuits", Tata McGraw Hill, 4th ed. , 1998
2. R. L. Boylestad and N. Nashlesky, "Electronic Devices and Circuit Theory", Pearson Education, 11th Ed., 2014

References:

1. Adel S. Sedra and Kenneth C. Smith, "Micro Electronic Circuits Theory and Applications," 5th Edition , OUP, 2004.
2. B. Kumar and S. B. Jain, "Electronic Devices and Circuits"", Prentice Hall of India, 2007
3. S Salivahanan, and N. Suresh Kumar, "Electronic Devices and Circuits", McGraw Hill Education (India), 2018
4. B.P. Singh and Rekha Singh, "Electronic Devices and Integrated Circuits", Pearson Education, 2009.
5. J. J. Cathey, "Schaum's Outline of Theory and Problems in Electronic Devices and Circuits", McGraw Hill, 2002.

Paper Code: ICT223	**Paper: Analog Communication**	**L**	**T/P**	**C**
Paper ID:		**3**		**3**

Prerequisite Paper: None

Marking Scheme:

1. Teacher's Continuous Evaluation: 25 Marks
2. Term End Theory Examination: 75 Marks

Instruction for paper setter:

1.There should be 9 questions in the term end examinations question paper.
2.The first question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type questions of total 15 marks.
3.Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto five sub-parts/sub-questions. Each unit will have a marks weightage of 15.
4.The questions are to be framed keeping in view the learning outcomes of the course/paper. The standard/level of questions to asked should be at the level of the prescribed textbook.
5.The requirements of (scientific) calculators/ log-tables/ data- tables may be specified if required.

Course Objectives:

1.	To impart understanding of the concepts of analog communication systems.
2.	To impart understanding of various modulation and demodulation techniques of analog communication.
3.	To impart understanding of transmitters and receivers in analog communication.
4.	To impart understanding of the causes of noise and noise performance of analog communication.

Course Outcome (CO):

CO 1	To understand the concepts of analog communication systems.
CO 2	To understand various modulation and demodulation techniques of analog communication.
CO 3	To understand transmitters and receivers in analog communication.
CO 4	To understand the causes of noise and noise performance of analog communication.

Course Outcomes (CO) to Programme Outcomes (PO) Mapping (Scale - 1: Low, 2: medium, 3: High)

CO/PO	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO1	3	3	3	3	2	1	1	-	2	1	-	2
CO2	3	3	3	3	2	1	1	-	2	1	-	2
CO3	3	3	3	3	2	1	1	-	2	1	-	2
CO4	3	3	3	3	2	1	1	-	2	1	-	2

UNIT I

The Communication Process, Review of Fourier Transforms and Dirac Delta Functions, Transmission through Linear Systems, Filters (low pass and band pass signals), Phase and Group Delay, Sources of Information.
Amplitude Modulation: Introduction, Double Sideband – Suppressed Carrier Modulation, Quadrature – Carrier Multiplexing, Single-Sideband and Vestigial-Sideband methods of modulation, Frequency Translation, Frequency-Division Multiplexing

UNIT II

Angle Modulation: Introduction, Basic Definitions, Frequency Modulation, Phase-Locked Loop, Nonlinear Effects in FM Systems, Superheterodyne receiver.

UNIT III

Probability and Random Processes: Introduction; Probability; Random Variables, Statistical Averages; Random Processes; Mean, Correlation, and Covariance functions; Transmission of a Random Process Through a Linear Filter, Power Spectral Density, Gaussian Process, Noise, Narrowband Noise

UNIT IV

Noise: Introduction, Receiver Model, Noise in DSB-SC Receivers, Noise in AM Receivers, Noise in FM Receivers, Pre-emphasis and De-emphasis in FM.

Note: The practical list shall be notified by the teacher in the first week of the class commencement.

Textbook(s):

1. Simon Haykins and Michael Moher, "Communication Systems" John Wiley &sons Inc, 5th edition, 2009.

References:

1. B P Lathi and Zhi Ding, "Modern Digital and Analog Communication Systems", OUP, 5th edition, 2019.
2. H. Taub, D. L. Schilling and Gaotam Saha, "Taub's Principles of Communication Systems", McGraw Hill Eduction, 4th edition, 2017.
3. J. G. Proakis, M. Salehi, "Fundamentals of Communications Systems", Pearson, 2nd Edition, 2014.
4. W. Tomasi, "Electronic communications systems (Fundamentals Through Advanced)", Pearson Education, 5th Edition, 2008.
5. G. Kennedy and B. Davis, "Electronic communication systems", TMH, 4th Edition, 2008 (reprint)

Paper Code: ICT225	**Paper: Engineering Electromagnetics**	**L**	**T/P**	**C**
Paper ID:164225		**4**	**0**	**4**

Prerequisite Paper: None

Marking Scheme:
1. Teacher's Continuous Evaluation: 25 Marks
2. Term End Theory Examination: 75 Marks

Instruction for paper setter:

1. There should be 9 questions in the term end examinations question paper.
2. The first question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type questions of total 15 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus.
Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain up to five sub-parts/sub-questions. Each unit will have a marks weightage of 15.
4. The questions are to be framed keeping in view the learning outcomes of the course/paper. The standard/level of questions to asked should be at the level of the prescribed textbook.
5. The requirements of (scientific) calculators/ log-tables/ data- tables may be specified if required.

Course Objectives:

1.	To impart the knowledge of the basic laws of electromagnetism
2.	To impart the knowledge of solution to real life plane wave problems for various boundary conditions and analyze the field equations for the wave propagation in special cases
3.	To impart the knowledge of the characteristics and Carryout impedance transformation on high frequency transmission lines
4.	To impart the knowledge of the wave propagation on metallic waveguides

Course Outcome (CO):

1.	To understand the basic laws of electromagnetism
2.	To Provide solution to real life plane wave problems for various boundary conditions and analyze the field equations for the wave propagation in special cases
3.	Understand the characteristics and Carryout impedance transformation on high frequency transmission lines
4.	Analyze wave propagation on metallic waveguides in modal form

Course Outcomes (CO) to Programme Outcomes (PO) Mapping (Scale - 1: Low, 2: medium, 3: High)

CO/PO	**PO01**	**PO02**	**PO03**	**PO04**	**PO05**	**PO06**	**PO07**	**PO08**	**PO09**	**PO10**	**PO11**	**PO12**
CO01	**3**	**3**	**3**	**3**	**2**	**1**	**1**	**-**	**2**	**1**	**-**	**2**
CO02	**3**	**3**	**3**	**3**	**2**	**1**	**1**	**-**	**2**	**1**	**-**	**2**
CO03	**3**	**3**	**3**	**3**	**2**	**1**	**1**	**-**	**2**	**1**	**-**	**2**
CO04	**3**	**3**	**3**	**3**	**2**	**1**	**1**	**-**	**2**	**1**	**-**	**2**

UNIT – I

Vector algebra and vector calculus with significance of del operators- theorems and applications, Maxwell's equations(for static, time varying fields) in integral and differential forms, Continuity equation, boundary conditions for electric and magnetic fields, Programmatic solutions to Maxwell's equations using MATLAB, Poisson's and Laplace's equations

UNIT – II

Electromagnetic waves: wave generation and equations in free space, lossy and lossless dielectrics, conductors-skin depth – Plane wave reflection and refraction – Standing Wave –Applications. Wave propagation in lossless and conducting medium, phase and group velocity, Reflection by a perfect conductor, insulator, Brewster Angle, surface impedance. Guided waves and flow of power: Poynting vector and Poynting theorem, applications, power loss in a conductor.

UNIT – III

Transmission Lines: General solution of transmission lines - Equations of voltage and current, Standing waves and impedance transformation, Lossless and low-loss transmission lines, meaning of reflection coefficient – wavelength and velocity of propagation, distortion less transmission line, Impedance matching - quarter wave line, single stub matching, double stub matching, Power transfer, Microstrip transmission line, Smith chart.

UNIT – IV

Waveguides: Rectangular waveguide, characteristic of TE and TM waves- cutoff wavelength and phase velocity impossibility of TEM waves in waveguides- dominant mode, Surface currents, Attenuation, impedances. Circular wave guides- solution of field equations in cylindrical coordinates- TE and TM waves in circular guides – wave impedance and characteristic impedance, Microwave cavities: rectangular cavity resonators, circular cavity resonators- Q-factor.

Introduction to antenna: monopole, dipole antenna and microstrip antenna.

Textbook(s):

1. M. N.O. Sadiku, "Elements of Electromagnetics", Oxford Universit y Press.
2. W.H. Hayt, "Engineering Electromagnetics", Tata McGraw Hill.

References:

1. E.C. Jordan & K.G. Balmain, Electromagnetic waves & Radiating Systems, Prentice Hall, India.
2. G. S. Rao, "Electromagnetic Field Theory and Transmission lines" Wiley India.
3. David M. Pozar, "Microwave Engineering" John Wiley -2nd edition

Paper Code: ICT 202	**Paper: Computer Graphics**	**L**	**T/P**	**C**
Paper ID:		**3**	**-**	**3**

Prerequisite Paper: ICT209

Marking Scheme :

1. Teacher's Continuous Evaluation : 25 marks
2. Term and Theory Examinations : 75 marks

Instructions for paper setter

1. There should be 9 questions in the term end examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type questions of total 15 marks.
3. Apart from question one which is compulsory, rest of the paper shall consists of four units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain up to 5 sub-parts/sub-questions. Each unit shall have a marks weightage of 15.
4. The questions are to be framed keeping in view the learning objectives of course/paper. The standard /level of the questions to be asked should be at the level of the prescribed text book.

Course Objectives :

1.	To introduce fundamentals of computer graphics, types of graphics and Raster graphics algorithms
2.	To introduce geometric manipulation in 2D and 3D space, perspective projections, surface and solid modelling.
3.	To understand Color models and various illumination models
4.	To understand Rendering techniques and Advanced modelling techniques

Course Outcomes (CO)

CO 1	Ability to understand the usage of the computer graphics primitives and perform the operations on it like clipping etc.
CO 2	Ability to perform any editing of operations on geometry of the objects through 2D and 3D transformations as per the requirements and should be able to model curves and surfaces using different techniques.
CO 3	Ability to make the model appearance realistic in terms of desired color, material and final appearance calculations.
CO 4	Ability to understand the concepts of different rendering techniques and advanced modelling techniques.

Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High)

	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO 1	3	2	2	2	2	-	-	-	2	2	1	3
CO 2	3	2	2	2	2	-	-	-	2	2	1	3
CO 3	3	2	2	3	2	-	-	-	2	2	1	3
CO 4	3	2	2	3	2	-	-	-	2	2	1	3

UNIT - I

Introduction to graphics and types of graphics, quality parameters of graphics display. Basic raster graphics algorithms for drawing 2 D primitives: DDA line, Bresenham's line, Bresenham's circle, midpoint circle, midpoint ellipse. Conic Sections, Clipping of line (Cohen Sutherland algorithm), clipping of polygon (Sutherland Hodgeman algorithm), polygon filling. Attributes of Output primitives, Antialiasing

UNIT - II

Geometric manipulation in 2D and 3D space, window to viewport transformations, homogeneous coordinates, projections: parallel and perspective projections.
Generating curves like Hermite, Bezier and B-spline. Surface generation, wireframe, surface and solid modelling. 3-D polygon surfaces, polygon tables, polygon meshes.

UNIT - III

Visible surface determination techniques for visible surface determination: Z-buffer, A- buffer algorithm, scanline algorithm, area subdivision algorithm for implementation of hidden surface removal. Achromatic and hardware color models and software color models. Local and global illumination models calculations, Lambert, Gouraud & Phong shading techniques.

UNIT - IV

Rendering: introduction to ray casting, ray-tracing, recursive ray tracing, and shadows. Advanced

procedural modelling: fractals, concept of fractals generation, concept of grammar-based modelling.

Textbook(s):

1. D. D. Hearn, M.P. Baker, "Computer Graphics C version", Pearson Education India, 2nd Edition, 2002.
2. J.D. Foley et. al., "Computer Graphics Principles & Practice in C", Pearson Education India, 2nd Edition, 2006.

References:

1. R.H. Bartels, J.C. Beatty and B.A. Barsky, "An Introduction to Splines for use in Computer Graphics and Geometric Modeling", Morgan Kaufmann Publishers Inc., 1996.
2. W. M. Newman and R. F. Sproul, "Principles of Interactive Computer Graphics", McGraw-Hill Education, 2nd Edition, 2001.
3. Z. Xiang and R. Plastock, "Theory and Problems of Computer Graphics", Schaum's Series, McGraw Hill, 2nd Edition, 2017.
4. F.P. Preparata and M.I. Shamos, "Computational Geometry: An Introduction", Springer, Reprint of the original 1st ed. 1985 Edition, 2012.
5. D. Rogers and J. Adams, "Mathematical Elements for Computer Graphics", McGraw Hill Education, 2nd Edition , 2017.
6. David F. Rogers, "Procedural Elements for Computer Graphics", McGraw Hill Education, 2nd Edition , 2017.
7. Alan Watt and Mark Watt, "Advanced Animation and Rendering Techniques", Addison-Wesley, 2002.

Paper Code: ICT 206	**Paper: Design and Analysis of Algorithms**	**L**	**T/P**	**C**
Paper ID:		**4**	**0**	**4**

Prerequisite Paper: ICT211

Marking Scheme :

1. Teacher's Continuous Evaluation : 25 marks
2. Term and Theory Examinations : 75 marks

Instructions for paper setter

1. There should be 9 questions in the term end examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type questions of total 15 marks.
3. Apart from question one which is compulsory, rest of the paper shall consists of four units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain up to 5 sub-parts/sub-questions. Each unit shall have a marks weightage of 15.
4. The questions are to be framed keeping in view the learning objectives of course/paper. The standard /level of the questions to be asked should be at the level of the prescribed text book.
5. The requirement of (scientific) calculators/log tables/data-tables may be specified if required**.**

Course Objectives :

1.	To introduce the basic concept of Algorithm analysis, Growth of function and Disjoint sets
2.	To introduce the concept of dynamic programming and greedy programming techniques
3.	To understand graphs, graph traversal and applications of graphs.
4.	To understand String matching and NP complete problems

Course Outcomes (CO)

CO 1	To be able to understand time complexity and disjoint sets
CO 2	To be able to differentiate between dynamic programming and greedy programming methodologies
CO 3	To have a knowledge of graphs and applications of graphs.
CO 4	To have basic knowledge of string matching and NP complete problems using few examples of NP complete problems

Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High)

	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO 1	3	3	3	2	3	-	-	-	3	2	3	3
CO 2	3	3	3	2	3	-	-	-	3	2	3	3
CO 3	3	3	3	3	3	-	-	-	3	3	3	3
CO 4	3	3	3	3	3	-	-	-	3	3	3	3

UNIT - I

Growth of Functions, Summations, Algorithm Design Paradigms, Divide and Conquer Strategy Strassen's algorithm for matrix multiplication, analysis of Merge sort, Quick Sort and Heap Sort, sorting in Linear Time: Counting sort, Radix Sort, Bucket Sort, Medians and Order Statistics, Disjoint Set operations, Rooted Tree Representations, Linked List representation of disjoint sets, disjoint set forests.

UNIT - II

Matrix Chain Multiplication, LCS, Optimal Binary Search Tree, General Greedy Approach Vs Dynamic Programming approach, Case studies: Knapsack problem, Huffman Coding Problem, Matroids

String Matching: The Naïve String Matching Algorithm, The Rabin Karp Algorithm, String Matching with Finite Automata, The Knuth Morris Pratt Algorithm.

UNIT - III

Representation of Graphs, Breadth First Search, Depth First Search, Topological Sort, Strongly Connected Components, Algorithms of Kruskal's and Prim's, Dijkstra's and Bellman ford algorithm, All pair shortest path, Flyod Warshall Algorithm

UNIT - IV

NP-Complete Problems: Polynomial Time Verification, NP-Completeness, Satisfiability and Reducibility, NP Completeness proof, NP-Complete Problems: The vertex-cover problem, the traveling-salesman problem,

the set-covering problem, the vertex-cover problem, Hamilton Circuit Problem

Textbook(s):

1. T .H . Cormen, C . E . Leiserson, R .L . Rivest, Clifford Stein "Introduction to Algorithms", PHI Learning Pvt. Ltd. (Originally MIT Press); Third edition (2 February 2010)
2. A .V. Aho, J . E . Hopcroft, J . D . Ullman "The Design & Analysis of Computer Algorithms", Addison Wesley, 1998.

References:

1. E. Horwitz and S. Sahani "Fundamentals of Computer Algorithms", Galgotia, 1998.
2. Udi Manber "Introduction to Algorithms – A Creative Approach", Addison Wesley, 1998.
3.Anany Levitin, "Introduction to the Design and Analysis of Algorithms", Pearson; 3 edition,2011
4. David Harel, Yishai Feldman, "Algorithmics: The Spirit of Computing", 3rd Edition, 1987, Addison Wesley Publishers Limited and Pearson Education Limited

Paper Code: ICT 208	**Paper: Theory of Computation**	**L**	**T/P**	**C**
Paper ID:		**4**	**0**	**4**

Prerequisite Paper: ICT201

Marking Scheme :

1. Teacher's Continuous Evaluation : 25 marks
2. Term and Theory Examinations : 75 marks

Instructions for paper setter

1. There should be 9 questions in the term end examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type questions of total 15 marks.
3. Apart from question one which is compulsory, rest of the paper shall consists of four units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain up to 5 sub-parts/sub-questions. Each unit shall have a marks weightage of 15.
4. The questions are to be framed keeping in view the learning objectives of course/paper. The standard /level of the questions to be asked should be at the level of the prescribed text box.
5. The requirement of (scientific) calculators/log tables/data-tables may be specified if required**.**

Course Objectives :

1.	To understand Automata (Deterministic and Non-Deterministic) and Language Theory
2.	To understand Context Free Grammar (CFG), Parse Trees and Push Down Automata
3.	To introduce the concepts of Turing Machines and Computability Theory
4.	To understand Complexity Theory (NP-completess NP-hardness) and Space complexity

Course Outcomes (CO)

CO 1	Ability to understand the design aspects of "abstract models" of computers like finite automata, pushdown automata, and Turing machines.
CO 2	Ability to comprehend the recognizability (decidability) of grammar (language) with specific characteristics through these abstract models.
CO 3	Ability to decide what makes some problems computationally hard and others easy?
CO 4	A ability to deliberate the problems that can be solved by computers and the ones that cannot?

Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High)

	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO 1	3	2	2	2	2	-	-	-	2	1	1	3
CO 2	3	2	2	2	2	-	-	-	2	1	1	3
CO 3	3	2	2	2	2	-	-	-	2	1	1	3
CO 4	3	2	2	2	2	-	-	-	2	1	1	3

UNIT – I

Automata and Language Theory: Chomsky Classification, Finite Automata, Deterministic Finite Automata (DFA), Non-Deterministic Finite Automata (NFA), Regular Expressions, Equivalence of DFAs, NFAs and Regular Expressions, Closure properties of Regular grammar, Non-Regular Languages, Pumping Lemma.

UNIT - II

Context Free Languages: Context Free Grammar (CFG), Parse Trees, Push Down Automata (deterministic and non-deterministic) (PDA), Equivalence of CFGs and PDAs, Closure properties of CFLs, Pumping Lemma, Parsing, LL(K) grammar.

UNIT - III

Turing Machines and Computability Theory: Definition, design and extensions of Turing Machine, Equivalence of various Turing Machine Formalisms, Church – Turing Thesis, Decidability, Halting Problem, Reducibility and its use in proving undecidability. Rices theorem. Undecidability of Posts correspondence problem., Recursion Theorem.

UNIT - IV

Complexity Theory: The class P as consensus class of tractable sets. Classes NP, co-NP. Polynomial time reductions. NP-completess, NP-hardness. Cook- Levin theorem (With proof). Space complexity, PSPACE and NPSPACE complexity classes, Savitch theorem (With proof). Probabilistic computation, BPP class. Interactive proof systems and IP class. relativized computation and oracles.

Textbook(s):

1. Sipser, Michael. Introduction to the Theory of Computation, Cengage Learning, 2012.
2. J. Hopcroft, R. Motwani, and J. Ullman, Introduction to Automata Theory, Language and Computation, Pearson, 2nd Ed, 2006.

References:

1. Peter Linz, An Introduction to Formal Languages and Automata, 6th edition, Viva Books, 2017
1. Maxim Mozgovoy, Algorithms, Languages, Automata, and Compilers, Jones and Bartlett, 2010.
2. D. Cohen, Introduction to Computer Theory, Wiley, N. York, 2nd Ed, 1996.
3. J. C. Martin, Introduction to Languages and the Theory of Computation, TMH, 2nd Ed. 2003.
4. K. L. Mishra and N. Chandrasekharan, Theory of Computer Science: Automata, Languages and Computation, PHI, 2006.
5. Anne Benoit, Yves Robert, Frédéric Vivien , A Guide to Algorithm Design: Paradigms, Methods, and Complexity Analysis, CRC Press, 2013.

Paper Code: ICT 210	**Paper: Software Engineering**	**L**	**T/P**	**C**
Paper ID:		**3**		**3**

Prerequisite Paper: ICT 101 or ICT209

Marking Scheme :

1. Teacher's Continuous Evaluation : 25 marks
2. Term and Theory Examinations : 75 marks

Instructions for paper setter

1. There should be 9 questions in the term end examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type questions of total 15 marks.
3. Apart from question one which is compulsory, rest of the paper shall consists of four units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain up to 5 sub-parts/sub-questions. Each unit shall have a marks weightage of 15.
4. The questions are to be framed keeping in view the learning objectives of course/paper. The standard /level of the questions to be asked should be at the level of the prescribed text box.

Course Objectives :

1.	To introduce the concepts of Software engineering, software processes and its models
2.	To understand Software requirements analysis, SRS document, software metrics and system modelling
3.	To understand fundamentals of Software Design, Software Quality and software maintenance
4.	To understand Software Testing and System Security

Course Outcomes (CO)

CO 1	Ability to demonstrate fundamentals of software engineering and techniques.
CO 2	Ability to develop, maintain and evaluate software systems.
CO 3	Ability to produce and execute test cases for software systems using different testing techniques.
CO 4	Ability to discover how to evaluate the software quality, evolutionary process and security.

Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High)

	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO 1	3	3	3	2	3	-	-	-	2	3	2	3
CO 2	3	3	3	2	3	-	-	-	2	3	2	3
CO 3	3	3	3	2	3	-	-	-	2	3	2	3
CO 4	3	3	3	2	3	-	-	-	2	3	2	3

UNIT - I

Introduction: software processes and its models (waterfall, incremental development, spiral model, re-use oriented model, prototype), Process activities, Process improvement (CMM Levels).

Agile Development model, plan driven vs agile model of development, agile methods and development techniques (user stories, refactoring, test first development, pair programming, agile project management (SCRUM agile method).

UNIT - II

Requirement Engineering: Functional and non-functional requirements, requirement elicitation, use case development, requirement analysis and validation, requirement review or requirement change, SRS document.

Size Estimation: Software Size, LOC and function point, cost and effort estimation, COCOMO, ISO 9001:2015 Certification.

System modelling: Interaction models: Use case diagram, sequence diagrams, Structural models: class diagrams, generalization, aggregation, Behavioural models: ER diagrams, Data flow diagrams, data dictionaries.

UNIT - III

Software Design: Architectural views and patterns, Modularity (cohesion and coupling), information hiding, functional independence, function oriented design, object oriented design, SOA, SAAS.

Software Quality: McCall's Quality Factors, ISO 9126 Quality Factors, Quality Control, Quality Assurance, Software Reliability.

Software Evolution: Evolution process, legacy system, software maintenance: Maintenance prediction, Re-

Engineering, Refactoring.

UNIT –IV

Software Testing: verification, validation, Development testing (unit testing, component testing, system testing, Test Driven Development (TDD), Release Testing (Requirement based testing, scenario testing, performance testing), User testing (alpha, beta and acceptance testing), Regression Testing, Stress Testing.
System Security: Reliability engineering, reliability requirements (functional and non-functional) and its measurement, safety engineering: safety critical systems, its requirement, security engineering and its requirements, security guidelines

Note: The practical list shall be notified by the teacher in the first week of the class commencement.

Textbook(s):

1. Ian Sommerville, "Software Engineering", 10th edition, Pearson, 2018.
2. K.K. Aggarwal & Yogesh Singh, "Software Engineering", New Age International Publishers, New Delhi, Third Edition, 2008.

References:

1. Pankaj Jalote,"A Concise Introduction to Software Engineering", Springer, 2008.
2. Roger S. Pressman, "Software Engineering- A Practitioner's Approach", Eighth Edition, McGraw-Hill International Edition, 2010.
3. Cem Kaner, Jack Falk, Nguyen Quoc, "Testing Computer Software", Second Edition, Van Nostrand Reinhold, New York, 1993.
4. Gojko Aszic, "Specification by Example", Manning Publications, 2011.
5. Kent Back, "Test-Driven Development By Example", Pearson Education.
6. Boris Beizer, "Software System Testing and Quality Assurance", Van Nostrand Reinhold, New York, 1984.
7. Mike Cohn, "Software Development Using Scrum Succeeding with Agile", Pearson Education.

Paper Code: ICT 212	**Paper: Computer Networks**	**L**	**T/P**	**C**
Paper ID:		**4**	**0**	**4**

Prerequisite Paper: None

Marking Scheme :

1. Teacher's Continuous Evaluation : 25 marks
2. Term and Theory Examinations : 75 marks

Instructions for paper setter

1. There should be 9 questions in the term end examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type questions of total 15 marks.
3. Apart from question one which is compulsory, rest of the paper shall consists of four units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain up to 5 sub-parts/sub-questions. Each unit shall have a marks weightage of 15.
4. The questions are to be framed keeping in view the learning objectives of course/paper. The standard /level of the questions to be asked should be at the level of the prescribed text box.
5. The requirement of (scientific) calculators/log tables/data-tables may be specified if required**.**

Course Objectives :

1.	To introduce fundamentals of Data communication and Computer Networking
2.	To impart Physical layer concepts and data link layer functions
3.	To create awareness about data link control, channel access mechanisms and data link protocols
4.	To understand Networking, addressing, routing protocols and transmission control protocol

Course Outcomes (CO) :

CO 1	Ability to understand the concepts of computer networks, OSI model and TCP/IP model.
CO 2	Ability to understand the physical layer concepts and error control at Data link Layer
CO 3	Ability to understand the data link layer functions and protocols.
CO 4	Ability to understand network layer functions, Routing protocols and Transport layer functions

Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High)

	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO 1	3	3	3	2	2	-	-	-	3	2	2	3
CO 2	3	3	3	2	2	-	-	-	3	2	2	3
CO 3	3	3	3	2	2	-	-	-	3	2	2	3
CO 4	3	3	3	2	2	-	-	-	3	2	2	3

UNIT I

Overview; protocol suites: TCP/IP and OSI, History, Standard.

Application Layer: Application layer paradigm, Client-server paradigm, Standard Client Server Applications, P2P, Socket Interface programming.

Transport Layer: Protocols: simple, stop-and-wait, GBN, Selective repeat, Bidirectional protocols, Internet Transport Layer protocols, UDP, TCP

UNIT II

Network Layer: Introduction, IPv4, ICMPv4, Unicast Routing, Multicast routing, IPV6, ICMPv6.

Data-Link Layer (Wired Networks): Introduction, DLC, Multiple Access Protocols, Wired LANS (Ethernet, others)

UNIT III

Data-Link Layer (Wireless Networks): Introduction, IEEE 802.11, Bluetooth, WiMAX, Cellular telephony, Satellite Networks, Mobile IP.

Physical Layer and Transmission Media: Data and Signals, Digital Transmission, Analog Transmission, Bandwidth utilization, Transmission Media.

Multimedia and QoS: Data types, streaming of audio/video, real-time interactive protocols, Quality of Service.

UNIT IV

Network Management: Introduction, SNMP, ASN.1

Security: Introduction, Ciphers, Application layer security, transport layer security, network layer security,

packet filter firewall, proxy firewall.
Programming: Socket programming.

Textbook(s):

1. B. A. Forouzan and F. Mosharraf, “Computer Networks: A Top-Down Approach”, TMH, 2012
2. James F. Kurose and Keith W.,"Computer Networking: A Top-Down Approach", 7th Edition, Pearson Education, 2017.

References:

1. Behrouz A. Forouzan, “Data Communications and Networking”, 5th Edition, Tata McGraw Hill, 2013
2. Andrew S. Tanenbaum and David J. Wetherall, “Computer Networks”, 5th Edition, Pearson Education India 2013.
3. Larry L. Peterson and Bruce S. Davie, "Computer Networks: A Systems Approach", 5th Edition, Elsevier, 2012
4. Natalia Olifer and Victor Olifer, “Computer Networks: Principles, Technologies and Protocols for Network Design”, Wiley, 2006
5. Jerry FitzGerald, Alan Dennis and Alexandra Durcikova, “Business Data Communications and Networking”, John Wiley & Sons, 2019
6. William Stallings, "Data and Computer Communications", 10th Edition, Pearson Education, India, 2017
7. Wayne Tomasi, “Introduction to Data Communication and Networking”, Pearson Education, 2005

Paper Code: MS 214	**Paper: Accountancy For Engineers**	**L**	**T/P**	**C**
Paper ID:		**2**	**0**	**2**

Prerequisite Paper: None

Marking Scheme :

1. Teacher's Continuous Evaluation : 25 marks
2. Term and Theory Examinations : 75 marks

Instructions for paper setter

1. There should be 9 questions in the term end examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type questions of total 15 marks.
3. Apart from question one which is compulsory, rest of the paper shall consists of four units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain up to 5 sub-parts/sub-questions. Each unit shall have a marks weightage of 15.
4. The questions are to be framed keeping in view the learning objectives of course/paper. The standard /level of the questions to be asked should be at the level of the prescribed text book.
5. The requirement of (scientific) calculators/log tables/data-tables may be specified if required**.**

Course Objectives :

1.	To teach the principles of accountancy
2.	To teach preparation of trial balance.
3.	To teach preparation of final accounts.
4.	To teach depreciation handling

Course Outcomes (CO)

CO 1	Understand the principles of accountancy
CO 2	Ability to understand journal entry, preparation of balance sheet and trial balance
CO 3	Ability to understand final account statement
CO 4	Ability to model depreciation.

Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High)

CO/PO	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO 1	-	-	-	-	-	2	2	2	-	-	3	2
CO 2	-	-	-	-	-	2	2	2	-	-	3	2
CO 3	-	-	-	-	-	2	2	2	-	-	3	2
CO 4	-	-	-	-	-	2	2	2	-	-	3	2

UNIT – I

Objectives and Nature of Accounting, Definitions and Functions of Accounting, Book Keeping and Accounting, Interrelationship of Accounting with other Disciplines, Branches, Limitation.
Accounting Principles, Accounting Concepts and Conventions.

UNIT – II

Journal entries, Compound Journal Entries, Opening Entry, Ledger Posting and Trial Balance, Preparation of Ledger, Posting, Cash Book, Sales and Purchase Book and trial Balance.

UNIT – III

Preparation of Final Accounts with Adjustment, Trading Account, Profit and Loss Account, Balance Sheet. Green Accounting, Social Responsibility Accounting, Accounting ethics

UNIT – IV

Concept of Depreciation, Causes and Features of Depreciation, Depreciation Accounting, Fixation of Depreciation Amount, Methods of recording Depreciation, methods of providing Depreciation, Depreciation Policy.

Textbook:

1. S. N. Maheshwari, Suneel K. Maheshwari and Sharad K. Maheshwari, "Financial Accounting for BBA", Vikas Publishing House, 2018.

References:

1. S. N. Maheshwari, Suneel K. Maheshwari and Sharad K. Maheshwari, "Financial Accounting", Vikas Publishing House, 2018.

2. S. Chakraborty and N.S. Roy, "Accounting and Finance for Engineers", Lawpoint Publications, 2016.
3. Y. P. Singh, "Accounting and Financial Management for I.T. Professional", New Age International, 2007.
4. P.C. Tulsian, "Financial Accounting", Pearson, 2002.

Paper Code: ICT216	**Paper: Network Analysis and Synthesis**	**L**	**T/P**	**C**
Paper ID:		**4**	**0**	**4**

Prerequiste Paper: ICT215

Marking Scheme:

1. Teacher's Continuous Evaluation: 25 Marks
2. Term End Theory Examination: 75 Marks

Instruction for paper setter:

1.There should be 9 questions in the term end examinations question paper.
2.The first question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type questions of total 15 marks.
3.Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto five sub-parts/sub-questions. Each unit will have a marks weightage of 15.
4.The questions are to be framed keeping in view the learning outcomes of the course/paper. The standard/level of questions to asked should be at the level of the prescribed textbook.
5.The requirements of (scientific) calculators/ log-tables/ data- tables may be specified if required.

Course Objectives:

1.	To impart understanding of basic component of electrical network and transformations used for analysis.
2.	To impart understanding of basic theorems for DC and AC circuits.
3.	To impart understanding of the phase and frequency response and two port network analysis.
4.	To impart understanding of the synthesis of network and passive filter design.

Course Outcome (CO):

CO 1	To understand basic component of electrical network and transformations used for analysis.
CO 2	To understand basic theorems for DC and AC circuits.
CO 3	To understand the phase and frequency response and two port network analysis.
CO 4	To understand the synthesis of network and passive filter design.

Course Outcomes (CO) to Programme Outcomes (PO) Mapping (Scale - 1: Low, 2: medium, 3: High)

CO/PO	**PO01**	**PO02**	**PO03**	**PO04**	**PO05**	**PO06**	**PO07**	**PO08**	**PO09**	**PO10**	**PO11**	**PO12**
CO 1	**3**	**3**	**3**	**3**	**2**	**1**	**1**	**-**	**2**	**1**	**-**	**2**
CO 2	**3**	**3**	**3**	**3**	**2**	**1**	**1**	**-**	**2**	**1**	**-**	**2**
CO 3	**3**	**3**	**3**	**3**	**2**	**1**	**1**	**-**	**2**	**1**	**-**	**2**
CO 4	**3**	**3**	**3**	**3**	**2**	**1**	**1**	**-**	**2**	**1**	**-**	**2**

UNIT - I

Circuits: Voltage, Ideal Voltage Source, Current Ideal Current Sources, Classification of Circuits, Ohm's Law, Resistively, Temperature Effect, Resistors, Resistor Power Absorption, Nominal Values and Tolerances, Colour Codes, Open and Short Circuits, Internal Resistance. Capacitance, Inductance, Transformers, Fourier series, Fourier transform, Laplace transform and analysis of differential equations with constant coefficients.

UNIT - II

DC Circuits: Series and Parallel Circuits, Kirchhoff's Voltage and Current Law, Mesh Analysis, Loop Analysis, Nodal Analysis, Thevenin's and Norton's Theorem, Maximum Power Transfer Theorem, Superposition Theorem, Millman's Theorem, Tellegens Theorem, Y - Δ and Δ- Y Transformation, Bridge Circuits.
AC Circuits: Circuits containing Capacitors and Inductors, Transient Response, Alternating Current and Voltages, Phasors, Impedences and Admittance, Mesh Analysis, Loop Analysis, Nodal Analysis, Thevenin's and Norton's Theorem, Y - Δ and Δ- Y Transformation, Bridge Circuits. Resonant Circuits, Complex Frequency and Network Function, Maximum Power Transfer Theorem, Superposition Theorem.

UNIT - III

Amplitude and phase response, Bode plots, single tuned circuits, double tuned circuits, on poles and zeros and time delay, network functions, Two port Networks. Relationship between two port parameters, transmission parameters, hybrid parameters, incidental dissipation, interconnections of two port, analysis of ladder networks, Passive Filters. Graph Techniques for Network Analysis, Causality and stability, Hurwitz polynomials,

positive real functions, elementary synthesis procedures, Properties of LC immittance, RC driving point impedances, RL impedances and RC admittances, synthesis of LC driving point immittances, RC impedance or RL admittances, synthesis of certain RLC functions.

UNIT - IV

Properties of transfer functions and synthesis of constant resistant resistance networks. Analog filter design: filter design problem, approximation problem in network theory, maximally flat low pass filter approximation, other low pass filter approximations, Transient response of lowpass filters, method to reduce overshoot in filters, maximally flat delay and controllable magnitude approximation, synthesis of low pass filters, magnitude and frequency normalization, frequency transformations.

Textbook(s):

1. Franklin F. Kuo, "Network Analysis and synthesis", 2nd Edition, Wiley India Pvt Ltd.
2. Behrouz Peikari, "Fundamentals of Network Analysis & synthesis", Jaico Publishing House, 2006.

References:

1. M. E. van Valkenberg and T. S. Rathore, "Network Analysis", 3rd Edition, Pearson, 2019.
2. S. P. Ghosh and A. K. Chakraborty, "Network Analysis and Synthesis", Tata McGraw Hill Education, 2010
3. S. K. Bhattacharya and Manpreet Singh, "Network Analysis and Synthesis", Pearson, 2015

aper Code: ICT218	**Paper: Control System**	**L**	**T/P**	**C**
Paper ID:		**4**	**0**	**4**

Prerequisite Paper: ICT215

Marking Scheme:

1. Teacher's Continuous Evaluation: 25 Marks
2. Term End Theory Examination: 75 Marks

Instruction for paper setter:

1.There should be 9 questions in the term end examinations question paper.
2.The first question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type questions of total 15 marks.
3.Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto five sub-parts/sub-questions. Each unit will have a marks weightage of 15.
4.The questions are to be framed keeping in view the learning outcomes of the course/paper. The standard/level of questions to asked should be at the level of the prescribed textbook.
5.The requirements of (scientific) calculators/ log-tables/ data- tables may be specified if required.

Course Objectives:

1.	To impart knowledge to design Lead-Lag compensators based on frequency data for an open-loop linear system.
2.	To impart knowledge to compute gain and phase margins from Bode diagrams and Nyquist plots and understand their implications in terms of robust stability.
3.	To impart knowledge to compute stability of linear systems using the Routh array test and use this to generate control design constraints.
4.	To impart knowledge to interpret and apply block diagram representations of control systems and design PID controllers based on empirical tuning rules.

Course Outcome (CO):

CO 1	To be able to design Lead-Lag compensators based on frequency data for an open-loop linear system.
CO 2	To be able to compute gain and phase margins from Bode diagrams and Nyquist plots and understand their implications in terms of robust stability.
CO 3	To be able to compute stability of linear systems using the Routh array test and use this to generate control design constraints.
CO 4	To be able to interpret and apply block diagram representations of control systems and design PID controllers based on empirical tuning rules.

Course Outcomes (CO) to Programme Outcomes (PO) Mapping (Scale - 1: Low, 2: medium, 3: High)

CO/PO	**PO01**	**PO02**	**PO03**	**PO04**	**PO05**	**PO06**	**PO07**	**PO08**	**PO09**	**PO10**	**PO11**	**PO12**
CO 1	**3**	**3**	**3**	**3**	**2**	**1**	**1**	**-**	**2**	**1**	**-**	**2**
CO 2	**3**	**3**	**3**	**3**	**2**	**1**	**1**	**-**	**2**	**1**	**-**	**2**
CO 3	**3**	**3**	**3**	**3**	**2**	**1**	**1**	**-**	**2**	**1**	**-**	**2**
CO 4	**3**	**3**	**3**	**3**	**2**	**1**	**1**	**-**	**2**	**1**	**-**	**2**

UNIT - I

Introduction to Control Systems; Introduction, Control Systems, Closed-Loop Control versus Open-Loop Control. Mathematical Modeling of Control Systems; Transfer Function and impulse Response Function, Atomatic Control Systems, Modeling in state space, State-Space Representation of Scalar Differential Equation System, Transformation of Mathematical models, Linearization of Nonlinear Mathematical Models. Mathematical Modeling of Mechanical Systems and Electrical Systems, Introduction, Mathematical Modeling of Mechanical Systems, Mathematical Modeling of Electrical Systems, Example Problems and Solutions Problems. Mathematical Modeling of Fluid Systems and Thermal Systems; Liquid-Level Systems, Pneumatic Systems, Hydraulic Systems, Thermal Systems.

UNIT - II

Transient and Steady-State Response Analyses; First-Order Systems, Second-Order Systems, Higher Order Systems, Transient-Response Analysis, Routh's Stability Criterion, Effects of Integral and Derivative Control Actions on System, Steady-State Errors in Unity-Feedback Control Systems. Control Systems Analysis and design by the Root-Locus Method; Root-Locus Plots, plotting Root Loci, Root-Locus Plots of Positive Feedback

Systems, Root-Locus Approach to control Systems Design, Lead Compensation, Lag Compensation, Lag-Lead Compensation.

UNIT - III

Control Systems Analysis and Design by the Frequency Response Method; Bode Digrams, Polar Plots, Log-Magnitude-versus-Phase plots, Nyquist Stability Criterion, Stability Analysis, Relative Stability Analysis, Closed-Loop Frequency Response of Unity-feedback Systems, Determination of Transfer functions, Control Systems design by Frequency Response Approach, Lead Compensation, Lag Compensation, Lag-Lead Compensation.PID Controllers and Modified PID Controllers; Introduction,Ziegler- Nichols Rules for tuning PID controllers, Design of PID Controllers with Frequency Response Approach, Design of PID Controllers with Computational Optimization Approach, Modification of PID Control Schemes, Two-Degrees-of-freedom PID Control Schemes, Zero Placement Approach to Improve Response.

UNIT - IV

Control Systems Analysis in State Space; Introduction,State-space Representations of Transfer-Function Systems, Transformation of System Models, Solving the Time-Invariant State Equation, Some Useful Results in vector-Matrix Analysis, Controllability, Observability.Control Systems Design of in State Space; Introduction, Pole Placement,Solving Pole-Placement Problems, Design of Servo Systems, State Observers, Design of Regulator Systems with Observers, Design of Control Systems with Observers, Quadratic Optimal Regulator Systems, Robust Control Solutions.

Textbook(s):

1. K. Ogata, Modern Control Engineering, Prentice Hall India, 5th ed., 2010.

References:

1. William Boltons, Control Systems; Newnes, 2002.
2. Norman S. Nise, Control Systems Engineering, Wiley, 8th ed., 2019.
3. Benjamin C. Kuo and Farid Golnaraghi, Automatic Control Systems, Tata McGraw Hill, 10 ed., 2017.

Paper Code: ICT220	**Paper: Analog Electronics -II**	**L**	**T/P**	**C**
Paper ID:		**4**		**4**

Prerequisite Paper: ICT221

Marking Scheme:

1. Teacher's Continuous Evaluation: 25 Marks
2. Term End Theory Examination: 75 Marks

Instruction for paper setter:

1.There should be 9 questions in the term end examinations question paper.
2.The first question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type questions of total 15 marks.
3.Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto five sub-parts/sub-questions. Each unit will have a marks weightage of 15.
4.The questions are to be framed keeping in view the learning outcomes of the course/paper. The standard/level of questions to asked should be at the level of the prescribed textbook.
5.The requirements of (scientific) calculators/ log-tables/ data- tables may be specified if required.

Course Objectives:

1.	To understand Basic building block and characteristic of Op-Amp
2.	To understand the frequency response and Configurations of Op-Amp
3.	To analyze and design linear, nonlinear and Oscillators circuits using Op-Amp
4.	To analyze and design active filters and to understand function of Op-Amp based special ICs

Course Outcome (CO):

CO 1	Ability to understand and use Op-Amps to design open-loop and closed loop configuration.
CO 2	Ability to analyse frequency response of and Op-Amp circuit.
CO 3	Ability to use Op-Amp in linear and non-linear applications.
CO 4	Ability to design Active Filters

Course Outcomes (CO) to Programme Outcomes (PO) Mapping (Scale - 1: Low, 2: medium, 3: High)

CO/PO	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO 1	3	3	3	3	2	1	1	-	2	1	-	2
CO 2	3	3	3	3	2	1	1	-	2	1	-	2
CO 3	3	3	3	3	2	1	1	-	2	1	-	2
CO 4	3	3	3	3	2	1	1	-	2	1	-	2

UNIT - I

The Operational Amplifiers: Block diagram representation of OP-AMP; Evolution of IC and types, Power supply for Op-Amp; The Ideal Op-Amp: schematic, characteristics, equivalent circuit, Ideal voltage transfer curve, typical IC 741 characteristics

Open Loop Op-Amp configurations: The differential amplifier, inverting amplifier, non-inverting amplifier

Closed loop Op-Amp configurations: inverting and non-inverting amplifiers, voltage followers, differential amplifiers, closed loop frequency response & circuit stability, single supply operation of OP-AMP, Inverting and Non-Inverting op-amp.

UNIT - II

The Practical Op-Amp: Input offset voltage, input bias current, input offset current, Total output offset voltage, thermal drift, error voltage, Supply voltage rejection ration (SVRR), CMRR

Frequency Response of An Op-Amp: Frequency response compensator networks, High frequency OP-AMP equivalent circuit, open loop voltage gain as a function of frequency, Slew rate, causes of slew rates and its effects in application.

UNIT - III

Linear applications of Op-Amps: Summing, scaling and averaging amplifier (inverting, non-inverting & differential configuration), voltage to current & current to voltage converters, Integrator, Differentiator,

Non-Linear applications of IC op-amps: Comparator, Zero crossing detector, Schmitt Trigger, Clipping & Clamping Circuits, Precision Rectifiers, sample and hold circuit

Oscillators: Principles & Types; Phase shift, Wein-bridge & quadrature. Square wave, triangular wave and saw tooth wave generators, voltage-controlled oscillator

UNIT - IV

Active Filters: Classification and frequency response of filters, response Advantages of active filters, characteristics of butter worth, chebyshev, first order and second order butter worth filters- low pass and high pass types. Band pass & band reject filters.

Specialised IC- The 555 Timer: functional diagram, Monostable and Astable multivibrators; PLL: Basic PLL principle, monolithic 565 PLL; Voltage Regulators, Three terminal IC voltage regulators(LM 317

Note: The practical list shall be notified by the teacher in the first week of the class commencement.

Textbook(s):

1. Ramakant A. Gayakwad, "OP-AMP and Linear ICs", 4th Edition, Prentice Hall / Pearson Education, 2001.
2. D. Roy Choudhary & S. B Jain, "Linear Integrated Circuit", 2nd ed. New age publication.2018.

References:

1. Adel S. Sedra and Kenneth C. Smith, "Micro Electronic Circuits Theory and Applications," 5th Edition , OUP, 2004.
2. David A. Bell, "Op-amp & Linear ICs", Oxford, 2013.
3. James M. Fiore, "Op Amps & Linear Integrated Circuits Concepts & Applications", Cengage, 2010.
4. J. Michel Jacob, "Applications and Design with Analog Integrated Circuits", PHI, 2004.
5. R. L. Boylestad and N. Nashlesky, "Electronic Devices and Circuit Theory", Pearson Education, 11th Ed., 2014
6. J. Millman, C. Halkias, and C. D. Parikh, "Millman's Integrated Electronics: Analog and Digital circuits and system", McGraw Hill Education, 2018.

Paper Code: ICT222	**Paper: Digital Communication**	**L**	**T/P**	**C**
Paper ID:		**3**		**3**

Prerequisite Paper: ICT223

Marking Scheme:

1. Teacher's Continuous Evaluation: 25 Marks
2. Term End Theory Examination: 75 Marks

Instruction for paper setter:

1.There should be 9 questions in the term end examinations question paper.
2.The first question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type questions of total 15 marks.
3.Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto five sub-parts/sub-questions. Each unit will have a marks weightage of 15.
4.The questions are to be framed keeping in view the learning outcomes of the course/paper. The standard/level of questions to asked should be at the level of the prescribed textbook.
5.The requirements of (scientific) calculators/ log-tables/ data- tables may be specified if required.

Course Objectives:

1.	To understand importance of information theory in digital communication and various PCM modulation.
2.	To understand the variance basic concepts of digital communication.
3.	To understand the various digital Modulation-demodulation techniques
4.	To understand various coding in digital communications.

Course Outcome (CO):

CO 1	Ability to understand the channel information carrying capacity and conversion of analog to digital signals.
CO 2	Ability to understand the effect of additive white Gaussian Noise on digital communication modulation techniques.
CO 3	Ability to analyse the effect of inter symbol interference as the source of channel impairment and the effect of multipath phenomenon.
CO 4	Ability to use and design communication systems for reliable communication

Course Outcomes (CO) to Programme Outcomes (PO) Mapping (Scale - 1: Low, 2: medium, 3: High)

CO/PO	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO 1	3	3	3	3	2	1	1	-	2	1	-	2
CO 2	3	3	3	3	2	1	1	-	2	1	-	2
CO 3	3	3	3	3	2	1	1	-	2	1	-	2
CO 4	3	3	3	3	2	1	1	-	2	1	-	2

UNIT I

Review of probability theory and Stochastic processes, Poisson and Gaussian Process, Noise, Narrowband Noise, Sinewave plus Narrowband Noise. Information Theory: Entropy, Source Coding Theorem, Lossless data compression, Discrete Memoryless channel, Mutual Information, Channel Capacity, Channel Coding Theorem, Differential Entropy and Mutual Information for Continuous Random Ensembles, Information Capacity Law. Sampling Theory, PAM, Quantization characteristics, PCM, DPCM, Delta Modulation, Line Codes.

UNIT II

AWGN Channel Signalling: Geometric Representation of Signals, Conversion of Continuous AWGN Channel to a vector channel, : ASK, QASK, FSK, M-array FSK, BPSK, DPSK, DEPSK, QPSK, M-array PSK, QAM, MSK, GMSK, Coherent and non-coherent detection and other keying techniques.

UNIT III

Band Limited Channels: Error rate due to channel noise in a matched filer receiver, Intersymbol Interference, Signal Design for Zero ISI, Ideal Nyquist Pulse for Distortionless Baseband data transmission, Raised cosie and square root raised cosine spectrum, Eye pattern, Adaptive equalization, signalling over multiple baseband channel, Digital Subscriber Lines.

Fading Channels: Propagation effects, Jakes Model, Statistical Characteristics of wideband wireless channel, FIR modelling of doubly spread channel, Effects of flat fading, Diversity techniques, MIMO, MIMI Capacity for channel known at receiver, OFDM, Spread-spectrum signals, CDMA, Rake receiver and Multipath Diversity

UNIT IV

Error Control Coding: Introduction, Error Control using forward correction, Discrete Memory less channel, Linear Block Code, Cyclic Codes, Convolutional Codes, Optimum Decoding of Convolutional Codes

Note: The practical list shall be notified by the teacher in the first week of the class commencement.

Textbook(s):

1. Simon Haykins, "Digital Communication Systems" John Wiley, 2014

References:

1. Simon Haykins and Michael Moher, "Communication Systems" John Wiley &sons Inc, 5th edition, 2009.
2. B P Lathi and Zhi Ding, "Modern Digital and Analog Communication Systems", OUP, 5th edition, 2019
3. H P Hsu, Schaum Outline Series, Analog and Digital Communications, TMH 2006
4. J.G Proakis, Digital Communication, 4th Edition, Tata Mc Graw Hill Company, 2001.

Paper Code: ICT224	**Paper: Microprocessors**	**L**	**T/P**	**C**
Paper ID:		**4**	**0**	**4**

Prerequisite Paper: ICT219

Marking Scheme:

1. Teacher's Continuous Evaluation: 25 Marks
2. Term End Theory Examination: 75 Marks

Instruction for paper setter:

1.There should be 9 questions in the term end examinations question paper.
2.The first question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type questions of total 15 marks.
3.Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto five sub-parts/sub-questions. Each unit will have a marks weightage of 15.
4.The questions are to be framed keeping in view the learning outcomes of the course/paper. The standard/level of questions to asked should be at the level of the prescribed textbook.
5.The requirements of (scientific) calculators/ log-tables/ data- tables may be specified if required.

Course Objectives:

1.	To impart knowledge about computer organization concepts so that students can understand basic computer organization and design
2.	To impart knowledge about architecture and instruction set of 8085 microprocessor so that students can implement 8085 assembly language programs.
3.	To impart knowledge about interfacing of memory devices , data convertors and simple I/O devices with 8085 microprocessor.
4.	To impart knowledge about architecture and operation of Programmable Peripheral Devices and their interfacing with 8085 microprocessor.

Course Outcome (CO):

CO 1	Understand computer organization concepts and describe evolution of Microprocessor technology.
CO 2	Ability to understand and distinguish the use of different 8085 instructions and apply those instructions for implementing assembly language programs.
CO 3	Understand and realize the interfacing of memory devices, data convertors and simple I/O devices with 8085 microprocessor.
CO 4	Understand the architecture and operation of Programmable Peripheral Devices and ability to use them for interfacing I/O devices.

Course Outcomes (CO) to Programme Outcomes (PO) Mapping (Scale - 1: Low, 2: medium, 3: High)

CO/PO	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO 1	3	3	3	2	-	-	-	-	-	-	-	1
CO 2	3	3	3	2	3	-	1	-	2	-	2	-
CO 3	3	3	3	2	3	-	-	-	-	-	-	-
CO 4	3	3	3	2	3	-	-	-	-	-	-	-

UNIT - I

Computer Organization concepts: Stored Program Organization, Computer Registers, Machine language instructions, addressing modes, Instruction formats, Arithmetic Logic Unit, Data path, Design of Control Unit, Instruction pipelining concepts.

Introduction to microprocessors – Single Chip CPU, Microprocessors Evolution, Trends in Microprocessor Technology.

UNIT – II

Study 8-bit microprocessor8085-Architecture and Programming Model of 8085 Microprocessor, PIN Layout and description of Signals, Power supply requirements and system clock, Basic Interfacing Concepts, Memory mapped I/O, Instruction Set of 8085, Data transfer, Arithmetic, Logical and branch instructions, Format of 8085 machine instructions, Instruction Execution and Timing diagram, Example of an 8085 – based microcomputer board.

Assembly Language Programming of 8085- Counters and Time delays, Stacks and Subroutines, Code Conversion, BCD Arithmetic, implementing 16-bit operations on 8-bit microprocessor, implementing 8085 programs using a single board computer, writing programs using an assembler

UNIT – III

Methods of Data Transfer and Interrupt Structure of 8085- Data transfer mechanisms, Memory mapped and I/O mapped data transfer, Programmed data transfer, Parallel data transfer, Serial data transfer, RS-232 standard, RS-485 standard, GPIB/IEEE 488 standard, Interrupt driven data transfer, Interrupt Structure of 8085, RST instructions, Multiple interrupts and priorities, 8085 vectored interrupts, Direct Memory access concepts.

Interfacing of Memory devices with 8085-Generation of control signals for memory, Interfacing EPROM and RAM chips with 8085

Interfacing data converters with 8085-Interfacing 8-bit D/A and 8-bit A/D converters with 8085 using status check and interrupts.

UNIT – IV

Programmable peripheral devices and their Interfacing with 8085- 8255 programmable peripheral interface, operating modes, control words, Interfacing switches and LEDs, Interfacing A/D and D/A using 8255, Waveform generation, 8279 Keyboard and display controller, Interfacing seven segment displays and matrix keyboards, 8254 Programmable Interval Timer, 8259 Programmable Interrupt Controller, 8237 DMA Controller. Serial I/O and Data Communication, Asynchronous Serial I/O, Hardware Controlled Serial I/O using 8251

Textbook(s):

1. Ramesh Gaonkar, Microprocessor Architecture, Programming, and application with 8085, Sixth Edition, Penram International Publication, 2013.

References:

1. John Ufferbeck, Microcomputers and Microprocessors, Third Edition, PHI, 2000.
2. Barry B. Brey, Intel Microprocessors, 8th Edition, Pearson Education/Prentice Hall ,2009
3. J. L. Antonakos, "An Introduction to the Intel Family of Microprocessors", Thomson, 1996.

Paper Code: ICT 251	**Paper: Database Management lab**		**L**	**T/P**	**C**
Paper ID:			**-**	**2**	**1**
Teacher's Continuous Evaluation :	**40 Marks**	**Term End Examinations :**		**60 Marks**	

Instructions :

1. The course objectives and course outcomes are identical to that of ICT 207 (Database Management Systems) as this is the practical component of the corresponding theory paper.
2. The practical list shall be notified by the teacher in the first week of the class commencement.

Paper Code: ICT 253	**Paper: Object Oriented programming using C++ Lab**		**L**	**T/P**	**C**
Paper ID:			**-**	**2**	**1**
Teacher's Continuous Evaluation :	**40 Marks**	**Term End Examinations :**		**60 Marks**	

Instructions :

1. The course objectives and course outcomes are identical to that of ICT 209 (Object Oriented programming using C++) as this is the practical component of the corresponding theory paper.
2. The practical list shall be notified by the teacher in the first week of the class commencement.

Paper Code: ICT 255	**Paper: Data Structure Lab**		**L**	**T/P**	**C**
Paper ID:			**-**	**2**	**1**
Teacher's Continuous Evaluation :	**40 Marks**	**Term End Examinations :**		**60 Marks**	

Instructions :

1. The course objectives and course outcomes are identical to that of ICT 211 (Data Structure) as this is the practical component of the corresponding theory paper.
2. The practical list shall be notified by the teacher in the first week of the class commencement.

Paper Code: ICT 257	**Paper: Operating Systems Lab**		**L**	**T/P**	**C**
Paper ID:			**-**	**2**	**1**
Teacher's Continuous Evaluation :	**40 Marks**	**Term End Examinations :**		**60 Marks**	

Instructions :

1. The course objectives and course outcomes are identical to that of ICT 203 (operating Systems) as this is the practical component of the corresponding theory paper.
2. The practical list shall be notified by the teacher in the first week of the class commencement.

Paper Code: ICT256 / ICT 263	**Paper: Computational Methods Lab.**		**L**	**T/P**	**C**
Paper ID:			**-**	**2**	**1**
Teacher's Continuous Evaluation:	**40 Marks**	**Term End Examinations :**		**60 Marks**	

Instructions :

1. The course objectives and course outcomes are identical to that of ICT 204 / ICT 217 (Computational Methods) as this is the practical component of the corresponding theory paper.
2. The practical list shall be notified by the teacher in the first week of the class commencement.

Paper Code: ICT 259	**Paper: Digital Electronics Lab.**		**L**	**T/P**	**C**
Paper ID:			**-**	**2**	**1**
Teacher's Continuous Evaluation :	**40 Marks**	**Term End Examinations :**		**60 Marks**	

Instructions :

1. The course objectives and course outcomes are identical to that of ICT 219 (Digital Electronics) as this is the practical component of the corresponding theory paper.
2. The practical list shall be notified by the teacher in the first week of the class commencement.

Paper Code: ICT 261	**Paper: Analog Electronics – I Lab.**		**L**	**T/P**	**C**
Paper ID:			**-**	**2**	**1**
Teacher's Continuous Evaluation :	**40 Marks**	**Term End Examinations :**		**60 Marks**	

Instructions :

1. The course objectives and course outcomes are identical to that of ICT 221 (Analog Electronics - I) as this is the practical component of the corresponding theory paper.
2. The practical list shall be notified by the teacher in the first week of the class commencement.

Paper Code: ICT 265	**Paper: Signals and Systems Lab**		**L**	**T/P**	**C**
Paper ID:			**-**	**2**	**1**
Teacher's Continuous Evaluation :	**40 Marks**	**Term End Examinations :**		**60 Marks**	

Instructions :

1. The course objectives and course outcomes are identical to that of ICT 215 (Signals and Systems) as this is the practical component of the corresponding theory paper.
2. The practical list shall be notified by the teacher in the first week of the class commencement.

Paper Code: ICT 267	**Paper: Analog Communications Lab**		**L**	**T/P**	**C**
Paper ID:			**-**	**2**	**1**
Teacher's Continuous Evaluation :	**40 Marks**	**Term End Examinations :**		**60 Marks**	

Instructions :

1. The course objectives and course outcomes are identical to that of ICT 223 (Analog Communications) as this is the practical component of the corresponding theory paper.
2. The practical list shall be notified by the teacher in the first week of the class commencement.

Paper Code: ICT 252	**Paper: Computer Networks lab**		**L**	**T/P**	**C**
Paper ID:			**-**	**2**	**1**
Teacher's Continuous Evaluation :	**40 Marks**	**Term End Examinations :**		**60 Marks**	

Instructions :

1. The course objectives and course outcomes are identical to that of ICT 212 (Computer Networks) as this is the practical component of the corresponding theory paper.
2. The practical list shall be notified by the teacher in the first week of the class commencement.

Paper Code: ICT 254	**Paper: Design and Analysis of Algorithms Lab**		**L**	**T/P**	**C**
Paper ID:			**-**	**2**	**1**
Teacher's Continuous Evaluation :	**40 Marks**	**Term End Examinations :**		**60 Marks**	

Instructions :

1. The course objectives and course outcomes are identical to that of ICT 206 (Design and Analysis of Algorithms) as this is the practical component of the corresponding theory paper.
2. The practical list shall be notified by the teacher in the first week of the class commencement.

Paper Code: ICT 258	**Paper: Computer Graphics Lab.**		**L**	**T/P**	**C**
Paper ID:			**-**	**2**	**1**
Teacher's Continuous Evaluation :	**40 Marks**	**Term End Examinations :**		**60 Marks**	

Instructions :

1. The course objectives and course outcomes are identical to that of ICT 202 (Computer Graphics) as this is the practical component of the corresponding theory paper.
2. The practical list shall be notified by the teacher in the first week of the class commencement.

Paper Code: ICT 260	**Paper: Software Engineering Lab.**		**L**	**T/P**	**C**
Paper ID:			**-**	**2**	**1**
Teacher's Continuous Evaluation :	**40 Marks**	**Term End Examinations :**		**60 Marks**	

Instructions :

1. The course objectives and course outcomes are identical to that of ICT 210 (Software Engineering) as this is the practical component of the corresponding theory paper.
2. The practical list shall be notified by the teacher in the first week of the class commencement.

Paper Code: ICT 262	**Paper: Analog Electronics - II Lab.**		**L**	**T/P**	**C**
Paper ID:			**-**	**2**	**1**
Teacher's Continuous Evaluation :	**40 Marks**	**Term End Examinations :**		**60 Marks**	

Instructions :

1. The course objectives and course outcomes are identical to that of ICT 220 (Analog Electronics) as this is the practical component of the corresponding theory paper.
2. The practical list shall be notified by the teacher in the first week of the class commencement.

Paper Code: ICT 264	**Paper: Microprocessors Lab.**		**L**	**T/P**	**C**
Paper ID:			**-**	**2**	**1**
Teacher's Continuous Evaluation :	**40 Marks**	**Term End Examinations :**		**60 Marks**	

Instructions :

1. The course objectives and course outcomes are identical to that of ICT 224 (Microprocessors) as this is the practical component of the corresponding theory paper.
2. The practical list shall be notified by the teacher in the first week of the class commencement.

Paper Code: ICT 266	**Paper: Digital Communications Lab.**		**L**	**T/P**	**C**
Paper ID:			**-**	**2**	**1**
Teacher's Continuous Evaluation :	**40 Marks**	**Term End Examinations :**		**60 Marks**	

Instructions :

1. The course objectives and course outcomes are identical to that of ICT 222 (Digital Communications) as this is the practical component of the corresponding theory paper.
2. The practical list shall be notified by the teacher in the first week of the class commencement.

Paper Code: ICT 262	**Paper: Control Systems Lab.**		**L**	**T/P**	**C**
Paper ID:			**-**	**2**	**1**
Teacher's Continuous Evaluation :	**40 Marks**	**Term End Examinations :**		**60 Marks**	

Instructions :

1. The course objectives and course outcomes are identical to that of ICT 218 (Control Systems) as this is the practical component of the corresponding theory paper.
2. The practical list shall be notified by the teacher in the first week of the class commencement.