

MAHARAJA AGRASEN INSTITUTE OF TECHNOLOGY

DEPARTMENT OF ELECTRONICS AND
COMMUNICATION ENGINEERING

Academic Syllabus

ECE

PSP Area, Plot No-1, Sector-22, Rohini, Delhi-110086



Faculty Of ECE Department

The Department of Electronics and Communication Engineering at Maharaja Agrasen Institute of Technology, located at Sector 22, Rohini, Delhi, was formed to provide an outstanding research environment complemented by excellence in teaching. The Department offers a B.Tech. degree affiliated to Guru Gobind Singh Indraprastha University, Delhi. It has a comprehensive curriculum covering all major domains of Electronics and Communication Engineering, with a strong emphasis on hands-on learning and industry-relevant skills.

The Department is equipped with state-of-the-art infrastructure and modern laboratories, supported by high-speed Ethernet and Wi-Fi networks. Our experienced and dedicated faculty members aim to deliver top-class education by integrating their research expertise into effective classroom teaching. A number of conferences, symposia, and workshops are organized regularly, encouraging active participation from both students and faculty.

The Department also promotes innovation, interdisciplinary collaboration, and student-led initiatives through various technical societies and project-based learning. Many of our students have secured internships and placements in reputed companies and have excelled in national and international competitions. The Department remains committed to nurturing competent professionals and responsible technocrats of the future.

Maharaja Agrasen Institute of Technology

(Department of Electronics and Communication Engineering)

VISION

To excel in technical education, research, and development across diverse domains of Electronics and Communication Engineering developing entrepreneurs and ethical technocrats.

MISSION

M1: To provide advanced education in Electronics and Communication Engineering, inspiring lifelong learning and academic growth.

M2: To collaborate with industry to develop skilled professionals with ethical and social values.

M3: To enrich teaching by blending traditional methods with evolving digital resources while promoting research, innovation and entrepreneurship.

M4: To encourage teamwork and engage stakeholders in fostering overall development.

Maharaja Agrasen Institute of Technology

(Department of Electronics and Communication Engineering)

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1. Graduates will excel in industry, technical professions, higher education and research.

PEO2. Graduates will analyze real life problems and design feasible, socially acceptable systems.

PEO3. Graduates will embrace lifelong learning, ethics and leadership to resolve global challenges.

PEO4. Graduates will develop teamwork, entrepreneurship and a multidisciplinary outlook.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1: Apply Electronics & Communication knowledge to excel in research, industry and entrepreneurship.

PSO2: Innovate and solve complex problems using advanced semiconductor, communication, IoT, embedded and signal processing technologies.

PSO3: Utilize electronics hardware and software tools to address societal challenges.

In light of the eligibility condition specified in the **AICTE Process Handbook 2022-23** (Page Nos 89 and 90), the **Chemistry Papers BS-121 / BS-120 entitled “Basic Chemistry”** shall be offered to students admitted from Academic Session 2022-23 (in the 1st / 2nd Semester) in lieu of **Chemistry Papers BS-103 / BS-104 entitled “Applied Chemistry”**. 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) Computer Science and Technology (CST)
- 4) Information Technology and Engineering (ITE)
- 5) Electronics and Communications Engineering (ECE)
- 6) Electrical Engineering (EE)
- 7) Electrical and Electronics Engineering (EEE)
- 8) Instrumentation and Control Engineering (ICE)
- 9) Computer Science and Engineering (Artificial Intelligence) (CSE-AI)
- 10) Computer Science and Engineering (Artificial Intelligence and Machine Learning) (CSE-AIML)
- 11) Computer Science and Engineering (Data Science) (CSE-DS)
- 12) Computer Science and Engineering (Internet of Things) (CSE-IoT)
- 13) Computer Science and Engineering (Internet of Things and Cyber Security including Block Chain Technology) (CSE-ICB)
- 14) Computer Science and Engineering (Networks) (CSE-Net)
- 15) Computer Science and Engineering (Cyber Security) (CSE-CS)
- 16) Electronics Engineering (VLSI Design and Technology) (EE-VDT)
- 17) Electronics and Communication (Advanced Communication Technology) (EC-ACT)

Note: The corresponding practical paper (BS-155 / BS-156) shall be unchanged.(Addition from AY 2022-23)

First Semester					
Group	Code	Paper	L	P	Credits
Theory Papers					
ES BS	ES-101 BS-103/BS-121 [#]	*Any one of the following: Programming in 'C' Applied Chemistry / Basic Chemistry [#]	3	-	3
BS	BS-105	Applied Physics – I	3	-	3
ES BS	ES-107 BS-109	*Any one of the following: Electrical Science Environmental Studies	3	-	3
BS	BS-111	Applied Mathematics – I	4	-	4
HS	HS-113	**Group 1 or Group 2 shall be offered: Group 1: Communications Skills OR	3	-	3
HS	HS-115	Group 2: Indian Constitution***	2		2
HS	HS-117	Human Values and Ethics***	1		1
ES	ES-119	Manufacturing Process	4	-	4
Practical/Viva Voce					
BS	BS-151	Physics-I Lab	-	2	1
ES BS	ES-153 BS-155	Any of the following corresponding to the theory paper offered: Programming in 'C' Lab Applied Chemistry	-	2	1
ES	ES-157	Engineering Graphics-I	-	4	2
ES BS	ES-159 BS-161	Any of the following corresponding to the theory paper offered: Electrical Science Lab Environmental Studies Lab	-	2	1
Total			20	10	25

*For a particular batch of a programme of study one out of these two papers shall be taught in the first semester while the other shall be taught in the 2nd semester. Students who have to re-appear can only reappear in the odd semester if originally offered to the student in the 1st semester and similarly for the students who study the paper in the second semester. The institution shall decide which paper to offer in which semester.

**For a particular batch of a programme of study either the paper on “Communications Skills” (Group 1), or Group 2: papers (“Indian Constitution” and “Human values and ethics”) shall be taught in the first semester while the other group shall be taught in the 2nd semester. Students who have to re-appear can only reappear in the odd semester if originally offered to the student in the 1st semester and similarly for the students who study the paper(s) in the second semester. The institution shall decide which paper group to offer in which semester.

*****NUES**: All examinations to be conducted by the concerned teacher as specified in the detailed syllabus of the paper.

#The students who have not studied Chemistry at 10+2 level shall be offered BS-121 in lieu of BS-103, 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 BS	ES-102 BS-104/BS-120 [#]	*Any one of the following: Programming in ‘C’ Applied Chemistry / Basic Chemistry [#]	3	-	3
BS	BS-106	Applied Physics – II	3	-	3
ES BS	ES-108 BS-110	*Any one of the following: Electrical Science Environmental Studies	3	-	3
BS	BS-112	Applied Mathematics – II	4	-	4
HS	HS-114	***Group 1 or Group 2 shall be offered: Group 1: Communications Skills OR	3	-	3
HS	HS-116	Group 2: Indian Constitution***	2		2
HS	HS-118	Human Values and Ethics***	1		1
ES	ES-114	Engineering Mechanics	3	-	3
Practical/Viva Voce					
BS	BS-152	Physics-II Lab	-	2	1
ES BS	ES-154 BS-156	*Any of the following corresponding to the theory paper offered: Programming in ‘C’ Lab Applied Chemistry	-	2	1
ES	ES-158	Engineering Graphics-II	-	2	1
ES BS	ES-160 BS-162	*Any of the following corresponding to the theory paper offered: Electrical Science Lab Environmental Studies Lab	-	2	1
ES	ES-164	Workshop Practice		4	2
Total			19	12	25

*For a particular batch of a programme of study one out of these two papers shall be taught in the first semester while the other shall be taught in the 2nd semester. Students who have to re-appear can only reappear in the odd semester if originally offered to the student in the 1st semester and similarly for the students who study the paper in the second semester. The institution shall decide which paper to offer in which semester.

**For a particular batch of a programme of study either the paper on “Communications Skills” (Group 1), or Group 2: papers (“Indian Constitution” and “Human values and ethics”) shall be taught in the first semester while the other group shall be taught in the 2nd semester. Students who have to re-appear can only reappear in the odd semester if originally offered to the student in the 1st semester and similarly for the students who study the paper(s) in the second semester. The institution shall decide which paper group to offer in which semester.

*****NUES**: All examinations to be conducted by the concerned teacher as specified in the detailed syllabus of the paper.

#The students who have not studied Chemistry at 10+2 level shall be offered BS-120 in lieu of BS-104, as applicable in applicable disciplines. (Addition from the Academic Session 2022-23)

PaperCode: ES-101 / ES-102	Paper: Programming in 'C'	L	T/P	C								
		3	-	3								
Marking Scheme:												
1. Teachers Continuous Evaluation: 25 marks												
2. Term end Theory Examinations: 75 marks												
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 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.[8Hrs][T2]

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. [8Hrs] [T2]

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. [8Hrs][T2]

Unit IV

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 [3Hrs] [T1, R8]
Basic Algorithms: Finding Factorial, Fibonacci series, Linear and Binary 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 [7Hrs][T1]

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 Language 'C'* by American National Standards Institute, Information Technology Industry Council, 1990 (C89).
8. *ISO/IEC 9899:1999. International Standard for Programming Language - 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 Language 'C'* by American National Standards Institute, Information Technology Industry Council, 2012 (C11).

PaperCode: BS-103 / BS-104		Paper: Applied Chemistry		L	T/P	C						
				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 the fuels and their uses.											
2:	To understand phase rule and its applications. Also, to understand the properties and industrial applications of polymers.											
3:	To understand the methods used to make pure water.											
4:	To understand the chemical aspects of corrosion and gain a basic understanding about the principles of Green Chemistry and Nano-chemistry.											
Course Outcomes (CO):												
CO1	Ability to use fuels and perform energy conversion calculations.											
CO2	Understand the phase rule and its applications. Also, to understand the properties and industrial applications of polymers.											
CO3	Ability to analyse water and use technologies to purify it.											
CO4	Understand the chemical aspects of corrosion and its prevention. Also, to understand the basics of Green Chemistry and Nano-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	1	-	1

Unit I

Fuels: Classification and Characteristics of fuels, Calorific values, Comparison between solid, liquid and gaseous fuels, calorific values of fuels, determination of calorific values using Bomb calorimeter, Boy's calorimeter, theoretical calculation of calorific value using Dulong formula and numericals of Calorific values. Types of fuels: - Solid: Coal, proximate and ultimate analysis of coal and numericals, carbonisation of coal in Otto-Hoffman oven with recovery of by-products, metallurgical coke; Liquid: Petroleum products --- refining, cracking-thermal and catalytic, knocking characteristics, Octane and Cetane rating; Gaseous: Natural Gas (NG), CNG, LPG, Coal gas, Oil gas, Producer gas, Water gas; Combustion of fuels numericals. [9Hrs] [T1]

Unit II

Phase rule: Terms used in Gibb's Phase rule, phase diagram and its applications for study of one-component systems: Water and Sulphur and two-component systems: Lead-Silver and Zinc-Magnesium. Polymers: Classification, functionality and their types; Plastics: Synthesis (reactions) and properties of Polyethylene Plastics (Addition polymers) ---low-density polyethene (LDPE), high-density

polyethylene(HDPE), linear low density polyethylene(LLDPE) and ultra-high molecular weight polyethylene (UHMWPE); Vinyl Plastics (Condensation polymers) -Nylons, Phenol-formaldehyde resins(Bakelite) and Glyptal; Speciality Polymers: Engineering thermoplastics, Conducting polymers, Electroluminescent polymers, liquid crystalline polymers and biodegradable polymers. [9Hrs][T1, T2]

Unit III

Water: Introduction, water quality standards, physical, chemical and biological characteristics; hardness of water, disadvantages of hardness, determination of hardness (EDTA method) and related numerical questions. Alkalinity and its determination; Boiler problems with hard water and their prevention: Scale and sludge formation, boiler corrosion, caustic embrittlement, priming and foaming, boiler water treatment -internal or in-situ: carbonate and phosphate conditioning, colloidal and Calgon conditioning; external treatment: (a) Lime soda process and related numericals (b) Zeolite process and numericals, (c) Ion-exchange process. Municipal water supply - its treatment and disinfection using break -point chlorination. Desalination, Reverse Osmosis, Electrodialysis and defluoridation of water. [9Hrs][T1, T2]

Unit IV

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.

Green Technology and Green Chemistry

Twelve Principles of Green Chemistry, Zero Waste Technology, Atom economy, Use of alternative feedstock, innocuous reagents, alternative solvents, designing alternative reaction methodology, minimising energy consumption.

Nano Chemistry: Nanomaterials: Properties, synthesis and surface characterization techniques BET and TEM and applications. [9Hrs][T1, T2]

Textbooks:

1. Applied Chemistry by Achyutananda Acharya and Biswajit Samantray, Pearson, 2017.
2. *Engineering Chemistry: Fundamentals and Applications* by Shikha Agarwal, Cambridge University Press, 2019.

References:

1. *Applied Chemistry: A Textbook of Engineers and Technologists* by O. V. Roussk and H. D. Gesser, Springer, 2013.
2. Engineering Chemistry by Raghupati Mukhopadhyay and Sriparna Datta, New Age Int. (PO Ltd., 2007.
3. *Engineering Chemistry* by K. Shesha Maheswaramma and Mridula Chugh, Pearson, 2017.
4. *Basic Engineering Chemistry* by S.S. Dara, A. K.Singh, and Abhilasha Asthana, S. Cand and Co., 2012.
5. Engineering Chemistry by K. N. Jayaveera, G.V. Subba Reddy, and C. Ramachandraiah, McGraw Hill, 2016.
6. *Engineering Chemistry* by O. G. Palanna, McGraw-Hill, 2017.
7. *Textbook of Engineering Chemistry* by Jaya Shree Anireddy, Wiley, 2017.
8. *Engineering Chemistry* by E.R. Nagarajan and S. Ramalingam, Wiley, 2017.

PaperCode: BS-121 / BS-120	Paper: Basic Chemistry											
Year of Inclusion: 2022-23	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 the fuels and their uses.											
2:	To lay foundation for the application of engineering materials such as cement and glass Also, to understand the properties and industrial applications of polymers.											
3:	To understand the methods used to make pure water.											
4:	To understand the chemical aspects of corrosion.											
Course Outcomes (CO):												
CO1	Ability to use fuels and perform energy conversion calculations.											
CO2	Course will impart knowledge about some important engineering materials such as cement and glass. It will also enable the students to understand the properties and industrial applications of polymers.											
CO3	Ability to analyse water and use technologies to purify it.											
CO4	Students will be able to understand the chemical aspects of corrosion and its prevention.											
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	1	-	1

Unit I

Fuels: Classification and Characteristics of fuels, Calorific values, Comparison between solid, liquid and gaseous fuels, calorific values of fuels, determination of calorific values using Bomb calorimeter, Boy's calorimeter, theoretical calculation of calorific value using Dulong formula and numericals of Calorific values. Types of fuels: - Solid: Coal, proximate and ultimate analysis of coal and numericals, carbonisation of coal in Otto-Hoffman oven with recovery of by-products, metallurgical coke; Liquid: Petroleum products --- mining and refining of petroleum, knocking, numericals based on combustion of fuels (excluding flue gas analysis) . [9Hrs] [T1]

Unit II

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. [9Hrs][T1, T2]

Unit III

Water: Introduction, water quality standards, physical, chemical and biological characteristics; hardness of water, disadvantages of hardness, determination of hardness (EDTA method) and related numerical questions, Alkalinity of water and related numericals. Boiler problems with hard water and their prevention: Scale and sludge formation, boiler corrosion, caustic embrittlement, priming and foaming, boiler water treatment -internal or in-situ: carbonate and phosphate conditioning, colloidal and Calgon conditioning; external treatment: (a) Lime soda process and related numericals (b) Zeolite process and numericals (c) Ion-exchange process. Desalination, Reverse Osmosis, Electrodialysis. [9Hrs] [T1, T2]

Unit IV

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; Passivity. Factors influencing corrosion; protective measures: galvanization, cathodic protection, sacrificial anodic protection; electroplating. [9Hrs] [T1, T2]

Textbooks:

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

References:

1. *Applied Chemistry: A Textbook of Engineers and Technologists* by O. V. Roussk and H. D. Gesser, Springer, 2013.
2. *Engineering Chemistry* by Raghupati Mukhopadhyay and Sriparna Datta, New Age Int. (PO Ltd., 2007.
3. *Engineering Chemistry* by K. Shesha Maheswaramma and Mridula Chugh, Pearson, 2017.
4. *Basic Engineering Chemistry* by S.S. Dara, A. K.Singh, and Abhilasha Asthana, S. Cand and Co., 2012.
5. *Engineering Chemistry* by K. N. Jayaveera, G.V. Subba Reddy, and C. Ramachandraiah, McGraw Hill, 2016.
6. *Engineering Chemistry* by O. G. Palanna, McGraw-Hill, 2017.
7. *Textbook of Engineering Chemistry* by Jaya Shree Anireddy, Wiley, 2017.
8. *Engineering Chemistry* by E.R. Nagarajan and S. Ramalingam, Wiley, 2017.

PaperCode: BS-105	Paper: Applied Physics - I	L	T/P	C								
		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 (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 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:

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: ES-107 / ES-108	Paper: Electrical Science	L	T/P	C								
		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 (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 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. [9Hrs] [T1]

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. [9Hrs] [T1]

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. [9Hrs [T1]]

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. [9Hrs] [T1]

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 Electrical & 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:BS-109 / BS-110		Paper: Environmental Studies		L	P	C						
				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 (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.												
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	-	-	3	3	2	1	1	1	1
CO2	-	1	1	-	-	3	3	2	1	1	1	1
CO3	-	1	1	-	-	3	3	2	1	1	1	1
CO4	-	1	1	-	-	3	3	2	1	1	1	1

Unit I

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

Ecosystems: Concept, Structure and function of an ecosystem, Types, Functional Components, Different ecosystems, biogeochemical cycles.

Biodiversity: Introduction to biodiversity, biogeographical classification, India as a mega diversity nation, endangered and endemic species of India, threats to biodiversity and conservation of biodiversity. Bioprospecting and Biopiracy. [10Hrs] [T1,T2]

Unit III

Environmental Pollution: (a) Air Pollution: Source, Types, effects on biosphere and Meteorology, Air Quality, Control. (b) Water Pollution: Types and Sources. (c) Soil Pollution: Types and Control. (d) Noise Pollution: Effect, Control (e) Thermal Pollution. (f) Radiation Pollution (g) Solid waste Management, (h) Pollution Prevention, (i) Disaster Management [10Hrs][T1,T2]

Unit III

Social Issues and Environment: Concept of Sustainable Development; Urban problem related to energy; Water Conservation; Wasteland reclamation; Resettlement and Rehabilitation; Climate Change; Nuclear Accidents; Consumerism and Waste Products; Laws related to Environment, Pollution, Forest and Wild life; Environmental Impact Assessment. [8Hrs] [T1,T2]

Unit IV

Human Population and Environment: Population Growth, Human Rights, Family Welfare Programmes, Environment and Human Health, HIV/AIDS, Women and Child Welfare, Role of IT. [8Hrs] [T1,T2]

Textbooks:

1. *Environmental Studies* by Anindita Basak, Pearson, 2009.
2. *Environmental Studies: Simplified* by Benny Joseph, McGraw-Hill, 2017.

References:

1. *Environmental Studies* by D. L. Manjunath, Pearson, 2007.
2. *Environmental Studies* by Anil Kumar De and Arnab Kumar De, New Age Int. (P) Ltd, Publishers, 2005.
3. *Companion to Environmental Studies* edited by Coel Castree, Mike Hulme, and James D. Proctor, Routledge, 2018.
4. *Environmental Studies* by Deepa Sharma and Bhupendra Singh Chhabra, New Age Int. (P) Ltd, Publishers, 2007.
5. *Environmental Studies: Simplified* by Raj Kumar Singh, McGraw-Hill, 2012.
6. *Basics of Environmental Studies* by U. K. Khare, McGraw-Hill, 2014.

PaperCode: BS-111	Paper: Applied Mathematics - I	L	T/P	C								
		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 (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 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 algebra to solve formulated engineering problems.											
4:	To understand use vector calculus to 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 calculus to 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 under Integral sign, Jacobians and transformations of coordinates. [8Hrs][T2]

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 $J_n(x)$ and $Y_n(x)$. Gamma Function [12Hrs][T1]

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][T1]

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][T1]

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 with Dexter J. Booth, Macmillan, 2020.
2. *Advanced Engineering Mathematics* by Larry Tury, 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:HS-113 / HS-114	Paper: Communications Skills	L	T/P	C								
		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 (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.												
Course Objectives:												
1:	To understand the communication system paradigm.											
2:	To understand how language vocabulary can be increased and difference between Indian, British and American English.											
3:	To understand how to write a business letter and make a speech.											
4:	To improve grammar and sentence structure.											
Course Outcomes (CO):												
CO1	Ability to Communicate as an Individual and in a Group.											
CO2	Ability to learn new words, differentiate between Indian, British and American English.											
CO3	Ability to write business letters and make speeches.											
CO4	Improved grammar and sentence structure.											
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

Role and Importance of Communications, Attributes of Communications, Verbal and Non-Verbal Communications, Verbal Communications Skills, Non-verbal Communication Methods, Body Language, Barriers to Communications, Socio-psychological barriers, Inter-Cultural barriers, Overcoming barriers, Communication Mediums: Characterization and Choice of medium, Effective Communication: Correctness, Clarity, Conciseness, Courtesy, Group Communication: Meetings (types, purpose), Group Discussions, Conduct of Meeting, Participant Role, Making Presentations.

[8Hrs][T1]

Unit II

Spoken and Written English: Attributes of spoken and written communication, Formal & Informal Communication, Variation in between Indian, British and American English. Etiquette and Manners: Personal Behaviour, Greetings, Introductions, Telephone Etiquette. Vocabulary Development: Dictionaries and Thesaurus, Words often confused, generally used one word substitutions, Comprehension.

[8Hrs][T1]

Unit III

Letter writing: Planning the message, Planning Content, Structure, Language use, Layout, enquires and replies, asking for or giving quotations, Bargaining letters, Seller's reply, etc.; Complaints and Replies; Memos, Circulars and notices;
Paragraph Writing, Writing Scientific and Technical Reports: Types, Structure, Drafting and Delivering a Speech: Understanding the Environment, Understanding the Audience, Text preparing, Composition, Practicing, Commemorative Speeches, Welcome and Introduction, Farewell and Send-offs, Condolence [8Hrs][T1]

Unit IV

Articles: Indefinite, Definite; Tenses: Present, Past, Future, Perfect (Present, Past and Future), Tenses in conditional sentences; Active and Passive Voice: Formation, conversion; Direct and Indirect Speech, Degrees of Comparison, Common errors, Concepts of Learning and Listening [8Hrs][T1]

Textbooks:

1. *English Language Communication Skills* by Urmilla Rai, Himalaya Publishing House, 10th Ed., 2010.

References:

1. *Technical Communication: Principles and Practice* by Meenakshi Raman and Sangeeta Sharma, Oxford University Press, 2015.
2. *Communication Skills for Engineers* by C. Muralikrishna and Sunita Mishra, Pearson, 2011.
3. *Effective Technical Communication* by M. Ashraf Rizvi, McGraw-Hill, 2018.
4. *Business Communication: Skills, Concepts, and Applications* by P.D. Chaturvedi and Mukesh Chaturvedi, Pearson, 2013.
5. *Business Correspondence and Report Writing* by R.C. Sharma and Krishan Mohan, McGraw-Hill, 2016.
6. *English for Technical Communications* by Aysha Viswamohan, Tata McGraw-Hill, 2008.

PaperCode:HS-115 / HS-116		Paper: Indian Constitution		L	T/P	C						
				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												
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

Center-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* by V.N. Shukla, Eastern Book Agency, 2014

PaperCode:HS-117/HS-118		Paper: Human Values and Ethics			L	P	C					
					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 without compromising 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 of protesting 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]

Unit III

Safety definition, Safety and risk, Risk analysis, Assessment of safety and risk, Safe exit, Risk-benefit analysis

Safety 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]

Unit IV

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 Engineering by 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 Practice and Research* by Caroline Whitbeck, Cambridge University Press, 2007.

PaperCode: ES-119	Paper: Manufacturing Process	L	T/P	C								
		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 (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:	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 Welding Volume 1*, P. N Rao, , McGrawHill, 5e, 2018.
2. *Elements of Workshop Technology Vol. 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* by R.K.Jain and S.C. Gupta, Khanna Publishers. 16th Edition, 2001.

PaperCode: BS-151	Paper: Applied Physics - I Lab.	L	P	C
		-	2	1
Marking Scheme: 1. Teachers Continuous Evaluation: 40 marks 2. Term end Theory Examinations: 60 marks				
Instructions: 1. The course objectives and course outcomes are identical to that of (Applied 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 Head of Department / Institution in which the paper is being offered from the list of practicals below. Atleast 8 experiments must be performed by the students				

1. To determine the wavelength of sodium light by Newton's Rings.
2. To determine the wavelength of sodium light by Fresnel's biprism.
3. To determine the wavelength of sodium light using diffraction grating.
4. To determine the refractive index of a prism using spectrometer.
5. To determine the dispersive power of prism using spectrometer and mercury source.
6. To determine the specific rotation of cane sugar solution with the help of half shade polarimeter.
7. To find the wavelength of He-Ne laser using transmission diffraction grating.
8. To determine the numeral aperture (NA) of an optical fibre.
9. To plot a graph between the distance of the knife-edge from the center of the gravity and the time period of bar pendulum. From the graph, find (a) The acceleration due to gravity (b) The radius of gyration and the moment of inertia of the bar about an axis.
10. To determine the velocity of ultrasound waves using an ultrasonic spectrometer in a given liquid (Kerosene Oil).
11. To verify inverse square law.
12. To determine Planck's constant.

Note: Teacher's may use the prescribed books to choose the practicals in addition to above. Total 8 practicals minimum shall be performed by the students, they may be asked to do more. Atleast 4 experiments must be from the above list.

Textbook:

1. *B.Sc. Practical Physics* by C. L. Arora, S.Chand & Co., 2020.
2. *Practical physics* by R. K. Shukla and A. Srivastava, New Age Int. (P) Ltd., 2006.

PaperCode: ES-153 / ES-154	Paper: Programming in 'C' Lab.	L	P	C
		-	2	1
Marking Scheme: 1. Teachers Continuous Evaluation: 40 marks 2. Term end Theory Examinations: 60 marks				
Instructions: 1. The course objectives and course outcomes are identical to that of "Programming in '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 under intimation to the office of the Head of Department / Institution in which the paper is being offered from the list of practicals below. Atleast 8 experiments must be performed by the students				

1. Write a program to find divisor or factorial of a given number.
2. Write a program to find sum of a geometric series
3. Write a recursive program for tower of Hanoi problem
4. Write a recursive program to print the first m Fibonacci number
5. Write a menu driven program for matrices to do the following operation depending on whether the operation requires one or two matrices
 - a. Addition of two matrices
 - b. Subtraction of two matrices
 - c. Finding upper and lower triangular matrices
 - d. Transpose of a matrix
 - e. Product of two matrices.
6. Write a program to copy one file to other, use command line arguments.
7. An array of record contains information of managers and workers of a company. Print all the data of managers and workers in separate files.
8. Write a program to perform the following operators on Strings without using String functions
 - a. To find the Length of String.
 - b. To concatenate two string.
 - c. To find Reverse of a string.
 - d. To copy one string to another string.
9. Write a Program to store records of a student in student file. The data must be stored using Binary File. Read the record stored in "Student.txt" file in Binary code. Edit the record stored in Binary File. Append a record in the Student file.
10. Write a program to count the no of Lowercase, Uppercase numbers and special Characters presents in the contents of text File.

Note:

1. At least 8 Experiments out of the list shall be performed by the students. Teachers may introduce new experiments for the class in addition to above.
2. In addition Two Mini Projects based on the skills learnt shall be done by the students. Teachers shall create the mini projects so that the same is not repeated every year. These mini projects may be done in a group not exceeding group size of 4 students.
3. Usage of IDE like Visual Studio Community Edition, Codeblocks, etc. are recommended.

PaperCode: BS-155 / BS-156	Paper: Applied Chemistry Lab.	L	P	C
		-	2	1
Marking Scheme: 1. Teachers Continuous Evaluation: 40 marks 2. Term end Theory Examinations: 60 marks				
Instructions: 1. The course objectives and course outcomes are identical to that of “Applied Chemistry” 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 Head of Department / Institution in which the paper is being offered from the list of practicals below. Atleast 8 experiments must be performed by the students				

1. Determination of alkalinity of water sample.
2. Determination of hardness of water sample by EDTA method.
3. Determine the percentage composition of sodium hydroxide in the given mixture of sodium hydroxide and sodium chloride.
4. Determine the amount of oxalic acid and Sulphuric acid in one litre of solution, given standard sodium hydroxide and Potassium Permanganate.
5. Determine the amount of copper in the copper ore solution, provided hypo-solution (Iodometric Titration).
6. Determine the amount of chloride ions present in water using silver nitrate (Mohr's Precipitation Method).
7. Determine the strength of $MgSO_4$ solution by Complexometric titration.
8. Determine the surface tension of a liquid using drop number method.
9. Determine the viscosity of a given liquid (density to be determined).
10. Determine the cell constant of conductivity cell and titration of strong acid/strong base conductometrically.
11. To determine (a) λ max of the solution of $KMnO_4$. (b) Verify Beer's law and find out the concentration of unknown solution by spectrophotometer.
12. Determination of the concentration of iron in water sample by using spectrophotometer.
13. Determination of the concentration of Iron (III) by complexometric titration.
14. Proximate analysis of coal.
15. Determination of eutectic point and congruent melting point for a two component system by method of cooling curve.

References:

1. *Vogel's Text Book of Quantitative Chemical Analysis* by G.H. Jefferey, J. Bassett, J. Mendham, and R.C. Denney, Logmaan Scientific & Technical, 1989
2. *Essentials of Experimental Engineering Chemistry* by S. Chawla, Dhanpat Rai & Co., 2008.
3. *Experiments in Applied Chemistry* by S. Ratan, S.K. KAtaria & Sons, 2003.
4. *Practical Chemistry* by O.P.Pandey, D. N. Bajpai and S. Giri, S.Chand & Co., 2005.
5. *Engineering Chemistry with Laboratory Experiments* by M. S. Kaurav, PHI Learning Pvt. Ltd., 2011.
6. *Laboratory Manual on Engineering Chemistry* by S. K. Bhasin, and Sudha Rani, Dhanpat Rai & Co., 2006.

Note:

1. At least 8 Experiments out of the list shall be performed by the students. Teachers may introduce new experiments for the class in addition to above.

PaperCode: ES-157		Paper: Engineering Graphics-I		L	P	C						
				-	4	2						
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.

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: ES-159 / ES-160	Paper: Electrical Science Lab.	L	P	C
		-	2	1
Marking Scheme: 1. Teachers Continuous Evaluation: 40 marks 2. Term end Theory Examinations: 60 marks				
Instructions: 1. The course objectives and course outcomes are identical to that of “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 under intimation to the office of the Head of Department / Institution in which the paper is being offered from the list of practicals below. Atleast 8 experiments must be performed by the students				

1. To Design the circuit for a given load and selection of its various Components and instruments from the safety point of view

OR

To study different types of symbols and standard currently being used in electrical engineering.

2. Study and applications of CRO for measurement of voltage, frequency and phase of signals.
3. Connection of lamp by (1) Single Switch Method. (2) Two-way Switch Method.

OR

Performance comparison of fluorescent Tube & CFL Lamp.

3. To Verify Thevenin's & Norton's Theorem

OR

To Verify Superposition & Reciprocity Theorem.

OR

To Verify Maximum Power Transfer Theorem.

4. To Measure Power & Power Factor in a Single-Phase A.C Circuit using Three Ammeters or three Voltmeters.
5. To Measure Power & Power Factor in a Balanced Three Phase Circuit using Two Single Phase Wattmeters.
6. To study of Resonance in a series R-L-C or Parallel R-L-C Circuits.
7. To perform open circuit and short circuit test on 1-phase transformer.
8. Starting, Reversing and speed control of DC shunt Motor
9. Starting, Reversing and speed control of 3-phase Induction Motor
10. To Study different types of Storage Batteries & its charging system.
11. To Study different types of earthing methods including earth leakage circuit breaker (GFCI)

Note:

1. At least 8 Experiments out of the list shall be performed by the students. Teachers may introduce new experiments for the class in addition to above.

PaperCode: BS-161 /BS-162	Paper: Environmental Studies Lab.	L	P	C
		-	2	1
Marking Scheme: 1. Teachers Continuous Evaluation: 40 marks 2. Term end Theory Examinations: 60 marks				
Instructions: 1. The course objectives and course outcomes are identical to that of “Environmental Studies” 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 Head of Department / Institution in which the paper is being offered from the list of practicals below. Atleast 8 experiments must be performed by the students				

1. Determination of pH, conductivity and turbidity in drinking water sample.
2. Determination of pH and conductivity of soil/sludge samples.
3. Determination of moisture content of soil sample.
4. Determination of Total Dissolved Solids (TDS) of water sample.
5. Determination of dissolved oxygen (DO) in the water sample.
6. Determination of Biological oxygen demand (BOD) in the water sample.
7. Determination of Chemical oxygen demand (COD) in the water sample.
8. Determination of Residual Chlorine in the water sample.
9. Determination of ammonia in the water sample.
10. Determination of carbon dioxide in the water sample.
11. Determination of nitrate ions or sulphate ions in water using spectrophotometer.
12. Determination of the molecular weight of polystyrene sample using viscometer method.
13. Base catalyzed aldol condensation by Green Methodology.
14. Acetylation of primary amines using eco-friendly method.
15. To determine the concentration of particulate matter in the ambient air using High Volume Sampler.

Note:

1. For better understanding of various aspects of environment visits to local areas, depending upon easy access and importance may be planned to any nearby river, forest, grassland, hills and students should write a report based on their observations.
2. At least 8 Experiments out of the list shall be performed by the students. Teachers may introduce new experiments for the class in addition to above

References:

1. *Vogel's Text Book of Quantitative Chemical Analysis* by G.H. Jefferey, J. Bassett, J. Mendham, and R.C. Denney, Logmaan Scientific & Technical, 1989.
2. dst.gov.in/green-chem.pdf (monograph of green chemistry laboratory experiments).
3. *Essentials of Experimental Engineering Chemistry* by S. Chawla, Dhanpat Rai & Co., 2008.
4. *Experiments in Applied Chemistry* by S. Ratan, S.K. Kataria & Sons, 2003.
5. *Principles of Environment Science: Enquiry and Applications* by W. Cunningham and M. A. Cunningham, Tata McGraw Hill, 2003.
6. *Perspectives in Environment Studies* by A. Kaushik and C. P. Kaushik, New Age Int. (P) Pub., 2013.

PaperCode: BS-106	Paper: Applied Physics - II	L	T/ P	C								
		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 learn about the quantum nature of reality.											
2:	To learn about quantum statistics and its significance.											
3:	To understand the structures of crystals.											
4:	To learn about the band theory of solids and properties and characteristics of diodes.											
Course Outcomes (CO):												
CO1	Understand and appreciate the quantum nature of reality.											
CO2	Understand quantum statistics and its significance.											
CO3	Understand Crystalline Structure.											
CO4	Understand the band theory of solids and properties and characteristics of diodes.											
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. [8Hrs][T1,T2]

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. [8Hrs][T1,T2]

Unit III

Crystal Structure: Types of solids, Unit cell, Types of crystals, Translation vectors, Lattice planes, Miller indices, Simple crystal structures, Interplaner spacing, Crystal structure analysis: Bragg's law, Laue method, Point defects: Schottky and Frankel defects. [8Hrs][T1,T2]

Unit IV

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 [8Hrs][T1,T2]

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

PaperCode: BS-112	Paper: Applied Mathematics - II	L	T/P	C								
		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 (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 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 with Dexter J. Booth, Macmillan, 2020.
2. *Advanced Engineering Mathematics* by Larry Tury, 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: ES-114	Paper: Engineering Mechanics	L	T/P	C								
		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 (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 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, Varignon'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 University Press.

PaperCode: BS-152	Paper: Applied Physics - II Lab.	L	P	C
		-	2	1
Marking Scheme: 1. Teachers Continuous Evaluation: 40 marks 2. Term end Theory Examinations: 60 marks				
Instructions: 1. The course objectives and course outcomes are identical to that of (Applied 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 Head of Department / Institution in which the paper is being offered from the list of practicals below. Atleast 8 experiments must be performed by the students				

1. To determine the e/m ratio of an electron by J.J. Thomson method.
2. To measure the frequency of a sine-wave voltage obtained from signal generator and to obtain lissajous pattern on the CRO screen by feeding two sine wave signals from two signal generators.
3. To determine the frequency of A.C. mains by using Sonometer.
4. To determine the frequency of electrically maintained tuning fork by Melde's method.
5. Computer simulation (simple application of Monte Carlo): Brownian motion, charging & discharging of a capacitor.
6. To study the charging and discharging of a capacitor and to find out the time constant.
7. To study the Hall effect.
8. To verify Stefan's law.
9. To determine the energy band gap of a semiconductor by four probe method/or by measuring the variation of reverse saturation current with temperature.
10. To study the I-V characteristics of Zener diode.
11. To find the thermal conductivity of a poor conductor by Lee's disk method.
12. To study the thermo emf using thermocouple and resistance using Pt. Resistance thermometer.

Note: Teacher's may use the prescribed books to choose the practicals in addition to above. Total 8 practicals minimum shall be performed by the students, they may be asked to do more. Atleast 4 experiments must be from the above list.

Textbook:

1. *B.Sc. Practical Physics* by C. L. Arora, S.Chand & Co., 2020.
2. *Practical physics* by R. K. Shukla and A. Srivastava, New Age Int. (P) Ltd., 2006.

PaperCode: ES-158		Paper: Engineering Graphics-II		L	P	C						
				-	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.

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: ES-164	Paper: Workshop Technology	L	P	C								
		-	4	2								
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.

**Bachelor of Technology in Electronics and Communications
Engineering (ECE)
2nd Year Onward Scheme and implementation guideline**

Third Semester					
Group	Paper Code	Paper	L	P	Credits
Theory Papers					
ES	ES-201	Computational Methods	4		4
HS/MS	HS-203	Indian Knowledge System*	2		2
PC	ECC-205	Signals and Systems	3		3
PC	ECC-207	Digital Logic and Computer Design	4		4
PC	ECC-209	Analog Communications	4		4
PC	ECC-211	Analog Electronics-I	4		4
Practical / Viva Voce					
ES	ES-251	Computational Methods Lab		2	1
PC	ECC-253	Digital Logic and Computer Design Lab		2	1
PC	ECC-255	Analog Communications Lab		2	1
PC	ECC-257	Analog Electronics-I Lab		2	1
PC	ECC-259	Signals and Systems Lab		2	1
Total			21	10	26

***NUES:**All examinations to be conducted by the concerned teacher as specified in the detailed syllabus of the paper.

Fourth Semester					
Group	Paper Code	Paper	L	P	Credits
Theory Papers					
BS	BS-202	Probability, Statistics and Linear Programming	4		4
HS/MS	HS-204	Technical Writing*	2		2
PC	EEC-206	Network Analysis and Synthesis	3		3
PC	ECC-210	Microprocessors and Microcontrollers	3		3
PC	ECC-212	Digital Communications	3		3
PC	ECC-214	Analog Electronics-II	3		3
PC	ECC-216	Electromagnetic Field Theory	3		3
Practical / Viva Voce					
BS	BS-252	Probability, Statistics and Linear Programming Lab		2	1
PC	ECC-256	Microprocessors and Microcontrollers Lab		2	1
PC	ECC-258	Digital Communications Lab		2	1
PC	ECC-260	Analog Electronics-II Lab		2	1
PC	EEC-262	Network Analysis and Synthesis Lab		2	1
Total			21	10	26

***NUES:**All examinations to be conducted by the concerned teacher as specified in the detailed syllabus of the paper.

Fifth Semester					
Group	Paper Code	Paper	L	P	Credits
Theory Papers					
HS/MS	HS-301	Economics for Engineers	2		2
PC	ECC-303	Digital Signal Processing	4		4
PC	ECC-305	Microelectronics	3		3
PC	EEC-307	Introduction to Control Systems	3		3
PC	ECC-309	Transmission Lines, Waveguides and Antenna Design	4		4
PC	ECC-311	Data Communication and Networking	4		4
Practical / Viva Voce					
PC	ECC-351	Digital Signal Processing Lab		2	1
PC	ECC-353	Microelectronics Lab		2	1
PC	EEC-355	Introduction to Control Systems Lab		2	1
PC	ECC-357	Transmission Lines, Waveguides and Antenna Design Lab		2	1
PC	ECC-359	Data Communication and Networking Lab		2	1
PC / Internship	ES-361	Summer Training Report - 1 *			1
Total		-	20	10	26

***NUES:**Comprehensive evaluation of the Summer Training Report – 1 (after 4th Semester) shall be done by the 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 institute.

Sixth Semester					
Group	Paper Code	Paper	L	P	Credits
Theory Papers					
HS/MS	MS-302	Principles of Management for Engineers	3		3
HS/MS	HS-304	Universal Human Values*	1		1
PCE		Programme Core Elective Paper (PCE –1)			4
PCE		Programme Core Elective Paper (PCE – 2)			4
PCE		Programme Core Elective Paper (PCE – 3)			4
EAE / OAE		Emerging Area/Open Area Elective Paper (EAE – 1 /OAE – 1)			4
EAE / OAE		Emerging Area/Open Area Elective Paper (EAE – 2 /OAE – 2)			4
Practical / Viva Voce					
HS/MS	HS-352	NSS / NCC / Cultural Clubs / Technical Society / Technical Club**			2
Total					26

***NUES:**All examinations to be conducted by the concerned teacher as specified in the detailed syllabus of the paper.

****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 faculty 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 be evaluated on the basis their performance, by the faculty co-ordinator for the period of 3rd semester to 6th semester only.

Seventh Semester					
Group	Paper Code	Paper	L	P	Credits
Theory Papers					
HS/MS	MS-401	Principles of Entrepreneurship Mindset	2		2
PCE		Programme Core Elective Paper (PCE – 4)			4
PCE		Programme Core Elective Paper (PCE – 5)			4
EAE / OAE		Emerging Area / Open Area Elective Paper (EAE – 3 / OAE – 3)			4
EAE / OAE		Emerging Area / Open Area Elective Paper (EAE – 4 / OAE – 4)			4
EAE / OAE		Emerging Area / Open Area Elective Paper (EAE – 5 / OAE – 5)			4
Practical / Viva Voce					
PC / Project	ES-451	Minor Project**			3
PC / Internship	ES-453	Summer Training Report - 2 *			1
Total					26

***NUES:** Comprehensive evaluation of the Summer Training Report – 2 (after 6th Semester) shall be done by the 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 institute.

******The student shall be allocated a supervisor / guide for project work at the end 6th semester by the department / institution, 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 background 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 concerned supervisor while the term end examination 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 Director of the Institution / Head of the Department can assign the responsibility of the supervisor (for purpose of examinations) to any faculty of the Institution / Department.

Eight Semester					
Group	Paper Code	Paper	L	P	Credits
Practical / Viva Voce[%]					
PC / Project	ES-452	Major Project – Dissertation and Viva Voce [#]			18
	ES-454	Project Progress Evaluation*			2
PC / Internship	ES-456	Internship Report and Viva Voce [#]			18
	ES-458	Internship Progress Evaluation*			2
Total			0	0	20

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

[%]By default every student shall do the project work (ES-452 and ES-454). A student shall either be allowed to do a project work (ES-452 and ES-454) or an internship (ES-456 and ES-458). The student must apply for approval to do internship before the commencement of the 8th semester to the institute, and only after approval of Principal / Director of the institute through Training and Placement Officer of the institute, shall proceed for internship.

[#]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.

ES-452: 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 Examination Division (COE), for a total of 100 marks.

ES-454 / ES-458: Comprehensive evaluation by the committee of teachers, constituted by the Academic Programme Committee, out of 100.

ES-456: Evaluation shall be conducted of 40 marks (Teachers' continuous evaluation / internal assessment) by the Training and Placement Officer of the department / institute on the basis of the report submitted by the student. And, 60 marks by a bench of the Training and Placement Officer of the department / institute and the external examiner deputed by Examination 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 Director of the institute / Head of the Department can assign the responsibility of the supervisor or the Training and Placement Officer (for purpose of examinations) to any faculty of the department.

Note on Elective Papers: The elective papers shall be allowed to be taken / studied by the students, by the APC of the department / institute, 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.

Note on Examination of Elective Papers:

- (a) Papers with only theory component shall have 25 Marks continuous evaluation by the teacher and 75 Marks term-end examinations. Both these component marks shall be reflected on the marksheet of the student.
- (b) Papers with only practical component shall have 40 Marks continuous evaluation by the teacher and 60 Marks term-end examinations. Both these component marks shall be reflected on the marksheet of the student.

Note on Continuous Evaluation of All Papers:

- (a) Papers with only theory component shall have 25 Marks continuous evaluation by the teacher which shall be evaluated as:
 - i. Mid-Term Test* - 15 Marks (after 8 weeks of teaching or as decided by PCC)
 - ii. Assignments / Project / Quiz / Case Studies, etc. - 5 Marks
 - iii. Attendance / Class Participation - 5 Marks
- (b) Papers with only practical component shall have 40 Marks continuous evaluation by the teacher which shall be evaluated as:
 - i. Mid-Term Test and Viva Voce - 20 Marks (after 8 weeks of teaching or as decided by PCC)
 - ii. Practical File - 10 Marks
 - iii. Attendance / Lab Participation - 10 Marks

*** The mid-term test shall be coordinated by the Programme Coordination Committee.**

If a student could not appear for a mid-term test due to situation beyond the control by the student, a supplementary test may be arranged towards the end of the semester, in a similar manner to the mid-term test for such students. The students must apply for this provision to the department / institution. On examination of the reason for non-appearing in the mid-term test by the Head of the Department / Institute, and with reason for allowing to appear in the supplementary test to be recorded by the Head of the Department / Institute, the student may be allowed.

The attendance sheets, the question papers and the award sheets for the continuous evaluation to be retained by the concerned department / institute for at least 6 months after the declaration of the result by the Examination Division of the University.

Programme Core Electives

Semester	Paper Code	PCE – 1 (Choose Any One)	L	P	Credits
6	ECE-306T	VHDL Programming	3		3
	ECE-306P	VHDL Programming Lab		2	1
6	ECE-308T	Digital Image Processing	3		3
	ECE-308P	Digital Image Processing Lab		2	1
6	ECE-310	Mobile Communication	4		4
6	ECE-312T	Advanced Microprocessors and Microcontroller	3		3
	ECE-312P	Advanced Microprocessors and Microcontroller Lab		2	1
6	ECE-314T	RF and Microwave Engineering	3		3
	ECE-314P	RF and Microwave Engineering Lab		2	1
6	ECE-316T	Mobile Computing	3		3
	ECE-316P	Mobile Computing Lab		2	1
6	ECE-318T	Artificial Intelligence	3		3
	ECE-318P	Artificial Intelligence Lab		2	1
6	ECE-320T	Electronic Measurements	3		3
	ECE-320P	Electronic Measurements Lab		2	1
Semester	Paper Code	PCE – 2 (Choose Any One)	L	P	Credits
6	ECE-322T	Fabrication Technology	3		3
	ECE-322P	Fabrication Technology Lab		2	1
6	ECE-324	Multimedia Communication	4		4
6	ECE-326T	Optical Communication Systems and Networks	3		3
	ECE-326P	Optical Communication Systems and Networks Lab		2	1
6	ECE-328	Advanced Computer Architecture	4		4
6	ECE-330T	Antenna Design and Radiating Systems	3		3
	ECE-330P	Antenna Design and Radiating Systems Lab		2	1
6	ECE-332	Introduction to Information and Coding Theory	4		4
6	ECE-334T	Random Processes and Stochastic Systems	3		3
	ECE-334P	Random Processes and Stochastic Systems Lab		2	1
6	ECE-336T	Radio and Television Engineering	3		3
	ECE-336P	Radio and Television Engineering Lab		2	1
Semester	Paper Code	PCE – 3 (Choose Any One)	L	P	Credits
6	ECE-338T	CMOS Analog Integrated Circuit Design	3		3
	ECE-338P	CMOS Analog Integrated Circuit Design Lab		2	1
6	ECE-340T	Wavelets	3		3
	ECE-340P	Wavelets Lab		2	1
6	ECE-342T	Wireless Sensor Networks	3		3
	ECE-342P	Wireless Sensor Networks Lab		2	1
6	ECE-344T	Embedded System Architecture and Design	3		3
	ECE-344P	Embedded System Architecture and Design Lab		2	1
6	ECE-346	Solid State Microwave Device and their application	4		4
6	ECE-348	Radar and Satellite Communications	4		4
6	ECE-350T	Machine Learning	3		3
	ECE-350P	Machine Learning Lab		2	1
6	ECE-354T	Introduction to Power Electronics	3		3
	ECE-354P	Introduction to Power Electronics Lab		2	1
Semester	Paper Code	PCE – 4 (Choose Any One)	L	P	Credits
7	ECE-403T	RF Components and Circuit Design	3		3
	ECE-403P	RF Components and Circuit Design Lab		2	1
7	ECE-405T	Pattern Recognition	3		3
	ECE-405P	Pattern Recognition Lab		2	1

7	ECE-407	Next Generation Networks	4		4
7	ECE-409T	Micro-electromechanical Systems (MEMS) and Sensors	3		3
	ECE-409P	Micro-electromechanical Systems (MEMS) and Sensors Lab		2	1
7	ECE-411T	Fuzzy Logic and Neural Networks	3		3
	ECE-411P	Fuzzy Logic and Neural Networks Lab		2	1
7	ECE-413T	Ad hoc and Sensor Networks	3		3
	ECE-413P	Ad hoc and Sensor Networks Lab		2	1
7	ECE-415	Engineering Optimization	4		4
7	ECE-417T	Optoelectronics Devices	3		3
	ECE-417P	Optoelectronics Devices Lab		2	1
7	ECE-435T	Logic Design and Analysis using Verilog	3		3
	ECE-435P	Logic Design and Analysis using Verilog Lab		2	1
Semester	Paper Code	PCE – 5 (Choose Any One)	L	P	Credits
7	ECE-419T	Low Power VLSI Design	3		3
	ECE-419P	Low Power VLSI Design Lab		2	1
7	ECE-421T	Medical Image Processing, Analysis and Reconstruction	3		3
	ECE-421P	Medical Image Processing, Analysis and Reconstruction Lab		2	1
7	ECE-423T	Network Security and Cryptography	3		3
	ECE-423P	Network Security and Cryptography Lab		2	1
7	ECE-425	Real Time Operating Systems	4		4
7	ECE-427T	Smart Antennas	3		3
	ECE-427P	Smart Antennas Lab		2	1
7	ECE-429T	Introduction to Internet of Things	3		3
	ECE-429P	Introduction to Internet of Things Lab		2	1
7	ECE-431T	Nature Inspired Biological Optimization Techniques	3		3
	ECE-431P	Nature Inspired Biological Optimization Techniques Lab		2	1
7	ECE-433	Introduction to Robotics Engineering	4		4

Note:

1. An elective shall be offered to the student for each PCE group (That is for PCE-1, PCE-2, etc.) 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. At least two elective per PCE group must be offered to the students of the major discipline.

2. 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 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 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 150 (for lateral entry students it shall be at least 102 credits) 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. **The degree shall be awarded only after the fulfilment of all requirements of the Scheme and Syllabus of Examinations and the applicable Ordinance.**
5. (a) The students shall undergo the following group of Courses / Papers as enumerated in the scheme (**For the students admitted in the First Year / First Semester**).

Group	Semester (Credits)							Total Credits	Mandatory Credits
	I & II	III	IV	V	VI	VII	VIII		
BS	24		5					29	14
HS/MS	6	2	2	2	6	2		20	10
ES	20	5						25	15
PC		19	19	24		4	20	86	76
PCE					12	8		20	16
EAE/OAE					8	12		20	16
Total	50	26	26	26	26	26	20	200	147

TABLE 1: Distribution of Credits (Project / Internship credits are 25 out of the 86 credits for Programme Core (PC) credits, while extra-curricular activities credits are 2 out of 20 credits for Humanities / Management / Social Science Group (HS/MS)) . This table is for students admitted in the First Year / First Semester of the Degree Programme.

(b) The students admitted as Lateral Entry shall undergo the following group of Courses / Papers as enumerated in the scheme.

Group	Semester (Credits)						Total Credits	Mandatory Credits
	III	IV	V	VI	VII	VIII		
BS		5					5	0
HS/MS	2	2	2	6	2		14	7
ES	5						5	0
PC	19	19	24		4	20	86	76
PCE				12	8		20	16
EAE/OAE				8	12		20	16
Total	26	26	26	26	26	20	150	115

TABLE 2: Distribution of Credits (Project / Internship credits are 25 out the 86 credits for Programme Core (PC) credits, while extra-curricular activities credits are 2 out of 14 credits for Humanities / Management / Social Science Group (HS/MS)) This table is for students admitted as Lateral Entry Students in the Second Year / Third Semester of the Degree Programme.

- Mandatory Credits specify the number of credits from each subject group to be mandatorily acquired by the student for the award of the degree, 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 115, 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 11 and 12 also.
- 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 11 and 12 also.**
- The students may take 5 subjects from EAE / OAE groups. The open electives of the OAE group of courses may also 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 institute 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 institution for onwards transfer to the Examination Division. The Examinations Division 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 minor specialization.** The degree to the student on fulfilment of other requirements for such cases shall be through **clause 12.b. or 12.c.**

These MOOC courses taken by the students, if allowed by the APC of the institute 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.

- 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, this means, the student must submit the result of such papers on or before 15th July of the Admission Year plus 4 years.

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 institution 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 Institute. 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 Institute 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 Institute, then transferred to the Examination Division, shall be notified by the Examination Division of the University, and a separate marksheets shall be issued by the Examination Division. 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 13 also.**

10. Maximum Credits is at least 200 (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 150 (Table 2). **See clause 8 also.**

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

11. Minimum Credits required to be earned is atleast 180 (out of the 200 non Honours papers credits, see clause 10 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 135 (out of the 150 non Honours papers credits, see clause 10 also). See clause 6 also.

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

- a. The students shall be awarded one minor specialization, one from EAE/OEA route under the following conditions:
 - i. The student has earned the mandatory credits as defined in Table 1 or Table 2 (as applicable) and clause 6.
 - ii. The student earns 20 credits from one group of EAE / OAE courses offered as a minor specialization by the institute.
 - iii. In addition, the total credits (including the above specified credits) earned by the student is atleast as **specified in clause 11.**

The degree nomenclature of the degree shall be as: ***“Bachelor of Technology in Electronics and Communications Engineering with Minor Specializations in <concerned EAE/OAE discipline>”***; if criteria / **point 9** is not satisfied for Honours. Otherwise, if criteria / **point 9** is met, then the degree shall be an Honours degree and the nomenclature shall be as: ***“Bachelor of Technology in Electronics and Communications Engineering with Minor Specializations in <concerned EAE/OAE discipline>”***

(Honours)”, if in addition to **point 12.a.i, 12.a.ii, and 12.a.iii,** the student fulfils the criteria for Honours as specified at **point 9.**

- b. The students shall be awarded the degree without any minor specialization under the following conditions:
 - i. The student has earned the mandatory credits as defined in **Table 1** or **Table 2** (as applicable) and **clause 6.**
 - ii. In addition, the total credits (including the above specified credits) earned by the student is atleast as specified in **clause 11.**

The degree nomenclature of the degree shall be as: **“Bachelor of Technology in Electronics and Communications Engineering”;** if criteria / **point 9** is not satisfied for Honours. Otherwise, if criteria / **point 9** is met, then the degrees shall be an Honours degree and the nomenclature shall be as: **“Bachelor of Technology in Electronics and Communications Engineering (Honours)”**, if in addition to **point 12.b.i and 12.b.ii,** the student fulfils the criteria for Honours as specified at **point 9.**

- c. If the student does not fulfil any of the above criterions (**point 12.a, or 12.b**), if the student earns at least the minimum credits specified in clause 11 (disregarding the mandatory credits clause of **Table 1** or **Table 2 (as applicable)** and **Clause 6**), then the student shall be award the degree as **“Bachelor of Technology in Electronics and Communications Engineering”**. Such students shall not be eligible for the award of an Honours degree. Though, if credits are accumulated through MOOCs as per **clause 9**, the same shall be reflected in the marksheets of the students.
13. **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 year of the batch from the year of admission.** No Honours shall be conferred if the degree requirements are not completed in the minimum duration.
 14. **Pass marks in every paper shall be 40.**
 15. **Grading System shall be as per Ordinance 11 of the University.**
 16. The Programme Core Electives (PCE) shall be specific to a major discipline, minor specializations and papers for EAE shall be defined by the school defining the syllabus for the particular areas and minor specializations and papers for OAE shall be defined by the schools defining the elective streams.
 17. **Minor specialization in non-engineering disciplines may be offered under the aegis of the other schools (provided the individual institutions are offering programmes under the aegis of the school offering the non-engineering minor specialization). The minor specialization framework of 20 credits has to be offered within the framework of the current Scheme of Studies of the primary / major discipline.**
 18. The institution shall offer atleast two elective groups out of the emerging area / open area for students of each major discipline. The emerging area / open electives can also be offered as standalone papers not forming a part of any elective groups also. The institute 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 institute, 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 / primary discipline for which the paper / group is to be offered. The APC of the department / institute may define a maximum number of students allowed to register for a paper as an elective (EAE / OAE).
 19. The institution shall offer atleast two elective papers from each program core elective group for students of each major / primary discipline. The institute shall decide the individual papers to be offered as electives (PCE) based on the availability of infrastructure and faculty. From the papers offered by the institute, an elective paper 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 / primary discipline for which the paper is to be offered. The APC of the department / institute may define a maximum number of students allowed to register for a paper as an elective (PCE).
 20. Teachers of the other department(s), as and when deputed by their department, for teaching the students enrolled in programmes offered by the department offering the programme shall be a part of the Academic Programme Committee of the discipline. 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 department offering the programme of study. Similarly, the guest faculty, the visiting faculty and the Contract / Ad Hoc faculty as and when deputed to teach students of a particular department shall form a part of APC of the department.

21. The Paper IDs will be generated / issued / assigned by the Examination Division of the University.

22. The medium of instructions shall be English.

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.

**Syllabus of 2nd Year Papers
(3rd Semester for Lateral Entry Students only)**

Paper Code(s): BC-181	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 (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 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-183	L / P
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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 (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 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 Language 'C'* by American National Standards Institute, Information Technology Industry Council, 1990 (C89).

Syllabus of 2nd Year Papers

Paper Code(s): ES-201	L	P	C
Paper: Computational Methods	4	-	4

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end 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 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 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-eighth 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. E Balagurusamy "Numerical Methods" McGraw Hill Education (2017).

Paper Code(s): HS-203	L	P	C
Paper: Indian Knowledge System	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:

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 the Indian knowledge System.
2. To understand the foundational concepts for science and technology.
3. To understand the ancient Indian mathematics and astronomy.
4. To understand the ancient Indian engineering and technology.

Course Outcomes (CO)

- CO 1** Ability to understand the Indian knowledge System.
- CO 2** Ability to understand and apply foundational concepts for science and technology.
- CO 3** Ability to understand and apply ancient Indian mathematics and astronomy
- CO 4** Ability to understand ancient Indian engineering and technology.

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
CO 2	-	-	-	-	-	3	-	-	-	2	-	2
CO 3	3	3	-	-	-	-	-	-	-	-	-	2
CO 4	3	3	-	-	-	-	-	-	-	-	-	2

UNIT-I

Indian Knowledge System (IKS) - An Introduction:

Overview of IKS - Importance of Ancient Knowledge; Defining IKS; The IKS Corpus – A Classification Framework; Chaturdaśa-Vidyāsthāna; History of IKS, Some unique aspects of IKS;
The Vedic Corpus – Introduction to Vedas; The Four Vedas and their divisions; Vedāngas; Vedic Life;
Philosophical Systems – Indian Philosophical Systems; Vedic Schools of Philosophy; Non-Vedic Philosophical Systems; Wisdom through the Ages – Purāṇas, Itihāsa as source of wisdom, Rāmāyana, Mahābhārata, Niti-śāstras, Subhāssitas.

UNIT-II

Foundational Concepts for Science and Technology:

Linguistics - Components of Language; Pāṇini's work on Sanskrit Grammar; Phonetics in Sanskrit; Patterns in Sanskrit Vocabulary; Computational Concepts in Astādhyāyī, Logic for Sentence Construction; Importance of Verbs; Role of Sanskrit in Natural Language Processing

Number System and Units of Measurement – Number System in India; Salient Features of the Indian Numeral System; Unique approaches to represent numbers; Measurements for Time, Distance and Weight; Pingala and the Binary System

Knowledge: Framework and Classification – The Knowledge Triangle; Prameya; Pramāna; Samśaya; Framework for establishing Valid Knowledge

UNIT-III

Mathematic and Astronomy in IKS:

Mathematics – Unique aspects of Indian Mathematics; Great Mathematicians and their Contributions; Arithmetic; Geometry; Trigonometry; Algebra; Binary Mathematics and Combinatorial Problems in Chandah-śāstra of Pingala, Magic Squares in India

Astronomy - Unique aspects of Indian Astronomy; Historical Development of Astronomy in India; The Celestial Coordinate System; Elements of the Indian Calendar; Āryabhatīya and the Siddhāntic Tradition; Pancānga; Astronomical Instruments; Jantar Mantar of Rājā Jai Singh Sawai

UNIT - IV

Engineering and Technology in IKS:

Engineering and Technology: Metals and Metalworking – The Indian S & T Heritage; Mining and Ore Extraction; Metals and Metalworking Technology; Iron and Steel in India; Lost wax casting of Idols and Artefacts; Apparatuses used for Extraction of Metallic Components

Engineering and Technology: Other Applications – Literary sources for Science and Technology; Physical Structures in India; Irrigation and Water Management; Dyes and Painting Technology; Surgical Techniques; Shipbuilding; Sixty-four Art Forums; Status of Indigenous S & T

Textbook(s):

1. B. Mahadevan, Vinayaka Rajat Bhat & Nagendra Pavana R.N., “Introduction to Knowledge System: Concepts and Applications” PHI (2022).

References:

1. C.M Neelakandhan & K.A. Ravindran, “Vedic Texts and The Knowledge Systems of India”, Sri Sankaracharya University of Sanskrit, Kalady (2010).
2. P.P. Divakaran, “The Mathematics of India: Concepts, Methods, Connections”, Springer (2018)
3. C.A. Sharma, “Critical Survey of Indian Philosophy”, Motilal Banarasidass Publication (1964)
4. G. Huet, A. Kulkarni & P. Scharf, “Sanskrit Computational Linguistics”, Springer (2009).
5. A.K. Bag, “History of Technology in India”, Indian National Science Academy, Vol 1, (1997)

Paper Code(s): ECC-205	L	P	C
Paper: Signals and Systems	3	-	3

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end 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 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 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.

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(s): ECC-207	L	P	C
Paper: Digital Logic and Computer Design	4	-	4

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end 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 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 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(s): ECC-209	L	P	C
Paper: Analog Communication	4	-	4

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end 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 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 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
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 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.

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 Education, 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(s): ECC-211	L	P	C
Paper: Analog Electronics – I	4	-	4

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end 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 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 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
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

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(s): ES-251	L	P	C
Paper: Computational Methods Lab	-	2	1

Marking Scheme:

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

Instructions:

1. The course objectives and course outcomes are identical to that of (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 under intimation to the office of the Head of Department / Institution in which the paper is being offered from the list of practicals below. Atleast 10 experiments must be performed by the students, they may be asked to do more. Atleast 5 experiments must be from the given list.

Implementation to be done in C/C++

1. Program for finding roots of $f(x)=0$ Newton Raphson method.
2. Program for finding roots of $f(x)=0$ by bisection method.
3. Program for finding roots of $f(x)=0$ by secant method.
4. To implement Langrange's Interpolation formula.
5. To implement Newton's Divided Difference formula.
6. Program for solving numerical integration by Trapezoidal rule
7. Program for solving numerical integration by Simpson's 1/3 rule
8. To implement Numerical Integration Simpson 3/8 rule.
9. Inverse of a system of linear equations using Gauss-Jordan method.
10. Find the Eigen values using Power method.
11. Program for solving ordinary differential equation by Runge-Kutta Method.

Paper Code(s): ECC-253	L	P	C
Paper: Digital Logic and Computer Design Lab	-	2	1

Marking Scheme:

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

Instructions:

1. The course objectives and course outcomes are identical to that of (Digital Logic and Computer Design) 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 Head of Department / Institution in which the paper is being offered from the list of practicals below. Atleast 10 experiments must be performed by the students, they may be asked to do more. Atleast 5 experiments must be from the given list.

1. Design and implementation of adders and subtractors using logic gates.
2. Design and implementation of 4-bit binary adder/subtractor.
3. Design and implementation of multiplexer and demultiplexer.
4. Design and implementation of encoder and decoder.
5. Construction and verification of 4-bit ripple counter and Mod-10/Mod-12 ripple counter.
6. Design and implementation of 3-bit synchronous up/down counter.
7. Design and computer architecture: Design a processor with minimum number of instructions, so that it can do the basic arithmetic and logic operations.
8. Write an assembly language code in GNUsim8085 to implement data transfer instruction.
9. Write an assembly language code in GNUsim8085 to store numbers in reverse order in memory location.
10. Write an assembly language code in GNUsim8085 to implement arithmetic instruction.
11. Write an assembly language code in GNUsim8085 to add two 8 bit numbers.
12. Write an assembly language code in GNUsim8085 to find the factorial of a number.
13. Write an assembly language code in GNUsim8085 to implement logical instructions.
14. Write an assembly language code in GNUsim8085 to implement stack and branch instructions.

Paper Code(s): ECC-255	L	P	C
Paper: Analog Communications Lab	-	2	1

Marking Scheme:

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

Instructions:

1. The course objectives and course outcomes are identical to that of (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 under intimation to the office of the Head of Department / Institution in which the paper is being offered from the list of practicals below. Atleast 10 experiments must be performed by the students, they may be asked to do more. Atleast 5 experiments must be from the given list.

1. Generation of DSB-SC AM signal using balanced modulator.
2. To study amplitude demodulation by linear diode detector
3. Generation of SSB AM signal.
4. To study envelop detector for demodulation of AM signal and observe diagonal peak clipping effect.
5. To generate FM signal using voltage controlled oscillator.
6. To generate a FM Signal using Varactor & reactance modulation.
7. Detection of FM Signal using PLL & foster seelay method.
8. To study Super heterodyne AM receiver and measurement of receiver parameters viz.sensitivity, selectivity & fidelity.
9. To study Pre-emphasis and De-emphasis in FM.
10. Generation of Phase modulated and demodulated signal.

Paper Code(s): ECC-257	L	P	C
Paper: Analog Electronics – I Lab	-	2	1

Marking Scheme:

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

Instructions:

1. The course objectives and course outcomes are identical to that of (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 under intimation to the office of the Head of Department / Institution in which the paper is being offered from the list of practicals below. Atleast 10 experiments must be performed by the students, they may be asked to do more. Atleast 5 experiments must be from the given list.

1. To plot V-I characteristics of a semiconductor diode & Calculate Static & Dynamic Resistance.
2. To Study the Reverse characteristics of Zener diode
3. To Study the Rectifier circuit (With and Without Filter).
 - a. Half Wave Rectifier
 - b. Centre Tapped Rectifier.
 - c. Bridge Rectifier.
4. Plotting input and output characteristics and calculation of parameters of a transistor in common emitter configuration.
5. Transistor biasing circuit. Measurement of operating point (I_c and V_{ce}) for a :-
 - a. fixed bias circuit
 - b. potential divider biasing circuit.
6. Plot the FET characteristics & MOSFET characteristics.
7. To measure the overall gain of two stages at 1 KHz and compare it with gain of 1st stage, Also to observe the loading effect of second stage on the first stage
8. To plot the frequency response curve of two stage amplifier.
9. To study Emitter follower circuit & measurement of voltage gain and plotting of frequency response Curve.
10. Feedback in Amplifier. Single stage amplifier with and without bypass capacitor, measurement of voltage gain and plotting the frequency response in both cases.
11. To determine and plot firing characteristics of SCR by varying anode to cathode voltage, and varying gate current.
12. To note the wave shapes and voltages at various points of a UJT relaxation oscillator circuit.
13. For Transistorized push pull amplifier Measurement of optimum load, maximum undistorted power (by giving maximum allowable signal) Efficiency and percentage distortion factor.
14. To study the characteristics of single tuned & double tuned amplifier.

Paper Code(s): ECC-259	L	P	C
Paper: Signals and Systems Lab	-	2	1

Marking Scheme:

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

Instructions:

1. The course objectives and course outcomes are identical to that of (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 under intimation to the office of the Head of Department / Institution in which the paper is being offered from the list of practicals below. Atleast 10 experiments must be performed by the students, they may be asked to do more. Atleast 5 experiments must be from the given list.

1. Introduction to MATLAB and its basic commands.
2. Plot unit step, unit impulse, unit ramp, exponential, parabolic functions and sinusoidal signals
3. Plot the linear convolution of two sequences.
4. Plot the correlation of two sequences.
5. Plot the magnitude and phase spectra of a signal using Fourier transforms.
6. Plot the magnitude and phase spectrum of signal using Fourier series.
7. Find out the Z transform of a signal and check the stability using pole zero location.
8. Plot the spectra of ideally sampled signal w.r.t. sampling of Discrete time signals.
9. Verification of few properties of Fourier transform.
10. Evaluate the DTFS coefficients of a signal and plot them.
11. Plot the step response for any impulse response entered by user.

Paper Code(s): BS-202	L	P	C
Paper: Probability, Statistics and Linear Programming	4	-	4

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end 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 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 solving linear programming problems. |

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 formulate and solve linear programming 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	-	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 Multiplication and Total Probability Rules, Independence, Bayes' Theorem, Random Variables.

Discrete and Continuous Random Variables and Distributions: Probability Distributions and Probability Mass / density Functions, Cumulative Distribution Functions, Mean and Variance of a Random Variable, Discrete and continuous Uniform Distribution, Binomial Distribution, Geometric and Negative Binomial Distributions, 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.

Unit II

Joint Probability Distributions for Two Random Variables, Conditional Probability Distributions and Independence, Joint Probability Distributions for Two Random Variables, Covariance and Correlation, Common Joint Distributions, Linear Functions of Random Variables, 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

Limit Theorem without proof, General Concepts of Point Estimation, Methods of Point Estimation, Statistical Intervals for a Single Sample.

Unit III

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

Unit IV

Linear Programming: Introduction, formulation of problem, Graphical method, Canonical and Standard form of LPP, Simplex method, Duality concept, Dual simplex method, Transportation and Assignment problem.

Textbooks:

1. *Applied Statistics and Probability for Engineers* by Douglas G. Montgomery and Runger, Wiley, 2018
2. *Linear Programming* by G. Hadley, Narosa, 2002

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 Engineering*, William W. Hines, Douglas C. Montgomery, David M. Goldman, and Connie M. Borror, Wiley, 2003.
6. *Operations Research: An Introduction* by Hamdy A. Taha, Pearson, 10th Edition, 2016

Paper Code(s): HS-204	L	P	C
Paper: Technical Writing	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:

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 improve grammar and sentence structure and build vocabulary.
2:	To understand how to write different types of writings.
3:	To understand how to compose different types of business documents.
4:	To understand business ethics and develop soft skills.

Course Outcomes (CO):

CO1:	Ability to improve grammar and sentence structure and build vocabulary.
CO2:	Ability to write different types of writings with clarity.
CO3:	Ability to write different types of business documents.
CO4:	Ability to apply business ethics and enhance personality.

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	-	-	-	3	-	-
CO2	-	-	-	-	-	1	-	-	-	3	-	-
CO3	-	-	-	-	-	1	-	-	-	3	-	-
CO4	-	-	-	-	-	1	-	3	-	3	-	-

Unit I

Grammar and Vocabulary--- Types of sentences (simple, complex and compound) and use of connectives in sentences, Subject-verb agreement, Comprehension, Synonyms and Antonyms, Homophones and Homonyms, Word Formation: Prefixes and Suffixes, Indianism, Misappropriation and Redundant Words, Question Tags and Short Responses.

Unit II

Writing Styles -- Expository, Explanatory, Descriptive, Argumentative and Narrative.

Precis writing, Visual Aids in Technical Writing, Plagiarism and Language Sensitivity in Technical Writing, Dialogue Writing, Proposals: Purpose and Types.

Unit III

Letters at the Workplace—letter writing: Request, Sales, Enquiry, Order and Complaint.

Job Application---Resume and Cover letter, Difference between Resume and CV, Preparation for Interview.

Meeting Documentation--- Notice, Memorandum, Circular, Agenda, Office Order and Minutes of meeting, Writing Instructions.

Unit IV

Ethics and Personality Development-----The Role of Ethics in Business Communication—Ethical Principles, Time Management, Self-Analysis through SWOT and JOHARI Window, Emotional Intelligence and Leadership Skills, Team Building, Career Planning, Self Esteem.

Textbook:

1. Meenakshi Raman and Sangeeta Sharma, Technical Communication: Principles and Practice, Oxford University Press, New Delhi (2015).

References:

1. Sanjay Kumar and Pushp Lata, Communication Skills, Oxford University Press, New Delhi (2015).
2. Herta A Murphy, Herbert W Hildebrandt, Jane P Thomas, Effective Business Communication, Tata McGraw-Hill, Hill Publishing Company Limited, Seventh Edition.

Paper Code(s): EEC-206	L	P	C
Paper: Network Analysis and Synthesis	3	-	3

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end 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 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 network theorem in AC circuit. |
| 2. | To understand mathematical modelling of circuit. |
| 3. | To understand two port parameter and transfer function. |
| 4. | To understand realization of passive network and filter. |

Course Outcome (CO):

- | | |
|------|--|
| CO 1 | Ability to apply network theorems in AC circuit. |
| CO 2 | Ability to determine transient response of circuit. |
| CO 3 | Ability to determine two port parameter of circuit. |
| CO 4 | Ability to realize the circuit from their transfer function. |

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

Application of Mesh current analysis, Node voltage analysis and Network theorems in AC circuits.
Graph theory: concept of tree, tie set matrix, cut set matrix and application to solve electric networks.

UNIT-II

Periodic waveforms and signal synthesis, properties and applications of Laplace transform of complex waveform. System modeling in terms of differential equations and transient response of R, L, C, series and parallel circuits for impulse, step, ramp, sinusoidal and exponential signals by classical method and using Laplace transform.

UNIT-III

Two port networks – Introduction of two port parameters and their interconversion, interconnection of two 2-port networks, open circuit and short circuit impedances and ABCD constants, relation between image impedances and short circuit and open circuit impedances. Network functions, their properties and concept of transform impedance, Hurwitz polynomial.

UNIT IV

Positive real function and synthesis of LC, RC, RL Networks in Foster's I and II, Cauer's I & II forms, Introduction of passive filter and their classification, frequency response, characteristic impedance of low pass, high pass, Band Pass and Band reject prototype section.

Textbook(s):

1. W H Hayt "Engineering Circuit Analysis" TMH Eighth Edition
2. Kuo, "Network analysis and synthesis" John Wiley and Sons, 2nd Edition.

Reference Books:

1. S Salivahanan "Circuit Theory" Vikas Publishing House 1st Edition 2014
2. Van Valkenburg, "Network analysis" PHI, 2000.
3. Bhise, Chadda, Kulshreshtha, "Engineering network analysis and filter design" Umesh publication, 2000.
4. D. R. Choudhary, "Networks and Systems" New Age International, 1999
5. Allan H Robbins, W.C.Miller "Circuit Analysis theory and Practice" Cengage Learning Pub 5th Edition 2013
6. Bell "Electric Circuit" Oxford Publications 7th Edition.

Paper Code(s): ECC-210 / ECC-313	L	P	C
Paper: Microprocessors and Microcontrollers	3	-	3

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end 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 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 about architecture and instruction set of 8085 microprocessor so that students can implement 8085 assembly language programs.
2.	To impart knowledge about architecture and instruction set of 8086 microprocessor so that students can implement 8086 assembly language programs.
3.	To impart knowledge about interfacing of 8255, 8254/8253, 8251, 8259 and I/O devices with 8086 microprocessor.
4.	To impart knowledge about architecture and operation of 8051 microcontroller and their interfacing with memory and I/O.

Course Outcome (CO):

CO 1	Ability to understand and distinguish the use of different 8085 instructions, timing diagram, addressing modes, interrupts and apply those instructions for implementing assembly language programs.
CO 2	Ability to analyse the timing diagrams, understand its instruction set, assess its memory organisation and will implement the assembly language programs , interfacing of memory with 8086 successfully
CO 3	Understand and realize the interfacing of 8255 (PPI), 8254/8255 (PIT), 8251 (USART), 8259 (PIC), 8279 (Keyboard and display), Sample and hold circuit, DAC/ADC, LCD & Stepper motor with 8086 microprocessor.
CO 4	Understand the architecture and operation of 8051 microcontroller and ability to use them for designing various applications based on 8051 by implementing the elaborate instruction set.

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	1	-	-	-	-	1
CO 2	3	3	3	2	3	1	1	-	-	-	-	1
CO 3	3	3	3	2	3	1	1	-	1	-	-	1
CO 4	3	3	3	2	3	1	1	-	-	-	-	1

UNIT - I

Introduction to Microprocessor Systems: Architecture and PIN diagram of 8085, Timing Diagram, memory organization, addressing modes, interrupts. Assembly Language Programming.

UNIT – II

8086 Microprocessor: 8086 Architecture, difference between 8085 and 8086 architecture, generation of physical address, PIN diagram of 8086, Minimum Mode and Maximum mode, Bus cycle, Memory Organization, Memory

Interfacing, Addressing Modes, Assembler Directives, Instruction set of 8086, Assembly Language Programming, Hardware and Software Interrupts.

UNIT – III

Interfacing of 8086 with 8255, 8254/8253, 8251, 8259: Introduction, Generation of I/O Ports, Programmable Peripheral Interface (PPI)-Intel 8255, Sample-and-Hold Circuit and Multiplexer, Keyboard and Display Interface, Keyboard and Display Controller (8279), Programmable Interval timers (Intel 8253/8254), USART (8251), PIC (8259), DAC, ADC, LCD, Stepper Motor.

UNIT – IV

Overview of Microcontroller 8051: Introduction to 8051 Micro-controller, Architecture, Memory organization, Special function registers, Port Operation, Memory Interfacing, I/O Interfacing, Programming 8051 resources, interrupts, Programmer's model of 8051, Operand types, Operand addressing, Data transfer instructions, Arithmetic instructions, Logic instructions, Control transfer instructions, Timer & Counter Programming, Interrupt Programming.

Textbook(s):

1. Muhammad Ali Mazidi, "Microprocessors and Microcontrollers", Pearson, 2006
2. Douglas V Hall, "Microprocessors and Interfacing, Programming and Hardware" Tata McGraw Hill, 2006.
3. Ramesh Gaonkar, "MicroProcessor Architecture, Programming and Applications with the 8085", PHI

References:

1. Muhammad Ali Mazidi, Janice GillispieMazidi, Rolin D. MCKinlay "The 8051 Microcontroller and Embedded Systems", 2nd Edition, Pearson Education 2008.
2. Kenneth J. Ayala, "The 8086 Microprocessor: Programming & Interfacing The PC", Delmar Publishers, 2007.
3. A K Ray, K M Bhurchandi, "Advanced Microprocessors and Peripherals", Tata McGraw Hill, 2007.
4. Vaneet Singh, Gurmeet Singh, "Microprocessor and Interfacing", Satya Prakashan, 2007.

Paper Code(s): ECC-212	L	P	C
Paper: Digital Communications	3	-	3

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end 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 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 importance of information theory in digital communication and various PCM modulation.
2. To understand the various 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 need of digital communication 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. Sampling Theory, PAM, Quantization characteristics, PCM, DPCM, Delta Modulation, Adaptive 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 filter receiver, Intersymbol Interference, Signal Design for Zero ISI, Raised cosine and square root raised cosine spectrum, Eye pattern, Adaptive equalization, signalling over multiple baseband channel, Fading Channels: Propagation effects, Jakes Model,

Statistical Characteristics of wideband wireless channel, Diversity techniques, MIMO, MIMO Capacity for channel known at receiver, OFDM, Spread-spectrum signals.

UNIT IV

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. Error Control Coding: Introduction, Error Control using forward correction, Linear Block Code, Cyclic Codes, Convolutional Codes.

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(s): ECC-214	L	P	C
Paper: Analog Electronics – II	3	-	3

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end 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 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 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

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(s): ECC-213 / ECC-216	L	P	C
Paper: Electromagnetic Field Theory	3	-	3

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end 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 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 the basic laws of electrostatics.
2. To impart the knowledge of electromagnetics.
3. To impart the knowledge of solution to real life plan wave problems for various boundary conditions.
4. To impart the knowledge of characteristics and impedance transformation on high frequency transmission lines.

Course Outcomes (CO)

- | | |
|-------------|---|
| CO 1 | Ability to understand the basic laws of electrostatics. |
| CO 2 | To understand the basic laws of electromagnetics. |
| CO 3 | Ability to provide solution of real life plan wave problems for various boundary conditions. |
| CO 4 | To understand the characteristics and impedance transformation on high frequency transmission lines |

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	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: Review of scalar and vector field, Dot and Cross products, Coordinate Systems-Cartesian, cylindrical and spherical. Vector representation of surface, Physical interpretation of gradient divergence and curl, Transformation of vectors in different co-ordinate systems, dirac-delta function.

Electrostatics: Electric field due to point-charges, line charges and surface charges, Electrostatic potential, Solution of Laplace and Poisson's equation in one dimension, M-method of image applied to plain boundaries, field mapping and conformal transformation, Electric flux density, Boundary conditions. Capacitance: calculation of capacitance for simple rectangular, cylindrical and spherical geometries, Electrostatic energy.

[T1,T2]

UNIT II

Magnetostatics : Magnetic Induction and Faraday's Law, Magnetic Flux Density, Magnetic Field Strength H, Ampere, Gauss Law in the Differential Vector Form, Permeability, Energy Stored in a Magnetic Field, Ampere's Law for a Current Element, Volume Distribution of Current , Ampere's Law Force Law, Magnetic Vector Potential, The Far Field of a Current Distribution, Maxwell's Equations: The Equation of Continuity for Time Varying Fields, Inconsistency of Ampere's Law, Maxwell's Equations, Conditions at a Boundary Surface.

[T1,T2]

UNIT III

Electromagnetic Waves: Continuity equations, Displacement current, Maxwell's equation, Boundary conditions, Plane wave equation and its solution in conducting and non-conducting media, Phasor notation, Phase velocity, Group velocity, Depth of penetration, Conductors and dielectrics, Impedance of conducting medium. Polarization, Reflection and refraction of plane waves at plane boundaries, Poynting vectors, and Poynting theorem.

[T1,T2]

UNIT IV

Transmission Lines: Transmission line equations, Characteristic impedance, Distortion-less lines, Input impedance of a lossless line, computation of primary and secondary constants, Open and Short circuited lines, Standing wave and reflection losses, Impedance matching, Loading of lines, Input impedance of transmission lines, RF lines, Relation between reflection coefficient and voltage standing wave ratio (VSWR), Lines of different lengths – $\lambda/2$, $\lambda/4$, $\lambda/8$ lines, Losses in transmission lines, Smith chart and applications, impedance matching Single stub, Double stub.

[T1,T2]

Textbook(s):

1. Matthew N. O. Sadiku, "Elements of Electromagnetics", Oxford University Press
2. E. C. Jordan, K. G. Balmain, "Electromagnetic Waves & Radiation System" PHI – 2nd Edition

Reference Books:

1. William H. Hayt, "Engineering Electromagnetics", TMH
2. J.D. Kraus, "Electromagnetics", TMH
3. David K. Cheng, "Field and Wave Electromagnetic", 2nd Edition, Pearson Education Asia, 2001
4. John R. Reitz, "Foundations of Electromagnetic Theory". Pearson

Paper Code(s): BS-252	L	P	C
Paper: Probability, Statistics and Linear Programming Lab	-	2	1

Marking Scheme:

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

Instructions:

1. The course objectives and course outcomes are identical to that of (Probability, Statistics and Linear Programming) 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 Head of Department / Institution in which the paper is being offered from the list of practicals below. Atleast 10 experiments must be performed by the students, they may be asked to do more. Atleast 5 experiments must be from the given list.

Implementation to be done in MATLAB or in equivalent software.

1. Installation of Scilab and demonstration of simple programming concepts like matrix multiplication (scalar and vector), loop, conditional statements and plotting.
2. Program for demonstration of theoretical probability limits.
3. Program to plot normal distributions and exponential distributions for various parametric values.
4. Fitting of binomial distributions for given n and p.
5. Fitting of binomial distributions after computing mean and variance.
6. Fitting of Poisson distributions for given value of lambda.
7. Fitting of Poisson distributions after computing mean.
8. Fitting of normal distribution when parameters are given.
9. Fitting of linear regression line through given data set and testing of goodness of fit using mean error.
10. Fitting of Multiple Linear Regression (MLR) curve through given data set and testing of goodness of fit using mean error.
11. Solve a LPP of three variable using Simplex Method.
12. Solve a Transportation problem of three variables.
13. Solve an Assignment problem of three variables.

Paper Code(s): ECC-256 / ECC-363	L	P	C
Paper: Microprocessors and Microcontrollers Lab	-	2	1

Marking Scheme:

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

Instructions:

1. The course objectives and course outcomes are identical to that of (Microprocessors and Microcontrollers) 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 Head of Department / Institution in which the paper is being offered from the list of practicals below. Atleast 10 experiments must be performed by the students, they may be asked to do more. Atleast 5 experiments must be from the given list.

1. Write a program to add and subtract two 16-bit numbers with/ without carry using 8086.
2. Write a program to multiply two 8 bit numbers by repetitive addition method using 8086.
3. Write a Program to generate Fibonacci series.
4. Write a Program to generate Factorial of a number.
5. Write a Program to read 16-bit Data from a port and display the same in another port.
6. Write a Program to generate a square wave using 8254.
7. Write a Program to generate a square wave of 10 kHz using Timer 1 in mode 1(using 8051).
8. Write a Program to transfer data from external ROM to internal (using 8051).
9. Design a Minor project using 8086 Microprocessor (Ex: Traffic light controller/temperature controller etc)
10. Design a Minor project using 8051 Micro controller

Paper Code(s): ECC-258	L	P	C
Paper: Digital Communications Lab	-	2	1

Marking Scheme:

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

Instructions:

1. The course objectives and course outcomes are identical to that of (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 under intimation to the office of the Head of Department / Institution in which the paper is being offered from the list of practicals below. Atleast 10 experiments must be performed by the students, they may be asked to do more. Atleast 5 experiments must be from the given list.

1. To Study Sampling Theorem.
2. To Study Pulse Code Modulation.
3. To Study Differential Pulse Code Modulation.
4. To Study Delta Modulation.
5. To Study Adaptive Delta Modulation.
6. To Study Amplitude Shift Keying (ASK) and calculate its S/N ratio and Probability of error.
7. To Study Phase Shift Keying (PSK) and calculate its S/N ratio and Probability of error.
8. To Study frequency Shift Keying (FSK) and calculate its S/N ratio and Probability of error.
9. To Study Differential Phase Shift Keying Modulation (DPSK) and calculate its S/N ratio and Probability of error.
10. To Study Quadrature Phase Shift Keying Modulation (QPSK) and calculate its S/N ratio and Probability of error.
11. To Study Quadrature Amplitude Modulation (QAM) and calculate its S/N ratio and Probability of error.

Paper Code(s): ECC-260	L	P	C
Paper: Analog Electronics – II Lab	-	2	1

Marking Scheme:

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

Instructions:

1. The course objectives and course outcomes are identical to that of (Analog Electronics - 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 Head of Department / Institution in which the paper is being offered from the list of practicals below. Atleast 10 experiments must be performed by the students, they may be asked to do more. Atleast 5 experiments must be from the given list.

1. To study the op-amp (IC 741) as inverting and non-inverting amplifier and calculate its gain.
2. Observe and plot the output Wave shape of Op-Amp R-C differentiating circuits, R-C integrating circuits for square wave input
3. To study the op-amp (IC 741) as adder, subtractor and voltage follower, calculate its output voltage..
4. Construct biased and unbiased series and shunt clipping circuits & combinational clipper circuit for positive and negative peak clipping of a sine wave.
5. To study RC phase shift/Wien Bridge oscillator measurement of frequency and amplitude of oscillations using Op-Amp.
6. To study the waveform of square wave generator using 741 Op-Amp IC.
7. To study the waveform of Schmitt Trigger circuit & Precision Rectifier using 741 OP-AMP IC.
8. To make and test the operations of Monostable Multivibrator circuits using 555 timer.
9. To make and test the operations of Astable Multivibrator circuits using 555 timer.
10. To study the Sallen Key Voltage controlled voltage source active filters.

Paper Code(s): EEC-262	L	P	C
Paper: Network Analysis and Synthesis Lab	-	2	1

Marking Scheme:

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

Instructions:

1. The course objectives and course outcomes are identical to that of (Network Analysis and Synthesis) 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 Head of Department / Institution in which the paper is being offered from the list of practicals below. Atleast 10 experiments must be performed by the students, they may be asked to do more. Atleast 5 experiments must be from the given list.

1. Introduction to MATLAB and its basic commands.
2. Plot unit step, unit impulse, unit ramp, exponential, parabolic functions and sinusoidal signals
3. Study the transient response of series RLC circuit for different types of waveforms on CRO and verify using MATLAB
4. Study the time response of a simulated linear system and verify the unit step and square wave response of first order and second order, type 0,1 system
5. Using MATLAB determine current in various resistors connected in network using mesh current and node voltage analysis.
6. To determine Z and Y parameters of the given two port network.
7. To determine ABCD parameters of the given two port network.
8. To verify Reciprocity Theorem for the given two port network.
9. To determine Hybrid parameters of the given two port network.
10. To design Cascade Connection and determine ABCD parameters of the given two port network.
11. To design Series-Series Connection and determine Z parameters of the given two port network.
12. To design Parallel-Parallel Connection and determine Y parameters of the given two port network.
13. To design Series-Parallel Connection and determine h parameters of the given two port network
14. Study the frequency response of different filter circuits.

Economics for Engineers			
L	P	C	
2			2

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
All	5	HS/MS	HS	HS-301

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end 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 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 explain the basic micro and macro economics concepts.
2. To analyze the theories of production, cost, profit and break even analysis.
3. To evaluate the different market structures and their implications for the behavior of the firm.
4. To apply the basics of national income accounting and business cycles to Indian economy.

Course Outcomes (CO)

CO 1 Analyze the theories of demand, supply, elasticity and consumer choice in the market.

CO 2 Analyze the theories of production, cost, profit and break even analysis.

CO 3 Evaluate the different market structures and their implications for the behavior of the firm.

CO 4 Apply the basics of national income accounting and business cycles to Indian economy.

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	2	1	2	1	-	1	-	1	1	3	1
CO 2	1	2	1	2	1	-	1	-	1	1	3	1
CO 3	1	2	1	2	1	-	1	-	1	1	3	1
CO 4	1	2	1	2	1	-	1	-	1	1	3	1

UNIT-I

Introduction: Economics Definition, Basic economic problems, Resource constraints and welfare maximization. Micro and Macro economics. Production Possibility Curve. Circular flow of economic activities.

Basics of Demand, Supply and Equilibrium: Demand side and supply side of the market. Factors affecting demand & supply. Elasticity of demand & supply – price, income and cross-price elasticity. Market equilibrium price.

UNIT-II

Theory of Consumer Choice: Theory of Utility and consumer's equilibrium. Indifference Curve analysis, Budget Constraints, Consumer Equilibrium.

Demand forecasting: Regression Technique, Time-series, Smoothing Techniques: Exponential, Moving Averages Method

UNIT-III

Cost Theory and Analysis: Nature and types of cost, Cost functions- short run and long run, Economies and diseconomies of scale

Market Structure: Market structure and degree of competition Perfect competition, Monopoly, Monopolistic competition, Oligopoly

UNIT - IV

National Income Accounting: Overview of Macroeconomics, Basic concepts of National Income Accounting

Macro Economics Issues: Introduction to Business Cycle, Inflation-causes, consequences and remedies: Monetary and Fiscal policy.

Textbook(s):

1. H.C. Petersen, W.C. Lewis, Managerial Economics, 4th ed., Pearson Education 2001.

References:

1. S.K. Misra & V. K. Puri, Indian Economy, 38th ed., Himalaya Publishing House, 2020.
2. D.N. Dwivedi, Managerial Economics, 8th Edition, Vikas Publishing house
3. D. Salvatore, Managerial Economics in a Global Economy, 8th ed., Oxford University Press, 2015.
4. S. Damodaran, Managerial Economics, 2nd ed., Oxford University Press, 2010.
5. M. Hirschey, Managerial Economics, 12th ed., Cengage India, 2013.
6. P.A. Samuelson, W.D. Nordhaus, S. Nordhaus, Economics, 18th ed., Tata Mc-Graw Hill, 2006.

Digital Signal Processing			
L	P	C	
4		4	

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
ECE/ICE/EE-VDT/EC-ACT	5	PC	PC	ECC-303

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end 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 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 the basic knowledge of DFT, its properties, FFT and its applications.
2. To impart the knowledge of designing and realization of FIR filters.
3. To impart the knowledge of designing and realization of IIR filters.
4. To impart the knowledge of quantization errors in Digital Signal Processing and the concept of Multirate signal processing.

Course Outcomes (CO)

- | | |
|-------------|--|
| CO 1 | To understand the basic concept of DFT and FFT. |
| CO 2 | To Acquire a clear idea of FIR filter designing techniques and realization methods. |
| CO 3 | To understand the IIR filter designing techniques and realization methods and the stability. |
| CO 4 | To understand the quantization errors in Digital Signal Processing and the concept of Multirate signal processing. |

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	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 Discrete Time Fourier Transform, Z- transform and Discrete Fourier Transform, Properties of the DFT: Periodicity, Linearity and Symmetry properties, Multiplication of two DFTs, concept of circular convolution, computation of circular convolution by graphical and matrix form, relationship between linear convolution and circular convolution, computation of linear convolution from circular convolution, , linear filtering using DFT, aliasing error, filtering of long data sequences – Overlap-Save and Overlap-Add methods

Efficient computation of the DFT: Complexity analysis of direct computation of DFT, Concept of Fast Fourier transformation, Radix-2 computation of FFT using decimation-in-time and decimation-in-frequency algorithms, signal flow graphs, Butterflies, computations of FFT in one place using both algorithms, bit-reversal process, examples for DIT & DIF FFT Butterfly computations

UNIT II

Design & structure of FIR filters: Characteristics of practical frequency-selective filters, Basic concepts of IIR and FIR filters, Gibbs Phenomenon, Symmetric and Anti-symmetric FIR filters, Design of Linear-phase FIR filters using windows- Rectangular, Hamming, Hanning, Bartlett windows, FIR differentiator, FIR Hilbert Transformer. Design of FIR filters using frequency sampling method. Structure for FIR Systems: Direct form, Cascade form and Lattice structures.

UNIT III

Design & Structure of IIR filters: Concept of IIR digital filter, recursive and non-recursive system analog to digital domain transformation- Approximation of derivatives ,impulse invariant method and bilinear transformation and their properties, limitations of bilinear transformation, frequency warping and prewarping, methods to find out the order of IIR filter, mapping of poles and zeroes of filter in analog domain, computation of filter transfer function in analog domain, digital filter realization techniques, procedure to design Butterworth and Chebyshev digital IIR filters. Direct, Cascade, Parallel , Signal Flow graph and transposed structure, Lattice structures, Lattice and Lattice-Ladder Structures, Schur - Cohn stability Test for IIR filters

UNIT IV

Quantization Errors in Digital Signal Processing: Fixed point and floating point representation of numbers, Errors resulting from Rounding and Truncation, Digital Quantization of filter coefficients, Round-off effects in digital filters, Dead Band Effects.

Multirate Digital Signal Processing: Decimation, Interpolation, Sampling rate conversion by a rational factor; Frequency domain characterization of Interpolator and Decimator; Polyphase decomposition, Applications of Multirate signal processing.

Textbook(s):

1. Oppenheim & Schafer, Digital Signal Processing, PHI-latest edition.
2. Proakis and Manolakis, Digital Signal Processing, PHI Publication

Reference Books:

1. S. K. Mitra, Digital Signal Processing, TMH edition 2006
2. Johny. R. Johnson, Introduction to Digital Signal Processing, PHI, Latest edition
3. R.Babu, Digital Signal Processing, Scitech Publication.

Microelectronics			
L	P	C	
3		3	

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
ECE/EE-VDT/EC-ACT	5	PC	PC	ECC-305

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end 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 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 comprehend semiconductor physics, band theory, and material behavior, demonstrating knowledge of semiconductor applications in electronic devices. |
| 2. | To analyze and design analog and digital circuits, exhibiting skills in circuit analysis techniques for complex electronic systems. |
| 3. | To gain practical knowledge of semiconductor fabrication processes, understanding techniques such as lithography, doping, and their impact on device performance. |
| 4. | To use microelectronic components in designing and prototyping electronic systems, integrating devices into applications like integrated circuits, sensors, and communication devices. |

Course Outcomes (CO)

- | | |
|-------------|--|
| CO 1 | Comprehend semiconductor physics, band theory, and material behavior, demonstrating knowledge of semiconductor applications in electronic devices. |
| CO 2 | Ability to analyze and design analog and digital circuits, exhibiting skills in circuit analysis techniques for complex electronic systems. |
| CO 3 | Gain practical knowledge of semiconductor fabrication processes, understanding techniques such as lithography, doping, and their impact on device performance. |
| CO 4 | Ability to use microelectronic components in designing and prototyping electronic systems, integrating devices into applications like integrated circuits, sensors, and communication devices. |

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	1	1	-	-	2	1	2
CO 2	2	3	3	2	3	1	2	-	1	2	2	2
CO 3	2	3	3	2	3	1	2	-	1	2	2	2
CO 4	2	3	3	2	3	1	2	-	1	2	2	2

UNIT I

Introduction to Microelectronics, Overview of Microelectronics Technology, Basic IC Fabrication Processes (Oxidation, Diffusion, Ion Implantation, etc.), Cleanroom Protocols and Safety Measures. CMOS & NMOS process technology. MOS capacitor, device structure & electrical characteristics. MOS under external bias, derivation of threshold voltage equation, enhancement & depletion transistor, MOS device design equations, MOSFET capacitances. MOSFET scaling and various short channel effects, Moore's law, multi-gate MOSFETs, non-conventional MOSFET, technology nodes and ITRS.

UNIT II

CMOS inverter and its DC characteristics, Static & dynamic power dissipation. Rise time, fall time delays, noise margin. Combinational CMOS logic circuits, pass transistor and transmission gate designs, Sequential MOS logic circuits: SR latch, CMOS D latch and edge triggered flip flop. Dynamic CMOS logic circuits: Domino CMOS logic, NORA CMOS logic, Zipper, TSPC.

UNIT III

Current Mirrors and Differential Amplifiers, Operational Amplifiers (Op-Amps) Design: Ideal vs. Practical Models, Frequency Response of Op-Amps, Feedback Topologies (Voltage, Current, and Transconductance Feedback), Voltage Reference Circuits, Linear Voltage Regulators, Switching Voltage Regulators, Stability Analysis and Compensation Techniques.

Unit IV

Static RAM (SRAM) Design: 6T Cell, Read and Write Operations, Dynamic RAM (DRAM) Design: Basic Cell, Refresh Techniques, Flash Memories: NOR and NAND Architectures, Non-Volatile Memories Design: EEPROM, Ferroelectric RAM (FeRAM), MRAM, Low-Power IC Design Techniques, Analog-to-Digital Converters (ADCs), Digital-to-Analog Converters (DACs), Radio-Frequency Integrated Circuits (RFICs): Basics and Applications.

Textbooks:

1. Rabaey, J. M., Chandrakasan, A., & Nikolic, B. (2016). Digital Integrated Circuits: A Design Perspective. Pearson.
2. Razavi, B. (2016). Design of Analog CMOS Integrated Circuits. McGraw-Hill Education.
3. Weste, N. H. E., & Harris, D. (2015). CMOS VLSI Design: A Circuits and Systems Perspective. Pearson.
4. Kang, S. M., & Leblebici, Y. (2016). CMOS Digital Integrated Circuits: Analysis and Design. McGraw-Hill Education.

References:

1. Gray, P. R., Hurst, P. J., Lewis, S. H., & Meyer, R. G. (2001). Analysis and Design of Analog Integrated Circuits. Wiley.
2. Malvino, A. P., & Bates, J. A. (2012). Electronic Principles. McGraw-Hill Education.
3. Sedra, A. S., & Smith, K. C. (2014). Microelectronic Circuits. Oxford University Press.
4. Lee, T. H. (2004). The Design of CMOS Radio-Frequency Integrated Circuits. Cambridge University Press.

Introduction to Control Systems			
L	P	C	
3		3	

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
ECE/EE/EEE/ICE/EE-VDT/ EC-ACT	5	PC	PC	EEC-307

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end 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 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 provide an understanding about the concepts of transfer function and its evaluation.
2. To expose the students to time response of control systems
3. To understand the frequency response of control systems
4. To study compensators and controllers

Course Outcomes (CO)

- | | |
|-------------|---|
| CO 1 | Ability to define, understand various terms related to control system and evaluation of transfer function |
| CO 2 | Ability to apply knowledge of various types of signals in time response of systems |
| CO 3 | Ability to analyse frequency response of systems |
| CO 4 | Ability to design compensators and controllers |

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	1	1	1	1	-	1	3	-	3
CO 2	3	2	1	3	2	1	1	-	1	3	-	1
CO 3	3	2	1	2	3	1	1	-	1	3	-	3
CO 4	3	3	2	1	1	1	1	-	1	3	-	3

UNIT I

Control Systems: Basics & Components Introduction to basic terms, classifications & types of Control Systems, Mathematical modelling of real life systems, block diagrams & signal flow graphs. Transfer function, determination of transfer function using Block diagram reduction techniques and Mason's Gain formula. Control system components: Electrical/ Mechanical/Electromechanical/A.C./D.C. Servo Motors, Stepper Motors, Tacho Generators, Synchros, Magnetic Amplifiers, Servo Amplifiers.

UNIT II

Time: Domain Analysis of real life problems, Time domain performance specifications, transient response of first & second order systems, steady state errors and static error constants in unity feedback control systems, response with P, PI and PID controllers, limitations of time domain analysis.

UNIT III

Frequency Domain Analysis frequency domain specifications and performance of LTI systems, minimum/non minimum phase systems, Polar and inverse polar plots, Logarithmic plots (Bode plots), gain and phase margins, relative stability. Correlation with time domain performance, closed loop frequency responses from open loop response. Limitations of frequency domain analysis.

UNIT IV

Stability & Compensation Techniques Concepts, absolute, asymptotic, conditional and marginal stability, Routh–Hurwitz and Nyquist stability criterion, Root locus technique and its application. Concepts of compensation, series/parallel/ series-parallel/feedback compensation, Lag/Lead/Lag-Lead networks for compensation, compensation using P, PI, PID controllers.

Textbooks:

1. B. C. Kuo, “Automatic control system”, Prentice Hall of India, 7th edition 2001.
2. Nagrath Gopal, “Control Systems Engineering -Principles and Design” New Age Publishers

References:

1. Norman S. Nise, “Control systems engineering” John Wiley & Sons (Asia) Singapore.
2. B. S. Manke, Linear Control System, Khanna publication.
3. K. Ogata, “Modern control engineering”, Pearson 2002.
4. A. K. Jaurath , Problems And Solutions Of Control Systems: With Essential Theory (CBS Problems and Solutions Series)

Transmission Lines, Waveguides and Antenna Design	L	P	C
	4		4

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
ECE/EE-VDT/EC-ACT	5	PC	PC	ECC-309

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end 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 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 familiarise the various types of transmission lines and to deliberate the losses associated.
2. To communicate information about waveguide concepts
3. To impart the understanding of characteristics of different types of high frequency resonators.
4. To impart the knowledge to define different terminologies of antenna parameters.

Course Outcomes (CO)

- | | |
|-------------|--|
| CO 1 | To Understand the primary model of wave propagation in Transmission Lines and Analyze the various line parameters and Apply smith chart for line parameter and impedance calculations. |
| CO 2 | Discuss the fundamental concepts of wave propagation in rectangular and circular waveguides and evaluate their characteristics. |
| CO 3 | Understand the characteristics of resonance frequency of different types of resonator and its modes configuration. |
| CO 4 | To describe the basic parameters of antenna and interpret to solve the radiation components |

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	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

Microwave Transmission Lines: Transmission-Line Equations, Solutions of Transmission-Line Equations. Reflection Coefficient, Transmission Coefficient. Standing Wave, Standing-Wave Ratio, Line Impedance, Line Admittance, Open and short circuited lines. Smith Chart Impedance Matching: Single-Stub Matching, Double-Stub Matching. Losses in transmission lines. Lines of different lengths – $\lambda/2$, $\lambda/4$, $\lambda/8$ lines. Introduction to Microstrip transmission line.

UNIT II

Microwave Waveguides and Components:

Introduction Rectangular Waveguides: Solutions of Wave Equations in Rectangular Coordinates, TE Modes in Rectangular Waveguides, TM Modes in Rectangular Waveguides, Power Transmission in Rectangular Waveguides, Losses in Rectangular Waveguides, Excitations of Modes in Rectangular Waveguides.

Circular Waveguides: Solutions of Wave Equations in Cylindrical Coordinates, TE Modes in Circular Waveguides, TM Modes in Circular Waveguides, Excitations of Modes in Circular Waveguides.

UNIT III

Microwave Resonators: Series and Parallel Resonant Circuits: Series Resonant Circuit, Parallel Resonant Circuit, Loaded and Unloaded Q.

Transmission Line Resonators: Short-Circuited $\lambda/2$ line, Open-Circuited $\lambda/2$, Short-Circuited $\lambda/4$ Line; Rectangular Waveguide Cavities: Resonant Frequencies, Q of the TE_{101} Mode; Circular Waveguide Cavities: Resonant Frequencies, Q of the TE_{nm1} Mode. Dielectric Resonators: Resonant Frequencies, Q of the TE_{016} Mode. Excitation of Resonators: Critical Coupling, A Gap-Coupled Microstrip Resonator.

UNIT IV

Antennas: Introduction, Types of Antennas, Radiation Mechanism. Introduction monopole and dipole antenna.

Fundamental Parameters: Introduction, Radiation Pattern, Radiation Power Density, Radiation Intensity, Beamwidth, Directivity, Antenna Efficiency, Gain, Realized Gain, Beam Efficiency, Antenna Radiation Efficiency, Friis Transmission Equation and Radar Range Equation

Radiation Integrals and Auxiliary Potential Functions: The Vector Potential A for an Electric Current Source J, The Vector Potential F for A Magnetic Current Source M, Electric and Magnetic Fields for Electric (J) and Magnetic (M) Current Sources, Solution of the Inhomogeneous Vector Potential Wave Equation, Far-Field Radiation, Duality Theorem, Reciprocity Theorems

Textbook(s):

1. M. N. O. Sadiku , “Elements of Electromagnetics”, Oxford University Press 2007
2. S.Y Liao, “Microwave devices and Circuits” Pearson publications
3. D.M Pozar, “Microwave Engineering”, Wiley Publications.
4. Antenna for all Application-John D Kraus, third edition-TMH publication
5. Antenna Theory-Constantine A. Balanis -Third edition-Wiley Publication

References:

1. E. C. Jordon, K. G. Balman, “Electromagnetic Waves & Radiation System” Prentice Hall, India
2. Antennas and Wave Propagation—G. S. N. Raju (Pearson)
3. Foundations of Antenna Theory and Techniques – Vincent F. Fusco(Pearson)

Data Communication and Networking			
L	P	C	
4			4

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
ECE/EE-VDT/EC-ACT	5	PC	PC	ECC-311

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end 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 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 build an understanding of the fundamental concepts of data communication.
2. To familiarize the student with the basic taxonomy of data link layer.
3. To understand and implements the network routing, IP addressing, subnetting.
4. To enumerate the functions of transport layer and application layer.

Course Outcomes (CO)

CO 1 Understand basic concepts of data communications.

CO 2 Understand and explain various functions of data link layer.

CO 3 Understand and implements the network routing, IP addressing, subnetting.

CO 4 Enumerate the functions of transport layer and application layer.

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	1	1	3	1	-	-	-	-	-	3
CO 2	3	2	1	1	3	1	-	-	-	-	-	3
CO 3	3	2	1	1	3	1	-	-	-	-	-	3
CO 4	3	2	1	1	3	1	-	-	-	-	-	3

UNIT- I

Data Communications : Components, protocols and standards, Network and Protocol Architecture, Reference Model ISO-OSI, TCP/IP-Overview ,topology, transmission mode, digital signals, digital to digital encoding, digital data transmission, DTE-DCE interface, interface standards, modems, cable modem, transmission media-guided and unguided, transmission impairment, Performance, wavelength and Shannon capacity. Review of Error Detection and Correction codes.

Switching: Circuit switching (space-division, time division and space-time division), packet switching (virtual circuit and Datagram approach), message switching.

UNIT- II

Data Link Layer: Design issues, Data Link Control and Protocols: Flow and Error Control, Stop-and-wait ARQ. Sliding window protocol, Go-Back-N ARQ, Selective Repeat ARQ, HDLC, Point-to –Point Access: PPP Point –to-Point Protocol, PPP Stack

Medium Access Sub layer: Channel allocation problem, Controlled Access, Channelization, multiple access protocols, IEEE standard 802.3 & 802.11 for LANS and WLAN, high-speed LANs, Token ring, FDDI based LAN, Network Devices-repeaters, hubs, switches bridges.

UNIT- III

Network Layer: Design issues, Routing algorithms, Congestion control algorithms, Host to Host Delivery: Internetworking, addressing and routing, IP addressing (class full & Classless), Subnet, Network Layer Protocols: ARP, IPV4, ICMP, IPV6 ad ICMPV6.

UNIT- IV

Transport Layer: Process to Process Delivery: UDP; TCP, congestion control and Quality of service.

Application Layer: Client Server Model, Socket Interface, Domain Name System (DNS): Electronic Mail (SMTP), file transfer (FTP), HTTP and WWW.

Text Books:

1. A. S. Tannenbum, D. Wetherall, "Computer Networks", Prentice Hall, Pearson, 5th Ed
2. Behrouz A. Forouzan, "Data Communications and Networking", Tata McGraw-Hill, 4th Ed

Reference Books:

1. Fred Halsall, "Computer Networks", Addison – Wesley Pub. Co. 1996.
2. Larry L, Peterson and Bruce S. Davie, "Computer Networks: A system Approach", Elsevier, 4th Ed
3. Tomasi, "Introduction To Data Communications & Networking", Pearson 7th impression 2011
4. William Stallings, "Data and Computer Communications", Prentice Hall, Imprint of Pearson, 9th Ed.
5. Zheng , "Network for Computer Scientists & Engineers", Oxford University Press
6. Data Communications and Networking: White, Cengage Learning

Digital Signal Processing Lab	L	P	C
		2	1

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
ECE/ICE/EE-VDT/EC-ACT	5	PC	PC	ECC-351

Marking Scheme:

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

Instructions:

1. The course objectives and course outcomes are identical to that of (Digital Signal Processing) 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 Head of Department / Institution in which the paper is being offered from the list of practicals below. Atleast 10 experiments must be performed by the students, they may be asked to do more. Atleast 5 experiments must be from the given list.

1. Write Program to compute N point DFT of a given sequence and to plot magnitude and phase spectrum.
2. To implement Parseval theorem of DFT
3. To implement Time shifting and time reversal property of DFT
4. To find linear convolution of two given sequences.
5. To find circular convolution of two given sequences
6. To perform linear convolution from circular convolution and vice versa
7. To design LP FIR filter using windowing techniques
8. To design HP FIR filter using windowing techniques
9. To design LP IIR Butterworth filter for given specifications
10. To design LP IIR Chebyshev type-1 filter for given specifications
11. To verify the decimation of a given sequence
12. To verify the interpolation of a given sequence

Microelectronics Lab	L	P	C
		2	1

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
ECE/EE-VDT/EC-ACT	5	PC	PC	ECC-353

Marking Scheme:

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

Instructions:

1. The course objectives and course outcomes are identical to that of (Microelectronics) 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 Head of Department / Institution in which the paper is being offered from the list of practicals below. Atleast 10 experiments must be performed by the students, they may be asked to do more. Atleast 5 experiments must be from the given list.

1. To study the MOS characteristics and introduction to tanner EDA software tools.
2. To design and study the DC characteristics of PMOS and NMOS.
3. To design and study the DC and AC characteristics of CMOS inverter.
4. To design and study the characteristics of CMOS NAND and NOR gate.
5. To design any Boolean function using transmission gates.
6. To design and study the characteristics of CMOS multiplexer.
7. To design and study the layout of PMOS and NMOS transistors.
8. To design and study the layout of CMOS inverter.
9. To design and study the layout of 2 I/P CMOS NAND gate
10. To design and study the layout of 2 I/P CMOS NOR gate
11. To design and study the layout of CMOS XOR gate.

Introduction to Control Systems Lab	L	P	C
		2	1

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
ECE/EE/EEE/ICE/EE-VDT/ EC-ACT	5	PC	PC	EEC-355

Marking Scheme:

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

Instructions:

1. The course objectives and course outcomes are identical to that of (Introduction to 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 under intimation to the office of the Head of Department / Institution in which the paper is being offered from the list of practicals below. Atleast 10 experiments must be performed by the students, they may be asked to do more. Atleast 5 experiments must be from the given list.

1. Determination of step & impulse response for a second-order unity feedback system.
2. To study the speed-torque characteristics of SERVO MOTOR.
3. Experiment to draw synchro pair characteristics.
4. To determine the Transfer Function of the DC Machine.
5. Plot unit step response of the given transfer function and finds delay time, rise time, and peak overshoot.
6. Plot the pole-zero configuration in the s-plane for the given transfer function.
7. To determine the characteristics of Magnetic Amplifiers.
8. Linear System Analysis (Time Domain Analysis, Error Analysis) Using MATLAB.
9. To observe the effect of P, PI, PID, and PD Controller for open loop and closed loop of second order system.
10. To analyze the frequency response of a system by plotting Root locus, Bode plot, and Nyquist plot using MATLAB software.
11. Experiment to draw the frequency response characteristics of the lag-lead compensator network and determination of its transfer function.
12. Temperature Controller Using PID Controller.
13. Study of operation of a stepper motor interface with a microprocessor.

Transmission Lines, Waveguides and Antenna Design Lab	L	P	C
		2	1

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
ECE/EE-VDT/EC-ACT	5	PC	PC	ECC-357

Marking Scheme:

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

Instructions:

1. The course objectives and course outcomes are identical to that of (Transmission Lines, Waveguides and Antenna Design) 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 Head of Department / Institution in which the paper is being offered from the list of practicals below. Atleast 10 experiments must be performed by the students, they may be asked to do more. Atleast 5 experiments must be from the given list.

1. To design and simulate a coaxial transmission line and obtain the propagation constant.
2. To design and simulate strip line and microstrip line and coplanar line and obtain the propagation constants.
3. To design and simulate a rectangular waveguide.
4. To design and simulate a circular waveguide.
5. To design and simulate a dipole antenna.
6. To design and simulate a slotted a rectangular waveguide antenna.
7. To design and simulate a leaky wave antenna using the rectangular waveguide.
8. To design and simulate a rectangular microstrip patch antenna.
9. To design and simulate a circular patch antenna.
10. To design and simulate a rectangular microstrip patch antenna array.
11. To design and simulate a circular microstrip patch antenna array.

Note: These experiments may be performed using simulation software like HFSS, CST and IE3D.

Data Communication and Networking Lab			
	L	P	C
		2	1

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
ECE/EE-VDT/EC-ACT	5	PC	PC	ECC-359

Marking Scheme:

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

Instructions:

1. The course objectives and course outcomes are identical to that of (Data Communication and Networking) 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 Head of Department / Institution in which the paper is being offered from the list of practicals below. Atleast 10 experiments must be performed by the students, they may be asked to do more. Atleast 5 experiments must be from the given list.

1. Introduction to Computer Network laboratory
Introduction to Discrete Event Simulation
Discrete Event Simulation Tools - ns2/ns3, Omnet++
2. Using Free Open Source Software tools for network simulation – I Preliminary usage of the tool ns3
Simulate telnet and ftp between N sources - N sinks (N = 1, 2, 3). Evaluate the effect of increasing data rate on congestion.
3. Using Free Open Source Software tools for network simulation - II
Advanced usage of the tool ns3
Simulating the effect of queueing disciplines on network performance - Random Early Detection/Weighted RED / Adaptive RED (This can be used as a lead up to DiffServ / IntServ later).
4. Using Free Open Source Software tools for network simulation - III
Advanced usage of the tool ns3 Simulate http, ftp and DBMS access in networks
5. Using Free Open Source Software tools for network simulation - IV
Advanced usage of the tool ns3
Effect of VLAN on network performance - multiple VLANs and single router.
6. Using Free Open Source Software tools for network simulation - IV
Advanced usage of the tool ns3
Effect of VLAN on network performance - multiple VLANs with separate multiple routers.
7. Using Free Open Source Software tools for network simulation - V
Advanced usage of the tool ns3
Simulating the effect of DiffServ / IntServ in routers on throughput enhancement.
8. Using Free Open Source Software tools for network simulation - VI
Advanced usage of the tool ns3
Simulating the performance of wireless networks
9. Case Study I : Evaluating the effect of Network Components on Network Performance
To Design and Implement LAN With Various Topologies and To Evaluate Network Performance Parameters for DBMS etc)
10. Case Study II : Evaluating the effect of Network Components on Network Performance
To Design and Implement LAN Using Switch/Hub/Router As Interconnecting Devices For Two Different LANs and To Evaluate Network Performance Parameters.
11. Mini project - one experiment to be styled as a project of duration 1 month (the last month)

Principles of Management for Engineers	L	P	C
	3		3

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
All	6	HS/MS	MS	MS-302

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end 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 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 describe the functions, roles and skills of managers and illustrate how the manager's job is evolving.
2. To evaluate approaches to goal setting, planning and organizing in a variety of circumstances.
3. To evaluate contemporary approaches for staffing and leading in an organization
4. To analyze contemporary issues in controlling for measuring organizational performance.

Course Outcomes (CO)

- CO 1** Examine the relevance of the political, legal, ethical, economic and cultural environments in global business
- CO 2** Evaluate approaches to goal setting, planning and organizing in a variety of circumstances.
- CO 3** Evaluate contemporary approaches for staffing and leading in an organization
- CO 4** Analyze contemporary issues in controlling for measuring organizational performance.

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	2	2	1	2	-	2	-	-	1	2	3	2
CO 2	2	2	1	2	-	2	-	-	1	2	3	2
CO 3	2	2	1	2	-	2	-	-	1	2	3	2
CO 4	2	2	1	2	-	2	-	-	1	2	3	2

UNIT-I

Introduction to Managers and Management: Management an Overview: Introduction, Definition of Management, Role of Management, Functions of Managers, Levels of Management, Management Skills and Organizational Hierarchy, Social and Ethical Responsibilities of Management: Arguments for and against Social Responsibilities of Business, Social Stakeholders, Measuring Social Responsiveness and Managerial Ethics, Omnipotent and Symbolic View, Characteristics and importance of organizational culture, Relevance of political, legal, economic and Cultural environments to global business, Structures and techniques organizations use as they go international .

UNIT-II

Planning: Nature & Purpose, Steps involved in Planning, Objectives, Setting Objectives, Process of Managing by Objectives, Strategies, Policies & Planning Premises, Competitor Intelligence, Benchmarking, Forecasting, Decision-Making.

Directing: Scope, Human Factors, Creativity and Innovation, Harmonizing Objectives, Leadership, Types of Leadership, Directing, Managers as leaders, Early Leadership Theories... Trait Theories, Behavioral Theories, Managerial Grid, Contingency Theories of Leadership, Directing ... Path Goal Theory, contemporary views of Leadership, Cross Cultural Leadership, Leadership Training, Substitutes of Leadership

UNIT-III

Organizing: Organizing, Benefits and Limitations- De-Centralization and Delegation of Authority, Authority versus Power, Mechanistic Versus Organic Organization, Common Organizational Designs, Contemporary Organizational Designs and Contingency Factors, The Learning Organization Nature and Purpose, Formal and Informal Organization, Organization Chart, Structure and Process, Departmentalization by difference strategies, Line and Staff authority- Benefits and Limitations- De-Centralization and Delegation of Authority Versus, Staffing, Human Resource Inventory, Job Analysis, Job Description, Recruitment and

UNIT - IV

Controlling: Controlling, Introduction to Controlling System and process of Controlling, Requirements for effective control, The planning Control link, The process of control, types of control The Budget as Control Technique, Information Technology in Controlling, Productivity, Problems and Management, Control of Overall Performance, Direct and Preventive Control, Financial Controls, Tools for measuring organizational Performance, Contemporary issues in control Workplace concerns, employee theft, employee violence

Textbook(s):

1. Tripathi P.C. Principles of management. Tata McGraw-Hill Education; 6th Edition 2017.

References:

1. Koontz H, Weihrich H. Essentials of management: an international, innovation, and leadership perspective. McGraw-Hill Education; 10th Edition 2018.
2. Principles of Management Text and Cases, Pravin Durai, Pearson, 2015
3. Robbins, S.P. & Decenzo, David A. Fundamentals of Management, 7th ed., Pearson, 2010
4. Robbins, S.P. & Coulter, Mary Management; 14 ed., Pearson, 2009

Universal Human Values			
L	P	C	
1		1	

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
All	6	HS/MS	HS	HS-304

Marking Scheme:

4. Teachers Continuous Evaluation: 25 marks
5. Term end Theory Examinations: 75 marks
6. This is an NUES paper, hence 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.

Course Objectives :

1. To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
2. To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
3. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.
4. To analyze the value of harmonious relationship based on trust and respect in their life and profession

Course Outcomes (CO)

- | | |
|-------------|--|
| CO 1 | Evaluate the significance of value inputs in formal education and start applying them in their life and profession |
| CO 2 | Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc. |
| CO 3 | Examine the role of a human being in ensuring harmony in society and nature. |
| CO 4 | Apply the understanding of ethical conduct to formulate the strategy for ethical life and profession. |

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	1	1	-	1
CO 2	-	-	-	-	-	3	-	3	1	1	-	1
CO 3	-	-	-	-	-	3	-	3	1	1	-	1
CO 4	-	-	-	-	-	3	-	3	1	1	-	1

UNIT-I

Introduction-Basic Human Aspiration, its fulfillment through All-encompassing Resolution: The basic human aspirations and their fulfillment through Right understanding and Resolution, Right understanding and Resolution as the activities of the Self, Self being central to Human Existence; All-encompassing Resolution for a Human Being, its details and solution of problems in the light of Resolution

UNIT-II

Understanding Human Being: Understanding the human being comprehensively as the first step and the core theme of this course; human being as co-existence of the self and the body; the activities and potentialities of the self; Basis for harmony/contradiction in the self

UNIT-III

Understanding Nature and Existence: A comprehensive understanding (knowledge) about the existence, Nature being included; the need and process of inner evolution (through self-exploration, self-awareness and self-evaluation), particularly awakening to activities of the Self: Realization, Understanding and Contemplation in the Self (Realization of Co-Existence, Understanding of Harmony in Nature and Contemplation of Participation of Human in this harmony/ order leading to comprehensive knowledge about the existence).

UNIT - IV

Understanding Human Conduct, All-encompassing Resolution & Holistic Way of Living: Understanding Human Conduct, different aspects of All-encompassing Resolution (understanding, wisdom, science etc.), Holistic way of living for Human Being with All-encompassing Resolution covering all four dimensions of human endeavor viz., realization, thought, behavior and work (participation in the larger order) leading to harmony at all levels from Self to Nature and entire Existence

Textbook(s):

1. R R Gaur, R Asthana, G P Bagaria, 2019 (2nd Revised Edition), A Foundation Course in Human Values and Professional Ethics. ISBN 978-93-87034-47-1, Excel Books, New Delhi.
2. Premvir Kapoor, Professional Ethics and Human Values, Khanna Book Publishing, New Delhi, 2022.

References:

1. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and Harper Collins, USA
2. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.
3. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986.
4. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome’s report, Universe Books.
5. A Nagraj, 1998, Jeevan Vidya EkParichay, Divya Path Sansthan, Amarkantak.
6. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
7. A N Tripathy, 2003, Human Values, New Age International Publishers.
8. Subhas Palekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) Krishi Tantra Shodh, Amravati.
9. E G Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers, Oxford University Press
10. M Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.
11. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books.
12. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.

Artificial Intelligence			
L	P	C	
3		3	

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
CSE/IT/CST/ITE	6	PCE	PCE-3	CIE-374T
ECE	6	PCE	PCE-1	ECE-318T
CSE-AI/CSE-AIML	6	PC	PC	AI-302T
EAE	6	AI-EAE	AI-EAE-1	AI-302T
EAE	6	AIML-EAE	AIML-EAE-1	AI-302T

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end 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 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 the definition and basic knowledge of Artificial Intelligence.
2. To introduces AI by examining the nature of the difficult problems.
3. To understand with AI demonstration that intelligence requires ability to find reason.
4. To understand the latest techniques and the future scope of the technology.

Course Outcomes (CO)

- | | |
|-------------|---|
| CO 1 | Ability to use AI methods and control strategies to solve the problems. |
| CO 2 | Understand the production system and its applications. Also, to understand the properties and applications for the different search algorithms. |
| CO 3 | Applying the different algorithms and the techniques, also analyse the reason for the results. |
| CO 4 | Study the expert systems and the modern approaches. |

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	3	3	2	2	-	-	-	-	2
CO 2	3	3	3	3	3	2	2	-	-	-	-	2
CO 3	3	3	3	3	3	2	2	-	-	-	-	2
CO 4	3	3	3	3	3	2	2	-	-	-	-	2

UNIT-I

AI Definition, Problems, The Foundations of Artificial Intelligence, Techniques, Models, Defining Problem as a state space search, production system, Intelligent Agents: Agents and Environments, Characteristics, Search methods and issues in the design of search problems.

UNIT-II

Knowledge representation issues, mapping, frame problem. Predicate logic, facts in logic, representing instance and Isa relationship, Resolution, procedural and declarative knowledge, matching, control knowledge. Symbolic reasoning under uncertainty, Non monotonic reasoning, statistical reasoning.

UNIT-III

Game Playing, minimax search, Alfa beta cut-offs, Natural Language Processing, Learning, Explanation-based learning, discovery, analogy, Neural net learning and Genetic Learning.

UNIT - IV

Fuzzy logic systems, Perception and action, Expert systems, Inference in Bayesian Networks, K-means Clustering Algorithm, Machine learning.

Textbook(s):

1. Elaine Rich, Kevin Knight, and Shivashankar B Nair, "Artificial Intelligence", Tata McGraw Hill.
2. S. Russel and P. Norvig, "Artificial Intelligence: A Modern Approach", Pearson Edu.

References:

1. Deepak Khemani, "A First Choice in Artificial Intelligence", McGraw Hill.
2. K M Fu, "Neural Networks in Computer Intelligence", McGraw Hill.

Statistics, Statistical Modelling & Data Analytics			
		L	P
		3	3

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
CSE-AI/CSE-AIML/CSE-DS	6	PC	PC	DA-304T
EAE	6	AI-EAE	AI-EAE-2	DA-304T
EAE	6	AIML-EAE	AIML-EAE-2	DA-304T
EAE	6	DS-EAE	DS-EAE-1	DA-304T
EAE	6	SC-EAE	SC-EAE-1	DA-304T
EAE	6	MLDA-EAE	MLDA-EAE-1	DA-304T

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end 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 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 Statistics, visualisation and probability.
2. To impart basic knowledge about how to implement regression analysis and interpret the results.
3. To impart basic knowledge about how to describe classes of open and closed sets of R, concept of compactness Describe Metric space - Metric in R_n.
4. To impart basic knowledge about how to apply Eigen values, Eigen vectors.

Course Outcomes (CO)

- CO 1** Ability to learn and understand the basic concepts about Statistics, visualisation and probability.
- CO 2** Ability to implement regression analysis and interpret the results. Be able to fit a model to data and comment on the adequacy of the model
- CO 3** Ability to describe classes of open and closed sets of R, concept of compactness Describe Metric space - Metric in R_n.
- CO 4** Ability to impart basic knowledge about how to apply Eigen values, Eigen vectors.

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	3	3	-	-	1	2	-	-	3
CO 2	3	3	3	3	3	-	-	1	2	-	-	3
CO 3	3	3	3	3	3	-	-	1	2	-	-	3
CO 4	3	3	3	3	3	-	-	1	2	-	-	3

UNIT-I

Statistics: Introduction & Descriptive Statistics- mean, median, mode, variance, and standard deviation. Data Visualization, Introduction to Probability Distributions.
Hypothesis testing, Linear Algebra and Population Statistics, Mathematical Methods and Probability Theory, Sampling Distributions and Statistical Inference, Quantitative analysis.

UNIT-II

Statistical Modelling: Linear models, regression analysis, analysis of variance, applications in various fields. Gauss-Markov theorem; geometry of least squares, subspace formulation of linear models, orthogonal projections; regression models, factorial experiments, analysis of covariance and model formulae; regression diagnostics, residuals, influence diagnostics, transformations, Box-Cox models, model selection and model building strategies, logistic regression models; Poisson regression models.

UNIT-III

Data Analytics: Describe classes of open and closed set. Apply the concept of compactness. Describe Metric space - Metric in R^n . Use the concept of Cauchy sequence, completeness, compactness and connectedness to solve the problems.

UNIT – IV

Advanced concepts in Data Analytics: Describe vector space, subspaces, independence of vectors, basis and dimension. Describe Eigen values, Eigen vectors and related results.

Textbook(s):

1. Apostol T. M. (1974): Mathematical Analysis, Narosa Publishing House, New Delhi.
2. Malik, S.C., Arora, S. (2012): Mathematical Analysis, New Age International, New Delhi

References:

1. Pringle, R.M. and Rayner, A.(1971): Generalized Inverse of Matrices with Application to Statistics, Griffin, London
2. Peter Bruce, Andrew Bruce (2017), Practical Statistics for Data Scientists Paperback

Machine Learning			
	L	P	C
	3		3

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
ECE	6	PCE	PCE-3	ECE-350T
EAE	6	MLDA-EAE	MLDA-EAE-2C	ML-342T
CSE/IT/CST/ITE	7	PCE	PCE-5	CIE-421T
CSE-AIML	7	PC	PC	ML-407T
EAE	7	AIML-EAE	AIML-EAE-3	ML-407T

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end 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 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 need of machine learning
2. To learn about regression and feature selection
3. To understand about classification algorithms
4. To learn clustering algorithms

Course Outcomes (CO)

- CO 1** To formulate machine learning problems
- CO 2** Learn about regression and feature selection techniques
- CO 3** Apply machine learning techniques such as classification to practical applications
- CO 4** Apply clustering 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	3	3	3	3	2	2	-	-	-	-	2
CO 2	3	3	3	3	3	2	2	-	-	-	-	2
CO 3	3	3	3	3	3	2	2	-	-	-	-	2
CO 4	3	3	3	3	3	2	2	-	-	-	-	2

UNIT-I

Introduction: Machine learning, terminologies in machine learning, Perspectives and issues in machine learning, application of Machine learning, Types of machine learning: supervised, unsupervised, semi-supervised learning. Review of probability, Basic Linear Algebra in Machine Learning Techniques, Dataset and its types, Data preprocessing, Bias and Variance in Machine learning, Function approximation, Overfitting

UNIT-II

Regression Analysis in Machine Learning: Introduction to regression and its terminologies, Types of regression, Logistic Regression

Simple Linear regression: Introduction to Simple Linear Regression and its assumption, Simple Linear Regression Model Building, Ordinary Least square estimation, Properties of the least-squares estimators and the fitted regression model, Interval estimation in simple linear regression, Residuals

Multiple Linear Regression: Multiple linear regression model and its assumption, **Interpret Multiple Linear Regression Output (R-Square, Standard error, F, Significance F, Coefficient P values), Access the fit of multiple linear regression model (R squared, Standard error)**

Feature Selection and Dimensionality Reduction: PCA, LDA, ICA

UNIT-III

Introduction to Classification and Classification Algorithms: What is Classification? General Approach to Classification, k-Nearest Neighbor Algorithm, Random Forests, Fuzzy Set Approaches

Support Vector Machine: Introduction, Types of support vector kernel – (Linear kernel, polynomial kernel, and Gaussian kernel), Hyperplane – (Decision surface), Properties of SVM, and Issues in SVM.

Decision Trees: Decision tree learning algorithm, ID-3 algorithm, Inductive bias, Entropy and information theory, Information gain, Issues in Decision tree learning.

Bayesian Learning - Bayes theorem, Concept learning, Bayes Optimal Classifier, Naïve Bayes classifier, Bayesian belief networks, EM algorithm

Ensemble Methods: Bagging, Boosting and AdaBoost and XBoost,

Classification Model Evaluation and Selection: Sensitivity, Specificity, Positive Predictive Value, Negative Predictive Value, Lift Curves and Gain Curves, ROC Curves, Misclassification Cost Adjustment to Reflect Real-World Concerns, Decision Cost/Benefit Analysis

UNIT – IV

Introduction to Cluster Analysis and Clustering Methods: The Clustering Task and the Requirements for Cluster Analysis, Overview of Some Basic Clustering Methods: k-Means Clustering, k-Medoids Clustering, Density-Based Clustering: DBSCAN - Density-Based Clustering Based on Connected Regions with High Density, Gaussian Mixture Model algorithm, Balance Iterative Reducing and Clustering using Hierarchies (BIRCH), Affinity Propagation clustering algorithm, Mean-Shift clustering algorithm, ordering Points to Identify the Clustering Structure (OPTICS) algorithm, Agglomerative Hierarchy clustering algorithm, **Divisive Hierarchical**, Measuring Clustering Goodness

Textbook(s):

1. Tom M. Mitchell, "Machine Learning", McGraw-Hill Education (India) Private Limited, 2013.
2. M. Gopal, "Applied Machine Learning", McGraw Hill Education

References:

1. C. M. BISHOP (2006), "Pattern Recognition and Machine Learning", Springer-Verlag New York, 1st Edition
2. R. O. Duda, P. E. Hart, D. G. Stork (2000), Pattern Classification, Wiley-Blackwell, 2nd Edition

Digital Image Processing			
		L	P
		3	3

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
ECE	6	PCE	PCE-1	ECE-308T
CSE-in-EA	6	OAE-CSE-EA	OAE-1	IPCV-334T
EE-VDT/EC-ACT	6	OAE-ECE-EA	OAE-1	IPCV-334T
EAE	6	IPCV-EAE	IPCV-EAE-1A	IPCV-334T
EE/EEE	7	PCE	PCE-4	EEE-413T

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end 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 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 the basic knowledge of image fundamentals.
2. To impart the knowledge of simple image enhancement techniques in Spatial and Frequency domain.
3. To impart the knowledge of image compression and image segmentation techniques
4. To impart the knowledge of image representation and recognition techniques

Course Outcomes (CO)

- | | |
|-------------|---|
| CO 1 | Understand the basics and fundamentals of digital image processing, such as digitization, sampling, quantization, and basic neighbour operations. |
| CO 2 | Understand the techniques of smoothing, sharpening and enhancement. |
| CO 3 | Understand the concept of image compression and image segmentation techniques |
| CO 4 | Explain basic concepts of image representation and recognition 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	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 and Digital Image Fundamentals: The origins of Digital Image Processing, Examples of Fields that Use Digital Image Processing, Fundamentals Steps in Image Processing, Elements of Digital Image Processing Systems, Image Sampling and Quantization, Some basic relationships like Neighbours, Connectivity, Distance Measures between pixels, Linear and Non Linear Operations

UNIT II

Image Enhancement in the Spatial Domain: Some basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic and Logic operations, Basics of Spatial Filters, Smoothing and Sharpening Spatial Filters, Combining Spatial Enhancement Methods.

Frequency Domain: Introduction to Fourier Transform– Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters, Homomorphic filtering, Color image enhancement.

UNIT III

Image Compression: Coding, Interpixel and Psychovisual Redundancy, Image Compression models, Elements of Information Theory, Error free comparison, Lossy compression, Image compression standards.

Image Segmentation: Detection of Discontinuities, Edge linking and boundary detection, Thresholding, Region Oriented Segmentation, Motion based segmentation.

UNIT IV

Image Representation and Description: Representation, Boundary Descriptors, Regional Descriptors, Use of Principal Components for Description, Introduction to Morphology, Some basic Morphological Algorithms.

Object Recognition: Patterns and Pattern Classes, Decision - Theoretic Methods, Structural Methods.

Textbook(s):

1. Rafael C. Gonzalez, Richard E. Woods, 'Digital Image Processing', Pearson, Third Edition, 2010.
2. Anil K. Jain, 'Fundamentals of Digital Image Processing', Pearson, 2002.

References:

1. Bernd Jahne, "Digital Image Processing", 5th Ed., Springer, 2002.
2. William K Pratt, "Digital Image Processing: Paks Inside", John Wiley & Sons, 2001.

Introduction to Information and Coding Theory	L	P	C
	4		4

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
ECE	6	PCE	PCE-2	ECE-332
EE/EEE	6	PCE	PCE-3	EEE-366
EC-ACT	7	PC	PC	ACT-403

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end 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 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 efficient, error-free and secure delivery of information using binary streams.
2. To have in-depth knowledge of error-control coding.
3. To learn the process of encoding and decoding of digital data streams.
4. To learn and apply the methods of generation of these codes and evaluate the performance of them over the noisy communication channels.

Course Outcomes (CO)

- | | |
|-------------|--|
| CO 1 | To be able to understand the principles behind an efficient and secure transmission of digital data stream. |
| CO 2 | To be able to demonstrate the knowledge of channel capacity and coding. |
| CO 3 | To be able to implement the knowledge of encoding and decoding of digital data stream using Linear & Cyclic Codes. |
| CO 4 | To be able to analyse the encoding and decoding of digital data stream using Convolutional codes. |

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	1	1	1	-	-	-	2	-	3	-	1
CO 2	3	3	3	3	1	1	-	2	-	2	-	2
CO 3	3	3	3	3	3	1	-	2	-	2	-	2
CO 4	3	3	3	3	3	1	-	2	-	2	-	2

UNIT-I

Introduction to Information Theory, Uncertainty & Information, Mutual Information, Average mutual information, Entropy, Relative Entropy, Extension of an Information source and Markov Source, Maximum Entropy Principle, Information measure of Continuous random Variables, Maximum Entropy Principle, Jensen's Inequality, Fano's Inequality, Introduction to lossless coding, Source coding theorem Block code and its properties, Instantaneous code and its properties, Kraft-McMillan equality, Huffman Coding, Shannon Fano coding, Lempel Ziv Algorithm.

UNIT-II

Introduction to discrete information channels, Equivocation and Mutual Information, Properties of different information channels, Reduction of information channels, Noiseless channel, Properties of Mutual information, Introduction to channel capacity, Shannon's Channel Coding theorem, Bandwidth – S/N Trade Off, Channel capacity theorem, Shannon Limit, Channel capacity for MIMO system

UNIT-III

Definition of terms: Redundancy, code efficiency, systematic codes, Hamming distance, Hamming Weight, Hamming Bound, Types of Code: Parity check codes, Hamming codes, BCH Codes, RS Codes, Linear Block Codes, Generator and Parity Check matrix, Syndrome decoding, LDPC Codes, MDS codes.

Introduction to Cyclic Codes, Polynomials, division algorithm for polynomials, Generation and detection of cyclic codes, Matrix Description of cyclic codes, Golay Codes, CRC Codes, Circuit implementation of cyclic codes.

UNIT – IV

Burst Error Detecting and correcting codes, Convolutional codes, Time domain and frequency domain approaches, Code Tree, Trellis and State diagram, Decoding of convolutional codes, Viterbi's Algorithm, Sequential Decoding, Transfer function and Distance properties of convolutional codes, Bound on bit error rate, Coding Gain.

Textbook(s):

1. Ranjan Bose, "Information Theory Coding & Cryptography", 3rd Edition, McGraw Hill, 2017.
2. T.M. Cover and J.A Thomas, "Elements of Information Theory", 2nd Edition, Wiley India Pvt Ltd, 2013.

References:

1. Salvatore Gravano, Introduction to Error Control Codes, Oxford University Press, 2017.

Wireless Sensor Networks			
		L	P
		3	3

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
ECE	6	PCE	PCE-3	ECE-342T
CSE-IoT	6	PC	PC	IOT-328T
EAE	6	IOT-EAE	IOT-EAE-2C	IOT-332T
EAE	6	ICB-EAE	ICB-EAE-2C	IOT-332T
EEE	7	PCE	PCE-4	EEE-415T
CSE-NET	7	PC	PC	NET-475T
CSE-in-EA	7	OAE-CSE-EA	OAE-2	OECE-421T
EAE	7	NET-EAE	NET-EAE-5	NET-475T
OAE	7	ECE-OAE	ECE-OAE-4B	OECE-421T

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end 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 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 make students understand the basics of Wireless sensor Networks.
2. To familiarize with learning of the Architecture of WSN.
3. To familiarize with learning of the Architecture of WSN.
4. To study the design consideration of topology control and solution to the various problems.

Course Outcomes (CO)

- CO 1** Understand challenges and technologies for wireless networks.
- CO 2** Understand architecture and sensors.
- CO 3** Describe the communication, energy efficiency, computing, storage and transmission.
- CO 4** Explain the concept of programming the in WSN environment.

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	1	2	1	-	-	-	-	3	3
CO 2	3	2	2	1	2	1	-	-	-	-	3	3
CO 3	3	2	2	1	2	1	-	-	-	-	3	3
CO 4	3	2	2	1	2	1	-	-	-	-	3	3

UNIT-I

Introduction: Mobile Ad-hoc Networks (MANETs), Introduction to Sensor Networks, Constraints and Challenges, Advantage of Sensor Networks, Applications of Sensor Networks. Architecture: Single-Node

Architecture - Hardware Components, Energy Consumption of Sensor Nodes, Operating Systems, Network Architecture -Sensor Network Scenarios, Optimization Goals, Gateway Concepts.

UNIT-II

Networking Sensors: Physical Layer and Transceiver Design Considerations, MAC Protocols for Wireless Sensor Networks, classification of MAC protocols, MAC protocols for sensor network, location discovery, S-MAC, IEEE 802.15.4. Routing Protocols- Energy-Efficient Routing, Geographic Routing.

UNIT-III

Infrastructure Establishment: Topology Control, Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control. Case study of WSN"s for different applications.

UNIT – IV

Platform, Tool and Security: Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms, Node-level Simulators. Security issues in Sensor Networks. Future Research Direction.

Textbook(s):

1. Holger Karl and Andreas Willig, "Protocols And Architectures for Wireless Sensor Networks", John Wiley.
2. Feng Zhao and Leonidas J. Guibas, "Wireless Sensor Networks- An Information Processing Approach", Elsevier.
3. C.Siva Ram Murthy and B.S.Manoj, "Ad hoc Wireless Networks Architectures and Protocols", Pearson Education.

References:

1. Dr. Xerenium, Shen, Dr. Yi Pan , "Fundamentals of Wireless Sensor Networks", Theory and Practice", Wiley.
2. KazemSohraby, Daniel Minoli, &TaiebZnati, "Wireless Sensor Networks- Technology, Protocols, And Applications", John Wiley.

Artificial Intelligence Lab			
	L	P	C
		2	1

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
CSE/IT/CST/ITE	6	PCE	PCE-3	CIE-374P
ECE	6	PCE	PCE-1	ECE-318P
CSE-AI/CSE-AIML	6	PC	PC	AI-302P
EAE	6	AI-EAE	AI-EAE-1	AI-302P
EAE	6	AIML-EAE	AIML-EAE-1	AI-302P

Marking Scheme:

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

Instructions:

1. The course objectives and course outcomes are identical to that of (Artificial Intelligence) 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 Head of Department / Institution in which the paper is being offered from the list of practicals below. Atleast 10 experiments must be performed by the students, they may be asked to do more. Atleast 5 experiments must be from the given list.

1. Study of PROLOG.
2. Write simple fact for the statements using PROLOG
 - a. Ram likes mango.
 - b. Seema is a girl.
 - c. Bill likes Cindy.
 - d. Rose is red.
 - e. John owns gold.
3. Write predicates, one converts centigrade temperatures to Fahrenheit, the other checks if a temperature is below freezing using PROLOG.
4. Write a program to implement Breadth First Search Traversal.
5. Write a program to implement Water Jug Problem.
6. Write a program to remove punctuations from the given string.
7. Write a program to sort the sentence in alphabetical order.
8. Write a program to implement Hangman game using python.
9. Write a program to implement Hangman game.
10. Write a program to implement Tic-Tac-Toe game.
11. Write a program to remove stop words for a given passage from a text file using NLTK.
12. Write a program to implement stemming for a given sentence using NLTK.
13. Write a program to POS (part of speech) tagging for the given sentence using NLTK.
14. Write a program to implement Lemmatization using NLTK.
15. Write a program for Text Classification for the given sentence using NLTK.

Statistics, Statistical Modelling & Data Analytics Lab			
	L	P	C
		2	1

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
CSE-AI/CSE-AIML/CSE-DS	6	PC	PC	DA-304P
EAE	6	AI-EAE	AI-EAE-2	DA-304P
EAE	6	AIML-EAE	AIML-EAE-2	DA-304P
EAE	6	DS-EAE	DS-EAE-1	DA-304P
EAE	6	SC-EAE	SC-EAE-1	DA-304P
EAE	6	MLDA-EAE	MLDA-EAE-1	DA-304P

Marking Scheme:

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

Instructions:

1. The course objectives and course outcomes are identical to that of (Statistics, Statistical Modelling & Data Analytics) 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 Head of Department / Institution in which the paper is being offered from the list of practicals below. Atleast 10 experiments must be performed by the students, they may be asked to do more. Atleast 5 experiments must be from the given list.

1. Exercises to implement the basic matrix operations in Scilab.
2. Exercises to find the Eigenvalues and eigenvectors in Scilab.
3. Exercises to solve equations by Gauss elimination, Gauss Jordan Method and Gauss Siedel in Scilab.
4. Exercises to implement the associative, commutative and distributive property in a matrix in Scilab.
5. Exercises to find the reduced row echelon form of a matrix in Scilab.
6. Exercises to plot the functions and to find its first and second derivatives in Scilab.
7. Exercises to present the data as a frequency table in SPSS.
8. Exercises to find the outliers in a dataset in SPSS.
9. Exercises to find the most risky project out of two mutually exclusive projects in SPSS
10. Exercises to draw a scatter diagram, residual plots, outliers leverage and influential data points in R
11. Exercises to calculate correlation using R
12. Exercises to implement Time series Analysis using R.
13. Exercises to implement linear regression using R.
14. Exercises to implement concepts of probability and distributions in R

Digital Image Processing Lab			
	L	P	C
		2	1

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
ECE	6	PCE	PCE-1	ECE-308P
CSE-in-EA	6	OAE-CSE-EA	OAE-1	IPCV-334P
EE-VDT/EC-ACT	6	OAE-ECE-EA	OAE-1	IPCV-334P
EAE	6	IPCV-EAE	IPCV-EAE-1A	IPCV-334P
EE/EEE	7	PCE	PCE-4	EEE-413P

Marking Scheme:

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

Instructions:

1. The course objectives and course outcomes are identical to that of (Digital Image Processing) 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 Head of Department / Institution in which the paper is being offered from the list of practicals below. Atleast 10 experiments must be performed by the students, they may be asked to do more. Atleast 5 experiments must be from the given list.

1. Write Program to read any image, resize it to 256×256 . Apply a square mask so that only middle part of the image is visible.
2. Contrast stretching of a low contrast image, Histogram, and Histogram Equalization.
3. Write and execute program for geometric transformation of image (a) Translation (b) Scaling (c) Rotation (d) Shrinking (e) Zooming
4. Prepare any two images of size 256×256 in paint. Save it in JPEG format 256 gray levels. Perform logical NOR, NAND operations between two images. Write program and paste your results
5. To Implement smoothing or averaging filter in spatial domain
6. Program of sharpen image using gradient mask.
7. To implement sharpening in frequency domain using High pass filtering
8. Program for DCT/IDCT computation
9. To add salt and pepper noise in the image and apply image restoration technique using Wiener filter and median filter
10. Write and execute programs for image frequency domain filtering (a) Apply FFT on given image (b) Perform low pass and high pass filtering in frequency domain (c) Apply IFFT to reconstruct image
11. Edge Detection using Sobel, Prewitt and Roberts Operators
12. To create a program to eliminate the high frequency components of an image
13. Write a program for image compression
14. To fill the region of interest for the image
15. Morphological Operations on Binary Images: erosion and dilation

Wireless Sensor Networks Lab			
	L	P	C
		2	1

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
ECE	6	PCE	PCE-3	ECE-342P
CSE-IoT	6	PC	PC	IOT-328P
EAE	6	IOT-EAE	IOT-EAE-2C	IOT-332P
EAE	6	ICB-EAE	ICB-EAE-2C	IOT-332P
EEE	7	PCE	PCE-4	EEE-415P
CSE-NET	7	PC	PC	NET-475P
CSE-in-EA	7	OAE-CSE-EA	OAE-2	OECE-421P
EAE	7	NET-EAE	NET-EAE-5	NET-475P
OAE	7	ECE-OAE	ECE-OAE-4B	OECE-421P

Marking Scheme:

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

Instructions:

1. The course objectives and course outcomes are identical to that of (Wireless Sensor 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 under intimation to the office of the Head of Department / Institution in which the paper is being offered from the list of practicals below. Atleast 10 experiments must be performed by the students, they may be asked to do more. Atleast 5 experiments must be from the given list.

1. Introduction of Wireless sensor network applications and its simulation.
2. Network Simulator installation of wireless sensor network
3. Write TCL script for transmission between mobile nodes.
4. Write TCL script for sensor nodes with different parameters.
5. Generate tcl script for udp and CBR traffic in WSN nodes.
6. Generate tcl script for TCP and CBR traffic in WSN nodes.
7. Implementation of routing protocol in NS2 for AODV protocol.
8. Implementation of routing protocol in NS2 for DSR protocol.
9. Implementation of routing protocol in NS2 for TORA protocol.
10. Study other wireless sensor network simulators (Mannasim. Contiki.)

Machine Learning Lab			
	L	P	C
		2	1

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
ECE	6	PCE	PCE-3	ECE-350P
EAE	6	MLDA-EAE	MLDA-EAE-2C	ML-342P
CSE/IT/CST/ITE	7	PCE	PCE-5	CIE-421P
CSE-AIML	7	PC	PC	ML-407P
EAE	7	AIML-EAE	AIML-EAE-3	ML-407P

Marking Scheme:

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

Instructions:

1. The course objectives and course outcomes are identical to that of (Machine Learning) 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 Head of Department / Institution in which the paper is being offered from the list of practicals below. Atleast 10 experiments must be performed by the students, they may be asked to do more. Atleast 5 experiments must be from the given list.

1. Introduction to JUPYTER IDE and its libraries Pandas and NumPy
2. Program to demonstrate Simple Linear Regression
3. Program to demonstrate Logistic Regression
4. Program to demonstrate Decision Tree – ID3 Algorithm
5. Program to demonstrate k-Nearest Neighbor flowers classification
6. Program to demonstrate Naïve- Bayes Classifier
7. Program to demonstrate PCA and LDA on Iris dataset
8. Program to demonstrate DBSCAN clustering algorithm
9. Program to demonstrate K-Medoid clustering algorithm
10. Program to demonstrate K-Means Clustering Algorithm on Handwritten Dataset

Principles of Entrepreneurship Mindset			
		L	P
		2	2

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
All	7	HS/MS	MS	MS-401

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end 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 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 basic aspects of establishing a business in a competitive environment
2. To apply the basic understanding to examine the existing business ventures
3. To examine various business considerations such as marketing, financial and teaming etc.
4. To assess strategies for planning a business venture

Course Outcomes (CO)

CO 1 Understand basic aspects of establishing a business in a competitive environment

CO 2 Apply the basic understanding to examine the existing business ventures

CO 3 Examine various business considerations such as marketing, financial and teaming etc.

CO 4 Assessing strategies for planning a business venture

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	2	2	1	2	-	2	-	-	1	2	3	2
CO 2	2	2	1	2	-	2	-	-	1	2	3	2
CO 3	2	2	1	2	-	2	-	-	1	2	3	2
CO 4	2	2	1	2	-	2	-	-	1	2	3	2

UNIT-I

Entrepreneurial perspective: Foundation, Nature and development of entrepreneurship, importance of entrepreneurs, Entrepreneurial Mind, Individual entrepreneur Types of entrepreneurs, Entrepreneurship in India

UNIT-II

Beginning Considerations: Creativity and developing business ideas; Creating and starting the venture; Building a competitive advantage; Opportunity recognition, Opportunity assessment; Legal issues

UNIT-III

Developing Financial Plans: Sources of Funds, Managing Cash Flow, Creating a successful Financial Plan, Developing a business plan

UNIT - IV

Developing Marketing Plans: Developing a powerful Marketing Plan, E-commerce, Integrated Marketing Communications

Leading Considerations: Developing Team, Inviting candidates to join team, Leadership model

Textbook(s):

1. Robert D Hisrich, Michael P Peters & Dean A Shepherd, "Entrepreneurship" 10th Edition, McGraw Hill Education, 2018

References:

1. Norman M. Scarborough and Jeffery R. cornwell, "Essentials of entrepreneurship and small business management" 8th Edition, Pearson, 2016
2. Rajiv Roy, "Entrepreneurship", 2nd Edition, Oxford University Press, 2011
3. Sangeeta Sharma, "Entrepreneurship Development", 1st Edition, Prentice-Hall India, 2016
4. John Mullins, "The New Business Road Test: What entrepreneurs and investors should do before launching a lean start-up" 5th Edition, Pearson Education, 2017
5. Charantimath, Entrepreneurship Development and Small Business Enterprise, Pearson Education.

Machine Learning			
	L	P	C
	3		3

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
ECE	6	PCE	PCE-3	ECE-350T
EAE	6	MLDA-EAE	MLDA-EAE-2C	ML-342T
CSE/IT/CST/ITE	7	PCE	PCE-5	CIE-421T
CSE-AIML	7	PC	PC	ML-407T
EAE	7	AIML-EAE	AIML-EAE-3	ML-407T

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end 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 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 need of machine learning
2. To learn about regression and feature selection
3. To understand about classification algorithms
4. To learn clustering algorithms

Course Outcomes (CO)

- CO 1** To formulate machine learning problems
- CO 2** Learn about regression and feature selection techniques
- CO 3** Apply machine learning techniques such as classification to practical applications
- CO 4** Apply clustering 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	3	3	3	3	2	2	-	-	-	-	2
CO 2	3	3	3	3	3	2	2	-	-	-	-	2
CO 3	3	3	3	3	3	2	2	-	-	-	-	2
CO 4	3	3	3	3	3	2	2	-	-	-	-	2

UNIT-I

Introduction: Machine learning, terminologies in machine learning, Perspectives and issues in machine learning, application of Machine learning, Types of machine learning: supervised, unsupervised, semi-supervised learning. Review of probability, Basic Linear Algebra in Machine Learning Techniques, Dataset and its types, Data preprocessing, Bias and Variance in Machine learning, Function approximation, Overfitting

UNIT-II

Regression Analysis in Machine Learning: Introduction to regression and its terminologies, Types of regression, Logistic Regression

Simple Linear regression: Introduction to Simple Linear Regression and its assumption, Simple Linear Regression Model Building, Ordinary Least square estimation, Properties of the least-squares estimators and the fitted regression model, Interval estimation in simple linear regression, Residuals

Multiple Linear Regression: Multiple linear regression model and its assumption, **Interpret Multiple Linear Regression Output (R-Square, Standard error, F, Significance F, Coefficient P values), Access the fit of multiple linear regression model (R squared, Standard error)**

Feature Selection and Dimensionality Reduction: PCA, LDA, ICA

UNIT-III

Introduction to Classification and Classification Algorithms: What is Classification? General Approach to Classification, k-Nearest Neighbor Algorithm, Random Forests, Fuzzy Set Approaches

Support Vector Machine: Introduction, Types of support vector kernel – (Linear kernel, polynomial kernel, and Gaussian kernel), Hyperplane – (Decision surface), Properties of SVM, and Issues in SVM.

Decision Trees: Decision tree learning algorithm, ID-3 algorithm, Inductive bias, Entropy and information theory, Information gain, Issues in Decision tree learning.

Bayesian Learning - Bayes theorem, Concept learning, Bayes Optimal Classifier, Naïve Bayes classifier, Bayesian belief networks, EM algorithm

Ensemble Methods: Bagging, Boosting and AdaBoost and XBoost,

Classification Model Evaluation and Selection: Sensitivity, Specificity, Positive Predictive Value, Negative Predictive Value, Lift Curves and Gain Curves, ROC Curves, Misclassification Cost Adjustment to Reflect Real-World Concerns, Decision Cost/Benefit Analysis

UNIT – IV

Introduction to Cluster Analysis and Clustering Methods: The Clustering Task and the Requirements for Cluster Analysis, Overview of Some Basic Clustering Methods: k-Means Clustering, k-Medoids Clustering, Density-Based Clustering: DBSCAN - Density-Based Clustering Based on Connected Regions with High Density, Gaussian Mixture Model algorithm, Balance Iterative Reducing and Clustering using Hierarchies (BIRCH), Affinity Propagation clustering algorithm, Mean-Shift clustering algorithm, ordering Points to Identify the Clustering Structure (OPTICS) algorithm, Agglomerative Hierarchy clustering algorithm, **Divisive Hierarchical**, Measuring Clustering Goodness

Textbook(s):

1. Tom M. Mitchell, "Machine Learning", McGraw-Hill Education (India) Private Limited, 2013.
2. M. Gopal, "Applied Machine Learning", McGraw Hill Education

References:

1. C. M. BISHOP (2006), "Pattern Recognition and Machine Learning", Springer-Verlag New York, 1st Edition
2. R. O. Duda, P. E. Hart, D. G. Stork (2000), Pattern Classification, Wiley-Blackwell, 2nd Edition

Reinforcement Learning and Deep Learning	L	P	C
	3		3

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
CSE-AIML	7	PC	PC	ML-409T
EAE	7	AIML-EAE	AIML-EAE-4	ML-409T

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end 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 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 introduce the foundation of Reinforcement learning foundation and Q Network algorithm)
2. To understand policy optimization ,recent advanced techniques and applications of Reinforcement learning
3. To introduce the concept of deep learning and neural network
4. To understand the concept of NLP and computer vision in deep learning

Course Outcomes (CO)

- | | |
|-------------|---|
| CO 1 | Learn how to define RL tasks and the core principals behind the RL, including policies, value functions, deriving Bellman equations and underst and work with approximate solution(deep Q Network based algorithms) |
| CO 2 | Learn the policy gradient methods from vanilla to more complex cases and learn application and advanced techniques in Reinforcement Learning |
| CO 3 | Apply neural networks for problem solving |
| CO 4 | Able to Analyse images and have basic understanding of NLP in deep learning |

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	3	3	2	2	-	-	-	-	2
CO 2	3	2	3	3	3	2	2	-	-	-	-	2
CO 3	3	2	3	3	3	2	2	-	-	-	-	2
CO 4	3	2	3	3	3	2	2	-	-	-	-	2

UNIT-I

Reinforcement Learning Foundation: Introduction to Reinforcement learning and its terms,Features and elements of RL, Defining RL Framework and Markov Decision Process , Polices, Value Functions and Bellman Equations, Exploration vs. Exploitation, Code Standards and Libraries used in RL (Python/Keras/Tensorflow)

Tabular Methods and Q-networks: Planning through the use of Dynamic Programming and Monte Carlo, Temporal-Difference learning methods (TD(0), SARSA, Q-Learning), Deep Q-networks (DQN, DDQN, Dueling DQN, Prioritised Experience Replay)

UNIT-II

Policy Optimization: Introduction to policy-based methods, Vanilla Policy Gradient, REINFORCE algorithm and stochastic policy search, Actor-critic methods (A2C, A3C), Advanced policy gradient (PPO, TRPO, DDPG),

Model-Based RL: Model-based RL approach

Recent Advances and Applications: Meta-learning, Multi-Agent Reinforcement Learning, Partially Observable Markov Decision Process, Applying RL for real-world problems

UNIT-III

Introduction to Deep learning: Introduction to deep learning and its application, Examples of deep learning

Introduction to Neural Network: Introduction to Neural Network its types and application, Introduction to keras, Introduction to ANN Perceptron and its uses, Multilayer perceptron and deep neural network, Activation function and its working TanH function, sigma, relu etc, Feed forward network, Cost function, Backpropagation, Gradient Descent, Regularization and dropout technique, Batch normalization.

Types of Neural Network: Convolutional Neural network, CNN Pooling, CNN Layers, Flattening and Full connection, Preparing a fully connected neural network, Introduction to RNN, Deep RNN, Long Short Term Memory, GRU, Transfer Learning,

UNIT – IV

Deep Learning for Natural Language Processing: Introduction to NLP and Vector Space Model of Semantics Word Vector Representations: Continuous Skip-Gram Model, Continuous Bag-of-Words model (CBOW), Glove, Evaluations and Applications in word similarity, analogy reasoning

Deep Learning for Computer Vision: Image segmentation, object detection, automatic image captioning, Image generation with Generative adversarial networks, video to text with LSTM models. Attention models for computer vision tasks.

Textbook(s):

1. Richard S. Sutton and Andrew G. Barto, "Reinforcement learning: An introduction", 2nd Edition, MIT Press, 2019
2. Goodfellow, Ian, Yoshua Bengio, and Aaron Courville. "Deep learning." MIT press, 2016.
3. Antonio Gulli and Sujit Pal, "Deep learning with Keras"

References:

1. Wiering, Marco, and Martijn Van Otterlo. "Reinforcement learning: Adaptation, Learning, and Optimization" (2012)
2. Daniel Slater, Gianmario Spacagna and Peter Roelants, "Python Deep Learning", Packt Publication.

Pattern Recognition and Computer Vision			
L	P	C	
3		3	

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
CSE-AIML	7	PC	PC	ML-411T
EAE	7	AIML-EAE	AIML-EAE-5	ML-411T

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end 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 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. Understand the in-depth concept of Pattern Recognition
2. Implement Bayes Decision Theory
3. Understand the in-depth concept of Perception and related Concepts
4. Understand the concept of ML Pattern Classification

Course Outcomes (CO)

- CO 1** Discuss various concepts of pattern recognition
- CO 2** Understanding various algorithms
- CO 3** Explain and apply various computer vision techniques
- CO 4** Describe the concept of shape analysis and filtering

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	3	3	-	2	-	-	1	3	2
CO 2	3	3	1	1	1	-	1	1	-	2	2	1
CO 3	3	2	3	3	2	-	2	-	-	2	3	1
CO 4	1	2	3	2	2	-	1	-	-	1	2	2

UNIT-I

Induction Algorithms. Rule Induction. Decision Trees. Bayesian Methods. The Basic Naive Bayes Classifier. Naive Bayes Induction for Numeric Attributes. Correction to the Probability Estimation. Laplace Correction. No Match. Other Bayesian Methods. Other Induction Methods. Neural Networks. Genetic Algorithms. Instance-based Learning. Support Vector Machines.

UNIT-II

About Statistical Pattern Recognition. Classification and regression. Features and Feature Vectors, and Classifiers. Pre-processing and feature extraction. The curse of dimensionality. Polynomial curve fitting. Model complexity. Multivariate non-linear functions. Bayes' theorem. Decision boundaries. Parametric methods. Sequential parameter estimation. Linear discriminant functions. Fisher's linear discriminant. Feed-forward network mappings.

UNIT-III

Review of image processing techniques – classical filtering operations – thresholding techniques – edge detection techniques – corner and interest point detection – mathematical morphology – texture.

UNIT – IV

Binary shape analysis – connectedness – object labelling and counting – size filtering – distance functions – skeletons and thinning – deformable shape analysis – boundary tracking procedures – active contours – shape models and shape recognition – centroidal profiles – handling occlusion – boundary length measures – boundary descriptors – chain codes – Fourier descriptors – region descriptors – moments.

Textbook(s):

1. Pattern Classification, Richard O. Duda, Peter E. Hart, and David G. Stork. Wiley, 2000, 2nd Edition
2. D. L. Baggio et al., Mastering OpenCV with Practical Computer Vision Projects, Packt Publishing, 2012.

References:

1. Pattern Recognition, Jürgen Beyerer, Matthias Richter, and Matthias Nagel. 2018
2. E. R. Davies, Computer & Machine Vision, Fourth Edition, Academic Press, 2012

Supervised and Deep Learning			
L		P	C
3			3

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
EAE	7	MLDA-EAE	MLDA-EAE-3	ML-463T

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end 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 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 introduce students to the fundamentals of Supervised Learning and Deep Learning techniques and algorithms. |
| 2. | To enable students to develop skills in implementing supervised and deep learning algorithms using Python programming language and popular machine learning libraries. |
| 3. | To equip students with the ability to evaluate the performance of supervised and deep learning models and select the appropriate models for specific problems. |
| 4. | To provide students with hands-on experience in working with real-world supervised and deep learning projects. |

Course Outcomes (CO)

- | | |
|-------------|--|
| CO 1 | Develop a deep understanding of the concepts and applications of Supervised Learning and Deep Learning techniques and algorithms. |
| CO 2 | Develop proficiency in using Python programming language and popular machine learning libraries to implement supervised and deep learning models. |
| CO 3 | Demonstrate the ability to evaluate the performance of supervised and deep learning models and select the appropriate models for specific problems. |
| CO 4 | Gain hands-on experience in working with real-world supervised and deep learning projects, including image recognition, text analysis, and time-series analysis. |

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

Introduction to Machine Learning, Types of Machine Learning, Supervised Learning Basics, Regression and Classification, Linear Regression, Logistic Regression, Model Evaluation Metrics

UNIT-II

Introduction to Deep Learning, Artificial Neural Networks, Activation Functions, Loss Functions, Optimization Algorithms, Backpropagation Algorithm, Regularization Techniques

UNIT-III

Introduction to CNNs, CNN Architecture, Convolution and Pooling Layers, Object Detection, Image Segmentation, Transfer Learning, Introduction to RNNs, RNN Architecture, Long Short-Term Memory (LSTM), Gated Recurrent Unit (GRU), Text Generation, Language Translation

UNIT – IV

Generative Adversarial Networks (GANs), Autoencoders, Reinforcement Learning, Natural Language Processing (NLP), Sentiment Analysis, Time Series Analysis

Textbooks:

1. Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow", 2nd Edition, O'Reilly Media, 2019. ISBN: 978-1492032649
2. Francois Chollet, "Deep Learning with Python", 1st Edition, Manning Publications, 2017. ISBN: 978-1617294433

Reference Books:

1. "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" by Aurélien Géron.
2. "Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville.
3. "Pattern Recognition and Machine Learning" by Christopher M. Bishop.
4. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, "Deep Learning", 1st Edition, MIT Press, 2016. ISBN: 978-0262035613
5. Andrew Ng, "Machine Learning Yearning", eBook, 2018.
6. Sebastian Raschka and Vahid Mirjalili, "Python Machine Learning", 3rd Edition, Packt Publishing, 2019. ISBN: 978-1789955750

Unsupervised Learning			
		L	P
		3	3

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
EAE	7	MLDA-EAE	MLDA-EAE-4	ML-465T

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end 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 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 learn about unsupervised learning and clustering algorithms
2. To learn about Gaussian mixture models and linear dimensional reduction methods
3. To learn about autoencoders and generative adversarial network
4. To learn about outlier detection, density estimation methods and unsupervised learning networks

Course Outcomes (CO)

- | | |
|-------------|--|
| CO 1 | Applying clustering algorithms for the real world data |
| CO 2 | Applying Dimensional reduction techniques for feature extraction and learn, Gaussian mixture models |
| CO 3 | Learn about Autoencoders and Generative adversarial network |
| CO 4 | Applying outlier and novelty detection, density estimation methods to real world data and learn about unsupervised learning networks |

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	3	3	2	2	-	-	-	-	2
CO 2	3	2	3	3	3	2	2	-	-	-	-	2
CO 3	3	2	3	3	3	2	2	-	-	-	-	2
CO 4	3	2	3	3	3	2	2	-	-	-	-	2

UNIT-I

Unsupervised learning - Introduction, Unsupervised vs Supervised Learning, Application of Unsupervised Learning,

Clustering –Clustering as a Machine Learning task, Different types of clustering techniques, Partitioning methods, Hierarchical clustering, Density-based methods: DBSCAN

Biclustering :Spectral co-clustering, spectral biclustering

Finding Pattern using Association Rule - Definition of common terms, Association rule, Apriori algorithm.

UNIT-II

Gaussian Mixture Models: Gaussian mixture, Variational Bayesian Gaussian mixture

Manifold learning: Introduction, Isomap, Locally linear embedding, Modified locally linear embedding, Spectral embedding, MDS (Multi dimensional scaling, t-distributed Stochastic Neighbor Embedding (t-SNE))

Decomposing signals in components (matrix factorization problems): PCA (Principal component Analysis), Factor Analysis, Kernel Principal Component Analysis (kPCA), Truncated singular value decomposition and latent semantic analysis, Independent component analysis (ICA), Non-negative matrix factorization (NMF or NNMF), Latent Dirichlet Allocation (LDA)

UNIT-III

Autoencoders: Architecture, Layers in autoencoder, training of autoencoder, Sparse Coding, Undercomplete Autoencoders, Regularized Autoencoders, Stochastic Encoders and Decoders, Denoising Autoencoders, Contractive Autoencoders, Applications of Autoencoders.

Generative Adversarial Networks: Generative Vs Discriminative Modeling, Probabilistic Generative Model, Generative Adversarial Networks (GAN), GAN challenges: Oscillation Loss, Mode Collapse, Uninformative Loss, Hyperparameters, Tackling GAN challenges, Wasserstein GAN, Cycle GAN, Neural Style Transfer

UNIT - IV

Novelty and outlier detection: Overview of outlier detection methods, Novelty detection, outlier detection

Density estimation: Histograms and kernel density estimation

Unsupervised Learning Networks: Kohonen Self-Organizing Feature Maps – architecture, training algorithm, Kohonen Self-Organizing Motor Map, Restricted Boltzmann machine (neural network model)

Textbook(s):

1. Tom M. Mitchell, "Machine Learning", McGraw-Hill Education (India) Private Limited, 2013.
2. Benyamin Ghogho, Mark Crowley, Fakhri Karray, Ali Ghodsi, Elements of Dimensionality Reduction and Manifold Learning, Springer

References:

1. C. M. BISHOP (2006), "Pattern Recognition and Machine Learning", Springer-Verlag New York, 1st Edition
2. Kevin Murphy, *Machine learning: a probabilistic perspective*.
3. Jennifer Grange, "Machine Learning for Absolute Beginners: A Simple, Concise & Complete Introduction to Supervised and Unsupervised Learning Algorithms", Kindle

Machine Learning and Data Analytics Frameworks			
		L	P
		3	3

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
EAE	7	MLDA-EAE	MLDA-EAE-5B	ML-469T

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end 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 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. This course provides the fundamental concepts in data science.
2. Learn the Basics of statistical data analysis with examples.
3. Basics of Machine Learning and statistical measures.
4. Compile and visualize data using statistical functions.

Course Outcomes (CO)

- | | |
|-------------|---|
| CO 1 | Impart the knowledge of data classification, process of big data technology, user roles and skills in data science. |
| CO 2 | Understand how data is analysed and visualized using statistic functions |
| CO 3 | Analyze the methodologies of data science |
| CO 4 | To Introduce the concepts of data modelling techniques using Machine Learning for Data Analytics |

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	3	-	2	-	-	-	-	-	-
CO 2	-	3	-	2	-	-	-	-	-	-	2	-
CO 3	-	-	-	3	3	3	-	-	-	-	2	3
CO 4	-	-	3	2	-	3	-	-	-	-	2	2

UNIT-I

Introduction and Concepts, Differentiating algorithmic and model based frameworks, Regression: Ordinary Least Squares, Ridge Regression, Lasso Regression, Regression: Ordinary Least Squares, Ridge Regression, and Lasso Regression.

UNIT-II

Linear Discriminant Analysis Quadratic Discriminant Analysis, Support Vector Machine (SVM), Bias-Variance Dichotomy Model Validation Approaches, Neural Networks , Clustering, Association Rule Mining ,Deep learning Concepts.

UNIT-III

Data Analytics- Relation: Data Science, Analytics and Big Data Analytics. Data Science Components – Big data technology – Data Science user- roles and skills- Data Science use cases. Statistical methods: Descriptive Statistics Probability Distributions (Binomial, Poisson, Normal) Sampling Distributions (Chi-squared, t, F), Estimation

UNIT - IV

Prescriptive analytics: Creating data for analytics through Active learning, Creating data for analytics through Reinforcement learning, .Test of Hypothesis, ANOVA.

Textbook(s):

1. Data analytics with R by Dr. Bharti Motwani , wiley publication
2. V. Bhuvaneswari (2016). Data Analytics with R, Bharathiar University.

References:

1. Modellind Techniuques in Predictive Analytics, Thomas W Miller, Pearson
2. Introduction to Machine Learning with Python, A. C. Muller & S. Guido, O'Reilly

Engineering Optimization			
L	P	C	
4			4

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
CSE/CST	6	PCE	PCE-1	CIE-312
ECE	7	PCE	PCE-4	ECE-415

Marking Scheme:

1. Teachers Continuous Evaluation: 25 marks
2. Term end 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 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. This course will expose students to operations research modelling and essential tools for optimization.
2. Analyse models using optimization techniques based upon the fundamentals of engineering mathematics
3. The stochastic models for discrete and continuous variables to control inventory and simulation for decision making.
4. Formulation of mathematical models for quantitative analysis of managerial problems in industry.

Course Outcomes (CO)

- | | |
|-------------|--|
| CO 1 | To Identify appropriate optimization method to solve complex problems involved in various industries. |
| CO 2 | To Find the appropriate algorithm for resource management using mathematical foundations. |
| CO 3 | To Explain the theoretical workings of the analytical methods for making effective decision on variables so as to optimize the objective function. |
| CO 4 | To Apply the knowledge of modern methods of meta-heuristic concepts to articulate real-world competitive situations to identify strategic decisions to counter the consequences. |

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	1	1	2	-	-	-	-	-	-	-	2
CO 2	2	2	-	2	-	-	-	-	-	-	-	2
CO 3	2	1	-	2	2	-	-	-	-	-	-	2
CO 4	2	1	-	2	2	-	-	-	-	-	-	2

UNIT-I

Introduction to Optimization: Engineering application of Optimization – Statement of an Optimization problem – Optimal Problem formulation – Classification of Optimization problem. Definition of Global and Local optima – Optimality criteria.

UNIT-II

Optimization algorithms for solving unconstrained optimization problems – Gradient based method: Cauchy's steepest descent method, Newton's method, Conjugate gradient method.

UNIT-III

Optimization algorithms for solving constrained optimization problems – direct methods – penalty function methods – steepest descent method – Engineering applications of constrained and unconstrained algorithms.

UNIT - IV

Modern methods of Optimization: Genetic Algorithms – Simulated Annealing – Ant colony optimization – Tabu search – Neural-Network based Optimization – Fuzzy optimization techniques

Textbook(s):

1. Rao S. S., 'Engineering Optimization: Theory and Practice', New Age Publishers , 2012, 4th Ed

References:

1. Deb K., 'Optimization for Engineering Design Algorithms and Examples', PHI, 2000
2. Arora J., 'Introduction to Optimization Design', Elsevier Academic Press, New Delhi, 2004
3. Saravanan R., 'Manufacturing Optimization through Intelligent Techniques', Taylor & Francis (CRC Press), 2006
4. Hardley G., 'Linear Programming', Narosa Book Distributors Private Ltd., 2002

Introduction to Internet of Things			
		L	P
		3	3

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
CSE/IT/CST/ITE	6	PCE	PCE-2	CIE-330T
ICE	6	PCE	PCE-3	ICE-328T
CSE-IoT/CSE-ICB	6	PC	PC	IOT-324T
EE-VDT/EC-ACT	6	OAE-ECE-EA	OAE-1	IOT-324T
EAE	6	IOT-EAE	IOT-EAE-1A	IOT-324T
EAE	6	ICB-EAE	ICB-EAE-1A	IOT-324T
ECE	7	PCE	PCE-5	ECE-429T

Marking Scheme:

- Teachers Continuous Evaluation: 25 marks
- Term end Theory Examinations: 75 marks

Instructions for paper setter:

- There should be 9 questions in the term end examinations question paper.
- 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.
- 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.
- 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.
- The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

Course Objectives :

- Describe what IoT is and how it works today
- Recognise the factors that contributed to the emergence of IoT
- Design and program IoT devices
- Define the infrastructure for supporting IoT deployments

Course Outcomes (CO)

- CO 1** Demonstrate basic concepts, principles and challenges in IoT.
- CO 2** Illustrate functioning of hardware devices and sensors used for IoT
- CO 3** Analyze network communication aspects and protocols used in IoT
- CO 4** Apply IoT for developing real life applications using Arduino programming.

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	-
CO 2	1	-	2	-	3	-	-	-	-	1	-	2
CO 3	-	2	2	-	-	1	-	-	2	-	-	2
CO 4	2	1	-	-	2	-	-	-	-	1	1	-

UNIT-I

Internet of Things (IoT): Vision, Definition, Conceptual Framework, Architectural view, technology behind IoT, Sources of the IoT, M2M Communication, IoT Examples. Design Principles for Connected Devices: IoT/M2M systems layers and design standardization, communication technologies, data enrichment and consolidation, ease of designing and affordability

UNIT-II

Hardware for IoT: Sensors, Digital sensors, actuators, radio frequency identification (RFID) technology, wireless sensor networks, participatory sensing technology. Embedded Platforms for IoT: Embedded computing basics, Overview of IOT supported Hardware platforms such as Arduino, NetArduino, Raspberry pi, Beagle Bone, Intel Galileo boards and ARM cortex.

UNIT-III

Network & Communication aspects in IoT: Wireless Medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination

UNIT - IV

Programming the Arduino: Arduino Platform Boards Anatomy, Arduino IDE, coding, using emulator, using libraries, additions in arduino, programming the arduino for IoT.

Textbook(s):

1. Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things key applications and protocols", Willey
2. Jeeva Jose, Internet of Things, Khanna Publishing House

References:

1. Michael Miller, "The Internet of Things", Pearson
2. Raj Kamal, "Internet of Things", McGraw-Hill, 1st Edition

Machine Learning Lab			
	L	P	C
		2	1

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
ECE	6	PCE	PCE-3	ECE-350P
EAE	6	MLDA-EAE	MLDA-EAE-2C	ML-342P
CSE/IT/CST/ITE	7	PCE	PCE-5	CIE-421P
CSE-AIML	7	PC	PC	ML-407P
EAE	7	AIML-EAE	AIML-EAE-3	ML-407P

Marking Scheme:

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

Instructions:

1. The course objectives and course outcomes are identical to that of (Machine Learning) 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 Head of Department / Institution in which the paper is being offered from the list of practicals below. Atleast 10 experiments must be performed by the students, they may be asked to do more. Atleast 5 experiments must be from the given list.

1. Introduction to JUPYTER IDE and its libraries Pandas and NumPy
2. Program to demonstrate Simple Linear Regression
3. Program to demonstrate Logistic Regression
4. Program to demonstrate Decision Tree – ID3 Algorithm
5. Program to demonstrate k-Nearest Neighbor flowers classification
6. Program to demonstrate Naïve- Bayes Classifier
7. Program to demonstrate PCA and LDA on Iris dataset
8. Program to demonstrate DBSCAN clustering algorithm
9. Program to demonstrate K-Medoid clustering algorithm
10. Program to demonstrate K-Means Clustering Algorithm on Handwritten Dataset

Reinforcement Learning and Deep Learning Lab			
	L	P	C
		2	1

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
CSE-AIML	7	PC	PC	ML-409P
EAE	7	AIML-EAE	AIML-EAE-4	ML-409P

Marking Scheme:

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

Instructions:

1. The course objectives and course outcomes are identical to that of (Reinforcement Learning and Deep Learning) 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 Head of Department / Institution in which the paper is being offered from the list of practicals below. Atleast 10 experiments must be performed by the students, they may be asked to do more. Atleast 5 experiments must be from the given list.

1. Setting up the Spyder IDE Environment and Executing a Python Program
2. Installing Keras, Tensorflow and Pytorch libraries and making use of them
3. Implement Q-learning with pure Python to play a game
 - Environment set up and intro to OpenAI Gym
 - Write Q-learning algorithm and train agent to play game
 - Watch trained agent play game
4. Implement deep Q-network with PyTorch
5. Python implementation of the iterative policy evaluation and update.
6. Chatbot using bi-directional LSTMs
7. Image classification on MNIST dataset (CNN model with fully connected layer)
8. Train a sentiment analysis model on IMDB dataset, use RNN layers with LSTM/GRU
9. Applying the Deep Learning Models in the field of Natural Language Processing
10. Applying the Convolution Neural Network on computer vision problems

Pattern Recognition and Computer Vision Lab			
	L	P	C
		2	1

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
CSE-AIML	7	PC	PC	ML-411P
EAE	7	AIML-EAE	AIML-EAE-5	ML-411P

Marking Scheme:

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

Instructions:

1. The course objectives and course outcomes are identical to that of (Pattern Recognition and Computer Vision) 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 Head of Department / Institution in which the paper is being offered from the list of practicals below. Atleast 10 experiments must be performed by the students, they may be asked to do more. Atleast 5 experiments must be from the given list.

1. Write a MATLAB/Python function that computes the value of the Gaussian distribution $N(m,s)$ at given vector X and plot the effect of varying mean and variance to the normal distribution.
2. Implementation of Gradient descent.
3. Implementation of Linear Regression using Gradient descent.
4. Comparison of classification accuracy of SVM and CNN for the dataset.
5. Implementation basic Image Handling and processing operations on the image.
6. Implementation of Geometric Transformation.
7. Implementation of Perspective Transformation.
8. Implementation of Camera Calibration
9. Compute Fundamental Matrix.

Supervised and Deep Learning Lab			
	L	P	C
		2	1

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
EAE	7	MLDA-EAE	MLDA-EAE-3	ML-463P

Marking Scheme:

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

Instructions:

1. The course objectives and course outcomes are identical to that of (Supervised and Deep Learning) 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 Head of Department / Institution in which the paper is being offered from the list of practicals below. Atleast 10 experiments must be performed by the students, they may be asked to do more. Atleast 5 experiments must be from the given list.

1. Linear regression: Implement linear regression on a dataset and evaluate the model's performance.
2. Logistic regression: Implement logistic regression on a binary classification dataset and evaluate the model's performance.
3. k-Nearest Neighbors (k-NN): Implement k-NN algorithm on a dataset and evaluate the model's performance.
4. Decision Trees: Implement decision trees on a dataset and evaluate the model's performance.
5. Random Forest: Implement random forest algorithm on a dataset and evaluate the model's performance.
6. Support Vector Machines (SVM): Implement SVM on a dataset and evaluate the model's performance.
7. Naive Bayes: Implement Naive Bayes algorithm on a dataset and evaluate the model's performance.
8. Gradient Boosting: Implement gradient boosting algorithm on a dataset and evaluate the model's performance.
9. Convolutional Neural Networks (CNN): Implement CNN on an image classification dataset and evaluate the model's performance.
10. Recurrent Neural Networks (RNN): Implement RNN on a text classification dataset and evaluate the model's performance.
11. Long Short-Term Memory Networks (LSTM): Implement LSTM on a time-series dataset and evaluate the model's performance.
12. Autoencoders: Implement autoencoders on an image dataset and evaluate the model's performance.
13. Generative Adversarial Networks (GANs): Implement GANs on an image dataset and evaluate the model's performance.
14. Transfer Learning: Implement transfer learning on an image dataset and evaluate the model's performance.
15. Reinforcement Learning: Implement reinforcement learning on a game environment and evaluate the model's performance.

Unsupervised Learning Lab	L	P	C
		2	1

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
EAE	7	MLDA-EAE	MLDA-EAE-4	ML-465P

Marking Scheme:

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

Instructions:

1. The course objectives and course outcomes are identical to that of (Unsupervised Learning) 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 Head of Department / Institution in which the paper is being offered from the list of practicals below. Atleast 10 experiments must be performed by the students, they may be asked to do more. Atleast 5 experiments must be from the given list.

1. Setting up the Jupyter Notebook and Executing a Python Program
2. Installing Keras, Tensorflow and Pytorch, Pandas, numpy etc libraries and making use of them
3. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.
4. Program to demonstrate k-means clustering algorithm
5. Program to demonstrate DBSCAN clustering algorithm
6. Program to demonstrate PCA and LDA on Iris dataset
7. Compare the performance of PCA and Autoencoders on a given dataset
8. Build Generative adversarial model for fake (news/image/audio/video) prediction.
9. Outlier detection in time series dataset using RNN
10. Anomaly detection using Self-Organizing Network

Machine Learning and Data Analytics Frameworks Lab			
	L	P	C
		2	1

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
EAE	7	MLDA-EAE	MLDA-EAE-5B	ML-469P

Marking Scheme:

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

Instructions:

1. The course objectives and course outcomes are identical to that of (Machine Learning and Data Analytics Frameworks) 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 Head of Department / Institution in which the paper is being offered from the list of practicals below. Atleast 10 experiments must be performed by the students, they may be asked to do more. Atleast 5 experiments must be from the given list.

1. R AS CALCULATOR APPLICATION

- a. Using with and without R objects on console
- b. Using mathematical functions on console
- c. Write an R script, to create R objects for calculator application and save in a specified location in disk.

2. DESCRIPTIVE STATISTICS IN R

- a. Write an R script to find basic descriptive statistics using summary, str, quartile function on mtcars& cars datasets.
- b. Write an R script to find subset of dataset by using subset (), aggregate () functions on iris dataset.

3. READING AND WRITING DIFFERENT TYPES OF DATASETS

- a. Reading different types of data sets (.txt, .csv) from Web and disk and writing in file in specific disk location.
- b. Reading Excel data sheet in R.
- c. Reading XML dataset in R.

4. VISUALIZATIONS

- a. Find the data distributions using box and scatter plot.
- b. Find the outliers using plot.
- c. Plot the histogram, bar chart and pie chart on sample data.

5. CORRELATION AND COVARIANCE

- a. Find the correlation matrix.
- b. Plot the correlation plot on dataset and visualize giving an overview of relationships among data on iris data.
- c. Analysis of covariance: variance (ANOVA), if data have categorical variables on iris data

6. REGRESSION MODEL

Import a data from web storage. Name the dataset and now do Logistic Regression to find out relation between variables that are affecting the admission of a student in an institute based on his or her GRE score, GPA obtained and rank of the student. Also check the model is fit or not. Require (foreign), require (MASS).

Introduction to Internet of Things Lab			
	L	P	C
		2	1

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
CSE/IT/CST/ITE	6	PCE	PCE-2	CIE-330P
ICE	6	PCE	PCE-3	ICE-328P
CSE-IoT/CSE-ICB	6	PC	PC	IOT-324P
EE-VDT/EC-ACT	6	OAE-ECE-EA	OAE-1	IOT-324P
EAE	6	IOT-EAE	IOT-EAE-1A	IOT-324P
EAE	6	ICB-EAE	ICB-EAE-1A	IOT-324P
ECE	7	PCE	PCE-5	ECE-429P

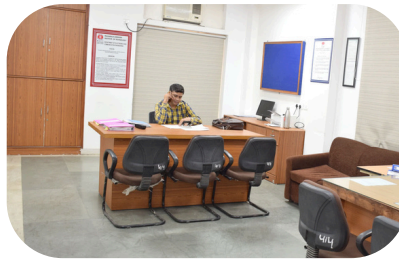
Marking Scheme:

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

Instructions:

1. The course objectives and course outcomes are identical to that of (Introduction to Internet of Things) 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 Head of Department / Institution in which the paper is being offered from the list of practicals below. Atleast 10 experiments must be performed by the students, they may be asked to do more. Atleast 5 experiments must be from the given list.

1. Start Raspberry Pi and try various Linux commands in command terminal window: ls, cd, touch, mv, rm, man, mkdir, rmdir, tar, gzip, cat, more, less, ps, sudo, cron, chown, chgrp, ping etc
2. Run some python programs on Pi like: a) Read your name and print Hello message with name b) Read two numbers and print their sum, difference, product and division. c) Word and character count of a given string. d) Area of a given shape (rectangle, triangle and circle) reading shape and appropriate values from standard input.
3. Run some python programs on Pi like: a) Print a name 'n' times, where name and n are read from standard input, using for and while loops. b) Handle Divided by Zero Exception. c) Print current time for 10 times with an interval of 10 seconds. d) Read a file line by line and print the word count of each line.
4. Light an LED through Python program
5. Get input from two switches and switch on corresponding LEDs.
6. Flash an LED at a given on time and off time cycle, where the two times are taken from a file.
7. Flash an LED based on cron output (acts as an alarm)
8. Switch on a relay at a given time using cron, where the relay's contact terminals are connected to a load.
9. Get the status of a bulb at a remote place (on the LAN) through web.
10. Push sensor data to cloud and Control an actuator through cloud.



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- Yagyashala
- Meditation Centre
- Spiritual Library
- E Vehicle Charging
- Rain Water Harvesting
- Solar Power Panels

Brand Promising Ranking



MAIT HIGHLIGHTS

- Many Prestigious Awards:** ISTE Best Faculty Chapter; 2024 Jagran Achievers Award; 2024 ASHRAE SBA Award, Orlando 2025; National Employability Award; North India Education Leadership Award 2023; AAAA by Career 360, 2024.
- ISO 9001: 2015 (2022-2025) Certified.**
- Multiple Sponsored National & International Projects** of worth more than Rs 2 Crores from ASHRAE, India-Russia Joint Research, DST, AICTE, DRDO, Society of Microelectronics and VLSI etc.
- International MoUs** with Mega group-Tokyo, Mitutoyo-Japan, US Work Study Pvt. Ltd. etc.
- Active NCC and NSS Wings**
- Unnat Bharat Abhiyaan** (adopted 5 villages)
- MAIT Promotes Social Activities:** Donated Rs 2 Cr for Sh. Ram Janam Bhoomi, PM Care Fund, PM Relief fund, Bharat ke Veer etc.
- Multiple technical and non-technical clubs/ Societies** like Drone, SAE, IEEE, ISTE, ASHRAE, Robotics, Coding, Sports, cultural etc.
- Hackathon Winners at National and International Levels**

COURSES OFFERED

ENGINEERING (B.TECH):

- Computer Science & Engineering (CSE)
- CSE (Artificial Intelligence)
- CSE (Data Science)
- CSE (Artificial Intelligence & Machine Learning)
- Computer Science & Technology (CST)
- Information Technology
- Information Technology & Engineering
- Electronics and Communication Engineering (ECE)
- EC- VLSI
- EC- ACT
- Electrical & Electronics Engineering (EEE)
- Mechanical Engineering (ME)
- BBA & MBA

B.Tech. (CSE, ECE, and MAE)
Accredited by



Band 201-300, 2024



CELEBRATING 25 YEARS OF EXCELLENCE IN EDUCATION

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