SYLLABUS

(With effect from 2023 -24)

ಪಠ್ಯಕ್ರಮ

(ಶೈಕ್ಷಣಿಕ ವರ್ಷ 2023-24)

Bachelor Degree

In

Electrical and Electronics Engineering

III & IV Semester

Outcome Based Education

With

Choice Based Credit System

[National Education Policy Scheme]

P.E.S. College of Engineering, Mandya - 571 401, Karnataka

[An Autonomous Institution affiliated to VTU, Belagavi,
Grant – in – Aid Institution (Government of Karnataka),
Accredited by NBA (All UG Programs), NAAC and Approved by AICTE, New Delhi]

ಪಿ.ಇ.ಎಸ್. ತಾಂತ್ರಿಕ ಮಹಾವಿದ್ಯಾಲಯ

ಮಂಡ್ಯ–571 401, ಕರ್ನಾಟಕ

(ವಿ.ಟಿ.ಯು, ಬೆಳಗಾವಿ ಅಡಿಯಲ್ಲಿನ ಸ್ವಾಯತ್ತ ಸಂಸ್ಥೆ)

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VISION

"PESCE shall be a leading institution imparting quality Engineering and Management education developing creative and socially responsible professionals."

MISSION

- *Provide state of the art infrastructure, motivate the faculty to be proficient in their field of specialization and adopt best teaching-learning practices.*
- *Impart engineering and managerial skills through competent and committed faculty using outcome based educational curriculum.*
- *Inculcate professional ethics, leadership qualities and entrepreneurial skills to meet the societal needs.*
- *Promote research, product development and industry-institution interaction.*

QUALITY POLICY

Highly committed in providing quality, concurrent technical education and continuously striving to meet expectations of stake holders.

CORE VALUES

***P**rofessionalism*
***E**mpathy*
***S**ynergy*
***C**ommitment*
***E**thics*

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Profile

Department of Electrical & Electronics Engineering Programme has been accredited by NBA for 6 Academic years (2017-18 to 2022-23)

The Department of Electrical and Electronics Engineering was established right from the inception of the institute in the year 1962. The various programs offered by the Department are B.E., M.Sc., (Engg.) by research and research leading Ph.D affiliated to Visvesvaraya Technological University (VTU), Belagavi. Also, Department is affiliated for Ph.D program with University of Mysore, Mysore . More than 100 research papers have been published by the Department faculty members in various International & National journals and conferences.

The Department emphasizes towards imparting quality education, rigorous teaching-learning, hands-on expertise and helping students to shape their all-round personality. The Department with its strong pool of faculty, well-developed laboratories, latest software and hardware facilities, contributes to develop life-long learning skills to its students and producing worthy researchers by offering doctoral research program.

The academic programs are designed and updated keeping in view the constantly changing industrial needs, skills and challenges emerging out of new research. The academic programs are well received by the industry and academia. The department has always exerted the best of its effort to meet the objectives of achieving technical excellence in the areas of Electrical and Electronics Engineering such as High Voltage Engineering, Power Electronics & Drives, Control Systems, Power Systems, Energy Systems, Analog and Digital Electronics, Signal Processing, PLC & SCADA and Microcontrollers

The Department regularly organizes industrial visits, Technical lectures by experts from industries and institutes in contemporary areas to bridge the gap between syllabi and current developments.

VISION

The department of E & E would endeavor to create a pool of Engineers who would be technically competent, ethically strong also fulfill their obligation in terms of social responsibility.

MISSION

- Adopt the best pedagogical methods and provide the best facility, infrastructure and an ambience conducive to imbibe technical knowledge and practicing ethics.
- Group and individual exercises to inculcate habit of analytical and strategic thinking to help the students to develop creative thinking and instil team skills.
- MOUs and Sponsored projects with industry and R & D organizations for Collaborative learning
- Enabling and encouraging students for continuing Education and moulding them for life-long learning process

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1: Excel in professional career and/or higher education by acquiring knowledge in mathematical, computing and Electrical & Electronics engineering principles

PEO2: Analyze real life problems and Design Electrical & Electronics Engineering system with appropriate solutions that are technically sound, economically feasible and socially acceptable

PEO3: Exhibit professionalism, ethical attitude, communications skills, team work in their profession and adapt to current trends by engaging in lifelong learning.

PROGRAMME OUTCOMES (POs)

PO-1: Graduates will apply the knowledge of mathematics, Physics, chemistry and allied engineering subjects to solve problems in Electrical and Electronics Engineering.

PO-2: Graduates will Identify, formulate and solve Electrical and Electronics Engineering problem.

PO-3: Graduates will design Electrical and Electronics systems meeting the given specifications for different problems taking safety and precautions into consideration.

PO-4: Graduates will design, conduct experiments, analyze and interpret data

PO-5: Graduates will use modern software tools to model and analyze problems, keeping in view their limitations.

PO-6: Graduates will understand the impact of local and global issues / happenings on Electrical Engineers.

PO-7: Graduates will provide sustainable solutions for problems related to Electrical and Electronics Engineering and also will understand their impact on environment.

PO-8: Graduates will have knowledge of professional ethics and code of conduct as applied to Electrical Engineers.

PO-9: Graduates will work effectively as an individual and as a member or leader in diverse teams and in multi-disciplinary settings.

PO-10: Graduates will communicate effectively in both verbal and written form.

PO-11: Graduates will plan, execute and complete projects

PO-12: Graduates will have the ability for self- education and lifelong learning

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO1: To understand the concept in Electrical and Electronics Engineering and apply them to develop modules analyze assess the performance of various power system equipment, generation, transmission, utilization and protection mechanisms.

PSO2: Design, develop, analyze and test electrical and electronics system: Deploy control strategies for electrical dives, power system networks, power electronics, high voltage and other related applications.

Bachelor of Engineering (III–Semester)										
Sl. No.	**Course Code**	**Course Title**	**Teaching Department**	**Hrs/Week**			**Credits**	**Examination Marks**		
				L	**T**	**P**		**CIE**	**SEE**	**Total**
1	P22MA301	Transforms and Series	MA	2	2	0	3	50	50	100
2	P22EE302	Electrical circuit Analysis	E&EE	2	2	-	3	50	50	100
3	P22EE303	Transformer and Induction Machines	E&EE	3	-	-	3	50	50	100
4	P22EE304	Digital Systems (Integrated)	E&EE	3	-	2	4	50	50	100
5	P22EE305	AEC and LIC (Integrated)	E&EE	3	-	2	4	50	50	100
6	P22EEL306	AC Machines Lab oratory	E&EE	-	-	2	1	50	50	100
7	P22HSMC307	Employability Enhancement Skills - III	HSMC	-	2	-	1	50	50	100
8	P22BFE308	Biology For Engineers	E&EE	2	-	-	2	50	50	100
9	P22NSS309	National Service Scheme (NSS)	NSS coordinator	-	-	2	0	100	-	100
	P22PED309	Physical Education (PE) (Sports and Athletics)	PED							
	P22YOG309	Yoga	YOGA							
Total							**21**			

10	P22MDIP301	Additional Mathematics – I	MA	2	2	-	0	100	-	100
11	P22HDIP307	Additional Communicative English - I	HSMC	-	2	-	0	100	-	100

Bachelor of Engineering (IV–Semester)										
Sl. No.	**Course Code**	**Course Title**	**Teaching Department**	**Hrs/Week**			**Credits**	**Examination Marks**		
				L	**T**	**P**		**CIE**	**SEE**	**Total**
1	P22MA401B	Mathematical and Numerical Technique	MA	2	2	0	3	50	50	100
2	P22EE402	Electrical Power Generation, Transmission & Distribution	E&EE	2	2	-	3	50	50	100
3	P22EE403	DC and Synchronous Machines	E&EE	3	-	-	3	50	50	100
4	P22EE404	Microcontroller (Integrated)	E&EE	3	-	2	4	50	50	100
5	P22EE405	Signals and Digital Signal Processing (Integrated)	E&EE	3	-	2	4	50	50	100
6	P22EEL406	DC Machines Lab oratory	E&EE	-	-	2	1	50	50	100
7	P22HSMC407B	Employability Enhancement Skills - IV	HSMC	-	2	-	1	50	50	100
8.	P22INT408	Internship – I	E&EE	-	-	-	2	-	100	100
9.	P22NSS409	National Service Scheme (NSS)	NSS coordinator	-	-	2	0	100	-	100
	P22PED409	Physical Education (PE) (Sports and Athletics)	PED							
	P22YOG409	Yoga	YOGA							
Total							**21**			

10	P22MDIP401	Additional Mathematics – II	MA	2	2	-	0	100	-	100
11	P22HDIP407	Additional Communicative English - II	HSMC	-	2	-	0	100	-	100

TRANSFORMS AND SERIES [As per Choice Based Credit System (CBCS) & OBE Scheme] **SEMESTER – III**			
Course Code:	**P22MA301**	**Credits:**	**03**
Teaching Hours/Week (L:T:P):	**2-2-0**	**CIE Marks:**	**50**
Total Number of Teaching Hours:	**40**	**SEE Marks:**	**50**

Course Learning Objectives:	
1	**Understand** the concept of infinite series; learn and apply Fourier series to represent periodical physical phenomena in engineering analysis.
2	To facilitate students to study, analyse and apply various transforms to solve engineering problems.

Unit	**Syllabus content**	**No. of hours**	
		Theory	**Tutorial**
I	**Infinite Series:** Introduction, convergence, divergence and oscillation of a series, Tests for convergence – Comparison test, Ratio test, Cauchy's root test Raabe's test, (All tests without proof)- Problems. **Self-study component:** Integral Test, Alternating series, Leibnitz's theorem – absolute and conditional convergence.	06	02
II	**Fourier Series:** Introduction, periodic function, even and odd functions, Dirichlet's conditions, Euler's formula for Fourier series (no proof). Fourier series for functions of arbitrary period of the form 2L (all particular cases) – problems, analysis- Illustrative examples from engineering field. Half Range Fourier series- Construction of Half range cosine and sine series and problems. Practical harmonic analysis- Illustrative examples from engineering field. **Self study**: Complex Fourier series.	06	02
III	**Laplace Transforms:** Definition – Transforms of elementary functions. Properties of Laplace Transforms- linearity, Change of scale, shifting, Transform of Derivative and Integrals, Transform of a function multiplied by t^n and division t (no proof)-Problems, Transforms of periodic function, unit step function (All results without proof)-Problems only. Inverse Laplace Transforms: Evaluation of inverse transforms by standard methods. Convolution theorem - Problems only. **Self-study component**- Transform of Unit impulse function. Solution of ODE by Laplace method and L-R-C circuits.	06	02
IV	**Fourier Transforms**: **Complex Fourier Transform**: Infinite Fourier transforms and Inverse Fourier transforms. Properties of Fourier Transforms- linearity Change of scale, shifting and modulation (no proof)-Problems, Fourier sine and cosine transforms and Inverse Fourier cosine and sine transforms with properties-Problems Convolution theorem and Parseval's identity for Fourier Transform (no proof)-problems. **Self study**: Fourier integrals- Complex forms of Fourier integral.	06	02

V	**Z-Transforms**: Definition. Some standard Z-transforms. Properties- linearity, Damping, Shifting, multiplication by *n*, initial and final value theorem-problems. Evaluation of Inverse Z- transforms- problems. **Application to Difference Equations**: Solutions of linear difference equations using Z- transforms. **Self study**: Convolution theorem and problems, two sided Z-transforms.	06	02

COURSE OUTCOMES: On completion of the course, student should be able to:

CO1 **Understand** the fundamental concepts of infinite series, transforms of functions

CO2 **Apply** series and transform techniques to obtain series expansion, discrete and continuous transformation of various mathematical functions.

CO3 **Analyze** various signals using series expansions and differential, integral and difference equations using transforms

CO4 **Evaluate** indefinite integrals, differential equations and difference equations subject to initial conditions using transforms and develop series for a discontinuous function

TEACHING - LEARNING PROCESS: Chalk and Talk, power point presentation, animations, videos.

TEXT BOOKS

1. B.S. Grewal, Higher Engineering Mathematics (44th Edition 2018), Khanna Publishers, New Delhi.
2. E. Kreysizig, Advanced Engineering Mathematics, John Wiley and sons, 10th Ed. (Reprint) 2016.

REFERENCE BOOKS

1. V. Ramana: Higher Engineering Mathematics, McGraw –Hill Education, 11th Ed.,
2. H. C. Taneja, Advanced Engineering Mathematics, Volume I & II, I.K. International Publishing House Pvt. Ltd., New Delhi.
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications,Reprint, 2010.

ONLINE RESOURCES

1. http://www.nptel.ac.in
2. https://en.wikipedia.org
3. https://ocw.mit.edu/courses/18-03sc-differential-equations-fall-2011/
4. https://ocw.mit.edu/courses/18-06sc-linear-algebra-fall-2011/
5. https://math.hmc.edu/calculus/hmc-mathematics-calculus-online-tutorials/differential-equations/first-order-differential-equations/

QUESTION PAPER PATTERN (SEE)	
PART-A	PART-B
One question from each unit carrying two marks each	Answer any **TWO** sub questions for maximum 18 marks from each unit

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**2**	**2**										
CO2	**2**	**3**										
CO3	**3**	**2**										
CO4	**2**	**3**										
Strength of correlation: Low-1, Medium- 2, High-3												

Electrical Circuit Analysis [As per Choice Based Credit System (CBCS) & OBE Scheme] SEMESTER – III			
Course Code:	**P22EE302**	**Credits:**	**03**
Teaching Hours/Week (L:T:P):	**2:2:0**	**CIE Marks:**	**50**
Total Number of Teaching Hours:	**40**	**SEE Marks:**	**50**

Course Learning Objectives: This course will enable the students to:

- Obtain solution to problems on electrical network using different techniques
- Obtain solution to problems on electrical network using different Theorems
- Analyse the behavior of circuit elements (R, L, C) at the instant of switching with D.C. excitation
- Describe the Laplace transform of standard functions, determination of Laplace transform of different wave forms by applying wave form synthesis. and Analysis of series and parallel a.c. circuits in time domain using Laplace transform
- Interpretation of the given network as two port network, determination of various two port parameters of a network and relation between parameter sets

UNIT – I	**Basic Circuit Concepts**	**8 Hours**

Basic Circuit Concepts: Introduction, Dependent and Independent sources, Source transformation, Star - Delta transformation for DC circuits, Mesh and Super mesh, Nodal &Super node analysis with dependent and independent sources for DC and AC networks. .

Self-study component:	Source transformation, Star - Delta transformation for AC circuits

UNIT – II	**Network theorems**	**8 Hours**

Network theorems: Superposition, Thevenin's, Maximum power transfer, Reciprocity ,Norton's and Millman's Theorem as applied to DC and AC circuits.

Self-study component:	**Self-study**: Verification of Superposition, Thevenin's, Maximum power transfer , Reciprocity ,Norton's and Millman's Theorem by using PSPICE

UNIT – III	**Transient analysis and Three-Phase Circuits**	**8 Hours**

Transient behavior and Initial and Final Conditions In Networks: Integro-differential equations for networks, Transient behavior of series R-L, R-C, R-L-C Circuits for DC excitation, Behavior of R, L and C at the instant of switching and at final conditions when the excitation is D.C

Three-Phase Circuits: Measurement of Three phase Power – Two wattmeter method

Self-study component:	Voltages, Currents and Power in balanced star and delta connected loads

UNIT – IV	Laplace Transform	8 Hours

Laplace Transform: Definition of Laplace transforms and it's inverse. (problems are excluded) Laplace transforms of standard signals - step, ramp, impulse and gate functions. Waveform synthesis of Recurring and Non-Recurring signals.

Network Analysis Using Laplace Transforms: Analysis of R, L, C, R-L, R-C and R-L-C Circuits to various functions such as step, ramp, impulse.

Self-study component:	Determination of Laplace transform of waveforms using gate function.

UNIT – V	Two Port Network	8 Hours

Two Port Network Parameters: Network configurations, Z - parameters, Y-parameters, Transmission parameters, h-parameters, Relationship between these parameter sets. Interconnection of two port networks – Parallel connection, series connection, series parallel connection and parallel series connection. (Calculation of these parameters for resistive networks).

Self-study component:	Interconnection of two port networks – Cascade connection

Course Outcomes: On completion of this course, students are able to:

COs	**Course Outcomes** with ***Action verbs*** for the Course topics	**Bloom's Taxonomy Level**	**Level Indicator**
CO1	Apply the knowledge of mathematics and electrical science to simplify electrical networks.	Applying	L3
CO2	Analyze complex electrical networks using network laws and theorems.	Analyzing	L4
CO3	Analyze the transient state behavior of complex electric networks.	Analyzing	L4
CO4	Solve two port networks to obtain different Parameters.	Applying	L3

Text Book(s):

1. VanValkenburg, "Network Analysis", PHI, Pearson Education, 2012.
2. Franklin F.Kuo, Network Analysis & Synthesis, Wiley International.
3. Roy Choudary, "Networks and system", New age Publication, 2nd edition, 2013

Reference Book(s):

1. P M Chandrashekaraiah. " Network Analysis '',
2. Ravish R. Singh Electrical Networks , TMH, Edition 1

Course Articulation Matrix

Course Outcome (CO)	Program Outcome													
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
Apply the knowledge of mathematics and electrical science to simplify electrical networks.	**3**												**3**	
Analyze complex electrical networks using network laws and theorems.		**3**												**2**
Analyze the transient state behavior of complex electric networks.		**3**												**2**
Solve two port networks to obtain different Parameters.		**3**												**2**

Transformers & Induction Machines [As per Choice Based Credit System (CBCS) & OBE Scheme] SEMESTER – III			
Course Code:	**P22EE303**	**Credits:**	**03**
Teaching Hours/Week (L:T:P):	**3:0:0**	**CIE Marks:**	**50**
Total Number of Teaching Hours:	**40**	**SEE Marks:**	**50**

Course Learning Objectives: This course will enable the students to:

- Analyze the theory, construction, classifications and working principle of single phase, three phase transformers and single phase, three phases Induction motors.
- Carry out different tests on single phase, three phase transformers and single phase, three phase Induction motors.
- Draw equivalent circuit, circle diagram to know the performance of three phase induction motor.
- Evaluate the performance in terms of efficiency and regulation of single phase transformers along with Practical applications

UNIT – I	**1-Ø Transformer**	**8 Hours**

Transformers: Principle of operation, constructional details of shell type and core type single phase transformers. Description of Power transformers, distribution transformers, constant voltage transformers.

Analysis and Performance of Single Phase Transformers: Equation for EMF induced in the two windings. Voltage & Current transformation ratio, Concept of Ideal transformers, transformer on no-load and load with phasor diagrams. Concept of M.M.F. balance in transformers, Equivalent circuit of a transformer. Auto transformer, saving of copper in an auto transformer, Advantages & Disadvantages, Applications

Self-study component:	Instrument Transformers.

UNIT – II	**Testing of Transformers**	**8 Hours**

Testing of Transformers: O.C. & S.C. test, pre-determination of efficiency and regulation, determination of equivalent circuit parameters. All day efficiency, Sumpner's test. Parallel operation: need, conditions for parallel operation & load sharing.

Self-study component:	Polarity Test

UNIT – III	**3-Ø Transformer**	**8 Hours**

Three phase Transformer: Three-Phase transformer connections: delta-delta, delta-star, star-delta, star-star & open delta. Single phase transformers for three phase operation. Scott connection for three phase to two phase conversion. Labeling of three phase transformer terminals, Parallel operation. Three winding transformer & its equivalent circuit, determination of parameters of three winding transformer, voltage regulation of three winding transformers.

Self-study component:	Tap changing transformers

UNIT – IV	3-Ø Induction Motor	8 Hours

Three Phase Induction Machines: Basic **c**oncepts of rotating magnetic field. Operating principle, construction, types: Squirrel-cage, Slip-ring.

Analysis of Three Phase Induction Motor: Induction motor operation on no-load and load conditions. Torque-slip characteristics of a three phase induction motor, Need for starter. Qualitative analysis of DOL, Star-Delta, auto-transformer starting, Speed control by voltage, frequency, and rotor resistance methods.

Self-study component:	Schrage Motor

UNIT – V	3-Ø Induction Machine & 1-Ø Induction Motor	8 Hours

Performance of Three Phase Induction Machines: No-load and blocked rotor tests. Performance evaluation - output power, torque, and efficiency, current and power factor using Circle diagram. Losses and efficiency in an induction motor. Cogging and crawling.

Single-phase Induction Motor: Principle of operation, production of rotating field double revolving field theory, determination of equivalent circuit parameters Types of single phase induction motors: split-phase, capacitor start, shaded pole motors, universal motors.

Self-study component:	Induction generator.

Course Outcomes: On completion of this course, students are able to:

COs	**Course Outcomes** with ***Action verbs*** for the Course topics	**Bloom's Taxonomy Level**	**Level Indicator**
CO1	Apply the knowledge of basic electrical laws to study the operating principle and characteristics of Transformers and Induction Motors.	Applying	L3
CO2	Analyze the operation of Transformers and Induction Motors using phasor/circle diagram.	Analyzing	L4
CO3	Apply the different testing methods to examine the performance of Transformers and Induction Motors.	Applying	L3
CO4	Solve the different problems on Transformers and Induction Motors.	Applying	L3

Text Book(s):

1. Alexander Langsdorf, "Theory of Alternating Current Machines", T.M.H, 2001
2. Dr.P.S.Bimbhra, "Electrical Machinery" Khanna publications", 3rd edition,New Delhi, 2006
3. B.L Theraja "Electrical Technology" Volume2, S. Chand, 22nd Edition.

Reference Book(s):

1. M.G.Say, "Performance and Design of A.C.Machines", C.B.S. Publishers, 2005
2. AshfaqHussain, "Electrical Machines", Dhanapatrai and Co, 2nd edition, 2012

Course Articulation Matrix

Course Outcome (CO)	Program Outcome													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Apply the knowledge of basic electrical laws to study the operating principle and characteristics of Transformers and Induction Motors.	**3**												**3**	
Analyze the operation of Transformers and Induction Motors using phasor/circle diagram.		**2**												**2**
Apply the different testing methods to examine the performance of Transformers and Induction Motors.	**3**												**2**	
Solve the different problems on Transformers and Induction Motors.		**2**												**2**

Digital Systems [As per Choice Based Credit System (CBCS) & OBE Scheme] SEMESTER – III			
Course Code:	**P22EE304**	**Credits:**	**04**
Teaching Hours/Week (L:T:P):	**3:0:2**	**CIE Marks:**	**50**
Total Theory Teaching Hours: **Total Laboratory Hours:**	**40** **24**	**SEE Marks:**	**50**

Course Learning Objectives: This course will enable the students to:

- Optimize logic expressions using Karnaugh map and Tabular method
- Simplify Boolean equation and design combinational circuits with optimal gates
- Analyze the working principles of sequential circuits
- Understand the basic concepts of shift registers and A/D & D/A converters
- Analyze the concepts of VLSI technology

UNIT – I	**Combinational Logic**	**8 Hours**

Logic operations, axioms & laws of Boolean algebra, Duality, Reduction of Boolean expressions, Boolean functions and their representation, Expansion in SOP & POS form Boolean Expression conversation into logic. Minimization of switching functions using K-Map, 2, 3 & 4 variable, mapping and minimization. Don't care combination solutions. Minimization by Quine - Mclusky method.

Self-study component:	Signed binary number representation with 1's and 2's complement methods.
Practical Topics: **(6 Hours)**	a. Simplification, realization of Boolean expressions using basic gates b. Simplification, realization of Boolean expressions using Universal gates.

UNIT – II	**Combinational Circuits**:	**8 Hours**

Combinational Circuits: Half adder, Full adder, Parallel binary adder, Look ahead carry Adder.
Encoder: octal to binary, decimal to BCD, Priority encoder: 4 input, decimal to BCD
Decoder: 3 to 8 Line, BCD to Decimal, Multiplexer: 2 input, 4 inputs, 8 inputs. De-multiplexer: 1 to 4 line, 1 to 8 line.

Self-study component:	Half/Full Subtractor
Practical Topics: **(6 Hours)**	a. Realization of Half/Full Adder using logic gates b. Realization of Multiplexer and De-multiplexer.

UNIT – III	**Sequential circuits**:	**8 Hours**

Flip-Flops: Basic stable element, latches, S R latches, Gated S-R latch, Gated D- Latch, SR, D, JK, and T F/Fs, Master- Slave ,SR,D,JK F/Fs, Conversion of SR to D, SR to JK and SR to T flip-flops
.**Counters**: Synchronous Counters, Mealy and Moore models, Modulo-N Synchronous counter design

Self-study component:	Conversion of D to SR, T & JKF/Fs and Asynchronous Counters Design.
Practical Topics: **(4 Hours)**	a. Truth table verification of flip-flops: D, T, SR & JK b. Realization of 3 bit counter, Mod N counter, ring/Johnson counter design.

UNIT – IV	Shift Registers and A/D & D/A Converters	8 Hours

Registers: Types of Shift registers - SISO, SIPO, PISO and PIPO, shift left and shift right register

A/D & D/A Converters:

A/D Converters - Successive Approximation, Delta-Sigma, Dual slope, Flash type.

D/A Converters - Weighted Resistor, R-2R ladder.

Self-study component:	Ring and Johnson Counter
Practical Topics: **(4 Hours)**	a. Shift register operations: Shift left; Shift right, SIPO, SISO, PISO, PIPO b. R-2R DAC

UNIT – V	Introduction to Verilog	8 Hours

Logic families: Two input TTL NAND gate, MOS and CMOS circuits & their operation.

Introduction to Verilog: Introduction to HDL & Verilog, Verilog constructs and operators , Basic coding of airthmetic operations. Verilog code for carry Save adder, multiplexer and Jk- flip-flops. Testbench writing and verifying Half adder and Full adder.

Self-study component:	Loops for Verilog.
Practical Topics: **(4 Hours)**	a. Execute a program for carry save adder, multiplexer and JK- flip-flops. b. Write and verify the test bench for Half and Full adder .

Course Outcomes: On completion of this course, students are able to

COs	Course Outcomes with *Action verbs* for the Course topics	Bloom's Taxonomy Level	Level Indicator
CO1	Apply the knowledge of simplification methods to optimize a Digital circuit	Applying	L3
CO2	Analyze the concepts of combinational circuits, sequential circuits and VLSI technology	Analyzing	L4
CO3	Design of combinational circuits and sequential circuits	Creating	L6
CO4	Analyze different types of shift registers and A/D & D/A converters.	Analyzing	L4
CO5	Conduct experiments using digital ICs for a given statement.	Applying	L2

Text Book(s):

1. A.Anand Kumar, Fundamentals of Digital Circuits,PHI,2011
2. Givone,Digital Principles & Design, McGraw Hill,2011
3. Samir Palnikar, Verilog HDL – A guide to digital design and synthesis, Pearson 2nd edition, IEEE-1364-2001 complaint,

Reference Book(s):

1.Morries Mano, Digital Logic Design, PHI,2012
2. A.K.Maini, Digital Electronics, Wiley,India,201

Course Articulation Matrix

Course Outcome (CO)	Program Outcome													
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
Apply the knowledge of simplification methods to optimize a Digital circuit	**3**													**2**
Analyze the concepts of combinational circuits, sequential circuits and VLSI technology		**3**												**2**
Design of combinational circuits and sequential circuits			**3**											**2**
Analyze different types of shift registers and A/D & D/A converters.		**2**												**2**
Conduct experiments using digital ICs for a given statement.	**2**	**2**	**2**	**2**	**3**				**2**	**2**				

Analog Electronics & Linear Integrated Circuits [As per Choice Based Credit System (CBCS) & OBE Scheme] **SEMESTER – III**			
Course Code:	**P22EE305**	**Credits:**	**04**
Teaching Hours/Week (L:T:P):	**3:0:2**	**CIE Marks:**	**50**
Total Theory Teaching Hours: **Total Laboratory Hours:**	**40** **24**	**SEE Marks:**	**50**

Course Learning Objectives: This course will enable the students to:

- Analyze and design Diode and Transistor circuit such as Clippers, Clampers, Voltage Multipliers and Amplifiers
- Analyze and design two port hybrid equivalent model for BJT amplifier and Various BJT Oscillator Circuits
- Analyze the effect of negative feedback and Power amplifier
- Analyze the frequency response, stability of op-amps and design the signal processing &waveform generator circuits

UNIT – I	**Diode Circuits and Transistor Biasing & Amplifiers**	**8 Hours**

Diode Circuits: Introduction, Clipping Circuits, Clampers, Voltage Doubler Circuits, Zener Regulator

Transistor Biasing & Amplifiers: Operating point, DC Load line and Voltage divider bias, Classification of Amplifiers, Distortions in Amplifiers, RC Coupled Amplifiers, and frequency responses of Amplifier

Self-study component:	Self and Emitter bias circuits.
Practical Topics: **(6 Hours)**	a. Clipping and Clamping Circuit b. RC Coupled Amplifier

UNIT – II	**BJT Transistor Modeling & Oscillators**	**8 Hours**

BJT Transistor Modeling: Introduction, Two port approach & hybrid Model, CB, CE, CC Hybrid equivalent Model, The Important Parameters: *Zi*, *Zo*, *Av*, *Ai*,

BJT Oscillators: Oscillator operation, Transistor RC Phase shift oscillator, Wien bridge oscillator, and Tuned oscillators (Hartley & Colpitt's) ,Crystal oscillator

Self-study component:	R_e transistor modeling
Practical Topics: **(6 Hours)**	a. RC oscillator b. Colpitt's and Hartley Oscillator

UNIT – III	**Feed Back Concepts & Power Amplifier**	**8 Hours**

Feed Back Concepts: Feedback concept, Loop gain, Transfer gain, Feedback connections type, Effect of Negative Feedback on Input Resistance and Output Resistance, Advantages of Feedback.

Power Amplifiers: Definitions of Power Amplifiers, Series fed Class A Amplifier, Transformer coupled Class A Amplifier, Transformer coupled Class B Push pull Amplifier.

Self-study component:	Distortions in Amplifiers.

Practical Topics: **(4 Hours)**	a. Feedback amplifier b. Power Amplifier circuit	
UNIT – IV	**Basics of Operational Amplifiers**	**8 Hours**
Op-Amps Frequency Response And Compensation : Op-amp circuit stability, Frequency and phase response, Frequency compensating methods , Manufacturer's recommended compensation **Op-Amps-Nonlinear Circuits:** Op-amps in switching circuits, Zero crossing detectors, Inverting & non-inverting Schmitt trigger, Astable & Mono stable multi vibrators.		
Self-study component:	. Circuit stability precautions	
Practical Topics: **(4 Hours)**	a. Inverting & non-inverting Schmitt trigger; b. Astable & Monostable multivibrators	
UNIT – V	**Op–Amp -2**	**8 Hours**
Signal Processing & Generator Circuits: Precision half wave & full wave rectifiers, Limiting circuits, Peak detectors, Sample & hold circuit. Triangular & rectangular wave generator, Phase shift oscillator, Oscillator amplitude stabilization.		
Self-study component:	Waveform generator design	
Practical Topics: **(4 Hours)**	a. Sample & hold circuit b. Phase shift oscillator.	

Course Outcomes: On completion of this course, students are able to:

COs	**Course Outcomes** with ***Action verbs*** for the Course topics	**Bloom's Taxonomy Level**	**Level Indicator**
CO1	Apply the knowledge of semiconductor devices in different electronics circuits.	Applying	L3
CO2	Analyze the performance of transistor, amplifier and oscillator circuits	Analyzing	L4
CO3	Analyze the frequency response, stability and applications of op-amps.	Analyzing	L4
CO4	Design analog electronic circuits for given application and specifications	Creating	L6
CO5	Conduct experiments to demonstrate an application of analog electronics using components	Analyzing	L4

Text Book(s):

1. Electronic Devices & Circuits, Boylestead & Neshelsky ,Pearson Education/PHI Ltd, 10th edition, 2010
2. "Operational amplifiers and linear IC's"- David A Bell, -PHI, 4th edition, 2011

Reference Book(s):

1. J. Millman and C. Halkias, Integrated Electronics: Analog and Digital Circuits and Systems, McGraw Hill, 1985.
2. Operational amplifiers and linear" - Ramakanth A Gayakwad,- IC's, Pearson Education, 4th edition, 2000..

Course Articulation Matrix

Course Outcome (CO)	Program Outcome													
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
Apply the knowledge of semiconductor devices in different electronics circuits.	**3**												**3**	
Analyze the performance of transistor, amplifier and oscillator circuits		**3**												**2**
Analyze the frequency response, stability and applications of op-amps.		**3**												**2**
Design analog electronic circuits for given application and specifications			**3**											**3**
Conduct experiments to demonstrate an application of analog electronics using components	**2**	**2**	**2**	**2**					**2**	**2**			**1**	**1**

AC Machines Laboratory [As per Choice Based Credit System (CBCS) & OBE Scheme] **SEMESTER – III**			
Course Code:	**P22EEL306**	**Credits:**	**01**
Teaching Hours/Week (L:T:P):	**0:0:2**	**CIE Marks:**	**50**
Total Number of Teaching Hours:	**20**	**SEE Marks:**	**50**

Course Learning Objectives: This course will enable the students to:

- Study OC and SC tests on single phase Transformer.
- Determine the performance characteristics of single phase induction motor.
- Study how the load can be shared between two transformers.

Sl.No	List of Experiments	No. of Hours
1.	OC & SC tests on Single Phase transformer: Pre-determination of efficiency & regulation.	**2**
2.	Sumpner's test on single phase transformers.	**2**
3.	Parallel operation of single phase transformers.	**2**
4.	Load test on single phase Induction motor.	**2**
5.	Load test on three phase induction motor.	**2**
6.	Performance evaluation of three phase induction Motor using Circle diagram.	**2**
7.	Speed control of three phase induction motor by Rotor resistance control.	**2**
8.	Load test on three phase Induction generator.	**2**
9.	Self study Experiment	**2**

Course Outcomes: On completion of this course, students are able to:

COs	**Course Outcomes** with ***Action verbs*** for the Course topics	Bloom's Taxonomy Level	Level Indicator
CO1	Conduct experiments to obtain performance characteristics of Transformers.	Applying	L3
CO2	Conduct experiments to obtain performance characteristics of Induction Machines.	Applying	L3
CO3	Ability to communicate effectively in a team/as an individual to conduct experiments.	Understanding	L2

Course Articulation Matrix

Course Outcome (CO)	Program Outcome													
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
Conduct experiments to obtain performance characteristics of Transformers.	**3**	**3**		**3**									**2**	**2**
Conduct experiments to obtain performance characteristics of Induction Machines.	**3**	**3**		**3**									**2**	**2**
Ability to communicate effectively in a team/as an individual to conduct experiments.								**1**	**3**	**3**				

EMPLOYABILITY ENHANCEMENT SKILLS - III [As per Choice Based Credit System (CBCS) & OBE Scheme] **SEMESTER – III**			
Course Code:	**P22HSMC307**	**Credits:**	**01**
Teaching Hours/Week (L:T:P)	**0:2:0**	**CIE Marks:**	**50**
Total Number of Teaching Hours:	**30**	**SEE Marks:**	**50**

Course Learning Objectives: This course will enable the students to:

- Calculations involving percentages, profit & loss and discounts.
- Explain concepts behind logical reasoning modules of direction sense and blood relations.
- Prepare students for Job recruitment process and competitive exams.
- Develop Problem Solving Skills.
- Apply programming constructs of C language to solve the real-world problem.

UNIT – I		**06 Hours**
Quantitative Aptitude: Number System – Divisibility & Remainder, Multiples & Factors, Integers, HCF & LCM, Decimal Fractions, Surds & Indices, Simplification.		
Self-study component:	Linear equations.	
UNIT – II		**06 Hours**
Quantitative Aptitude: Percentages, Profits, Loss and Discounts. **Logical Reasoning:** Blood Relations.		
Self-study component:	Inferred meaning, Chain rule.	
UNIT – III		**06 Hours**
Logical Reasoning: Direction Sense Test. **Verbal Ability:** Change of Speech and Voice, Sentence Correction.		
Self-study component:	Height & distance.	
UNIT – IV	**C-PROGRAMMING - I**	**06 Hours**
Introduction: Keywords and Identifier, Variables and Constants, Data Types, Input/Output, Operators, Simple Programs. **Flow Control:** If…else, for Loop, while Loop, break and continue, switch…case, goto, Control Flow Examples, Simple Programs. **Functions:** Functions, User-defined Functions, Function Types, Recursion, Storage Class, Programs **Arrays:** Arrays, Multi-dimensional Arrays, Arrays & Functions, Programs.		
Self-study component:	Evaluation of Expression.	
UNIT – V	**C-PROGRAMMING - II**	**06 Hours**
Pointers: Pointers, Pointers & Arrays, Pointers and Functions, Memory Allocation, Array & Pointer Examples. **Strings:** String Functions, String Examples, Programs. **Structure and Union:** Structure, Struct & Pointers, Struct & Function, Unions, Programs. **Programming Files:** Files Input/output		
Self-study component:	Error handling during I/O operations.	

Course Outcomes: On completion of this course, students are able to:			
COs	**Course Outcomes** with ***Action verbs*** for the Course topics	**Bloom's Taxonomy Level**	**Level Indicator**
CO1	Exhibit amplified level of confidence to express themselves in English.	Applying	L3
CO2	Solve the problems based on Number systems, percentages, profit & loss and discounts.	Analyzing	L4
CO3	Solve logical reasoning problems based on direction sense and blood relations.	Analyzing	L4
CO4	Apply suitable programming constructs of C language and / or suitable data structures to solve the given problem.	Applying	L3

Text Book(s):

1. The C Programming Language (2nd edition) by Brian Kernighan and Dennis Ritchie.
2. C in Depth by S K Srivastava and Deepali Srivastava.
3. Quantitative aptitude by Dr. R. S Agarwal, published by S. Chand private limited.
4. Verbal reasoning by Dr. R. S Agarwal, published by S. Chand private limited.

Reference Book(s):

1. E. Balaguruswamy, Programming in ANSI C, 7th Edition, Tata McGraw-Hill. Brian W. Kernighan and Dennis M. Ritchie, The 'C' Programming Language, Prentice Hall of India.
2. Quantitative Aptitude by Arun Sharma, McGraw Hill Education Pvt Ltd.

Web and Video link(s):

1. Problem Solving through Programming in C - https://archive.nptel.ac.in/courses/106/105/106105171/

COURSE ARTICULATION MATRIX
(EMPLOYABILITY ENHANCEMENT SKILLS - III – P22HSMC307)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1									2	3		2
CO2	2	2										
CO3	2	2										
CO4	2	2								2		1

BIOLOGY FOR ENGINEERS

[As per Choice Based Credit System (CBCS) & OBE Scheme]

SEMESTER – III

Course Code:	**P22BFE308**	**Credits:**	**02**
Teaching Hours/Week (L:T:P)	**2:0:0**	**CIE Marks:**	**50**
Total Number of Teaching Hours:	**25**	**SEE Marks:**	**50**

Course Learning Objectives:

The objectives of this course are to,

- Familiarize the students with the basic biological concepts and their engineering applications.
- Enable the students with an understanding of bio-design principles to create novel devices and structures.
- Provide the students an appreciation of how biological systems can be re-designed as substitute products for natural systems.
- Motivate the students to develop the interdisciplinary vision of biological engineering.

Course Content

Biomolecules And Their Applications (Qualitative): Carbohydrates (cellulose-based water filters, PHA and PLA as bio-plastics), Nucleic acids (DNA Vaccine for Rabies and RNA vaccines for Covid19, Forensics – DNA fingerprinting), Proteins (Proteins as food – whey protein and meat analogs, Plant based proteins), lipids (bio-diesel, cleaning agents/detergents), Enzymes (glucose-oxidase in bio-sensors, lingolytic enzyme in bio-bleaching). **5Hrs**

UNIT-II

Human Organ Systems And Bio-Designs-1 (Qualitative): Brain as a CPU system (architecture, CNS and Peripheral Nervous System, signal transmission, EEG, Robotic arms for prosthetics, Engineering solutions for Parkinson's disease), Heart as a pump system (architecture, electrical signaling - ECG monitoring and heart related issues, reasons for blockages of blood vessels, design of stents, pace makers, defibrillators). **5Hrs**

UNIT-III

HUMAN ORGAN SYSTEMS AND BIO-DESIGNS-2 (QUALITATIVE): Lungs as purification system (architecture, gas exchange mechanisms, spirometry, abnormal lung physiology - COPD, Ventilators, Heart-lung machine), Kidney as a filtration system (architecture, mechanism of filtration, CKD, dialysis systems). **5Hrs**

UNIT-IV

Nature Bio Inspired Materials And Mechanisms (Qualitative): Echolocation (ultra sonography, sonars), Photosynthesis (photovoltaic cells, bionic leaf). Bird flying (GPS and aircrafts).

5Hrs

UNIT-V

Trends In Bio- Engineering (Qualitative): DNA origami and Bio-computing, Bio-imaging and Artificial Intelligence for disease diagnosis, Self healing Bio-concrete (based on bacillus spores, calcium lactate nutrients and bio-mineralization processes), Bio-remediation and Bio-mining via microbial surface adsorption (removal of heavy metals like Lead, Cadmium, Mercury, Arsenic).

5Hrs

Suggested Learning Resources:

- Human Physiology, Stuart Fox, Krista Rompolski, McGraw-Hill eBook, 16thEdition, 2022.
- Biology for Engineers, Thyagarajan S, SelvamuruganN, Rajesh M. P, Nazeer R. A, Thilagaraj W, Barathi. S and Jaganthan M.K, Tata McGraw-Hill, New Delhi, 2012.
- Biology for Engineers, Arthur T.Johnson, CRC Press, Taylor and Francis, 2011.
- Bio-medical Instrumentation, Leslie Cromwell, Prentice Hall, 2011.
- Biology for Engineers, Sohini Singh and Tanu Allen,Vayu Education of India, New Delhi, 2014.
- Bio-mimetics: Nature Based Innovation,Yoseph Bar-Cohen,1st edition, 2012, CRC Press.
- Bio-Inspired Artificial Intelligence: Theories, Methods and Technologies, D. Floreano and C. Mattiussi, MIT Press, 2008.
- Bio-remediation of heavy metals: bacterial participation, C R Sunil Kumar, N Geetha, A C Udayashankar, Lambert Academic Publishing, 2019.
- 3D Bio-printing: Fundamentals, Principles and Applications by Ibrahim Ozbolat, Academic Press, 2016.
- Electronic Noses and Tongues in Food Science, Maria Rodriguez Mende, Academic Press, 2016.

Web links and Video Lectures (e-Resources):

- VTUEDUSAT/SWAYAM/NPTEL/MOOCS/Coursera/MIT-open learning resource
- https://nptel.ac.in/courses/121106008
- https://freevideolectures.com/course/4877/nptel-biology-engineers-other-non-biologists
- https://ocw.mit.edu/courses/20-020-introduction-to-biological-engineering-design-spring-2009
- https://ocw.mit.edu/courses/20-010j-introduction-to-bioengineering-be-010j-spring-2006
- https://www.coursera.org/courses?query=biology
- https://onlinecourses.nptel.ac.in/noc19_ge31/preview
- https://www.classcentral.com/subject/biology

1. https://www.futurelearn.com/courses/biology-basic-concepts

Course Outcomes

At the end of the course, students will be able to,

1. **Understand** the bio-design principles involved in building novel devices and structures.
2. **Elucidate** the basic biological concepts through relevant industrial/Engineering application.
3. **Apply** innovative bio based solutions solving socially relevant problems.

Course Articulation Matrix

Course Outcomes		Program Outcomes											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	**Understand** the bio-design principles involved in building novel devices and structures.	2	1				1	1	1				1
CO2	**Elucidate** the basic biological concepts through relevant industrial application.	2	1				1	1	1				1
CO3	**Apply** innovative bio based solutions solving socially relevant problems.	2	2				2	2	1				2

Blooms Level	Marks Weightage	Maps Course Outcome to the Corresponding Blooms Level
Understand/Elucidate	50-60%	
Apply	35-50%	

NATIONAL SERVICE SCHEME [As per Choice Based Credit System (CBCS) & OBE Scheme] **SEMESTER - III**			
Course Code:	**P22NSS309/409**	**Credits:**	**00**
Teaching Hours/Week (L:T:P):	**0:0:2**	**CIE Marks:**	**100**
Total Number of Teaching Hours:	**-**	**SEE Marks:**	**-**

Pre-requisites to take this Course:

1. Students should have a service oriented mind set and social concern.
2. Students should have dedication to work at any remote place, anytime with available resources and proper time management for the other works.
3. Students should be ready to sacrifice some of the time and wishes to achieve service oriented targets on time.

Corse Objectives :National Service Scheme (NSS) will enable the students to:

1. Understand the community in which they work
2. Identify the needs and problems of the community and involve them in problem-solving
3. Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems
4. Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes
5. Develop capacity to meet emergencies and natural disasters & practice national integration and
   social harmony

Content

1. Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing.
2. Waste management– Public, Private and Govt organization, 5 R's.
3. Setting of the information imparting club for women leading to contribution in social and economic issues.
4. Water conservation techniques – Role of different stakeholders– Implementation.
5. Preparing an actionable business proposal for enhancing the village income and approach for implementation.
6. Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/
   vocational education.
7. Developing Sustainable Water management system for rural areas and implementation approaches.
8. Contribution to any national level initiative of Government of India. Foreg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath,Make in India, Mudra scheme, Skill development programs etc.
9. Spreading public awareness under rural outreach programs.(minimum5 programs).
10. Social connect and responsibilities.
11. Plantation and adoption of plants. Know your plants.
12. Organize National integration and social harmony events /workshops /seminars. (Minimum 02 programs).
13. Govt. school Rejuvenation and helping them to achieve good infrastructure.

AND ONENSS – CAMP @ College /University /Stateor Central GovtLevel /NGO's /General Social Camps Students have to take up anyone activity on the above said topics and have to prepare content for awareness and technical contents for implementation of the projects and have to present strategies for implementation of the same. Compulsorily students have to attend one camp. CIE will be evaluated based on their presentation, approach and implementation strategies.	
Course Outcomes: After completing the course, the students will be able to	
CO1:	Understand the importance of his / her responsibilities towards society.
CO2:	Analyze the environmental and societal problems/issues and will be able to design solutions for the same.
CO3:	Evaluate the existing system and to propose practical solutions for the same for sustainable development.
CO4:	Implement government or self-driven projects effectively in the field.

PHYSICAL EDUCATION [As per Choice Based Credit System (CBCS) & OBE Scheme] **SEMESTER - III**			
Course Code:	**P22PED309**	**Credits:**	**00**
Teaching Hours/Week (L:T:P):	**0:0:2**	**CIE Marks:**	**100**
Total Number of Teaching Hours:		**SEE Marks:**	**-**

Fitness Components	Meaning and Importance, Fit India Movement, Definition of fitness, Components of fitness, Benefits of fitness, Types of fitness and Fitness tips. Practical Components: Speed, Strength, Endurance, Flexibility, and Agility KABADDI A. Fundamental skills 1. Skills in Raiding: Touching with hands, Use of leg-toe touch, squat leg thrust, side kick, mule kick, arrow fly kick, crossing of baulk line. Crossing of Bonus line. 2. Skills of holding the raider: Various formations, catching from particular position, different catches, catching formation and techniques. 3. Additional skills in raiding: Escaping from various holds, techniques of escaping from chain formation, offense and defense. 4. Game practice with application of Rules and Regulations. B. Rules and their interpretations and duties of the officials.
Speed Strength Endurance Agility Flexibility	
Kho kho	A. Fundamental skills 1. Skills in Chasing: Sit on the box (Parallel & Bullet toe method), Get up from the box (Proximal & Distal foot method), Give Kho (Simple, Early, Late & Judgment), Pole Turn, Pole Dive, Tapping, Hammering, Rectification of foul. 2. Skills in running: Chain Play, Ring play and Chain & Ring mixed play. 3. Game practice with application of Rules and Regulations. B. Rules and their interpretations and duties of the officials.
Kabaddi	A. Fundamental skills 1. Skills in Raiding: Touching with hands, Use of leg-toe touch, squat leg thrust, side kick, mule kick, arrow fly kick, crossing of baulk line. Crossing of Bonus line. 2. Skills of holding the raider: Various formations, catching from particular position, different catches, catching formation and techniques. 3. Additional skills in raiding: Escaping from various holds, techniques of escaping from chain formation, offense and defense. 4. Game practice with application of Rules and Regulations. B. Rules and their interpretations and duties of the officials

YOGA [As per Choice Based Credit System (CBCS) & OBE Scheme] SEMESTER - III			
Course Code:	**P22YOG309**	**Credits:**	**00**
Teaching Hours/Week (L:T:P):	**0:0:2**	**CIE Marks:**	**100**
Total Number of Teaching Hours:		**SEE Marks:**	**-**

Course objectives:

1) To enable the student to have good health.
2) To practice mental hygiene.
3) To possess emotional stability.
4) To integrate moral values.
5) To attain higher level of consciousness.

The Health Benefits of Yoga

The benefits of various yoga techniques have been supposed to improve

- body flexibility,
- performance,
- stress reduction,
- attainment of inner peace, and
- self-realization.

The system has been advocated as a complementary treatment to aid the healing of several ailments such as

- coronary heart disease,
- depression,
- anxiety disorders,
- asthma, and
- extensive rehabilitation for disorders including musculoskeletal problems and traumatic brain injury.

The system has also been suggested as behavioral therapy for smoking cessation and substance abuse (including alcohol abuse).

If you practice yoga, you may receive these physical, mental, and spiritual benefits:

- Physical

1. Improved body flexibility and balance
2. Improved cardiovascular endurance (stronger heart)
3. Improved digestion
4. Improved abdominal strength
5. Enhanced overall muscular strength
6. Relaxation of muscular strains
7. Weight control
8. Increased energy levels
9. Enhanced immune system

- Mental

1. Relief of stress resulting from the control of emotions
2. Prevention and relief from stress-related disorders
3. Intellectual enhancement, leading to improved decision-making skills

- Spiritual

1. Life with meaning, purpose, and direction
2. Inner peace and tranquility
3. Contentment

Yoga, its origin, history and development. Yoga, its meaning, definitions.
Different schools of yoga, Aim and Objectives of yoga, importance of prayer
Yogic practices for common man to promote positive health
Rules to be followed during yogic practices by practitioner
Yoga its misconceptions,
Difference between yogic and non yogic practices
Suryanamaskar prayer and its meaning, Need, importance and benefits of Suryanamaskar12 count, 2 rounds
Asana, Need, importance of Asana. Different types of asana. Asana its meaning by name, technique, precautionary measures and benefits of each asana
Different types of Asanas
a. Sitting 1. Padmasana
2. Vajrasana
b. Standing 1. Vrikshana
2. Trikonasana
c. Prone line 1. Bhujangasana
2. Shalabhasana
d. Supine line 1. Utthitadvipadasana
2. Ardhahalasana

Additional Mathematics - I [As per Choice Based Credit System (CBCS) & OBE Scheme] SEMESTER – III (Lateral Entry: Common to all branches)			
Course Code:	**P22MDIP301**	**Credits:**	**00**
Teaching Hours/Week (L:T:P):	**2-2-0**	**CIE Marks:**	**100**
Total Number of Teaching Hours:	**40**	**SEE Marks:**	**-**

Course Learning Objectives: The mandatory learning course P21MATDIP31 viz., Additiona Mathematics-I aims to provide basic concepts of complex trigonometry, vector algebra differential & integral calculus, vector differentiation and various methods of solving first order differential equations.

UNIT-I	
Complex Trigonometry: Complex Numbers: Definitions & properties. Modulus and amplitude of a complex number, Argand's diagram, De-Moivre's theorem (without proof). Vector Algebra: Scalar and vectors. Vectors addition and subtraction. Multiplication of vectors (Dot and Cross products). Scalar and vector triple products-simple problems **Self-study components:** De-Moivre's theorem (without proof). Roots of complex number - Simple problems.	**12Hrs**
UNIT-II	
Differential Calculus: Polar curves –angle between the radius vector and the tangent pedal equation- Problems. Taylors series and Maclaurin's series expansions- Illustrative examples. Partial Differentiation: Elimentary problems. Euler's theorem for homogeneous functions of two variables. Total derivatives-differentiation of composite and implicit function. **Self-study components**: Review of successive differentiation. Formulae for n^{th} derivatives of standard functions- Liebnitz's theorem (without proof). Application to Jacobians, errors & approximations.	**10Hrs**
UNIT-III	
Integral Calculus: reduction formulae for $sin^n x$, $cos^n x$, and $sin^m x cos^m x$ and evaluation of these with standard limits-Examples. Applications of integration to area, length of a given curve, volume and surface area of solids of revolution. **Self-study components**: Differentiation under integral sign (Integrals with constants limits)-Simple problems.	**10Hrs**
UNIT-IV	
Vector Differentiation: Differentiation of vector functions. Velocity and acceleration of a particle moving on a space curve. Scalar and vector point functions. Gradient, Divergence, Curl and Laplacian (Definitions only). **Self-study components**: Solenoidal and irrotational vector fields-Problems.	**10Hrs**
UNIT - V	
Ordinary differential equations (ODE's): Introduction-solutions of first order and first degree differential equations: homogeneous, exact, linear differential equations of order one and equations reducible to above types **Self-study components:** Applications of first order and first degree ODE's - Orthogonal trajectories of Cartesian and polar curves. Newton's law of cooling, R-L circuits- Simple illustrative examples from engineering field.	**10Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1:	Demonstrate the fundamental concepts –in complex numbers and vector algebra to analyze the problems arising in related area of engineering field.
CO2:	Identify – partial derivatives to calculate rate of change of multivariate functions
CO3:	Apply - the acquired knowledge of integration and differentiation to evaluate double and triple integrals to compute length surface area and volume of solids of revolution and indentify velocity, acceleration of a particle moving in a space
CO4:	Find analytical solutions by solving first order ODE's which arising in different branches of engineering.

Text Book:

- B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, New Delhi, 43rd Ed., 2015.

Reference books:

1. E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 10th Ed., 2015.
2. N.P.Bali and Manish Goyal: Engineering Mathematics, Laxmi Publishers,7th Ed., 2007.

Additional Communicative English – I [As per Choice Based Credit System (CBCS) & OBE Scheme] SEMESTER – III			
Course Code:	**P22HDIP307**	**Credits:**	**00**
Teaching Hours/Week (L:T:P):	**0:2:0**	**CIE Marks:**	**100**
Total Number of Teaching Hours:	**40**	**SEE Marks:**	**-**

Module-1

Introduction to Communication Skills **6 Hours**

Introduction to communication, Meaning and process, Channels of communication, Elements of communication, Barriers to effective communication. Activities - Making introductions, Sharing personal information, Describing feelings and opinions.

Module-2

Listening Skills I **4 Hours**

Hearing vs. Listening, Types of listening, Determinants of good listening, Active listening process, Barriers to listening, Activities - Listening for pronunciation practice, Listening for personal communication, Listening for communication - language functions

Module-3

Speaking Skills I **6 Hours**

Basics of speaking, Elements and Functions of speaking, Structuring your speech, Focusing on fluency, Homographs and Signpost words. Activities – Free Speech and Pick and Speak

Module-4

Reading Skills I **4 Hours**

Developing reading as a habit, Building confidence in reading, improving reading skills, Techniques of reading - skimming and scanning. Activities - understanding students' attitudes towards reading, countering common errors in reading, developing efficiency in reading.

Writing Skills I **4 Hours**

Improving writing skills, Spellings and punctuation, Letter and Paragraph writing. Activity – Writing your personal story

Module-5

Body Language and Presentation Skills **6 Hours**

Elements of body language, Types, Adapting positive body language, Cultural differences in body language. 4 Ps in presentations, Overcoming the fear of public speaking, Effective use of verbal and nonverbal presentation techniques. Activity – Group presentations

Course Outcomes: On completion of this course, students will be able to,

CO 1: Understand the role of communication in personal and professional success

CO 2: Comprehend the types of technical literature to develop the competency of students to Apprehend the nature of formal communication requirements.

CO 3: Construct grammatically correct sentences to strengthen essential skills in speaking & writing and to develop critical thinking by emphasizing cohesion and coherence

CO 4: Demonstrate effective individual and teamwork to accomplish communication goals.

Textbooks and Reference Books:

1. Communication Skills by Sanjay Kumar and Pushpa Lata, Oxford University Press - 2015.
2. Everyday Dialogues in English by Robert J. Dixson, Prentice-Hall of India Ltd., 2006.
3. Developing Communication Skills by Krishna Mohan& Meera Banerjee (Macmillan)
4. The Oxford Guide to Writing and Speaking, John Seely, Oxford.
5. English Language Communication Skills - Lab Manual cum Workbook by Rajesh Kumar Singh, Cengage learning India Pvt Limited – 2018

CO – PO – PSO Matrix

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1												2			
CO2										2					
CO3										2					
CO4									2						
CO									**2**	**2**		**2**			

MATHEMATICAL AND NUMERICAL TECHNIQUE [As per Choice Based Credit System (CBCS) & OBE Scheme] SEMESTER – IV (COMMON TO EC, EEE, CS, IS)			
Course Code:	**P22MA401B**	**Credits:**	**03**
Teaching Hours/Week (L:T:P):	**2-2-0**	**CIE Marks:**	**50**
Total Number of Teaching Hours:	**40**	**SEE Marks:**	**50**

Course Learning Objectives:	
1	**Familiarize** the importance of calculus associated with one variable and two variables.
2	**Analyze** Engineering problems by applying Ordinary Differential Equations
3	**Develop** the knowledge of Linear Algebra to solve system of equation by using matrices

Unit	**Syllabus content**	**No. of hours**	
		Theory	**Tutorial**
I	**Calculus of complex functions**: Introduction to complex variables. Definitions- limit, continuity, differentiability and Analytic functions of f(z) : Cauchy- Riemann equations in Cartesian and polar forms (no proof)-Harmonic function and Problems. Applications to flow problems. Construction of analytic functions when u or v or $u \pm v$ are given-Milne-Thomson method. Conformal transformations: Introduction. Discussion of transformations for $W = z^2, W = e^z, W = z + {}^1/_z$ where $z \neq 0$ **Self-Study**: Derivation of Cauchy- Riemann equation in Cartesian and polar form	06	02
II	**Complex integration:** Bilinear Transformations- Problems, line integrals of complex function. Cauchy's theorem, Cauchy's integral formula. Taylor's and Laurent's series (Statements only)- illustrative examples. Singularities, poles and residues with examples, Cauchy's Residues Theorem (statement only)- Illustrative examples. **Self-Study:**– Contour integration Type-I & Type-II problems	06	02
III	**Statistical Methods:** **Statistics:** Brief review of measures of central tendency and dispersion. Moments, skewness and kurtosis. **Curve Fitting:** Curve fitting by the method of least squares, fitting the curves of the forms $= ax + b$, $y = ab^x$ and $y = ax^2 + bx + c$. **Correlation and regression**: Karl Pearson's coefficient of correlation and rank correlation- problems, Regression analysis, lines of regression and problems. **Self-Study**: **Self-Study**: Fit a curve of the form $y = ax + b$, $y = a + bx + cx^2$	06	02
IV	**Probability and Distribution:** **Random variables and Probability Distributions:** Review of random variables. Discrete and continuous random variables-problems. Binomial, Poisson, Exponential and Normal distributions (with usual notation of mean and variance)-:problems. **Joint Probability Distributions :** Introduction, Joint probability and Joint distribution of discrete random variables and continuous random variables **Self-study:** Geometric and Gamma distributions- problems.	06	02

V	**Stochastic Processess and sampling theory**: **Markov Chains**: Markov chains, Classification of Stochastic processes, Probability vector, Stochastic matrix, Regular stochastic matrix, Transition probabilities and Transition probability matrix. **Testing of Hypothesis**: Sampling distributions-introduction. Standard error, Type-I and Type-II errors. Testing of hypothesis and confidence intervals for means. Student's t –distribution and Chi-square distribution as a test of goodness of fit - Illustrative examples only. **Self-study**: Classification of Stochastic process, Bernoulli Process, Poisson Process.	06	02

COURSE OUTCOMES: On completion of the course, student should be able to:

CO1 **Understand** fundamental concepts in calculus of complex functions, statistics, probability and special functions.

CO2 **Apply** tools taught to analyze transformations arising in engineering field and evaluate complex integrals and draw statistical inferences.

CO3 **Analyse** problems in engineering field by employing special functions, complex functions and statistical methods.

CO4 **Evaluate** integrals of complex functions, regression and correlation coefficient, probability of a discrete and continuous variable, series solution of special differential equations.

TEACHING - LEARNING PROCESS: Chalk and Talk, power point presentation, animations, videos.

TEXT BOOKS

1. B.S. Grewal, Higher Engineering Mathematics (44th Edition 2018), Khanna Publishers, New Delhi.
2. E. Kreysizig, Advanced Engineering Mathematics, John Wiley and sons, 10th Ed. (Reprint) 2016.

REFERENCE BOOKS

1. V. Ramana: Higher Engineering Mathematics, McGraw –Hill Education,11th Ed..
2. H. C. Taneja, Advanced Engineering Mathematics, Volume I & II, I.K. International PublishingHouse Pvt. Ltd., New Delhi.
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications,Reprint, 2010.

ONLINE RESOURCES

1. http://www.nptel.ac.in
2. https://en.wikipedia.org
3. https://ocw.mit.edu/courses/18-03sc-differential-equations-fall-2011/
4. https://ocw.mit.edu/courses/18-06sc-linear-algebra-fall-2011/
5. https://math.hmc.edu/calculus/hmc-mathematics-calculus-online-tutorials/differential-equations/first-order-differential-equations/

QUESTION PAPER PATTERN (SEE)	
PART-A	PART-B
One question from each unit carrying two marks each	Answer any **TWO** sub questions for maximum 18 marks from each unit

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**2**	**2**										
CO2	**2**	**3**										
CO3	**3**	**2**										
CO4	**2**	**3**										
Strength of correlation: Low-1, Medium- 2, High-3												

Electrical Power Generation, Transmission and Distribution [As per Choice Based Credit System (CBCS) & OBE Scheme] SEMESTER – IV			
Course Code:	**P22EE402**	**Credits:**	**03**
Teaching Hours/Week (L:T:P):	**2:2:0**	**CIE Marks:**	**50**
Total Number of Teaching Hours:	**40**	**SEE Marks:**	**50**

Course Learning Objectives: This course will enable the students to:

- Explain the detail description of hydroelectric plants, thermal power generation, nuclear power plants and diesel electric plants.
- Understand the concept of load curves, different tariff, grounding and power factor.
- Describe the transmission and distribution system scheme
- Describe and study the effect of sag and tension on over head transmission line
- Describe and study about line insulators and UG cables
- Describe and study the performance evaluation of OH lines having different configurations.
- Determine the line parameter values of 1-phase and 3-phase OH lines of different configuration.
- Describe and study the concept of corona and its impact on OH transmission line.
- Describe and study about DC and AC- distributors carrying point and/or uniformly varying load.

UNIT – I	**Conventional Power Generation**	**8 Hours**

Hydro Electric Power Generation: Selection of site, Classification, General arrangement and operation.

Thermal Power Generation: Plant layout, Working, Coal handling system, Ash disposal schemes.

Nuclear Power Station: Selection of site, Plant layout, Reactors.

Diesel Electric Station: Plant layout, Working and Maintenance, Choice and characteristics

Self-study component:	Hydro electric Turbines.

UNIT – II	**Economic Aspects and Grounding Systems**	**8 Hours**

Economic Aspects: Diversity factor, Load factor, Plant capacity factor, Plant use factor, Plant utilization factor, Loss factor. Power factor improvement and Tariffs.

Grounding Systems: Resistance grounding system, Neutral grounding, Ungrounded system, Resonant grounding, Solid grounding, Reactance grounding.

Self-study component:	Load curve and load duration curve and its uses

UNIT – III	**Typical Transmission and Distribution System Scheme and Overhead Transmission Line**	**8 Hours**

Typical Transmission and Distribution System Scheme: Single line diagram of typical transmission and distribution system scheme indicating various voltage levels, Standard voltages for transmission, Selection of optimal value of transmission voltage, Effect of increase of transmission

voltage on: i) volume of copper used ii) efficiency of transmission iii) line loss and regulation.

Overhead Transmission Line: Requirements and types of - line conductors, Line supports. Sag calculation in conductors i) suspended on level supports ii) supports at different levels; Effect of wind & ice on sag tension calculations (Problems excluded).

Self-study component:	Tension and sag at erection

UNIT – IV	**Insulators, Underground Cables and Performance of Power Transmission Lines**	**8 Hours**

Insulators: Requirement, Types of insulators, Potential distribution over a string of suspension insulators, String efficiency & methods of improving it.

Underground Cables: Types, Material used, Insulation resistance, Thermal rating of cables, Charging current, Grading of cables –capacitance grading & inter-sheath grading,

Performance of Power Transmission Lines: Classification of Over head transmission lines, Regulation of short transmission line, Medium transmission line using nominal T-method, Long transmission line-ABCD constants, Ferranti effect.

Self-study component:	Testing of insulators and cables

UNIT – V	**Corona and Distribution System**	**8 Hours**

Corona: Phenomenon of corona, Expression for disruptive & visual critical voltage, Corona power loss, Factors effecting corona power loss, Advantages and disadvantages of corona, Methods of reducing corona effect, Radio interference.

Distribution System: Typical distribution system scheme- Feeders, distributors & service mains; Requirements of distribution system, Radial & ring main systems, DC distributors, Calculation for concentrated loads, AC Distributors- when the load PFs referred to voltages at load.

Self-study component:	AC Distributors when PF refer to the supply voltage.

Course Outcomes: On completion of this course, students are able to:

COs	**Course Outcomes** with ***Action verbs*** for the Course topics	**Bloom's Taxonomy Level**	**Level Indicator**
CO1	Apply the knowledge of basic science in power generation, transmission & distribution systems.	Applying	L3
CO2	Analyze the performance characteristics of transmission and distribution system	Analyzing	L4
CO3	Analyze the classification of line conductors and voltage distribution in insulators and UG cables.	Analyzing	L4
CO4	Compute the parameters and performance of the transmission lines	Applying	L3

Text Book(s):

1. S. M. Singh, "Electrical power generation, transmission and distribution" -Prentice hall of India,

New Delhi, 2nd 2008.
2. Chakrabarti, M-L Soni, P.V. Gupta, U.S. Bhatnagar, "Power system Engineering", Dhanpat Rai & Co., 2001.
3. C L Wadwa, Electrical power systems –New Age Publishers, 6 th edition, 2010.

Reference Book(s):

1. Dr. S L Uppal & S Rao, Electrical Power –Khanna publications, 15 th edition, 2001.
2. M.V. Deshapande, "Electrical Power System Design" T.M.H., 1993.

Course Articulation Matrix

Course Outcome (CO)	Program Outcome													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Apply the knowledge of basic science in power generation, transmission & distribution systems.	**3**												**3**	
Analyze the performance characteristics of transmission and distribution system		**3**												**2**
Analyze the classification of line conductors and voltage distribution in insulators and UG cables.		**3**												**2**
Compute the performance parameters of the transmission lines	**3**												**2**	

DC & Synchronous Machines [As per Choice Based Credit System (CBCS) & OBE Scheme] **SEMESTER – IV**			
Course Code:	**P22EE403**	**Credits:**	**03**
Teaching Hours/Week (L:T:P):	**3:0:0**	**CIE Marks:**	**50**
Total Number of Teaching Hours:	**40**	**SEE Marks:**	**50**

Course Learning Objectives: This course will enable the students to:

- Know about basic operation and construction of different types of DC Generators.
- Know about basic operation and construction of different types of DC Motors.
- Analysis of various tests to be conducted on DC Machines.
- Study about voltage regulation of synchronous generators.
- Learn about principle of operation and the effect of load variation in synchronous motors

UNIT – I	**DC Generator**	**8 Hours**

DC Generator: Types of generators, Types of armature windings, EMF Equation**,** O.C.C and Load characteristics, Armature reaction and methods of reducing its effects. Ideal, Resistance and EMF Commutation, Compensating winding, Use of Inter poles

Self-study component:	Construction of DC Machines

UNIT – II	**DC Motor**	**8 Hours**

DC Motor: Introduction, Torque equation**,** Characteristics of Shunt, Series and Compound motors, Factors controlling motor speed, Rheostatic Speed Control of shunt and series motors, its Merits & Demerits, Necessity of a Starters, 3-point starter and Applications of DC motor.

Self-study component:	Back EMF and its significance.

UNIT – III	**Testing Of DC Machines**	**8 Hours**

Testing Of DC Machines: Direct and Indirect methods of testing of shunt and series motors: Swinburne's test, Hopkinson's test, Field test, Retardation test, Advantages and disadvantages.

Self-study component:	Permanent magnet DC motor.

UNIT – IV	**Synchronous Generator**	**8 Hours**

Synchronous Generator: Principle of operation, Construction of salient & non-salient pole machines, armature windings, Coil span factor, Distribution factor, Chorded coils and EMF equation.
Voltage Regulation: Significance, EMF, MMF & ZPF methods.

Self-study component:	Harmonics and its elimination

UNIT – V	**Synchronous Motor**	**8 Hours**

Synchronization: Parallel operation of alternators: Reasons & Conditions, Synchronization: synchroscope, Infinite Bus.
Synchronous Motor: Principle of operation, Motor on load with constant Excitation, Power Flow equations, Synchronous motor with different Excitation, Different Torques of Synchronous Motor,

Effect of Increased load with constant excitation and vice versa, V and inverted V curves.
Salient Pole Synchronous Machine: Two reaction theory, Power angle diagram, Reluctance power, Slip test.

Self-study component:	Hunting in synchronous machines and Damper windings

Course Outcomes: On completion of this course, students are able to:

COs	**Course Outcomes** with ***Action verbs*** for the Course topics	**Bloom's Taxonomy Level**	**Level Indicator**
CO1	Apply the knowledge of basic electrical laws to study the operating principle of DC & Synchronous machines.	Applying	L3
CO2	Analyze the performance characteristics of DC & Synchronous machines.	Analyzing	L4
CO3	Apply the different testing methods to examine the desired parameters of DC & Synchronous machines.	Applying	L3
CO4	Compute numerical problems on DC & Synchronous machines.	Applying	L3

Text Book(s):

1. Ashfaq Hussain "Electrical Machines", Dhanapath Rai& Co, 3rd Edition, Reprint 2015.
2. B.L Theraja "Electrical Technology" Volume2, S. Chand, 22nd Edition.

Reference Book(s):

1. A. Langsdorf, "Theory of alternating current machinery" TMH, 2005.
2. M.G.Say, "Performance and design of A.C. Machines" C.B.S Publishers, 2002.

Course Articulation Matrix

Course Outcome (CO)	Program Outcome													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Apply the knowledge of basic electrical laws to study the operating principle of DC & Synchronous machines.	**3**												**3**	
Analyze the performance characteristics of DC & Synchronous machines.		**3**												**2**
Apply the different testing methods to examine the desired parameters of DC & Synchronous machines.	**3**												**2**	
Compute numerical problems on DC & Synchronous machines.	**3**												**2**	

MICROCONTROLLERS [As per Choice Based Credit System (CBCS) & OBE Scheme] SEMESTER – IV			
Course Code:	**P22EE404**	**Credits:**	**04**
Teaching Hours/Week (L:T:P):	**3:0:2**	**CIE Marks:**	**50**
Total Theory Teaching Hours: **Total Laboratory Hours:**	**40** **24**	**SEE Marks:**	**50**

Course Learning Objectives: This course will enable the students to:

- The comparison of Microcontroller with Microprocessor and their evolution with the 8051architecture.
- Understanding the basic instruction set for program writing using different arithmetic and logical instructions.
- Describe and analyze the timer/counter operation with various modes
- Explain and analyze the various modes of serial communications with interfacing the circuits with external world.

UNIT – I	**Architecture of 8051**	**8 Hours**

Microprocessors and Microcontrollers, A Microprocessors survey. RISC & CISC CPU Architectures, Harvard & Von Neumann CPU architecture. Introduction of 8051 Micro controller Hardware, Input /output pins, Ports and circuits, Counter and Timers, Serial data input / output. Basics on Addressing modes.

Self-study component:	External memory
Practical Topics: **(6 Hours)**	a. Addition, Subtraction, Multiplication & Division of 8-bit data b. Addition &Subtraction of 16 bit data

UNIT – II	**Instruction set**	**8 Hours**

Introduction, Data moves & Logical Operations: External data moves, Code Memory, Read only data moves / Data exchanges, Addition, Subtraction, Multiplication and division (signed representation), Decimal arithmetic, Programs. Byte level logical operations, Bit level logical operations, Rotate and Swap operations. Incrementing and decrementing. JUMP and CALL program range, Jumps, Calls and Subroutines programs.

Self-study component:	Stack operation
Practical Topics: **(6 Hours)**	a. Largest and smallest number ; Counting of 1's & 0's of a given number; Ascending & Descending order b. **Code conversions:** Binary to Gray, ASCII to BCD, Hexadecimal to decimal and vice-versa c. Data movement with and without overlapping using external memory

UNIT – III	**Timer / Counter programming in 8051**	**8 Hours**

Timer / Counter programming in 8051: Programming 8051 Timers, Counter Programming, Programming timers 0 and 1 in assembly language

Self-study component:	Programs using subroutines
Practical Topics: **(4 Hours)**	a. Generation of waveforms with time delay using timers/counters in simulation b. Generation of waveforms without time delay using timers/counters in simulation

UNIT – IV	**8051 Serial Communication**	**8 Hours**

Basics of serial Communication, 8051 connecting to RS-232, 8051 Serial communication programming, Serial port programming in assembly language.

Self-study component:	Counter/Timer programming in C
Practical Topics: **(4 Hours)**	a. Programs on transmitting signals using RS232 in serial form to 8051. b. Programs on receiving signals using RS232 in serial form to 8051.

UNIT – V	**Interrupts and Interfacing applications**	**8 Hours**

Interrupts & Interfacing applications: 8051 interrupts, Programming Timer Interrupts, Programming external Hardware Interrupts, Programming the Serial Communication Interrupts, Interrupt Priority in the 8051, interrupt programming in assembly language. Interfacing 8051 to Stepper motor, Elevator & DC Motor Assembly language interfacing programming

Self-study component:	Serial port programming in C
Practical Topics: **(4 Hours)**	a. DC Motor interface with microcontroller. b. Stepper motor interface with microcontroller. c. Elevator interface with microcontroller.

Course Outcomes: On completion of this course, students are able to:

COs	**Course Outcomes** with ***Action verbs*** for the Course topics	**Bloom's Taxonomy Level**	**Level Indicator**
CO1	Apply basic computer knowledge to study the internal organization and instruction set of Microcontrollers	Applying	L3
CO2	Analyze different instructions set to write ALP's on logical, data transfer and mathematical operations.	Analyzing	L4
CO3	Analyze timers, counters and serial/parallel communication to interface the 8051 Microcontroller	Analyzing	L4
CO4	Execute ALP/ C Programs using Microcontroller kit /suitable simulation platform.	Applying	L3

Text Book(s):

1. Kenneth J. Ayala : "The 8051 Microcontroller Architecture, Programming & Applications" 2nd Edition, Penram International, 1996/ Thomason Learning 2005.
2. Muhammad Ali Mazidi and Janaice Gillespie Mazidi and Roollin D. Mckinlay" The 8051 Micro controller and Embedded Systems- using assembly and C " , Person Education, 2nd Edition 2006

Reference Book(s):

1. Predko "Programming and Customising the 8051 Micro controller" TMH 3rd Edition 2007
2. Ajaya V Deshmukh "Microcontrollers- Theory and applications", TMH 3rd Edition 2005
3. Rajkamal "Microcontrollers: Architecture, Programming, interfacing and system design", Person education, 4th Edition 2005

Course Articulation Matrix

Course Outcome (CO)	Program Outcome													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Apply basic computer knowledge to study the internal organization and instruction set of Microcontrollers	**3**												**2**	
Analyze different instructions set to write ALP's on logical, data transfer and mathematical operations.		**3**												**2**
Analyze timers, counters and serial/parallel communication to interface the 8051 Microcontroller		**3**												**2**
Execute ALP/ C Programs using Microcontroller kit /suitable simulation platform.	**2**	**2**	**2**	**2**	**2**				**2**	**2**				**2**

Signals and Digital Signal Processing [As per Choice Based Credit System (CBCS) & OBE Scheme] SEMESTER – IV			
Course Code:	**P22EE405**	**Credits:**	**04**
Teaching Hours/Week (L:T:P):	**3:0:2**	**CIE Marks:**	**50**
Total Theory Teaching Hours: **Total Laboratory Hours:**	**40** **24**	**SEE Marks:**	**50**

Course Learning Objectives: This course will enable the students to:

- Analyze the types of signals, operations which can be performed on signals and properties of systems.
- Explain the concept of Z-Transform.
- Describe the concept of discrete-time Fourier transform (DFT), Inverse DFT (IDFT) and properties of DFT and understand and use the FFT algorithms and its applications
- Carry out the design and implementation of IIR filters and FIR filters

UNIT – I	**Introduction**	**8 Hours**

Introduction: Definitions of signals and systems, Classification of signals, Basic operations on signals (Excluding Problems), Systems viewed as interconnections of operations on signals, Properties of systems.

Self-study component:	Elementary signals
Practical Topics: **(6 Hours)**	a. Generation of elementary signals in continuous and discrete time b. Multiplication of two discrete time sequences

UNIT – II	**Z-Transforms**	**8 Hours**

Z-Transforms: Introduction, Definition of the z-transform and its inverse, Region of Convergence, Properties of z-transforms(Excluding problems), z-transform Inversions, z-Transform analysis of LTI Systems.

Self-study component:	Initial and final value theorem
Practical Topics: **(6 Hours)**	a. Z-Transforms and inverse Z-Transforms of given sequenc b. Convolution Property of the Z-transform

UNIT – III	**Discrete Fourier transform (DFT)**	**8 Hours**

Introduction, definitions of Discrete Fourier Transform (DFT) and Inverse Discrete Fourier transform (IDFT). Properties of DFT – Periodicity, Linearity, Circular Symmetries of a sequence. Symmetry properties of the DFT - real valued sequences, real & even sequences, real & odd sequences, purely imaginary sequences and circular convolution. Additional DFT properties – time reversal of sequences, circular time shift of a sequence, circular frequency shift, complex conjugate properties

Self-study component:	Relation between DFT and DFS

Practical Topics: **(4 Hours)**	a. MATLAB Scripts to perform discrete convolution for the given sequences b. MATLAB program to perform the Discrete Fourier Transform (DFT) for the given sequences by computing the N point DFT of a given sequence and plot magnitude and phase spectrum.

UNIT – IV	**Fast Fourier Transform (FFT)**	**8 Hours**

Efficient computation of the DFT: FFT algorithms - Direct computation of DFT, Radix-2 algorithms - Decimation In Time and Frequency algorithms, Applications of FFT algorithms -Efficient computation of the DFTs of two real sequences (using a Single N-point DFT), Efficient computation of the DFTs of 2N point real sequences.

Self-study component:	Inverse Fast Fourier transform
Practical Topics: **(4 Hours)**	a. MATLAB program to perform the Discrete Fourier Transform (DFT) for the given sequences by using FFT algorithm of a given sequence and plot magnitude and phase spectrum. b. Circular Convolution using FFT Algorithm

UNIT – V	**Design of filters:**	**8 Hours**

(a) Design of Analog IIR filters – Analog Filter Specifications, classification of analog Filters, Butterworth analog filter, frequency/spectral transformations, design of Low pass (analog) Butterworth filters.
(b) Digital filters: Design of IIR filters from analog filters -Bilinear transformation, Impulsive invariance transformation.
(c) Design of FIR filters: Introduction, design of Linear phase FIR filter using windows. Windowing functions, rectangular

Self-study component:	Design of Chebyshev Filter
Practical Topics: **(4 Hours)**	a. Design of IIR Butterworth analog filter to meet the given specification. b. Design of IIR Butterworth digital filter to meet the given specification.

Course Outcomes: On completion of this course, students are able to

COs	**Course Outcomes** with ***Action verbs*** for the Course topics	**Bloom's Taxonomy Level**	**Level Indicator**
CO1	Apply the knowledge of mathematics to visualize, Classify and perform computation on discrete time signals, systems and properties	Applying	L3
CO2	Analyze both continuous and discrete time systems in time, frequency and z-domains	Analyzing	L4
CO3	Design simple signal conditioning systems by using different techniques	Creating	L6
CO4	Execute MATLAB program to implement signal operations, processing and filter algorithms	Applying	L3

Text Book(s):

1. Simon Haykin and Barry Van Veen, "Signals and Systems", John Wiley & Sons, Second edition, 2008.
2. J.S.Chitode , "Digital Signal Processing" - Technical publications. Pune. 2013

Reference Book(s):

1. Michel J Roberts, "Signals and Systems: Analysis of signals through Linear Systems", Tata McGraw-Hill, 2003..
2. H. P. Hsu and R. Ranjan, "Signals and Systems", Schaum's Outline Series, T.M.H., 2006.
3. D. Ganesh Rao and SatishTunga, "Signals and Systems: A Simplified Approach", Sanguine Technical Publishers.
4. 4. Dr. D Ganesh Rao & Vineeta P. Gejji , "Digital Signal Processing", Sanguine Technical Publishers, 2013

Course Articulation Matrix

Course Outcome (CO)	Program Outcome													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Apply the knowledge of mathematics to visualize, Classify and perform computation on discrete time signals, systems and properties	**3**												**2**	
Analyze both continuous and discrete time systems in time, frequency and z-domains		**3**												**2**
Design simple signal conditioning systems by using different techniques			**2**											**1**
Execute MATLAB program to implement signal operations, processing and filter algorithms	**2**	**2**	**2**	**2**	**2**				**2**	**2**			**2**	**2**

DC Machines Laboratory [As per Choice Based Credit System (CBCS) & OBE Scheme] **SEMESTER – IV**			
Course Code:	**P22EEL406**	**Credits:**	**01**
Teaching Hours/Week (L:T:P):	**0:0:2**	**CIE Marks:**	**50**
Total Number of Teaching Hours:	**20**	**SEE Marks:**	**50**

Course Learning Objectives: This course aims to:

- Study OCC and load characteristics of DC generator & DC Motor
- Study the different methods of speed control of DC motor
- Determine the efficiency of machine both as generator and motor by conducting various tests.
- Know the working of synchronous Motor

Sl.No	List of Experiments	No. of Hours
1.	Speed control of DC shunt motor	**2**
2.	Load Characteristics of a DC Generators	**2**
3.	Load test on DC shunt motor by Electrical Loading	**2**
4.	Swinburne's test	**2**
5.	Field test on DC series motor	**2**
6.	Regulation of Alternator by EMF & MMF methods	**2**
7.	Slip test	**2**
8.	Hopkinson's test	**2**
9.	Self study experiment	**2**

Course Outcomes: On completion of this course, students are able to:

COs	**Course Outcomes** with ***Action verbs*** for the Course topics	Bloom's Taxonomy Level	Level Indicator
CO1	Conduct experiments to obtain performance characteristics of DC Machines.	Applying	L3
CO2	Conduct experiments to obtain performance characteristics of Synchronous Machines.	Applying	L3
CO3	Ability to communicate effectively in a team/as an individual to conduct experiments.	Understanding	L2

Course Articulation Matrix

Course Outcome (CO)	Program Outcome													
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
Conduct experiments to obtain performance characteristics of DC Machines.	**3**	**3**		**3**									**2**	**2**
Conduct experiments to obtain performance characteristics of Synchronous Machines.	**3**	**3**		**3**									**2**	**2**
Ability to communicate effectively in a team/as an individual to conduct experiments.								**1**	**3**	**3**				

EMPLOYABILITY ENHANCEMENT SKILLS - IV

[As per Choice Based Credit System (CBCS) & OBE Scheme]

SEMESTER – IV for CSE, ISE, ECE, CSE(AIML), CSBS & CSE(DS) Branches only

Course Code:	**P22HSMC407B**	**Credits:**	**01**
Teaching Hours/Week (L:T:P)	**0:2:0**	**CIE Marks:**	**50**
Total Number of Teaching Hours:	**30**	**SEE Marks:**	**50**

Course Learning Objectives: This course will enable the students to:

- Calculations involving simple and compound interest, averages, alligations & mixtures, proportions, variations and partnership.
- Explain concepts behind logical reasoning modules of series, coding & decoding, seating and data arrangements.
- Develop problem solving skills through Data structures.

UNIT – I		**06 Hours**

Quantitative Aptitude: Simple and Compound Interest, Averages.

Logical Reasoning: Series, Coding & Decoding.

Self-study component:	Mensuration

UNIT – II		**06 Hours**

Quantitative Aptitude: Alligations and Mixtures, Ratios, Proportions and Variations.

Logical Reasoning: Seating Arrangement, Data Arrangement.

Self-study component:	Types of cryptarithm

UNIT – III		**06 Hours**

Quantitative Aptitude: Partnership.

Verbal Ability: Sentence Completion, Ordering of Sentences.

Self-study component:	Game based assessments

UNIT – IV	**DATA STRUCTURES I - Problem Solving Techniques and Object-Oriented Programming**	**06 Hours**

Recursion: Introduction to recursion, Principle of mathematical induction, Fibonacci numbers, Recursion using arrays, Recursion using strings, Recursion using 2D arrays.

Time and Space Complexity: Order complexity analysis, Theoretical complexity analysis, Time complexity analysis of searching and recursive algorithms, Theoretical space complexity, Space complexity analysis of merge sort.

Backtracking: Introduction to Backtracking, Rat In a Maze, N-queen, Word Search.

Basics of OOP: Introduction to oops, Creating objects, Getters, and setters, Constructors and related concepts, Inbuilt constructor and destructor, Example classes.

Advance Concepts of OOP: Static members, Function overloading and related concepts, Abstraction, Encapsulation, Inheritance, Polymorphism, Virtual functions, Abstract classes, Exception handling.

Self-study component:	Examples of Abstract Data Type

UNIT – V	DATA STRUCTURES II – Linear Data Structures and Tress	06 Hours

Linked Lists: Introduction to linked list, Inserting node in linked list, Deleting node from linked list, Midpoint of linked list, Merge two sorted linked lists, merge sort of a linked list, Reversing a linked list.

Stacks and Queues: Introduction to stacks, Stack using arrays, Dynamic Stack class, Stack using linked list, Inbuilt stack, Queue using arrays, Dynamic queue class, Queue using linked list, Inbuilt queue.

Generic Trees: Introduction to Trees, Making a tree node class, Taking a tree as input and printing, Tree traversals, Destructor for tree node class.

Binary Trees: Introduction to Binary Trees, Taking a binary tree as input and printing, Binary Tree traversals, Diameter of binary tree.

Binary Search Trees: Introduction to Binary Search Trees, Searching a node in BST, BST class, Inserting and Deleting nodes in BST, Types of balanced BSTs.

Self-study component:	Huffman tree, Expression Trees.

Course Outcomes: On completion of this course, students are able to:

COs	**Course Outcomes** with ***Action verbs*** for the Course topics	**Bloom's Taxonomy Level**	**Level Indicator**
CO1	Solve the problems based on simple and compound interests, averages, alligations & mixtures, ratios, proportions, variations and partnerships.	Applying	L3
CO2	Solve logical reasoning problems based on seating arrangements, data arrangement and verbal ability skills of sentence corrections and ordering of sentences.	Applying	L3
CO3	Analyze and represent various data structures and its operations.	Analyzing	L4
CO4	Develop programs with suitable data structure based on the requirements of the real-time applications	Applying	L3

Text Book(s):

1. Data Structures and Algorithms Made Easy by Narasimha Karumanchi
2. Data Structures through C in Depth by by S K Srivastava and Deepali Srivastava
3. Quantitative aptitude by Dr. R. S Agarwal, published by S. Chand private limited.
4. Verbal reasoning by Dr. R. S Agarwal, published by S. Chand private limited.

Reference Book(s):

1. Aaron M Tenenbaum, Yedidyah Langsam and Moshe J Augenstein, "Data Structures using C", 2014, low price edition ,Pearson education.
2. Seymour Lipschutz ,"Data Structures with C (Schaum's Outline Series)" , July 2017, McGraw Hill Education.
3. Quantitative Aptitude by Arun Sharma, McGraw Hill Education Pvt Ltd.

Web and Video link(s):

1. Data Structures and algorithms offered by NPTEL: https://nptel.ac.in/courses/106102064/

COURSE ARTICULATION MATRIX
(EMPLOYABILITY ENHANCEMENT SKILLS - IV – P22HSMC407)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2										
CO2	2	2										
CO3	2	2										
CO4	1	1	2									1

Internship - I [As per Choice Based Credit System (CBCS) & OBE Scheme] SEMESTER – IV			
Course Code:	**P22INT409**	**Credits:**	**02**
Teaching Hours/Week (L:T:P):	**0:0:2**	**CIE Marks:**	**-**
Total Number of Teaching Hours:	**-**	**SEE Marks:**	**100**

All the students registered to II year of BE shall have to undergo a mandatory internship of 02 weeks during the intervening vacation of II and III semesters or III and IV semester. Internship shall include Inter / Intra Institutional activities. A Semester End Examination (Presentation followed by question-answer session) shall be conducted during IV semester and the prescribed credit shall be included in IV semester. The internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take up / complete the internship shall be declared fail and shall have to complete during subsequent Semester End Examination after satisfying the internship requirements. (The faculty coordinator or mentor has to monitor the students' internship progress and interact to guide them for the successful completion of the internship.)

<table>
<tr><th colspan="4">PHYSICAL EDUCATION
[As per Choice Based Credit System (CBCS) & OBE Scheme]
SEMESTER - IV</th></tr>
<tr><td colspan="2">Course Code:</td><td>P22PED409</td><td>Credits:</td><td>00</td></tr>
<tr><td colspan="2">Teaching Hours/Week (L:T:P):</td><td>0:0:2</td><td>CIE Marks:</td><td>100</td></tr>
<tr><td colspan="2">Total Number of Teaching Hours:</td><td>-</td><td>SEE Marks:</td><td>-</td></tr>
<tr><td>Fitness Components</td><td colspan="4">Track Events</td></tr>
<tr><td>Athletics
Track- Sprints
Jumps- Long Jump
Throws- Shot Put</td><td colspan="4">1.1. Starting Techniques: Standing start and Crouch start (its variations) use of Starting Block.
1.2. Acceleration with proper running techniques.
1.3. Finishing technique: Run Through, Forward Lunging and Shoulder Shrug.
Long Jump: Approach Run, Take-off, Flight in the air (Hang Style/Hitch Kick) and Landing
Shot put: Holding the Shot, Placement, Initial Stance, Glide, Delivery Stance and Recovery (Perry O’Brien Technique.</td></tr>
<tr><td>Kho kho</td><td colspan="4">A. Fundamental skills
1. Service: Under arm service, Side arm service, Tennis service, Floating service.
2. Pass: Under arm pass, Over head pass.
3. Spiking and Blocking.
4. Game practice with application of Rules and Regulations
B. Rules and their interpretation and duties of officials.</td></tr>
<tr><td>Throw ball
Athletics
Track- 110 &400 Mtrs
Hurdles
Jumps- High Jump
Throws- Discuss Throw</td><td colspan="4">A. Fundamental skills:
Overhand service, Side arm service, two hand catching, one hand overhead return,side arm return.
B. Rules and their interpretations and duties of officials
110 Mtrs and 400Mtrs:
Hurdling Technique :Lead leg Technique, Trail leg Technique ,Side Hurdling, Over the Hurdles
Crouch start (its variations) use of Starting Block.
Approach to First Hurdles, In Between Hurdles, Last Hurdles to Finishing.
High jump: Approach Run, Take-off, Bar Clearance (Straddle) and Landing.
Discus Throw: Holding the Discus, Initial Stance Primary Swing, Turn, Release and Recovery (Rotation in the circle).</td></tr>
</table>

YOGA [As per Choice Based Credit System (CBCS) & OBE Scheme] SEMESTER - IV			
Course Code:	**P22YOG409**	**Credits:**	**00**
Teaching Hours/Week (L:T:P):	**0:0:2**	**CIE Marks:**	**100**
Total Number of Teaching Hours:	**-**	**SEE Marks:**	**-**

Course objectives:

6) To enable the student to have good health.
7) To practice mental hygiene.
8) To possess emotional stability.
9) To integrate moral values.
10) To attain higher level of consciousness.

The Health Benefits of Yoga

The benefits of various yoga techniques have been supposed to improve

- body flexibility,
- performance,
- stress reduction,
- attainment of inner peace, and
- self-realization.

The system has been advocated as a complementary treatment to aid the healing of several ailments such as

- coronary heart disease,
- depression,
- anxiety disorders,
- asthma, and
- extensive rehabilitation for disorders including musculoskeletal problems and traumatic brain injury.

The system has also been suggested as behavioral therapy for smoking cessation and substance
abuse (including alcohol abuse).

If you practice yoga, you may receive these physical, mental, and spiritual benefits:

- Physical

10. Improved body flexibility and balance
11. Improved cardiovascular endurance (stronger heart)
12. Improved digestion
13. Improved abdominal strength
14. Enhanced overall muscular strength
15. Relaxation of muscular strains
16. Weight control
17. Increased energy levels
18. Enhanced immune system

• Mental 4. Relief of stress resulting from the control of emotions 5. Prevention and relief from stress-related disorders 6. Intellectual enhancement, leading to improved decision-making skills • Spiritual 4. Life with meaning, purpose, and direction 5. Inner peace and tranquility 6. Contentment
Patanjali's Ashtanga Yoga, its need and importance. Yama :Ahimsa, satya, asteya, brahmacarya, aparigraha Niyama :shoucha, santosh, tapa, svaadhyaya, Eshvarapranidhan Suryanamaskar12 count- 4 rounds of practice Asana, Need, importance of Asana. Different types of asana. Asana its meaning by name, technique, precautionary measures and benefits of each asana Different types of Asanas a. Sitting 1. Sukhasana 2. Paschimottanasana b. Standing 1. Ardhakati Chakrasana 2. Parshva Chakrasana c. Prone line 1. Dhanurasana d. Supine line 1. Halasana 2. Karna Peedasana Meaning, importance and benefits of Kapalabhati. 40 strokes/min 3 rounds Meaning, Need, importance of Pranayama. Different types. Meaning by name, technique, precautionary measures and benefits of each Pranayama Pranayama – 1. Suryanuloma –Viloma 2. Chandranuloma-Viloma 3. Suryabhedana 4. Chandra Bhedana 5. Nadishodhana

Additional Mathematics - II [As per Choice Based Credit System (CBCS) & OBE Scheme] **SEMESTER – IV (Lateral Entry: Common to all branches)**			
Course Code:	**P22MDIP401**	**Credits:**	**00**
Teaching Hours/Week (L:T:P):	**2-2-0**	**CIE Marks:**	**100**
Total Number of Teaching Hours:	**40**	**SEE Marks:**	**-**

Course Objectives: The mandatory learning course**: P21MATDIP401** viz., **Additional Mathematics-II** aims to provide essential concepts of linear algebra, introductory concepts of second & higher order differential equations along with various techniques/ methods to solve them, Laplace & inverse Laplace transforms and elementary probability theory.

UNIT-I	
Linear Algebra: Introduction - Rank of matrix by elementary row operations - Echelon form of a matrix. Consistency of system of linear equations - Gauss elimination method. Gauss-Jordan and LU decomposition methods. Eigen values and Eigen vectors of a square matrix. **Self-study Components**: Application of Cayley-Hamilton theorem (without proof) to compute the inverse of a matrix-Examples.	**10 Hrs**
UNIT-II	
Higher order ODE's: Linear differential equations of second and higher order equations with constant coefficients. Homogeneous /non-homogeneous equations. Inverse differential operators. and variation of parameters. Solution of Cauchy's homogeneous linear equation and Legendre's linear differential equation. **Self-study Components**: Method of undetermined coefficients	**12 Hrs**
UNIT-III	
Multiple Integrals: Double and triple integrals-region of integration. Evaluation of double integrals by change of order of integration. Vector Integration: Vector Integration: Integration of vector functions. Concept of a line integrals, surface and volume integrals. Green's, Stokes's and Gauss theorems (without proof) problems. **Self-study Components**: Orthogonal curvilinear coordinates.	**10 Hrs**
UNIT-IV	
Laplace transforms: Laplace transforms of elementary functions. Transforms of derivatives and integrals, transforms of periodic function and unit step function-Problems only. Inverse Laplace transforms: Definition of inverse Laplace transforms. Evaluation of Inverse transforms by standard methods. **Self-study Components**: Application to solutions of linear differential equations and simultaneous differential equations..	**12Hrs**
UNIT-V	
Probability: Introduction. Sample space and events. Axioms of probability. Addition and multiplication theorems. Conditional probability – illustrative examples. **Self-study Components**: State and prove Bayes's theorem	**06Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1:	Apply matrix theory for solving systems of linear equations in the different areas of linear algebra.
CO2:	Solve second and higher order differential equations occurring in of electrical circuits, damped/un-damped vibrations.
CO3:	Identify - the technique of integration evaluate double and triple integrals by change of variables, and vector integration technique to compute line integral
CO4:	Explore the basic concepts of elementary probability theory and, apply the same to the problems of decision theory,

Text Book:

- B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, New Delhi, 43rd Ed., 2015.

Reference books:

1. E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 10th Ed., 2015.
2. N.P.Bali and Manish Goyal: Engineering Mathematics, Laxmi Publishers,7th Ed., 2007.

Additional Communicative English - II [As per Choice Based Credit System (CBCS) & OBE Scheme] **SEMESTER – IV**			
Course Code:	**P22HDIP407**	**Credits:**	**00**
Teaching Hours/Week (L:T:P):	**0:2:0**	**CIE Marks:**	**100**
Total Number of Teaching Hours:	**30**	**SEE Marks:**	**-**

Module-1

Listening Skills II — **2 Hours**

Levels of listening, Active listening, Techniques of listening. Activity: Listening for main ideas and Listening for specific information

Speaking Skills II — **6 Hours**

Language of discussion – Giving opinion, agreeing / disagreeing, asking questions, making suggestions. Sentence stress – content and structure words, Speaking situations, Intonations and Summarizing skills

Module-2

Reading Skills II — **2 Hours**

Guessing meaning from the context, Understanding graphical information, Summarizing. Activity: Book review

Writing Skills II — **4 Hours**

Linkers and connectives, Sentence and paragraph transformation, Mind mapping techniques, Letter writing, Essay writing

Module-3

Email Etiquette — **4 Hours**

Parts of an email, Writing an effective subject line, email language and tone. Activity: Email writing practice - Scenario based emails

Group Presentations — **2 Hours**

Group presentations by the students

Module-4

Goal Setting — **2 Hours**

Defining goals, types of goals, Establishing SMART goals, Steps in setting goals, Goal setting activity

Individual Presentations — **4 Hours**

Individual presentation by the students

Module-5

Teamwork — **4 Hours**

Defining teams, Team vs. Group, Benefits and challenges of working in teams, Stages of team building, Building effective teams, Case studies on teamwork

Course Outcomes: On completion of this course, students will be able to,

CO 1: Understand the role of communication in personal and professional success

CO 2: Comprehend the types of technical literature to develop the competency of students to apprehend the nature of formal communication requirements.

CO 3: Construct grammatically correct sentences to strengthen essential skills in speaking & writing and to develop critical thinking by emphasizing cohesion and coherence

CO 4: Demonstrate effective individual and teamwork to accomplish communication goals.

Textbooks and Reference Books:

1. Communication Skills by Sanjay Kumar and Pushpa Lata, Oxford University Press - 2015.
2. Everyday Dialogues in English by Robert J. Dixson, Prentice-Hall of India Ltd., 2006.
3. Developing Communication Skills by Krishna Mohan& Meera Banerjee (Macmillan)
4. The Oxford Guide to Writing and Speaking, John Seely, Oxford.
5. English Language Communication Skills - Lab Manual cum Workbook by Rajesh Kumar Singh, Cengage learning India Pvt Limited – 2018
6. The 7 habits of highly effective people by Stephen R Covey, Simon & Schuster – 2020
7. You Are the Team: 6 Simple Ways Teammates Can Go from Good to Great by Michael G. Rogers

CO – PO – PSO Matrix

CO	PO												PSO		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1												2			
CO 2										2					
CO 3										2					
CO 4									2						
CO									**2**	**2**		**2**			