Curriculum with Multiple Entry & Multiple Exit (ME-ME) adhering to NEP 2020
(Academic Regulation 2023 – 2024)

Department of Electrical and Electronics Engineering

	Credit requirement	Exit credit requirement	Total credit	Level as per NCrF
Undergraduate Certificate| (After the one year of study)	40	10	50	L5
Diploma| (After two year of study)	80	10	90	L6
Advanced Diploma | (After two year of study) - Lateral Entrants	40	10	50	
B.Sc. in Engineering (After three years of study)	120	-	120	L7
B. Tech. (Regular) | (Four years of study)	160	-	160	L8
B. Tech. (Minor)	12 (Inclusive of 160)	-	160	L8
B. Tech. (Honors)	175	15 (160+15)	175	L8

Semester I								Category
No.	Code	Course Title	POs / PSOs	L/D[1]	T[2]	P	Credit	
1	23BSX31	Engineering Physics	1, 2, 7	3	1	0	3.0	HS
2	23BSX11	Linear Algebra & Calculus	1, 2	3	1	0	3.0	BS
3	23ESX03	Basics of Civil & Mechanical Engineering	1	3	0	0	3.0	ES
4	23ESX02	Introduction to Programming	1, 2, 3	3	0	0	3.0	ES
5	23BSX32	Engineering Physics Lab	1, 4	0	0	2	1.0	BS
6	23ESX06	Engineering Workshop	1	0	0	3	1.5	ES
7	23ESX05	Computer Programming Lab	1, 2, 3, 4, 5	0	0	3	1.5	ES
8	23ESX07	Engineering Graphics	1, 10	2	0	2	3.0	ES
9	23SOC01	IT Workshop	1, 2, 3, 4, 5	0	0	2	1.0	SOC
10	23WLP01	Health, Wellness, Yoga & Sports	2, 7, 12	-	-	1	0.5	Wellness
						Sub-total	20.5	
Semester II								Category
No.	Code	Course Title	POs / PSOs	L/D[1]	T[2]	P	Credit	
1	23HSX01	Communicative English	5, 8, 10	2	0	2	2.0	HS
2	23BSX21	Chemistry	1, 2, 7	3	1	0	3.0	BS
2	23BSX12	Differential Equations and Vector Calculus	1, 2, 5	3	1	0	3.0	BS
3	23EE201	Electrical Circuit Analysis - I	1, 2, 3, PSO #1	3	0	0	3.0	PC
4	23ESX01	Basics of Electrical and Electronics Engg.	1, 2, 3, PSO #1	3	0	0	3.0	ES
5	23BSX22	Chemistry Lab	1, 4	0	0	2	1.0	BS
6	23HSX02	Communicative English Lab	9, 10	0	0	2	1.0	HS
7	23ESX04	Electrical and Electronics Workshop	1, 2, 4	0	0	3	1.5	ES
8	23EE202	Electrical Circuits Lab	1, 2, 4	0	0	3	1.5	PC
9	23CSP01	NSS/ NCC/Scouts & Guides/Community Service	7, 8, 12	-	-	1	0.5	CSP
						Sub-total	19.5	
Exit mandate at the level of I year for the award of Undergraduate Certificate[3]								
1		Certification #1		Min. 60 hours			2.0	SOC
2		Certification #2		Min. 60 hours			2.0	SOC
3		Job Specific Internship / OJT / Apprenticeship		Min. 60 Days			6.0	OJT

[1] In case of digital learning other than face-to-face learning, double the number of learning hours is mandate for the equivalent credit as per NCRF

[2] Suggested tutorials do not carry credits

[3] Students exiting at the level of first year of study must complete two skill-oriented courses and Job specific Internship/ OJT/ Apprenticeship that tunes to a total of 10 credits

Semester III								Category
No.	Code	Course Title	POs / PSOs	L/D	T	P	Credits	
1	23BSX14	Complex Variables & Numerical Methods	1, 2	3	0	0	3.0	BS
2	23HSX03	Universal Human Values Understanding Harmony	8, 9, 10	2	1	0	3.0	MC
3	23EE303	Electrical Circuit Analysis-II	1, 2, 3	3	0	0	3.0	PC
4	23EE304	DC Machines & Transformers	2, 3, PSO #1	3	0	0	3.0	PC
5	23EE305	Electro Magnetic Field Theory	1,2,3 PSO#1	3	0	0	3.0	PC
6	23EE306	Electrical Circuit Analysis and Simulation Lab - II	1, 4	0	0	3	1.5	PC
7	23EE307	DC Machines & Transformers Lab	4	0	0	3	1.5	PC
8	23AIS01	Data Structures Lab	1, 2, 3, 5 PSO #1,2	0	1	2	2.0	SOC
9	23ACX01	Environmental Science[4]	1, 12	2	0	0	0.0	MC
						Sub-total	**20.0**	
Semester IV								Category
No.	Code	Course Title	POs / PSOs	L/D	T	P	Credits	
1	23HSX03	Managerial Economics & Finance analysis	11, 12	2	0	0	2.0	HS
2	23ESX09	Analog Circuits	1,2,3, PSO#1	3	0	0	3.0	ES
3	23EE403	Induction Motors and Synchronous Machines	2, 3, PSO#1	3	0	0	3.0	PC
4	23EE404	Control Systems	3, PSO#1	3	0	0	3.0	PC
5	23EE405	Power Systems-I	1, 2, 7	3	0	0	3.0	PC
6	23EE406	Control Systems Lab	4, PSO#1	0	0	3	1.5	PC
7	23EE407	Induction Motors and Synchronous Machines Lab	4	0	0	3	1.5	PC
8	23ESX08	Design Thinking & Innovation	1,2	0	0	4	2.0	ES
9	23DSS01	Python Programming	1, 2, 3, 5 PSO#1,2	0	1	2	2.0	SOC
						Sub-total	**21.0**	
Exit mandate at the level of I year for the award of Diploma[5]								
1	23SOC20	Certification #3		Min. 60 hours			2.0	SOC
2	23SOC26	Certification #4		Min. 60 hours			2.0	SOC
3		Job Specific Internship/OJT/Apprenticeship		Min. 60 Days			6.0	OJT

[4] The courses that come under mandatory category may be promoted either through self-learning or blended learning and accordingly campus LMS platform may be customized. It is mandate for all students to pursue an online certification course for minimum duration of 30 hours covering the areas of Sustainability, Climate changes, Environmental Impact Assessment in line with Sustainable Development Goals (SDG)

[5] Students exiting at the level of second year study must complete two skill-oriented courses and Job specific Internship/ OJT/ Apprenticeship that tunes to a total of 10 credits

List of Electives

Inter – disciplinary Elective #1[6]			Pre-requisite[7]							
1	23CEO01	Environment Pollution and Control	-	-	-	3	0	0	3.0	MI-ES
2	23CSO01	Operating Systems	-	-	-	3	0	0	3.0	MI-
3	23AIO01	Introduction to Python	23ESX02	-	-	3	0	0	3.0	MI-
4	23DSO01	Introduction to Database Management Systems	23BSX11	-	-	3	0	0	3.0	MI-
5	23ECO01	Semi-Conductor Devices and Circuits	23BSX31	23ESX01	-	3	0	0	3.0	MI-
6	23EEO01	Basics of DC Machines	23ESX01	-	-	3	0	0	3.0	MI-
7	23MEO01	Nano Technology	23BSX21	-	-	3	0	0	3.0	MI-
Inter – Disciplinary Elective #2			Pre-requisite							
8	23CEO02	Air Pollution	-	-	-	3	0	0	3.0	MI-ES
9	23CSO02	Software Engineering	-	-	-	3	0	0	3.0	MI-
10	23AIO02	Fundamentals of Artificial Intelligence	-	-	-	3	0	0	3.0	MI-
11	23DSO02	Introduction to Data Science	23BSX15	-	-	3	0	0	3.0	MI-
12	23ECO02	Digital Electronics	23ESX01	-	-	3	0	0	3.0	MI-
13	23EEO02	Basics of AC Machines	23ESX01	-	-	3	0	0	3.0	MI-
14	23MEO02	Biomaterials	23BSX21	-	-	3	0	0	3.0	MI-
Inter – Disciplinary Elective #3			Pre-requisite							
15	23CEO03	Climate Change Mitigation & Adaption	23MCX04	23CE008	-	3	0	0	3.0	MI-ES
16	23CSO03	Database Management Systems	-	-	-	3	0	0	3.0	MI-
17	23AIO03	Machine Learning for Engineers	23BSX15	-	-	3	0	0	3.0	MI-
18	23DSO03	Introduction to Big data	-	-	-	3	0	0	3.0	MI-
19	23ECO03	Analog Electronic Circuits	23BSX31	-	-	3	0	0	3.0	MI-
20	23EEO03	Basics of Power electronics	23EEO01	23EEO02	-	3	0	0	3.0	MI-
21	23MEO03	Micro Electro mechanical Systems	23ESX03	-	-	3	0	0	3.0	MI-
Inter – Disciplinary Elective #4			Pre-requisite							
22	23CEO04	Sustainability and Pollution Prevention Practices	23MCX04	23CE008	-	3	0	0	3.0	MI-ES
23	23CSO04	Computer Networks	23SOC01	-	-	3	0	0	3.0	MI-
24	23AIO04	Fundamentals of Deep Learning	-	-	-	3	0	0	3.0	MI-
25	23DSO04	Introduction to Data Visualization	23SOC01	-	-	3	0	0	3.0	MI-
26	23ECO04	Communication Systems	-	-	-	3	0	0	3.0	MI-
27	23EEO04	Introduction to Electric Vehicles	23EEO02	23EEO03	-	3	0	0	3.0	MI-
28	23MEO04	Surface Engineering	-	-	-	3	0	0	3.0	MI-
Trans – Disciplinary Stream #1 (Liberal Arts)										
1	23HSM01	Psychology			-	3	0	0	3.0	MI
2	23HSM02	English for Media			-	3	0	0	3.0	MI
3	23HSM03	Journalism and Mass media			-	3	0	0	3.0	MI
4	23HSM04	Tourism			-	3	0	0	3.0	MI
Trans – Disciplinary Stream #2 (Statistics)										
1	23HSM05	Statistical Methods			-	3	0	0	3.0	MI
2	23HSM06	Statistical Inference			-	3	0	0	3.0	MI
3	23HSM07	Statistical Quality Control			-	3	0	0	3.0	MI
4	23HSM08	Introduction to Time Series			-	3	0	0	3.0	MI
Trans – Disciplinary Stream #3 (General Management)										
1	23MBM01	General Management			-	3	0	0	3.0	MI
2	23MBM02	Organization Behavior			-	3	0	0	3.0	MI
3	23MBM03	Entrepreneurship and Business Venture Planning			-	3	0	0	3.0	MI
4	23MBM04	Cross Culture Management			-	3	0	0	3.0	MI
Trans – Disciplinary Stream #4 (Human Resource Management)										
1	23MBM05	Human Resource Planning			-	3	0	0	3.0	MI
2	23MBM06	Compensation Management & Employee Welfare Laws			-	3	0	0	3.0	MI

[6] Inter-disciplinary elective/trans-disciplinary electives shall be factored under B.Tech. minor. To travel in a particular minor track, two pre-requisite courses should be completed to a tune of six credit out of four or equivalent courses that suits the pre-requisite.

[7] Pre-requisite courses are those that are offered in core or in elective pertaining to minor offered by the respective program of study. It is not the program core of the parent department

BS 23BSX31 Engineering Physics 3 0 0 3

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

Code	Course Outcomes	Mapping with POs PO1	PO2	PO7	DoK
23BSX31.1	Choose the experimental evidence of wave nature of light to understand interference in thin films, diffraction and polarization	3	2	1	L1 - L3
23BSX31.2	Apply the laws of physics, classify various types of lasers & optical fibers	3	2	1	L1 - L3
23BSX31.3	Interpret the concepts and applications of magnetic and dielectric materials	3	2	1	L1 - L3
23BSX31.4	Identify and summarize the crystal structures and XRD techniques	3	2	1	L1 - L3
23BSX31.5	Interpret the microscopic behaviour of matter with quantum mechanics, summarise various types of solids based on band theory and identify the type of semiconductor using Hall effect	3	2	1	L1 - L3

All the COs are mapped to PO12 as few self-learning topics are inbuilt in syllabus promoting autonomous learning

Unit I: Wave Optics **9 Hours**

Interference: Introduction**,** Interference in thin films by reflection–Newton's rings (Theory, Experimental study), applications (wavelength of a source and refractive index of a liquid). Diffraction: Concept of diffraction difference between Fresnel's and Fraunhofer diffraction-Fraunhofer diffraction at single slit (quantitative), diffraction at double slit Diffraction grating. Raleigh's criteria, Resolving Power of grating. Polarization: Types of polarization, polarization by reflection, refraction and Double refraction–Nicol's prism construction and working Wave plates: half wave plate and quarter wave plate **COs: CO1**

Self – Learning Topic: Young's double slit experiment

Unit II: Lasers and Fiber Optics **9 Hours**

Laser: Concept of laser, Characteristics of laser, Spontaneous and Stimulated emission of radiation, Einstein's Coefficients, pumping mechanisms, Ruby laser, Helium Neon Laser-Applications of Laser (Communications, R&D, Medicinal, etc.)

Fiber Optics: Introduction to Optical fiber, Principle and structure of optical fiber, classification of optical fibers (based on modes and refractive index profile). Acceptance angle, Acceptance cone Numerical Aperture-Applications of optical fiber. (Communications, Medicinal etc.) **COs: CO2**

Self – Learning Topic: Concepts of 3 level and 4 level LASER systems

Unit III: Magnetic Materials and Dielectric Materials **9 Hours**

Introduction, magnetic dipole moment, Magnetic Susceptibility-Magnetic permeability–Classification of Magnetic materials–Dia, Para, Ferro, Weiss Domain theory(qualitative) Hysteresis curve, Soft and Hard magnetic materials–Applications. Dielectric Materials: Dielectric Polarization–Dielectric Polarizability, Susceptibility and Dielectric constant-types of polarizations: Electronic, Ionic and Orientational polarizations (qualitative), Lorentz internal field (qualitative), Claussius-Mossoti Equation-Applications of dielectrics **COs: CO3**

Self – Learning Topic: Relation between D, E and P & Dielectric losses

Unit IV: Crystallography and X-Ray Diffraction **9 Hours**

Crystallography: Introduction, Space lattice, Basis, Unit cell, Bravais lattices–Crystal systems–structures and packing fractions of SC, BCC and FCC X-Ray Diffraction: Directions and planes in crystals–Miller indices–Separation between successive (h k l) planes–Bragg's law. Bragg's spectrometer, X-ray diffraction methods (powder and Laue) **COs: CO4**

Self – Learning Topic: Concept of Brillouin zones

Unit V: Quantum Mechanics and Semiconductor Physics **9 Hours**

Quantum Mechanics: Introduction De-Broglie's concept of Matter waves–Physical significance of wave function-Schrodinger Time Independent and time dependent wave equations–Particle in a one-dimensional potential box Semiconductor physics: Origin of energy band formation in solids, classification of materials into conductors, semiconductors and insulators using band diagram, Intrinsic and Extrinsic semiconductors. Hall Effect, Hall coefficient and applications of Hall Effect **COs: CO5**

Self – Learning Topic: Density of states - Fermi energy

Board of Studies		Basic Science & Humanities (Physics)	
Approved in: BoS No. II		October 06, 2023	
Approved in ACM: ACM No. VIII		October 21, 2023	
Expert talk (To be delivered by SMEs from industries)		**COs**	**POs**
1	LASER as a source in optical fiber communications	CO2	PO1, PO2, PO7
2	Merits and demerits of X-ray diffraction	CO4	PO1, PO2, PO7

Text Books

1. Avadhanulu M. N. & K Shirasagar P.G., "A Text Book of Engineering Physics", 1st Edition S. Chand Publications, 2011
2. Palanisamy P. K., "Engineering Physics", 4th Edition ,SciTech Publishers, 2014
3. Pillai S.O., "Applied Physics", 2nd Edition, New Age international Publishers, 2008

Reference Books

1. Charles Kittle, "Introduction to solid state physics", 5th Edition ,Willey India Pvt. Ltd., 2012
2. Arumugam M., "Applied Physics", 4th Edition , Anuradha Agencies, 2013
3. Bhattacharya D. K., "Engineering Physics", 2nd Edition , Oxford University Press, 2010
4. Sanjay D Jain and Girish G Sahasrabudhe "Engineering Physics", 1st Edition ,University Press, 2010
5. Pandey B. K. & Chaturvedi S., "Engineering Physics", 1st Edition, Cengage Learning, 2012
6. Srinivasan M. R., "Engineering Physics", 2nd Edition , New Age international Publishers, 2014

Web References

1. http://link.springer.com/physics
2. http://www.thphys.physics.ox.ac.uk
3. http://www.sciencedirect.com/science
4. http://www.e-booksdirectory.com
5. https://nptel.ac.in

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	40	40
L2	50	50
L3	10	10
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. Define interference
2. Define types of polarization
3. State Dielectric polarization and electric susceptibility
4. Define types of polarization in dielectrics
5. Define Spontaneous emission of radiation

L2: Understand

1. Explain the construction and working principle of Nicol's prism
2. Demonstrate working principle of He-Ne laser with energy level diagram
3. Outline de Broglie concept of matter waves
4. Discuss polarization by reflection
5. Explain the Raleigh's criteria

L3: Apply

1. Suggest a dielectric material with high dielectric constant, high operating voltage range and also which can be eco friendly for the preparation of a capacitor. Justify your answer
2. Suggest a soft magnetic material with low retentivity and coercivity, and also which can be eco friendly for the preparation of an electromagnet. Justify your answer
3. Even though based on quantum mechanical principles quantum free theory is a partly successful theory. Justify the statement

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BS 23BSX11 Linear Algebra and Calculus 3 0 0 3

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

Code	Course Outcomes	Mapping with POs PO1	PO2	DoK
23BSX11.1	Solve homogenous & non- homogenous linear system of equations	3	2	L1 – L4
23BSX11.2	Use Cayley- Hamilton theorem to find inverse & powers of a matrix and identify the nature of the quadratic forms using eigen values and eigen vectors	3	2	L1 – L4
23BSX11.3	Solve a given inequality using mean value theorems	3	2	L1 – L4
23BSX11.4	Make use of functions of several variables which is useful in optimization	3	2	L1 – L4
23BSX11.5	Analyze double and triple integrals using Beta and Gamma functions	3	3	L1 – L4

All the COs are mapped to PO12 as few self-learned topics are inbuilt in syllabus promoting autonomous learning

Unit I: Solving Homogeneous and Non-Homogeneous Systems of linear equations **9 Hours**

Rank of a matrix by echelon form, normal form. Inverse of Non- singular matrices by Gauss-Jordan method, System of linear equations: Solving system of Homogeneous and Non-Homogeneous equations by Gauss elimination method

COs: CO1

Self – Learning Topic: Rank by using minors

Unit II: Eigen Values and Eigen Vectors, Cayley - Hamilton theorem and Quadratic forms **9 Hours**

Eigen values, Eigen vectors and their properties, Diagonalization of a matrix, Cayley-Hamilton Theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton theorem, Quadratic forms and Nature of the Quadratic Forms, Reduction of Quadratic form to canonical forms by Orthogonal Transformation.

COs: CO2

Self – Learning Topic: Applications of Eigen Values and Eigen Vectors

Unit III: Calculus (Mean value theorems) **9 Hours**

Rolle's Theorem, Lagrange's mean value theorem with their geometrical interpretation, Cauchy's mean value theorem, Taylor's and Maclaurin theorems with remainders (without proof), Problems on the above theorems.

COs: CO3

Self – Learning Topic: Applications on the above theorems

Unit IV: Partial Differentiation and applications (Multi Variable Calculus) **9 Hours**

Partial Derivatives, Total derivatives, Chain Rule, Change of variables, Taylor's and Maclaurin's series expansion of functions ot two variables, Jacobians, maxima and minima of functions of two variables, method of lagrange multipliers.

COs: CO4

Self – Learning Topic: Jacobian of Implicit functions

Unit V: Beta and Gamma Functions & Multiple Integrals **9 Hours**

Gamma, Beta Functions and their Properties - Relation between Beta and Gamma Functions - Evaluation of Improper Integrals. Evaluation of Double triple Integrals - Direct Method

COs: CO5

Self – Learning Topic: Dirichlet's Integrals

Board of Studies		Basic Science & Humanities (Mathematics)	
Approved in: BoS No. VI		October 06, 2023	
Approved in: ACM No. VIII		October 21, 2023	
Expert talk (To be delivered by SMEs from industries)		**COs**	**POs**
1	Introduction to MATLAB	CO1-CO5	PO2, PO5
2	Applications of Singular Value Decomposition	CO2	PO3

Text Books

1. Grewal, B. S. "Higher Engineering Mathematics", 44th Edition, 12th reprint, Khanna Publishers, 2022
2. Ramana, B. V. "Higher Engineering Mathematics",1st Edition, 35th Reprint,Tata McGraw Hill Education, 2019

Reference Books

1. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, Wiley India, 2021
2. Bali, N. P. "Engineering Mathematics",1st Edition, Lakshmi Publications, 2017
3. Peter O' Neil, "Advanced Engineering Mathematics",1st Edition, Cengage, 2010
4. Iyengar, T. K. V. Prasad, M. V. S. S. N., Ranganatham S. & B. Krishna Gandhi**,** "Engineering Mathematics – II", 3rd Edition, S. Chand Publications, 2020

Web References

1. http://nptel.ac.in/courses/
2. https://onlinecourses.nptel.ac.in
3. https://www.classcentral.com/course/swayam-basic-linear-algebra-13003
4. https://ocw.mit.edu/courses

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	15	15
L2	55	55
L3	20	20
L4	10	10
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. State Cayley-Hamilton theorem
2. State Euler's theorem
3. Define the rank of a matrix
4. What is an orthogonal transformation?
5. What is the necessary condition for a non-homogenous system AX=B to be consistent
6. What is the index of a quadratic form?
7. State Rolle's Theorem

L2: Understand

1. Check whether x = r cosθ and y= r sinθ are functionally dependent.
2. Check the consistency of the system x+ y+ z =4, 2x+3y-2z=3, x+7y-7z=5
3. Find whether the homogenous system x+y-3z+2w=0,2x-y+2z-3w=0,3x-2y+z-4w=0,-4x+y-3z+w=0 possess a non-trivial solution
4. If $u= x^2+y^2+z^2$, v= xy + yz + zx, w = x + y + z, show that u, v, w are functionally dependent and find the relationship between them

5. Verify Rolle's theorem for $f(x) = (x+2)^3(x-3)^4$ in [-2,3]

L3: Apply

1. Find non-singular matrices P and Q such that PAQ is in the normal form for $A=\begin{bmatrix}\mathbf{2} & \mathbf{3} & \mathbf{-1}\\ \mathbf{0} & \mathbf{1} & \mathbf{2}\\ \mathbf{3} & \mathbf{-4} & \mathbf{-2}\end{bmatrix}$
2. Reduce the matrix A to echelon form where $A = \begin{bmatrix}\mathbf{1} & \mathbf{2} & \mathbf{4} & \mathbf{-3}\\ \mathbf{-2} & \mathbf{7} & \mathbf{5} & \mathbf{2}\\ \mathbf{4} & \mathbf{13} & \mathbf{0} & \mathbf{-4}\\ \mathbf{6} & \mathbf{5} & \mathbf{-3} & \mathbf{3}\end{bmatrix}$
3. Find the shortest distance from origin to the surface $xyz^2 = 2$
4. Find the points on the surface $z^2 = x\,y + 1$ that are nearest to the origin

L4: Analyze

1. Consider the matrix $A = \begin{bmatrix}2 & 0 & 0\\ -1 & 3 & 2\\ 1 & -1 & 0\end{bmatrix}$.If the characteristic polynomial of T is
   a. $C_T(\lambda) = (\lambda-1)^p(\lambda-1)^q$ then P =____q =_____
2. Find the minimal polynomial? what can be concluded from minimal polynomial?
3. Find a matrix S (if one exists) that diagonalizes [T]. What is the diagonal form of A of [T] produced
   i. by the matrix. **Answe**r: $S = \begin{bmatrix}a & b & a\\ b & b & -c\\ -b & a & b\end{bmatrix}$ then a =____ b =____ c =_____
4. The matrices $A = \begin{bmatrix}a & 1\\ -2 & d\end{bmatrix}$ and $B = \frac{1}{25}\begin{bmatrix}a & 1\\ -2 & d\end{bmatrix}$ have same Eigen values then find the values
   a. of **a** and **d**
5. 5.Consider the matrix $A = \begin{bmatrix}a & 1 & 1\\ 1 & a & 1\\ 1 & 1 & a\end{bmatrix}$ for what ranges of values of a the matrix is positive definite?
6. Compare Rolles theorem with LMVT and identify which is the the generalized onest
7. Test whether the pair of functions $\frac{x+y}{1-xy}$ and $tan^{-1}x + tan^{-1}y$ are functionally dependent and if so find the relation between them?

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ES 23ESX03 Basics of Civil and Mechanical Engineering 3 0 0 3

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

Code	Course Outcomes	Mapping with POs PO1	Mapping with POs PSO1	DoK
23ESX03.1	Comprehend the evolution of civil engineering, scope, functions and various building elements and materials	3	2	L1, L2
23ESX03.2	Demonstrate the principles of surveying	3	2	L1, L2
23ESX03.3	Calculate the required quantity of water and the purification process involved, solid waste management along with the sewage systems	3	2	L1, L2
23ESX03.4	Outline the role of mechanical engineering in the society and study of various metals and materials	3	2	L1, L2
23ESX03.5	Demonstrate the different manufacturing process, working principles of thermal systems	3	2	L1, L2
23ESX03.6	Illustrate the working principles of various power plants, Power transmission systems and fundamentals of robotics	3	2	L1, L2

All the COs are mapped to PO12 as few self-learning topics are inbuilt in syllabus promoting autonomous learning

Unit I: Introduction to Civil Engineering **9 Hours**

History and development of civil engineering – scope for the civil engineering – Functions of civil engineering. Characteristics of good building materials like stone, brick, tile, timber, cement aggregate and concrete. General concepts relating to Buildings: Selection of site – Basic functions of buildings – Major components of buildings. Foundations - Purpose of a foundation – Bearing capacity of soils – types of foundations and their uses.

COs: CO1

Self - Learning Topic: Representation of the building plan

Unit II: Surveying **9 Hours**

Surveying: Definition and purpose – classification – Basic principles – Measurement of length by chains and tapes – Calculation of area of a plot – Introduction to Bearings, basic problems of Bearing - Levelling instruments used for levelling, calculation of the instrument height. Types of Highways, Types of pavements, Cross-section of the pavements, Camber

COs: CO2

Self - Learning Topics: Rise & fall method, Materials used for the various pavements

Unit III: Water supply & Sanitary Engineering **9 Hours**

Sources of water supply – Quantity of water requirements – Purification of water involving sedimentation, filtration and disinfection. Definition of terms – Collection and disposal of solid wastes – Sewage systems – Septic tanks – Oxidation ponds.

COs: CO3

Self - Learning Topics: Methods of water distribution, types of filters

Unit IV: Introduction to Mechanical Engineering **9 Hours**

Role of mechanical engineering in industries and society - Technologies in different sectors such as energy, Manufacturing, Automotive, Aerospace, and Marine sectors.
Engineering Materials – Metals - Ferrous and Non-ferrous, Ceramics, Composites, Smart materials.

COs: CO4

Self - Learning Topic: Nanomaterials

Unit V: Manufacturing Processes & Thermal Engineering **9 Hours**

Principles of Casting, Forming, joining processes, Machining, Introduction to CNC machines, 3D printing, and Smart manufacturing.
Thermal Engineering – Working principle of Boilers, Otto cycle, Diesel cycle, Refrigeration and air-conditioning

COs: CO5

cycles, IC engines, 2-Stroke and 4-Stroke engines, SI/CI Engines, Components of Electric and Hybrid Vehicles.

Self - Learning Topic: Surface finishing

Unit VI: Power plants, mechanical power transmission and Robotics **9 Hours**

Power plants – Working principle of Steam, Diesel, Hydro, Nuclear power plants.
Mechanical Power Transmission **-** Belt Drives, Chain, Rope drives, Gear Drives and their applications.
Introduction to Robotics – Joints & links, configurations, and applications of robotics. **COs: CO6**

Self - Learning Topic: Kinematics of robotics

Board of Studies		Civil Engineering & Mechanical Engineering	
Approved in: BoS No. VI		October 06, 2023	
Approved in: ACM No. VIII		October 21, 2023	
Expert talk (To be delivered by SMEs from industries)		**COs**	**POs**
1	Importance of the safe bearing capacity of soils	CO1	PO1, PO7
2	Real time applications of mechanical systems	CO4 - CO6	PO1

Text Books

1. Shanmugam G. and Palanisamy M. S., "Basic Civil and the Mechanical Engineering", 4th Edition, Tata McGraw Hill Publications (India) Pvt. Ltd., 2013
2. Bhavikatti S. S.," Basic Civil Engineering", 3rd Edition, New Age International Publishers, 2022
3. Ganesan V., "Internal Combustion Engines", Tata McGraw Hill Publications (India) Pvt. Ltd., 2017
4. Rattan S. S., "A Tear book of Theory of Machines", Tata McGraw Hill Publications, (India) Pvt. Ltd., 2012

Reference Books

1. Punmai B. C.," Surveying Volume-1", 16th Edition, Laxmi Publications Pvt Ltd, 2006
2. Duggal S. N., "Environmental Engineering-1", 8th Edition, Tata McGraw Hill Publications (India) Pvt. Ltd., 2013
3. Appuu Kuttan K. K, "Robotics" Volume-I, 1st Edition, I. K. International Publishing House Pvt. Ltd., 2013
4. Jyothish Kumar L, Pulak M Pandey, "3D printing & Additive Manufacturing Technology", 2nd Edition, Springer Publications, 2018
5. Mahesh M Rathore, "Thermal Engineering", 5th Edition, Tata McGraw Hill Publications (India) Pvt. Ltd., 2010
6. Rao P. N, "Manufacturing Technology" – Vol. 1, 4th Edition, Tata McGraw Hill publications (India) Pvt. Ltd., 2017
7. Rao P. N, "Manufacturing Technology" – Vol. 2, 4th Edition, Tata McGraw Hill publications (India) Pvt. Ltd., 2018

Web References

1. https://www.youtube.com/watch?v=f2uuyKh02n4
2. https://www.youtube.com/watch?v=jdVgwbXZef8
3. https://nptel.ac.in/courses/112/103/112103019/

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	40	40
L2	60	60
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. What are the properties of good stone?
2. What are the basic principles of surveying?
3. What are the sources of water supply?
4. What are ferrous metals?
5. List any two joining process
6. Define Robot
7. What is meant by pulverization?

L2: Understand

1. Identify the requirements in the selection of site for a construction
2. Illustrate the way to find the levels at various points of the plain area which is irregular in shape
3. Demonstrate the procedure which you want to follow in collecting and disposing the waste in your own community
4. How to calculate the area for the given plot by the use of conventional practice?
5. How to calculate the quantity of water requires for the given area?
6. Explain the role of mechanical engineer in manufacturing industry
7. Classify various engineering materials
8. Compare two stroke and four stroke IC engines
9. Explain the working principle of Hydro - electric power plant
10. Differentiate between two stroke and four stroke engines
11. Explain the working of overfeed and underfeed fuel beds
12. Explain the auxiliaries of a diesel power plant with neat sketch

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Chairmans
Board of Studies (CE & ME)

ES 23ESX02 Introduction to Programming 3 0 0 3

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

Code	Course Outcomes	Mapping with POs / PSOs					DoK
		PO1	PO2	PO3	PSO1	PSO2	
23ESX02.1	Illustrate basics of computers, problem solving approach and algorithmic thinking	3	3	2	3	2	L1, L2
23ESX02.2	Demonstrate the control structures, branching and looping statements	3	3	3	3	2	L1 – L3
23ESX02.3	Make use of arrays, pointers and string fundamentals	3	3	3	3	2	L1 – L3
23ESX02.4	Develop Modular program aspects in solving complex problems	3	3	3	3	2	L1 – L3
23ESX02.5	Identify the use of userdefined data types and files	3	3	3	3	2	L1 – L3

All the COs are mapped to PO12 as few self learning topics are inbuilt in syllabus promoting autonomous learning

Unit I: Introduction to Programming and Problem Solving **9 Hours**

Programs and Algorithms, Computer Problem Solving Requirements, Phases of Problem Solving, Problem. Solving Strategies, Top-Down Approach, Algorithm Designing, Program Verification, Improving Efficiency, Algorithm Analysis and Notations.

COs : CO1

Self - Learning Topics: Compilation and Interpretation

Unit II: Basics of C Programming **9 Hours**

Introduction, Structure of a C Program. Comments, Keywords, Identifiers, Data Types, Variables, Constants, Input/output Statements. Operators, Type Conversion. Control Flow, Relational Expressions: Conditional Branching Statements: if, if-else, if-else-if, switch. Basic Loop Structures: while, do-while loops, for loop, nested loops, The Break and Continue Statements, goto statement.

COs: CO2

Self - Learning Topic: Escape Sequence

Unit III: Arrays, Pointers and Strings **9 Hours**

Introduction, Operations on Arrays, Two Dimensional Arrays, Multidimensional Arrays. Pointers: Concept of a Pointer, Declaring and Initializing Pointer Variables, Pointer Expressions and Address Arithmetic, Null Pointers, Generic Pointers, Pointers and Arrays, Pointer to Pointer, Dynamic Memory Allocation, Dangling Pointer. Strings: String Fundamentals, String handling functions.

COs: CO3

Self - Learning Topic: String pattern matching

Unit IV: Functions **9 Hours**

Introduction to Function: Declaration, Function Definition, Function Call, Categories of Functions, Passing Parameters to Functions, Scope of Variables, Arrays as Function Arguments, Pointers as Function Arguments, Command Line Arguments, Variable Storage Classes. Recursion.

COs: CO4

Self - Learning Topic: Implementation of recursion

Unit V: User Defined Data types, File Handling **9 Hours**

Structures, Unions, Bit Fields: Introduction, Nested Structures, Arrays of Structures, Structures and Functions, Self-Referential Structures, Unions, Enumerated Data Type — Enum variables, Using Typedef keyword, Bit Fields. Data Files: Introduction to Files, Using Files in C, Reading from Text Files, Writing to Text Files, Random File Access.

COs: CO5

Self - Learning Topics: Binary files and operations on binary files

Board of Studies		Computer Science and Engineering	
Approved in: BoS No. VI		October 06, 2023	
Approved in ACM: ACM No. VIII		October 21, 2023	
Expert talk (To be delivered by SMEs from industries)		**COs**	**POs / PSOs**
1	Logic building using C Programming	CO1 – CO6	PO1, PO2, PO3, PO12, PSO1, PSO2
2	Real time applications of C Proramming	CO2 – CO6	PO1, PO2, PO3, PO12, PSO1, PSO2

Text Books

1. Behrouz A. Forouzan., Richard F. Gilberg, "A Structured Programming Approach Using C", 3rd Edition, Cengage, 2007
2. Dromey R. G., "How To Solve It By Computer", 1st Edition, Pearson Education, 2014
3. Byron Gottfried, "Programming with C", 3rd Edition, Tata McGraw Hill, 2017
4. Herbert Schildt, "C The Complete Reference", 4th Edition, TMH, 2017
5. Ajay Mittal, "Programming In C A-Practial Approach", 1st Edition, Pearson, 2010

Reference Books

1. Balagurusamy E., "Computing fundamentals and C Programming", 2nd Edition, McGraw-Hill Education, 2017
2. Rema Theraja, "Programming in C", 2nd Edition,OUP India, 2016
3. Prasad F. E. V, "C Programming: A Problem-Solving Approach", Giliberg, Cengage Learning, 2010
4. Yashavant Kanetkar, "Let Us C", 16th Edition, BPB, 2017

Web References

1. https://www.geeksforgeeks.org/c-programming-language
2. https://www.tutorialspoint.com/cprogramming/index.html
3. https://www.javatpoint.com/c-programming-language-tutorial

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	30	20
L2	30	40
L3	40	40
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. What do you mean by flowchart?
2. What are the components in the flowchart?
3. What are various storage classes in C?
4. What is a string?
5. Write a C program to copy one string to another
6. Write a C program to read and display the content of a file
7. What is recursive function?
8. What are the constraints for defining a recursive function with an example?
9. Why switch statement is more advantageous than nested if-else statement
10. What is meant by a variable in C programming?
11. Write a C program to count number of vowels and consonants in a string using pointers

L2: Understand

1. Explain about enumerated types with example

2. Explain counter controlled and exit controlled loops with examples
3. Write a program to compare two strings for equality without using strcmp() function
4. Demonstrate about declaration and initialization of string in C. How strings are displayed with different formats? Explain with examples
5. Illustrate a C program to find the sum of first and last digit of a number
6. Illustrate a C program to merge two files into single file
7. Explain different looping statement with syntax and example
8. Explain function prototype and explain different methods to call the function
9. Explain in detail about array of structure and pointer to structure with example
10. Discuss the usage of bitwise logical operators used in C? Compare them from logical operators with suitable program
11. Explain about call by value and call by reference with reference to functions with example
12. Explain the term dynamic memory allocation and the terms malloc(), calloc() and realloc() functions

L3: Apply

1. Write a C program to check whether the given number is palindrome or not
2. Write a C program to solve the factorial of a given number using for loop
3. Write an algorithm, flowchart and pseudo code to identify largest of given 3 numbers using conditional operator
4. Write a C program to perform the operation of multiplication of two matrices
5. Write a C program to interchange the largest and smallest elements in an array
6. Write a C program by applying pointers to count number of vowels and consonants in a string
7. Write a C program to select any arithmetic operations using switch cases
8. Write a C program to find given number is Armstrong or not
9. Write a C program to check whether the given string is palindrome or not
10. List file handling functions. Utilize file handling functions with an example
11. Design a modular banking application using C programme that can facilitate transactions such as deposit and withdrawal of funds
12. How can you design an efficient algorithm to generate a list of the first n prime numbers? Can you analyse the time complexity of your algorithm? Implement and test your program to ensure it works correctly for a range of input values
13. Write a C program that finds the second largest element in an array of integers. Explain how you handle different cases such as empty array, array with only one element, array with duplicate elements, etc.
14. Write a C program that simulates a simple calculator that can perform addition, subtraction, multiplication, and division operations on two operands. Explain how you handle user input, error checking, and precedence of operators
15. Write a C program that reads a text file and counts the number of words, lines, and characters in it. Explain how you handle different types of delimiters and end-of-file conditions

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Board of Studies (CSE)

BS 23BSX32 Engineering Physics Lab 0 0 2 1

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

Code	Course Outcomes	Mapping with POs PO1	PO4
23BSX32.1	Relate the principle of physics in engineering field and compare the results with theoretical calculations	3	3
23BSX32.2	Demonstrate modern engineering physics techniques and tools in real time applications in engineering studies	3	3
23BSX32.3	Develop the laboratory skills in handling of electrical and optical instruments	3	3
23BSX32.4	Demonstrate the interference and diffraction phenomena of light	3	3
23BSX32.5	Analyse the effect of sound on physical parameters	3	3

List of Experiments

1.	Determination of Radius of Curvature of Plano Convex Lens by Newton's rings	**COs: CO1-CO4**
2.	Determination of wavelength of a source using Diffraction Grating Normal incidence method	**COs: CO1-CO4**
3.	Determination of thickness of thin Object- Air wedge method	**COs: CO1-CO4**
4.	Determination of wavelength of Laser source	**COs: CO1-CO4**
5.	Verify the relation between frequency and volume- Using Volume resonator	**COs: CO1,CO5**
6.	Determination of Rigidity modulus of material (wire)- (torsional pendulum)	**COs: CO1,CO2**
7.	Verify magnetic field along the axis of a current carrying coil – Stewart and Gee's apparatus	**COs: CO1-CO3**
8.	Determination of dispersive power of prism	**COs: CO1-CO3**
9.	Determine acceleration due to gravity and radius of gyration using compound pendulum	**COs: CO1,CO2**
10.	To find the Energy Band gap of a Semiconductor using p - n junction	**COs: CO1-CO3**
11.	Study the characteristics of a Thermistor and obtain its temperature coefficient	**COs: CO1-CO3**
12.	Determination of dielectric constant using charging discharging method	**COs: CO1-CO3**
13.	Determination of resolving power of a grating	**COs: CO1-CO4**
14.	Verification of laws of stretched string by using Sonometer	**COs: CO1,CO5**
15.	Estimation of Planck's constant using photo electric effect	**COs: CO1-CO4**
16.	Study the variation of B versus H by magnetizing the magnetic material (B-H curve)	**COs: CO1-CO4**
17.	Verification of Brewster's law	**COs: CO1,CO2, CO4**
18.	Determination of frequency of electrically maintained tuning fork by Melde's experiment	**COs: CO1-CO3**

Note: In the above experiments at least 10 assessment experiments should be completed in a semester, out of which 2 experiments may be conducted in virtual mode

References

1. Balasubramanian S., Srinivasan M. N. ,"A Text Book of Practical Physics"- S. Chand Publishers, 2017
2. Lab Manual for Engineering Physics, Department of Basic Science and Humanities, NSRIT, 2023

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Chairman
Board of Studies (BS & H)

ES **23ESX06 Engineering Workshop** **0 0 3 1.5**

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

Code	Course Outcomes	Mapping with POs PO1
23ESX06.1	Demonstrate the workshop tools and their operational capabilities	1
23ESX06.2	Employ workshop tools for various joints and fitting.	1
23ESX06.3	Interpret the development of sheet metal using tin smithy tools	1
23ESX06.4	Illustrate the house wiring	1
23ESX06.5	Make use of moulding tools prepare a pattern	1

List of Experiments

Student shall **do two experiments** from five trades

Demonstration: Safety practices and precautions to be observed in workshop.

1	Wood Working: Familiarity with different types of woods and tools used in wood working and make following joints. a) Half –Lap joint b) Mortise and Tenon joint c) Corner Dovetail joint or Bridle joint	**COs:CO1, CO2**
2	Sheet Metal Working: Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job from GI sheets. a) Tapered tray b) Conical funnel c) Elbow pipe d) Brazing	**COs:CO1, CO2**
3	Fitting: Familiarity with different types of tools used in fitting and do the following fitting exercises. a) V-fit b) Dove tail fit c) Semi-circular fit d) Bicycle tyre puncture and change of two-wheeler tyre	**COs:CO1, CO2**
4	Electrical Wiring: Familiarity with different types of basic electrical circuits and make the following connections. a) Parallel and series b) Two-way switch c) Go-down lighting d) Tube light e) Three phase motor f) Soldering of wires	**COs:CO1, CO3**
5	Foundry Trade: Demonstration and practice on Moulding tools and processes, Preparation of Green Sand Moulds for given Patterns.	**COs:CO1, CO4**

Add-on Experiments

1	Welding Shop: Demonstration and practice on Arc Welding and Gas welding. Preparation of Lap joint and Butt joint	**COs: CO1**
2	Plumbing: Demonstration and practice of Plumbing tools, Preparation of Pipe joints with coupling for same diameter and with reducer for different diameters	**COs: CO1**

References

1. Lab Manual for Engineering Workshop, Department of Mechanical Engineering, NSRIT

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Board of Studies (ME)

ES 23ESX05 Computer Programming Lab 0 0 3 1.5

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

Code	Course Outcomes	Mapping with POs / PSOs						
		PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
23ESX05.1	Demonstrate the use of basic language features	2	2	2	1	3	2	1
23ESX05.2	Apply the right control structure for solving the problem	3	3	3	3	3	3	2
23ESX05.3	Implement simple programs to solve computing problems using user defined functions	3	3	3	3	3	3	2
23ESX05.4	Develop programs using arrays and pointers	3	3	3	3	3	3	2
23ESX05.5	Experiment with user defined data types and file operations	3	3	3	3	3	3	2

List of Experiments

1. Write C programs to familiarization with programming environment **COs: CO1**
2. Write simple C programs with printf(), scanf() functions **COs: CO1**
3. Write C programs to simple computational problems using arithmetic expressions **COs: CO1**
4. Write C programs to computational problems using the operator' precedence and associativity **COs: CO1**
5. Write C programs involving if-then-else structures **COs: CO2**
6. Write C programs on while and for loops **COs: CO2**
7. Write C programs on 1D array manipulation, linear search **COs: CO4**
8. Write C programs on matrix, string operations **COs: CO4**
9. Write C programs on functions, call by value, scope and extent **COs: CO3**
10. Write C programs to implement recursive functions **COs: CO3**
11. Write C programs on simple functions using call by reference, dangling pointers **COs: CO4**
12. Write C programs on pointers, structures and dynamic memory allocation **COs: CO4**
13. Write C programs on bitfields, self-referential structures **COs: CO4**
14. Write C programs to implement file operations **COs: CO5**
15. Domain Specific Applications
    - (i) Write a program to implement employee management system **COs: CO5**
    - (ii) Write a program to implement election system **COs: CO4**
    - (iii) Calculate the Eluer's load for a column with various end conditions **COs: CO2**
    - (iv) Calculate the Shear force and Bending Moments for a beam under the various loading condition **COs: CO2**
    - (v) Write a C program for resolution of forces **COs: CO3**
    - (vi) Write a C program for calculation of coefficient of discharge **COs: CO2**
    - (vii) Write a C program to find the efficiency of the DC motor for different values of time T **COs: CO2**
    - (viii) Write a C program to derive the transfer function of a DC motor for given values **COs: CO2**

Exercise problems

1. Basic Linux environment and its editors like Vi, Vim & Emacs etc.
2. Exposure to Turbo C, gcc
3. Writing simple programs using printf(), scanf()
4. Write a C program to find sum and average of 3 numbers

5. Conversion of Fahrenheit to Celsius and vice versa
6. Simple interest calculation
7. Finding the square root of a given number
8. Finding compound interest
9. Area of a triangle using heron's formulae
10. Distance travelled by an object
11. Evaluate the following expressions
    a. A+B*C+(D*E)+F*G
    b. A/B*C-B+A*D/3
    c. A+++B---A
    d. J= (i++)+(++i)
12. Find the maximum of three numbers using conditional operator
13. Take marks of 5 subjects in integers, and find the total, average in float
14. Write a C program to find the max and min of four numbers using if-else
15. Write a C program to generate electricity bill
16. Find the roots of the quadratic equation
17. Write a C program to simulate a calculator using switch case
18. Write a C program to find the given year is a leap year or not
19. Find the factorial of given number using any loop
20. Find the given number is a prime or not
21. Compute sine and cos series
22. Checking a number palindrome
23. Construct a pyramid of numbers
24. Find the min and max of a 1-D integer array
25. Perform linear search on 1D array
26. The reverse of a 1D integer array
27. Find 2's complement of the given binary number
28. Eliminate duplicate elements in an array
29. Addition of two matrices
30. Multiplication two matrices
31. Write a C program to concatenate two strings without built-in functions
32. Write a C program to find reverse a string using built-in and without built-in string functions
33. Write a C function to calculate NCR value
34. Write a C function to find the length of a string
35. Write a C function to transpose of a matrix
36. Write a C function to demonstrate numerical integration of differential equations using Euler's method
37. Write a recursive function to generate Fibonacci series
38. Write a recursive function to find the lcm of two numbers
39. Write a recursive function to find the factorial of a number
40. Write a C program to swap two numbers using call by reference
41. Demonstrate Dangling pointer problem using a C program
42. Write a C program to copy one string into another using pointer
43. Write a C program to find no of lowercase, uppercase, digits and other characters using pointers
44. Write a C program to find the sum of a 1D array using malloc()
45. Write a C program to find the total, average of n students using structures
46. Enter n students data using calloc() and display failed students list
47. Write a C program to implement realloc()
48. Read student name and marks from the command line and display the student details along with the total marks
49. Create and display a singly linked list using self-referential structure
50. Demonstrate the differences between structures and unions using a C program
51. Write a C program to shift/rotate using bitfields
52. Write a C program to copy one structure variable to another structure of the same type
53. Write a C program to write and read text into a file
54. Write a C program to write and read text into a binary file using fread() and fwrite()
55. Write a C program to copy the contents of one file to another file

56. Write a C program to merge two files into the third file using command-line arguments
57. Write a C program to find no. of lines, words and characters in a file
58. Write a C program to print last n characters of a given file

References

1. Ajay Mittal, “Programming in C – A Practical Approach”, 1st Edition, Pearson, 2010
2. Behrouz A. Forouzan, Richard F. Gilberg, “A Structured Programming Approach Using C”, 3rd Edition, Cengage, 2007
3. Forouzan, Gilberg, Prasad, "C Programming: A Problem - Solving Approach", 1st Edition, Cengage Learning, 2011
4. Lab Manual for Computer Programming, Department of Computer Science & Engineering, NSRIT

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Board of Studies (CSE)

ES **23ESX07 Engineering Graphics** **1 0 3 3**

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

Code	Course Outcomes	Mapping with POs PO1	PO10	PSO1	DoK
23ESX07.1	Demonstrate the principles of engineering drawing, including engineering curves, scales, orthographic and isometric projections.	3	3	2	L1 - L3
23ESX07.2	Construct the orthographic projections of points and lines in front and top views.	3	3	2	L1 - L3
23ESX07.3	Construct the systems of projection of planes and solids with respect to the observer, object and the reference planes	3	3	2	L1 - L3
23ESX07.4	Develop the concepts of sectional views to represent details of solids in simple positions.	3	3	2	L1 - L3
23ESX07.5	Develop the ability to draw isometric views and orthographic views and should be able to convert isometric views to orthographic views and vice versa.	3	3	2	L1 - L3

All the COs are mapped to PO12 as few self learning topics are inbuilt in syllabus promoting autonomous learning

Unit I: Introduction of Geometrical Constructions **9 Hours**

Introduction: Lines, Lettering and Dimensioning, Geometrical Constructions and Constructing regular polygons by general methods.

Curves: construction of ellipse, parabola and hyperbola by general, Involutes, Normal and tangent to Curves.

Scales: Plain scales, diagonal scales and vernier scales.

COs: CO1

Self - Learning Topic: Construct polygons by special methods

Unit II: Introduction of Orthographic Projections **9 Hours**

Orthographic Projections: Reference plane, importance of reference lines or Plane, Projections of a point situated in any one of the four quadrants.

Projections of Straight Lines: Projections of straight lines parallel to both reference planes, perpendicular to one reference plane and parallel to other reference plane, inclined to one reference plane and parallel to the other reference plane. Projections of Straight Line Inclined to both the reference planes

COs: CO2

Self - Learning Topic: Traces of lines

Unit III: Projections of Planes and Solids **9 Hours**

Projections of planes: Regular planes perpendicular to both reference planes, parallel to one reference plane and inclined to the other reference plane; plane inclined to both the reference planes

Projections of solids: Types of solids: Polyhedra and Solids of revolution. Projections of solids in simple positions: Axis perpendicular to horizontal plane, Axis perpendicular to vertical plane and Axis parallel to both the reference planes, Projection of solids with axis inclined to one reference plane and parallel to other

COs: CO3

Self - Learning Topic: Auxiliary views of planes

Unit IV: Projection and Section of solids **9 Hours**

Projections of Solids Projection of Solids with axis inclined to one reference plane and parallel to other Sections of Solids**:** Perpendicular and inclined section planes, Sections of solids in simple position only. **COs: CO4, CO5**

Self - Learning Topic: Development of surfaces

Unit V: Conversion of Views **9 Hours**

Conversion of Views: Conversion of isometric views to orthographic views and vice versa.

Computer graphics: Creating 2D & 3D drawings of objects including PCB and Transformations using Auto CAD (Not for end examination). **COs: CO5**

Self - Learning Topic: Isometric Projection

Board of Studies		Mechanical Engineering	
Approved in: BoS No. VI		October 07, 2023	
Approved in: ACM No. VIII		October 21, 2023	
Expert talk (To be delivered by SMEs from industries)		**COs**	**POs**
1	Real time applications of engineering graphics	CO4 - CO5	PO1, PO10
2	Spatial Visualization	CO4 - CO5	PSO1

Text Books

1. Bhatt N.D.," Engineering Drawing", 53rd Edition, Chariot Publications, 2018
2. Agarwal and Agarwal," Engineering Drawing", 3rd Edition, Tata McGraw Hill Publishers, 2017
3. Sham Tickoo," Auto CAD 2017", Engineers & Designers", 23rd Edition, Dream tech Press, 2016

Reference Books

1. Narayana K. L. and Kannaiah P.," Engineering Drawing", 5th Edition, Scitech Publishers, 2017
2. Varghese P.I," Engineering Graphics", Mc Graw Hill Publishers, 2013
3. Venugopal K. Prabhu Raja V.," Engineering Drawing + Auto Cad", 5th Edition, New Age Publications, 2011

Web References

1. https://nptel.ac.in/courses/112/103/112103019/

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	20	10
L2	40	30
L3	40	60
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

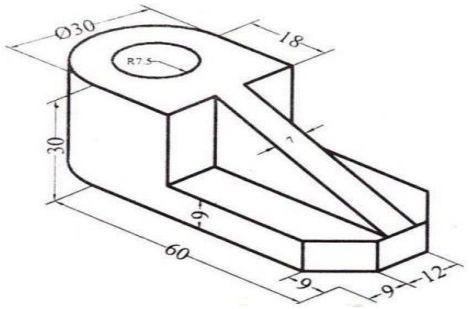
1. Divide a straight-line AB of 60 mm long into eight numbers of equal parts
2. How to draw an Octagon given the length of side 25 mm
3. Draw an equilateral triangle of 75 mm side and inscribe a circle in it
4. Show a regular pentagon in a circle of 100 mm diameter

L2: Understand

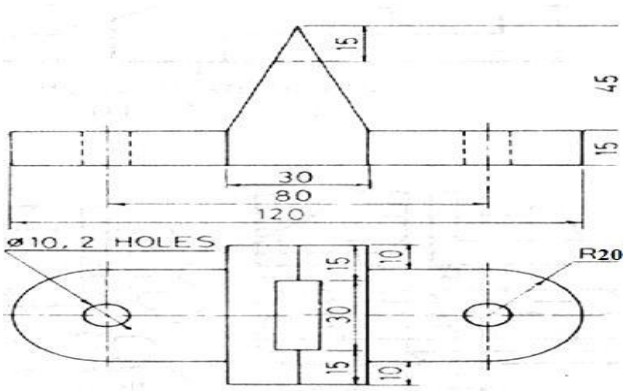
1. Cconstruct a cycloid for a generating circle of radius 30 mm. Also draw a tangent and normal at any point on the cycloid
2. A line AB is on HP and its one end A is 20 mm in front of VP. The line makes an angle of 45° with VP and its front view is 60 mm long. Draw the projections of the line and determine the true length
3. A regular hexagon of 40 mm side has a corner in the HP. Its surface inclined at 45° to the HP. And the top view of the diagonal through the corner which is in the HP. makes an angle of 60° with the VP. Demonstrate its projections
4. A pentagonal pyramid has an edge of the base in the VP and inclined at 30° to the HP, while triangular face containing that edge makes an angle of 45° with the VP. Illustrate the three views of the pyramid. Length of side of the base is 30 mm, while that of the axis is 65 mm

L3: Apply

1. A thin circular plate of 45mm diameter with its centre 35 mm above HP and 40 mm in front of VP is perpendicular to VP and inclined to HP at angle of 30°. Develop the projections of the plate
2. A square pyramid of base 40 mm and height 60 mm is on HP with one of its base edges so that the axis is making 45° with HP and the base edge making 30° with VP. Construct the projections
3. Construct a scale of 1.5 inches = 1 foot to show inches and long enough to measure up to 4 feet
4. Draw (i) Front View (ii) Top View (iii) Left Hand Side View



5. Build the Isometric view



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Chairman
Board of Studies (ME)

SOC 23SOC01 IT Workshop

0 0 2 1

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

Code	Course Outcomes	Mapping with POs / PSOs						
		PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
23SOC01.1	Perform Hardware troubleshooting	3	2	-	-	2	2	1
23SOC01.2	Explain the world wide web and Internet	3	2	2	-	2	2	2
23SOC01.3	Develop a working knowledge of HTML, CSS	2	2	-	-	3	2	2
23SOC01.4	Demonstrate the usage of MS-Word, MS-Excel spreadsheets	3	3	3	2	3	2	2
23SOC01.5	Show the use of MS-PowerPoint for presentations and experiment with ChatGPT AI tool	3	2	2	1	3	2	2

List of Experiments

PC Hardware **COs: CO1**

Task 1: Identify the peripherals of a computer, components in a CPU and its functions. Draw the block diagram of the CPU along with the configuration of each peripheral and submit to your instructor.

Task 2: Every student should disassemble and assemble the PC back to working condition. Lab instructors should verify the work and follow it up with a Viva. Also, students need to go through the video which shows the process of assembling a PC. A video would be given as part of the course content.

Task 3: Every student should individually install MS windows on the personal computer. Lab instructor should verify the installation and follow it up with a Viva.

Task 4: Every student should install Linux on the computer. This computer should have windows installed. The system should be configured as dual boot (VMWare) with both Windows and Linux. Lab instructors should verify the installation and follow it up with a Viva

Internet & World Wide Web **COs: CO2**

Task1: Orientation & Connectivity Boot Camp: Students should get connected to their Local Area Network and access the Internet. In the process they configure the TCP/IP setting. Finally, students should demonstrate, to the instructor, how to access the websites and email. If there is no internet connectivity preparations need to be made by the instructors to simulate the WWW on the LAN.

Task 2: Web Browsers, Surfing the Web: Students customize their web browsers with the LAN proxy settings, bookmarks, search toolbars and pop-up blockers. Also, plug-ins like Macromedia Flash and JRE for applets should be configured.

Task 3: Search Engines & Netiquette: Students should know what search engines are and how to use the search engines. A few topics would be given to the students for which they need to search on Google. This should be demonstrated to the instructors by the student.

Task 4: Cyber Hygiene: Students would be exposed to the various threats on the internet and would be asked to configure their computer to be safe on the internet. They need to customize their browsers to block pop ups, block active x downloads to avoid viruses and/or worms.

HTML and Introduction to CSS **COs: CO3**

Task 1: Coding Basics: Introduction to HTML syntax, HTML, head, title, & body tags headings, paragraphs, & lists, strong & em tags, doctype, lang attribute, meta tag & Unicode character set

Task 2: Coding Links: Absolute & Relative URLs, Anchor tags & hrefs Linking to other websites, Linking to pages within a website Opening a link in a new browser window/tab

Task 3: Adding Images: Break tag, image tag & source attribute using the width, height, & alt attributes, using horizontal rules

Task 4: Introduction to Cascading Style Sheets (CSS): Style tag, tag selectors, font-size, font-family, color, & line-height properties, hexadecimal color codes

WORD **COs: CO4**

Task 1: Creating project abstract Features to be covered: Formatting Styles, inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check, Track Changes.

Task 2: Creating a Newsletter: Features to be covered: Table of Content, Newspaper columns, Images from files and clipart, drawing toolbar and Word Art, Formatting Images, Textboxes, Paragraphs and Mail Merge in word.

Excel **COs: CO4**

Excel Orientation: The mentor needs to tell the importance of MS office or equivalent (FOSS) tool Excel as a Spreadsheet tool, give the details of the four tasks and features that would be covered in each. Using Excel – Accessing, overview of toolbars, saving excel files, Using help and resources.

Task 1: Creating a Scheduler - Features to be covered: Gridlines, Format Cells, Summation, auto fill, Formatting Text

Task 2: Calculating GPA -. Features to be covered: Cell Referencing, Formulae in excel – average, std. deviation, Charts, Renaming and Inserting worksheets, Hyper linking, Count function,

LOOKUP/VLOOKUP **COs: CO4**

Task 3: Split cells, freeze panes, group and outline, Sorting, Boolean and logical operators, Conditional formatting

Power point **COs: CO5**

Task 1: Students will be working on basic power point utilities and tools which help them create basic power point presentations. PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows in PowerPoint.

Task 2: Interactive presentations - Hyperlinks, Inserting –Images, Clip Art, Audio, Video, Objects, Tables and Charts.

Task 3: Master Layouts (slide, template, and notes), Types of views (basic, presentation, slide slotter, notes etc), and Inserting – Background, textures, Design Templates, Hidden slides.

AI Tools – ChatGPT **COs: CO5**

Task 1: Prompt Engineering: Experiment with different types of prompts to see how the model responds. Try asking questions, starting conversations, or even providing incomplete sentences to see how the model

completes them.
Ex: Prompt: "You are a knowledgeable AI. Please answer the following question: What is the capital of France?"

Task 2: Creative Writing: Use the model as a writing assistant. Provide the beginning of a story or a description of a scene, and let the model generate the rest of the content. This can be a fun way to brainstorm creative ideas
Ex: Prompt: "In a world where gravity suddenly stopped working, people started floating upwards. Write a story about how society adapted to this new reality."

Task 3.1: Language Translation: Experiment with translation tasks by providing a sentence in one language and asking the model to translate it into another language. Compare the output to see how accurate and fluent the translations are.
Ex: Prompt: "Translate the following English sentence to French: 'Hello, how are you doing today?'"

Task 3.2: Futuristic Predictions: Have fun by asking the model to predict future technological advancements, societal changes, or even hypothetical scenarios. Compare its responses with your own ideas.
Ex: Prompt: "Predict how artificial intelligence will transform everyday life in the next 20 years."

References

1. Vikas Gupta, "Comdex Information Technology Course tool Kit", 6th Edition, Dreamtech Press, 2005
2. Cheryl A. Schmidt, "The Complete Computer Upgrade and Repair Book", 3rd Edition, Dreamtech Press, 2002
3. ITL ESL, "Introduction to Information Technology", 2nd Edition, Pearson, 2012
4. Kate J. Chase, "PC Hardware and A+ Handbook", Microsoft Press, 2004
5. Lab Manual for IT-Workshop, Department of Computer Science & Engineering, NSRIT

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Chairman
Board of Studies (CSE)

Wellness **23WLP01 Health And Wellness, Yoga and Sports** **0 0 1 0.5**

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

Code	Course Outcomes	Mapping with POs		
		PO2	PO7	PO12
23WLP01.1	Be physical fit to perform daily routine without undue fatigue	3	1	1
23WLP01.2	Be mentally alert and socially cohesive	3	1	1
23WLP01.3	Consider success and failure equally	3	2	1
23WLP01.4	Develop positive personality	2	1	1
23WLP01.5	Improve leadership qualities	2	2	1

Unit I: Concept of health and fitness, Nutrition and Balanced diet, basic concept of immunity Relationship between diet and fitness, Globalization and its impact on health, Body Mass Index (BMI) of all age groups. **3 Hours**

Activities

i) Organizing health awareness programmes in community
ii) Preparation of health profile **COs: CO1**
iii) Preparation of chart for balance diet for all age groups

Unit II: Concept of yoga, need for and importance of yoga, origin and history of yoga in Indian context, classification of yoga, Physiological effects of Asanas- Pranayama and meditation,stress management and yoga, Mental health and yoga practice. **3 Hours**

Activities

Yoga practices – Asana, Kriya, Mudra, Bandha, Dhyana, Surya Namaskar **COs: CO2**

Unit III: Concept of Sports and fitness, importance, fitness components, history of sports, Ancient and Modern Olympics, Asian games and Commonwealth games. **3 Hours**

Activities

i) Participation in one major game and one individual sport viz., Athletics, Volleyball, Basketball, Handball, Football, Badminton, Kabaddi, Kho-kho, Table tennis, Cricket etc.Practicing general and specific warm up, aerobics **COs: CO3**
ii) Practicing cardiorespiratory fitness, treadmill, run test, 9 min walk, skipping and running

General Guidelines

1. Institutes must assign slots in the timetable for the activities of Health/Sports/Yoga
2. Institutes must provide field/facility and offer the minimum of five choices of as many as Games/Sports
3. Institutes are required to provide sports instructor / yoga teacher to mentor the students

Assessment Pattern

1. Evaluated for a total of 100 marks
2. A student can select 6 activities of his/her choice with a minimum of 01 activity per unit. Each activity shall be evaluated by the concerned teacher for 15 marks, totalling to 90 marks
3. A student shall be evaluated by the concerned teacher for 10 marks by conducting viva voce on the subject

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Board of Studies (B S & H)

HS **23HSX01 Communicative English** **2 0 0 2**

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

Code	Course Outcomes	Mapping with POs PO 5	PO 8	PO 10	DoK
23HSX01.1	Make use of the setting, subject, and specific details from social or transactional discussions	1	1	3	L1 - L3
23HSX01.2	Identify grammatical frameworks to construct sentences and select the appropriate word forms	1	1	3	L1 - L3
23HSX01.3	Examine discourse markers to talk coherently about a subject in informal conversations	1	1	3	L1 - L3
23HSX01.4	Assessing the reader's or listener's overall comprehension of reading, listening, and summary materials	1	1	3	L1 – L6
23HSX01.5	Justify intelligible essays, resumes, and paragraphs	1	1	3	L1 – L6

All the Cos are mapped to PO12 as few self learning topics are inbuilt in syllabus promoting autonomous learning.

Unit I: HUMAN VALUES: A Power of a Plate of Rice by Ifeoma Okoye **9 Hours**
"Tomorrow is waiting" by Holli Mintzer - Strange Horizons
Listening: Identifying the topic, the context and specific pieces of information by listening to short audio texts and answering a series of questions
Speaking: Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing one self and others
Reading: Skimming to get the main idea of a text; scanning to look for specific pieces of information
Writing: Mechanics of Writing - Capitalization, Spellings, Punctuation – Parts of Sentences
Grammar: Parts of Speech, Basic Sentence Structures – forming question
Vocabulary: Synonyms, Antonyms, Affixes (Prefixes/Suffixes), Root words

COs: CO1

Self Learning Topic: The Time Machine – H.G. Wells

Unit II: NATURE: Night of the Scorpion by Nissim Ezekiel (Indian & Contemporary) **9 Hours**
Patterns of a Murmuration, in billions of data points by Jy Yang - Clares World
The Brook by Alfred Tennyson (Poem)
Listening: Answering a series of questions about main ideas and supporting ideas after listening to audio texts
Speaking: Discussion in pairs/small groups on specific topics followed by short structure talks
Reading: Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together
Writing: Structure of a paragraph – Paragraph writing (specific topics)
Grammar: Cohesive devices - linkers, use of articles and zero article; prepositions
Vocabulary: Homonyms, Homophones, Homographs

COs: CO2

Self Learning Topic: In Watermelon Sugar –Brautigan

Unit III: BIOGRAPHY: Elon Musk/Steve Jobs **9 Hours**

"The Life cycle of Software Objects" is a novella by American writer Ted Chiang, originally published in 2010 by Subterranean Press.
Listening: Listening for global comprehension and summarizing what is listened to
Speaking: Discussing specific topics in pairs orsmall groups and reporting what is discussed
Reading: Reading a text in detail by making basic inferences-recognizing and interpreting specific context clues; strategies to use text clues for comprehension
Writing: Summarizing, Note-making, paraphrasing
Grammar: Verbs-tenses; subject-verb agreement; Compound words, Collocations
Vocabulary: Compound words, Collocations

COs: CO3

Self Learning Topic: The Reader – Bernhard Schlink

Unit IV: Inspiration: TheToys of Peace by Saki **9 Hours**
A Story Told by a Machine The Circuitous Path to AI Writing
Listening: Making predictions while listening to conversations/transactional dialogues without video; listening with video
Speaking: Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions
Reading: Studying the use of graphic elements in texts to convey information, reveal trends/patterns/ relationships, communicate processesor display complicated data
Writing: Letter Writing: Official Letters, Resumes
Grammar: Reporting verbs, Direct & Indirect speech, Active & Passive Voice
Vocabulary: Words often confused, Jargons

COs: CO4

Self Learning Topic: The Prime of Life – Simone De Beauvoir

Unit V: MOTIVATION: The Power of Intra personal Communication (An Essay) **9 Hours**
The interplay of AI, modern lives and literature by Mimi Mondal - Hindusthan Times
Listening: Identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension
Speaking: Formal oral presentations on topics from academic contexts
Reading: Reading comprehension
Writing: Writing structured essays on specific topics
Grammar: Editing short texts – identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject verb agreement)
Vocabulary: Technical Jargons

COs: CO5

Self Learning Topic: Do Androids Dream of electric ship? PhilipK.Dick The City and the Stars – Aarthur C. Clarke

Board of Studies	Basic Science & Humanities (English)	
Approved in: BoS No. II	October 06, 2023	
Approved in ACM: ACM No.VIII	October 21, 2023	
Expert talk (To be delivered by SMEs from industries)	**COs**	**POs**
Workshop on Drama and enactive sessions	CO5	PO5, PO8, PO10
Seminar with Language expert	CO3	PO5, PO8, PO10

Text Books

1. Path finder: Communicative English for Undergraduate Students,1st Edition, Orient Black Swan, 2023 (Units 1, 2 & 3)
2. Empowering English by Cengage Publications, 2023 (Units 4 & 5)

Reference Books

1. Dubey, ShamJi & Co. English for Engineers, Vikas Publishers, 2020
2. Bailey, Stephen, Academic writing: A Handbook for International Students Routledge, 2014
3. Murphy, Raymond, English Grammar in Use, 4th Edition, Cambridge University Press, 2019
4. Lewis, Norman, Word Power Made Easy – The Complete Handbook for Building a Superior Vocabulary, Anchor, 2014

Web References

Grammar

1. www.bbc.co.uk/learningenglish
2. https://dictionary.cambridge.org/grammar/british-grammar/
3. www.eslpod.com/index.html
4. https://www.learngrammar.net/
5. https://english4today.com/english-grammar-online-with-quizzes/
6. https://www.talkenglish.com/grammar/grammar.aspx

Vocabulary

1. https://www.youtube.com/c/DailyVideoVocabulary/videos
2. https://www.youtube.com/channel/UC4cmBAit8i_NJZE8qK8sfpA

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	50	15
L2	20	30
L3	10	30
L4	10	15
L5	05	05
L6	05	05
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. List the major characters in the story
2. Who is the author of the poem "The Brook"?
3. What is the specific natural element that the poem revolves around?
4. Who is Elon Musk?
5. Can you name some of the companies founded or co-founded by Elon Musk?

L2: Understand

1. Can you summarize the plot of the story in your own words?
2. Explain the significance of the Brook's journey in the poem
3. What emotions or feelings does the poem evoke in you as a reader?
4. Explain the significance of SpaceX in Elon Musk's career and the aerospace industry
5. What are some of the major technological advancements associated with Elon Musk's companies?

L3: Apply

1. How would you apply the lessons from this story to your own life?
2. Can you apply the poem's themes to a different natural setting or body of water that you are familiar with?
3. Describe a real-life situation or natural phenomenon that parallels the Brook's journey in the poem
4. Apply Elon Musk's philosophy on sustainable energy to a current environmental issue
5. Describe a scenario in which the principles of innovation and risk-taking, as demonstrated by Elon Musk, could be applied in a different industry

L4: Analyze

1. How does the setting contribute to the overall mood of the story?
2. How does the poem's structure, including its rhyme scheme and meter, contribute to the overall meaning and mood of the poem?
3. Explore the role of sound and sensory imagery in conveying the Brook's essence
4. How has Elon Musk's leadership style contributed to the success of his companies?
5. Compare and contrast the goals and missions of SpaceX and Tesla, Inc.

L5: Evaluate

1. Evaluate the impact of the surprise ending in the story
2. Evaluate the effectiveness of the poem in conveying its themes and emotions
3. How might different readers interpret the poem's meaning based on their personal experiences or perspectives?
4. Do you agree with Elon Musk's vision for a sustainable future and his approach to achieving it? Why or why not?
5. Assess the ethical considerations surrounding some of Elon Musk's projects, such as Neuralink or the Hyperloop

L6: Create

1. Create a modern-day version of the story, updating the setting and circumstances while retaining the central theme of sacrifice
2. Write a short paragraph or poem that continues the story of the brook after the poem ends
3. Compose a piece of music inspired by the imagery and emotions conveyed in "The Brook"
4. Write a short essay discussing the potential long-term effects of Elon Musk's ventures on the global economy and society
5. Develop a concept for a new technology or project that aligns with Elon Musk's innovative spirit and goals

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Board of Studies (B S & H)

BS 23BSX23 Chemistry 3 0 0 3

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

Code	Course Outcomes	Mapping with POs PO1	PO2	PO7	DoK
23BSX23.1	Compare types of polymers and their applications in various technological fields	3	2	1	L1 - L3
23BSX23.2	Interpret the Nernst equation for electrode potential and classify various types of energy storage devices	3	2	1	L1 - L3
23BSX23.3	Compare the molecular orbital energy level diagram of different molecular species	3	2	1	L1 - L3
23BSX23.4	Apply the principle of Band diagrams in the application of conductors and semiconductors.	3	2	1	L1 - L3
23BSX23.5	Explain the principles of spectrometry, chromotography in separation of solid and liquid mixture	3	2	1	L1 - L3

All the COs are mapped to PO12 as few self-learned topics are inbuilt in syllabus promoting autonomous learning

Unit I: Polymer Chemistry **9 Hours**

Introduction to polymers, functionality of monomers, chain growth and step growth polymerization, coordination polymerization with specific examples and mechanisms of polymer formation. Plastics –Thermo and Thermosetting plastics, preparation, properties and applications of – PVC, Teflon, Bakelite, Nylon-6, 6, carbon fibres. Elastomers–Buna-S, Buna-N–preparation, properties and applications. Conducting polymers – polyacetylene, polyaniline–mechanism of conduction and applications. Bio-Degradable polymers-Poly Glycolic Acid (PGA), Polyl Lactic Acid (PLA). **COs: CO1**

Self – Learning Topic: Advanced polymer methods

Unit II: Electrochemistry and Applications **9 Hours**

Electrochemical cell, Nernst equation, cell potential calculations and numerical problems, potentiometry-potentiometric titrations (redox titrations), concept of conductivity, conductivity cell, conductometric titrations (acid-base titrations).Electrochemical sensors – potentiometric sensors with examples, amperometric sensors with examples.Primary cells – Zinc-air battery, Secondary cells –lithium-ion batteries- working of the batteries including cell reactions; Fuel cells, hydrogen-oxygenfuel cell– working of the cells. Polymer Electrolyte Membrane Fuel cells (PEMFC) with examples. **COs: CO2**

Self – Learning Topic: Fundamentals and applications of electrochemistry

Unit III: Structure and Bonding Models **9 Hours**

Planck's quantum theory, dual nature of matter, Schrodinger equation, significance of Ψ and Ψ2, applications to hydrogen,molecular orbital theory – bonding in homo- and heteronuclear diatomic molecules – energy level diagrams of O_2 andCO, etc. π-molecular orbitals of butadiene and benzene, calculation of bond order. **COs: CO3**

Self – Learning Topic: Shapes and significance of atomic orbitals

Unit IV: Modern Engineering materials **9 Hours**

Coordination compounds: Crystal field theory – salient features – splitting in octahedral and tetrahedral geometry. Properties of coordination compounds-Oxidation state, coordination, magnetic and colour. Semiconductor materials, super conductors- basic concept, band diagrams for conductors, semiconductors and insulators, Effect of doping on band structures. Supercapacitors: Introduction, Basic Concept-Classification – Applications. Nano chemistry: Introduction, classification of nanomaterials, properties and Quantum Dots, applications of Fullerenes, carbon nano tubes and Graphines nanoparticles. **COs: CO4**

Self – Learning Topic: Metal organic complexes

Unit V: Instrumental Methods of Chemical Analysis **9 Hours**

Electromagnetic spectrum. Absorption of radiation: Beer-Lambert's law. UV-Visible Spectroscopy, electronic transition, Instrumentation, IR spectroscopies, fundamental modes and selection rules, Instrumentation. Chromatography-Basic Principle, Classification-HPLC: Principle, Instrumentation and Applications **COs: CO5**

Self – Learning Topic: The fundamental principles of instrumental measurements

Board of Studies		Basic Science & Humanities (Chemistry)	
Approved in: BoS No. II		October 06, 2023	
Approved in ACM: ACM No. VIII		October 21, 2023	
Expert talk (To be delivered by SMEs from industries)		**COs**	**POs**
1	Principles and methodologies involved in the manufacturing of different eco-friendly polymers, FRP materials	CO1	PO1, PO2, PO7
2	Demonstration on principles and applications of Chemical energy sources	CO2, CO3	PO1, PO2, PO7

Textbooks

1. Jain and Jain, "Engineering Chemistry", 16th Edition, Dhanpatrai Publications, 2013
2. Peter Atkins, Julio de Paula and James Keeler, Atkins "Physical Chemistry", 10th Edition, Oxford University Press, 2010
3. Shikha Agarwal., "Engineering Chemistry: Fundamentals and Applications",13th Edition, 2012

Reference Books

1. Lee J. D., "Concise Inorganic Chemistry", 5th Edition, Oxford University Press, 2008
2. Skoog and West, "Principles of Instrumental Analysis", 6th Edition, Thomson, 2007

Web References

1. http://link.springer.com/chemistry
2. http://www.thphys.chemistry.ox.ac.uk
3. http://www.sciencedirect.com/science
4. http://www.e-booksdirectory.com

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	30	30
L2	50	50
L3	20	20
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. What is a polymer?
2. How do polymers dissolve in solvents?
3. Define thermoplastic polymers and give two examples
4. What are single electrode potentials?
5. What is electromagnetic spectrum?

L2: Understand

1. Explain the free radical polymerization mechanism
2. Differentiate between addition polymerization and condensation polymerization
3. Explain the standard electrode potential by taking calomel electrode as an example
4. Demonstrate one or two applications of Zinc-air cell with chemical equations
5. Demonstrate the construction, working principle and one or two applications of electrochemical sensor with a neat schematic diagram

L3: Apply

1. Why would it be desirable to synthesize a polymer with a high degree of crystallinity? You are working for a company that produce a small appliances that use gears. Originally theyare using metal gears but have now decided to use plasic gears. Is the decision is acceptable? Justify it
2. Based on everyday experience, name one method of corrosion protection which you have observed in use?
3. Various studies on the annual cost of corrosion always conclude that corrosion amounts to 3-5% of nations gross national product, no matter in what year the study was under taken. Does this means that corrosion science and engineering are not making any headway. Justify with your answer
4. Describe one aspect of the operation of a semiconductor using principles from chemistry (Ex: Intrinsic, Extrinsic)

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Chairman
Board of Studies (BS & H)

BS 23BSX12 Differential Equations and Vector Calculus 3 0 0 3

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

Code	Course Outcomes	Mapping with POs PO1	PO2	PO5	DoK
23BSX12.1	Solve the first order differential equations related to various engineering fields	3	2	1	L1 - L4
23BSX12.2	Solve the second order differential equations related to various engineering fields	3	2	1	L1 - L4
23BSX12.3	Identify solution methods for partial differential equations that model physical processes	3	2	1	L1 - L4
23BSX12.4	Apply Gradient, Divergence, Curland Laplacian to scalar and vector point functions	3	2	1	L1 - L4
23BSX12.5	Interpret Gradient, Directional Derivative, Divergence, Curl and Green's, Stoke's and Gauss theorems	3	2	1	L1 - L4

All the COs are mapped to PO12 as few self-learned topics are inbuilt in syllabus promoting autonomous learning

Unit I: Differential Equations of First Order and first degree **9 Hours**

Linear differential equations – Bernoulli's equations- Exact equations and equations reducible to exact form. Applications: Newton's Law of cooling – Law of natural growth and decay- Electrical circuits, Orthogonal trajectories

COs: CO1

Self – Learning Topic: Orthogonal trajectories

Unit II: Linear differential equations of higher order (Constant Coefficients) **9 Hours**

Linear differential equations, linear differential equations with constant coefficients, The operator D, the inverse operator $\frac{1}{D}$, $\frac{1}{D-a}$, $\frac{1}{D+a}$, Homogeneous & Non-Homogeneous Differential equations, Complimentary Function, Particular Integral, General solution, Wronskian, Method of Variation of parameters, Applications to L-C-R circuit problems

COs: CO2

Self – Learning Topic: Simple Harmonic motion

Unit III: Partial Differential equations **9 Hours**

Formation of Partial Differential Equations by elimination of arbitrary constants and arbitrary functions, solutions of first order linear equations using Lagrange's method. Homogeneous Linear Partial differential equations with constant coefficients.

COs: CO3

Self – Learning Topic: Classification of second order partial differential equations

Unit IV: Vector Differentiation **9 Hours**

Scalar and vector point functions, vector operator del, del applied to scalar point functions - Gradient, del applied to vector point functions-Divergence and Curl, Laplacian operator, vector identities (without proofs).

COs: CO4

Self – Learning Topic: Geometrical meaning of all operators

Unit V: Vector Integration **9 Hours**

Line integral – circulation - work done, surface integral - flux, Green's theorem in the plane (without proof), Stoke's theorem (without proof), volume integral, Divergence theorem (without proof).

COs: CO5

Self – Learning Topic: Applications of the above theorems

Board of Studies		Basic Science & Humanities (Mathematics)	
Approved in: BoS No. VI		October 06, 2023	
Approved in: ACM No. VIII		October 21, 2023	
Expert talk (To be delivered by SMEs from industries)		**COs**	**POs**
1	Solving one-dimensional wave equation and two-dimensional equations using MATLAB	CO3	PO1, PO2, PO5
2	Applications of vector calculus in different branches of Engineering	CO4	PO1, PO2

Text Books

1. Grewal B. S., "Higher Engineering Mathematics", 44th Edition,12th Reprint, Khanna Publishers, 2022
2. Ramana B. V.,"Higher Engineering Mathematics",1st Edition, 35th Reprint, Tata McGraw Hill Education, 2019

Reference Books

1. Erwin Kreyszig, "Advanced Engineering Mathematics",10th Edition, Wiley India, 2021
2. Bali N .P., "Engineering Mathematics",1st Edition, Lakshmi Publications, 2017
3. Peter O' Neil, "Advanced Engineering Mathematics",1st Edition, Cengage Publications, 2010
4. Iyengar T. K. V., Prasad M. V. S. S. N., Ranganatham S. and Krishna Gandhi B., "Engineering Mathematics - I", 2nd Revised Edition, S. Chand Publications, 2021
5. Iyengar T. K. V., Prasad M. V. S. S. N., Ranganatham S. and Krishna Gandhi B., "Engineering Mathematics - III", 8th Revised Edition, S. Chand Publications, 2020

Web References

1. http://nptel.ac.in/courses/
2. https://onlinecourses.nptel.ac.in
3. https://nptel.ac.in/courses/111/108/111108144/
4. https://ocw.mit.edu/courses

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	15	15
L2	55	55
L3	20	20
L4	10	10
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. Define a partial differential equation
2. What is a Bernoulli's equation?
3. What is the general form of Leibnitz's equation in y?
4. What is the sufficient condition for the exactness of Mdx+Ndy=0
5. Solve the PDE z=px+qy-2√pq
6. Solve(D^2+2DD1+1)z=0
7. Find the unit normal vector at (1,2,2) to the surface $\mathbf{x^2 + y^2 + z^2}$= 9
8. Define a line integral and explain its significance in physics or engineering contexts
9. Define a homogeneous linear partial differential equation with constant coefficients

L2: Understand

1. Solve $(D^2-DD1+D1-1)z= \cos(x+2y)+e^{y-x}$
2. Find the directional derivative of the function $\emptyset = xy^2 + yz^3$ at the point (2,-1,1) in the direction of the normal to the surface x logz − y2 + 4 = 0 at (-1,2,1)
3. If $F=x^2yz$, G= xy -3z² Then find div(grad F x grad G)
4. Find the surface integral of F = xyi + z²j + 2yzk over the tetrahedron bounded by x=0, y=0, z= 0 and the plane x+ y+ z =1
5. Solve Dx + $2\mathbf{D}'$u = u, u (x ,0) = 6 $\mathbf{e^{-3x}}$ by the method of separation of variables
6. Solve $(1+y^2)$ dx +$(x-e^{\tan^{-1}x})$ dy=0
7. Solve (D^2+3D+2) y = 4 cos2x
8. Explain the process of forming a partial differential equation by eliminating arbitrary constants and arbitrary functions from a given expression
9. Explain how the Wronskian is used to determine linear in dependence of solutions
10. Explain the geometric interpretation of the dot product and cross product of two vectors. How are these operators used in vector calculus

L3: Apply

1. Find the area of the circle $x^2+ y^2 =a^2$ using double integral in polar coordinates
2. Find the volume of the sphere $x^2 +y^2+z^2=a^2$ using spherical coordinates
3. Find by double integration the area lying between the parabolas $y^2=4ax$ and $x^2=4ay$
4. Find the scalar potential of the vector F= (x^2-yz) i + (y^2-zx) j + (z^2-xy)k, if exists
5. Evaluate by Gauss divergence theorem $F=(x^3-yz)$i−2x²yj−zk taken over the surface of the cube formed by the planes $x=y=z=a$
6. Analyze the implications of having complex roots in the characteristic equation of a second order differential equation
7. Given the PDE $\boldsymbol{u_x}$ + 2$\boldsymbol{u_x}$ =0, solve it using Lagrange's method to find the general solution

L4: Analyze

1. If f(x, y, z) $= 4x^2$+7xy +3xz^2, what is the direction in which the function f(x, y, z) increases more rapidly at the point P=(1.0.2)
2. List some physical examples of scalar and vector fields
3. From Stoke's theorem, analyze the form of Green's function for a curve lying in
   i. xy - plane ii. zx - plane
4. Asses the circulation of the field F = yī + (x+2y) j̄ around the closed path $x^2 +y^2=4$ where circulation in counter clockwise direction
5. Evaluate $\int(x + \sqrt{y})$ dS along a curve C, where c is given by C = $C_1 + C_2$ such that $C_1 = \{x = t. y = t2\}$ from (0,0) to (1,1) and $C_2 = \{x = t. y = t\}$ from (1,1) to (0,0)

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Chairman
Board of Studies (BS & H)

PC **23EE201 Electrical Circuit Analysis - I** **3 0 0 3**

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

Code	Course Outcomes	Mapping with POs				DoK
		PO1	PO2	PO3	PSO 1	
23EE201.1	Solve various electrical circuits	3	3	2	1	L1 - L3
23EE201.2	Explain concepts of magnetic circuits	3	2	1	1	L1 - L3
23EE201.3	Illustrate study state analysis on AC circuits	3	2	2	1	L1 - L3
23EE201.4	Interpret the concept of resonance and locus diagrams	3	2	2	1	L1 - L3
23EE201.5	Apply network theorems to DC and AC circuits	3	2	2	1	L1 - L3

All the COs are mapped to PO12 as few self-learned topics are inbuilt in syllabus promoting autonomous learning

Unit I: Introduction to Electrical Circuits **9 Hours**

Basic concepts of passive elements of R, L, C and their V-I relations, Sources (dependent and independent), Kirchhoff's laws, Network reduction techniques (series, parallel, series-parallel, star-to-delta and delta-to-star transformation), source transformation technique, nodal analysis and mesh analysis to DC networks with dependent and independent voltage and current sources.

COs: CO1

Self - Learning Topic: Real Time applications of DC circuits

Unit II: Magnetic Circuits **9 Hours**

Basic definition of MMF, flux and reluctance, analogy between electrical and magnetic circuits, Faraday's laws of electromagnetic induction - concept of self and mutual inductance, Dot convention – coefficient of coupling and composite magnetic circuit, basic concept of series and parallel magnetic circuits

COs: CO2

Self - Learning Topic: Applications of Faraday's laws of electromagnetic induction

Unit III: Single Phase Circuits **9 Hours**

Characteristics of periodic functions, average value, R.M.S. value, form factor, representation of a sine function, concept of phasor, phasor diagrams, and node, mesh analysis.

Steady state analysis of R, L and C circuits to sinusoidal excitations-response of pure resistance, inductance, capacitance, series RL circuit, series RC circuit, series RLC circuit, parallel RL circuit, parallel RC circuit.

COs: CO3

Self - Learning Topic: Application of RC, RL circuits

Unit IV: Resonance and Locus Diagrams **9 Hours**

Series Resonance: Characteristics of a series resonant circuit, Q-factor, selectivity and bandwidth, expression for half power frequencies.

Parallel resonance: Q-factor, selectivity and bandwidth.

Locus diagram: RL, RC, RLC with R, L and C variables.

COs: CO4

Self - Learning Topic: Parallel resonant circuit

Unit V: Network Theorems (DC & AC Excitation) **9 hours**

Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum Power Transfer theorem, Reciprocity theorem, Millman's theorem and compensation theorem,

COs: CO5

Self - Learning Topic: Tellegen's Theorem

Board of Studies		Electrical and Electronics Engineering	
Approved in: BoS No. VI		October 07, 2023	
Approved in ACM: ACM No. VIII		October 21, 2023	
Expert talk (To be delivered by SMEs from industries)		**COs**	**POs**
1	Applications of Maximum Power Transfer Theorem	CO 5	PO1, PO2, PO3, PSO1
2	Characteristics and Applications of Series RLC resonance	CO 4	PO1, PO2, PO3, PSO1

Text Books

1. Chakrabarthi A., "Circuit Theory (Analysis and Synthesis)", Dhanpat Rai & Co., 4th Edition, 2020
2. Sudhakar A., Shyammohan S. Palli, "Circuits and Networks: Analysis and Synthesis", 5th Edition, Tata McGraw Hill, 2021
3. Sivanagaraju S., Kishore G. and Srinivasa Rao C., "Electrical Circuit Analysis", 4th Edition, Cengage, 2019
4. William Hayt and Jack E. Kemmerley., "Electrical Circuit Analysis", 9th Edition, Tata McGraw Hill, 2020

Reference Books

1. Van Valkenburg, "Network Analysis", 3rd Edition, Prentice Hall of India Private Ltd., 2019
2. Charles K. Alexander and Mathew N. O. Sadiku., "Fundamentals of Electrical Circuits", 3rd Edition, McGraw Hill Education (India), 2021
3. David A. Bell, "Electric Circuits", 4th Edition, Oxford Publications, 2019
4. De Carlo, Lin, "Linear Circuit Analysis", 2nd Edition, Oxford Publications, 2021

Web References

1. https://nptel.ac.in/courses/117106108
2. https://archive.nptel.ac.in/courses/108/104/108104139/

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	20	20
L2	50	40
L3	30	40
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. What are Active elements?
2. Define MMF, Flux and Reluctance
3. What is form factor and Peak Factor?
4. Define Bandwidth and Quality Factor of Series RLC
5. State maximum power transfer theorem

L2: Understand

1. Explain the principle of duality
2. Explain the concept of self and mutual inductances
3. Explain the condition of resonance in series RLC circuit
4. Explain the procedure of superposition theorem

L3: Apply

1. Determine the power dissipation in the 4Ω resistor of the given circuit by using nodal analysis

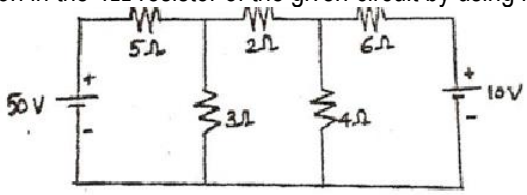

Figure.2

2. Find the voltage across 4Ω resistance using superposition theorem

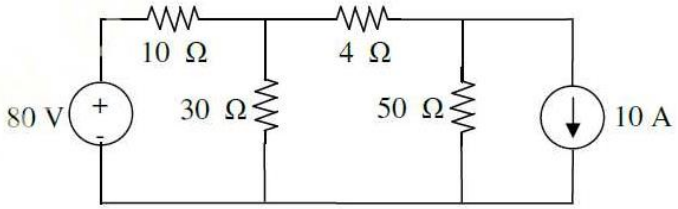

Figure.3

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Chairman
Board of Studies (EEE)

ES **23ESX01 Basics of Electrical and Electronics Engineering** **3 0 0 3**

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

Code	Course Outcomes	Mapping with POs				DoK
		PO1	PO2	PO3	PSO1	
23ESX01.1	Understand basic concepts of electrical circuits	3	2	-	1	L1, L2
23ESX01.2	Explain the operation of various machines and instruments	3	1	-	1	L1,L2
23ESX01.3	Understand the operation of different power plants	3	2	2	1	L1,L2
23ESX01.4	Analyze the working of electronic devices	3	-	-	1	L1 - L4
23ESX01.5	Examine the working of electronics circuits and devices	3	-	-	1	L1 - L4
23ESX01.6	Analyze various digital logic gates	3	2	2	1	L1 - L4

All the COs are mapped to PO12 as few self-learned topics are inbuilt in syllabus promoting autonomous learning

Unit I: DC & AC Circuits **9 Hours**

DC Circuits: Electrical circuit elements (R, L and C), Ohm's Law and its limitations, KCL & KVL, series, parallel, series-parallel circuits, Super Position theorem, Simple numerical problems.

AC Circuits: A.C. Fundamentals: Equation of AC Voltage and current, waveform, time period, frequency, amplitude, phase, phase difference, average value, RMS value, form factor, peak factor, voltage and current relationship with phasor diagrams in R, L, and C circuits, concept of Impedance, active power, reactive power and apparent power, concept and measurement of power and power factor (Simple numerical problems). **COs: CO1**

Self- Learning Topic: Applications of electrical circuits

Unit II: Machines and Measuring Instruments **9 Hours**

Machines: Construction, principle and operation of (i) DC Motor, (ii) DC Generator (iii) Single Phase Transformer, (iv) Three Phase Induction Motor and (v) Alternator, Applications of electrical machines.

Measuring Instruments: Construction and working principle of Permanent Magnet Moving Coil (PMMC), Moving Iron (MI) Instruments and Wheat Stone bridge **COs: CO2**

Self - Learning Topic: Applications of electrical machines

Unit III: Energy Resources, Electricity Bill & Safety Measures **9 Hours**

Energy Resources: Conventional and non-conventional energy resources; Layout and operation of various power generation systems: Hydel, Nuclear, Solar & Wind power generation.

Electricity Bill: Power rating of household appliances including air conditioners, PCs, Laptops, Printers, etc. Definition of "unit" used for consumption of electrical energy, two-part electricity tariff, calculation of electricity bill for domestic consumers. **COs: CO3**

Equipment Safety Measures: Working principle of fuse and miniature circuit breaker (MCB), merits and demerits. Personal safety measures: Electric Shock, Earthing and its types, safety precautions to avoid shock.

Self - Learning Topic: Importance of electrical safety measures

Unit IV: Semiconductor Devices **9 Hours**

Introduction - Evolution of electronics – Vacuum tubes to nano electronics - Characteristics of PN junction Diode — Zener Effect — Zener Diode and its characteristics. Bipolar Junction Transistor — CB, CE, CC configurations and characteristics — Elementary – Treatment of Small Signal Amplifier. **COs: CO4**

Self - Learning Topic: Applications of Zener diode

Unit V: Basic Electronic Circuits and Instrumentation **9 Hours**

Rectifiers and power supplies: Block diagram description of a dc power supply, working of a full wave bridge rectifier, capacitor filter (no analysis), working of simple Zener voltage regulator. Amplifiers: Block diagram of

Public Address system, Circuit diagram and working of common emitter (RC coupled) amplifier with its frequency response, Concept of voltage divider biasing. Electronic Instrumentation: Block diagram of an electronic instrumentation system. **COs:CO5**

Self - Learning Topic: Applications of rectifiers and amplifiers

Unit VI: Digital Electronics **9 Hours**

Logic gates including Universal Gates, BCD codes, Excess-3 code, Gray code, Hamming code. Boolean Algebra, Basic Theorems and properties of Boolean Algebra, Truth Tables and Functionality of Logic Gates – NOT, OR, AND, NOR, NAND, XOR and XNOR Integrated Circuits (ICs). Simple combinational circuits–Half and Full Adders. Introduction to sequential circuits, Flip flops, Registers and counters. **COs: CO6**

Self - Learning Topics: Application of logic gates

Board of Studies		Electrical and Electronics Engineering	
Approved in: BoS No. VI		October 07, 2023	
Approved in ACM: ACM No. VIII		October 21, 2023	
Expert talk (To be delivered by SMEs from industries)		**COs**	**POs**
1	Operation of Brush-less DC motor and its applications to industry	CO 2	PO1, PO2, PO3, PSO1
2	Operation of servo motor and its applications to industry	CO 2	PO1, PO2, PO3, PSO1

Text Books

1. Kulshreshtha D. C., "Basic Electrical Engineering", Revised 1st Edition, McGraw Hill, 2021
2. Rajendra Prasad, "Fundamentals of Electrical Engineering", 3rd Edition, PHI Publishers, 2020
3. Kotari D. P. and Nagrath I. J., "Basic Electrical Engineering", 3rd Edition ,Tata McGraw Hill, 2020
4. Boylestad R. L., & Louis Nashlesky, "Electronic Devices & Circuit Theory", Pearson Education, 2021

Reference Books

1. Mehta V. K. & Rohit Mehta, "Principles of Electrical Machines", 4th Edition, S. Chand Publications, 2019
2. Sedha R. S., "A Text Book of Electronic Devices and Circuits", 3rd Edition, S. Chand & Co., 2014
3. Madhu Sahu K. B., "Basic Electrical Engineering", 4th Edition, Scitech Publications (India) Pvt. Ltd., 2019
4. Paynter R. T., "Introductory Electronic Devices & Circuits – Conventional Flow Version", 2nd Edition, Pearson Education, 2009

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1. https://www.classcentral.com/course/swayam-electrical-machines-iitd-14030
2. https://onlinecourses.nptel.ac.in/noc20_ee60/preview
3. https://onlinecourses.swayam2.ac.in/nou22_ec03/preview

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	30	20
L2	70	30
L3	-	30
L4	-	20
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

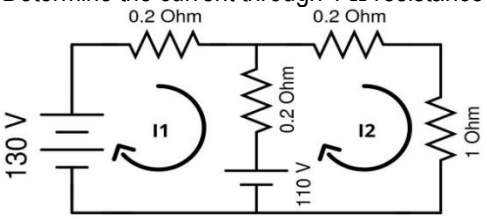
1. What is ohm's law?
2. Define RMS and peak values
3. What is form factor?
4. List any 2 types of rectifiers
5. List any 4 applications of operational amplifiers

L2: Understand

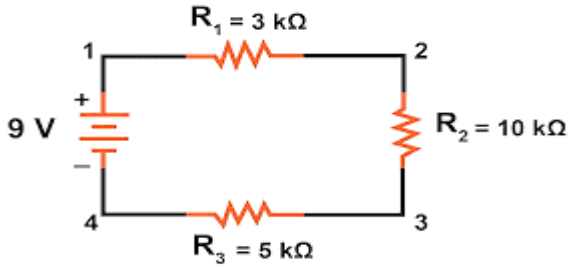
1. Explain in detail about Kirchhoff's current and voltage Law
2. Explain working principle of DC shunt generator
3. Explain the operation of single phase transformer

L3: Apply

1. Determine the current through 1 Ω resistance by using Kirchhoff's voltage law / Mesh analysis



2. By applying Kirchhoff's voltage law find current through R_3



L4: Analyze

1. Capacitors can be used for the filtering of ripples at the output of a rectifier. Suggest some other device which can work as a better filter
   a. Design the filter circuit
   b. Find the filter coefficients
   c. Analyse the form factor and ripple factor values of the rectifier by comparing them with the values of a rectifier which uses a capacitor for filtering
2. After completing the design and fabrication of an SSI-based digital system, a designer finds that one more inverter is required. However, the only spare gates in the system are a 2 input OR, a 3 input AND, and 2 input XNOR. How should the designer realize the inverter function without adding another IC?
3. For the manufacturing of a p-n junction diode we use either Germanium or Silicon semiconducting materials. Analyse the behaviour of a diode if it is made of a compound form of semiconducting materials like GaAs
   a. What change do you observe in the doping levels during the formation of p-region and n-region?
   b. What change do you observe in the V-I characteristics when compared with the characteristics of a conventional diode?

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Board of Studies (EEE & ECE)

BS 23BSX24 Chemistry Lab 0 0 2 1

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

Code	Course Outcomes	Mapping with POs	
		PO1	PO4
23BSX24.1	Determine the free ions in conductance of solutions	3	3
23BSX24.2	Analyze the various spectral of some organic compounds	3	3
23BSX24.3	Prepare advanced polymer materials	3	3
23BSX24.4	Measure the strength of an acid present in secondary batteries	3	3
23BSX24.5	Illustrate the functioning of the instruments such as Potentiometric meters	3	3

List of Experiments

1.	Estimation of Ferrous Iron by Dichrometry	**COs: CO1-CO3**
2.	Conductometrictitration of strong acid Vs. strong base	**COs: CO1,CO5**
3.	Conductometrictitration of weak acid Vs. strong base	**COs: CO1,CO5**
4.	Determination of copper (II) using standard hypo solution (Iodimetric titration)	**COs: CO1-CO3**
5.	Potentiometry - determination of redox potentials and emfs	**COs: CO1,CO5**
6.	Determination of Strength of an acid in Pb-Acid battery	**COs: CO1,CO4**
7.	Preparation of a Bakelite	**COs: CO3**
8.	Measurement of 10Dq by spectrophotometric method	**COs: CO2**
9.	Verify Lambert-Beer's law	**COs: CO2**
10.	Wavelength measurement of sample through UV-Visible Spectroscopy	**COs: CO2**
11.	Identification of simple organic compounds by IR	**COs: CO2**
12.	Preparation of nanomaterials by precipitation method	**COs: CO3**

References

1. Mendham J., Denney R. C., Barnes J. D., Thosmas M. and Siva Sankar B. Vogel's "Quantitative Chemical Analysis" 6th Edition, Pearson Publishers, 2000
2. Lab Manual for Chemistry, Department of Basic Science and Humanities, NSRIT, 2023

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Board of Studies (BS & H)

HS 23HSX02 Communicative English Lab 0 0 2 1

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

Code	Course Outcomes	Mapping with POs	
		PO10	PO9
23HSX02.1	Recognize the various facets of English language ability, with a focus on LSRW abilities	3	1
23HSX02.2	Use numerous activities for language learners to practice communication skills	3	1
23HSX02.3	To improve listening and speaking comprehension, analyze the sounds, stress, rhythm, intonation, and syllable division of English speech	3	1
23HSX02.4	Assess your professionalism when taking part in group discussions and debating	3	1
23HSX02.5	Develop compelling messaging and get ready for upcoming interviews	3	1

List of Experiments

1. Vowels & Consonants **COs: CO1,CO2**
2. Neutralization/Accent Rules **COs: CO1,CO2**
3. Communication Skills & JAM **COs: CO3,CO4**
4. Role Play or Conversational Practice **COs: CO3,CO4**
5. E-mail Writing **COs: CO4,CO5**
6. Resume Writing, Cover letter, SOP **COs: CO4,CO5**
7. Group Discussions-methods & practice **COs: CO4,CO5**
8. Debates- Methods & Practice **COs: CO4,CO5**
9. PPT Presentations/ Poster Presentation **COs: CO4,CO5**
10. Interviews Skills **COs: CO4,CO5**

Reference Books

1. Meenakshi Raman, Sangeeta-Sharma, 4th Edition, Technical Communication, Oxford Press, 2022
2. Grant Taylor: English Conversation Practice, 1st Edition,Tata McGraw-Hill Education India, 2001
3. Hewing's, Martin, Cambridge Academic English (B2), Cambridge University Press, 2012
4. Balasubramanyam T., A Text Book of English Phonetics for Indian Students, 3rd Edition, Trinity, 2022

Suggested Software

- Walden Infotech
- Young India Films

Web Resources

Spoken English

1. www.esl-lab.com
2. www.englishmedialab.com
3. www.englishinteractive.net
4. https://www.britishcouncil.in/english/online
5. http://www.letstalkpodcast.com/
6. https://www.youtube.com/c/mmmEnglish_Emma/featured
7. https://www.youtube.com/c/ArnelsEverydayEnglish/featured
8. https://www.youtube.com/c/engvidAdam/featured
9. https://www.youtube.com/c/EnglishClass101/featured
10. https://www.youtube.com/c/SpeakEnglishWithTiffani/playlists
11. https://www.youtube.com/channel/UCV1h_cBE0Drdx19qkTM0WNw

Voice & Accent

12. https://www.youtube.com/user/letstalkaccent/videos
13. https://www.youtube.com/c/EngLanguageClub/featured
14. https://www.youtube.com/channel/UC_OskgZBoS4dAnVUgJVexc
15. https://www.youtube.com/channel/UCNfm92h83W2i2ijc5Xwp_IA

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ES **23ESX04 Electrical and Electronics Engineering Workshop** **0 0 3 1.5**

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

Code	Course Outcomes	Mapping with POs		
		PO1	PO2	PO4
23ESX04.1	Verify Kirchhoff's laws and theorems	3	2	3
23ESX04.2	Determine various parameters of electrical measuring instruments	3	2	3
23ESX04.3	Determine the basic characteristics of electrical machines	3	2	3
23ESX04.4	Illustrate the characteristics of various electron devices	3	2	3
23ESX04.5	Examine the operation of a logical circuit	3	2	3

List of Experiments

Part-A: Basic Electrical Engineering Lab

1. Verification of KCL and KVL **COs: CO1**
2. Verification of superposition theorem **COs: CO1**
3. Measurement of resistance using Wheat Stone bridge **COs: CO2**
4. Magnetization characteristics of DC shunt generator **COs: CO3**
5. Conduct brake test on DC shunt motor **COs: CO3**
6. Speed control of DC shunt motor by field and armature control **COs: CO3**
7. Perform Swinburne's test on DC machine **COs: CO3**
8. Measurement of power and power factor using single - phase wattmeter **COs: CO2**
9. Measurement of earth resistance using Megger **COs: CO2**
10. Calculation of electrical energy for domestic premises **COs: CO2**

Part-B: Basic Electronics Engineering Lab

1. Plot V-I characteristics of PN Junction diode A) Forward bias B) Reverse bias **COs: CO4**
2. Plot V-I characteristics of Zener diode and its application as voltage regulator **COs: CO4**
3. Implementation of half wave and full wave rectifiers **COs: CO4**
4. Plot input & output characteristics of BJT in CE and CB configurations **COs: CO4**
5. Frequency response of CE amplifier **COs: CO4**
6. Simulation of RC coupled amplifier with the design supplied **COs: CO5**
7. Verification of truth table of AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gates using ICs **COs: CO5**
8. Verification of truth tables of S-R, J-K& D flip flops using respective ICs **COs: CO5**

Web References

1. https://www.vlab.co.in/broad-area-electrical-engineering

References

1. Kulshreshtha D. C., "Basic Electrical Engineering", Revised 1st Edition, McGraw Hill, 2021
2. Sedha R. S., "A Text Book of Electronic Devices and Circuits", 3rd Edition, S. Chand & Co, 2014
3. Lab Manual for "Electrical and Electronics Engineering Workshop", Department of Electrical and Electronics Engineering & Department of Electronics and Communication Engineering, NSRIT

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Board of Studies (EEE & ECE)

PC	**23EE202 Electrical Circuits Lab**	**0**	**0**	**3**	**1.5**

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

Code	**Course Outcomes**	**Mapping with POs**		
		PO1	**PO2**	**PO4**
23EE202.1	Demonstrate Network reduction techniques and theorems	3	2	3
23EE202.2	Determine parameters of coil	3	2	3
23EE202.3	Interpret the behaviour series of RL & RC circuits	3	2	3
23EE202.4	Verify self and mutual inductance	3	2	3
23EE202.5	Interpret the behavior of series and parallel resonance	3	2	3

List of Experiments

1.	Verification of Kirchhoff's circuit laws	**COs: CO1**
2.	Verification of node and mesh analysis	**COs: CO1**
3.	Verification of network reduction techniques	**COs: CO1**
4.	Determination of cold and hot resistance of an electric lamp	**COs: CO2**
5.	Determination of parameters of a choke coil	**COs: CO2**
6.	Determination of self, mutual inductances, and coefficient of coupling	**COs: CO4**
7.	Series and parallel resonance	**COs: CO5**
8.	Locus diagrams of R-L (L Variable) and R-C (C Variable) series circuits	**COs: CO3**
9.	Verification of Superposition theorem	**COs: CO1**
10.	Verification of Thevenin's and Norton's theorems	**COs: CO1**
11.	Verification of Maximum power transfer theorem	**COs: CO1**
12.	Verification of Compensation theorem	**COs: CO1**
13.	Verification of Reciprocity and Millman's theorems	**COs: CO1**

Web References

1. https://asnm-iitkgp.vlabs.ac.in/List%20of%20experiments.html
2. https://vlab.amrita.edu/?sub=1&brch=75

References

1. Chakrabarthi A., "Circuit Theory (Analysis and Synthesis)", Dhanpat Rai & Co., 4th Edition, 2020
2. Sudhakar A., Shyammohan S. Palli, "Circuits and Networks: Analysis and Synthesis", 5th Edition, Tata McGraw Hill, 2021
3. Lab Manual for "Electrical Circuits Lab", Department of Electrical and Electronics Engineering, NSRIT

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Board of Studies (EEE)

CSP **23CSP01 NSS /NCC /Scouts & Guides /Community Service Project** **0 0 1 0.5**

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

Code	Course Outcomes	Mapping with POs		
		PO7	PO8	PO12
23CSP01.1	Understand the importance of discipline, character and service motto	3	1	1
23CSP01.2	Outline the needs and problems of the community	3	1	1
23CSP01.3	Solve some societal issues by applying acquired knowledge, facts, and techniques	3	2	1
23CSP01.4	Explore human relationships by analyzing social problems	2	1	1
23CSP01.5	Determine to extend their help for the fellow beings and downtrodden people	2	2	1

Unit I: Orientation

General Orientation on NSS/NCC/ Scouts & Guides/Community Service activities, career guidance. **3 Hours**

Activities:

i) Conducting –ice breaking sessions-expectations from the course-knowing personal talents and skills
ii) Conducting orientations programs for the students –future plans-activities-releasing road map etc. **COs: CO1**
iii) Displaying success stories-motivational biopics- award winning movies on societal issues etc.
iv) Conducting talent show in singing patriotic songs-paintings- any other contribution.

Unit II: Nature & Care

Activities:

i) Best out of waste competition.
ii) Poster and signs making competition to spread environmental awareness.
iii) Recycling and environmental pollution article writing competition. **3 Hours COs: CO2**
iv) Organising Zero-waste day.
v) Digital Environmental awareness activity via various social media platforms.
vi) Virtual demonstration of different eco-friendly approaches for sustainable living.

Write a summary on any book related to environmental issues

Unit III: Community Service **3 Hours**

Activities:

i) Conducting One Day Special Camp in a village contacting village-area leaders- Survey in the village, identification of problems- helping them to solve via media- authorities-experts-etc.
ii) Conducting awareness programs on Health-related issues such as General Health, Mental health, Spiritual Health, HIV/AIDS,
iii) Conducting consumer Awareness. Explaining various legal provisions etc. **COs: CO3**
iv) Women Empowerment Programmes- Sexual Abuse, Adolescent Health and Population Education.
v) Any other programmes in collaboration with local charities, NGOs, etc.

General Guidelines

1. Institutes must assign slots in the Timetable for the activities
2. Institutes are required to provide instructor to mentor the students

Assessment Pattern

1. Evaluated for a total of 100 marks
2. A student can select 6 activities of his/her choice with a minimum of 01 activity per unit. Each activity shall be evaluated by the concerned teacher for 15 marks, totalling to 90 marks
3. A student shall be evaluated by the concerned teacher for 10 marks by conducting viva voce on the subject

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SOC **23SOC07 Plumbing** **0 0 0 2**

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

Code	Course Outcomes
23SOC07.1	Demonstrate the principles of designing plumbing systems for different types of fluids, including gas, air, steam, sewage and water
23SOC07.2	Demonstrate competency in the use of specialized tools and equipment essential for professional pipe installation
23SOC07.3	Diagnose and troubleshoot common plumbing problems in residential, commercial and industrial settings

Min. 60 Hours

Plumbing tools, levelling instruments, valves and meters, soft soldering, rigging and hoisting, Pipe Materials & Joining Methods, Plumbing Fixture, Distribution Piping, Drain, Waste & Vent System, Water Heating / Fuel Storage Equipment, Site & Drain Design, installing water supply piping, septic systems, storm ater and sumps, reapiring water supply systems, supporting and testing pipe.

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SOC 23SOC08 Refirgeration and Air Conditioning 0 0 0 2

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

Code	Course Outcomes
23SOC08.1	Develop the knowledge and practical skills required to install, troubleshoot, and repair a wide range of R&AC systems, including heating, ventilation, air conditioning, furnaces, and water heaters
23SOC08.2	Demonstrate the procedures for conducting warranty services, including documenting issues, ordering replacement parts, and completing repairs within warranty coverage
23SOC08.3	Learn to assess and identify maintenance issues in refrigeration and air condition equipment, as well as recommend preventive measures to improve system longevity and performance

Min. 60 Hours

Refrigeration and Air Conditioning: Types of refrigerants, study of refirgeartion cycles, Vapour absorption system, Vapour compression refrigeration test rig, study of compressors, valves, types of air conditioning, Summer and winter air conditioning, Fitting and Welding, Thermal Insulation,Commercial RAC Plants & Car Air Conditioner, Commercial Compressor & Capacity Control, Water Softening Plants & Chiller, three fulid refrigeration

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Board of Studies (ME)

SOC 23SOC09 Mobile Troubleshooting 0 0 0 2

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

Code	Course Outcomes
23SOC09.1	Demonstrate the Basic electronics concepts and Basics of mobile communications and different mobile technologies.
23SOC09.2	Gain proficiency in various components of PCB and different Sections on Motherboard and Different ICs used in MotherBoard.
23SOC09.3	Gain proficiency in Hardware and Software tools and trouble Shootings.

Min. 60 Hours

Basic Electronics - Current, Voltage, AC Current & DC Current, Resistor, Transistor, Capacitor, Diode, Inductor / Coil, Transformer, Integrated Circuit , Study of Digital Electronics, Study of Various components inside the mobile phone, Assembling and disassembling of various models of mobile phones,Study of various tools and equipment used in mobile phone repairs, Using a multi-meter, Use of DC Power Supply, Introduction and study of Printed Circuit Board (Motherboard), Details of various components on the PCB, Circuits and Different Sections on Motherboard: Power Circuit, Charging Circuit, SIM Circuit, Display Circuit, Keypad Circuit, Touch Screen Circuit, Audio Circuit, Memory card Circuit, Speaker and Microphone Circuit, Network Circuit, Bluetooth Circuit, Wi-fi Circuit, Testing of various parts and components, Study of different ICs (chips) used on the motherboard, How to recognize various ICs, Soldering & de-soldering of components by using a soldering iron, Soldering & de-soldering of components by using a rework station, Reheating and mounting of various BGA and SMD chips. Use of various secret codes. Fault finding, troubleshooting and repairing of various faults, Common repair procedure for hardware related faults, Common repair procedure for software related faults, Water damaged repair techniques, Circuit tracing, jumper techniques and solutions, Troubleshooting through schematic diagrams, Advanced troubleshooting techniques.

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SOC 23SOC10 Computer Servicing 0 0 0 2

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

Code	Course Outcomes
23SOC10.1	Demonstrate system Assembling and hardware troubleshooting
23SOC10.2	Identify automated backups of your system
23SOC10.3	Build systems to safeguard from various types of user activities
23SOC10.4	Solve and configure Networking related issues

Min. 60 Hours

Identify motherboard components and connections, understand error code for fault troubleshooting, verify components with the configuration of CMOS BIOS set up, Test and understand various beep sounds in case of trouble, Assemble and disassembling a Computer System, Upgrade RAM, HDD and other parts. Test fault finding and troubleshooting techniques, Configuration of camera, mic, WLAN and Bluetooth etc, install any popular antivirus software – View its various options, Explore Firewall options, use various disk cleanup utilities to remove junk files from hard disk, create automated backups, identify various Network devices – Switch, Router, Rack, crimping LAN cables, installing a printer and carrying self-test, Replacement of toner cartridge of laser printers.

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Board of Studies (CSE)

SOC **23SOC11 Digital Marketing** **0 0 0 2**

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

Code	Course Outcomes
23SOC11.1	Identify the Market and the behaviour of the customer and how the digital marketing will be useful
23SOC11.2	Search engines, methods to identify the search engines and their optimization in both on page and off page
23SOC11.3	Exercise on the Social media marketing and Email Marketing and gaining the reputation through online management
23SOC11.4	Demonstrate cognitive knowledge of the skills required in conducting online research and research on online markets

Min. 60 Hours

Introduction to Digital Marketing: Nature and Scope of Digital Marketing, Evolution of Digital Marketing, Traditional versus digital marketing, Integration of Market Place from conventional to the virtual, Social Media and Communication Mix – Benefits & Challenges – social media and Customer Engagement – ROC – New Role of Customers – The Social Business Eco system – REAN, RACE, integrating social media with Overall Market efforts – Developing Social Media Marketing plan. Social Media Business Blocks: Segmenting B2C Market – B2B Markets – managing the cyber social Campaign – Joining the Conversation – Lurking and Listening – Engagement with Audience – Staying Engaged – Engagement on the Social Web – Social Objects – Social graph – Social Applications – leveraging Search Engine Optimization (SEO) for social media – Optimizing social media for Search Engines. Digital Media Mix: Blogs, Podcasts, Vlogs – Blog – Create a Podcast – Producing the Video cast – Measuring Blogging, Podcasting, Vlogging Metrics using any social media like Facebook, Twitter, LinkedIn etc. Measuring the Results – Other Social Media Marketing Sites – Communities.

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Board of Studies (CSE)

SOC **23SOC12 Machining** **0 0 0 2**

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

Code	Course Outcomes
23SOC12.1	Demonstrate the various components and parts of a lathe machine, and to Understand the types of cutting tools, tool holders, and tool materials
23SOC12.2	Develop proficiency in performing fundamental lathe operations, such as turning, facing, drilling, boring, threading, and taper turning
23SOC12.3	Learn and adhere to safety guidelines, including the use of personal protective equipment (PPE), safe work habits, and hazard recognition in a lathe shop environment

Min. 60 Hours

Precision and Non Precision Instruments, Various Lathe Parts, Centering of Job in 4 Jaw and 3 Jaw Chuck, Lathe Operations like Straight Turning, TaperTurning, Facing Operation, Boring, Grooving, Knurling Operation, Metric and SSW Thread Cutting in Right Hand and Left Hand Direction, BSP Thread Cutting on the Pipe and Internal Thread Cutting on the Flange, Tool Grinding on Bench Grinder, Personal Safety and Safe Working Practices

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Board of Studies (ME)

SOC 23SOC13 Electrical Wiring 0 0 0 2

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

Code	Course Outcomes
23SOC13.1	Examine various tools and know their usage
23SOC13.2	Explain different joints, soldering practice andexecute wiring circuits
23SOC13.3	Perform various methods of earthing

Min. 60 Hours

Identify size, shape, purpose, speed and use of electrical wiring tools with respect to screw drivers, polers, drilling machines, Rawl plug jumpers, Line tester, Splicers, Standard wire gauge, Identify different types of electrical wiring accessories with respect to switches, Ceiling roses, Lamp holders and adopters, Sockets, Plug, Fuses, Identify different types of main switches with respect to SP, DP mains, TP, ICDP, ICTP, SPDT, DPDT, TPDT, Change over-Knife type, Rotary, Micro, Modular switches, 2-pole and 3-pole MCBs. Prepare straight joint/Married joint, T joint, Western union joint, Pig tail joint, Femialirisation to use soldering tools and components and soldering of simple electronic circuits on PCB. Make a circuit with one lamp controlled by one switch with PVC surface conduit system, two lamps controlled by two switches with PVC surface conduit system, Make a circuit with one lamp controlled by one switch and provision of 2/3-pin socket. Make a circuit for stair case wiring, Make a circuit for godown wiring, Control two lamps by series - Parallel connection using one 1-way switch & two 2-way switches with PVC surface conduit system, Controlt wosub – circuits through energy meter, MCB's and two1-way switches, Prepare switch board with star delta starter, MCB, Pilot lamps for 3 phase motor, Control and practice the wiring for fluorescent lamp, Connect computer by main switch board with a miniature circuit breaker. Prepare pipe earthing and plate earthing.

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Board of Studies (EEE)

SOC **23SOC14 Masonry** **0 0 0 2**

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

Code	Course Outcomes
23SOC14.1	Identify the tools required for various purposes and its working in construction activity
23SOC14.2	Preparing the cement sand motor mix in appropriate proportions based on the suitability and type of work
23SOC14.3	Undergo the types of openings, floors and need for the slope and ceiling finish as per the drawings and standards

Min. 60 Hours

Introduction to the tools and their usage, materials, properties, ratios of the mix, types masonry, types of bonds in masonry, height and width of rooms based on the purpose, types of partition, materials for partition, openings, requirements of openings, height and width of openings and ventilators, types of materials used as ventilators, provision of grooves in the brick work, finishing materials, thickness of finish, motor ratio for the finishings, types of shuttering, checking of the level by the Plum bob or liquid levels. Performing the RCC works by rod cutting, bending & placing. Making of the different floors with various materials with determination and formation of slopes, performing the ceilings finishing for the slabs must be done as per the standards and with drawing specifications maintaining the accuracy.

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Board of Studies (CE)

SOC 23SOC15 Automobile Servicing and Maintenance 0 0 0 2

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

Code	Course Outcomes
23SOC15.1	Identify parts in a diesel and petrol engine of LMV/ HMV
23SOC15.2	Observe and report the reading of Tachometer, Odometer, temp. and Fuel gauge under ideal and on load condition
23SOC15.3	Engage in practical exercises to discern variances in the constituents of gasoline and diesel engines, and acquire hands-on experience in disassembling both light and heavy motor vehicle engines following established protocols

Min. 60 Hours

Description of internal & external combustion engines, Classification of IC engines, Principle & working of 2 & 4 - stroke diesel engine (Compression ignition Engine (C.I)), Principle of Spark Ignition Engine(SI), differentiate between 2-stroke and 4 stroke, C.I engine and S.I Engine, Direct injection and Indirect injection, Technical terms used in engine, Engine specification. Study of various gauges/instrument on a dash board of a vehicle- Speedometer, Tachometer, Odometer and Fuel gauge, and Indicators such a gearshift position, Seat belt warning light, Parking-brake-engagement warning light and an Engine- malfunction light.

Different type of starting and stopping method of Diesel Engine Procedure for dismantling of diesel engine from a vehicle.

Petrol Engine Basics: 4-stroke spark-ignition engines- Basic 4-stroke principles. Spark-ignition engine components - Basic engine components, Engine cams & camshaft, Engine power transfer, Scavenging, Counter weights, Piston components. Intake & exhaust systems – Electronic fuel injection systems, Exhaust systems. Intake system components, Air cleaners, Carburettor air cleaners, EFI air cleaners, Intake manifolds, Intake air heating.

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Board of Studies (ME)

BS 23BSX14 COMPLEX VARIABLES AND NUMERICAL METHODS 3 0 0 3

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

Code	Course Outcomes	Mapping with POs PO1	Mapping with POs PO2	DoK
23BSX14.1	Apply C-R equations to complex functions to determine whether a given continuous function is analyticand find the integration of complex functions used in engineering problems	3	2	L1 – L4
23BSX14.2	Apply Cauchy residue theorem to evaluate certain integrals used in engineering problems	3	2	L1 – L4
23BSX14.3	Calculate the approximate roots of the algebraic equations and Transcendental equations by different techniques	3	2	L1 – L4
23BSX14.4	Make use of the concepts of interpolation to estimate the unknown functional values	3	2	L1 – L4
23BSX14.5	Find approximate values of finite integrals using different numerical techniques and use different algorithms for approximating solutions of ordinary differential equation to its analytical computations	3	3	L1 – L4

All the COs are mapped to PO12 as few self-learned topics are inbuilt in syllabus (italic) promoting autonomous learning

Unit I Complex Variable – Differentiation **9 Hours**
COs: CO1

Introduction to functions of complex variable-concept of Limit & continuity- Differentiation, Cauchy-Riemann equations, analytic functions harmonic functions, finding harmonic conjugate - construction of analytic function by Milne Thomson method

Self Learning Topic: Applications of Conjugate Harmonic Functions

Unit II Complex Variable – Integration **9 Hours**
COs: CO2

Line integral-Contour integration, Cauchy's integral theorem(Simple Case), Cauchy Integral formula, Power series expansions: Taylor's series, zeros of analytic functions, singularities, Laurent's series, Residues, Cauchy Residue theorem (without proof),

Self Learning Topic: Evaluation of definite integral involving sine and cosine.

Unit III Solution of Algebraic & Transcendental Equations: **9 Hours**
COs: CO3

Introduction-Bisection method - Iterative method - Regula falsi method - Newton-Raphson method System of Algebraic equations:-Gauss Jacobi method, Gauss Seidel method.

Self Learning Topic: Convergence of bisection method-Method of falsi position-Newton-Raphson method

Unit IV: **Interpolation** **9 Hours**
COs: CO4

Finite differences -Newton's forward and backward interpolation formulae – Lagrange's formulae. Gauss forward and backward formula, Stirling's formula, Bessel's formula, Milne's method.

Self Learning Topic: Newton's Divided Difference interpolation formula, *Errors in polynomial interpolation-Error Propagation in a difference table*

Unit V Numerical differentiation, integration & Solution of Initial Value problems to Ordinary Differential Equations of first order: **9 Hours**

COs: CO5

Numerical Differentiation and Numerical integration: Numerical differentiation using Newton's forward & backward interpolation formulae; Numerical Integration by trapezoidal rule, Simpson's l/3rd and 3/8th rules.Numerical Solutions of Ordinary differential equation: Solution by Taylor's series, picard's method of successive approximations, Euler's method, modified' Euler's method and Runge-Kutta method of fourth order.

Self Learning Topic:cubic spline interpolation,Numerical differentials

Board of Studies	Basic Science & Humanities (Mathematics)
Approved in : BoS No. IV	
Approved in : ACM No.	

Textbooks:

1.B. S. Grewal, Higher Engineering Mathematics,44/e, Khanna Publishers, 2017
2.S.S.Sastry, Introductory Methods of Numerical Analysis, 5/e, PHI publication, 2012

Reference Books:

1.Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, Wiley publications, 2011.
2.Steven C. Chapra and Raymond P. Canale, Numerical Methods for Engineers, 6/e, Mc Graw Hill, 2010.
3.C. Ray Wylie and Louis C. Barrett, Advanced Engineering Mathematics, 6/e, McGraw-Hill Education 1995.

Online Learning Resources:

https://archive.nptel.ac.in/courses/127/106/127106019/

https://archive.nptel.ac.in/courses/111/107/111107105/

https://nptel.ac.in/courses/122106033

https://archive.nptel.ac.in/courses/122/106/122106033/

http://digimat.in/nptel/courses/video/111106111/L01.html

http://acl.digimat.in/nptel/courses/video/122106033/L38.html

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	15	15
L2	55	55
L3	20	20
L4	10	10
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. Define C - R equations in polar form.
2. State Cauchy's theorem.

3. Prove that (1+Δ)(1-∇)=1
4. Identify the root lies between the values x^3-5x+1=0
5. Write the formula for the Fourier transform of f(x).

L2: Understand

1. Show that $u = e^{-x}(x\,sin y - y\,sin x)$
2. Find the value of the integral $\int_{1-i}^{2+i} (2x + 1 + iy)dz$ along the line joining 1-i to 2+I.
3. Find one root of the equation $\cos x = xe^x$ using the Regula-Falsi method correct to four decimal places.
4. Using Lagrange's interpolation formula, find the polynomial of the given data:

x	-1	0	3	6
f(x)	3	-6	39	822

L3: Apply

1. Determine the analytic function $w = u + iv$, where $u = \frac{2\cos x \cosh y}{\cos 2x + \cosh 2y}$ given $f(0) = 1$.
2. Find the Laurent's series expansion of the function $f(z) = \frac{z^2 - 6z - 1}{(z-1)(z-3)(z+2)}$ in the region $3 < |z+2| < 5$.
3. Using the method of separation of symbols, prove that
$u_0 + u_1 + u_2 + u_3 + \ldots\ldots + u_n = (n+1)C_1 u_0 + (n+1)C_2 \Delta u_0 + (n+1)C_3 \Delta^2 u_0 + \ldots\ldots\ldots (n+1)C_{n+1} \Delta^n u_0$
4. Solve the following equations by Gauss – Seidel method:
4x - y +z =12, -x + 4y -2z =-1, x -2y + 4z =5
5. Using Runge-Kutta 4th order method, evaluate $y(0.1)$ and $y(0.2)$ given that $y^1 = 3x + \frac{y}{2}, y(0) = 1$

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Board of Studies-(BS&H)

HS **23HSX03 Universal Human Values**

3 0 3003 0 3

Version 01.00

Pre-requisite: -

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

Code	Course Outcomes	Mapping with POs			DoK
		PO8	PO9	PO10	
23HSX03.1	Develop holistic vision of life	3	2	1	L1, L2, L3
23HSX03.2	Improve socially responsible behaviour	3	2	1	L1, L2, L3
23HSX03.3	Familiarize environmentally responsible work	3	2	1	L1, L2, L3
23HSX03.4	Develop ethical human conduct	3	2	1	L1, L2, L3
23HSX03.5	Identify Competence and Capabilities for Maintaining Health and Hygiene	3	2	1	L1, L2, L3

All the COs are by default mapped to PO12 as few topics are inbuilt in syllabus promoting autonomous learning

Unit I Introduction to Value Education **9 hours**

Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education), Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfil the Basic Human Aspirations **COs: CO1**

Practice Session: Sharing about Oneself, Exploring Human Consciousness, Exploring Natural Acceptance

Unit II Harmony in the Human Being **9 hours**

Understanding Human being as the Coexistence of the Self and the Body, distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health **COs: CO2**

Practice Session: Exploring the difference of Needs of Self and Body, Exploring Sources of Imagination in the Self, Exploring Harmony of Self with the Body

Unit III Harmony in the Family and Society **9 hours**

Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to-Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order **COs: CO3**

Practice Session: Exploring the Feeling of Trust, Exploring the Feeling of Respect, Exploring Systems to fulfill Human Goal

Unit IV: Harmony in the Nature/Existence **9 hours**

Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence **COs: CO4**

Practice Session: Exploring the Four Orders of Nature, Exploring Co-existence in Existence

Unit V Implications of the Holistic Understanding – a Look at Professional Ethics **9 hours**

Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics, Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession **COs: CO5**

Practice Session: Exploring Ethical Human Conduct, Exploring Humanistic Models in Education, Exploring Steps of Transition towards Universal Human Order

Board of Studies		BASIC HUMANITIES AND SCIENCES	
Approved in : BoS No.			
Approved in : ACM No.			
Expert talk		COs	POs
1	Seminar with Socialists	CO1	PO8

Text Books

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1. The Textbook: A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034- 47-1
2. The Teacher's Manual Teachers'**:** Manual for A Foundation Course in Human Values and Professional Ethics, RR Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53

Reference Books

1. JeevanVidya: EkParichaya, A Nagaraj, JeevanVidyaPrakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book)
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
6. Small is Beautiful - E. F Schumacher

Internal Assessment Pattern

CognitiveLevel	InternalAssessment#1(%)	InternalAssessment#2(%)
L1	20	20
L2	50	50
L3	30	30
Total(%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. What is Value education?
2. Write any two naturally accepted situations as your real-life experiences.
3. What is the basic unit of human interaction?
4. What is self-regulation?

L2: Understand

1. Briefly explain the self-exploration as the process for value education.
2. Explain the basic unit of interaction.
3. Explain 'respect' as the right evaluation.

L3: Apply

1. Discuss the role of a family dynamics play in shaping an individual's understanding of values and holistic well-being.
2. In what aways can holistic understandings of societal issues influence the values we prioritize as individuals and communities?
3. Discuss how can educational institutions integrate value-based teachings to cultivate a holistic understanding of societal harmony within students?

PC **23EE303 Electrical Circuit Analysis-II** **3 0 0 3**

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

Code	Course Outcomes	Mapping with POs PO1	PO2	PO3	DoK
23EE303.1	Apply mathematical modelling for three phase balanced and unbalanced circuits	3	3	1	L1 – L3
23EE303.2	Solve Transient response of RLC circuits	3	2	3	L1 – L3
23EE303.3	Solve Two Port Networks to determine various parameters	3	2	3	L1 – L3
23EE303.4	Apply Fourier Series to electrical systems	3	2	2	L1 – L3
23EE303.5	Interpret filters over various classifications	3	2	1	L1 – L3

All the COs are mapped to PO12 as few self-learned topics are inbuilt in syllabus (italic) promoting autonomous learning

Unit I: Analysis of three phase balanced and unbalanced circuits **12 hours**

Analysis of three phase balanced circuits: Phase sequence, star and delta connection of sources and loads, relation between line and phase quantities, analysis of balanced three phase circuits,

Analysis of three phase unbalanced circuits: Loop method, Star-Delta transformation technique, two-wattmeter method for measurement of three phase power.

COs:CO1

Self-Learning Topics : measurement of active and reactive power

Unit II: Laplace transforms and Transient Analysis **12 hours**

Laplace transforms – Definition and Laplace transforms of standard functions– Shifting theorem – Transforms of derivatives and integrals, Inverse Laplace transforms and applications.

Transient Analysis: Transient response of R-L, R-C and R-L-C circuits (Series and parallel combinations) for D.C. and sinusoidal excitations – Initial conditions - Solution using Laplace transform approach

COs:CO2

Self-Learning Topics : Solution using differential equation approach

Unit III: Network Parameters **12 hours**

Impedance parameters, Admittance parameters, Hybrid parameters, Transmission (ABCD) parameters, conversion of Parameters from one form to other, Interconnection of Two Port networks in Series, Parallel and Cascaded configurations- problems

COs:CO3

Self-Learning Topics : Conditions for Reciprocity and Symmetry of two port network parameters

Unit IV: Analysis of Electric Circuits with Periodic Excitation **12 hours**

Trigonometric and exponential form of Fourier series, evaluation of Fourier coefficients, Symmetry in Fourier Series – Even Symmetry, Odd Symmetry, Half Wave Symmetry, Quarter Wave Symmetry, Average & RMS values of periodic waveforms, Analysis of Electric Circuits with Periodic Excitation

COs:CO4

Self-Learning Topics : Fourier series and evaluation of Fourier coefficients

UNIT V : Filters **12 hours**

Classification of filters-Low pass, High pass, Band pass and Band Elimination filters, Constant-k filters -Low pass and High Pass

COs: CO5

Self-Learning Topics : Design of Filters

Board of Studies		Electrical and Electronics Engineering Board of Studies	
Approved in : BoS No. VII		July 05, 2024	
Approved in ACM: ACM No. IX			
Expert talk (To be delivered by SMEs from industries)		COs	POs
1	Analysis of three phase circuits	23EE303.1	PO 1,2,3

Textbooks:

1. William Hayt and Jack E. Kemmerly, "Engineering Circuit Analysis", 8th Edition, McGraw-Hill, 2022
2. Charles K. Alexander, Mathew N. O. Sadiku, "Fundamentals of Electric Circuits", 3rd Edition, Tata McGraw-Hill, 2023

Reference Books:

1. M. E. Van Valkenburg, "Network Analysis" 3rd Edition, PHI, 2019.
2. N. C. Jagan and C. Lakshminarayana, "Network Theory", 1st Edition, B. S. Publications, 2021.
3. A. Sudhakar, Shyam Mohan S. Palli, "Circuits and Networks Analysis and Synthesis", 5th Edition, Tata McGraw-Hill, 2020.
4. Durgesh C. Kulshreshtha Gopal G. Bhise, Prem R. Chadha, "Engineering Network Analysis and Filter Design" (Including Synthesis of One Port Networks) Umesh Publications 2021.
5. A. Chakrabarti, DhanpatRai & Co., "Circuit Theory: Analysis and Synthesis", 7th Revised Edition, 2020.

Web References

1. https://archive.nptel.ac.in/courses/117/106/117106108/
2. https://archive.nptel.ac.in/courses/108/105/108105159/

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	20	20
L2	40	40
L3	40	40
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

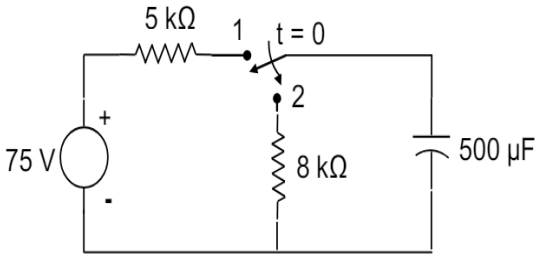
1. What is Phase sequence?
2. Define Transient response
3. Write Initial conditions of R,L,C

L2: Understand

1. Explain the star and delta connection
2. Explain the Transient response of series R-L circuit

L3: Apply

1. The switch in circuit shown was in position1 for a long time. It is moved from position 1 to position 2 at time t = 0. Sketch the wave form of vC(t) for t > 0



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Board of Studies (EEE)

PC 23EE304 **DC Machines & Transformers** **3 0 0 3**

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

Code	Course Outcomes	Mapping with POs			DoK
		PO2	PO3	PSO1	
23EE304.1	Understand the process of voltage build-up in DC generators and characteristics.	3	3	2	L1- L3
23EE304.2	Understand the process of torque production, starting and speed control of DC motors and illustrate their characteristics	3	2	2	L1,- L3
23EE304.3	Obtain the equivalent circuit of single-phase transformer, auto transformer and determine its efficiency & regulation.	3	2	1	L1 - L3
23EE304.4	Apply various testing methods for transformers	1	1	1	L1- L3
23EE304.5	Analyze various configurations of three-phase transformers.	2	3	1	L1 - L4

All the COs are mapped to PO12 as few self-learned topics are inbuilt in syllabus (italic) promoting autonomous learning

Unit I: DC Machines **9 hours**

Construction and principle of operation of DC machines – EMF equation for generator –Excitation techniques – characteristics of DC generators –applications of DC Generators, Back emf and torque equations of DC motor- Characteristics of DC motors - Applications of DC motors – Armature reaction and commutation. **COs:CO1**

Self-Learning Topic: Purpose Equalizer rings

Unit II: Starting, Speed Control and Testing of DC Machines **9 hours**

Necessity of a starter – starting by 3-point and 4-point starters – speed control by armature voltage and field current control – Testing of DC machines, losses and efficiency – brake test, Swinburne's test –Hopkinson's test– Field Test. **COs:CO2**

Self-Learning Topic: Separation of iron and friction losses

Unit III: Single-phase Transformers **9 hours**

Introduction to single-phase Transformers (Construction and principle of operation)–emf equation – operation on no-load and on load –lagging, leading and unity power factor loads – phasor diagrams– equivalent circuit – regulation – losses and efficiency – effect of variation of frequency and supply voltage on losses – auto transformer - all day efficiency **COs:CO3**

Self-Learning Topic: Transformer cooling methods

Unit IV: Testing of Transformers **9 hours**

Open-Circuit and Short-Circuit tests – Sumpner's test – separation of losses— Parallel operation with equal and unequal voltage ratios— equivalent circuit – comparison with two winding transformers. **COs:CO4**

Self-Learning Topic: Polarity test and back-to-back test

Unit V: Three-Phase Transformers **9 hours**

Polyphase connections- Y/Y, Y/Δ, Δ/Y, Δ/Δ, open Δ and Vector groups – third harmonics in phase voltages– Parallel operation–three winding transformers- transients in switching –off load and on load tap changers–Scott connection **COs: CO5**

Self-Learning Topic: Applications and comparison with two winding transformers

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Expert talk (To be delivered by SMEs from industries)		**COs**	**POs**
1	Transformers & harmonics in phase voltages	CO3,CO4,CO5	PO2,PO3
2			

Text Books

1. Bhimbra P.S. "Electrical Machines", 4th Edition, Khanna Publishers, 2015
2. Theraja B.L., Theraja A.K., "A Textbook Of Electrical Technology: AC And DC Machines", volume 2, S Chand, 1999
3. A.E.Fitzgerald, Charles kingsley, Stephen D.Umans "Electric Machinery", 6th Edition, Tata McGraw- Hill 2013

Reference Books

1. Kothari D. P., Nagarth I .J., "Electrical Machines", 4th edition, Mc Graw Hill Publications, 2010
2. Rajput R.K. "Electrical Machines", 5th edition, Lakshmi publications, 2016
3. Mulukutla S.Sarma & Mukesh k.Pathak "Electric Machines", 4th Edition, CENGAGE Learning, 2012
4. Guptha J.B., "Theory & Performance of Electrical Machines", 6th Edition, S.K.Kataria & Sons, 2008

Web References

1. https://nptel.ac.in/courses/108/105/108105017/
2. https://www.youtube.com/watch?v=AECBgmkWvo0&list=PLbMVogVj5Njqbg9363J1uq5Fnq4m1Ygxl

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	20	20
L2	40	30
L3	30	40
L4	10	10
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. What is a back e.m.f? Why the e.m.f generated in the armature of a DC motors is called back emf
2. Discuss briefly the principle of energy conversion
3. List any three advantages of three – phase transformer over three single – phase transformers
4. Define voltage regulation of a transformer
5. Why OC test is performed on LV side of a single phase transformer?
6. Define all day efficiency of a single phase transformer?
7. Write the applications of series, shunt and compound DC motors

8. Why is armature control superior to field control scheme in case of a DC shunt motor
9. Why the main flux in a transformer is remains practically constant from no load to full load

L2: Understand

1. A 6-pole lap wound DC generator has 720 conductors; a flux of 80 mWb/poleis driven at 1000 rpm. Find the generated e.m.f.
2. Explain what would happen if the DC Motor is directly switched on to the supply without any starter
3. Distinguish between core type and shell type transformers
4. Explain the concept of Scott connection (three phase to two phase) conversion with a neat circuit diagram
5. Explain the effects of third harmonic component in a three phase transformer
6. Explain with relevant diagrams, the different methods of excitation of DC machines
7. Explain the speed torque characteristics of DC shunt, series and cumulative compound motors
8. Derive the emf equation of a transformer.
9. Explain the significance of swinburne's test on dc machine?
10. Explain the necessity of commutating poles and compensating windings in a dc machine?
11. Explain the significance of interpoles in DC machines?

L3: Apply

1. Calculate (i) the total torque developed (ii) the useful torque of a 250 V, 4 pole series motor with 782 wave connected conductors developing 8 kW and taking 40 A with a flux per pole of 25 mWb. The armature resistance of the motor is 0.75 ohms.
2. In a retardation test on a D.C motor, with its field normally excited, the speed fell from 1525 to 1475 in 25 seconds. With an average load of 1 kW supplied by the armature, the same speed drop occurred in 20 seconds. Find the moment of inertia of the rotating parts in kg.m2?
3. In a 400 V, 50 Hz transformer, the total iron loss is 2300 W. When the supply voltage and the frequency reduced to 200 V and 25 Hz respectively the corresponding loss is 800 W. Calculate the eddy current loss at normal voltage and frequency.
4. A 2-winding 10 kVA, 440/110 V transformer is reconnected as a step-down 550/440 V autotransformer. Compare volt-ampere rating of the autotransformer with that of original 2-winding transformer. Calculate power transferred to the load: (i) inductively (ii) conductively.
5. A balanced 3-phase, 100 kW load at 400V and 0.8 p.f. lag is to be obtained from a balanced 2-phase, 1100V lines. Determine the kVA rating of each unit of the Scott-connected transformer.
6. A 20 kW, 250 V, 6 pole lap connected dc generator runs at 1250 rpm. Armature has 550 conductors. For full load armature – ohmic loss of 250 W, find the useful flux per pole. Take 2 V as the brush drop at full load
7. A DC series motor, with unsaturated magnetic circuit and negligible resistance, when running at a certain speed on a given load, takes 60 A at 600 V. If the load torque varies as the cube of the speed, find the resistance to be inserted to reduce the speed by 50 %.
8. A 4.5 kVA, 400/210 V,50 Hz single phase transformer has the following test data
   :O.C. test (l.v.side) 210V, 1A,70 W
   S.C. test (h.v.side) 15 V, 10.8A, 100 W
   Calculate (i) Equivalent circuit referred to l.v side and
   (ii) Secondary load voltage on full load at 0.8 power factor lagging
   (iii) Efficiency of transformer at ¾ th load and 0.7 power factor (lag).
9. A balanced 3-phase, 250 kW load at 415 V and 0.88 power factor lagging is to be supplied from a two – phase 1100 V supply. Determine voltage and current rating of each winding of scott connected transformers and kVA rating of each unit.
10. A 8 kW, 220 V, 4 – pole wave connected dc motor has 450 armature conductors. At full load, the useful flux per pole is 0.023 Wb and rotational losses are 110 W. Find the full load speed

L4: Analyse

1. In a DC generator, if the load increases the flux per pole decreases. Justify the statement
   How can determine the direction of rotation of a DC motor? And also explain how to change the direction of rotation?
2. Analyse the condition for maximum efficiency of any DC machine?
3. Draw and Analyse the load characteristics of a separately-excited dc generator
4. Analyse the purpose of using equalizing bars in parallel operation
5. Indirect test is superior to the direct test justify this statement with proof
6. A 22.38 kw, 440 V, 4-pole wave wound D.C. shunt motor has 840 armature conductors and 140 commutator segments. Its full-load efficiency is 88% and the shunt field current is 1.8 A. If brushes are shifted backwards through 1.5 segments from the geometrical neutral axis, find the demagnetizing and distorting amp-turns/pole
7. A 500 kw, 500 V, 10 pole d.c. generator has a lap wound armature with 800 conductors. Calculate the number of pole face conductors in each pole of a compensating winding if the pole face covers 75 percent of pole pitch
8. Two shunt generators A and B operate in parallel and their load characteristics may be taken as straight lines. The voltage of A falls from 240 V at no-load to 220 V at 200 A, while that of B falls from 245 V at no-load to 220 V at 150 A. determine the current which each machine supplies to a common load of 300 A and the bus bar voltage at this load.
9. In d.c. machine the total iron losses is 8 kw at its rated speed and excitation. If excitation remains the same, but speed is reduced by 25%, the total iron loss is found to be 5 kw. Calculate the hysteresis and eddy current losses at (i) full speed (ii) half the rated speed
10. Two generators each having no load voltage of 500 V, are connected in parallel to a constant resistance load consuming 400 kw. The terminal p.d. of one machine falls linearly to 470 V as the load is increased to 850 A while that of the falls linearly to 460 V when the load is 600 A. find the load current and voltage of each generator. If the induced e.m.f. of one machine is increased to share load equally find the new current and voltage.

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PC **23EE305 Electro Magnetic Field Theory** **3 0 0 3**

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

Code	Course Outcomes	Mapping with POs				DoK
		PO1	PO2	PO3	PSO 1	
23EE305.1	Apply the various operations of vector calculus to Static Electric Field	3	2	2	1	L1 - L3
23EE305.2	Understand the behavior of Conductors and Boundary Conditions	3	2	2	1	L1, L2
23EE305.3	Apply magnetic force on various current carrying elements	3	2	2	1	L1 - L3
23EE305.4	Illustrate the influence of Mutual Inductance on different cables	3	2	2	1	L1 - L3
23EE305.5	Explain effect on time varying fields	3	2	2	1	L1, L2

All the COs are mapped to PO12 as few self-learned topics are inbuilt in syllabus (italic) promoting autonomous learning

Unit I: Vector Analysis **9 hours**

Vector Algebra: Scalars and Vectors, Unit vector, Vector addition and subtraction, Position and distance vectors, Vector multiplication, Components of a vector. Rectangular Co – Ordinate Systems **COs:CO1**

Vector Calculus: Differential length, Area and Volume Del operator, Gradient of a scalar, Divergence of a vector and Divergence theorem (definition only). Curl of a vector and Stoke's theorem (definition only), Laplacian of a scalar

Electro Statics: Coulomb's law and Electric field intensity (EFI) – EFI due to Continuous charge distributions (line and surface charge), Electric flux density, Gauss's law (Maxwell's first equation, $\nabla.\vec{D} = \rho_v$), Electric Potential, Work done in moving a point charge in an electrostatic field (second Maxwell's equation for static electric fields, $\nabla \times \vec{E} = 0$), Potential gradient, Laplace's and Poison's equations

Self - Learning Topic: Cylindrical and Spherical coordinate systems

Unit II: Conductors – Dielectrics and Capacitance **9 hours**

Behavior of conductor in Electric field, Electric dipole and dipole moment – Potential and EFI due to an electric dipole, Torque on an Electric dipole placed in an electric field, Current density-conduction and convection current densities, Ohm's law in point form, Behavior of conductors in an electric field, Polarization, dielectric constant and strength, Continuity equation and relaxation time, Boundary conditions between conductor to dielectric, dielectric to dielectric and conductor to free space, Capacitance of parallel plate, coaxial and spherical capacitors, Energy stored and density in a static electric field,. **COs:CO2**

Self - Learning Topic: Coupled and decoupled capacitors

Unit III: Magneto statics, Ampere's Law and Force in magnetic fields **9 hours**

Biot-Savart's law and its applications viz. Straight current carrying filament, circular, square, rectangle and solenoid current carrying wire – Magnetic flux density and Maxwell's second Equation ($\nabla.\vec{B} = 0$) **COs:CO3**

Ampere's circuital law and its applications viz. MFI due to an infinite sheet, long filament, solenoid, point form of Ampere's circuital law, Maxwell's third equation ($\nabla \times \vec{H} = \vec{J}$).

Magnetic force, moving charges in a magnetic field – Lorentz force equation, force on a current element in a magnetic field, force on a straight and a long current carrying conductor in a magnetic field, force between two straight long and parallel current carrying conductors, Magnetic dipole, Magnetic torque, and moment.

Self - Learning Topic: Toroidal current carrying conductor

Unit IV: Self and mutual inductance **9 hours**

Self and mutual inductance – determination of self-inductance of a solenoid, toroid, coaxial cable and mutual inductance between a straight long wire and a square loop wire in the same plane – Energy stored and energy density in a magnetic field. **COs:CO4**

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Self - Learning Topic: Applications of Self and Mutual Inductance

Unit V: Time Varying Fields **9 hours**

COs:CO5

Faraday's laws of electromagnetic induction, Maxwell's fourth equation $\left(\nabla \times \vec{E} = -\frac{\partial \vec{B}}{\partial t}\right)$, integral and point forms of Maxwell's equations, statically and dynamically induced EMF, Displacement current, Modification of Maxwell's equations for time varying fields

Self - Learning Topic: Poynting theorem and Poynting vector.

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Expert talk (To be delivered by SMEs from industries)		**COs**	**POs**
1	Industrial application of Maxwell's equation	23EE305.5	PO 1, 2, 3
2	Industrial application of Lorentz Force equation	23EE305.4	PO 1, 2, 3

Text Books

1. Matthew N O Sadiku, "Elements of Electromagnetics", 7th Edition, Tata McGraw Hi Oxford Publications, 2022
2. William H. Hayt & John. A. Buck, "Engineering Electromagnetics", 7th Edition, Tata McGraw Hill, 2021
3. Van Valkenburg M. E., "Network Analysis", 3rd Edition, Prentice Hall of India, 2021

Reference Books

1. D J Griffiths, "Introduction to Electro Dynamics", 2th Edition, Prentice-Hall of India Pvt. Ltd, 2022
2. Sunil Bhooshan, "Fundamentals of Engineering Electromagnetics" 2nd Edition, Oxford University Press, 2021

Web References

1. https://archive.nptel.ac.in/courses/108/106/108106073/
2. https://nptel.ac.in/courses/117103065

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	20	30
L2	30	40
L3	50	30
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. Define Divergence, Gradient and Curl
2. What is dipole?
3. What is vector field and vector potential?
4. State gauss law
5. What is mutual Inductance?

L2: Understand

1. Explain Stokes theorem
2. Explain behavior of conductor in Electric field
3. Explain energy density in a magnetic field

4. Illustrate a expression for capacitance of a parallel plate capacitor

L3: Apply

1. Derive the expression for infinite sheet of current in electric field
2. Derive the expression for infinite line of current in electric field
3. Derive the expression for energy stored and energy density in magnetic field
4. Derive the expression for mutual inductance between a straight long wire and a square loop wire in the same plane
5. Derive Maxweel's 4^{th} equation and its various forms

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PC	**23EE306 Electrical Circuit Analysis and Simulation lab – II**	**0**	**0**	**3**	**1.5**

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

Code	**Course Outcomes**	**Mapping with POs**	
		PO1	**PO4**
23EE306.1	Determine the power calculations in three phase circuits.	3	3
23EE306.2	Analyze the time response of given network.	3	3
23EE306.3	Determination of two port network parameters.	3	3
23EE306.4	Simulate and analyze electrical circuits using software tools	3	3
23EE306.5	Apply various theorems to solve different electrical networks using simulation tools	3	3

All the COs are mapped to PO12

List of Experiments

1.	Measurement of Active Power and Reactive Power for balanced loads.	**COs:CO1**
2.	Measurement of Active Power and Reactive Power for unbalanced loads.	**COs:CO1**
3.	Determination of Z and Y parameters.	**COs:CO3**
4.	Determination of ABCD and hybrid parameters	**COs:CO3**
5.	Verification of Kirchhoff's current law and voltage law using simulation tools.	**COs:CO5**
6.	Verification of mesh and nodal analysis using simulation tools.	**COs:CO5**
7.	Verification of super position and maximum power transfer theorems using simulation tools.	**COs:CO5**
8.	Verification of Reciprocity and Compensation theorems using simulation tools.	**COs:CO3**
9.	Verification of Thevenin's and Norton's theorems using simulation tools.	**COs:CO5**
10.	Verification of series and parallel resonance using simulation tools.	**COs:CO3**
11.	Simulation and analysis of transient response of RL, RC and RLC circuits.	**COs:CO2**
12.	Verification of self-inductance and mutual inductance by using simulation tools.	**COs:CO4**

Web references

1. https://asnm-iitkgp.vlabs.ac.in/List%20of%20experiments.html
2. https://vlab.amrita.edu/?sub=1&brch=75

References

1. Chakrabarti. A, "Circuit Theory (Analysis and Synthesis)", Dhanpat Rai&Co., 4th edition, 2020
2. Sudhakar, Shyammohan S. Palli, "Circuits and Networks: Analysis and Synthesis", Tata McGraw Hill, 5th Edition, , 2021

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PC **23EE307 DC Machines & Transformers Lab** **0 0 3 1.5**

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

Code	Course Outcomes	Mapping with POs PO4
23EE307.1	Demonstrate starting and speed control methods of DC Machines.	3
23EE307.2	Apply theoretical concepts to determine the performance characteristics of DC Machines	3
23EE307.3	Analyze the parallel operation of single phase transformers	3
23EE406.4	Determine the performance parameters of single-phase transformer.	3
23EE202.5	Analyze the performance analysis of transformers using various tests	3

List of Experiments

1.	Speed control of DC shunt motor by Field Current and Armature Voltage Control	**COs:CO1**
2.	Brake test on DC shunt motor- Determination of performance curves	**COs:CO1**
3.	Swinburne's test - Predetermination of efficiencies as DC Generator and Motor	**COs:CO1**
4.	Hopkinson's test on DC shunt Machines	**COs:CO2**
5.	Load test on DC compound generator-Determination of characteristics	**COs:CO2**
6.	Load test on DC shunt generator-Determination of characteristics	**COs:CO2**
7.	Fields test on DC series machines-Determination of efficiency	**COs:CO2**
8.	Brake test on DC compound motor-Determination of performance curves	**COs:CO2**
9.	OC & SC tests on single phase transformer	**COs:CO5**
10.	Sumpner's test on single phase transformer	**COs:CO5**
11.	Scott connection of transformers	**COs:CO4**
12.	Parallel operation of Single-phase Transformers	**COs:CO4**
13.	Separation of core losses of a single-phase transformer	**COs:CO5**

Web references

1. https://asnm-iitkgp.vlabs.ac.in/List%20of%20experiments.html
2. https://vlab.amrita.edu/?sub=1&brch=75

References

1. Lab Manual for "DC Machines & Transformers Lab", Department of Electrical and Electronics Engineering, NSRIT

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SOC **23AIS01 Data structures lab** **0 1 2 2.0**

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

Code	Course Outcomes	Mapping with POs / PSOs						
		PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
23AIS01.1	Identify the role of data structures in organizing and accessing data.	3	3	2	1	1	2	1
23AIS01.2	Design, implement, and apply linked lists for dynamic data storage.	3	3	2	1	1	2	1
23AIS01.3	Develop applications using stacks.	3	3	2	1	1	2	1
23AIS01.4	Develop applications using queues.	3	3	2	1	1	2	1
23AIS01.5	Devise novel solutions to small scale programming challenges involving data structures such as stacks, queues, Trees.	3	3	2	1	1	2	1

Unit-I:

Introduction to Data Structures: Definition and importance of Data structures, Abstract data types (ADTs) and its specifications, Arrays: Introduction, 1-D, 2-D Arrays, accessing elements of array, Row Major and Column Major storage of Arrays, Searching Techniques: Linear & Binary Search, Sorting Techniques: Bubble sort, Selection sort, Quick sort.

Sample Programs:

1. Program to find min & max element in an array.
2. Program to implement matrix multiplication.
3. Find an element in given list of sorted elements in an array using Binary search.
4. Implement Selection and Quick sort techniques.

Unit-II:

Linked Lists: Singly linked lists: representation and operations, doubly linked lists and circular linked lists, Comparing arrays and linked lists, Applications of linked lists.

Sample Programs:

1. Write a program to implement the following operations. a. Insert b. Deletion c. Traversal
2. Write a program to store name, roll no, and marks of students in a class using circular double linked list.
3. Write a program to perform addition of given two polynomial expressions using linked list

Unit-III:

Stacks: Introduction to stacks, properties and operations, implementing stacks using arrays and linked lists, Applications of stacks in expression evaluation, backtracking, reversing list etc.

Sample Programs:

1. Implement stack operations using
   a. Arrays b. Linked list
2. Convert given infix expression into post fix expression using stacks.

3. Evaluate given post fix expression using stack.
4. Write a program to reverse given linked list using stack.

Unit-IV:

Queues: Introduction to queues: properties and operations, Circular queues, implementing queues using arrays and linked lists, Applications of queues scheduling, etc. Deques: Introduction to deques (double-ended queues), Operations on deques and their applications.

Sample Programs:

1. Implement Queue operations using
   a. Arrays b. Linked list
2. Implement Circular Queue using
   a. Arrays b. Linked list
3. Implement Dequeue using linked list.

Unit-V:
Trees: Introduction to Trees, Binary trees and traversals, Binary Search Tree – Insertion, Deletion & Traversal.

Sample Programs:

1. Implement binary tree traversals using linked list.
2. Write program to create binary search tree for given list of integers. Perform in-order traversal of the tree. Implement insertion and deletion operations.

References

1. Algorithms and Data Structures: The Basic Toolbox by Kurt Mehlhorn and Peter Sanders.
2. C Data Structures and Algorithms by Alfred V. Aho, Jeffrey D. Ullman, and John E. Hopcroft.
3. Problem Solving with Algorithms and Data Structures by Brad Miller and David Ranum.
4. Introduction to Algorithms by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein.
5. Algorithms in C, Parts 1-5 (Bundle): Fundamentals, Data Structures, Sorting, Searching, and Graph Algorithms" by Robert Sedgewick.

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BS 23ACX01 Environmental Science 2 0 0 0

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

Code	Course Outcomes	Mapping with POs PO1	PO12	DoK
23ACX01.1	Gain in-depth knowledge on importance of environment,natural resources utilization and exploitation	3	1	L1, L2, L3
23ACX01.2	Classify the various types of an eco systems and Identify their interconnections	3	1	L1, L2, L3
23ACX01.3	Illustrate the impacts of ever increasing environmental pollution and understand the issues on global environment.	3	1	L1, L2, L3
23ACX01.4	Understand various acts formulated by Govt.of India and apply the knowledge gained in conserving energy and environmental protection	3	1	L1, L2, L3
23ACX01.5	Explain the importance of Environment and human health.	3	1	L1, L2, L3

Unit I: Multidisciplinary Nature of Environmental Studies & Natural Resources **4 hours**

Multidisciplinary Nature of Environmental Studies: – Definition, Scope and Importance – Need for Public Awareness.

Natural Resources : Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. – Energy resources

COs: CO1

Unit II: Ecosystems& Biodiversity and its Conservation : **4 hours**

Ecosystems: Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem:

a. Forest ecosystem.
b. Grassland ecosystem
c. Desert ecosystem.
d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

COs: CO2

Biodiversity and its Conservation : Introduction ,Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-sports of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

Unit III: Environmental Pollution& Solid Waste Management : **4 hours**

Environmental Pollution: Definition, Cause, effects and control measures of :

a. Air Pollution.
b. Water pollution
c. Soil pollution
d. Marine pollution
e. Noise pollution
f. Thermal pollution
g. Nuclear hazards

COs: CO3

Solid Waste Management: Causes, effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

Unit IV: Social Issues and the Environment: **4 hours**

From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies – Wasteland reclamation. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.

COs: CO4

Unit V: Human Population and the Environment: **4 hours**

Population growth, variation among nations. Population explosion – Family Welfare Programmes. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.

Field Work: Visit to a local area to document environmental assets River/forest grassland/hill/mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc..

COs: CO5

Textbooks

1. Textbook of Environmental Studies for Undergraduate Courses ErachBharucha for University Grants Commission, Universities Press.
2. Palaniswamy, “Environmental Studies”, Pearson education
3. S.AzeemUnnisa, “Environmental Studies” Academic Publishing Company
4. K.RaghavanNambiar, “Text book of Environmental Studies for Undergraduate Courses as per UGC model syllabus”, Scitech Publications (India), Pvt. Ltd.

Reference Books

1. Deeksha Dave and E.Sai Baba Reddy, “Textbook of Environmental Science”, Cengage Publications.
2. M.Anji Reddy, “Text book of Environmental Sciences and Technology”, BS Publication.
3. J.P.Sharma, Comprehensive Environmental studies, Laxmi publications.
4. J. Glynn Henry and Gary W. Heinke, “Environmental Sciences and Engineering”, Prentice hall of India Private limited
5. G.R.Chatwal, “A Text Book of Environmental Studies” Himalaya Publishing House
6. Gilbert M. Masters and Wendell P. Ela, “Introduction to Environmental Engineering and Science, Prentice hall of India Private limited.

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Chairman Board of Studies

(EnvironmentalScience)

HS 23HSX04 Managerial Economics and Financial Analysis 2 0 0 2

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

Code	Course Outcomes	Mapping with POs		DoK
		PO11	PO12	
23HSX04.1	Understand the theoretical concepts of managerial economics to make decisions for business problems	2	1	L1,L2
23HSX04.2	Gain adequate theoretical knowledge on production function and cost concepts to perform successful business operations	2	1	L2,L3
23HSX04.3	Understand the types of market structure and pricing strategies	2	1	L1,L2
23HSX04.4	Apply investment decisions and maximize returns to make successful longterm investment decisions.	2	1	L2,L3
23HSX04.5	Analyze accounting concepts and interprete financial strength of business	2	1	L2,L3

1. Weakly Contributing | 2. Moderately Contributing | 3. Strongly Contributing, for the attainment of respective Pos
L1: Remember | L2: Understand | L3: Apply | L4: Analyze | L5: Evaluate | L6: Create. DoK: Depth of Knowledge

Unit I : Introduction to Managerial Economics and Demand Analysis **6 Hours**

Definition of Managerial Economics –Scope of Managerial Economics and its Relationship with other Subjects – Concept of Demand, Types of Demand, Determinants of Demand- Law of Demand and its Limitations- Elasticity of Demand, Types of Elasticity of Demand - Demand Forecasting.

Unit II: Production and Cost Analysis **6 Hours**

Theory of Production: Meaning and Factors of Production, Production Function with One Variable Input (Law of Variable Proportion), With Two Variable Inputs (Law of Returns to Scale) Theory of Cost: Different Cost Concepts and Different Relations between Cost and Output in Short Run and Long Run, Break-Even Point.

Unit III: Business Organisation and Markets **6Hours**

Introduction – Forms of Business Organizations- Sole Proprietary - Partnership - Joint Stock Companies -. Types of Markets Perfect and Imperfect Competition - Features of Perfect Competition Monopoly- Monopolistic Competition–-Price-Outp Determination - Pricing Methods and Strategies

Unit IV: Introduction to Capital Planning **6 Hours**

Cocept of Capital – Types of Capital - Capital Budgeting -: Meaning of Capital-Capitalization-Meaning of Capital Budgeting--Traditional Methods – Pay back period method, accounting rate of return, Modern Methods- net present value , internal rate of return, profitability index.

Unit V : Financial Accounting and Ratio Analysis **6 Hours**

Financial Accounting- Concepts and Conventions – Double Entry System – Preparation of Journal, Ledger and Trial Balance – Preparation of Final Accounts: Trading, Profit and Loss Account and Balance Sheet. Introduction to Financial Analysis - Analysis and Interpretation of Liquidity Ratios, Activity Ratios, Capital structure Ratios , Profitability ratios.

Text Books

1. AppaRao N., Vijay Kumar P., “Managerial Economics and Financial Analysis”, Cengage Publications, New Delhi, 2011
2. Siddiqui S. A. and Siddiqui A. S., “Managerial Economics and Financial Analysis”, New Age International Publishers, 2012
3. Kuberudu B. and Ramana T. V., “Managerial Economics and Financial Analysis”, Himalaya Publishing House, 2014
4. Aryasri A. R., “Managerial Economics and Financial Analysis”, Tata Mcgraw Hill, 2011

Reference Books

1. Maheswari V., "Managerial Economics", Sultan Chand,2014
2. Suma Damodaran, " Managerial Economics", Oxford, 2011
3. Vanitha Agarwal, " Managerial Economics", Pearson Publications, 2011
4. Sanjay Dhameja, "Financial Accounting for Managers", Pearson Publications, 2011
5. Maheswari V., "Financial Accounting", Vikas Publications, 2012
6. Dominick Salvatore,"Managerial Economics: Principles and World Wide Application", 7th Edition, Oxford University Press, 2012

Web References

1. https://btechgeeks.com/mefa-notes/#google_vignette
2. https://www.smartzworld.com/notes/managerial-economics-and-financial-analysis-pdf-notes-mefa
3. https://www.scribd.com/document/259129127/Mefa-course-plan
4. https://www.coursera.org/browse/business/entrepreneurship

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	50	25
L2	35	30
L3	15	45
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. What is Managerial Economics?
2. What is meant by Elasticity of demand? How do you measure it?
3. Define different product curves
4. Define Accounting
5. Define Partnership

L2: Understand

1. Explain the role of a Managerial Economist in a Business firm
2. Explain the concept cross elasticity of demand. Illustrate your answer with suitable examples
3. Explain the formation of a Joint Stock Company
4. Distinguish between a partnership and a joint stock company
5. Explain accounting principles
6. Journalise the following transactions
   2013 Jan 1st ABC Firm commenced business with Rs.40000
   Jan 2nd Deposited into bank Rs.30000
   Jan 3rd Bought goods worth Rs.48000 from Kamala
   Jan 4th Sold goods worth Rs.60000
7. Calculate Net Profit Ration from the following data
   Sales returns Rs.100000 Administration expences Rs.10000
   Gross Profit Rs.40000 Selling expences Rs.10000
   Income from investment Rs.5000 Loss on account of fire Rs.3000

L3: Apply

1. From the following particulars findout
   Selling price Rs.200 per unit
   Variable cost Rs.100 per unit
   Total fixed cost Rs.96000
   i) Break even units and values
   ii) Sales to earn a profit Rs.20000

2. The following are the Ratios related to XYZ Limited company.
   Inventory holding period 2 months
   Gross profit ration 25 %
   Gross profit for the current year announced Rs.200000
   Closing stock is excess of Rs 40000 over opening stock. Findout
   A) Sales
   B) Cost of goods sold
   C) Closing stock
   D) Opening stock

3. A Project cost is Rs.144000. The average annual cash inflows are likely to be Rs.45000 for a period of 5 Years calucalte IRR for the project
4. The cost of project is Rs.50000 The annual cash iunflows for the next 4 years are Rs.25000 what is the PBP for the project
5. A firm is considering two different investment options A & B detailes of both the options are given below (Rs,in Lakhs)

	Investment cost	**Inflow 1**	**Inflow 2**	**Inflow 3**
Option A	(25)	10	10	12
Option B	(40)	15	20	24

6. ARR method (ARR on original investment)
   Inintial investment Rs.1200000

Year	Cashinflows (Rs)	
	Project A	Project B
1	600000	500000
2	500000	300000
3	200000	200000
4	-	300000

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Chairman
Board of Studies (MBA)

ES 23ESX09 Analog Circuits 3 0 0 3

Pre-requisite: Electronic Devices and Circuits

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

Code	Course Outcomes	Mapping with POs				DoK
		PO1	PO2	PO3	PSO1	
23ESX09.1	Analyze diode clipping and clamping circuits. Understand different types of biasing circuits of a transistor.	3	3	2	2	L1, L2, L3
23ESX09.2	Use small signal modeling for transistor circuit analysis and illustrate the operation of feedback amplifiers.	3	3	2	2	L1, L2, L3
23ESX09.3	Understand operation of oscillators, operational amplifiers.	3	3	2	3	L1, L2, L3
23ESX09.4	Analyze the op-amp applications, comparators and wave form generators.	3	3	2	3	L1, L2, L3
23ESX09.5	Use 555 timers in multi-vibrators, Schmitt Trigger and PLL applications and describe the operation of different ADC's and DAC's.	3	3	2	2	L1, L2, L3

Unit I: Diode clipping and clamping circuits **9 hours**

Diode clipping and clamping circuits: Diode Clippers-Positive and Negative clippers, Diode Clampers - Positive and Negative Clampers. Transfer characteristics of clippers and clampers.

DC biasing of BJTs: Load lines, Operating Point, Bias Stability, Collector-to-Base Bias, Self Bias, Stabilization against Variations in VBE and β for the Self-Bias Circuit, Bias Compensation, Thermal Runaway, Thermal Stability. **COs: CO1**

Unit II: Small Signals Modelling of BJT: **9 hours**

Analysis of a Transistor Amplifier Circuit using h-parameters, Simplified CE Hybrid Model, Analysis of CE, CC, CB Configuration using Approximate Model, Frequency Response of CE and CC amplifiers.

Feedback Amplifiers: Classification of Amplifiers, the Feedback Concept, General Characteristics of Negative-Feedback Amplifiers, Effect of Negative Feedback upon Output and Input Resistances, Voltage-Series Feedback, Current-Series Feedback, Current-Shunt Feedback, Voltage-Shunt Feedback. **COs: CO2**

Unit III: Oscillator Circuits **9 hours**

Barkhausen Criterion of oscillation, Oscillator operation, R-C phase shift oscillator, Wien bridge Oscillator, Crystal Oscillator.

Operational Amplifiers: Introduction, Basic information of Op-Amp, Ideal Operational Amplifier, Block Diagram Representation of Typical Op-Amp, OP-Amps Characteristics: Introduction, DC and AC characteristics, 741 op-amp & its features. **COs: CO3**

Unit IV: OP-AMPS Applications **9 hours**

Introduction, Basic Op-Amp Applications, Instrumentation Amplifier, AC Amplifier, V to I and I to V Converter, Sample and Hold Circuit, Log and Antilog Amplifier, Multiplier and Divider, Differentiator, integrator. Comparators and Waveform Generators: Introduction, Comparator, Square Wave Generator, Monostable Multivibrator, Triangular Wave Generator, Sine Wave Generators. **COs: CO4**

Unit V: Timers and Phase Locked Loop **9 hours**

Introduction to 555 timer, functional diagram, Monostable and Astable operations and applications, Schmitt Trigger, PLL block schematic, principles and description of individual blocks, 565 PLL, Applications of VCO (566). Digital to Analog and Analog to Digital Converters: Introduction, basic DAC techniques, weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, A-D Converters – parallel Comparator type ADC, counter type ADC, successive approximation ADC and dual slope ADC, **COs: CO5**

Board of Studies			
Approved in : BoS No.			
Approved in : ACM No.			
Expert talk (To be delivered by SMEs from industries)		COs	POs
1			
2			

DAC and ADC Specifications.

Textbooks

1. Electronic Devices and Circuits- J. Millman, C.Halkias, Tata Mc-Graw Hill, 4th Edition, 2015.
2. Linear Integrated Circuits – D. Roy Choudhury, New Age International (p) Ltd, 5th

Reference Books

1. Electronic Devices and Circuit Theory – Robert L.Boylestad and Lowis Nashelsky, Pearson Edition, 2021
2. Electronic Devices and Circuits–G.K. Mithal, Khanna Publisher, 23rd Edition, 2017.
3. Electronic Devices and Circuits – David Bell, Oxford Publications, 2010.
4. Electronic Principles–Malvino, Albert Paul, and David J. Bates, McGraw-Hill/Higher Education, 9th Edition 2021.
5. Operational Amplifiers and Linear Integrated Circuits– Gayakwad R.A, Pearson,4th edition, 2021.
6. Operational Amplifiers and Linear Integrated Circuits –Sanjay Sharma, Kataria& Sons, 2ndEdition, 2010.rris, Pearson Publications, 2020.
7. Principles of Communication Systems- Taub and Schilling,Tata McGraw Hill, 2007.

Web References

1. https://nptel.ac.in/courses/122106025.
2. https://nptel.ac.in/courses/108102112.

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	20	20
L2	40	40
L3	40	40
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. Define clipper.
2. Classify feedback amplifiers.
3. Define an operational amplifier.
4. Define input offset voltage.
5. Mention the advantages of integrated circuits.

L2: Understand

1. Explain Transistor Amplifier Circuit using h-parameters
2. Explain General Characteristics of Negative-Feedback Amplifiers
3. Explain the following terms in an OP-AMP. 1. Input Bias current 2. Input offset voltage 3. Input offset current.
4. Explain practical integrator circuit using IC 741.

5. Explain pole zero compensation and frequency compensation in op-amp.
6. Explain various DC and AC characteristics of an opamp.

L3: Apply

1. Design a square wave generator of frequency 100 Hz and duty cycle of 75% using 555 timer.
2. Design a wideband reject filter having fh=400 Hz and fl= 2 KHz having a pass band gain as 2.
3. Design a differentiator that differentiate an input signal with fmax=100Hz.
4. With suitable expressions explain about the working of a Weighted resistor D/A converter.
5. Obtain the expressions for successive approximation A/D converter.
6. Draw and explain about the working of a dual slope A/D converter.

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Chairman Board of Studies (ECE)

PC 23EE403 **Induction Motors & Synchronous Machines** **3 0 0 3**

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

Code	Course Outcomes	Mapping with POs			DoK
		PO2	PO3	PSO1	
23EE403.1	Demonstrate performance of three phase induction motors and their characteristics	1	1	3	L1 - L3
23EE403.2	List the different techniques related to speed control and starting of 3-phase induction motor.	1	1	3	L1, L2
23EE403.3	Discuss the operation and design different types of single-phase induction motor	1	3	1	L1, L2
23EE403.4	List the different types of alternators and design alternators based on their performance characteristics	1	3	1	L1 - L3
23EE403.5	Interpret the performance of synchronous motors based on their applications	1	1	2	L1, L2

All the COs are mapped to PO12 as few self-learned topics are inbuilt in syllabus (italic) promoting autonomous learning

Unit I: 3-phase induction motors **9 hours**

Construction of Squirrel cage and Slipring induction motors– production of rotating magnetic field – principle of operation – rotor emf and rotor frequency – rotor current and power factor at standstill and during running conditions– rotor power input, rotor copper loss and mechanical power developed and their inter-relationship – equivalent circuit – phasor diagram. **COs:CO1**

Self-Learning Topic: Power Balance Equation & Numerical

Unit II: Performance of 3-Phase induction motors **9 hours**

Torque equation – expressions for maximum torque and starting torque – torque-slip characteristics – double cage and deep bar rotors –No load, Brake test and Blocked rotor tests –circle diagram for predetermination of performance- methods of starting –starting current and torque calculations -speed control of induction motor with V/f control method, rotor resistance control and rotor emf injection technique –crawling and cogging – induction generator operation- Losses of three phase induction motor **COs:CO2**

Self-Learning Topic: Effect of change in supply voltage on starting torque

Unit III: Single Phase Motors **9 hours**

Single phase induction motors – constructional features – double revolving field theory, Cross field theory – equivalent circuit- starting methods: capacitor start capacitor run, capacitor start induction run, split phase & shaded pole, Universal Motor **COs:CO3**

Self-Learning Topic: Applications & AC series motor

Unit IV: Synchronous Generator **9 hours**

Constructional features of non-salient and salient pole type alternators- armature windings – distributed and concentrated windings – distribution& pitch factors – E.M.F equation –armature reaction – voltage regulation by synchronous impedance method – MMF method and Potier triangle method –two reaction analysis of salient pole machines -methods of synchronization- Slip test – Parallel operation of alternators- Applications of synchronous generator **COs:CO4**

Self-Learning Topic: Effect of change in excitation and mechanical power input

Unit V: Synchronous Motor **9 hours**

Synchronous motor principle and theory of operation – Effect of excitation on current and power factor– synchronous condenser –expression for power developed –hunting and its suppression – methods of starting-comparison of synchronous and induction motor.

Special Electrical Machines Introduction to PMDC Motor, Stepper Motor, Switched Reluctance Motor, Permanent Magnet Brushless DC Motor **COs: CO5**

Self-Learning Topic: Applications of Synchronous Motor

Board of Studies		Electrical and Electronics Engineering Board of Studies	
Approved in : BoS No. VII		July 05, 2024	
Approved in ACM: ACM No. IX			
Expert talk (To be delivered by SMEs from industries)		**COs**	**POs**
1	Working of Induction machines and synchronous machines	23EE403.1 – 23EE403.5	PO2,PO3

Text Books

1. Bhimbra P.S. "Electrical Machines", 4th Edition, Khanna Publishers, 2015.
2. M.G. Say "Performance and analysis of AC machines" , CBS, 2002.

Reference Books

1. Kothari D. P., Nagarth I .J., "Electrical Machines", 4th edition, Mc Graw Hill Publications, 2010 .
2. Guptha J.B., "Theory & Performance of Electrical Machines", 6th Edition, S.K.Kataria & Sons, 2008
3. A.E.Fitzgerald, Charles kingsley, Stephen D.Umans "Electric Machinery", 6th Edition, Tata McGraw- Hill 2013

Web References

1. https://nptel.ac.in/courses/108/105/108105131
2. https://nptel.ac.in/courses/108106072

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	40	40
L2	40	40
L3	20	20
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. State the principle of three phase induction motor
2. Mention the types of speed control methods of three phase induction motor
3. State why the single phase induction motor is not self-starting
4. State the need of parallel operation of synchronous generators

5. Define synchronous condenser

L2: Understand

1. Explain the construction of three phase induction motor
2. Describe the operation of single phase induction motor
3. Explain about double cage rotor in three phase induction motor
4. Explain the starting methods of synchronous motor

L3: Apply

1. Construct the circle diagram of three phase induction motor
2. Calculate equivalent circuit parameters of single phase induction motors
3. Derive the EMF equation for three phase alternators

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Chairman
Board of Studies (EEE)

PC **Control Systems** **3 0 0 3**

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

Code	Course Outcomes	Mapping with POs PO3	PSO1	DoK
23EE404.1	Derive the transfer function of physical systems and determine overall transfer function using block diagram algebra and signal flow graphs.	2	3	L1 – L3
23EE404.2	Obtain the time response of first and second order systems and determine error constants. Analyze the absolute and relative stability of LTI systems using Routh's stability criterion and root locus method.	2	3	L1 – L3
23EE404.3	Analyze the stability of LTI systems using frequency response methods.	2	1	L1 – L4
23EE404.4	Design Lag, Lead, Lag-Lead compensators to improve system performance using Bode Diagrams.	3	1	L1 – L4
23EE404.5	Apply state space analysis concepts to represent physical systems as state models, derive transfer function and determine the response. Understand the concepts of controllability and observability	3	3	L1 – L4

All the COs are mapped to PO12 as few self-learned topics are inbuilt in syllabus (italic) promoting autonomous learning

Unit I: **12 hours**

Mathematical Modelling of Control Systems

Classification of control systems - open loop and closed loop control systems and their differences - Feedback characteristics - transfer function of linear system, differential equations of electrical networks- translational and rotational mechanical systems- block diagram reduction techniques – representation by signal flow graph – reduction using Mason's gain formula. **COs:CO1**

Self-Learning Topic: Effect of feedback on disturbance and Noise

Unit II: **12 hours**

Time Response Analysis

Standard test signals – time response of first and second order systems – time domain specifications - steady state errors and error constants - effects of proportional (P) – proportional integral (PI) - proportional derivative (PD) proportional integral derivative (PID) systems. **COs:CO2**

Stability And Root Locus Technique:

The concept of stability – Routh's stability criterion – limitations of Routh's stability, root locus concept – construction of root loci (simple problems) - Effect of addition of Poles and Zeros to the transfer function.

Self - Learning Topic: Effect of addition of poles and zeroes on root locus

Unit III: Frequency Response Analysis **12 hours**

Introduction to frequency domain specifications – Bode diagrams – transfer function from the Bode diagram – Polar plots, Nyquist stability criterion- stability analysis using Bode plots (phase margin and gain margin). **COs:CO3**

Self - Learning Topic: M & N circles, Nicholas Charts

Unit IV: Classical Control Design Techniques **12 hours**

Lag, lead, lag-lead compensators - physical realization - design of compensators using Bode plots **COs:CO4**

Self - Learning Topic: Pole Zero plots of Lag, lead, lag-lead compensators

Unit V: State Space Analysis of LTI Systems **12 hours**

Concepts of state - state variables and state model - state space representation of transfer function: Controllable Canonical Form - Observable Canonical Form - Diagonal Canonical Form - diagonalization using linear transformation - solving the time invariant state equations State Transition Matrix and its properties- concepts of controllability and observability. **COs: CO5**

Self - Learning Topic: Eigen Vectors and Diagonalization

Board of Studies		Electrical and Electronics Engineering Board of Studies	
Approved in : BoS No. VII		July 05, 2024	
Approved in ACM: ACM No. IX			
Expert talk (To be delivered by SMEs from industries)		**COs**	**POs**
1	Industrial applications of control systems - Temperature control in buildings, Speed of conveyor belts in process plant	23EE404.1, 2EE404.2	PO3
2	Motor Controls in Electric Vehicles	2EE404.2	PO3

Text Books

1. Kotsuhiko Ogata, "Modern Control Engineering", Prentice Hall of India, 5th edition, 2015.
2. Benjamin C.Kuo, "Automatic control systems", Prentice Hall of India, 9th Edition,2014.

Reference Books

1. M.Gopal, "Control Systems principles and design", Tata Mc Graw Hill education Pvt Ltd., 4th Edition, 2020
2. Norman S. Nise,"Control Systems Engineering" by, Wiley Publications, 7th edition, 2021
3. by Manik Dhanesh N, "Control Systems", Cengage publications, 3rd Edition, 2020

Web References

1. https://archive.nptel.ac.in/courses/107/106/107106081/
2. https://archive.nptel.ac.in/courses/108/106/108106098/
3. https://nptelvideos.com/video.php?id=1423&c=14

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	20	20
L2	30	40
L3	50	30
L4	-	10
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

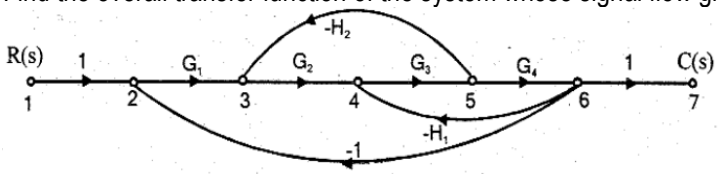
1. Write the expression for Mason's gain formula?
2. What are the standard test signals used in control systems
3. Discuss the limitations of root locus plot?
4. What is a Phase Lead compensator and why is it used?

L2: Understand

1. Describe the construction of synchro transmitter with neat diagram.
2. Explain in detail about any two practical examples on open loop and closed loop control systems? And list out its merits and demerits?
3. Explain in detail about the steady state errors and error constants?
4. How RH Stability Criterion Can Be Used to Study the Relative Stability?

L3: Apply

1. Find the overall transfer function of the system whose signal flow graph is shown in figure



2. Examine stability of the following system given by $S^4 + 3S^3 + 3S^2 + 2S + 1$ using Routh-Hurwitz stability criterion
3. Draw the Nyquist plot for the system whose open loop transfer function is $G(S)H(S) = \frac{(1+4s)}{S^2(1+S)(1+2S)}$.

   Determine the stability of a closed loop system. If the closed loop system is not stable then find the number of closed loop poles lying on the right half of S-plane.

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Board of Studies (EEE)

PC **23EE405 Power Systems - I** **3 0 0 3**

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

Code	Course Outcomes	Mapping with POs PO1	PO2	PO7	DoK
23EE405.1	Understand the different types of power plants, operation of power plants	2	2	2	L2
23EE405.2	Explain the concepts of distribution systems, underground cables, economic aspects and tariff	2	2	2	L2
23EE405.3	Interpret various substations that are located in distribution systems	2	2	2	L2
23EE405.4	Apply the above concepts to illustrate different power generation layouts	2	2	2	L3
23EE405.5	Understand various economic aspects related to power generation and distribution	2	2	2	L2

All the COs are mapped to PO12 as few self-learned topics are inbuilt in syllabus (italic) promoting autonomous learning

Unit I: Hydroelectric Power Stations **9 hours**

Selection of site, general layout of a hydroelectric power plant with brief description of major components and principle of operation

Thermal Power Stations:

Selection of site, general layout of a thermal power plant. Brief description of components: boilers, Feed water circuit, types of turbines: Kaplan and Francis turbine super heaters, economizers and electrostatic precipitators, Steam turbine: impulse and reaction turbines, condensers **COs:CO1**

Self-Learning Topics: cooling towers and chimney.

Unit II: Nuclear Power Stations: **9 hours**

Location of nuclear power plant, working principle, nuclear fission, nuclear fuels, nuclear chain reaction, nuclear reactor components: moderators, control rods, reflectors and coolants, types of nuclear reactors and brief description of PWR, BWR and FBR. **COs:CO2**

Self-Learning Topics: radiation hazards and shielding, nuclear waste disposal.

Unit III: Substations: **9 hours**

Air Insulated Substations – indoor & outdoor substations, substations layouts of 33/11 kV showing the location of all the substation equipment. Bus bar arrangements in the sub-stations: simple arrangements like single bus bar, sectionalized single bus bar, double bus bar with one and two circuit breakers, main and transfer bus bar system with relevant diagrams. **COs:CO3**

Gas Insulated Substations (GIS) – advantages of gas insulated substations, constructional aspects of GIS, comparison of air insulated substations and gas insulated substations

Self-Learning Topics :Difference between Air insulated substations and Gas insulated substations

Unit IV: Distribution Systems: **9 hours**

Classification of Distribution systems, A.C Distribution, Overhead versus Underground system, Connection schemes of Distribution system, Requirements of Distribution system, Design considerations in Distribution system. **COs:CO4**

Underground Cables:

Types of cables, construction, types of insulating materials, calculation of insulation resistance, stress in insulation and power factor of cable. Capacitance of single and 3-Core belted Cables.

Self-Learning Topics: Grading of cables: capacitance grading and inter sheath grading.

UNIT V **9 hours**

Economic Aspects & Tariff:

Economic Aspects – load curve, load duration and integrated load duration curves, discussion on economic aspects: connected load, maximum demand, demand factor, load factor, diversity factor, plant capacity factor and plant use factor, base and peak load plants.

Tariff Methods– Costs of generation and their division into fixed, semi-fixed and running costs, desirable characteristics of a tariff method, tariff methods: simple rate, flat rate, block-rate, two-part, three–part, and power factor tariff methods. **COs: CO5**

Self-Learning Topics: Time of Day (ToD) tariff and Time of Use (ToU) tariff.

Board of Studies		Electrical and Electronics Engineering Board of Studies	
Approved in : BoS No. VII		July 05, 2024	
Approved in ACM: ACM No. IX			
Expert talk (To be delivered by SMEs from industries)		COs	POs
1	Gas Insulated Substations	20EE403.3	2,7
2	Bus bar arrangements	20EE403.3	2,7

Textbooks:

S. N. Singh, Electric Power Generation, Transmission and Distribution, PHI Learning Pvt Ltd, New Delhi, 2nd Edition, 2010

J. B. Gupta, Transmission and Distribution of Electrical Power, S. K. Kataria and sons,10th Edition, 2012

Reference Books:

I. J. Nagarath & D.P. Kothari, Power System Engineering, McGraw-Hill Education, 3rd Edition, 2019.

C. L. Wadhwa, Generation, Distribution and Utilization of Electrical Energy, New Age International Publishers, 6th Edition, 2018.

2. V. K. Mehta and Rohit Mehta, Principles of Power System, S. Chand, 4th Edition, 2005. Turan Gonen, Electric Power Distribution System Engineering, McGraw-Hill, 1985. Handbook of switchgear, BHEL, McGraw-Hill Education, 2007.

Web References

1. https://nptel.ac.in/courses/108102047

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	40	40
L2	90	40
L3	10	20
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. Differentiate renewable and non-renewable sources
2. Define Tariff
3. Define nuclear fission

L2: Understand

1. Explain the brief layout of nuclear power plant
2. Explain the calculation of two part tariff
3. Explain main and transfer bus bar system with relevant diagrams

L3: Apply

1. Apply the Connection schemes of Distribution system
2. Apply the Capacitance grading of single and 3-Core belted Cables**.**

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PC **23EE406 Control Systems Lab** **0 0 3 1.5**

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

Code	Course Outcomes	Mapping with POs PO4	PSO1
23EE406.1	Analyze the performance of first, second order system, Synchros, AC, DC Servo motors and potentiometer as error detector	3	2
23EE406.2	Demonstrate the magnitude and phase plot of Lead – lag compensation system and stability analysis of Linear Time Invariant system using various techniques	3	2
23EE406.3	Determine the transfer function of DC machine, linear system analysis, state space model and transfer function of DC machine	3	2
23EE406.4	Analyse controllability and observability of a system and sate space model for transfer function	3	2
23EE406.5	Analyse the effect of P, PD, PI, PID controller on a second order system	3	2

All the COs are mapped to PO12

List of Experiments

1. Analysis of second order system in time domain (For Step, Ramp Inputs) **COs:CO1**
2. Analysis of First order system in time domain (For Step, Ramp Inputs) **COs:CO1**
3. Characteristics of Synchros **COs:CO1**
4. Characteristics of AC Servo Motor **COs:CO1**
5. Characteristics of DC Servo Motor **COs:CO1**
6. Lead Compensation – Magnitude and Phase Plot **COs:CO2**
7. Lag Compensation – Magnitude and Phase Plot **COs:CO2**
8. Stability analysis of Linear Time Invariant system using Root Locus Technique (MATLAB) **COs:CO2**
9. Stability analysis of Linear Time Invariant system using Bode Plot Technique (MATLAB) **COs:CO2**
10. Stability analysis of Linear Time Invariant system using Nyquist Plot Technique (MATLAB) **COs:CO2**
11. Transfer Function of DC machine using MATLAB **COs:CO3**
12. Kalman's test of Controllability and Observability using MATLAB **COs:CO4**
13. Potentiometer as an error detector **COs:CO1**
14. State space model for classical transfer function using MATLAB **COs:CO4**
15. Determination of controllability and Observability of system using MATLAB **COs:CO4**
16. Effect of P, PD, PI, PID Controller on a second order system **COs:CO5**

Web References

1. https://asnm-iitkgp.vlabs.ac.in/List%20of%20experiments.html
2. https://vlab.amrita.edu/?sub=1&brch=75

References

1. Lab Manual for "Control Systems Lab", Department of Electrical and Electronics Engineering, NSRIT.

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PC **23EE407 Induction Motors & Synchronous Machines Lab** **0 0 3 1.5**

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

Code	Course Outcomes	Mapping with POs PO4
23EE407.1	Analyze various performance characteristics of 3-phase and 1-phase induction motors	3
23EE407.2	Evaluate the performance of 3-phase Induction Motor by obtaining the circle diagram and equivalent circuit of 3-phase Induction Motor and single phase induction motor	3
23EE407.3	Adapt the power factor improvement methods for single phase Induction Motor	3
23EE407.4	Pre-determine the regulation of 3-phase alternator	3
23EE407.5	Determine the synchronous machine reactance of 3-phase alternator.	3

List of Experiments

1.	Brake test on three phase Induction Motor	COs:CO1
2.	Circle diagram of three phase induction motor.	COs:CO1
3.	Speed control of three phase induction motor by V/f method.	COs:CO1
4.	Equivalent circuit of single-phase induction motor.	COs:CO2
5.	Power factor improvement of single-phase induction motor by using capacitors.	COs:CO2
6.	Load test on single phase induction motor	COs:CO3
7.	Regulation of a three -phase alternator by synchronous impedance	COs:CO4
8.	Regulation of a three -phase alternator by MMF Method	COs:CO4
9.	Regulation of three-phase alternator by Potier triangle method	COs:CO4
10.	V and Inverted V curves of a three-phase synchronous motor.	COs:CO5
11.	Determination of Xd, Xq & Regulation of a salient pole synchronous generator	COs:CO5
12.	Determination of efficiency of three phase alternator by loading with three phase induction motor	COs:CO4
13.	Parallel operation of three-phase alternator under no-load and load conditions.	COs:CO4

Web references

1. https://asnm-iitkgp.vlabs.ac.in/List%20of%20experiments.html
2. https://vlab.amrita.edu/?sub=1&brch=75

References

1. Lab Manual for “Induction Motors & Synchronous Machines Lab”, Department of Electrical and Electro Engineering, NSRIT
2. https://em-coep.vlabs.ac.in/List%20of%20experiments.html

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HS 23ESX08 Design Thinking & Innovations 3 0 0 3

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

Code	Course Outcomes	DoK PO1	DoK PO2	DoK
23ESX08.1	Explain the fundamentals of Design Thinking and innovation .	3	2	L1 – L4
23ESX08.2	Emphatize and Analyze the model action plan in implementing the process in driving innovations	3	2	L1 – L4
23ESX08.3	Evaluate the value of creativity & Analyse to work in a multidisciplinary environment	3	2	L1 - L4
23ESX08.4	Describe the principles of innovation and idea generation in product design	3	2	L1 – L4
23ESX08.5	Formulate specific problem statements of real time issues	3	3	L1 – L4

All the COs are mapped to PO12 as few self-learned topics are inbuilt in syllabus (italic) promoting autonomous learning

Unit I: Introduction to Design Thinking **9 Hours**

Introduction to elements and principles of Design, basics of design-dot, line, shape, form as fundamental design components. Principles of design. Introduction to design thinking, history of Design Thinking, New materials in Industry **COs: CO1**

Self learning topic

Unit II: Design Thinking Process **9 Hours**

Design thinking process (empathize, analyze, idea & prototype), implementing the process in driving inventions, design thinking in social innovations. Tools of design thinking - person, costumer, journey map, brainstorming, product development

Activity: Every student presents their idea in three minutes, Every student can present design process in the form of flow diagram or flow chart etc. Every student should explain about product development. **COs: CO2**

Self Learning Topic:

Unit III: Innovation **9 Hours**

Art of innovation, Difference between innovation and creativity, role of creativity and innovation in organizations- Creativity to Innovation- Teams for innovation- Measuring the impact and value of creativity.

Activity: Debate on innovation and creativity, Flow and planning from idea to innovation, Debate on value-based innovation. **COs: CO3**

Self Learning Topic

Unit IV: Product Design **9 Hours**

Problem formation, introduction to product design, Product strategies, Product value, Product planning, product specifications- Innovation towards product design- Case studies

Activity: Importance of modelling, how to set specifications, Explaining their own product design. **COs: CO4**

Self Learning Topic:

Unit V: Design Thinking in Business Processes **9 Hours**

Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs- Design thinking for Startups- Defining and testing Business Models and Business Cases- Developing & testing prototypes. **COs: CO5**

Activity: How to market our own product, About maintenance, Reliability and plan for startup

Self Learning

Board of Studies		Basic Science & Humanities (Mathematics)	
Approved in : BoS No.		IV	
Approved in : ACM No.		IX	
Expert talk (To be delivered by SMEs from industries)		**COs**	**POs**
1	Design Thinking-Overview	CO1-CO5	PO2, PO3
2	Success Stories of Companies benefited from Design Innovations	CO5	PO2, PO3

Textbooks:

1. Tim Brown,Change by design, Harper Bollins (2009)
2. Idris Mootee, Design Thinking for Strategic Innovation, 2013, John Wiley & Sons.

Reference Books:

1. David Lee, Design Thinking in the Classroom, Ulysses press
2. Shrutin N Shetty, Design the Future, Norton Press
3. William Lidwell,Universal Principles of Design- Kritinaholden, Jill Butter.
4. Chesbrough.H, The Era of Open Innovation – 2013

Online Learning Resources:

https://nptel.ac.in/courses/110/106/110106124/
https://nptel.ac.in/courses/109/104/109104109/
https://swayam.gov.in/nd1_noc19_mg60/preview

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	15	15
L2	55	55
L3	20	20
L4	10	10
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. What do you mean by Design Thinking?
2. What are the tools of design Thinknig?
3. What are the new materials in the industry?

L2: Understand

1. Explain the elements of Design
2. Differentiate between innovation and creativity
3. Why new materials are important for industry?

L3: Apply

1. How design thinking helped financial sector to gain the customer trust?
2. Explain the method of implementing Design thinking process driving inventions

3. What are some contemporary examples of design thinking in action.

L4: Analyze

1. How can organizations capture and evaluate the value of creativity in their design innovations?
2. Evaluate the impact and value of creativityin the context of design innovations?

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SOC **23DSS01 Python Programming** **0 1 2 2.0**

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

Code	Course Outcomes	Mapping with POs / PSOs					
		PO1	PO2	PO3	PO5	PSO1	PSO2
23DSS01.1	Illustrate the use of basic concepts and control structures of python programming	3	3	2	1	2	1
23DSS01.2	Apply python programming concepts like functions, strings to solve a variety of computational problems	3	3	2	1	2	1
23DSS01.3	Exhibit competence in implementing and manipulating fundamental data structures such as lists, tuples, sets, dictionaries	3	3	2	1	2	1
23DSS01.4	understand the principles of object-oriented programming (OOP) in Python, including classes, Objects, inheritance, polymorphism, and encapsulation, and apply them to design and implement Python programs	3	3	2	1	2	1
23DSS01.5	Become proficient in using commonly used Python libraries such as JSON, NumPy, pandas	3	3	2	1	2	1

Unit-I:

History of Python Programming Language, Thrust Areas of Python, Installing Anaconda Python Distribution, Installing and Using Jupyter Notebook.

Parts of Python Programming Language: Identifiers, Keywords, Statements and Expressions, Variables, Operators, Precedence and Associativity, Data Types, Indentation, Comments, Reading Input, Print Output, Type Conversions, the type () Function and Is Operator, Dynamic and Strongly Typed Language.

Control Flow Statements: if statement, if-else statement, if...elif…else, Nested if statement, while Loop, for Loop, continue and break Statements.

Sample Programs:

1. Write a program to find the largest element among three Numbers.
2. Write a program to swap two numbers without using a temporary variable.
3. Demonstrate the following Operators in Python with suitable examples.
   i) Arithmetic Operators ii) Relational Operators iii) Assignment Operators iv) Logical Operators v) Bit wise Operators vi) Ternary Operator vii) Membership Operators viii) Identity Operators
4. Write a program to add and multiply complex numbers
5. Write a program to print multiplication table of a given number.
6. Write a Program to display all prime numbers within an interval

Unit-II:

Functions: Built-In Functions, Commonly Used Modules, Function Definition and Calling the function, return Statement and void Function, Scope and Lifetime of Variables, Default Parameters, Keyword Arguments, *args and **kwargs, Command Line Arguments.

Strings: Creating and Storing Strings, Basic String Operations, Accessing Characters in String by Index Number, String Slicing and Joining, String Methods, Formatting Strings.

Lists: Creating Lists, Basic List Operations, Indexing and Slicing in Lists, Built-In Functions Used on Lists, List Methods, del Statement.

Sample Programs:

7. Write a program to define a function with multiple return values.
8. Write a program to define a function using default arguments.
9. Write a program to find the length of the string without using any library functions.
10. Write a program to check if the substring is present in a given string or not.
11. Write a program to count the number of vowels in a string (No control flow allowed).
12. Write a program to create, display, append, insert and reverse the order of the items in the array.
13. Write a program to add, transpose and multiply two matrices.
14. Write a program to perform the given operations on a list:
    i. Addition ii. insertion iii. slicing
15. Write a program to perform any 5 built-in functions by taking any list.

Unit-III:

Dictionaries: Creating Dictionary, Accessing and Modifying key:value Pairs in Dictionaries, Built-In Functions Used on Dictionaries, Dictionary Methods, del Statement.

Tuples and Sets: Creating Tuples, Basic Tuple Operations, tuple() Function, Indexing and Slicing in Tuples, Built-In Functions Used on Tuples, Relation between Tuples and Lists, Relation between Tuples and Dictionaries, Using zip() Function, Sets, Set Methods, Frozenset.

Sample Programs:

16. Write a program to create tuples (name, age, address, college) for at least two members and concatenate the tuples and print the concatenated tuples.
17. Write a program to check if a given key exists in a dictionary or not.
18. Write a program to add a new key-value pair to an existing dictionary.
19. Write a program to sum all the items in a given dictionary.

Unit-IV:

Files: Types of Files, Creating File, Reading and Writing Data, Reading and Writing Binary Files, Pickle Module, Reading and Writing CSV Files, Python os and os.path Modules.

Object-Oriented Programming: Classes and Objects, Creating Classes in Python, Creating Objects in Python, Constructor Method, Classes with Multiple Objects, Class Attributes Vs Data Attributes, Encapsulation, Inheritance, Polymorphism, Catching Exceptions Using try and except Statement.

Sample Programs:

20. Write a program to sort words in a file and put them in another file. The output file should have only lower-case words, so any upper-case words from source must be lowered.
21. Python program to print each line of a file in reverse order.
22. Python program to compute the number of characters, words and lines in a file.
23. Write a Python program to create a class that represents a shape. Include methods to calculate its area and Perimeter. Implement subclasses for different shapes like circle, triangle, and square.

Unit-V:

GUI Library: tkinter
Mathematical Libraries: JSON, NumPy, Pandas, Matplotlib

Sample Programs:

24. Python program to check whether a JSON string contains complex object or not.
25. Python Program to demonstrate NumPy arrays creation using array () function.
26. Python program to demonstrate use of ndim, shape, size, dtype.
27. Python program to demonstrate basic slicing, integer and Boolean indexing.
28. Python program to find min, max, sum, cumulative sum of array
29. Create a dictionary with at least five keys and each key represent value as a list where this list contains at least ten values and convert this dictionary as a pandas data frame and explore the data through the data frame as follows:
    a) Apply head () function to the pandas data frame
    b) Perform various data selection operations on Data Frame
30. Select any two columns from the above data frame, and observe the change in one attribute with respect to other attribute with scatter and plot operations in matplotlib

References

1. Gowri shankar S, Veena A., Introduction to Python Programming, CRC Press.
2. Python Programming, S Sridhar, J Indumathi, V M Hariharan, 2nd Edition, Pearson, 2024
3. Introduction to Programming Using Python, Y. Daniel Liang, Pearson.

Online Learning Resources/Virtual Labs:

1. https://www.coursera.org/learn/python-for-applied-data-science-ai
2. https://www.coursera.org/learn/python?specialization=python#syllabus

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HO 23EEH01 SMART GRID 4 0 0 4

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

Code	Course Outcomes	Mapping with PO's			DoK
		PO1	PO2	PO3	
23EEH01.1	Get acquainted with different smart devices and smart meters	3	1	2	L1-L2
20EE H01.2	Describe how modern power distribution system functions	3	1	2	L1-L2
20EE H01.3	Identify suitable communication networks for Smart Grid applications	3	1	2	L1-L2
20EE H01.4	Identify suitable smart meters for Smart Grid applications	3	1	2	L1-L2
20EE H01.5	Describe basics of Communication Networks & IOT	3	1	2	L1-L2
1. Weakly Contributing | 2. Moderately Contributing | 3. Strongly Contributing, for the attainment of respective Pos					
L1: Remember | L2: Understand | L3: Apply | L4: Analyze | L5: Evaluate | L6: Create, DoK: Depth of Knowledge					

Unit I: Introduction to Smart Grid **12 Hours**

Introduction - Evolution of Electric Grid, Smart Grid Concept - Definitions and Need for Smart Grid – Functions – Opportunities – Benefits and challenges, Technology Drivers

Cos: CO1

Self Learning Topic : Difference between conventional & Smart Grid

Unit II: Energy Management System **12 Hours**

Energy Management System (EMS) - Smart substations - Substation Automation - Feeder Automation, SCADA – Remote Terminal Unit – Protocols, Phasor Measurement Unit – Wide area monitoring protection and control, Smart integration of energy resources – Renewable, intermittent power sources – Energy Storage.

Cos: CO1

Self Learning Topic: Intelligent Electronic Devices

Unit III: Distribution Management System **12 Hours**

Distribution Management System (DMS) – Volt / VAR control – Fault Detection, Isolation and Service Restoration, Network Reconfiguration, Outage management System, Geographical Information System, Effect of Plug in Hybrid Electric Vehicles.

Cos: CO1

Self Learning Topic: Customer Information System

Unit IV: SMART METERS **12 Hours**

Introduction to Smart Meters – Advanced Metering infrastructure (AMI), AMI protocols – Standards and initiatives, Demand side management and demand response programs, Demand pricing and Time of Use,

Cos: CO1

Self Learning Topic : Real Time Pricing, Peak Time Pricing

Unit V: Communication Networks & IOT **12 Hours**

Elements of communication and networking – architectures, standards, PLC, Zigbee, GSM, BPL, Local Area Network (LAN) - House Area Network (HAN) - Wide Area Network (WAN) - Broadband over Power line (BPL) - IP based Protocols - Basics of Web Service and CLOUD Computing

Cos: CO1

Self Learning Topic : Cyber Security for Smart Grid.

Textbooks:

1. Stuart Borlase, “Smart Grid: Infrastructure”, Technology and Solutions, CRC Press 2012.
2. Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, “Smart Grid: Technology and Applications”, Wiley, 2012.

Reference Books:

1. Mini S. Thomas, John D McDonald, “Power System SCADA and Smart Grids”, CRC Press, 2015
2. Kenneth C. Budka, Jayant G. Deshpande, Marina Thottan, “Communication Networks for Smart Grids”, Springer, 2014.

Web References:

1. https://nptel.ac.in/courses/108/107/108107113/

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	50	50
L2	50	50
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. Define smart grid concept and explain its necessity.
2. Compare micro grid and smart grid.
3. Compare conventional metering and smart metering.

L2: Understand

1. Explain IED application for monitoring and protection.
2. Explain how the automatic meter reading can make the system smarter.
3. Explain the smart substation.

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HO 23EEH02 Advanced Smart Power Grids 4 0 0 4.0

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

Code	Course Outcomes	Mapping with PO's		DoK
		PO 2	PSO 1	
23EEH02.1	Understand smart grids and analyze the smart grid policies and developments in smart grids.	2	2	L1 - L2
23EEH02.2	Understand the concepts of smart grid technologies in hybrid electrical vehicles	2	2	L1 - L2
23EEH02.3	Analyze smart substations, feeder automation, GIS.	3	2	L1 - L3
23EEH02.4	Explain micro grids and distributed generation systems	2	2	L1 - L2
23EEH02.5	Understand the effect of power quality in smart grid	3	2	L1 - L2
1. Weakly Contributing | 2. Moderately Contributing | 3. Strongly Contributing, for the attainment of respective Pos				
L1: Remember | L2: Understand | L3: Apply | L4: Analyze | L5: Evaluate | L6: Create, DoK:Depth of Knowledge				

Unit I: Introduction to Smart Grid — 12 Hours

Evolution of Electric Grid, Concept of Smart Grid, Definitions, Need of Smart Grid, Functions of Smart Grid, Opportunities & Barriers of Smart Grid, Difference between conventional & smart grid, Concept of Resilient &Self-Healing Grid.

CO's:CO1

Self learning topics: *Present development & International policies on Smart Grid*

Unit II: Smart Grid Technologies Part 1 — 12 Hours

Introduction to Smart Meters, Real Time Prizing, Smart Appliances, Automatic Meter Reading(AMR), Outage Management System(OMS), Plug in Hybrid Electric Vehicles(PHEV), Vehicle to Grid, Smart Sensors,

CO's:CO2

Self learning topics: *Home & Building Automation, Phase Shifting Transformers*

Unit III: Smart Grid Technologies Part 2 — 12 Hours

Smart Substations, Substation Automation, Feeder Automation. Geographic Information System(GIS), Intelligent Electronic Devices(IED) & their application for monitoring & protection, Smart storage like Battery, SMES, Pumped Hydro,
Compressed Air Energy Storage.

CO's:CO3

Self learning topics: *Wide Area Measurement System(WAMS), Phase Measurement Unit(PMU).*

Unit IV: Micro grids and Distributed Energy Resources — 12Hours

Concept of micro grid, need & applications of microgrid, formation of microgrid, Issues of interconnection, protection control of microgrid. Plastic & Organic solar cells, Thin film solar cells, Variable speed wind generators, fuel cells, microturbines.

CO's:CO4

Self learning topics: *Captive power plants, Integration of renewable energy sources*

Unit V: Power Quality Management in Smart Grid: **12Hours**

Power Quality & EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, Web based Power Quality monitoring, Power Quality Audit.

Information and Communication Technology for Smart Grid: Advanced Metering Infrastructure (AMI), Home Area Network (HAN), Neighborhood Area Network (NAN). **CO's:CO5**

Self learning topics: *Wide Area Network (WAN).*

Text Books

1. Ali Keyhani, Mohammad N. Marwali, Min Dai "Integration of Green and Renewable Energy in Electric Power Systems", Wiley
2. Clark W. Gellings, "The Smart Grid: Enabling Energy Efficiency and DemandResponse", CRC Press
3. Peter S. Fox Penner, "Smart Power: Climate Changes, the Smart Grid, and the Future of Electric Utilities", Island Press; 1 edition 8 Jun 2010

Reference Books

1. JanakaEkanayake, Nick Jenkins, KithsiriLiyanage, Jianzhong Wu, Akihiko Yokoyama, "Smart Grid: Technology and Applications", Wiley
2. Jean Claude Sabonnadière, NouredineHadjsaïd, "Smart Grids", Wiley Blackwell 19
3. S. Chowdhury, S. P. Chowdhury, P. Crossley, "Microgrids and Active Distribution Networks." Institution of Engineering and Technology, 30 Jun 2009
4. Stuart Borlase, "Smart Grids (Power Engineering)", CRC Press
5. Andres Carvallo, John Cooper, "The Advanced Smart Grid: Edge Power Driving

Web References

1. https://www.google.com/aclk?sa=l&ai=DChcSEwi965uQ7-r1AhXEwJYKHYCJDkQYABAAGgJ0bA&ae=2&sig=AOD64_0RNc3a64DXk7r07Vbp47On1IZgCA&q&nis=1&adurl&ved=2ahUKEwjA7pKQ7-r1AhWgslYBHUwNCqAQ0Qx6BAgDEAM
2. https://www.smartgrid.gov/the_smart_grid/smart_grid.html
3. https://nptel.ac.in/courses/108/107/108107113/

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	40	40
L2	50	50
L3	10	10
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. Define smart grid concept
2. Compare micro grid and smart grid.
3. State the issues of interconnecting the micro grid with the utility grid.
4. What is power quality control technologies?
5. How the power quality can be improved in smart grid

L2: Understand

1. Explain the role of HAN in smart grid
2. Draw the flow chart of procedure for monitoring power quality and issues of power quality monitoring

3. Explain Bluetooth, Wi-Fi and GPS
4. Explain Wi-Max based communication and wireless mesh network.

L3: Apply

1. Explain the power quality issues in power grid related to renewable energy sources
2. Describe the significance of electromagnetic compatability in power system with power grid

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HO 23EEH03 Electric Power Quality 4 0 0 4

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

Code	Course Outcomes	Mapping with Po's			DoK
		PO1	PO6	PSO1	
23EEH03.1	Differentiate different types of power quality problems.	3	2	1	L1-L2
23EEH03.2	Explain the sources of voltage sag, voltage swell, interruptions, transients, long duration over voltages in a power system.	3	2	1	L1-L2
23EEH03.3	Explain the principle of voltage regulation and power factor improvement methods.	3	2	1	L1-L3
23EEH03.4	Explain the harmonics in a power system.	3	2	1	L1-L2
23EEH03.5	Explain the relationship between distributed generation and power quality.	3	2	1	L1-L2

1. Weakly Contributing | 2. Moderately Contributing | 3. Strongly Contributing, for the attainment of respective Pos
L1: Remember | L2: Understand | L3: Apply | L4: Analyze | L5: Evaluate | L6: Create, DoK: Depth of Knowledge

Unit I: Introduction **12 Hours**

Overview of power quality – Concern about the power quality – General classes of power quality and voltage quality problems – Transients – Long–duration voltage variations –Short–duration voltage variations – Voltage unbalance – Waveform distortion – Voltage fluctuation – Power frequency variations.

CO's:CO1

Self learning topics : *Understanding of transmission lines, Different types of losses and conditions*

Unit II: Voltage imperfections in power systems **12 Hours**

Power quality terms – Voltage sags – Voltage swells and interruptions – Sources of voltage sag, swell and interruptions – Nonlinear loads – IEEE and IEC standards. Source of transient over voltages – Principles of over voltage protection – Devices for over voltage protection – Utility capacitor switching transients.

CO's:CO2

Self learning topics : *Causes and Effects of Transient Voltages*

Unit III: Voltage Regulation and power factor improvement **12 Hours**

Principles of regulating the voltage – Device for voltage regulation – Utility voltage regulator application – Capacitor for voltage regulation – End–user capacitor application – Regulating utility voltage with distributed resources – Flicker – Power factor penalty – Static VAR compensations for power factor improvement.

CO's:CO3

Self learning topics : *Capacitor Banks, Synchronous Condenser, Phase Advancers.*

Unit IV: Harmonic distortion and solutions **12 Hours**

Voltage distortion vs. Current distortion – Harmonics vs. Transients – Harmonic indices – Sources of harmonics – Effect of harmonic distortion – Impact of capacitors, transformers, motors and meters – Point of common coupling – Passive and active filtering – Numerical problems

CO's:CO4

Self learning topics : *The Effects of Harmonics on Power Quality and Energy Efficiency*

Unit V: Distributed Generation, Power Quality and Monitoring **12 Hours**

Resurgence of distributed generation – DG technologies – Interface to the utility system – Power quality issues and operating conflicts – DG on low voltage distribution networks. Power quality monitoring and considerations – Historical perspective of PQ measuring instruments – PQ measurement equipment – Assessment of PQ measuring data – Application of intelligent systems – PQ monitoring standards.

CO's:CO5

Self learning topics : *various real time monitoring of power quality*

Textbooks

1. Dugan R.C., McGranaghan M.F., Santoso S., and Beaty H.W., "Electrical Power Systems Quality", Second Edition, McGraw–Hill, 2012, 3rd edition.
2. Bollen M.H.J., "Electric power quality problems", IEEE series-Wiley India publications,2011.

Reference Books

1. Primer, Kennedy B.W., "Power Quality", First Edition, McGraw–Hill, 2000.
2. Bollen M.H.J., "Understanding Power Quality Problems: Voltage Sags and Interruptions", First Edition, IEEE Press; 2000.
3. Arrillaga J. and Watson N.R., "Power System Harmonics", Second Edition, John Wiley & Sons, 2003.
4. Kazibwe W.E. and Sendaula M.H., Van Nostrad Reinhold, "Electric Power Quality control Techniques", New York.

Web References

1. http://www.gcebargur.ac.in/sites/gcebargur.ac.in/files/lectures_desk/electrical_power_system s_quality.pdf
2. http://nptel.ac.in/courses/108106025/Power%20quality_in_power_distribution_systems.pdf
3. https://www.accessengineeringlibrary.com/browse/power-quality-in-electrical-systems#

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	40	40
L2	40	40
L3	20	20
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. What are the causes for interruptions?
2. Write the remedies to improve power quality?
3. Distinguish power quality and voltage quality
4. Write different types of DG technologies
5. Write standards of power quality monitoring
6. Write different types of non linear loads

L2: Understand

1. Explain different types of transients
2. Explain about various solutions for over voltage protection
3. Explain about long duration and short duration voltage variations

L3: Apply

1. Draw block diagram of advanced power quality monitoring systems and explain
2. Explain impact of DG on low voltage distribution networks
3. Explain Static VAR compensation for power factor improvement

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MI **23EEO01 Basics of DC Machines** **3 0 0 3**

Version 01.00

Pre-requisite: Basic Electrical and Electronics Engineering

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

Code	Course Outcomes	Mapping with POs PO1	PO2	DoK
23EEO01.1	Classify various types of DC machines	2	1	L1 – L2
23EEO01.2	Explain operation of DC machines	2	1	L1 – L2
23EEO01.3	Summarize the characteristics of DC motor	2	1	L1 – L2
23EEO01.4	Summarize the characteristics of DC generator	2	1	L1 – L2
23EEO01.5	Understand various testing methodologies of DC Machine	2	1	L1 – L2

All the COs are by default mapped to PO12 as few topics are inbuilt in syllabus promoting autonomous learning

Unit I: Introduction to DC Machines **9 hours**

Overview of electrical machines and their classification, Basic principles of electromagnetism and magnetic circuits, Constructional features of DC machines: parts and their functions, Working principle of a DC machine and basic operation

COs: CO1

generation of electromotive force (EMF)

Unit II: DC Machine Fundamentals **9 hours**

Understanding the working of DC generators and DC motors, Types of DC generators: series, shunt, and compound generators, Types of DC motors: series, shunt, and compound motors and Operating characteristics

COs: CO2

differences between generators and motors

Unit III: DC Generator Operation and Characteristics **9 hours**

Armature reaction and its effects in DC generators, Voltage regulation in DC generators: methods and significance, Open circuit and short circuit characteristics of DC generators,

COs: CO3

Analysis of load conditions and their impact on generator performance

Unit IV: DC Motor Operation and Characteristics **9 hours**

Torque production and speed control in DC motors, Armature reaction in DC motors: compensating windings and methods to reduce effects, Starting methods for DC motors: series, shunt, and compound starters, Speed control techniques: armature control, field control, and

COs: CO4

Combined speed control methods

Unit V: DC Machine Testing and Maintenance **9 hours**

Testing procedures for DC machines: no-load test, load test, and efficiency calculation, Faults and troubleshooting in DC machines: common issues and remedies, Preventive maintenance practices for ensuring optimal performance: advancements and future prospects

COs: CO5

Emerging trends in DC machine technology

Text Books

1. Bhimbra P.S. "Electrical Machines", 4th Edition, Khanna Publishers, 2015
2. Theraja B.L., Theraja A.K., "A Textbook Of Electrical Technology: AC And DC Machines", volume 2, S Chand, 1999
3. A.E.Fitzgerald, Charles kingsley, Stephen D.Umans "Electric Machinery", 6th Edition, Tata McGraw- Hill 2013

Reference Books

1. Kothari D. P., Nagarth I .J., "Electrical Machines", 4th edition, Mc Graw Hill Publications, 2010
2. Rajput R.K. "Electrical Machines", 5th edition, Lakshmi publications, 2016
3. Mulukutla S.Sarma & Mukesh k.Pathak "Electric Machines", 4th Edition, CENGAGE Learning, 2012
4. Guptha J.B., "Theory & Performance of Electrical Machines", 6th Edition, S.K.Kataria & Sons, 2008

Web References

1. https://nptel.ac.in/courses/108/105/108105017/
2. https://www.youtube.com/watch?v=AECBgmkWvo0&list=PLbMVogVj5Njqbg9363J1uq5Fnq4m1Ygxl

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	50	50
L2	50	50
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1 List all the classification of machines
2 What are the various faults that occur in a DC machine

L2: Understand

1. Explain the operation of a DC machine
2. Explain various starting methods of DC machine

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SOC 23SOC20 Electrical Engineering Materials 0 0 0 2

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

Code	Course Outcomes
23SOC20.1	Understand the properties and applications of various electrical engineering materials.
23SOC20.2	Gain knowledge about the selection criteria for materials used in electrical and electronic components
23SOC20.3	Study the behaviour of materials under different electrical and environmental conditions.

Min. 60 Hours

Introduction to Electrical Engineering Materials - Classification of materials based on electrical properties: Conductors, Insulators, and Semiconductors. Importance of materials in electrical engineering. Factors influencing the selection of materials. Conducting Materials - Electrical properties of conductors, Common conducting materials: Copper, Aluminum, Silver, and Gold. Applications of conducting materials in electrical and electronic components. Superconductors and their applications. Insulating Materials - Electrical and thermal properties of insulators. Types of insulating materials: Solid, Liquid, and Gaseous insulators, Common insulating materials: PVC, Rubber, Glass, Mica, and Ceramics, Applications of insulating materials in cables, transformers, and other electrical equipment. Magnetic Materials, Basic concepts of magnetism and magnetic fields. Types of magnetic materials: Diamagnetic, Paramagnetic, Ferromagnetic, and Ferrimagnetic materials. Common magnetic materials: Iron, Steel, Ferrites, and Alnico, Applications of magnetic materials in transformers, motors, and generators. Semiconductor Materials - Properties and characteristics of semiconductors. Common semiconductor materials: Silicon, Germanium, and Gallium Arsenide. Doping of semiconductors and the creation of p-type and n-type materials. Applications of semiconductor materials in diodes, transistors, and integrated circuits. Dielectric Materials - Definition and properties of dielectrics. Polarization in dielectric materials. Common dielectric materials: Paper, Mica, Glass, and Plastics. Applications of dielectric materials in capacitors and insulating systems. Modern Materials and Nanotechnology - Introduction to nanotechnology and nanomaterials. Carbon nanotubes, Graphene, and their properties. Applications of nanomaterials in electrical and electronic devices. Smart materials and their uses in advanced applications. Testing and Characterization of Materials, Methods of testing electrical properties of materials. Mechanical and thermal testing of materials. Characterization techniques: X-ray diffraction, Scanning Electron Microscopy, and Spectroscopy. Importance of material testing in ensuring quality and reliability.

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SOC 23SOC26 Electrical Estimation and Costing 0 0 0 2

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

Code	Course Outcomes
23SOC26.1	Understand the principles of electrical estimation and costing.
23SOC26.2	Gain knowledge on various types of electrical installations and their cost analysis.
23SOC26.3	Develop skills for preparing and interpreting electrical drawings and specifications.

Min. 60 Hours

Introduction to Estimation and Costing - Definition and importance of estimation and costing, Purpose of estimating and costing in electrical engineering. Types of estimates: Preliminary, Detailed, and Supplementary. Factors affecting cost estimation. Electrical Symbols and Diagrams - Standard electrical symbols and notations. Reading and interpreting electrical diagrams. Preparation of electrical layouts and circuit diagrams. Materials and Components Types of electrical materials: Conductors, insulators, cables, switches, and accessories. Specification and standards for electrical materials. Quality and quantity of materials required for various installations. Estimation for Residential Buildings Load calculation and demand estimation. Preparation of detailed estimates for residential wiring. Cost analysis for residential electrical installations. Preparation of schedule of rates. Estimation for Commercial Buildings Estimation techniques for commercial buildings. Load calculation for commercial setups. Cost estimation for commercial electrical installations. Preparation of tender documents and quotations. Industrial Electrical Installations Types of industrial electrical installations. Estimation and costing for industrial setups. Safety regulations and standards in industrial installations. Preparation of bill of quantities (BOQ) for industrial projects. Tendering and Contracting Overview of the tendering process. Types of contracts: Lump sum, Item rate, and Percentage rate contracts. Preparation and submission of tenders. Evaluation and comparison of tenders. Electrical Safety and Regulations Electrical safety standards and codes. Safety measures and practices in electrical installations. Regulatory compliance and certification processes.

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