NATIONAL INSTITUTE OF TECHNOLOGY ANDHRA PRADESH

RULES AND REGULATIONS

SCHEME OF INSTRUCTION AND SYLLABI

B.Tech. – Electrical Engineering

Effective from 2024-25

NATIONAL INSTITUTE OF TECHNOLOGY ANDHRA PRADESH

VISION

To nurture and produce highly competent engineers, scientists and entrepreneurs committed towards catering to futuristic societal challenges through holistic education synergetic with innovations and vibrant research eco-system.

MISSION

- To implement best practices in teaching-learning methodologies for establishing dynamic knowledge-connected society.
- To create a conducive environment for carrying out research in multi-disciplinary areas and thereby nurturing novel thinking capabilities.
- To strengthen the industry-institute interface to inculcate entrepreneurship abilities.
- To address all technological needs of the nation for self-sustenance.

DEPARTMENT OF ELECTRICAL ENGINEERING

VISION

Aiming to nurture globally competent electrical engineers in research and innovation through quality education and develop cutting edge technologies for the betterment of society

MISSION

M1. Effective technology adoption into teaching and learning Strategies by faculty that result in observable students' achievement

M2. Create an open platform for innovative research work in sustainable electrical power systems

M3. Nurture creative thinking with understanding engineering principles and develop real-time solutions for global problems with industry collaboration

M4. Deploy energy efficient and green energy technologies to address social, environmental, and economical effects

Department of Electrical Engineering:

About the Department:

The Department of Electrical Engineering at the National Institute of Technology (NIT), Andhra Pradesh offers B. Tech. and Ph.D. programs which keenly emphasize global learning. The main theme of the department is to create a platform for knowledge assimilation, dissemination and generation. It is committed to work in emerging areas and develop sustainable technologies & innovations in the electrical engineering field. The students and faculty are encouraged to work in interdisciplinary projects with a stimulating and wonderful learning experience.

Programme Educational Objectives (PEOs) for the B.Tech. (EEE) Programme

Within few years after the end of the B.Tech. in Electrical and Electronics Engineering programme, graduates will be able to:

PEO1	Design and develop innovative products and services in the field of electrical and electronics engineering and allied engineering disciplines.
PEO2	Apply the knowledge of electrical and electronics engineering to solve problems of social relevance and pursue higher education and research.
PEO3	Work effectively as individuals and as team members in multidisciplinary projects.
PEO4	Engage in life-long learning, career enhancement and adopt to changing professional and societal needs.

Programme Articulation Matrix (PEO vs. Mission) for the B.Tech. (EEE) Programme

PEO\Mission	M1	M2	M3	M4
PEO1	3	1	3	3
PEO2	3	2	3	3
PEO3	2	1	2	1
PEO4	2	3	2	3

1- Low correlation; 2 - Medium correlation; 3 - Strong correlation

Programme Outcomes (POs) for the B.Tech. (EEE) Programme

At the end of any B.Tech. program in NIT Andhra Pradesh, graduates will be able to:

PO1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem analysis**: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/Development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis

	and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PO6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project management and Finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-long learning**: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Programme Specific Outcomes (PSO) for the B.Tech. (EEE) Programme

At the end of the B.Tech. in Electrical and Electronics Engineering programme, graduates will be able to:

PSO1	Design, analyze, implement, verify and validate efficient solutions to complex engineering problems related to the ideation, development, testing and maintenance of electrical systems.
PSO2	Construct or leverage contemporary tools, techniques, and frameworks in developing or refactoring an electrical system or its component.

Degree Requirements for B.Tech. (EEE) Programme

Category	Category Description	Credits	Percentage
BSC	Basic Science Courses (BSC)	**15**	10%
ESC	Engineering Science Courses (ESC)	**15**	10%
Professional Major Courses (PMC)	Professional Major Core Courses (PCC)	**60**	60%
	Professional Major Elective Courses (DEC)	**18**	
	Professional Major Work (PRC)	**6**	
	Semester-Long Internship (SLI)	**6**	
Open/Free Electives	Open Elective Courses (OEC) and DAC approved Free Electives (NPTEL, MOOCs, etc.)	**15**	10%
HSC Courses	Liberal Arts/Creative Arts Courses (LCA)	**6**	10%
	Sports Courses (Any two sports of 1 Credit each)	**2**	
	NCC/Social Service	**1**	
	Yoga	**1**	
	English Communication	**2**	
	Personality Development/Life Skills	**1**	
	Introduction to Entrepreneurship	**1**	
	Design Thinking	**1**	
	Total Credits	**150**	**100%**

NOTE: The no. of credits required to award B.Tech. degree is 150 as per the curriculum.

	Credit Distribution in Each Semester								
	I	II	III	IV	V	VI	VII	VIII	TOT
BSC	6	5	3	1	0	0	0	0	**15**
ESC	7	5	0	3	0	0	0	0	**15**
HSC	1	3	1	2	1	4	3	0	**15**
PCC	3	6	16	12	12	9	2	0	**60**
DEC	0	0	0	3	6	6	3	0	**18**
OEC	0	0	0	3	3	3	6	0	**15**
PRC/ SLI	0	0	0	0	0	0	6	6	**12**
Total	**17**	**19**	**20**	**24**	**22**	**22**	**20**	**6**	**150**

Note:

BSC: Basic Science Courses
ESC: Engineering Science Courses
PCC: Programme Core Courses
DEC: Departmental Elective Courses
OEC: Open Elective Courses
HSC: Humanities and Social Science Courses
PRC: Project Work
SLI: Semester-Long Internship

SCHEME OF INSTRUCTION

B.Tech. (Electrical Engineering) Course Structure

Note:

1. **All BSC courses must be offered in I & II Year Only.**
2. **All ESC courses must be offered before VI Sem.**
3. **For MSC, HSC, OEC, and DEC slots are reserved in the template.**

I – Year: I – Semester

S. No.	Course Code	Course Title	L	T	P	Credits	Cat. Code
1	MA1011	Principles of Differential and Integral Calculus	3	0	0	3	BSC
2	EE1011	Basic Electrical Circuits	3	0	0	3	PCC
3	PH1021	Physics for Electrical Engineering	3	0	0	3	BSC
4	ME1021	Basics of Mechanical Engineering	2	0	0	2	ESC
5	CS1031	Problem Solving through Computer Programming	3	0	0	3	ESC
6	CS1032	Problem Solving through Computer Programming lab	0	1	2	2	ESC
7	PE1012	Physical Education I	0	0	2	1	HSC
		Total				**17**	

I – Year: II – Semester

S. No.	Course Code	Course Title	L	T	P	Credits	Cat. Code
1	HS1011	English for Engineers-I	2	0	0	2	HSC
2	MA1021	Matrices and Differential Equations	3	0	0	3	BSC
3	CY1021	Chemistry of Energy Systems	2	0	0	2	BSC
4	EE1021	Analog Electronics	3	0	0	3	PCC
5	EE1031	Electrical Network Analysis	3	0	0	3	PCC
6	CS2101	Data Structures and Applications	3	0	0	3	ESC
7	CS2102	Data Structures and Applications lab	0	0	2	1	ESC
8	ME1013	Engineering Graphics with CAD	0	0	2	1	ESC
9	PE1022	Physical Education II	0	0	2	1	HSC
		Total				**19**	

Summer Internship – I#

II – Year: I – Semester

S. No.	Course Code	Course Title	L	T	P	Credits	Cat. Code
1	EE2011	Measurements and Instrumentation	3	0	0	3	PCC
2	EE2021	DC Machines and Transformers	3	0	0	3	PCC
3	EE2031	Power System Generation and Transmission	3	0	0	3	PCC
4	EE2041	Digital Electronics	3	0	0	3	PCC
5	MA2051	Complex Variables and Mathematical Methods	3	0	0	3	BSC
6	EE2012	Analog and Digital Circuits Lab	0	1	2	2	PCC
7	EE2022	Circuits and Measurements Lab	0	1	2	2	PCC
8	HS2012	NCC/Social Services	0	0	2	1	HSC
						20	

II – Year: II – Semester

S. No.	Course Code	Course Title	L	T	P	Credits	Cat. Code
1	EC1521	Signals and Systems for Electrical Engineers	3	0	0	3	ESC
2	HS2011	Personality Development	0	0	2	1	HSC
3	PE2012	Yoga	0	0	2	1	HSC
4	EE2051	AC Rotating Machines	3	0	0	3	PCC
5	EE2061	Control Systems	3	0	0	3	PCC
6	EE2071	Power Systems Analysis	4	0	0	4	PCC
7	EE2010	Minor Project (Audit Course) - I	0	0	1	0	PCC
8	EE2032	DC Machines and Transformers Lab	0	1	2	2	PCC
9	MA2092	Numerical Methods Lab	0	0	2	1	BSC
10	EE2XX1	Department Elective – I	3	0	0	3	DEC
11	EEXXXX	Open Elective /DAC Approved Free Electives (NPTEL, MOOCS, Etc.)-I	3	0	0	3	OEC
		Total				24	

Summer Internship – II#

III – Year: I – Semester

S. No.	Course Code	Course Title	L	T	P	Credits	Cat. Code
1	EE3011	Power Electronics	3	0	0	3	PCC
2	EE3021	Power System Protection and Control	3	0	0	3	PCC
3	SM3021	Design Thinking	1	0	0	1	HSC
4	EE2042	Control Systems Lab	0	1	2	2	PCC
5	EE2052	AC Rotating Machines Lab	0	1	2	2	PCC
6	EE2062	Power Systems & Renewable Energy Lab	0	1	2	2	PCC
7	EE3XX1	Department Elective – II	3	0	0	3	DEC
8	EE3XX1	Department Elective – III	3	0	0	3	DEC
9	EEXXXX	Open Elective /DAC Approved Free Electives (NPTEL, MOOCS, Etc.)-II	3	0	0	3	OEC
		Total				22	

III – Year: II – Semester

S. No.	Course Code	Course Title	L	T	P	Credits	Cat. Code
1	EE3031	Embedded Systems	3	0	0	3	PCC
2	EE3041	Electric Power Drives	3	0	0	3	PCC
3	SM3011	Introduction to Entrepreneurship	1	0	0	1	HSC
4	EE3012	Power Electronics Lab	0	1	2	2	PCC
5	EE3022	Embedded Systems Lab	0	0	2	1	PCC
6	EE3010	Minor Project (Audit Course)-II	0	0	1	0	PCC
7	EEXXXX	Department Elective – IV	3	0	0	3	DEC
8	EEXXXX	Department Elective – V	3	0	0	3	DEC
9	EEXXXX	Open Elective /DAC Approved Free Electives (NPTEL, MOOCS, Etc.)-III	3	0	0	3	OEC
10	HSXXXX	Liberal Arts/Creative Arts Courses –I	3	0	0	3	HSC
		Total				22	

Summer Internship – III#

#: The student should do at least one summer internship with a duration of minimum 45 days at Institutes / Organizations / Industries and produce the certificate of completion to the department.

IV – Year: I – Semester

S. No.	Course Code	Course Title	L	T	P	Credits	Cat. Code
1	EE3032	Electric Power Drives Lab	0	1	2	2	PCC
2	EE4014	Professional Major Work	0	0	12	6	PRC
3	EE4XX1	Department Elective – VI	3	0	0	3	DEC
4	EEXXXX	Open Elective /DAC Approved Free Electives (NPTEL, MOOCS, Etc.)-IV	3	0	0	3	OEC
5	EEXXXX	Open Elective /DAC Approved Free Electives (NPTEL, MOOCS, Etc.)-V	3	0	0	3	OEC
6	HSXXXX	Liberal Arts/Creative Arts Courses –II	3	0	0	3	HSC
		Total				**20**	

IV – Year: II – Semester

S. No.	Course Code	Course Title	L	T	P	Credits	Cat. Code
1	EE4024	Semester-Long Internship (SLI) / Additional Project at the Institute/ Additional Department Elective Courses for 6 Credits	0	0	12	6	SLI
Total						6	

Departmental Elective Courses:

Department Elective – I (II-II)

Elective Number	Course Code	Course Title	L	T	P	Credits	Offered Sem
I	EE2601	Basics of Internet of Things	3	0	0	3	IV
	EE2611	Renewable Power Generation	3	0	0	3	
	EE2621	Introduction to Machine Learning	3	0	0	3	

Department Elective – II (III-1)

Elective Number	Course Code	Course Title	L	T	P	Credits	Offered Sem
II	EE3601	Advanced Control Systems	3	0	0	3	V
	EE3611	Wind and Solar Electrical Systems	3	0	0	3	
	EE3621	Digital Signal Processing	3	0	0	3	

Department Elective – III (III-I)

Elective Number	Course Code	Course Title	L	T	P	Credits	Offered Sem
III	EE3631	Soft Computing Techniques	3	0	0	3	V
	EE3641	Introduction to Electric Vehicles	3	0	0	3	
	EE3651	Advanced Computer Methods in Power Systems	3	0	0	3	
	EE3661	Advanced Power Electronics	3	0	0	3	

Department Elective – IV (III-II)

Elective Number	Course Code	Course Title	L	T	P	Credits	Offered Sem
IV	EE3671	Industrial Instrumentation and Automation	3	0	0	3	VI
	EE3681	Converters for Renewable Energy Systems	3	0	0	3	
	EE3691	Deep Learning Algorithms	3	0	0	3	
	EE3701	Electrical Machine Design	3	0	0	3	

Department Elective – V (III-II)

Elective Number	Course Code	Course Title	L	T	P	Credits	Offered Sem
V	EE3711	Introduction to Smart Grid	3	0	0	3	VI
	EE3721	Battery Energy Storage and EV Charging Systems	3	0	0	3	
	EE3731	Power Systems Security and Reliability	3	0	0	3	
	EE3741	Switched Mode Power Supplies	3	0	0	3	
	EE3751	New Venture Creation	3	0	0	3	

Department Elective – VI (IV-I)

Elective Number	Course Code	Course Title	L	T	P	Credits	Offered Sem
VI	EE4601	Energy Management and Audit	3	0	0	3	VII
	EE4611	Power Quality Improvement	3	0	0	3	
	EE4621	Distribution System Planning and Automation	3	0	0	3	
	EE4631	Special Machines	3	0	0	3	

Open Elective Courses (offered to other departments):

Elective Number	Course Code	Course Title	L	T	P	Credits	Offered Sem
I	EE1031	Electrical Network Analysis	3	0	0	3	IV
II	EE2011	Measurements and Instrumentation	3	0	0	3	V
III	EE2061	Control Systems	3	0	0	3	VI
IV	EE3011	Power Electronics	3	0	0	3	VII
V	EE3641	Introduction to Electric Vehicles	3	0	0	3	VII

Liberal Arts/Creative Arts Courses – I (3 Credits)

Course Code	Course Title	L	T	P	Credits	Offered Sem
HS3011	English for Engineers II	2	0	2	3	VI
HS3021	German/Other Foreign languages	2	0	0	2	VI
HS3031	Indian Philosophy	1	0	0	1	VI
HS3041	Introduction to Psychology	1	0	0	1	VI
HS3051	Psychology of Wellbeing	1	0	0	1	VI
HS3061	Introduction to Mass Communication	1	0	0	1	VI
HS3071	Introduction to Media Studies	1	0	0	1	VI
HS3081	Vedic Maths	3	0	0	3	VI
HS3091	Indian Heritage and Culture	1	0	0	1	VI
HS3101	Indian Business History	1	0	0	1	VI
HS3111	Post-Harvest Technology	1	0	0	1	VI
HS3121	Ethics in Technology	1	0	0	1	VI
HS3131	Financial marketing	1	0	0	1	VI
HS3141	Bharatiya Nyaya Sanhita: Indian Judicial Code – An Overview	1	0	0	1	VI
HS3151	Introduction to the Constitution of India	1	0	0	1	VI
HS3162	Photography	1	0	0	1	VI
HS3172	Pottery	1	0	0	1	VI
HS3182	Painting	1	0	0	1	VI
HS3192	Music	1	0	0	1	VI

Liberal Arts/Creative Arts Courses – II (3 Credits)

Course Code	Course Title	L	T	P	Credits	Offered Sem
HS3501	Sanskrit	3	0	0	3	VII
HS3511	Introduction to Academic Writing	1	0	0	1	VII
HS3521	Contemporary Issues in Philosophy of Mind & Cognition	1	0	0	1	VII
HS3531	Psychology and Mental Health	1	0	0	1	VII
HS3541	Psychology at Work	1	0	0	1	VII
HS3561	Introduction to Journalism	1	0	0	1	VII
HS3561	Introduction to Film Studies	1	0	0	1	VII
HS3571	Introduction to Anthropology	1	0	0	1	VII
HS3581	Ethics for AI	1	0	0	1	VII
HS3591	Introduction to Sociology	1	0	0	1	VII
HS3601	Personal Finance	1	0	0	1	VII
HS3611	Introductory Economics	1	0	0	1	VII
HS3621	Cyber Law for Engineers	1	0	0	1	VII
HS3631	Food and Nutrition	1	0	0	1	VII
HS3641	Youth, Gender and Identity	1	0	0	1	VII
HS3652	Dance	1	0	0	1	VII
HS3662	Theatre Arts	1	0	0	1	VII
HS3672	Sculpture	1	0	0	1	VII
HS3682	Introduction to Animation	0	0	2	1	VII
HS2052	National Service Scheme	0	0	2	1	VII

Each engineering department should identify the list of courses for the Minor & Double major degree programmes. These identified courses will be offered to the Minor/ Double major degree students as mentioned below.

Minors:

Courses for Minor							
S. No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**	**Offered Sem**
1	EE2031	Power System Generation and Transmission	3	0	0	3	III
2	EE2611	Renewable Power Generation	3	0	0	3	IV
3	EE3021	Power System Protection and Control	3	0	0	3	V
4	EE3711	Introduction to Smart Grid	3	0	0	3	VI
		TOTAL	**12**	**0**	**0**	**12**	

Double Major:

Courses for Double Major							
S. No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**	**Offered Sem**
1	EE2011	Measurements and Instrumentation	3	0	0	3	III
2	EE2021	DC Machines and Transformers	3	0	0	3	III
3	EE2051	AC Rotating Machines	3	0	0	3	IV
4	EE2601	Basics of Internet of Things	3	0	0	3	IV
5	EE3011	Power Electronics	3	0	0	3	V
6	EE3641	Introduction to Electric Vehicles	3	0	0	3	V
7	EE3681	Converters for Renewable Energy Systems	3	0	0	3	VI
8	EE3721	Battery Energy Storage and EV Charging Systems	3	0	0	3	VI
		TOTAL	**24**	**0**	**0**	**20**	

Note:

1. **A student is permitted to do either a Minor or Double major only, but not both.**
2. A student is permitted to have only one minor/ one Double major.

MA1011	Principles of Differential and Integral Calculus	BSC	3-0-0	3 Credits

Pre-requisites: None.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand the concepts of limit, continuity, and differentiability.
CO2	Understand the concepts of partial derivative, chain rule, and total differentiation.
CO3	Find the maxima and minima of multivariable functions.
CO4	Analyze improper integrals and evaluate multiple integrals in various coordinate systems.
CO5	Apply the concepts of gradient, divergence, and curl to formulate engineering problems.
CO 6	Convert line integrals into area integrals and surface integrals into volume integrals.

Syllabus:

Differential Calculus of functions of several variables: Review of Limit, continuity (sequential verification) and differentiability, Partial differentiation; Total differentiation; Euler's theorem and generalization; Change of variables- Jacobians; Maxima and minima of functions of several variables (2 and 3 variables); Lagrange's method of multipliers.

Integral Calculus: Convergence of improper integrals; Beta and Gamma integrals; Differentiation under integral sign; Double and Triple integrals - computation of surface areas and volumes; change of variables in double and triple integrals.

Vector Calculus: Scalar and vector fields; vector differentiation; level surfaces; directional derivative; gradient of a scalar field; divergence and curl of a vector field; Laplacian; Line and Surface integrals; Green's theorem in a plane; Stokes' theorem; Gauss Divergence theorem.

Text Books:

1. Joel R. Hass, Maurice D. Weir, George B. Thomas, Thomas' Calculus, 12th edition, Pearson, 2010.
2. Erwin Kreyszig, Advanced Engineering Mathematics, Eighth Edition, John Wiley and Sons, 2015
3. B. S. Grewal, Higher Engineering Mathematics, Khanna Publications, 2015
4. R. K. Jain and S. R. K. Iyengar, *"Advanced Engineering Mathematics"*, Fifth Edition, Narosa Publishing House, 2016.

Reference Books:

1. T. M. Apostol, Calculus, Volumes 1 and 2 (2nd Edition), Wiley Eastern, 1980.

EE1011	Basic Electrical Circuits	PCC	3-0-0	3 Credits

Pre-requisites: None.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Apply the knowledge of basic circuital law and simplify the network using reduction techniques.
CO2	Analyze the circuits using Kirchhoff's law and electric DC circuits.
CO3	Evaluate single-phase AC circuits.
CO4	Analyze series and parallel resonant circuits.
CO5	Solve simple magnetic circuits.

Syllabus:

Basic Circuit elements: Types of circuit components and their V-I relationship, kirchhoff's laws, dependent and independent sources, source transformations, star-delta transformation, mesh and nodal analysis, concept of super-node and super mesh.
Graph of a network – incidence matrix formation of equilibrium equations – dual network.
Analysis of Single-phase AC Circuits: Alternating quantities - average value, effective value, form and peak factors for square, triangle, trapezoidal, and sinusoidal waveforms. Concept of phasors, single phase series, parallel, series-parallel circuits, concept of power factor, solution of AC networks using mesh and nodal analysis.
Resonance: Series and parallel resonance, bandwidth, Q-factor and selectivity
Magnetic Circuits: MMF, magnetic flux, reluctance, energy stored in a magnetic field, solution of magnetic circuits. Inductance - faraday's law of electromagnetic induction, Lenz's law, self and mutual inductance, inductances in series and parallel, mutual flux and leakage flux, coefficient of coupling, dot convention, cumulative and differential connection of coupled coils.
Electrical Safety: Electrical shock and precautions against it, concept of fuses and their classification, selection, and application; concept of earthing.

Text Books:

1. Engineering Circuit Analysis, William H. Hayt Jr., Jack E. Kemmerly, Steven M. Durbin, Tata McGraw Hill, 2020, 9th Edition.
2. Fundamentals of Electrical Circuits by Charles k. Alexander, Mattew N.O. Sadiku, Tata McGraw Hill, 2022, 7th Edition.
3. Ravish R Singh, Basic Electrical Engineering, MC Graw Hill Education, 3rd edition, 2018.

Reference Books:

1. M.E. Van Valken Burg, Network analysis, Pearson education, 2015, 3rd Edition.
2. J. A. Edminister, Electric circuit theory, Schaum's outline series: 6th ed., McGraw Hill, 2014.

Online resources:

1. https://archive.nptel.ac.in/courses/108/105/108105159/
2. https://nptel.ac.in/courses/108/104/108104139/
3. https://nptel.ac.in/courses/108/102/108102097/

PH1021	Physics for Electrical Engineering	BSC	3-0-0	3 Credits

Pre-requisites: None

Course Outcomes: At the end of the course, the student will be able to:

CO1	Solve engineering problems using the concepts of Electrostatics
CO2	Understand the concept of magnetic dipole and solve the engineering problems of magnetostatics
CO3	Construct quantum mechanical model to explain the behaviour of a system at microscopic level
CO4	Understand the nature and characterization of various functional materials for applications
CO5	Apply the concepts of energy harvesting and understand the mechanisms of photo-voltaic cells.

Syllabus:

Electrostatics: Electric field, charge density: line, surface and volume, Coulomb's law, electric field intensity, Gauss's Law, boundary relations, physical concepts of divergence, gradient and curl. Electric potentials, electric boundary conditions, Poisson's and Laplace's equations.

Magnetostatics: Magnetic field, Biot-Savart's law, Ampere's circuit law, field due to a magnetic dipole, Magnetic dipole in external magnetic field, Magnetic boundary conditions, Inductors and Inductances, Magnetic energy.

Quantum Physics: Origin of quantum theory and related experiments: Black-Body radiation and photo-electric effect. Heisenberg's uncertainty principle, de- Broglie's wave concept, wave function, and its properties, operators, Schrodinger's time-dependent and time-independent equations (Quantitative), particle in one-dimensional, infinite potential well, quantum tunnelling phenomena and their applications in alpha decay, and scanning tunnelling microscopy (STM) – Introduction to Quantum technology (Q-switching, interaction of radiation with matter).

Functional Materials: Magnetic Materials: Introduction to Weiss theory of ferromagnetism, concepts of magnetic domains, spontaneous magnetization, Curie transition, hard and soft magnetic materials and their applications.

Dielectric materials: Introduction to dielectrics, dielectric constant, polarizability, frequency and temperature-dependent polarization mechanism in dielectrics, dielectric loss and applications

Photovoltaic Materials & NDT: Introduction to semiconductors – Intrinsic semiconductors, energy band diagram: direct and indirect bandgap semiconductors, extrinsic semiconductors - Photovoltaic Materials: Solar spectrum, photovoltaic (PV) effect, materials, structure and working principle, I-V characteristics, power conversion efficiency, quantum efficiency, emerging PV technologies, and applications.

NDT: Introduction, Methods of non-destructive testing.

Text Books:

1. A Textbook of Engineering Physics, M. N. Avadhanulu, P. G. Kshirsagar, S. Chand and Company (2015).
2. Concepts of Modern Physics – Seventh Edition, Arthur Beiser, Shobhit Mahajan, S Rai Choudhury, Mc. Graw Hill Publishers (2020).
3. Electricity and Magnetism, D. Chattopadhyay, P. C. Rakshit, New Central Book Agency (2018).

Reference Books:

1. Materials Science and Engineering: An Introduction (Tenth edition), William D. Callister, John Wiley & Sons (2018).
2. Introduction to Solid State Physics, Charles Kittel, Wiley Publishers (2011).
3. Introduction to Electrodynamics, 4th Edition, David J. Griffiths, Pearson Education (2013).

ME1021	Basics of Mechanical Engineering	BSC	2-0-0	2 Credits

Pre-requisites: None.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Identify Materials for Engineering Applications.
CO2	Comprehend the functioning of mechanisms and power transmission systems for a given application.
CO3	Understand the fundamental concepts of thermodynamics, fluid mechanics, heat transfer and their applications to thermal machines.
CO4	Understand manufacturing processes and the principles of operation of machine Tools.
CO5	Understand the principles of work study, CPM, PERT and Operations Research.

Syllabus:

Engineering Materials: Evolution during Industrial Revolutions, Introduction to Engineering Materials, Classification and Properties.
Design Engineering: Evolution during industrial revolutions, Simple to complex mechanisms - kinematics, dynamics, the evolution of Automobile Engineering, Power Transmission, Fasteners, and Bearings, introduction to - design of machine elements, CAD.
Thermal Engineering: Evolution during Industrial Revolutions, Fundamentals of Thermodynamics, fluid mechanics and heat transfer, Energy sources, Energy generation and conversion, Prime movers - Steam power, IC Engines, Introduction to - High altitude propulsion, Refrigeration and Air-Conditioning.
Production Engineering: Evolution during Industrial Revolutions, Manufacturing Processes – subtractive, confirmative, and additive, Machine Tools – classification, working principle, surface finishing processes, introduction to CAM.
Industrial Engineering: Evolution during industrial revolutions, Scientific management, introduction to – work study, CPM, PERT, and Operations Research.
Future of Mechanical Engineering: Industry 4.0-principles and concepts, Introduction to – Robotics, Autonomous Vehicles - Artificial Intelligence and Machine Learning.

Text Books:

1. History of Mechanical Engineering, Ce Zhang, Jianming Yang, Springer, 2020, 1 st edition.
2. A Brief History of Mechanical Engineering, Dixit, U., Hazarika, M. and Davim, J., Springer International Publishing, 2017, 1 st edition.

Reference Books:

1. Basic Mechanical Engineering, Praveen Kumar, Pearson Education, 2018, 2 nd edition.
2. Exploring Engineering: An introduction to Engineering and Design, Philip Kosky, Rober Balmer, William Keat, George Wise, Academic Press, 2015, 4 th edition.
3. Saeed Movaveni, Engineering Fundamentals: An Introduction to Engineering, Cengage Learning India Pvt. Ltd., 2011, 4 th edition.

Online Material:

1. https://www.bbc.co.uk/programmes/p00kjq6d
2. https://www.natgeotv.com/in/super-factories/videos
3. https://www.discoveryuk.com/series/how-do-they-do-it/
4. https://www.historyindia.com/show/how-trains-changed-the-world.

CS1031	Problem Solving through Computer Programming	ESC	3-0-0	3 Credits

Pre-requisites: None.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Apply problem-solving strategies such as top-down and bottom-up approaches to design simple algorithms and flowcharts for computational problems.
CO2	Construct algorithms for solving problems that requires solutions involving searching, sorting, selection and / or a numerical method as a sub-routine.
CO3	Analyze the suitability of different algorithmic design paradigms for solving problems with an understanding of the time and space complexities incurred.
CO4	Construct efficient modular programs for implementing algorithms by leveraging suitable control structures.
CO5	Construct efficient programs by selecting and using suitable in-built Data Structures and programming language features available.

Syllabus:

Fundamentals of Computers, Historical perspective, Early computers, Modern Computers, Hardware Components of a Computer, Data Representation in Computers, Introduction to Operating Systems, Software and Firmware, Problems, Flowcharts, Memory, Variables, Values, Instructions, Programs.
Problem solving techniques – Algorithmic approach, characteristics of algorithms, Problem solving strategies: Top-down approach, Bottom-up approach, Time and space complexities of algorithms, Algorithm Analysis.
Basic Syntax in Python, Data Types, Variables, Assignments, immutable variables, Types of Operators, Expressions, Comments, Boolean Logic, Logical Operators in Python. Conditional statements - If-else, Loops - while, for, Lazy Evaluation Inbuilt Data Structures and their operations in Python: List, Tuples and Dictionaries.
Fundamental Algorithms: Swapping variables, Problems involving summation of a series, Sine function computation, Base Conversion, generation of sequences like Fibonacci, Reversing the digits of an integer, Character to number conversion.
Factoring Methods: Finding the square root, Finding the smallest divisor of an integer, finding the greatest common divisor using Euclid's algorithm, Computing the prime factors of an integer, generating prime numbers, Raising a number to a large power, Computation of the nth Fibonacci number.
Functions – Modular programming and benefits, user defined functions, library functions, parameter passing, Formal and Actual arguments, named arguments return values, Recursion.
Sorting algorithms: Bubble, Selection and Insertion sorts, Search algorithms: Linear and binary search
String processing: Algorithms for implementing String functions like Strlen, Strcpy, StrRev, Strcmp, Searching for a keyword or pattern in a text.
File and Directory Handling: Reading and Writing to/from a file, Formatted File creation and operations.

Text Books:

1. Kenneth Lambert, Fundamentals of Python: First Programs, Cengage Learning, 2019
2. R.G. Dromey, how to solve it by Computer, Pearson, 2008.
3. Brian W.Kernighan, Dennis Ritchie, "The C Programming Language", 2nd edition, Person Education India, 2015
4. Hanly J R & Koffman E.B, "Problem Solving and Programm design in C", 7th edition, Pearson Education
5. Randal E. Bryant, David R. O'Hallaron, "Computer Systems. A Programmer's Perspective", 2nd Edition, Prentice Hall.

CS1032	Problem Solving through Computer Programming Lab	ESC	0-1-2	2 Credits

Pre-requisites: None.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Construct, debug, test and run efficient programs by leveraging suitable flow of control constructs and syntactic units of the programming language.
CO2	Construct efficient programs by constructing and translating algorithms for solving problems using sorting, searching, selection and / or arithmetic computations.
CO3	Implement, refactor, test and debug functional programs in a shell-based run time environment.
CO4	Apply algorithmic thinking to break down complex problems into logical steps and implement efficient solutions through structured programming constructs.

Syllabus:

Familiarization with Python installation, basic syntax and running scripts in the shell, conditional control constructs, iterative constructs. (While, do-while, for), user defined functions and in-built function calls, Recursion, in-built data structures like List, Tuples and Dictionaries, String processing, Files and I/O.

Implementation of Factoring methods, sorting, searching and selection as sub-routines, simple 2D graphics.
Implementation of a capstone application to unify the concepts learnt in the course.

Text Books:

1. Kenneth Lambert, Fundamentals of Python: First Programs, Cengage Learning, 2019.
2. R.G. Dromey, how to solve it by Computer, Pearson, 2008.
3. Hanly J R & Koffman E.B, “Problem Solving and Programm design in C”, 7th edition, Pearson Education
4. Randal E. Bryant, David R. O’Hallaron, “Computer Systems. A Programmer’s Perspective”, 2nd Edition, Prentice Hall
5. The Python Tutorial, Available at: https://docs.python.org/3/tutorial/.

PE1012	Physical Education I	PEC	0-0-2	1 Credits

Pre-requisites: None.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand the fundamental concepts and importance of health and personal hygiene practices.
CO2	Identify the components of a balanced diet and apply principles of weight management.
CO3	Assess and improve their physical fitness through appropriate activities and exercises.

Syllabus:

Introduction to Physical Education: Meaning & Definitions of Physical Education, Aim & Objectives of Physical Education in Higher Education, Importance of Physical Education in the present era, Role of Physical Education in General & Professional Education, Line Formations and Marching

Health Education & Personal Hygiene: Meaning and Definitions of Health Education, Meaning and Definitions of Health, Factors Affecting of Health and Need for and Importance of Health in Present Era, Meaning and Definitions of Personal Hygiene, Need for and Importance of Personal Hygiene, Personal Cleanliness & Hygiene (Teeth, Ears, Eyes, Nose, Throat, Nails &Fingers, Skin, Cloths &Hair).

Nutrition: Meaning and Definitions of Nutrition and Basic Guideline of Nutrition, Components of Balanced Diet and Design Balance Diet Plan Healthy Lifestyle, Nutrition Daily Caloric Requirement and Expenditure, Weight Management in Modern Era and Factor Affecting Weight Management, Dieting Versus Exercise for Weight Control, Values of Weight Management, Common Myths About Weight Loss, Design Diet Plan and Exercise Schedule for Weight Gain and Loss and Ideal Weight. Obesity Meaning and Definitions and Types of Obesity, Health Risks Associated with Obesity, Obesity Causes and Solutions for Overcoming Obesity.

Components of Physical Fitness: Meaning and Definitions of Physical Fitness, Need for and Importance of Physical Fitness, Warming Up and Limbering Down Exercises, Strength and Training of Strength Development, Speed and Training of Speed Development, Endurance and Training of Endurance Development, Flexibility and Training of Flexibility Development, Coordination and Training of Coordination Development.

Sports/ Games: Select any Game/Sport of choice of student out of: Athletics, Badminton, Basketball, Cricket, Chess, Football, Handball, Kabaddi, Kho-Kho, Tennis, Table Tennis, Volleyball, Weight and Power Lifting, and Yoga. etc. Teaching of the Game/Sport, Latest General Rules of the Game/Sport, Training &Coaching of the Game /Sport of Techniques, Skills, Tactics, and Strategies, Specifications of Playgrounds and Related Sports Equipment.

Text Books:

1. Bucher, C. A. (n.d.) Foundation of physical education. St. Louis: The C.V. Mosby Co.
2. Deshpande, S. H. (2014). Physical Education in Ancient India. Amravati: Degree college of Physical education.
3. Plimmar, R. (2006). Food, Health and Vitamins. New Delhi: Sports Publication.
4. Muller, J. (2007). Health, Exercise and Fitness. New Delhi: Sports Publication.
5. S.N. Ghosh. (1989). Hygiene and Public health. Calcutta: Scientific Publishing Company.
6. Srivastava, V. (2009). *Nutrition and diet for sportsmen*. New Delhi: Bhagwati Publishers.
7. Bunn, J. W. (1972). *Scientific principles of coaching*. Englewood Cliffs, NJ: Prentice Hall.
8. Matvyew, L.P. (1981). Fundamental of sports training. Moscow: Progress Publishers.
9. Sharkey, B. J. (1990). Physiology of fitness, Human Kinetics Book.
10. Bunn, J. W. (1968). The art of officiating sports. Englewood cliffs N.J. Prentice Hall.
11. Bunn, J. W. (1972). Scientific principles of coaching. Englewood cliffs N. J. Prentice Hall.

HS1011	English for Engineers-I	HSC	2-0-0	2 Credits

Pre-requisites: None.

Course Outcomes: At the end of the course, the student will be able to:

CO1	To develop a strong foundation in grammar.
CO2	To develop vocabulary and to write effective paragraphs and formal letters
CO3	To improve reading comprehension and team-skills/collaborative skills
CO4	To cultivate interpretive and critical thinking skills

Syllabus:

Module 1: Basics of Language: Tense, Concord, Error detection, Reading Comprehension.

Module 2: Writing: Paragraphs, Precis writing, Formal letters, and Email etiquette.

Module 3: Interpretation and Critical Thinking: Cross cultural communication, Identifying biases, Interpretation of visual data and information, and Logical reasoning.

Module 4: Understanding Audience/Profiling Readers, Introduction to workplace communication, Group Contract/Team Contract, Presentation skills, and Techniques to enhance listening skills

Text Books:

1. Anderson, Marilyn, Pramod K. Nayar, and Madhucchanda Sen. *Critical Thinking,*
2. *Academic Writing and Presentation Skills*. Pearson Education, 2008.
3. Emden, Joan van. *Effective Communication for Science and Technology*. Macmillan Education UK, 2001.
4. Murphy, Raymond. Intermediate English Grammar. Cambridge University Press, 2014.
5. Narayanaswami, V. R. Strengthen Your Writing. Orient Longman Private Limited, 2005.
6. Sharma, Sangeetha and Binoth Mishra. *Communication Skills for Engineers and Scientists.* PHI, 2023

Reference Books:

1. Aarts, Bas. *Oxford Modern English Grammar*. Oxford University Press, 2011.
2. Blake, Gary. *The Elements of Technical Writing*. Pearson,2000
3. Carlisle, Joanne and Melinda S. Rice. *Improving Reading Comprehension Research-based Principles and Practices*. York Press, 2002.
4. Carter, Ronald and Michael McCarthy. *Cambridge Grammar of English: A Comprehensive Guide*. Cambridge University Press, 2006.
5. Carter, Ronald, Rebecca Hughes, and Michael McCarthy. *Exploring Grammar in Context: Upper-intermediate and Advanced*. Cambridge University Press, 2000.
6. Dobelli, Rolf. *The Art of Thinking Clearly: Better Thinking, Better Decisions.* Sceptre,2013.
7. Eastwood, John. *Oxford Guide to English Grammar*. Oxford University Press, 1994.
8. Paul, Richard.*Critical Thinking. How to Prepare Students for a Rapidly Changing World*. Foundation for Critical Thinking,1995. 4th Edition.
9. https://learnenglish.britishcouncil.org/

MA1021	Matrices and Differential Equations	BSC	3-0-0	3 Credits

Pre-requisites: Principles of differential and integral calculus.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Solve the consistent system of linear equations.
CO2	Apply orthogonal transformations to a quadratic form.
CO3	Solve higher-order linear differential equations with constant coefficients.
CO4	Apply the concepts in solving physical problems arising in engineering.
CO5	Apply Laplace transforms to solve physical problems arising in engineering.

Syllabus:

Matrix Theory: Linear dependence and independence of vectors; Rank of a matrix; Consistency of the system of linear equations; Eigenvalues and eigenvectors of a matrix; Caley-Hamilton theorem and its applications; Reduction to diagonal form; Reduction of a quadratic form to canonical form - orthogonal transformation; Properties of complex matrices - Hermitian, skew-Hermitian and Unitary matrices.

Ordinary Differential Equations of Higher Order: Review of First-order Ordinary Differential Equations, Higher order linear differential equations with constant coefficients - homogeneous and non-homogeneous; Euler and Cauchy's differential equations; Method of variation of parameters; System of linear differential equations; applications in physical problems - forced oscillations, electric circuits, etc.

Laplace Transforms: Laplace transforms; inverse Laplace transforms; Properties of Laplace transforms; Laplace transforms of unit step function, impulse function, periodic function; Convolution theorem, Solving certain initial value problems, Solving system of linear differential equations, Finding responses of systems to various inputs viz. sinusoidal inputs acting over a time interval, rectangular waves, impulses, etc.

Text Books:

1. E. Kreyszig, Advanced Engineering Mathematics, Eighth Edition, John Wiley and Sons, 2015.
2. B. S. Grewal, Higher Engineering Mathematics, Khanna Publications, 2015.
3. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, Fifth Edition, Narosa Publishing House, 2016.

Reference Books:

1. G. Strang, Linear Algebra and Its Applications, 4th Edition, Brooks/Cole India, 2006.
2. T. M. Apostol, Calculus, Volume 2 (2nd Edition), Wiley Eastern, 1980.
3. G. F. Simmons, Differential equations with applications and historical notes. CRC Press, 2016.

CY1021	Chemistry of Energy Systems	BSC	2-0-0	2 Credits

Pre-requisites: None.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Students will gain foundational knowledge on how chemical principles influence the electrochemical properties of matter.
CO2	Students are able to understand the atomic, electronic, and vibrational properties of materials.
CO3	Students will understand how basic chemical principles relate to everyday materials.
CO4	Students are able to establish the vital link between chemistry and industry.

Syllabus:

Electrochemistry: Redox reactions; Electrode potential; Types of electrodes; Electromotive force (EMF); Nernst Equation and numerical problems; electrochemical cells; rechargeable batteries (lead-acid, Nickel-Cadmium and Lithium-ion batteries); Fuel Cells (Hydrogen-oxygen and Methanol-oxygen fuel cells); Photovoltaic cells; Basic concepts of electrochemical supercapacitors; Fundamentals of Cyclic voltammetry.

Polymer Chemistry: Introduction; Types of polymers; Synthesis and mechanisms; characterization and properties; Conducting polymers: Introduction, types, synthesis, conduction mechanism and applications, Recyclability of polymers.

Engineering Materials: Organic light-emitting diode (OLED): Structure, principle, and applications; Liquid crystals: types of liquid crystals, properties, and mechanism; Optical fibres: principle and applications.

Spectroscopy: Electromagnetic radiation and interaction with matter; Vibrational (IR) spectroscopy: principle and applications. Electronic (UV-visible) spectroscopy: electronic transitions, Beer-Lambert's law, Woodward-Fieser rules for calculating maximum absorption wavelength; Atomic absorption spectroscopy.

Text Books:

1. Engineering Chemistry by Jain and Jain, Dhanpat Rai Publishing Company.
2. Introduction to Spectroscopy by Donald L. Pavia, 5th edition, Cengage Learning India Private Limited, 2015.
3. Polymer Science and Technology by Premamoy Ghosh, 3rd edition, McGraw-Hill, 2010.

Reference Books:

1. P. W. Atkins, Elements of Physical Chemistry, Oxford University Press, 2007.
2. M. S. Bhatnagar, A textbook of Polymer Chemistry, S. Chand, ISBN-13: 978-8121932301.
3. W. Kemp, Organic Spectroscopy, 2nd edition, Macmillan publishers, 2019.
4. B. Welz, M. Sperling, Atomic absorption spectrometry, John Wiley & Sons, 2008.

EE1611	Basics of Electrical Engineering (for Civil Engineering)	ESC	2-0-0	2 Credits

Pre-requisites: None.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Analyze DC & AC circuits and determine power & power factor.
CO2	Understand the principle and operation of transformers.
CO3	Identify the type of DC machines for a given application.
CO4	Identify the type of AC machines for a given application.
CO5	Acquire the knowledge on electrical safety.

Syllabus:

DC Circuits: Kirchoff's voltage and current laws, superposition theorem, star delta transformations.

AC Circuits: Complex representation of impedance, phasor diagrams, power & power factor, solution of 1-phase series & parallel circuits.

Single Phase Transformers: Principle of operation of a single-phase transformer, emf equation, phasor diagram, equivalent circuit of a 1-phase transformer, voltage regulation & efficiency.

DC Machines: Principle of operation, classification, emf and torque equations, characteristics of generators and motors. Speed control methods.

AC Machines: 3-Phase induction motor- principle of operation, torque – speed characteristics of 3-phase induction motor & applications. **Single phase induction motor** - equivalent circuit - starting methods of single-phase induction motors - applications.

Electrical Safety: Electrical shock and precautions, concept of fuses, and application; concept of earthing.

Text Books:

1. Engineering Circuit Analysis, William H. Hayt Jr., Jack E. Kemmerly, Steven M. Durbin, Tata McGraw Hill, 2020, 9th Edition.
2. Fundamentals of Electrical Circuits by Charles k. Alexander, Mattew N.O. Sadiku, Tata McGraw Hill, 2022, 7th Edition.
3. V.N.Mittle, Basic Electrical Engineering, 2nd edition, MC Graw Hill Education, 1 July 2017
4. Ravish R Singh, Basic Electrical Engineering, MC Graw Hill Education, 3rd edition, 2018.
5. R. Boylested and L. Nashelsky, "Electronics Devices and Circuits", Prentice Hall India, 2009.

Reference Books:

1. J. A. Edminister, Electric Circuit Theory, Schaum's Outline series: 5th edition, McGraw Hill, 2017.
2. D. P. Kothari & I.J. Nagrath, Basic Electrical Engineering, 4th edition, MC Graw Hill Education, 2019.

EE1621	Introduction to Electrical & Electronics Engineering (for Mechanical Engg.)	ESC	2-0-0	2 Credits

Pre-requisites: None.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Analyze DC & AC circuits and determine power & power factor.
CO2	Understand the principle and operation of transformers.
CO3	Identify the type of DC electrical machines for a given application.
CO4	Identify the type of AC machines for a given application.
CO5	Analyze basic electronic circuits.

Syllabus:

Electrical Circuits: Kirchoff's voltage and current laws, superposition theorem, star delta transformations. Complex representation of impedance, phasor diagrams, power & power factor, solution of 1-phase series & parallel circuits.

Single Phase Transformers: Principle of operation of a single-phase transformer, emf equation, phasor diagram, equivalent circuit of a 1-phase transformer, voltage regulation & efficiency.

DC Machines: Principle of operation, classification, emf and torque equations, characteristics of generators and motors.

AC Machines: 3-Phase induction motor- principle of operation, torque – speed characteristics of 3-phase induction motor & applications. **Single phase induction motor** - equivalent circuit - starting methods of single-phase induction motors - applications.

Electronic Devices & Circuits: P-N junction diode, I-V characteristics, bipolar junction transistor operation and characteristics.

Text Books:

1. Engineering Circuit Analysis, William H. Hayt Jr., Jack E. Kemmerly, Steven M. Durbin, Tata McGraw Hill, 2020, 9th Edition.
2. Fundamentals of Electrical Circuits by Charles k. Alexander, Mattew N.O. Sadiku, Tata McGraw Hill, 2022, 7th Edition.
3. V.N.Mittle, Basic Electrical Engineering, 2nd edition, MC Graw Hill Education, 1 July 2017
4. Ravish R Singh, Basic Electrical Engineering, MC Graw Hill Education, 3rd edition, 2018.
5. R. Boylested and L. Nashelsky, "Electronics Devices and Circuits", Prentice Hall India, 2009.

Reference Books:

1. J. A. Edminister, Electric Circuit Theory, Schaum's Outline series: 5th edition, McGraw Hill, 2017.
2. D. P. Kothari & I.J. Nagrath, Basic Electrical Engineering, 4th edition, MC Graw Hill Education, 2019.

EE1021	Analog Electronics	PCC	3-0-0	3 Credits

Pre-requisites: Basic electrical circuits.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand and analyze the different biasing techniques used in BJTs, FETs and MOSFETs.
CO2	Understand and analyze different amplifier circuits using AC equivalent models.
CO3	Design the power amplifier circuits.
CO4	Analyze and design Inverting, Non-inverting, linear and non-linear amplifier structures with operational amplifier.
CO5	Design monostable and astable multivibrators using 555 timer.

Syllabus:

Small signal amplifiers: Biasing circuits of BJT and FET transistors, analysis and design of BJT, FET and MOSFET amplifiers.

Large signal amplifiers: Analysis and design of class A and class B power amplifiers, class C and class D amplifiers, push-pull operation.

Op-amp circuits: Amplifiers, summers, differentiators, integrators, active filters, schmitt triggers, and oscillators, differential amplifier and its DC, AC analysis, OP-AMP characteristics, Non-Inverting/Inverting voltage and current feedback.

Oscillators: Barkhausen criterion for oscillation, hartley & colpitt's oscillators, phase shift, wien bridge and crystal oscillators.

Pulse circuits: Attenuators, RC integrator and differentiator circuits, diode clampers and clippers, multivibrators, schmitt trigger, UJT oscillator.

555 timers: Monostable and astable operation.

Text Books:

1. Millma, Halkias, and Chetan "Integrated Electronics", McGraw Hill Education; 2nd edition, 2017.
2. R. Boylested and L. Nashelsky, "Electronics Devices and Circuits", Prentice Hall India, 2009.
3. David A Bell, 'Fundamentals of Electronic Devices and Circuits', Oxford University Press, Incorporated, 2009.
4. Allen Mottershead, 'Electronic Devices and Circuits-An Introduction', PHI, 18th Reprint, 2006.

Reference Books:

1. Millman and Halkias, "Electronics Devices and Circuits", TMH Edition.
2. Malcolm Goodge, "Analog Electronics Analysis and Synthesis", TMH Edition. Malvino, "Electronics Principles", TMH Edition.
3. Jacob Millman and Christos C. Halkias, 'Integrated Electronics: Analog and Digital Circuits and Systems', 2nd Edition, Tata McGraw Hill Education, 2011.

EE1021	Electrical Network Analysis	PCC	3-0-0	3 Credits

Pre-requisites: Differential and integral calculus, matrices and differential equations, engineering physics, basic electrical circuits.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Simplify the analysis of electric circuits using network theorems.
CO2	Formulate and assess the dynamic time-domain response of RLC circuits.
CO3	Synthesize electrical excitations with standard signals, and use Laplace Transformations to solve electric circuits.
CO4	Analyse and simplify two-port networks using their properties and interrelationships.
CO5	Analysis of three-phase circuits for various configurations.

Syllabus:

Network Theorems: Superposition theorem, reciprocity theorem, Thevenin's theorem, Norton's theorem, maximum power transfer theorem, millman's theorem, Tellegen's theorem.
Time Domain and Frequency Domain Analysis: Solution of network equations in time domain, classical differential- equations approach, initial conditions & evaluation, applications to simple series and parallel RL, RC, and RLC circuits.
Laplace transforms of various signals of excitation, Laplace transformed networks, determination and representation of initial conditions, waveform synthesis, response for impulse function and its relation to network admittance, convolution integral and applications.
Two Port Networks: Two port networks-characterization in terms of impedance, admittance, hybrid and transmission parameters - inter relationships among parameter sets - interconnection of two port networks: series, parallel and cascade.
Three-Phase Circuits: Balanced three-phase voltages, balanced star-star connection, balanced star-delta connection, balanced delta- delta connection, balanced delta-star connection, power in a balanced system, unbalanced three phase systems.

Text Books:

1. Engineering Circuit Analysis, William H. Hayt Jr., Jack E. Kemmerly, Steven M. Durbin, Tata McGraw Hill, 9th Edition, 2020.
2. Fundamentals of Electrical Circuits by Charles k. Alexander, Mattew N.O. Sadiku, Tata McGraw Hill, 7th Edition, 2022.
3. Electrical and Electronics Technology, Edward Hughes, Pearson Education, 12th Edition, 2016.

Reference Books:

1. Network Analysis, M.E. Van Valken Burg, Pearson Education, 3rd Edition, 2015.
2. J. A. Edminister, Electric Circuit Theory, Schaum's Outline series: 6th edition, McGraw Hill, 2014.

Online resources:

1. https://archive.nptel.ac.in/courses/108/105/108105159/
2. https://nptel.ac.in/courses/108/104/108104139/
3. https://nptel.ac.in/courses/108/102/108102097/

CS2101	Data Structures and Applications	ESC	3-0-0	3 Credits

Pre-requisites: Problem solving through computer programming.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Construct abstract data types for modelling entities using appropriate data constructs and methods.
CO2	Construct list-based data structures namely stacks, queues, circular queues and linked lists.
CO3	Construct non-linear data structures namely trees & graphs and set-based structures like disjoint sets.
CO4	Construct suitable data structures and algorithms to facilitate searching, sorting and selection.
CO5	Construct efficient algorithms for performing operations on data structures within a given time and /or space complexity.
CO6	Assess the suitability of various data structures for solving a given problem with a comprehension of trade-offs in time and space complexities.

Syllabus:

Introduction to Data Structures, Algorithm Analysis and Examples based on Asymptotic Notations, Abstract Data Types (ADTs), Stacks, Queues, Circular Queues and Linked List (Singly Linked, Doubly Linked and Circular). Applications of Stacks, Queues and Linked Lists.

Trees: Representation of Trees, Binary Trees, Binary Search Trees, Applications of Trees.

Priority Queues, Binary Heap and applications

Hash Tables and Operations, Collision Resolution: Open Addressing and Chaining, Applications of Hash Tables.

Graphs: Representation of Graphs, Graph Traversal Techniques, Minimum Cost Spanning Trees: Prim's and Kruskal's Algorithms, Shortest Path Algorithms: Dijkstra's Algorithm and Floyd-Warshall Algorithm. Applications of Graphs.

Sorting Algorithms: Merge Sort, Heap Sort, Quick Sort and Counting Sort.

Text Books:

1. Michael T. Goodrich, R. Tamassia, and Mount, Data Structures and Algorithms in C++, Second Edition, John Wiley and Sons, 2011.
2. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, Fourth Edition, Pearson Education. Ltd., 2014.
3. Adam Drozdek, Thomson, Data structures and algorithms in C++, Fourth Edition, Cengage, 2013.
4. Richard F. Gilberg, Behrouz A. Forouzan, Data Structures: A Pseudocode Approach with C++, Second Edition, Thomson Learning, 2004.
5. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, Introduction to Algorithms, Third Edition, PHI, 2009.

CS2102	Data Structures and Applications Lab	ESC	0-0-2	1 Credit

Pre-requisites: Problem solving through computer programming and problem solving through computer programming lab.

Course Outcomes: At the end of this course, students will be able to:

CO1	Construct solutions for problems using linear data structures such as linked list, stacks and queues.
CO2	Construct solutions for problems using non-linear data structures such as trees and graphs.
CO3	Implement solutions for problems that requires sorting and searching as a sub-routine.
CO4	Analyze, evaluate and choose appropriate data structures and algorithms for a specific application.
CO5	Analyze algorithms with respect to their time and space complexities.

List of Experiments:

1. Implementation of Stack and Queue using Arrays.
2. Implementation of Stack-based applications like postfix expression evaluation and infix to postfix conversion.
3. Implementation of Queue and Circular Queue.
4. Implementation of Single Linked List, Doubly Linked List and Circular Linked List.
5. Implementation of Stack and Queue using Linked List.
6. Representative problems with solutions involving Stack, Queue and Linked List.
7. Implementation of Binary Search Tree.
8. Implementation of BST traversals in recursive and non-recursive ways.
9. Implementation of AVL Tree.
10. Implementation of Priority Queue.
11. Implementation of Dictionaries using open and closed addressing schemes.
12. Implementation of Trie for fast text matching.
13. Implementation of Quick, Merge, Counting, Radix and Bucket sorts.
14. Implementation of Graphs and Depth First & Breadth First Traversals.
15. Mini project involving design, memory organization, implementation and complexity analysis of data structures and their associated operations.
16. Case study/Mini project

*Minimum 10 number of experiments should be performed to fulfil curriculum.

Text Books:

1. Michael T. Goodrich, R. Tamassia, and Mount, Data Structures and Algorithms in C++, Second Edition, John Wiley and Sons, 2011.
2. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, Fourth Edition, Pearson Education. Ltd., 2014.
3. Adam Drozdek, Thomson, Data structures and algorithms in C++, Fourth Edition, Cengage, 2013.
4. Richard F. Gilberg, Behrouz A. Forouzan, Data Structures: A Pseudocode Approach with C++, Second Edition, Thomson Learning, 2004.
5. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, Introduction to Algorithms, Third Edition, PHI, 2009.

ME1072	Engineering Graphics with CAD	ESC	0-0-2	1 Credit

Pre-requisites: None.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Apply BIS standards and conventions while drawing Lines, printing Letters and showing Dimensions.
CO2	Classify the systems of projection with respect to the observer, object, and reference planes.
CO3	Construct orthographic views of an object when its position with respect to the reference planes is defined.
CO4	Analyze the internal details of an object through sectional views.
CO5	Analyze the details of an object through the development of surfaces and the isometric projections.

List of Experiments:

1. Introduction to AUTOCAD
2. Introduction to Engineering Graphics
3. Introduction to orthographic projections
4. Projection of solids: In simple positions
   (i) Axis perpendicular to H.P
   (ii) Axis perpendicular to V.P and
   (iii) Axis parallel to both H.P and V.P.
5. Projection of solids with axes inclined to one of the reference planes and parallel to other:
   (i) Axis inclined to V.P and parallel to H.P
   (ii) Axis inclined to H.P and parallel to V.P
6. Projection of solids with axes inclined to both H.P and V.P.
7. Sections of solid: when cutting plane
   (i) Parallel to V.P and
   (ii) Parallel to H.P
8. Sections of solid: when cutting plane
   (i) Perpendicular to H.P and Inclined to V.P
   (ii) Perpendicular to V.P and Inclined to H.P
9. Development of Surfaces
10. Isometric Projections

Text Books:

1. Engineering Graphics, N.D. Bhatt and V.M. Panchal, Charotar Publishers, 2013.
2. AutoCAD 2017 for Engineers & Designers, Sham Tickoo, Dreamtech Press, 2016, 23rd Edition.

PE1022	Physical Education II	PEC	0-0-1	1 Credit

Pre-requisites: None.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Demonstrate an understanding of gym practices and various training exercises.
CO2	Identify components of physical fitness and apply appropriate development methods.
CO3	Assess body efficiency using standardized tests and measurements.
CO4	Recognize postural deformities and apply corrective exercises to improve body posture.

Syllabus:

Gym and Weight Training Exercises: Toning the Upper Body with Light Weight - Exercises with Curling Machine , Bench Press, Bicep Curling with Single Rod , Bicep Curling with Dumbbell , Exercises for Triceps , Exercises for Biceps, Shoulders, latissimus dorsi , and Exercises for Forearm. Toning the Lower Body with Light Weights – Squats, Dead Lift, Exercises for Lower Back, Hamstring, Gastronomical Muscle, Ankles, and Exercises on Leg Curling Machines. Body Part Split Training Program Schedules - Beginners Training Schedule (Starting One Month), Mediocre Training Schedule (After 1 Month to 6 Months), Advanced Training Schedule (After Six Months).

Training Methods in Physical Education: Continuous Training Method (Endurance), Interval Training Method (Speed Endurance), Repetition Training Method (Speed). Fartlek Training (Endurance), Weight (Resistance)Training (Strength), Circuit Training Method (Strength Endurance), Plyometric Training Method (Power), Flexibility Training Methods (Flexibility), High-Intensity Interval Training (HIIT), (Cardiovascular), Cross Country Training Method.

Test, Measurement and Evaluation: Measurement of Height, Weight, Age, and Calculation of BMI. Norms, Procedure and Conduct of Physical Fitness Tests - 30-Meter Sprint (Speed), Standing Broad Jump (Explosive Strength), Bent Knee Sit–Ups (Abdominal Strength), 12-Minute Run/Walk (Cardiovascular Endurance), Sit and Reach (Flexibility), 6x10 Meters Shuttle Run (Agility).

Posture and Somoto Body Types: Concept and Significance of Good Posture, Postural Deformities, lordosis, kyphosis scoliosis, Scoliosis, Knocked knees, Bow legs, flat foot and their Remedies, Corrective Exercises for Postural illnesses and deformities, Meaning and Definitions of Somatic, BodyKreshemer Classification - Asthetic, Athletic,Pyknic and Dyplastic body types, Sheldon classification - Ectomorph, Mesomorph and Endomorph body types.

Sports/Games: Select any Game/Sport of choice of student out of: Athletics, Badminton, Basketball, Cricket, Chess, Football, Handball, Kabaddi, Kho-Kho, Tennis, Table Tennis, Volleyball, Weight and Power Lifting, and Yoga. etc. Teaching of the Game/Sport, Latest General Rules of the Game/Sport. Training &Coaching of the Game /Sport of Techniques, Skills, Tactics, and Strategies, Specifications of Playgrounds and Related Sports Equipment.

Text Books:

1. Singh, A., Gill, J. S., Bains, J., & Brar, R. S. (2004). *Physical education for B.P.E., B.P.Ed., and M.P.Ed.* Ludhiana: Kalyani Publishers.
2. Harre, D. (1982). *Principles of sports training*. Berlin: Sportverlag.
3. Hardayal Singh, “Sports Training: General Theory & Methods” Netaji Subhas National Institute of Sports, 1984.
4. Singh, H. (1984). Sports training, general theory and methods. Patials: NSNIS. Uppal, A.K., (1999). Sports Training. New Delhi: Friends Publication.
5. Bompa, T. O., & Buzzichelli, C. (2019). Periodization Theory and Methodology of Training. Human Kinetics.
6. Barrow, H. M., & McGee, R. (2000). Barrow and McGee's Practical Measurement and Assessment. Lippincott Williams and Wilkins.
7. Clarke, H. D. (1987). Application of Measurement to Physical Education. Englewood Cliffs, Prentic Hall.

EE2011	Measurements and Instrumentation	PCC	3-0-0	3 Credits

Pre-requisites: Physics for electrical engineering, basic electrical circuits, and electrical network analysis.

Course Outcomes: At the end of the course, the student will be able to

CO1	Understanding the principles of Measurement and errors during process.
CO2	Understand the principle and performance of PMMC, MI, dynamometer type & induction type measuring instruments.
CO3	Analyze the working principles of resistance, inductance and capacitance quantities with necessary skill development in instrument design.
CO4	Compute and analyze the errors in CTs and PTs.
CO5	Design sensors and analyze the operation of electronic measuring instruments.

Syllabus:

Measuring Instruments: Definitions- accuracy, tolerance, sensitivity, reproducibility. errors & error analysis in measurements. Classification of measuring instruments and their characteristics.

Electromechanical Instruments – permanent magnet moving coil, moving iron instruments and electrodynamometer type instruments: construction, working, types, torque equation, range extension, errors, advantages and disadvantages, active- and reactive- power measurements in single-phase and three-phase circuits.

Measurement of Resistance, Inductance and capacitances: DC bridges: Wheatstone, kelvin's, kelvin's double bridge, megger, earth resistance measurement, loss of charge method for measurement of high resistance; AC bridges: Maxwell's bridges, De-sauty, Anderson, Schering, Wien; for measurement of inductance and capacitance and their limitation

Instrument Transformers: Construction, working, testing & applications of current transformer and potential transformer.

Electronic Instruments and Transducers: Digital voltmeters, dual trace and dual beam cathode ray oscilloscopes, measurement of voltage and frequency, Lissajous patterns, wave analyzers, harmonic distortion analyzer, LCR meter and Q-meter.

Digital energy meter design components; circuit diagram; digital meter software algorithm; meter working principle; automatic meter reading, advanced metering infrastructure environments. Thermistor, RTD, thermocouple, LVDT, strain gauge, piezoelectric transducers, digital shaft encoders, tachometer, hall effect sensors.

Text Books:

1. A Course in Electrical and Electronic Measurements and Instrumentation, K. Sawhney, Dhanpat Rai and Co., 2020, 19th Edition.
2. Modern Electronic Instrumentation and Measurements Techniques, Albert D. Helfrick, William D. Cooper, Pearson Education India, 2016, 1st Edition.

Reference Books:

1. Electrical Measurements and Measuring Instruments, E.W. Golding, F.C. Widdis, Reem Publications,2011, 3rd Edition.
2. Electronic Instrumentation and Measurements, H S Kalsi, McGraw Hill, Fourth Edition,2019, 4th Edition.

EE2021	DC Machines and Transformers	PCC	3–0–0	3 Credits

Pre-requisites: Basic electrical circuits and physics for electrical engineering.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand the construction and principle of operation of DC machines.
CO2	Analyze starting methods and speed control of DC machines.
CO3	Evaluate the performance and applications of DC machines.
CO4	Discuss constructional details and principle of operation of transformers.
CO5	Apply knowledge about the testing and applications of transformer.

Syllabus:

DC Machines: Review of electromagnetic fundamentals, principles of energy conversion – basic magnetic circuit analysis, construction, principle of operation, lap and wave windings; methods of excitation, emf and torque equations, characteristics of machines operating as motors and generators; commutation, armature reaction.
speed control methods, losses and efficiency; starters for DC motors. Testing of DC machines.

Single-Phase Transformers: types and construction, principle of operation, EMF equation, equivalent circuit, phasor diagram, losses, efficiency and regulation; OC and SC tests, polarity test, parallel operation, Sumpner's test, auto transformers, saving of copper and its application.

Three-Phase Transformer: Construction**,** type of connections, voltage and current relations, all day efficiency, use of tertiary winding, tap changing, scott connection, cooling methods.

Text Books:

1. A.E Fitzgerald, Charles Kingsley, Stephen D Umans Electrical Machines–TMH Publishers, 6th Edition, 2003.
2. Nagarath & D.P. Kothari: Electrical Machines, TMH Publishers, 4th Edition, 2010.
3. P.C. Sen, "Principles of Electric Machines and Power Electronics", Wiley Student Edition, 2008.
4. Irving L. Kosow, "Eectric Machinery and Transformers", PHI, Second Edition, 2007.

Reference Books:

1. A. E. Clayton & C.I. Hancock Performance and Design of DC Machines, CBS Publishers, 2018.
2. P. S. Bimbhra, Electrical Machines, 7th edition, Khanna Publishers, 2007.
3. Fitzerald Kingsley Otmans, Electrical Machines, 7 edition, McGraw-Hill Education, 1 March 2013

EE2031	Power System Generation and Transmission	PCC	3-0-0	3 Credits

Pre-requisites: Basic electrical circuits and electrical network analysis.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understanding the different strategies of power generation
CO2	Identify the effects of resistance, inductance, and capacitance in a transmission system
CO3	Analyse the performance of the transmission system.
CO4	Understand the applications and performance of various insulator in the transmission system and analyse the concept of sag in the transmission system
CO5	Understand the concept of underground cables

Syllabus:

Electrical power generation: Typical layout of an electrical power system, present power scenario in India.
Hydro power stations, thermal power plants, nuclear power plants, geothermal power plants and gas turbine power plants.
Economics of Generation: Introduction, definitions of connected load, maximum demand, demand factor, load factor, diversity factor, load duration curve, number and size of generator units. base load and peak load plants. Cost of electrical energy-fixed cost, running cost, Tariff on charge to customer, basics of economic dispatch.
Transmission Line Parameters: Resistance, inductance and capacitance calculations – single-phase and three phase lines – double circuit lines – effect of earth on transmission line capacitance.
Performance of Transmission Lines: Regulation and efficiency – short, medium and long transmission lines, power flow through a transmission line – power circle diagrams, introduction to transmission loss and formation of corona – critical voltages – effect on line performance – travelling waveform phenomena.
Mechanical Design of Overhead Lines: Line supports – insulators, voltage distribution in suspension insulators –testing of insulators – string efficiency – stress and sag calculation – effects of wind and ice loading.
Underground Cables: Comparison with overhead line – types of cables – insulation resistance –potential gradient – capacitance of single-core and three-core cables.

Text Books:

1. Chakrabarti A., Soni M.L., Gupta P.V., and Bhatnagar U.S., 'A Text Book on Power Systems Engg', Dhanpat Rai and Sons, New Delhi, 2nd Revised Edition, 2010.
2. C.L. Wadhwa, "Electrical Power Systems", 7th Edition, New Age International, 2016.
3. D P Kothari, I J Nagrath and R K Saket Modern Power System Analysis, 5th Edition, 2022.

Reference Books:

1. Wadhwa, C.L., 'Generation Distribution and Utilisation of Electrical Energy', New Age International Publishers, 3rd Edition, 2010.
2. Hadi Saadat, Power System Analysis, Tata Mc Graw Hill Pub.Co. 4th Edition 2011.

EE2601	Network Analysis (for ECE)	ESC	3-0-0	3 Credits

Pre-requisites: None.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Solve network problems using mesh current and node voltage equations.
CO2	Time domain analysis of RL, RC circuits with various excitation.
CO3	Steady State analysis of circuits, Phasor approach, resonance conditions of RLC circuits, Laplace transform approach.
CO4	Analyze networks using Thevenin, Norton, Maximum power transfer, Superposition, Miller and Tellegen's theorems.
CO5	Understanding of two port parameters.

Syllabus:

Circuit Elements and Relations: Types of circuit components, types of sources and source transformations, KVL and KCL with dependent and independent Sources, Power balance relations, DC circuit analysis, formation of loop and node equations.

Transient Analysis: Inductance circuits: Initial condition, energy storage, RL circuit analysis with DC excitation, discharging energy from inductor circuits. Capacitance circuits: Initial condition, energy storage, RC circuit analysis with DC excitation, discharging energy from capacitator circuits, general method of solving linear differential equation for RL, RC circuits with DC excitation, sinusoidal excitation and exponential excitation.

Steady State Analysis of Circuits for Sinusoidal Excitations: Concept of phasor, circuit analysis in phasor domain, phasor diagrams, concept of real power, reactive power, complex power, power factor, resonance- series and parallel resonance, bandwidth, Q-factor and selectivity, solution of network equations using Laplace transform.

Network Theorems: Nortons, Thevenin's, star-delta transformation, Telligen's theorem, Reciprocity, Maximum Power transfer theorem.

Linear 2-port Network Parameters: Z parameters, Y parameters, H parameters, ABCD parameters.

Text Books:

1. Engineering Circuit Analysis, William H. Hayt Jr., Jack E. Kemmerly, Steven M. Durbin, Tata McGraw Hill, 2013, 8th Edition.
2. Fundamentals of Electrical Circuits by Charles k. Alexander, Mattew N.O. Sadiku, Tata McGraw Hill company.
3. Network Analysis, M.E. Van Valken Burg, PHI, 2015, 3rd edition.
4. Electrical Technology, Edward Hughes, ELBS, 2001, 6th Edition.

Reference Books:

1. Electrical Engineering Fundamentals, Vincent Del Toro, Pearson Education India, 2015, 2nd Edition.
2. Basic Electrical Engineering, V N Mittle, A Mittal, Tata McGraw Hill, 2005, 2 nd Edition.
3. Linear circuit Analysis, RA DeCarlo & Pen-Min Lin, Oxford University Press, 2003, 2 nd Edition.

Online resources:

1. https://archive.nptel.ac.in/courses/108/105/108105159/
2. https://nptel.ac.in/courses/108/104/108104139/
3. https://nptel.ac.in/courses/108/102/108102097/

EE2041	Digital Electronics	PCC	3-0-0	3 Credits

Pre-requisites: Analog electronics.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand and apply number systems and boolean algebra.
CO2	Understand the operation of digital logic gates.
CO3	Design and implement combinational logic circuits.
CO4	Develop sequential logic circuits.
CO5	Design of programmable logic device and programmable logic array.

Syllabus:

Digital Electronics:
Boolean algebra, minimization of boolean functions using boolean identities and karnaugh map, logic gates; digital IC families.

Digital Circuits: Combinatorial circuits: arithmetic circuits, code converters, multiplexers, decoders.

Combinational Logic: Realization of logic operation using gates, analysis of fundamental properties of gates, adder, subtractor, encoder/decoder.

Sequential Logic: Latches and flip-flops, counters, finite state machines, propagation delay, edge triggering, asynchronous inputs, shift registers, universal shift register, applications. binary counters – synchronous and asynchronous up/down counters, mod-n counter, counters for random sequence, setup and hold time, critical path delay, sample and hold circuits, ADCs, DACs. Semiconductor memories.

Programmable Logic: Look-up table design, programmable logic device and programmable logic array.

Introduction to Verilog HDL, structural, dataflow and behavioral modelling of combinational and sequential logic circuits.

Text Books:

1. Floyd, Thomas L., Digital Fundamentals, 2017, 11th Edition, Pearson Education
2. Roth C H and Kinney L L, Fundamentals of Logic Design, Cengage Learning (2014).
3. Mano M M and Ciletti M D, Digital Design: with Introduction to the Verilog HDL, VHDL, and SystemVerilog, Pearson (2018).
4. Donald P. Leach, Albert P. Malvino and Goutam Saha, “Digital Principles & Applications”, McGraw Hill.

Reference Books:

1. Brown S and Vranesic Z, Fundamentals of Digital Logic with VHDL Design, McGraw Hill (2009).
2. Roth, Charles, Lizy K. John, and Byeong Kil Lee, Digital systems design using Verilog,2017, 1st Edition, Cengage India Private Limited.
3. Morris Mano, Digital Electronics, First edition, Pearson Education India, 30 June 2016
4. R. P. Jain, Modern Digital Electronics, 4th edition, McGraw Hill Education, 27 July 2009.

MA2051	Complex Variables and Mathematical Methods	BSC	3-0-0	3 Credits

Pre-requisites: Principles of differential and integral calculus and matrices and differential equations.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand and use of complex variables and evaluation of real integrals
CO2	Obtain the Fourier series and Fourier transform for a given function
CO3	Determine the solution of a PDE by variable separable method
CO4	Understand the concepts of various numerical methods

Syllabus:

Complex Variables: Analytic function - Cauchy Riemann equations - Harmonic functions -Conjugate functions - complex integration - line integrals in complex plane - Cauchy's theorem (simple proof only), Cauchy's integral formula - Taylor's and Laurent's series expansions -zeros and singularities - Residues - residue theorem, use of residue theorem to evaluate the real integrals without poles on the x-axis, Bilinear transformations, Conformal mapping.

Fourier Series: Expansion of a function in Fourier series for a given range- Convergence of Fourier series - Half range sine and cosine expansions.

Fourier Transforms: Fourier transformation and inverse transforms - sine, cosine transformations and inverse transforms - simple illustrations.

Partial Differential Equations: Classification of Second order linear Partial Differential Equations, D'alembert's solution of wave equation, Method of separation of variables - Solution of one dimensional wave equation, one dimensional heat conduction equation and two dimensional steady state heat conduction equation with illustrations.

Numerical Methods: Bisection method, Secant method, Newton-Raphson method, Fixed-point iteration scheme, Gaussian elimination, Jacobi, Gauss Seidel methods, Trapezoidal rule, Simpson's 1/3, and 3/8-rules, Taylor series, Euler's method, Modified Euler's method, Runge-Kutta method.

Text Books:

1. R.K. Jain and S.R.K. Iyengar, *Advanced Engineering Mathematics,* Narosa Publishing House, 5th edition, 2016.
2. E. Kreyszig, *Advanced Engineering Mathematics*, John Wiley and Sons, 8th edition, 2008.
3. B.S. Grewal, *Higher Engineering Mathematics*, Khanna Publications,44th edition, 2017.

Reference Books:

1. M. Spiegel, S. Lipschutz , J. Schiller, and D. Spellman, *Complex Variable (Schaum's Outlines)*, Revised 2nd edition, 2017.
2. R.V. Churchill and J.W. Brown, *Complex variables and its applications*, McGraw Hill, 2009.

EE2012	Analog and Digital Circuits Lab	PCC	0-1-2	2 Credits

Pre-requisites: Analog electronics and digital electronics.

Course Outcomes: At the end of the course, the student will be able to:

CO1	To learn and understand the basic concepts of electronic devices and circuits.
CO2	Design electronic circuits to meet specific requirements.
CO3	Understand the operation of analog and digital devices and circuits.
CO4	Understand the importance and need for verification and testing of circuits.

List of Experiments:

1. Study of basic properties of bipolar junction transistor and field effect transistor
2. Study of basic properties of operational amplifier: inverting and non-inverting amplifiers.
3. Study of differentiator and integrator using operational amplifier
4. To analyse the voltage comparator circuit.
5. To study log and antilog amplifiers.
6. To study voltage to current converter.
7. To analyse a function generator using an operational amplifier (sine, triangular and square wave).
8. To study astable and monostable multivibrator
9. To verify and interpret the logic and truth table for AND, OR, NOT, NAND, NOR, Ex-OR, and Ex-NOR gates using RTL (Resistor Transistor Logic).
10. To verify the truth table of mathematical operations by using XOR and NAND gates.
11. To verify the truth table and timing diagram of RS, JK, T, and D flip-flops by using NAND & NOR gates ICs.
12. Design and simulation of an 8-bit synchronous counter

*Minimum 10 number of experiments should be performed to fulfil curriculum.

Text Books:

1. J. Millman, ‘Integrated Electronics’, McGraw-Hill, 2018.
2. Robert L. Boylested, Electronic Devices and Circuit Theory, 9th Edition, Pearson.
3. Mano, M Morris, Ciletti, Michael D, Digital design, Pearson 2012

EE2022	Circuits and Measurements Lab	PCC	0-1-2	2 Credits

Pre-requisites: Basic electrical circuits, electrical network analysis, measurements and instrumentation.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Validate network theorems.
CO2	Evaluate the time response and frequency response characteristics of RLC series.
CO3	Measure the resistance, inductance, and capacitance using DC & AC bridges.
CO4	Perform measurement of power & energy in single and poly phase systems.

List of Experiments:

1. Verification of Kirchhoff's laws.
2. Verification of Superposition, Thevenin's Theorem, and Tellegen's Theorem.
3. Verification of maximum power transfer and reciprocity theorems.
4. Transient characteristics of RC/RL/R-L-C circuit.
5. Experiments and analysis of resonance in the RLC circuits.
6. measurement of self-inductance, mutual inductance and coupling coefficient of windings.
7. Extension of range of ammeter/voltmeter using shunt/series resistance and calibration of the meter using standard ammeter/voltmeter.
8. Measurement of low/medium resistance using Kelvin's double bridge and Wheatstone's bridge.
9. Calibration of single–phase energy meter by direct loading and phantom loading at various power factors.
10. Measurement of three-phase power using two wattmeter method.
11. Measurement of reactive power and power factor with different loads.
12. Measurement of inductance using Anderson bridge.
13. Measurement of capacitance using Schering bridge.
14. Study and observe the oscilloscope as a test and measuring instrument.
15. Measurement of temperature using RTD and thermistor
16. Measurement of pressure and weight using piezoelectric transducer.
17. Study of electric shock phenomenon, precautions, preventions, earthing.
18. Study of Fuse, MCB, ELCB – Selection of Fuse rating for circuits.
19. Demonstration and practice on electrical tools and safety practices.

*Minimum 10 number of experiments should be performed to fulfil curriculum.

Text Books:

1. Engineering Circuit Analysis, William H. Hayt Jr., Jack E. Kemmerly, Steven M. Durbin, Tata McGraw Hill, 2013, 8th Edition.
2. Fundamentals of Electrical Circuits by Charles k. Alexander, Mattew N.O. Sadiku, Tata McGraw Hill company.
3. A Course in Electrical Measurements, Electronic Measurements and Instrumentation, A.K. Sawhney, Dhanpat Rai and Co., 2015.
4. Modern Electronic instrumentation and Measurements Techniques, William D. Cooper, Albert D. Helfrick, Prentice Hall of India Pvt. Ltd. 2002.

EC1521	Signals and Systems for Electrical Engineers	ESC	3–0–0	3 Credits

Pre-requisites: None.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Classify the signals as Continuous time and Discrete time.
CO2	Analyze the spectral characteristics of signals using Fourier analysis.
CO3	Classify systems based on their properties and determine the response of LTI system using convolution.
CO4	Identify system properties based on impulse response and Fourier analysis.
CO5	Apply transform techniques to analyze continuous-time and discrete-time signals and systems.
CO6	Comprehensive understanding of control systems, order of systems & stability Analysis.

Syllabus:

Basics of Signals and Systems: Continuous Time and Discrete Time signals, Exponential and Sinusoidal Signals, Unit Impulse and Unit Step Functions, Continuous and Discrete Time Systems, basic System Properties.

Linear Time Invariant Systems: Discrete Time LTI Systems, Continuous Time LTI Systems, properties of LTI Systems, causal LTI Systems Described by Difference equations.

Fourier Series Representation of Periodic Signals: Response of LTI systems to Complex Exponentials, Fourier series Representation of CT periodic Signals, properties of CT Fourier Series, Fourier Series representation of DT periodic Signals, properties of DFS, Fourier series and LTI Systems, Filtering, Examples of CT filters, Examples of DT filters.

Continuous Time Fourier Transform: Representation of a periodic Signals by continuous FT, FT of periodic signals, convolution and multiplication property of continuous FT, systems characterized by Linear Constant Coefficient Differential Equations.

Time And Frequency Characterization of Signals and Systems: Magnitude and phase representation of FT, Magnitude and phase response of LTI systems, Time domain and Frequency domain aspects of ideal and non-ideal filters.

Discrete Time Fourier Transform (DTFT) convolution property, multiplication property, Duality, Systems characterized by Linear Constant Coefficient Difference Equations.

Laplace Transforms: Review of Laplace transforms, Inverse Laplace transform, Concept of region of convergence (ROC) for Laplace transforms, Properties of Laplace Transforms. relation between Laplace and Fourier transforms.

Text Books:

1. Signals and Systems, Alan V. Oppenheim, Alan S. Willsky, S. Hamid Nawab, Prentice Hall India, 2nd Edition, 2009.
2. Linear Systems and Signals, B.P Lathi, 2nd edition Oxford University, 2008.
3. Fundamentals of Signals and Systems, Micheal J Roberts, Special Indian edition, Tata Mc Graw hill, 2010.
4. Digital Signal Processing: Principles, Algorithms and Applications, Fourth Addition, J. Proakis and D. Manolakis, Pearson,2014.
5. S.Haykin and Barry Van Veen, Signals and Systems, 2nd Edition Wiley, 2007.

HS2011	Personality Development	BSC	1-0-0	1 Credit

Pre-requisites: None.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Students will develop a deeper self-awareness, gaining insights into their strengths, weaknesses, values, and emotional triggers.
CO2	Students will enhance their communication skills, enabling them to express themselves more clearly and engage effectively with others.
CO3	Students will improve their emotional intelligence and cultivate a growth mindset, equipping them to navigate challenges with resilience and adaptability.
CO4	Students will strengthen their abilities in conflict management, adaptability, and networking, preparing them for successful interactions in personal and professional contexts.

Syllabus:

Module 1: Introduction to personality development - self assessment- SWOT - personal values statement - (punctuality, attitude, responsibility, ethics, integrity, values, and trust, and self-confidence) - imposter syndrome, communication skills (verbal and non-verbal, body language and posture, avoiding miscommunication) - techniques for persuasive communication - key principles to increase clarity of communication

Module 2: Emotional Intelligence - ways to improve emotional intelligence - application of emotional intelligence - identifying emotional triggers - Building rapport and maintaining positive interactions - Fixed and growth mindset - emotions in personal and professional relationships, strategies for effective networking - social and dining etiquette - greetings - dress code.

Text Books:

1. Mitra, Barun K. *Personality Development and Soft Skills.* 2nd ed. Oxford Higher Education, 2016.
2. Sharma, Prashant. Soft Skills: Personality Development for Life Success. 3rd ed. BPB Publications, India, 2022.
3. Goleman, D. (1995). Emotional intelligence: Why it can matter more than IQ. Bantam Books.
4. Carnegie, D. (2020). *How to win friends and influence people*. Srishti Publishers and Distributors.
5. Khera, S. (2014). *You can win: A step-by-step tool for top achievers*. Bloomsbury India.

PE2012	Yoga	PEC	0-0-2	1 Credit

Pre-requisites: None.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Recognize the concept of yoga and understand its importance.
CO2	Practice of Asanas, Pranayamas, meditation techniques, and yogic kriyas.
CO3	Role of yogic practices in promoting health and preventing health issues.

Syllabus:

Introduction: Meaning & Definitions of Yoga., Need for and Importance of the Present Era. **Yogic Warm Up** - Jogging or Spot Marching, Neck Movements, Shoulder Rotations, Spinal Twists Wrist, Knee Movements and Ankle Rotations, **Yogic Coll Down** - Gentle Forward Bendings, ne Twists, Deep Breathing / Pranayama and Shavasana. **Surya Namaskar** (Sun Salutation) - 12 Steps of Surya Namaskar.

Yoga Asanas & Various Categories of Asanas: Meaning and Definitions of Asanas and its benefits, Standing Asanas, Sitting Asanas, Supine Asanas, Prone Asanas Meditative Asanas, Inverted Asanas, Relaxation Asanas

Pranayama & Techniques: Meaning and Definitions of Pranayama & Its Benefits, Nadi Shodhana Pranayama, Surya Bhedana Pranayama, Chandra Bhedana Pranayama Techniques

Yogic Kriyas and Techniques: Meaning and Definitions of Yogic Kriyas and Its Benefits, Yogic Kriyas and Essential Equipments, Kapalabhati, Jala Neti, Sutra Neti, Trataka

Yoga and Lifestyle: Definition, Etiological (Causes) Clinical Features (Signs & Symptoms) and Yogic Treatment of Disorders: Arthritis, Cervical Spondylosis, Lumbago, Sciatica, Migraine, Insomnia, Indigestion, Constipation, Ulcer, Obesity, and Diabetes. Definition, Etiological (Causes) Clinical Features (Signs & Symptoms) and Yogic Treatment of Disorders: Bronchial Asthma, Bronchitis, Hypertension, Hypothyroidism.

Text Books:

1. Certification of Yoga Professionals - Official Guide Book (For Level I &II Instructor and Level II Teacher), Excel Books Pvt. Ltd., 2024

EE2051	AC Rotating Machines	PCC	3–0–0	3 Credits

Pre-requisites: Physics for electrical engineering, basic electrical circuits, DC machines and transformers.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understanding the construction and principle of operation of induction machines and synchronous machines.
CO2	Evaluate performance characteristics of induction machine and synchronous machines.
CO3	Analyze starting and speed control methods of induction machines and synchronous machines.
CO4	Analyze the effects of excitation and mechanical input on the operation of synchronous machine.
CO5	Select appropriate AC machine for any application and appraise its significance.

Syllabus:

Three-Phase Induction Machine: Classification of AC machines, Construction, principle of operation, phasor diagram, equivalent circuit, No-load and load characteristics, No-load and blocked rotor test, circle diagram, starting and speed control methods, braking methods, losses & efficiency and applications.

Synchronous Generator: Construction, types, winding factors, production of emf, harmonics, armature reaction, phasor diagram, load characteristics, OC and SC tests, voltage regulation, parallel operation, operation on infinite bus. Analysis of two reaction theory, power expressions for cylindrical and salient pole machines, OC & SC characteristics.

Synchronous Motor: Principle of operation, starting methods, phasor diagram, torque angle characteristics, variation of current and power factor with excitation, V curves. Concept of PM excitation.

Single Phase Induction Motor: Construction, principle and types, double revolving field theory, equivalent circuit, no load & block rotor tests, starting methods.

Text Books:

1. P.S.Bhimbra, Generalised Theory of Electrical Machines, 7th edison, Khanna publishers, 2021
2. CharlesI. Hubert: Electric Machines – Pearson, Second Edition, 2003.
3. Stephen. J.Chapman: Electric Machinery Fundamentals–McGraw Hill Education, Fourth Edition,2007.
4. A.E. Fitzgerald, Charles Kingsley. Jr., Stephen D. Umans: Electric Machinery, 7th Edition TMH 2013.

Reference Books:

1. M.G. Say, Performance & design of A.C. Machines, 3rd Edition, CBS, 1 December 2005
2. Nagrath & Kothari, Electrical Machines, 4 Edition.

EE2061	Control Systems	PCC	3-0-0	3 Credits

Pre-requisites: Differential and integral calculus, matrices and differential equations, engineering physics, DC Machines and Transformers

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand the control system components and their modelling.
CO2	Analyze the control systems in the time domain.
CO3	Analyze the control systems in the frequency domain.
CO4	Understand the concepts of state space analysis.
CO5	Design of controllers and compensators.

Syllabus:

Control system terminology, examples of simple control systems, open loop and closed loop control systems, Types of control systems.
Mathematical Models of Physical Systems: Analogy with mechanical systems, formulation of differential equations for electrical systems transfer functions of open and closed loop systems, DC & AC servomotors, synchro pair as error detector, block diagram representation of control systems: block diagram algebra, signal flow graph, Mason's gain formula.
Time Domain Analysis: Standard test signals – step, ramp, parabolic, and impulse; impulse response, characteristic equation of feedback systems, transient response of first order and second order systems to standard test signals, time domain specifications, steady-state error and error constants, introduction to P, PI, PID controllers.
Stability Analysis: Concept of stability and conditions for stability, Routh – Hurwitz criterion, dominant poles of transfer function.
Root Locus Technique: The root locus concept, basic properties, magnitude and angle conditions, properties and construction of the complex root loci, effects of adding poles and zeros to G(s) H(s) on the root loci.
Frequency Response Analysis: Introduction, frequency response specifications, correlation between time and frequency response, specifications, stability analysis from Bode plot, Nyquist plot, effect of adding poles & zeros to G(s) H(s) on the shape of polar plots. Introduction to lead, lag, lead-lag compensation techniques.
State Space Analysis: State variables, State equations, converting a transfer function to state space, converting from state space to a transfer function, Laplace transform solution of state equations, time-domain solution of state equations, concept of controllability and observability.

Text Books:

1. J Nagrath & M Gopal, "Control System Engineering", 7th Edition New Age International Publication, New Delhi 2021.
2. B.C. Kuo," Automatic Control Systems", Prentice Hall India Publications, NewDelhi, Eighth Edition,2014.

Reference Books:

1. Norman S. Nise "Control Systems Engineering", 7th edition, Wiley, 2018
2. William Bolton "Control Systems" Newnes, 2002
3. William S. Levine "Control System Fundamentals" CRC Press, 2010
4. K. Warwick "Control systems: an introduction" Prentice Hall, 1989
5. M. Gopal "Control Systems: Principles and Design" Tata McGraw-Hill Education, 2002

EE2071	Power System Analysis	PCC	4-0-0	4 Credits

Pre-requisites: Basic electrical circuits, electrical network analysis, power system generation and transmission.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Study the power system modelling using single-line diagrams.
CO2	Carry out load flow study of a practical system.
CO3	Understand the importance of sequence components in power system.
CO4	Analyse and calculate various faults.
CO5	Study the stability of power systems.

Syllabus:

Modelling of Power System Components: The one-line diagram, impedance and reactance diagrams, per unit quantities, changing the base of per unit quantities, advantages of per unit system. single line diagram, bus impedance and admittance matrix.
Power Flow Studies: Introduction, bus classification, load flow equations - iterative methods - gauss seidel methods, newton-raphson method-jacobian matrix, fast decoupled method, merits and demerits of various load flow methods- system data for load flow study. Distribution load flow analysis-backward-forward load flow.
Sequence Components: Significance of positive, negative and zero sequence components, average 3-phase power in terms of symmetrical components, sequence impedances and sequence networks.
Fault Analysis: Classification of faults, fault current calculations - sequence network diagrams for single line to ground fault, line to line fault, double line to ground fault, three phase fault, faults on power systems, and faults with fault impedance, reactors and their location, short circuit capacity of a bus.
Stability Studies: The stability problem- steady state stability, transient stability and dynamic stability-swing equation. Equal area criterion of stability-applications of equal area criterion, step-by-step solution of swing equation-factors affecting transient stability, methods to improve steady state and transient stability, introduction to voltage stability.

Text Books:

1. C.L. Wadhwa, Electrical Power Systems, 7th Edition, New Age International, 2016.
2. D P Kothari, I J Nagrath and R K Saket Modern Power System Analysis, 5th Edition, 2022.
3. Hadi Saadat, Power System Analysis, Tata Mc Graw Hill Pub.Co. 4th Edition 2011.

Reference Books:

1. Prabha S. Kundur, Om P Malik, ‘Power System Stability and Control’, McGraw-Hill, NewYork,2nd edition, 2022.
2. John J. Grainger, W.D. Stevenson: Power System Analysis, McGraw-Hill International (Indian Edition) 2017.
3. Electric Energy System Theory – an Introduction, Elgerd.O.I, Tata McGraw Hill, New Delhi, 2013.

EE2032	DC Machines and Transformers Lab	PCC	0–1–2	2 Credits

Pre-requisites: DC machines and transformers.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Select apparatus based on the ratings of DC machines and transformers.
CO2	Determine equivalent circuit parameters and performance of transformers.
CO3	Evaluate the performance of DC machines and transformers by direct and indirect loading methods.
CO4	Select braking and speed control methods of DC machines.

List of Experiments:

1. Determination of open circuit characteristic of D.C. machine
2. Determination of Load characteristics of D.C. generators
3. Speed control of D.C. motors using Armature control and Field control Methods
4. Brake test on D.C. Shunt motor
5. Swinburne's Test on DC machine
6. Retardation test on D.C. machines to determine the Moment of Inertia
7. Field's test on two identical D.C. Series machines
8. Hopkinson test on two identical D.C. machines
9. O.C. and S.C. tests on single phase transformer
10. Load test on single phase transformer
11. Sumpner's test on two single phase transformers
12. Scott connection of single phase transformers
13. Separation of no load losses of a single phase transformer

*Minimum 10 number of experiments should be performed to fulfil curriculum.

Text Books:

1. P.S. Bimbhra: Electrical Machinery – Khanna Publishers, Seventh Edition, 2011.
2. CharlesI. Hubert: Electric Machines – Pearson, Second Edition, 2003.

Reference Books:

1. Stephen.J.Chapman: Electric Machinery Fundamentals–McGraw Hill Education, Fourth Edition, 2007.
2. A.E. Fitzgerald, Charles Kingsley. Jr., Stephen D. Umans: Electric Machinery –Sixth Edition TMH 2003.

MA2092	Numerical Methods Lab	BSC	0-0-2	1 Credit

Pre-requisites: Principles of differential and integral calculus and matrices and differential equations.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Write computer programs to solve engineering problems with Python language.
CO2	Implement numerical methods in Python language.
CO3	To solve linear and nonlinear systems.
CO4	To solve ordinary differential equations.

Syllabus:

Solution of a non-linear equation: Bisection method, Secant method, Newton-Raphson method, Fixed-point iteration scheme.

Solution of linear systems: Gaussian elimination, Jacobi, Gauss Seidel methods.

Integration: Trapezoidal rule, Simpson's 1/3, and 3/8-rules.

Ordinary Differential Equations: Taylor series, Euler's method, Modified Euler's method, Runge-Kutta method.

Text Books:

1. M. K. Jain, S.R.K.Iyengar and R.K.Jain, *Numerical methods for Scientific and Engineering Computation*, New Age International Publications, 2008.
2. Erwin Kreyszig, *"Advanced Engineering Mathematics"*, Eighth Edition, John Wiley and Sons, 2015.
3. S. D. Conte and C. de Boor, *Elementary Numerical Analysis: An Algorithmic approach*, 3rd edition, McGraw-Hill Book Company, New York, 1980.

Reference Books:

1. K. E. Atkinson, Introduction to Numerical Analysis, 2nd Edition, John Wiley,New York, 1989.

EE3011	Power Electronics	PCC	3-0-0	3 Credits

Pre-requisites: Basic electrical circuits, electrical network analysis, and analog electronics.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand the characteristics of important power semiconductor switches to select switching devices for a given power converter.
CO2	Evaluate the performance of phase-controlled rectifiers.
CO3	Understand the operation of Inverter circuits.
CO4	Understand the operation and design of DC-DC converters.
CO5	Developing control for inverter and DC-DC converters.

Syllabus:

Introduction: Concept of power electronics, power semiconductor switches operation, and their V-I characteristics, methods of SCR commutation, gate drive circuits- control-, protection and conduction losses in a generic power semiconductor device, understanding data sheets of commercially available power semiconductor devices, Introduction of various types of AC-DC, DC-DC, DC-AC, and AC-AC Conversions.

Phase-Controlled Rectifiers: Principles of single-phase half and fully-controlled converter with R, RL, and RLE load with and without freewheeling diode, principles of three-phase fully-controlled converter operation with RLE load, effect of load and source inductances.

Inverters: Principle of operation and performance parameters of single phase bridge inverters with R, RL, and RLC loads and 3-phase bridge inverters, 180 and 120 degrees mode of operation, single pulse width modulation, multiple pulse width modulation, sinusoidal pulse width modulation, unipolar and bipolar schemes.

DC-DC Converters: Switched mode DC-DC converters (non-isolated) - buck converter – boost converter – buck-boost converter; operation, design, and control (preliminary approach). Cuk and Sepic converter operation.

Text Books:

1. M.H.Rashid, Power Electronics - Circuits, Devices and Applications, Pearson India, 4th edition, 2017.
2. P.S.Bimbhra, Power Electronics, Khanna Publishers, New Delhi, 7th ed, 2022.
3. Mohan, Undeland, Robin, Power Electronics, 3ed (An Indian Adaptation): Converters, Applications and Design, Wiley India Pvt Ltd., 2022

Reference Books:

1. M D Singh, K B Khanchandani, Power Electronics, Tata McGraw-Hill Publishing Company Limited, 2009.

Online Resources:

1. https://www.ti.com/power-management/overview.html#

EE3021	Power System Protection and Control	PCC	3-0-0	3 Credits

Pre-requisites: Power system generation and transmission, and power systems analysis.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand the operation of relays and circuit breakers.
CO2	Design protection schemes for power systems.
CO3	Describe the causes of overvoltage and protection against overvoltage.
CO4	Understand the role of frequency and voltage controllers in power system.
CO5	Analyze the economic operations of power system.

Syllabus:

Fundamentals of Power System Protection: Review of power system faults, zones of protection, primary and secondary backup protection, current transformer, voltage transformer, fuses, thermal relays, overcurrent relays, distance relays, differential relays, static comparators as relays, earth leakage protection, numerical relaying fundamentals, circuit breakers.

Power System Component Protection: Transformer protection, busbar protection, transmission lines protection, induction motor protection, generator protection, capacitors and reactors.

Load Frequency Control: Load frequency control of single area and two area systems - tie line bias control - automatic voltage regulator and its dynamics.

Control of Reactive Power and Voltage: Voltage profile control by generators, control by transformers, automatic voltage control, reactive power and voltage control by compensating devices (reactive power injection).

Economic Dispatch and Unit Commitment: General problem formulation and constraints - offer and locational marginal pricing-based dispatch - solution methods.

Text Books:

1. Badri Ram and Vishwakarma, D.N., 'Power System Protection and Switchgear', Tata McGraw Hill Publishing Company Ltd., 2nd Edition, 2011.
2. D P Kothari and I J Nagrath “Modern Power System Analysis”, McGraw-Hill.

Reference Books:

1. C.L. Wadhwa, ‘Electrical Power Systems’, Wiley-Blackwell, 6th Edition, 2007.
2. Ravindranath B., and Chander, N., ‘Power Systems Protection and Switch Gear', Wiley Eastern Ltd., 1st Edition, 1977.
3. Sunil S. Rao, 'Protective Switch Gear', Khanna Publishers, New Delhi, 13th Edition, 2008.

SM3021	Design Thinking	PCC	1-0-0	1 Credit

Pre-requisites: None.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand and apply advanced Design Thinking techniques for problem-solving.
CO2	Develop proficiency in ideation and visualization tools to structure innovative concepts, analyze biases in user and developer perspectives to enhance communication.
CO3	Implement frameworks to sustain a culture of innovation, apply Design Thinking principles to real-world challenges through exercises and case-based discussions.

Syllabus:

Listening and empathizing techniques, observation techniques, structured open-ended approaches, overcoming cognitive fixedness, behavior models, innovation heuristics, case-based discussions-exercises.

Use of diagrams and maps in design thinking, empathy map, affinity diagram, mind map, journey map-combining ideas into complex innovation concepts, storytelling and scenario planning-improvisation, scenario development, evaluation tools, frog design-prototyping, interactive workshops, case-based discussions.

Text Books:

1. Roger Martin, *The Design of Business: Why Design Thinking is the Next Competitive Advantage*, Harvard Business Press, 2009.
2. Christoph Meinel, Larry Leifer, and Hasso Plattner (eds), *Design Thinking: Understand – Improve– Apply*, Springer, 2011.
3. Idris Mootee*, Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School*, John Wiley & Sons, 2013.

EE2042	Control Systems Lab	PCC	0-1-2	2 Credits

Pre-requisites: Control systems.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Determine the performance of first and second-order systems in time domain.
CO2	Analyze second-order systems using frequency domain analysis.
CO3	Control of systems with high degree of freedom.
CO4	Design of feedback control systems.

LIST OF EXPERIMENTS:

1. Time-response of first and second-order systems
2. Frequency-response of second-order system
3. Design of PID controller
4. Lag and lead compensator design for second-order system
5. Lead-lag compensator design for second-order system
6. Design and control of a ball balancing system
7. Stabilization of a linear inverted pendulum
8. Control of a rotary inverted pendulum system
9. Study and control of a system with higher degree of freedom (DOF)
10. Study and control of a system with multiple actuators
11. Stabilization of a rotary inverted pendulum

*Minimum 10 number of experiments should be performed to fulfil curriculum.

Text Books:

1. J Nagrath & M Gopal, “Control System Engineering”, 5th Edition New Age International Publication, New Delhi 2011.
2. B.C. Kuo,” Automatic Control Systems”, Prentice Hall India Publications, NewDelhi, Eighth Edition,2010.

Reference Books:

1. Norman S. Nise “Control Systems Engineering”, 7th edition, Wiley, 2015
2. William Bolton “Control Systems” Newnes, 2002
3. William S. Levine “Control System Fundamentals” CRC Press, 2010
4. K. Warwick “Control systems: an introduction” Prentice Hall, 1989
5. M. Gopal “Control Systems: Principles and Design” Tata McGraw-Hill Education, 2002

EE2052	AC Rotating Machines Lab	PCC	0–1–2	2 Credits

Pre-requisites: AC rotating machines.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Determine the performance of the induction motor by direct and indirect loading methods.
CO2	Evaluate the parameters and performance of the induction motor and synchronous motor.
CO3	Determine the V and inverted V curves of synchronous motor.
CO4	Determine the performance characteristics of Schrage motor.

List of Experiments:

1. Determination of equivalent circuit parameters of three phase induction motor
2. Circle diagram of 3-phase induction motor
3. Brake test on 3-phase induction motor
4. Single phase operation of 3-phase induction motor
5. Speed control of 3-phase induction motor
6. Regulation of 3-phase alternator by E.M.F. method & MMF methods
7. Regulation of 3-phase alternator by Z.P.F. method
8. Determination of Xd and Xq of a Salient pole Synchronous Machine
9. Parallel operation of alternators
10. Determination of V and inverted V curves of 3-phase synchronous machine
11. Determination of equivalent circuit parameters of single-phase induction motor
12. Induction generator simulation/experiment.

*Minimum 10 number of experiments should be performed to fulfil curriculum.

Text Books:

1. P.S. Bimbhra: Electrical Machinery – Khanna Publishers, Seventh Edition, 2011.
2. CharlesI. Hubert: Electric Machines – Pearson, Second Edition, 2003.

Reference Books:

1. Stephen. J.Chapman: Electric Machinery Fundamentals–McGraw Hill Education, Fourth Edition,2007

EE2062	Power Systems & Renewable Energy Lab	PCC	0-1-2	2 Credits

Pre-requisites: Power system generation and transmission, Power system analysis, and Power system protection and control.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand the reactive power control in a tap changing transformer & long transmission lines.
CO2	Understand the characteristics of PV array and wind power plants.
CO3	Analyze the power system/distribution system status using different load flow solution methods.
CO4	Determine the stability of power system.

List of Experiments:

1. Reactive power control using tap changing transformer
2. Characteristics of artificial transmission line:
   (a) Regulation and efficiency Characteristics
   (b) Reactive power compensation
3. Determination of sequence reactance of alternator
4. Analysis of unbalanced voltages using symmetrical component analyzer
5. Formation of bus admittance matrix by using direct inspection method
6. Power flow solution by using: a). Gauss-siedel method, b). Newton-raphson method, c). Fast decoupled method.
7. Load frequency control of single area and two area systems
8. Solution of economic load dispatch problem using lambda logic method
9. Solution of swing equation using point-by-point method
10. Distribution load flow solution by using backward/forward method
11. Characteristics of PV Array
12. Harmonic analysis of linear and non-linear domestic and crest-factor loads and its mitigation using passive filters.
13. Simulation of wind power plant

*Minimum 10 number of experiments should be performed to fulfil curriculum.

Text Books:

1. D.P. Kothari and I J Nagrath “Modern Power System Analysis” McGraw-Hill, 4th Edition, 2011.
2. C. L. Wadhwa, “Electrical Power Systems” New Age International Pvt Ltd, 6th Edition, 2007.
3. Kundur P “Power System Stability and Control”, McGraw-Hill.

EE3031	Embedded Systems	PCC	3-0-0	3 Credits

Pre-requisites: Introduction to algorithmic thinking and programming, digital electronics.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Identify the applications, design metrics and hardware-software codesign challenges of Embedded system.
CO2	Understand Microcontroller architecture and Instruction set.
CO3	Implement interfacing through hardware or software or hardware-software codesign.
CO4	Apply efficient practices for Embedded systems hard ware or software development.
CO5	Design Embedded systems for a task.

Syllabus:

Embedded Software Development: Microprocessor & microcontroller fundamentals; embedded systems- introduction, build, functions, constraints and their impacts; software development- concurrency, static schedule, dynamic schedule, waterfall & V development model, architecture, design, coding and software unit testing.

Cortex-M4 Core: ARM: Architectures, processors, cortex-M series; cortex-M4 - processor, block diagram, registers, memory map, bitband operations and program image; ARM and thumb instruction set; cortex-m4 instruction set - memory access, general data processing, arithmetic, bitfield, branch, control and float point.

Interfacing: Interrupts: entering & exiting exception, microcontroller interrupts and timing analysis; GPIO: basic concepts, port circuitry and alternate functions; A/D conversion; D/A conversion; peripherals, comparator; timers: interrupt timer, PWM module, low power timer and real time clock; serial communication.

Textbooks:

1. Shibu K.V : Introduction to Embedded Systems, McGraw Hill
2. Ariel Lutenberg, Pablo Gomez, Eric Pernia: A Beginner's Guide to Designing Embedded System Applications on Arm Cortex-M Microcontroller, arm Education Media.
3. Muhammad Tahir and Kashif Javed: ARM® Microprocessor Systems Cortex®-M Architecture, Programming, and Interfacing, CRC Press 2017.
4. Perry Xiao: Designing Embedded Systems and the Internet of Things (IoT) with the ARM® Mbed™, Wiley
5. Mark Fisher: Arm® Cortex® M4 Cookbook, O'Reilly

EE3041	Electric Power Drives	PCC	3-0-0	3 Credits

Pre-requisites: DC machines and transformers, AC rotating machines, power electronics.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand the various drive mechanisms and methods for energy conservation.
CO2	Develop closed-loop control strategies of drives and selection of motors for a specific application.
CO3	Apply power electronic converters to control the speed of DC motors.
CO4	Acquire knowledge on induction motor and synchronous motor drives.
CO5	Acquire knowledge on filed oriented and direct torque control methods.

Syllabus:

Introduction to Electric Drives: Advantages of electric drives, parts of electrical drives, electric motors, sources, choice of electric drives, and selection of drives for various applications.
DC Motor Drives: Torque-speed equation of DC motor, speed control of DC motors using single-phase and three-phase fully controlled and half controlled rectifiers in continuous and discontinuous mode of operation, chopper-controlled drives in continuous and discontinuous mode of operation, Applications.
Induction Motor Drives: Speed control of induction motor with V/F control, static rotor resistance control, and slip power recovery scheme. Advanced speed control techniques- field oriented control-direct torque control-speed sensorless control techniques, advantages and disadvantages, applications.
Permanent Magnet Motor Drives: Basic configuration of pm motors, basic principle and operation of PM motors, types, performance analysis and control of permanent magnet motor drives, advantages and disadvantages.

Text Books:

1. G.K. Dubey: Fundamentals of Electric Drives –Narosa Publishers, Second edition, 2007.
2. S.B. Dewan, G.R. Slemom, A. Straughen: Power semiconductor drives, John Wiley & Sons.
3. VedamSubramanyam: Electric Drives Concepts & Applications –Tata McGraw Hill Edn. Pvt.Ltd, Second Edition, 2011.
4. V. Subrahmanyam: Thyristor Control of Electric Drives, Tata McGraw Hill Edn. Pvt.Ltd, 2010.
5. Malcolm Barnes, “Practical Variable Speed Drives and Power Electronics”, Newnes, 2003.
6. Chris Mi, M. Abul Masrur, and Davis Wenzhong Gao “Hybrid Electric Vehicles- Principles and Applications with Practical Perspectives”, A John Wiley & Sons, Ltd., Publication, 2nd edition, 2017.

Reference Books:

1. Werner Leonhard: Control of Electric Drives, Springer international edition2001.
2. Nisit K.De and Swapan K.Dutta: Electric Machines and Electric Drives, PHI learning Pvt. Ltd, 2011.
3. Mohan, Undeland, Robin, Power Electronics, 3ed (An Indian Adaptation): Converters, Applications and Design, Wiley India Pvt Ltd., 2022.

Online Resources:

1. https://github.com/mathworks/MATLAB-Simulink-Challenge-Project Hub/tree/main/projects/Disturbance%20Rejection%20Control%20for%20PMSM%20Motors
2. https://tec.ieee.org/newsletter/december-2013/electric-drive-power-electronics-an-overview.

SM3011	Introduction to Entrepreneurship	HSC	1-0-0	1 Credits

Pre-requisites: None.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Acquaint themselves with starting new ventures and introducing new products and service ideas.
CO2	Explore the processes of establishing a start-up and develop strategies and methods to mobilize resources.
CO3	Create venture capitalists, consultants to new firms or new business development units of larger corporates.

Syllabus:

The entrepreneur's role, task, and personality- typology of entrepreneurs: entrepreneurship as a style of management.

Identify problems worth solving-political economical, and social- technical analysis-opportunity recognition-business model identification-new product franchising-sponsorship and acquisition- internal & external entry strategies.

Startup ecosystem and support system- role of incubators- government initiatives.

Writing and pitching business plan-entrepreneurial tool-venture capital and other forms of financing-sources of external support-developing entrepreneurial marketing-competencies-maintaining competitive advantage.

References:

1. B.D.Singh. *Managing Conflict and Resolution.* Excel Books.2008
2. B. R. Barringer and D. Ireland, *Entrepreneurship*, Prentice Hall,2009.
3. G. Kawasaki, L. Filby, *The Art of the Start 2.0: The Time-Tested, Battle-Hardened Guide for Anyone Starting Anything* , Penguin,2015.
4. R. Bansal, *Connect the Dots,* Westland, 2011.
5. Ries, Eric *The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses,* Crown Business, 2011.
6. S. S. Khanka, *Entrepreneurial Development,* S. Chand & Co.2006.

EE3012	Power Electronics Lab	PCC	0-1-2	2 Credits

Pre-requisites: Basic electrical circuits, electrical network analysis, power electronics.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand the operation and performance parameters of rectifier circuits.
CO2	Evaluate various PWM techniques of inverters.
CO3	To design and develop DC-DC converter topologies.
CO4	Developing three phase induction motor speed control techniques.

List of Experiments:

1. Study of Characteristics of SCR, MOSFET &IGBT.
2. Design and implementation of gate driver circuit for a MOSFET and SCR and gate pulse generation using micro-controller.
3. Study of single-phase half & fully controlled bridge converter with R, RL and RLE load.
4. Study of three-phase half & fully controlled bridge converter with R and RL load.
5. Study of AC voltage controllers using TRIAC with R and RL load.
6. Study of Buck Chopper
7. Study of DC-DC Boost converter
8. Study of DC-DC Buck-Boost converter
9. Study of speed control of DC motor using H-bridge converter
10. Study of uni-polar and bi-polar PWM based single-phase inverters.
11. Study of 3-Phase PWM & non-PWM inverters.
12. Study of speed control of 3-Phase inverter fed induction motor based on open loop V/F control method.

*Minimum 10 number of experiments should be performed to fulfil curriculum

Text Books:

1. L. Ashok Kumar, A. Kalaiarasi, Y. Uma Maheswari, Power Electronics with MATLAB Cambridge University Press, 2018.
2. Narayanaswamy P R Iyer, Power Electronic Converters: Interactive Modelling Using Simulink, CRC Press, Inc., 2018.

Reference Books:

1. Mohan, Undeland, Robin, Power Electronics, 3ed (An Indian Adaptation): Converters, Applications and Design, Wiley India Pvt Ltd., 2022.

Online Resources:

1. https://www.ti.com/power-management/overview.html#
2. https://matlabacademy.mathworks.com/details/power-electronics-simulation onramp/ power electronics

EE3022	Embedded Systems Lab	PCC	0-0-2	1 Credits

Pre-requisites: Embedded systems.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Identify the applications, design metrics and hardware-software codesign challenges of embedded system.
CO2	Understand microcontroller architecture and instruction set.
CO3	Implement interfacing through hardware or software or hardware-software codesign.
CO4	Apply efficient programming practices for embedded system software development.

List of Experiments:

1. Performing arithmetic operations using ARM cortex
2. Interface a simple switch and display its status through relay, buzzer and LED.
3. Interface a keyboard and display the key code on an LCD
4. Perform digital I/O operations using ARM cortex
5. Implementing interrupts and exploring low power modes
6. Interface analog input and output using ADC and DAC
7. Generate precise time delay and PWM signals
8. Establish serial communication using UART
9. Controlling multiple LEDs using multiple switches and understand the concept of multiplexing.
10. Generate and visualize different analog waveforms (sine, square, triangular).

Text Books:

1. Shibu K.V : Introduction to Embedded Systems, McGraw Hill
2. Ariel Lutenberg, Pablo Gomez, Eric Pernia: A Beginner's Guide to Designing Embedded System Applications on Arm Cortex-M Microcontroller, arm Education Media.
3. Muhammad Tahir and Kashif Javed: ARM® Microprocessor Systems Cortex®-M Architecture, Programming, and Interfacing, CRC Press 2017.

Reference Books:

1. Perry Xiao: Designing Embedded Systems and the Internet of Things (IoT) with the ARM® Mbed™, Wiley
2. Mark Fisher: Arm® Cortex® M4 Cookbook, O'Reilly

EE3032	Electric Power Drives Lab	PCC	0-1-2	2 Credits

Pre-requisites: Power electronics and electric power drives.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand the operation and control of multi-phase induction motor and DC motor drive.
CO2	Performance comparison of multilevel inverter drive.
CO3	Design of traction systems for electric vehicles.
CO4	Performing simulation of electric drives.

List of Experiments:

1. Simulation of DC drive in four quadrant mode.
2. Performance of cascaded H-bridge based three phase Induction motor drive.
3. Neutral clamped inverter based three phase Induction motor drive.
4. Simulation of field-oriented control of Induction motor.
5. Simulation of direct torque control of induction motor drive.
6. Simulation of field-oriented control of permanent magnet synchronous motor.
7. Study of speed regulation of brushless DC motor drive.
8. Study of power traction in electric vehicle.
9. Study of static Kramer drive.
10. Study of speed control of 3-Phase inverter fed induction motor based on closed loop V/F control method.
11. Study of Five phase induction motor drive.

Text Books:

1. Ned Mohan, Advanced Electric Drives: Analysis, Control, and Modeling Using MATLAB/Simulink, John Wiley & Sons, Inc., 2014
2. Liuping Wang, Shan Chai, Dae Yoo, Lu Gan, Ki Ng, PID and Predictive Control of Electrical Drives and Power Converters Using MATLAB/Simulink, John Wiley & Sons, Inc., 2015.

Reference Books:

1. Werner Leonhard: Control of Electric Drives, Springer international edition2001.
2. Nisit K.De and Swapan K.Dutta: Electric Machines and Electric Drives, PHI learning Pvt. Ltd, 2011.

Online Resources:

1. https://in.mathworks.com/help/sps/motor-drives.html

EE 2601	Basics of Internet of Things	DEC	3-0-0	3 Credit

Pre-requisites: None.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Identify the hardware and software components, challenges of Internet of Things.
CO2	Assess different Internet of Things technologies and their applications.
CO3	Design basic circuits using sensors interfacing, data conversion process and shield libraries to interface with the real world.
CO4	Build and demonstrate the project successfully by sensor requirements, coding, emulating and testing.
CO5	Analyse the different Technologies behind IoT.

Syllabus:

IoT Fundamentals:
Definition and characteristics of Internet of Things (IoT) - challenges and issues - physical design of IoT - logical design of IoT - IoT functional blocks.

IoT Communication: Control units, communication modules – bluetooth – zigbee – WiFi – GPS - IoT protocols (IPv6, 6LoWPAN, RPL, CoAP) – MQTT - wired communication - power sources.

Technologies Behind IoT: Four pillars of IoT paradigm: RFID, wireless sensor networks, supervisory control and data acquisition (SCADA) - M2M - IoT enabling technologies: bigdata analytics, cloud computing, embedded systems.

Programming for IoT: Working principles of sensors – IoT deployment for raspberry Pi /Arduino/equivalent platform – reading from sensors, communication: connecting microcontroller with mobile devices - communication through bluetooth - WiFi and USB - contiki OS - Cooja simulator.

Text Books:

1. Simone Cirani, Gianluigi Ferrari, Marco Picone, Luca Veltri. Internet of Things: Architectures, Protocols and Standards, 2019.
2. Bahga, Arshdeep, and Vijay Madisetti. Internet of Things: A Hands-on Approach, 2014.

Reference Books:

1. Vlasios Tsiatsis, Jan Holler, Catherine Mulligan, Stamatis Karnourskos and David Boyle. Internet of Things: Technologies and Applications for a New Age of Intelligence, 2018.

EE2611	Renewable Power Generation	DEC	3-0-0	3 Credits

Pre-requisites: Power system generation and transmission.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Explain the basic principles of various renewable energy conversion processes and devices used therein.
CO2	Identify various parameters that influences the performance of renewable energy devices/processes.
CO3	Undertake the field projects in the area of solar thermal, solar PV, wind, biomass, ocean energy, geothermal etc.
CO4	Identify suitable renewable sources and technology for a given requirement.
CO5	Develop the integrated renewable energy technology for decentralized power sector.

Syllabus:

Need of sources of renewable energy: Introduction to different sources of renewable energy and applications. basic concepts of radiation, radiation measuring instruments, and applications.
Solar Energy: Basics of solar thermal applications in both low and high temperature ranges, principle of photovoltaics including an introduction to various components of photovoltaic systems for standalone/hybrid/grid-connected systems.
Wind Energy: Wind resource assessment including instrumentation used in resource assessment, basic theory of wind, wind power generators, performance characteristics, augmentation of wind power, betz criteria.
Bioenergy: Types and availability of biomass resources, various methods of biomass utilization for energy generation, types of bio-gas digesters and its utilizations,
Geothermal Energy: Availability and methods of utilization of geothermal resource for thermal applications and electricity generation
Ocean Energy: Principles utilization, thermodynamic cycles, tidal and wave energy, potential and conversion technique, principle of ocean thermal energy conversion system.
Fuel Cells and Hydrogen Energy: Introduction, principle of fuel cells, thermodynamic analysis of fuel cells, types of fuel cells, fuel cell batteries, applications of fuel cells. hydrogen as a renewable energy source, sources of hydrogen, and methods of hydrogen production.

Text Books:

1. Duffie, J. A., & Beckman, W. A. (2013). Solar engineering of thermal processes, fourth edition, Wiley.
2. Tiwari, G. N., & Ghosal, M. K. (2007). Fundamentals of renewable energy sources. Alpha Science International Limited.
3. Mukherjee, D., & Chakrabarti, S. (2004). Fundamentals of renewable energy systems. New Age International.

Reference Books:

1. Sukhatme, S. P. (2005). Solar Energy Principles of Thermal Collection and storage Tata McGraw Hill Publishing Company Ltd. New Delhi.
2. Kothari, D. P., Singal, K. C., & Ranjan, R. (2011). Renewable energy sources and emerging technologies. PHI Learning Pvt. Ltd.

EE2621	Introduction to Machine Learning	DEC	3-0-0	3 Credits

Pre-requisites: Differential and integral calculus, matrices and differential equations

Course Outcomes: At the end of the course, the student will be able to:

CO1	Identify design practices for efficient Machine Learning based solution
CO2	Understand Machine Learning algorithms in practice
CO3	Implement strategies to boost the existing Machine Learning model
CO4	Design Machine Learning architecture for a task
CO5	Design Machine Learning modelling pipeline for Electrical engineering applications

Syllabus:

Machine Learning Landscape: Introduction, learning paradigm, machine learning algorithm attribution: inductive learning, online learning, active learning, unsupervised learning, semi-supervised learning, active learning, reinforcement learning, metric learning.

Learning Algorithms: Linear regression; logistic regression; artificial neural networks: perceptron, gradient descent and the delta rule, multilayer networks, derivation of backpropagation rule, backpropagation algorithm, support vector machine, decision trees; random forest; bayes classifier. clustering, principle component analysis, graph based methods.

Augmenting Machine Learning: Convergence, generalization, inductive bias, regularization, loss function, optimizers, feature extraction, subset selection, ensemble learning, data augmentation.

Electrical Applications of Machine Learning: Control applications, forecasting pipelines, anomaly detection.

Text Books:

1. Tom.M.Mitchell, Machine Learning, McGraw Hill International Edition, 2017.
2. C Bishop – Pattern Recognition and Machine Learning – Springer, 2009.

References:

1. Ian Goodfellow, Yoshua Bengio, AaronCourville – Deep Learning, The MIT Press Cambridge, Massachusetts, London, England, 2016

EE3601	Advanced Control Systems	DEC	3-0-0	3 Credits

Pre-requisites: Control systems.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand the advantages of discrete time control systems over continuous time control systems.
CO2	Apply z–z-transformations and their application in mathematical analysis and also different stability tests to find out the stability of a system.
CO3	Design a control system with state space methods.
CO4	Synthesize intelligent control system.
CO5	Design of optimum and robust control techniques for robust stability, robust performance, and robust control of single and multivariable process.

Syllabus:

Digital Control System Design: Ideal sampling, the z-transform, stability in the z-plane, mapping from the s-plane into z-plane, the jury stability test, lyapunov stability analysis, root locus analysis in the z-plane, root locus construction rules, digital compensator types and design.

Optimal and Robust Control System Design: Types of optimal control problems, selection of performance index, the linear quadratic regulator, continuous form and discrete form, the kalman filter: state estimation process, robust control, internal model control, H_2- and H_∞-optimal control, robust stability and robust performance, multivariable robust control.

Intelligent Control System Design: Intelligence in machines, fuzzy logic control systems, neural network control systems, genetic algorithms and their application to control system design.

Text Books:

1. K.Ogata, " Modern control Engineering", PHI,.KhannaPublishers,7th Edition,2015.
2. K.Ogata, " Discrete time control systems", Pearson Education, 2005.
3. M. Gopal, " Digital control and state variable methods", 4th Edition, TMH, 2017.

References:

1. Norman.S.Nise, " Control system Engineering", 7th edition, Wiley
2. B.C.Kuo, "Digital control systems" Holt Saunder's International edition,1991.

EE3611	Wind and Solar Electrical Systems	DEC	3-0-0	3 Credits

Pre-requisites: AC rotating machines and power electronics.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Describe the solar radiation, measurements and characteristics of solar PV cell.
CO2	Develop the model of a PV system and its applications.
CO3	Describe the basic types and mechanical characteristics and model of wind turbine.
CO4	Analyze the electrical characteristics and operation of various wind-driven electrical generators.
CO5	Analyze the power electronic converters for interfacing wind electric generators

Syllabus:

Basic characteristics of sunlight – solar spectrum – insolation specifics– irradiance and irradiation- pyranometer – solar energy statics- solar PV cell – I-V characteristics –P-V characteristics– fill factor- modeling of solar cell– maximum power point tracking.

PV module – blocking diode and bypass diodes– composite characteristics of PV module – PV array– PV system –PV-powered fan–PV fan with battery backup–PV-powered pumping system –PV powered lighting systems– grid- connected PV systems.

Wind source–wind statistics-energy in the wind –turbine power characteristics - aerodynamics – rotor types – parts of wind turbines– braking systems–tower- control and monitoring system.

General characteristics of induction generators– grid-connected and self-excited–steady-state equivalent circuit-performance predetermination–PMSG–steady-state performance.

Power electronic converters for interfacing wind electric generators – power quality issues-hybrid systems wind-diesel systems – wind-solar systems.

Textbooks:

1. S N Bhadra, S Banerjee and D Kastha, ‘Wind Electrical Systems’, Oxford University Press, 1st Edition, 2005.
2. Chetan Singh Solanki, ‘Solar Photovoltaics: Fundamentals, Technologies and Applications’ PHI Learning Publications, 2nd Edition, 2011.

Reference Books:

1. Roger A. Messenger and Jerry Ventre, ‘Photovoltaic Systems Engineering’, Taylor and Francis Group Publications, 2nd Edition, 2003.
2. M. Godoy Simoes and Felix A. Farret, ‘Alternative Energy Systems: Design and Analysis with Induction Generators’, CRC Press, 2nd Edition, 2008.
3. Ion Boldea, ‘The Electric Generators Handbook- Variable Speed Generators’, CRC Press, 2010.
4. Bin Wu, Yongqiang Lang, Navid Zargari, Samir Kouro, ‘Power Conversion and Control of Wind Energy Systems’, IEEE Press Series on Power Engineering, John Wiley & Sons, 2011.
5. S. Sumathi,L. Ashok Kumar,P. Surekha ,‘Solar PV and Wind Energy Conversion Systems’, Springer 2015.

EE3621	Digital Signal Processing	DEC	3-0-0	3 Credits

Pre-requisites: Differential and integral calculus, matrices and differential equations, complex variables and transform techniques, and signals and systems.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand the characteristics of signals and systems in time domain and frequency domain.
CO2	Understand the transforms and their properties.
CO3	Analyze systems in fourier domain.
CO4	Synthesis of FIR and IIR filter structures.
CO5	Design FIR and IIR type digital filters.

Syllabus:

Basic Elements of Digital Signal Processing: Review of signals & systems**,** DTFT, Z transform, DFT, DFT properties.

Fast Fourier Transforms: Efficient computation of DFT, FFT algorithms: radix-2 and radix-4 FFT algorithms, decimation in time and decimation in frequency algorithms, use of FFT algorithms in linear filtering, reconstruction and aliasing in time and frequency domains.

Digital Filter Synthesis: FIR and IIR filters - direct form realization, cascade form, and linear phase realization. IIR filter - direct form I, direct form II, cascade form, parallel form, Lattice form realization.

Digital Filters Design: Linear phase FIR filter, characteristic response, location of zeros, design of FIR filter - windowing, frequency sampling, FIR Filters- moving average filters, windowing method, design of IIR filters from analog filters - Impulse invariance, bilinear transformation, matched z-transform. IIR filters: simple design example. equalization and noise cancellation and adaptive FIR filter.

Text Books:

1. Alan V. Oppenheim, Ronald W. Schafer – “Discrete Time Signal Processing”, Pearson Education, 2013.
2. Sanjit K. Mitra, “Digital Signal Processing – A computer based approach”, Mc Graw Hill International Edition, Fourth Edition, 2011.
3. Sanjit K. Mitra, “Digital Signal Processing Laboratory using MATLAB”, Mc Graw Hill International Edition, 2001.
4. David J. De Fatta, Joseph G. Lucas, William S. Hodgkiss, “Digital Signal Processing- A System Design Approach”, John Wiley and Sons, Inc. Pte. Ltd., Singapore.
5. Monson H. Hayes, Schaum’s Outlines of Theory and Problems of Digital Signal Processing, Mc Graw Hill Publishing Company, (c 1999).

Reference Books:

1. Proakis and Manolakis: Digital signal processing principles –algorithms and applications-PHI–2003
2. Lawrence R. Rabiner, Bernard Gold, “Theory and application of Digital Signal Processing”, Prentice Hall of India Private Limited, New Delhi – 110 001, 1993, Eastern Economy Edition.
3. Thomas J. Cavicchi, “Digital Signal Processing”, John Wiley and Sons (Pte.)
4. Jonathan (Y) Stein, “Digital Signal Processing – A Computer Science Perspective”, Wiley Student Edition, John Wiley and Sons (Asia) Pte Ltd.

Online Resources:

1. https://ocw.mit.edu/courses/res-6-008-digital-signal-processing-spring-2011/pages/study-materials/
2. https://archive.nptel.ac.in/courses/108/106/108106151/

EE3631	Soft Computing Techniques	DEC	3-0-0	3 Credits

Pre-requisites: None.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand soft computing fundamentals.
CO2	Explore genetic algorithms and analyse convergence of GA.
CO3	Investigate computational swarm intelligence.
CO4	Examine meta heuristic techniques.
CO5	Develop intelligent systems using soft computing techniques.

Syllabus:

Fundamentals of Soft Computing Techniques: Definition, constrained & unconstrained optimization, intelligent systems, soft computing, hard computing, various types of soft computing techniques, applications of soft computing.

Genetic Algorithms: History, working principle, various encoding methods, GA operators-reproduction, cross-over and mutation, convergence of GA, multi-level optimization.

Computational Swarm Intelligence: Optimization theory and multi-objective optimization, particle swarm optimization, Ant colony optimization, bee colony optimization, bats algorithm

Meta-heuristic Techniques: Water wave optimization algorithm, multi verse optimization algorithm, symbiotic organisms search algorithm, invasive weed optimization, applications of soft computing techniques in electrical engineering.

Text Books:

1. Xin-She Yang, “Recent Advances in Swarm Intelligence and Evolutionary Computation”, Springer International Publishing, Switzerland, 2015.
2. Kalyanmoy Deb “Multi-Objective Optimization using Evolutionary Algorithms”, John Wiley & Sons, 2010.
3. James Kennedy and Russel E Eberheart, “Swarm Intelligence”, The Morgan Kaufmann Series in Evolutionary Computation, 2001.

Reference Books:

1. "Principles of Soft Computing" by S.N. Sivanandam and S.N. Deepa (Wiley India, 2011)
2. "Soft Computing: Techniques and its Applications in Electrical Engineering" edited by Anita Khosla, Ritu Khosla, and Kusum Deep (Springer, 2017).
3. "Soft Computing and Intelligent Systems Design: Theory, Tools and Applications" by Fakhreddine O. Karray and Clarence de Silva (Pearson Education, 2004).

EE3641	Introduction to Electric Vehicles	3-0-0	3 Credits

Pre-requisites: None.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Calculation of energy losses and performance efficiency of a conventional vehicle.
CO2	Identify the power flow in electric and hybrid electric vehicles.
CO3	Understand global developments, standards and emerging research in EV sector.
CO4	Analyze the performance of Battery energy systems for electric vehicles.
CO5	Illustrate the configurations of different types of EV charging stations.

Syllabus:

Basic Concepts of Vehicle Energy and Fuel Consumption: Main elements of the energy conversion scheme in vehicles, energy domains in vehicle propulsion systems, upstream processes, energy density of on-board energy carriers, fuel efficiency, pathways to better fuel economy, types of losses, uphill driving force, performance and drivability, energy demand in driving cycles.

Vehicle Power Management in Electric and Hybrid Electric Vehicles: Configurations of hybrid electric vehicles (HEVs) and Electric vehicles (EVs), Types of HEVs and EVs, regenerative braking, battery technologies, role of power electronics and electric machines, advantages over conventional vehicles.

Global & National Developments and Technical Standards in EV Sector: Study of global EV Outlook – trends and developments in EV markets, promotion, polices, IEA technology road map on electric and plug-in hybrid vehicles, FAME schemes, bureau of energy efficiency, niti aayog, progress and plans of OEMs.

Battery Technologies and their Performance in EVs: Battery parameters, types of batteries, comparison, ultracapacitor, flywheel, battery charging and discharging, battery efficiency, battery testing, factors affecting battery failures.

EV Charging Infrastructure: Wired charging station (Static): Electric vehicle supply equipment, classification of electric vehicle supply equipment, DC charging station, AC charging station, advantages and disadvantages of wired charging station, IEC standards for wired charging Station.

Wireless Charging Station (Dynamic): Composition of the wireless charging system, Wireless charging challenges, IEC Standards for wireless charging Station.

Text Books:

1. Lino Guzzella and Antonio Sciarretta “Vehicle Propulsion Systems”, Springer, 2005
2. Xi Zhang and Chris Mi “Vehicle Power Management” Springer, 2011
3. James Larminie, John Lowry, “Electric Vehicle Technology Explained,” 2nd edition Willey, 2012.

Reference Books:

1. Sandeep Dhameja, “Electric Vehicle Battery Systems,” 1st edition Elsevier, 2001.
2. Naoui Mohamed, Flah Aymen, Mohammed Alqarni, Rania A. Turky, Basem Alamri, Ziad M. Ali, Shady H.E. Abdel Aleem, “A new wireless charging system for electric vehicles using two receiver coils,” Ain Shams Engineering Journal, Volume 13, Issue 2, 2022.

Online Resources:

1. https://www.iea.org/, IEA Global EV Outlook 2023
2. https://fame2.heavyindustries.gov.in/, National Automotive Board (NAB), Ministry of Heavy Industries, Govt of India
3. https://www.iso.org/, International Organization for Standardization
4. https://www.araiindia.com/, Automotive Research Association of India (ARAI)
5. https://www.siam.in/, Society of Indian Automobile Manufacturers (SIAM)
6. https://eeslindia.org/en/home/, Energy Efficiency Services Limited (EESL)
7. https://evyatra.beeindia.gov.in/go-electric/, Energy Efficiency Services Limited (EESL)
8. https://e-amrit.niti.gov.in/home, Niti Aayog

EE3651	Advanced Computer Methods in Power Systems	DEC	3-0-0	3 Credits

Pre-requisites: Power system generation and transmission and power systems analysis.

Course Outcomes: At the end of the course the student will be able to:

CO1	Design mathematical models for power system components.
CO2	Analyze and pick the best algorithm for a selected power system problem.
CO3	Understand the importance of spasticity technique for load flow analysis.
CO4	Understand the concepts contingency problems in power systems.
CO5	Analyze state estimation concept in transmission system.

Syllabus:

Incidence and Network Matrices: Introduction, graphs, incidence matrices, primitive matrices, types of network matrices, formation of network matrix, PI-representation of off-nominal tap transformers, Y-bus by singular transformation, examples of formation of incidence matrices, formation of Y-bus by inspection.

Algorithms for Formation of Z-bus Matrix: Step by step algorithm for formation of Z-bus. modification of Z-bus matrix for changes in the network, example of formation and modification of Z-bus matrix.

Short Circuit Calculations: Introduction, short circuit calculations using matrices for various faults, example of short circuit calculations using Zbus102 for L-L-L and L-G faults.

Sparsity Technique in Load Flow Studies: Introduction, sparsity technique for Y-bus and gauss-seidel method.

Contingency Analysis in Power Systems: Contingency calculations using ZBUS and YBUS table of factors. state estimation – least square and weighted least square estimation methods for linear systems.

Text Books:

1. Stagg and ElAbiad, Computer Methods in Power Systems Analysis, McGrawHill ISE, 2019.
2. M.A. Pai, Computer Techniques in Power System Analysis, Tata McGraw-Hill Education, 2017, 3rd Edition.

Reference Books:

1. Hadi Saadat, Power System Analysis, PSA Publishing, 2010.
2. William Stevenson and John Grainger, Power System Analysis, McGraw Hill Education, 2017.
3. Allen J. Wood and Bruce F. Wollenberg, Power Generation, Operation, and Control, Wiley Blackwell, 1996.

Online Resources:

1. https://www.youtube.com/watch?v=kxm0Prghn64
2. https://www.youtube.com/watch?v=dke92EPNNoA
3. https://www.youtube.com/watch?v=OLmfyXVcszc
4. https://www.youtube.com/watch?v=UL-3R9t_QUk
5. https://www.youtube.com/watch?v=8yPyyWFozbg

EE3661	Advanced Power Electronics	DEC	3-0-0	3 Credits

Pre-requisites: Power electronics.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand the various power factor correction rectifier circuits.
CO2	Understand the soft-switching is enabled using resonant tank circuits in DC-DC converters.
CO3	Analyzing single phase and three phase AC-AC converter topologies.
CO4	Understand the operation of state of art matrix.
CO5	Understand the operation of multi-phase and multi-level inverters.

Syllabus:

PFC Converters: Controlled and uncontrolled converters, multi-pulse converters, and PWM converters – operation, analysis, and control.

Soft-switching DC-DC Converters: Zero-voltage-switching converters, zero-current-switching converters, Cascaded DC-DC converters – ripple reduction and its advantages, dual active bridge rectifier-operation and control.

AC-AC Converters: Single phase cyclo-converters-working-Analysis-various modes-operation and three phase cyclo-converters-working-Analysis-various modes.

Inverters: Matrix converters, multi-phase inverters, multi-level converters: cascaded H-bridge, diode clamped, NPC, flying capacitor – operation, modulation techniques-SPWM-SVM.

Text Books:

1. M.H.Rashid, Power Electronics - Circuits, Devices and Applications, Pearson India, 4th edition, 2017.
2. P.S.Bimbhra, Power Electronics, Khanna Publishers, New Delhi, 7th ed, 2022.
3. Mohan, Undeland, Robin, Power Electronics, 3ed (An Indian Adaptation): Converters, Applications and Design, Wiley India Pvt Ltd., 2022.

Reference Books:

1. M D Singh, K B Khanchandani, Power Electronics, 2009, Tata McGraw-Hill Publishing Company Limited, ISBN-13: 978-0-07-058389-4

Online Resources:

1. https://www.ti.com/power-management/overview.html#

EE3671	Industrial Instrumentation and Automation	DEC	3-0-0	3 Credits

Pre-requisites: Measurements and instrumentation.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Identify the sensors/transducers suitable for Industrial applications.
CO2	Design of signal conditioning circuits for industrial instrumentation and automation.
CO3	Analyze the concepts of data transmission and virtual instrumentation related to automation.
CO4	Develop the logic for the process control applications using PLC programming.
CO5	Describe the fundamental concepts of DCS and SCADA systems.

Syllabus:

Sensors and Transducers: Process control basics: overview, process control loop and its elements; sensor time response: understanding first and second-order responses; transducers: characteristics, selection criteria, and applications.
Signal Conditioning Circuits and Final Control: Electronic amplifiers: types include differential, instrumentation, precision rectifiers, log amplifiers, carrier amplifiers, lock-in amplifiers, isolation amplifiers, charge amplifiers, and phase-sensitive detectors; final control operations: signal conversion and actuators and control elements.
Data Transmission and Virtual Instrumentation System: Data transmission methods: analog and digital cable transmission, fiber optics, pneumatic systems; process control networks: functions, characteristics, fieldbus, profibus, and wireless communication; virtual instrumentation: architecture and comparison with traditional instruments, including graphical programming concepts.
Programmable Logic Controllers (PLC): PLC: Organization, hardware details, I/O power supply, CPU; standards programming aspects: ladder programming: realization of AND, OR logic, the concept of latching, introduction to timer/counters, exercises based on timers and counters.
SCADA and DCS Systems: SCADA: Introduction, architecture, components, supervision, control, HMI, RTU, and protocols (IEC 60870-5-101, DNP3); DCS: Introduction, architecture, and control modes.

Text Books:

1. Curtis D Johnson , “Process Control Instrumentation Technology”, PHI Learning Pvt Ltd New Delhi, 2005
2. Doeblin E.O, “Measurement Systems: Application and Design”, Fourth Edition, McGraw Hill, Newyork, 1992
3. DVS. Murty, “Transducers and Instrumentation”, Second Edition, PHI Learning Pvt Ltd New Delhi, 2013
4. Jovitha Jerome, “Virtual instrumentation using LabVIEW”, Prentice Hall of India, 2010. William Bolton, “Programmable Logic Controllers”, Fifth edition, ELSEVIER INDIA Pvt Ltd New Delhi, 2011
5. Stuart A. Boyer, "SCADA: Supervisory Control and Data Acquisition", Fourth edition, International Society of Automation, 2010

References:

1. G.K.McMillan, ‘Process/Industrial Instrument and control and hand book’ McGraw Hill, New York,2019
2. Michael P .Lucas, ‘Distributed Control system’, Van Nastrant Reinhold Company, New York Patranabis, D., ‘Principles of Industrial Instrumentation’, Second Edition Tata McGraw Hill Publishing Co. Ltd. New Delhi
3. Robert B. Northrop, ‘Introduction to instrumentation and measurements’, CRC, Taylor and Francis 2005

EE3681	Converters for Renewable Energy Systems	DEC	3-0-0	3 Credits

Pre-requisites: Power electronics and advanced power electronics.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand the principles of operation of advanced PWM converters.
CO2	Appraise various advanced converter topologies and suitable control schemes.
CO3	Recognize recent developments in design aspects of renewable power conversion systems.
CO4	Analysis of the MLI in renewable energy applications
CO5	Analysis of the Hybrid converters in renewable energy applications

Syllabus:

Advanced Converters: Drawbacks of conventional converters & Inverters, multi-pulse converters & Inverters, Improved power quality AC-DC converters such as single-phase buck, boost, buck-boost AC-DC converters, PWM based single- phase, three-phase voltage source converters, current source inverters.
Multilevel Converters/ Inverters: Advance converter topologies for PEE – Interleaved converters, multilevel converters: cascaded H-bridge, diode clamped, NPC, flying capacitor, multi pulse PWM current source converters, advanced control schemes, capacitor unbalance.
PWM Schemes: Conventional PWM schemes & their performance, multilevel PWM schemes, hybrid PWM schemes, power converter topologies for solar and wind– control of DC-DC converter, inverters and relevant.
Case Studies: Literature- MLI applications in drives and power quality, hybrid converters- inverters- closed loop renewable energy conversion systems- PV power conversion using MLIs.

Text Books:

1. N. Mohan, T. M. Undeland and W. P. Robbins, Power Electronics Converter Application and Design, ThirdEdition, John Willey & Sons, 2004.
2. M. H. Rashid, Power Electronics, Circuits, Devices and Applications, Pearson, 2002, India.
3. K. Billings, Switch Mode Power Supply Handbook, McGraw-Hill, 1999, Boston.
4. Bin Wu, High-Power Converters and AC Drives, IEEE Press, A John Wiley & Sons, Inc Publication, New York,2006.
5. Relevant literature review for case studies and course applications.

EE3691	Deep Learning Algorithms	DEC	3-0-0	3 Credits

Pre-requisites: None.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand the mathematics behind the functioning of various neurons.
CO2	Identify design metrics of deep learning architectures.
CO3	Analyze a given dataset for representation.
CO4	Synthesis of a deep learning pipeline for a task.
CO5	Design of deep learning models for electrical applications.

Syllabus:

Introduction to Deep Learning: basic supervised classification task, optimizing logistic classifier using gradient descent, stochastic gradient descent, momentum, and adaptive sub-gradient method.
Neural Networks: Feedforward neural networks, deep networks, regularizing a deep network, model exploration, and hyper parameter tuning.
Convolution Neural Networks: Introduction to convolution neural networks: stacking, striding and pooling, applications like image, and text classification, temporal convolution,
Sequence Modeling: Recurrent Nets: Unfolding computational graphs, recurrent neural networks (RNNs), bidirectional RNNs, encoder-decoder sequence to sequence architectures, deep recurrent networks, LSTM networks.
Encoder and Decoder: Regularized autoencoders, sparse autoencoders, denoising autoencoders, representational power, layer, size, and depth of autoencoders, attention: transformers, BERT, variants.
Applications of Electrical Engineering: Role of deep learning in control and predictive tasks.

Text Books

1. Bunduma, N. (2017). Fundamentals of Deep Learning, O'reilly machine learning.
2. Heaton, J. (2015). Deep Learning and Neural Networks, Heaton Research Inc.

Reference Books:

1. Goodfellow, I. (2016). Deep Learning. MIT Press.
2. Deng, L., & Yu, D. (2009). Deep Learning: Methods and Applications (Foundations and Trends in Signal Processing). Publishers Inc.
3. Hall, M.L, (2011). Deep Learning. VDM Verlag.

EE3701	Electrical Machine Design	DEC	3-0-0	3 Credits

Pre-requisites: DC machines and transformers and AC rotating machines

Course Outcomes: At the end of the course, the student will be able to:

CO1	Knowledge of design of DC machines.
CO2	Knowledge of design of transformers.
CO3	Knowledge of design of induction motors.
CO4	Knowledge of design of synchronous machine.
CO5	Analyse the recent industrial trends in electrical machines design.

Syllabus:

General Concepts & Considerations of Electrical Machine Design: Heating and cooling characteristics of machine, magnetic circuit calculations.

Design of DC Machines: Output equation, specific loadings and number of poles, main dimensions of DC machines, winding design.

Design of Transformers: Output equation, determination of main dimensions, design of LV and HV winding, estimation of no load current, leakage reactance and voltage regulation.

Design of Induction Motors: Output equation, main dimensions, stator winding design, length of air gap, design of squirrel cage and wound rotor, estimation of no load current and leakage reactance.

Design of Synchronous Machine: Output equation, main dimensions, stator winding design, design of rotor, introduction to computer aided design.

Recent Industrial Trends in electrical machines design.

Text Books:

1. Clayton, Design of DC Machines, CBS, 2 July 2004
2. M.G.Say, Performance and Design of A.C. Machines, 3rd Edition, CBS, 1 December 2005.
3. G.C.Jain, Design, Operation and Testing of Synchronous Machines, Asia Publishing House, February 1967
4. Say & Sinha, Computer aided design.

Reference Books:

1. V.N.Mittle & A.Mittal, Performance & Design of Electrical Machines.
2. A.K.Sawhney, Design of Electrical Machines.
3. B.H.E.L, Transformer, Tata McGraw-Hill Education, 01-Jan-2003.
4. J.H. Walker, Large A.C. Machines: Design, Manufacture and operation, Oxford University Press, 1 August 1981.

EE3711	Introduction to Smart Grid	DEC	3-0-0	3 Credits

Pre-requisites: Power system generation and transmission, power systems analysis, power system protection and control

Course Outcomes: At the end of the course the student will be able to:

CO1	Understand features of smart grid in the context of indian grid.
CO2	Analyze the role of automation in transmission/distribution.
CO3	Apply evolutionary algorithms for the smart grid/distribution generation.
CO4	Access the role of renewable energy systems in microgrid and smart grid.
CO5	Understand the operation and importance of communication technologies and control in smart grids.

Syllabus:

Introduction to Smart Grid: Introduction to smart grid - working definitions of smart grid and associated concepts – smart grid functions – traditional power grid and smart grid – new technologies for smart grid – advantages – Indian smart grid – dimensions of smart grid-key challenges for smart grid.

Smart Grid Architecture: Components and architecture of smart grid design – review of the proposed architectures for smart grid. The fundamental components of smart grid designs – transmission automation – distribution automation – renewable and distributed energy integration.

Tools and Techniques for Smart Grid: Computational techniques – static and dynamic optimization techniques – computational intelligence techniques – evolutionary algorithms-artificial intelligence techniques.

Distributed Generation Technologies: Introduction to renewable energy technologies – micro grids– storage technologies –electric vehicles and plug – in hybrids – environmental impact and climate change – economic issues.

Communication Technologies: Introduction to communication technology-synchro-phasor measurement units – wide area measurement systems.

Control of Smart Grid System and Smart Cities: Load frequency control in micro grid system – voltage control in micro grid system – reactive power control in smart grid. Case studies and test beds for the smart grids, smart grids to the smart cities: new paradigms for future networks**.**

Text Books:

1. Mani Vadari, Smart Grid Redefined: Transformation of the electric utility. Artech House, 2018.
2. Stuart Borlase, Smart Grids, Infrastructure, Technology and Solutions, CRC Press, 2013.

Reference Books:

1. M. L. Scala, S. Bruno, C. A. Nucci, S. Lamonaca, U. Stecch, Smart Grids to the Smart Cities: New Paradigms for Future Networks, Vol-II, Wiley publication, 2017.
2. N. Ramesh Babu, Smart Grid Systems: Modeling and Control, 1st ed, CRC Press, 2019.
3. A.G. Phadke and J.S. Thorp Synchronized Phasor Measurements and their Applications, Springer Edition, 2010.

Online Resources:

1. https://nptel.ac.in/courses/108/107/108107113/
2. https://www.coursera.org/lecture/electric-power-systems/smart-grid-utilities-consumers- TSfBn

EE3721	Battery Energy Storage and EV Charging Systems	3-0-0	3 Credits

Pre-requisites: Chemistry for electrical engineering.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand the necessity of battery systems for electric vehicles.
CO2	Analyze the performance of EV Battery including BMS.
CO3	Understand the configurations of both AC and DC wired charging stations.
CO4	Understand the concept of wireless power transfer for EV battery charging.
CO5	Understand the current developments in charging stations across national and global

Syllabus:

Introduction to Battery Technology: Battery parameters, battery types-lead acid, nickel based, sodium based, lithium, metal air based batteries, comparison, battery modelling, use of batteries in EVs.

Battery Performance: Battery charging, battery fast charging, battery discharging, battery efficiency, battery performance, battery testing, battery management system – SOC, SoH, factors affecting failures of battery.

Wired Charging Station (Static): Electric vehicle supply equipment, classification of EVSE, DC charging station-configuration, performance, AC charging station-configuration, performance, advantages and disadvantages of wired charging station, IEC standards.

Wireless Charging Station (Dynamic): Composition of the wireless charging system, IEC standards on wireless power transfer, wireless charging challenges, case studies on recent practical deployments, advantages and disadvantages.

Current Developments in Charging Stations across National and Global: EV charging infrastructure with reference to IEA and EESL, statistical analysis and progress.

Text Books:

1. Lino Guzzella and Antonio Sciarretta “Vehicle Propulsion Systems”, Springer, 2005
2. Xi Zhang and Chris Mi “Vehicle Power Management” Springer, 2011
3. James Larminie, John Lowry, “Electric Vehicle Technology Explained,” 2nd edition Willey, 2012.

Reference Books:

1. Sandeep Dhameja, “Electric Vehicle Battery Systems,” 1st edition Elsevier, 2001.
2. Naoui Mohamed, Flah Aymen, Mohammed Alqarni, Rania A. Turky, Basem Alamri, Ziad M. Ali, Shady H.E. Abdel Aleem, “A new wireless charging system for electric vehicles using two receiver coils,” Ain Shams Engineering Journal, Volume 13, Issue 2, 2022.

Online Resources:

1. https://www.iea.org/, IEA Global EV Outlook 2023
2. https://fame2.heavyindustries.gov.in/, National Automotive Board (NAB), Ministry of Heavy Industries, Govt of India
3. https://www.iso.org/, International Organization for Standardization
4. https://www.araiindia.com/, Automotive Research Association of India (ARAI)
5. https://www.siam.in/, Society of Indian Automobile Manufacturers (SIAM)
6. https://evyatra.beeindia.gov.in/go-electric/, Energy Efficiency Services Limited (EESL)
7. https://e-amrit.niti.gov.in/home, Niti Aayog

EE3731	Power System Security and Reliability	DEC	3-0-0	3 Credits

Pre-requisites: Power systems analysis and power system protection and control.
Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand the concepts to overcome security issues and contingency problems in power systems.
CO2	Understand the importance of maintaining the reliability of power system components.
CO3	Apply the probabilistic methods for evaluating the reliability of generation and transmission systems.
CO4	Assess the different models of system components in reliability studies.
CO5	Analyse the reliability of single-area and multi-area systems.

Syllabus:

Preliminaries for Power System Security Problems: Per unit quantities - modeling of generators, transformers, off-nominal tap setting and phase shifting transformers, transmission lines and loads. Primitive parameters - bus admittance matrix - bus impedance matrix - reduction due to zero bus currents and zero bus voltages - solution through factored matrices - solution of non-linear algebraic equation and non-linear differential equations.
Power System Security Assessment & Security Constrained Optimization: Network sensitivity factors, contingency selection, contingency ranking, performance indices and methods, direct methods, indirect methods, sensitivity factors, generation shift factors, line outage distribution factors, basis of evolutionary optimization techniques, preventive, emergency and restorative controls though non-linear programming and linear programming methods
Basic Reliability Concepts: The general reliability function, exponential distribution – mean time to failures – series and parallel systems. Markov process – continuous markov process – recursive techniques – simple series and parallel system models.
Generating Capacity – Basic Probability Methods: The generation system model – loss of load indices – capacity expansion analysis – scheduled outages. Load forecast uncertainty loss of energy indices. The frequency and duration method.
Transmission Systems Reliability Evaluation: Radial configuration – conditional probability approach – network configurations – state selection.

Text Books:

1. Roy Billinton and Ronald Allan Pitam: Reliability Evaluation of Power Systems,1996.
2. J. Endremyl: Reliability Modelling in Electric Power Systems, John Wiley, 2005.
3. G W Stagg and A H El Abiad, “Computer Methods in Power System Analysis”, McGraw Hill, 1968.

Reference Books:

1. J J Grainger and W D Stevension, “Power System Analysis”, McGraw-Hill, Inc., 1994.
2. D P Kothori and I J Nagrath, “Modern Power System Analysis”, Tata McGraw Hill Education Private Limited, 2011.
3. Hadi Saadat, “Power System Analysis” McGraw-Hill, 2004. 6. M A Pai,” Computer Techniques in Power System Analysis”, Tata McGraw Publishing Company Limited, 2006.
4. K.R.PADIYAR , Power System Dynamics: Stability and Control, II Edition, B.S.Publications.
5. P.M. Anderson and A.A. Fouad, Power system control and stability, John Wiley & sons.

EE3741	Switched Mode Power Supplies	DEC	3-0-0	3 Credits

Pre-requisites: Power electronics.

Course Outcomes: At the end of the course the student will able to:

CO1	Understanding isolated DC power supplies.
CO2	Analyse the operation of DC-DC converters and isolated DC-DC converters with voltage mode control.
CO3	Analyse the operation of DC-DC converters and isolated DC-DC converters with current mode control.
CO4	Development of small signal model for power converter control design.
CO5	Understanding power converter design.

Syllabus:

Isolated DC-DC Converter Topologies: forward, and fly-back converters, half and full bridge topologies, push pull converter- operation and analysis.
Converter Modelling: Small-signal modelling of buck and boost converters for control Design.
Controller Design: Design of Type-I, Type-2 and Type-3 compensators for voltage mode control of smps based on small-signal transfer functions – realization of these compensators using OPAMPs.
Current Mode Control – Advantages – subharmonic instability – slope compensation – ideal slope for slope compensation – design of outer voltage control loop in current mode controlled converter.
Power Converter Design: Design of filter inductor & capacitor, and power transformer, ratings for switching devices, current transformer for current sensing, design of drive circuits for switching devices, considerations for PCB layout, techniques to reduce EMI emissions

Text Books:

1. Mohan, Undeland, Robin, Power Electronics, 3ed (An Indian Adaptation): Converters, Applications and Design, Wiley India Pvt Ltd., 2022.
2. Abraham I. Pressman, Keith Billings, Taylor Morey: Switching Power Supply Design, McGraw Hill International, Third Edition,2009.
3. Sanjaya Maniktala - Switching power supplies A to Z. – 2nd edition, Newnes, 2012

Reference Books:

1. M D Singh, K B Khanchandani, Power Electronics, 2009, Tata McGraw-Hill Publishing Company Limited, ISBN-13: 978-0-07-058389-4
2. P.C. Sen: Modern Power Electronics, S.Chand& Company, Second Edition, 2005.
3. Andrzej M. Trzynadlowski: Introduction to Modern Power Electronics, Second Edition, illustrated Publisher John Wiley & Sons, 2010.
4. Muhammad H. Rashid: Power electronics hand book, Pearson Education; Fourth edition, 2017.
5. Bin Wu, Mehdi Narimani: High-power Converters and AC Drives, IEEE Press, John Wiley & Sons, 2006.

Online Resources:

1. https://www.ti.com/power-management/overview.html

EE3751	New Venture Creation	OE	3-0-0	3 Credits

Pre-Requisites: None.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand the process and practice of entrepreneurship and new venture creation.
CO2	Understand conceptual frameworks for identifying entrepreneurial opportunities and for preparation of business plan.
CO3	Explore opportunities for launching a new venture.
CO4	Identify functional management issues of running a new venture.
CO5	Case study on a small-scale Enterprise in new venture creation.

Syllabus:

Entrepreneur and Entrepreneurship: Entrepreneurship and small-scale enterprises (SSE) – role in economic development, entrepreneurial competencies, institution interface for SSE.
Establishing the Small-Scale Enterprise: Opportunity scanning and identification, market assessment for SSE, choice of technology and selection of site, financing the new/small enterprises, preparation of the business plan, ownership structures and organizational framework.
Operating the Small-Scale Enterprises: Financial management issues in SSE, operational management issues in SSE, marketing management issues in SSE, organizational relations in SSE.

Text Books:

1. Burns, Entrepreneurship and Small Business: Start-up, Growth and Maturity, Palgrave Macmillan, 2022"
2. Khanka & Gupta, Entrepreneurship Development and Small Business Enterprises, Sultan Chand & Sons, 2022
3. Kumar & Yadav, Entrepreneurship in Micro and Small-Scale Enterprises, Serials Publications Pvt. Ltd., 2018

Reference Books:

1. Kuratko, New Venture Management: The Entrepreneur's Roadmap, Pearson Education India, 2008.
2. Holt, "Entrepreneurship: New Venture Creation", PHI(P), Ltd.,2001.
3. Rob Adams, Stephen Spinelli ,"New Venture Creation: Entrepreneurship for the 21st Century", McGraw Hill Higher Education; 10th edition .
4. Lisa K. Gundry, Jill R. Kickul: Entrepreneurship Strategy: Changing Patterns in New Venture Creation, Growth, and Reinvention, Sage Publications, 2007.

EE4601	Energy Management and Audit	DEC	3-0-0	3 Credits

Pre-requisites: None.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand the basics of energy management and audit.
CO2	Understand and gain knowledge on tools and techniques employed in energy auditing.
CO3	Understand the energy management for building and lighting.
CO4	Understand the energy management for motor and Industries.
CO5	Impact practical concepts and case studies of energy management and auditing.

Syllabus:

Introduction to Energy Management and Audit: Definition, need of energy management, principles of energy management - energy audit: types and methodology, energy audit reporting format, understanding energy costs, benchmarking and energy performance, matching energy usage to requirement, maximising system efficiency, fuel and energy substitution, energy audit instruments.

Implementation of Energy Management & Audit: Energy and power, model energy policy, energy conversion factors, power factor, efficiency, energy balance, organising for energy management, location of energy management leadership, top management support, roles and responsibilities, accountability, develop day-to-day operations.

Energy Management for Buildings and Lighting: Green buildings, lighting, daylighting, motors, HVAC systems, effective outdoor lighting, illumination, metering and monitoring, energy efficient lighting, energy efficient street lighting, energy efficiency of lighting systems, energy saving options and opportunities in lighting, effectiveness of task lighting.

Energy Management for Motors and Industries: Energy management for electric motors, electric motor categories and applications, transformer and reactors - capacitors and harmonic compensators, electrical interconnection.

Case Studies of Energy Management and Best Practices: Case studies: direct effects of energy management, indirect effects of energy management. Challenges: facilities energy management. Best practices: management, team work, resources, energy efficient operation and maintenance. career opportunities in energy management.

Text Books:

1. Abbi, Y.P. and Jain, S., Handbook on Energy Audit and Environment Management, The Energy and Resources Institute, TERI PRESS, 2009.
2. Barney L. Capehart, Wayne C. Turner, and William J. Kennedy, Guide to Energy Management, Fifth Edition, The Fairmont Press, Inc., 2006
3. Electricity in buildings good practice guide, McGraw-Hill Education, 2016.
4. Stephen A. Roosa, W.C. Turner, Energy management hand book, Fairmont Press in 2018.

Reference Books:

1. W.R. Murphy & G. Mckay Butter worth, Energy management, Heinemann publications, 2016
2. LC Witte, PS Schmidt and DR Brown: Industrial Energy Management and Utilization 6th Edition the Fairmont Press, Inc 2007.

Online Resources:

1. https://nredcap.in/BeeManuals.aspx, Energy Efficiency Services Limited (EESL)
2. https://global.abb/topic/ee-playbook/en, ABB Group
3. http://www.npcindia.gov.in/) National Productivity Council
4. https://www.beeindia.gov.in/, Bureau of Energy Efficiency

EE4611	Power Quality Improvement	DEC	3-0-0	3 Credits

Pre-requisites: Power electronics.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand power quality issues in power systems.
CO2	Understand the voltage sag mitigation techniques.
CO3	Understand reactive power compensation techniques.
CO4	Understand various harmonic mitigation techniques to improve the power quality.
CO5	Understand the static reactive power compensators and their control.

Syllabus:

Overview of Power Quality: Power quality –overview of power quality phenomena -basic terminologies –power quality issues – causes for reduction in power quality — power quality standards and indices.

Voltage Sags and Mitigation: Causes of voltage sags and its effect on drives and peripherals– series active power filters: operating principle, configurations, state of the art, design and control strategies.

Harmonic Sources and Mitigation: Harmonic introducing devices and its effects. shunt active power filters to mitigate harmonics: operating principle, configurations, state of the art, analysis, design and control strategies.

Power Factor Improvement: Active power factor corrected single phase front end-control methods for single phase APFC three phase APFC and control techniques- PFC based on bilateral single phase and three phase converter static VAR compensators-SVC and STATCOM.

Reactive Power Compensation- Static reactive power compensators and their control.

Text Books:

1. N.G. Hingorani & L. Gyugyi, ‘Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems’, IEEE Press, 2000.
2. Dugan Roger C, Santoso Surya, Mc Granaghan, Marks F. Beaty and H. Wayre, “Electrical Power Systems Quality”, 3rd edition, McGraw Hill,2012.

Reference Books:

1. Bhim Singh, Ambrish Chandra, Kamal Al- Haddad, “Power Quality: Problems and Mitigation Techniques”, Wiley, 2014.
2. J. Arrillaga, N.R. Watson, “Power System Harmonics”, John Wiley & Sons Ltd, 2nd edition, 2003.
3. H. Akagi, E. H. Watanabe, M. Aredes, “Instantaneous Power Theory and Applications to Power Conditioning”, Wiley-IEEE Press, 2007.

EE4621	Distribution System Planning and Automation	DEC	3-0-0	3 Credits

Pre-requisites: Power systems analysis.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand and Characteristics of distribution systems from transmission systems
CO2	Design, analyze and evaluate distribution system design based on forecasted data
CO3	Identify and select appropriate substation location.
CO4	Design and evaluate a distribution system for a given geographical service area from alternate design alternatives.
CO5	Study the communication protocols for the Distribution System.

Syllabus:

Distribution System Planning- Planning and forecasting techniques – present and future – role of computers- load characteristics- load forecasting using ANN – load management – tariffs and metering of energy.
Distribution Transformers: Types - three phase and single phase transformers – connections – causes and types of failures in distribution transformers.
Primary Distribution Systems and Distribution Sub–Stations: Distribution substations – bus schemes –comparison of switching schemes- substation location and rating- types of feeders – voltage levels.
Voltage Drop and Power Loss Calculations: Three phase primary lines – copper loss – distribution feeder costs – loss reduction and voltage improvement in rural networks.
Capacitors in Distribution Systems: Effects of series and shunt capacitors – justification for capacitors – procedure to determine optimum capacitor size and location.
Distribution System Management: Integrated sub–station metering system – revenue improvement – issues in multi–year tariff and availability based tariff.
Distribution System Automation: Reforms in power sector – methods of improvement – reconfiguration –automation – communication systems – sensors –basic architecture of distribution automation system – software and open architecture – RTU and data communication – SCADA requirement and application functions –communication media for distribution system automation- communication protocols for distribution systems – IEC 61850 and IEEE 802.3 standards.

Text Books:

1. Juan M. Gers, Distribution Systems Analysis and Automation, IET power series, 2020.
2. James Northcote-Green, Robert G. Wilson, Control and Automation of Electrical Power Distribution Systems: Taylor & Fransis, 2006.
3. A. S. Pabla, Electric Power Distribution, TMH, 2000.

Reference Books:

1. Dr. M.K. Khedkar, Dr. G.M. Dhole,A Textbook of Electric Power Distribution Automation, Laxmi Publications Ltd., 2010.
2. Turan Gonen, Electric Power Distribution Engineering, Mc-Graw Hill, 2014.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc22_ee35

EE4631	Special Machines	DEC	3-0-0	3 Credits

Pre-requisites: DC machines and transformers and AC rotating machines.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Acquire the knowledge of synchronous reluctance motors.
CO2	Acquire the knowledge of variable reluctance and switched reluctance motors.
CO3	Acquire knowledge of brushless DC motors.
CO4	Analyse the performance of linear induction motor & hysteresis motor.
CO5	Understand the control and applications of special machines.

Syllabus:

Synchronous Reluctance Motors: Constructional features– types– axial and radial flux motors– operating principles– variable reluctance and hybrid motors–voltage and torque equations- phasor diagram - characteristics.

Stepper Motors: Constructional features– principle of operation– variable reluctance motor – hybrid motor– single and multi stack configurations– torque equations– modes of excitations– characteristics– drive circuits– microprocessor control of stepping motors– closed loop control.

Switched Reluctance Motors: Constructional features– rotary and linear SRM-principle of operation– torque production– steady state performance prediction- analytical method- power converters and their controllers – methods of rotor position sensing – sensorless operation – closed loop control of SRM - characteristics.

Permanent Magnet Brushless DC Motors: Permanent magnet materials– magnetic characteristics – permeance coefficient- principle of operation– types– magnetic circuit analysis–EMF and torque equations – commutation power controllers– motor characteristics and control.

Other motors: linear induction motor, hysteresis motor, Energy efficient motors. Control and applications of special machines.

Text Books:

1. T.J.E. Miller, Brushless magnet and Reluctance motor drives, Oxford University Press, 1989
2. R.Krishnan, Switched Reluctance motor drives, 1st Edition, CRC Press, 28 June 2001
3. T.Kenjo, Stepping motors and their microprocessor controls, Clarendon Press, 19 January 1995
4. K. Venkataratnam, Special Electric Machines, 1st Edition, CRC Press, 22 May 2009
5. B.K Bose, Modern Power electronics and AC drives, Prentice Hall, 12 October 2001

Reference Books:

1. N.Mohan, Power Electronics, 3rd Revised Edition, Wiley, 8 November 2002
2. E.G.Janardanan, Special Electric Machines, Prentice Hall India Learning Private Limited, 2014

Students may identify/register the list of courses as Liberal Arts/Creative Arts Courses to fulfil the requirements of 3 credits from the below mentioned courses.

Liberal Arts/Creative Arts Courses – I (3 Credits):

Course Code	Course Title	L	T	P	Credits	Offered Sem
HS3011	English for Engineers II	2	0	2	3	VI
HS3021	German/Other Foreign languages	2	0	0	2	VI
HS3031	Indian Philosophy	1	0	0	1	VI
HS3041	Introduction to Psychology	1	0	0	1	VI
HS3051	Psychology of Wellbeing	1	0	0	1	VI
HS3061	Introduction to Mass Communication	1	0	0	1	VI
HS3071	Introduction to Media Studies	1	0	0	1	VI
HS3081	Vedic Maths	3	0	0	3	VI
HS3091	Indian Heritage and Culture	1	0	0	1	VI
HS3101	Indian Business History	1	0	0	1	VI
HS3111	Post-Harvest Technology	1	0	0	1	VI
HS3121	Ethics in Technology	1	0	0	1	VI
HS3131	Financial marketing	1	0	0	1	VI
HS3141	Bharatiya Nyaya Sanhita: Indian Judicial Code – An Overview	1	0	0	1	VI
HS3151	Introduction to the Constitution of India	1	0	0	1	VI
HS3162	Photography	1	0	0	1	VI
HS3172	Pottery	1	0	0	1	VI
HS3182	Painting	1	0	0	1	VI
HS3192	Music	1	0	0	1	VI

Liberal Arts/Creative Arts Courses – II (3 Credits)

Course Code	Course Title	L	T	P	Credits	Offered Sem
HS3501	Sanskrit	3	0	0	3	VII
HS3511	Introduction to Academic Writing	1	0	0	1	VII
HS3521	Contemporary Issues in Philosophy of Mind & Cognition	1	0	0	1	VII
HS3531	Psychology and Mental Health	1	0	0	1	VII
HS3541	Psychology at Work	1	0	0	1	VII
HS3561	Introduction to Journalism	1	0	0	1	VII
HS3561	Introduction to Film Studies	1	0	0	1	VII
HS3571	Introduction to Anthropology	1	0	0	1	VII
HS3581	Ethics for AI	1	0	0	1	VII
HS3591	Introduction to Sociology	1	0	0	1	VII
HS3601	Personal Finance	1	0	0	1	VII
HS3611	Introductory Economics	1	0	0	1	VII
HS3621	Cyber Law for Engineers	1	0	0	1	VII
HS3631	Food and Nutrition	1	0	0	1	VII
HS3641	Youth, Gender and Identity	1	0	0	1	VII
HS3652	Dance	1	0	0	1	VII
HS3662	Theatre Arts	1	0	0	1	VII
HS3672	Sculpture	1	0	0	1	VII
HS3682	Introduction to Animation	0	0	2	1	VII
HS2052	National Service Scheme	0	0	2	1	VII

HS3011	English for Engineers II	HSC	2-0-2	3 Credits

Pre-requisites: English for Engineers I.

Course Outcomes: At the end of the course, the student will be able to:

CO1	To equip students to develop Questionnaire and to pitch ideas.
CO2	To cultivate delegation skills and strategic planning.
CO3	To equip students to creating career related documents.
CO4	To equip students with technical and business writing.
CO5	To improve oral communication and interview readiness.

Syllabus:

Module 1: Cover letter - resume - statement of purpose
Module 2: Technical report writing - proposal writing - minutes of the meeting
Module 3: Pitching ideas - client correspondence - preparation of questionnaire
Module 4: Diplomacy skills - strategic planning - delegation skills - feedback
Language Laboratory. Group presentation-presentation with emphasis on body language-public speaking-extempore speech. Pronunciation practice (Automatic Speech Recognition). Mock interview : Interview etiquette, Common interview questions

Text Books:

1. Brown, Carla L. Essential Delegation Skills. Routledge, 2017.
2. Carter, Ronald and Michael McCarthy. Cambridge Grammar of English: A
3. Comprehensive Guide. Cambridge University Press, 2006.
4. Harris, David.F. Complete Guide to Writing Questionnaires. I& M Press, 2014.
5. Hering, Lutz and Heike Hering. How to Write Technical Reports: Understandable
6. Structure, Good Design, Convincing Presentation. Springer; 2010.Mohan, Krishna and Meera Banerji. Developing Communication Skills. Macmilla India Limited, 2000.
7. Muralikrishna and Sunitha Mishra. Communication Skills for Engineers. Pearson, 2011.

Reference Books:

1. Busan, Tony. Mind Map Mastery. Walkins, 2018.
2. Huckin N. Thomas and Leslie A. Olsen
3. Technical Writing and Professional Communication for Non-native Speakers. McGraw-Hill Education,1991.
4. Laplante, Phillip A. Technical Writing: A Practical Guide for Engineers, Scientists,and Nontechnical Professionals. CRC Press, 2018.
5. Mc Quail, Dennis. Audience Analysis. Sage, 1997
6. Ogden, Richard. Introduction to English Phonetics. Edinburgh University Press, 2017.
7. Parker, Glenn M. Team Players and Teamwork: New Strategies for Developing Successful Collaboration. Wiley, 2011.
8. Seely, John. Oxford Guide to Effective Writing and Speaking: How to Communicate Clearly. Oxford University Press: 2013.

HS3021	German/other Foreign Languages	HSC	2-0-0	2 Credits

Pre-requisites: None.

Course Outcomes: At the end of the course, the student will be able to:

CO1	To be able to read and communicate in German in their day today life.

Syllabus:

1. Begrüssung, Landeskunde, Alphabet, Personalpronomen, Verben- heissen, kommen,wohnen, lernen,Zahlen (1-100), W-Fragen, Aussagesätze, Nomen- Singular und Plural, der Artikel -Bestimmter- UnbestimmterArtikel)

   Lernziel : Sichvorstellen, GrundlegendesVerständnisvon Deutsch, Deutschland in Europa
2. Konjugation der Verben(regelmässig /unregelmässig),dasJahr- Monate, Jahreszeitenund die Woche, Hobbys, Berufe, Artikel, Zahlen (Hundert bis eine Million), Ja-/Nein- Frage, Imperativ mit ,,Sie''
   Lernziel: Sätzeschreiben, über Hobbys, Berufeerzählen, usw.
3. Possessivpronomen, Negation, Kasus (Bestimmter- UnbestimmterArtikel) Trennbareverben, Modalverben, Uhrzeit, Präpositionen, Lebensmittel, Getränkeund Essen, Farben, Tiere
   Lernziel : Sätze mit Modalverben, VerwendungvonArtikel, AdjektivbeimVerb
4. Übersetzung: (Deutsch – Englisch / Englisch – Deutsch)
   Lernziel :Die Übungvon Grammatik undWortschatz
5. Leserverständnis. Mindmapmachen, Korrespondenz- Briefe und Email
   Lernziel:Übung der Sprache, Wortschatzbildung.
6. Aufsätze :
   Die Familie, Bundesländer in Deutschland, EinFest in Deutschland,
   Lernziel :Aktiver, selbständigerGebrauch der Sprache
7. Dialoge:
   a) Gespräche mit einem/einer Freund /Freundin.
   b) GesprächebeimEinkaufen ; in einemSupermarkt ; in einerBuchhandlung ;
   c) in einemHotel - an der Rezeption ; einTerminbeimArzt.
   Ein Telefongespräch ; Einladung–Abendessen
8. GuestLectures/ NativeSpeakers (Einleitung in die deustcheKulturundPolitik)

Text Books:

1. Netzwerk Deutsch alsFremdsprache A1, Stefanie Dengler, Paul Rusch, Helen Schmtiz, Tanja Sieber, Klett-LangenscheidtVerlag, München : 2013

Reference Books:

1. Lagune ,HartmutAufderstrasse, Jutta Müller, Thomas Storz, 2012.
2. Studio d A1, Hermann Funk, Christina Kuhn, CorneslenVerlag, Berlin, 2010
3. Deutsche SprachlehrefürAusländer, Heinz Griesbach, Dora Schulz, 2013
4. TangramAktuell-I, Maria-Rosa, SchoenherrTil, Max Hueber Verlag, Muenchen, 2012.
5. Web site adresses: www.goethe.de;wirtschaftsdeutsch.de; hueber.de; klett-sprachen.de.
6. www.deutschtraning.org; https://bpb.de/lernen.

HS3031	Indian Philosophy	HSC	1-0-0	1 Credit

Pre-requisites: None.

Course Outcomes: At the end of the course, the student will be able to:

CO1	The course is designed to introduce the students about the different Indian philosophy.
CO2	The course highlights the origin, concepts, key belief of Philosophy.

Syllabus:

Introduction to Indian Philosophy: 1. Brief Discussion on Veda and Upanishads. 2. Origin of Indian Philosophy.
Charvaka Philosophy: 1. Epistemology. 2. Metaphysics.
Samkhya Philosophy: 1. Metaphysics. 2. Theory of Causation. Prakṛti. Purusa. Evolution. 3. Epistemology. Bondage and Liberation.
Yoga Philosophy: 1. Organization of the YogaSutras. 2. Psychology of Yoga. Stages of Citta. Forms of Citta. Modifications of Citta. Kinds of Klesas. 3. The Eight-Fold Yoga. 4. God and Liberation.
Nyaya Philosophy: 1. Epistemology. Perception (Pratyaksa). Inference (Anumāna). Comparison (Upamāna). Testimony (Sabda). 2. Theory of Causation (Asatkāryavāda). 3. Self and Liberation. 4. The Concept of God.
Mimansa Philosophy: 1. Epistemology. Validity of Knowledge. 2. Sources of Valid Knowledge (Pramāna). Perception. Inference. Comparison. Verbal Testimony. Postulation (Arthapati). NonApprehension (Anupalabdhi). 3. Theories of Error (Khyativāda). Akhyativāda. Anirvacaniya Khytivāda. Viparitakhyativāda. 4. Metaphysics. Theory of Causation. 5. Nature of Self. 6. God and Liberation.
Vaisesika Philosophy: 1. Metaphysics and the Categories. Substance (Dravya). Quality (Guṇa). Action (Karma). Generality (Sāmānya). Particularity (Vaiśeṣa). Inherence (Samavāya). Non-existence (Abhāva). 2. Epistemology. 3. The Concept of God. 4. Bondage and Liberation.
Buddhist Philosophy: 1. Epistemology. Dependent Origination. 2. Four Noble Truths. 3. Eight-Fold Paths. 4. Ethics. 5. Karma and Rebirth. 6. Liberation.
Jaina Philosophy: 1. Syādavāda. 2. Anekāntavāda. 3. Ethics. 4. Karma and Liberation.

Text Books:

1. Barlingay,S.S.(1965) A Modern Introduction to Indian Logic, Delhi: National Publishing House.
2. Chatterjee,S.C.(1950) The Nyaya Theory of Knowledge, Calcutta: University of Calcutta Press.
3. Chattejee,S.G. and Datta, D.M. (1960) An Introduction to Indian Philosophy, University of Calcutta Press.
4. Muller, F.M.(1928) The Six Systems of Indian Philosophy, London: Longmans Green and Co.Publication.
5. Sharma, C.(1964) A Critical Survey of Indian Philosophy, Delhi: Motilal Banarasidass Publication.
6. Satya Sundar Sethy, NOC: Indian Philosophy. NPTEL
7. Eknath Easwaran, The Bhagavad Gita, Nilgiri Press, 2007
8. Pattabhi Jois, Yoga mala, Picador India, 2010
9. Swami Swatamarama, The Hatha Yoga Pradipika, Yoga Publications Trust, Munger, Bihar, India, 2016
10. Sri Swami Satchidananda, The Yoga Sūtras of Patañjali, Translation and Commentary, 2011 The Yoga Sutras of Patanjali: Commentary on the Raja Yoga Sutras by Sri Swami Satchidananda.

HS3041	Introduction to Psychology	HSC	1-0-0	1 Credit

Pre-requisites: None.

Course Outcomes: At the end of the course, the student will be able to:

CO1	The course is designed to expose students to various concepts of psychology.
CO2	This course will teach the importance of interpersonal relationship and stress management.
CO3	It is also designed to introduce the ergonomics concepts.

Syllabus:

Unit 1: Meaning and Definitions of Psychology - History of Psychology - Nature and scope of Psychology – Learning -theories of Learning – Memory – Theories of Memory – Motivation – theories of Motivation

Psychology is the study of human mind and behaviour. It is not only useful to engineering students but to everyone. Psychology particularly equips engineering students with valuable skills and insights that enhance both their technical work and their ability to create products that positively impact users and society.

Unit 2: Interpersonal Relationship and engineers – Importance – How to develop?

Interpersonal skills are crucial for engineers as they work with diverse teams and stakeholders, requiring effective communication, collaboration, and problem-solving. Strong interpersonal skills, such as active listening, empathy, and clear communication, are essential for building positive relationships, navigating conflicts, and leading effectively.

Unit 3: Stress – meaning – Impact of stress – Identification – strategies to handle Stress

Engineering students often experience high levels of stress, impacting their mental and physical health. Factors contributing to this include academic pressure, heavy workloads, and a demanding curriculum. Many students also face barriers to seeking help for their mental health concerns. A detailed study about stress will help the students to be alert and manage stress better.

Unit 4: Engineering Psychology (or) Ergonomics (Human Factor Engineering) - Meaning and Definitions – Principles - Benefits – Applicability

Engineering psychology, a fascinating and interdisciplinary field, lies at the intersection of psychology and engineering. Also known as human factors engineering or ergonomics, it delves into the intricate relationship between humans and the design of products, systems, and environments.

Text Books:

1. Sarabjeet Kaur, A concise Text Book of Human Psychology – 2019 edition, B. Jain Publishers.
2. Morgan and King, Introduction to Psychology – 9th Edition, EWP (Affiliated East West Press Private Limited), 2025
3. Robert Feldman Understanding Psychology, Mc Graw Hill Education India. 15th Edition – 2021
4. Neha Bakshi, Essential Interpersonal Skills for Engineers – 1st Edition – 2024, JEC Publications
5. Whitcomb Clifford, Effective Interpersonal Skills and Team Communication Skills for engineers, Wiley Blackwell, 2013
6. Anjali Ghanekar, Managing Stress – Best Practices, 1st Edition, Everest Publishing House, 2018
7. Vinita Kochagaway, Introduction to stress, stress management and coping mechanisms, Synergy 2024
8. R.S. Bridger, Introduction to Human Factors and Ergonomics 4th Edition, CRC Press, 2017
9. Lehto and Landry, Introduction to Human Factors and Ergonomics for engineers, CRC Press 2012.

HS3051	Psychology of Wellbeing	HSC	1-0-0	1 Credit

Pre-requisites: None.

Course Outcomes: At the end of the course, the student will be able to:

CO1	The course is designed to introduce the students with the concepts of positive emotions, character strengths and resilience and their relation to well-being.
CO2	The course also describes the health managements through positive psychology.

Syllabus:

Unit 1: Introduction To Psychology of Health and Well-Being

Introduction to health psychology, Illness, Health and Wellbeing; Health continuum; models of health and illness: Medical, Bio psychosocial; Holistic Health; Health and Wellbeing.

Unit 2: Stress And Coping

Nature and Sources of Stress, Personal and Social Mediators, Effects on Physical and Mental Health, Coping and management.

Unit 3: Health Management

Health enhancing behaviours: Exercise, Nutrition, Meditation, Yoga; Health compromising behaviours (alcoholism, smoking, internet addiction); Health Protective behaviours, Illness Management.

Unit 4: Promoting Human Strengths and Life Enhancement

Strength: Meaning; Realizing strength; Maximizing Unrealized Strength. Weakness – Meaning, Identifying & Overcoming Weakness. Strategies to develop hope and optimism

Text Books:

1. Carr. A., Positive Psychology: The science of happiness and human strength Routledge. 2004
2. Di Matteo, M.R &. Martin, L.R.. Health Psychology. Pearson. 2002
3. Farshaw, M, Advanced Psychology: Health Psychology. Hodder and Stoughton Forshaw, M. (2003).
4. Hick. J.W. Advanced Psychology: Health Psychology. Hodder and Stoughton, 2005.
5. Snyder, C R., & Lopez. S.J. Fifty signs of Mental Health. A Guide to understanding mental health. Yale University Press. 2007.
6. Shane J. Lopez, Jennifer Teramoto Pedrotti, Charles Richard Snyder, Positive Psychology: The scientific and practical explorations of human strengths. SAGE Publications, Inc, 2014
7. Taylor. S.E. Health Psychology.6th Edition. Flew Delhi: Tata, 2006.
8. Yasir Hamid, Psychology for Health and Well Being, cec19_hs03, NPTEL

HS3061	Introduction to Mass Communication	HSC	1-0-0	1 Credit

Pre-requisites: None.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand key concepts and theories in mass communication and analyze the historical development of various mass media.
CO2	Develop critical media literacy skills and recognize ethical considerations in mass communication.

Syllabus:

Session 1: Foundations of Mass Communication Introduction to the course and expectations. Defining mass communication Basic communication models Functions of mass media in society Q&A and discussion.
Session 2: Evolution of Mass Media. Historical development of print media. The emergence of electronic media. The digital revolution. Convergence of media platforms. Case study: From newspaper to multimedia organization.
Session 3: Media Industries and Ownership. Media ownership structures. Media concentration and conglomeration. Political economy of media. Regulation and policy. Workshop: Tracking media ownership.
Session 4: Content and Audiences. Content production processes. Audience analysis and measurement. Active vs. passive audience theories. Encoding/decoding model. Activity: Analyzing media content.
Session 5: Media Effects and Influences. Theories of media effects. Information flow and gatekeeping. Agenda-setting and framing. Media and public opinion. Discussion: Media influence in current events.
Session 6: Digital Media and Social Networks-Social media platforms and dynamics. User-generated content. Citizen journalism. Filter bubbles and echo chambers. Exercise: Social media content analysis.
Session 7: Media Ethics and Literacy. Ethical principles in mass communication. Media literacy components. Critical consumption of media. Future trends in mass communication. Final discussion and course wrap-up.
Assessment Methods: Class participation (20%), Media analysis assignment (30%), Media consumption journal (20%), Final reflection paper (30%).

Text Books:

1. Abhay Chawla. *Introduction to Mass Communication*. Pearson Education, 2021.
2. Baran, Stanley J. *Introduction to Mass Communication: Media Literacy and Culture*. 9th ed., McGraw-Hill Education, 2016.
3. Dominick, Joseph R. *The Dynamics of Mass Communication: Media in the Digital Age*. 12th ed., McGraw-Hill Education, 2012.
4. John V. Pavlik & Shawn McIntosh. *Converging Media: A New Introduction to Mass Communication*. Oxford University Press, 2016.
5. McQuail, Denis. *McQuail's Mass Communication Theory. 6th ed., Sage Publications, 2010.*
6. Miller, Katherine. *Communication Theories: Perspectives, Processes, and Contexts*. 3rd ed., McGraw-Hill Education, 2004
7. Richard Campbel et al. *Media & Culture: An Introduction to Mass Communication.* Bedford/St. Martin's, 2017.
8. Seema Hasan. *Mass Communication: Principles and Concepts.*CBS Publishers & Distributors, 2013

HS3071	Introduction to Media Studies	HSC	1-0-0	1 Credit

Pre-requisites: None.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand key concepts, theories, and methodologies in media studies and analyze media texts and their cultural, political, and economic contexts.
CO2	Develop critical media literacy and analytical skills, recognize patterns of representation and power in media and evaluate the relationship between media technologies and social change.

Syllabus:

Session 1: Foundations of Media Studies. Introduction to the field of media studies. Key concepts and terminology. Media ecology and medium theory. Historical development of media forms. Activity: Media autobiography reflection.
Session 2: Media Theories and Approaches. Frankfurt School and critical theory. Cultural studies perspectives. Medium is the message (McLuhan). Political economy of media. Discussion: Applying theoretical lenses to current media examples.
Session 3: Media Texts and Representation. Semiotics and meaning-making. Encoding/decoding model. Representation of identity (gender, race, class, sexuality). Stereotyping and counter-narratives. Workshop: Deconstructing media representations.
Session 4: Media Industries and Production. Media ownership structures and concentration. Production processes and practices. Audience measurement and feedback loops. Global media flows and cultural imperialism. Case study: Evolution of a media conglomerate.
Session 5: Digital Media and Networked Culture. The internet and social media platforms. Participatory culture and prosumers. Algorithms, filter bubbles, and personalization. Digital divides and access issues. Exercise: Social media platform analysis.
Session 6: Media Audiences and Reception. Active audience theories. Fandom and audience communities. Media effects debates. Media rituals and everyday life. Activity: Audience ethnography planning.
Session 7: Contemporary Media Issues and Future Directions. Fake news and information disorder. Surveillance capitalism and data privacy. Media convergence and transmedia storytelling. Emerging technologies (AR, VR, AI). Final discussion: The future of media studies.
Assessment Methods: Class participation and discussion (20%), Media text analysis assignment (25%), Media diary and reflection (25%), Final research project (30%).

Text Books:

1. Campbell, Richard. Media & Culture: An Introduction to Mass Communication. Bedford/St. Martin's, 2008.
2. Chandler, Daniel. *Semiotics: The Basics*. Routledge, 2002.
3. Jenkins, Henry. *Convergence Culture: Where Old and New Media Collide*. New York University Press, 2006.
   Lister, Martin, et al. New Media: A Critical Introduction. Routledge, 2009.
4. Kirubhakaran, Jones. *The Future of Media: Concepts and Trends for Communication Professionals*. 2021.
5. McLuhan, Marshall and. *Understanding Media: The Extensions of Man*. The MIT Press, 1994.
6. O'Shaughnessy, Michael, and Jane Stadler. Media and Society: An Introduction. Oxford University Press, 2002.
7. Sylvia, J.J. Introduction to Communication and Media Studies. ROTEL, 2024.
8. Wulfemeyer, K. Tim. *Contemporary Media: Structures, Functions, Issues and Ethics*. Kendall Hunt, 4th ed., 2008.

HS3081	Vedic Maths	HSC	3-0-0	3 Credits

Pre-requisites: None.

Course Outcomes: At the end of the course, the student will be able to:

CO1	To foster the passion for mathematics by creating a positive attitude through Vedic and Ancient Indian Mathematics.
CO2	To enhance computational proficiency by involving procedures in Linear and Matrix Algebra.
CO3	To improve geometrical thinking by understanding the basic tenets of geometry and conceptual knowledge used in Ancient India over procedural processes.

Syllabus:

Contribution of Indian Mathematicians to Mathematics, Introduction of simple equation, Solutions of simple equations, Solutions of linear equations in two variables, Practical application of linear equations in two variables.

Introduction and history of Matrices and Determinants, Matrices and Determinants of third order, Inverse of Matrices.

Different forms of straight lines, The Triangle, The Cyclic Quadrilateral, Squares, and the Circle, Geometrical constructions (such as Altars), Transformation of simple shapes, Kalpa Sutras-Srautha Sutras and Sulbha Sutras.

Introduction to differentiation, Application of derivatives, Introduction to Integration, Application of Integration.

Text Books:

1. Jagadguru Swami Sri Bharati Krishna Tirthaji Maharaja, Vedic Mathematics Motilal Banarsidas Publishers, New Delhi, First Edition, 2015.
2. Rajesh Kumar Thakur, The Essential of Vedic Mathematics, Rupa Publications, New Delhi, 2013.
3. Vandana Singhal, Vedic Mathematics for All Ages, Motilal Banarsidas Publishers, New Delhi, 2008.
4. Udayan S. Patankar, Sunil M. Patankar, Elements of Vedic Mathematics, TTU Press, 2018.
5. Ronak Bajaj, Vedic Mathematics: The Problem Solver, Black Rose Publications, New Delhi, 2005.
6. S. K. Kapoor, Vedic Geometry Course, Lotus Press, New Delhi, 2007.
7. Gardner, Robert and J.F. Staal. Altar of Fire. Documentary. The Film Study Center at Harvard University, 1976.

HS3091	Indian Heritage and Culture	HSC	1-0-0	1 Credit

Pre-requisites: None.

Course Outcomes: At the end of the course, the student will be able to:

CO1	To understand and analyze the evolution of India's culture, process of modernization of Indian society and culture from past to future.
CO2	To evaluate scientific development of India in various spheres.

Syllabus:

Coexistence of various religions since ancient times Hinduism, Buddhism, Jainism and Atheism, Sikhism etc., The concepts of seela, karuna, kshama, maitri, vinaya, santhi and ahimsa. Family system, Important seasonal festivals.

Modern Society: Family unity, Community service, Social Harmony, Civic Sense, Gender Sensitivity, Equality, National Fervor. Developments in Industry, Agriculture, Medicine, Space, Alternate Energy, Communications, Media through ages.

Text Books:

1. Soma Sundera Rao, C. Rajendra Prasad, B. Aloka, P. Ramakrishna Reddy, V., History of India and Culture (Upto 1526 A.D), Dr. B.R. Ambedkar Open Unviersity, Hyderabad, First Edition 1994, 2004 Reprint.
2. Telugu Academy, History of India and Culture (1526 A.D to 1964), Telugu Academy, 2023 Reprint.
3. Basham, A.L (ed), A Cultural History of India, Oxford University Press, New Delhi, 199\97.
4. Hana S. Noor Al-Deen & J.A.Hendricks, Social Media: Usage and Impact, Lexington Books, Lanham, MD, 2013.
5. Bipan Chandra, Aditya Mukherjee, Mridula Mukherjee, India After Independence, Penguin Books India, 2020.
6. S.K.Thakur, ISRO: History and Achievements, Neelkanth Prakashan Publishers, Third Edition, 2017.

HS3101	Indian Business History	HSC	1-0-0	1 Credit

Pre-requisites: None.

Course Outcomes: At the end of the course, the student will be able to:

CO1	The course is designed to introduce the students about the history of the evolution of businesses post-Independence.
CO2	The course highlights the historical nature of policies that shaped Indian business cultures in the wider socio-political landscape.

Syllabus:

Introduction to Indian Business History:

- The arrival and Impact of the East India Company, 1700-1800
- Rise of Indian Cities and Industrial Houses, 1750-1850
- Swadeshi Movement and Indian entrepreneurs, 1850-1900
- Indian Business and Economy during the First and Second World Wars, 1914-1945, (HAL)
- Independence & Industrial Planning, 1947-1960: Origin and evolution of PSUs
- "License Raj" and Impact on Business, 1960-1980: Nationalisation of Banks and Key Energy
- Sector PSUs
- Liberalization and Contemporary Business Trends: ONGC and Oil Diplomacy

Text Books:

1. Vipul Dutta, Indian Business History, 109103171.pdf - Google Drive, 25.04.2025 (https://drive.google.com/file/d/1LLHVh2MNEnsz-NMi9qmz7LNAKQt_Wz7F/view)
2. Vipul Dutta, NOC:Indian Business History, IIT Guwahati.
3. Medha Kudaisya (ed) The Oxford India anthology of business history (Oxford University Press: 2011)
4. Gita Piramal, Business Maharajas (Penguin: 1996)
5. Atul Kohli, Democracy and development in India: from socialism to pro–business (OUP: 2010)
6. D. Tripathi and J. Jumani, The concise Oxford history of Indian business (OUP: 2007)
7. Douglas Haynes, Small Town Capitalism in Western India: Artisans, Merchants and the Making of the Informal Economy (CUP: 2012)
8. Claude Markovits, Merchants, traders, entrepreneurs: Indian business in the colonial era (Palgrave Macmillan: 2008)

HS3111	Post-Harvest Technology	HSC	1-0-0	1 Credit

Pre-requisites: None.

Course Outcomes: At the end of the course, the student will be able to:

CO1	To understand the basic concepts in post-harvest handling, maturity and harvesting indices, factors for post-harvest losses of horticulture products.
CO2	To assess the quality parameters and storage methods of horticulture products.

Syllabus:

Importance of Postharvest Technology in horticultural crops; Pre-harvest factors affecting quality, factors affecting maturity of horticultural crops. Maturity indices, harvesting, handling, grading of Fruits, Vegetables, Flowers and Plantation crops. Factors responsible for deterioration of fruits, vegetables, cut flowers. Physiological and bio-chemical changes during ripening; Hastening and delaying ripening process.

Quality parameters and specification in fruits, vegetables and cut flowers. Structure of fruits, vegetables and cut flowers related to physiological changes after harvest. Different methods of storage for local market and export. Technical advances in pre and post harvesting of horticultural crops.

Text Books:

1. Jacob John, P. A Handbook on Post Harvest management of Fruits and vegetables, Daya Publishing House, Delhi, 2008.
2. Battacharjee, S. K. and De, L. C, Post Harvest Technology of Flowers and Ornamentals Plants. Ponteer Publisher, Jaipur, 2005.
3. Neetu Sharma and Mashkoor Alam, M, Post Harvest Diseases of Horticultural Perishables. International Book Distributing Co., Lucknow, 1998.
4. Saraswathy, S. et. Al, Post harvest Management of Horticultural Crops. Agrobios India, 2008.

HS3121	Ethics in Technology	HSC	1-0-0	1 Credit

Pre-requisites: None.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand fundamental ethical theories and how they apply to technological contexts.
CO2	Analyze ethical dilemmas in emerging technologies.
CO3	Develop responsible design and development practices.
CO4	Encourage critical thinking about the societal impact of technological decisions.

Syllabus:

Module 1: Foundations of Ethics and Technology
Introduction to ethics: utilitarianism, deontology, virtue ethics. Ethical reasoning and decision-making. History and philosophy of technology. The role of ethics in engineering and computing.
Module 2: Data, Privacy, and Surveillance
Data collection and consent, privacy in the digital age, Government surveillance and corporate data usage, General Data Protection Regulation (GDPR) and other data protection laws.
Module 3: Artificial Intelligence and Automation
Algorithmic bias and fairness, Ethics of automation and job displacement, AI in decision-making (e.g., healthcare, law enforcement), Autonomous systems (e.g., self-driving cars, drones)
Module 4: Technology, Society, and the Future
Ethical design and inclusive technology. Environmental ethics and e-waste. Misinformation, deepfakes, and digital responsibility and Tech for social good and ethical entrepreneurship

Text Books:

1. Ethics for the Information Age (9th Edition, 2024) by Michael J. Quinn, published by Pearson
2. The Ethical Algorithm: The Science of Socially Aware Algorithm Design (2019) by Michael Kearns & Aaron Roth, published by Oxford University Press
3. Weapons of Math Destruction (2016) by Cathy O'Neil, published by Crown Publishing Group
4. Race After Technology: Abolitionist Tools for the New Jim Code (2019) by Ruha Benjamin, published by Polity Press
5. Code: The Hidden Language of Computer Hardware and Software (1999) by Charles Petzold, published by Microsoft Press

Additional Resources:

1. IEEE and ACM Code of Ethics
2. MIT Technology Review (www.technologyreview.com)
3. AI Now Institute Reports (www.ainowinstitute.org)
4. The Stanford Encyclopedia of Philosophy (plato.stanford.edu)
5. Privacy International (www.privacyinternational.org)
6. Facebook and Cambridge Analytica - Case Study
7. Stanford Encyclopedia of Philosophy: Ethics and Technology - https://plato.stanford.edu/entries/technology/

HS3131	Financial Marketing	HSC	1-0-0	1 Credit

Pre-requisites: None.

Course Outcomes: At the end of the course, the student will be able to:

CO1	This course is designed to expose students to the different form of financial market.
CO2	The course will illustrate how financial market concepts can be applied to a real-life situation.

Syllabus:

Module 1: Indian Financial System: Financial System- role and functions- Financial markets – primary and secondary markets – major players and instruments in secondary market - Functioning of stock exchanges, trading and settlement procedures at NSE & BSE. Impact of various Policies on Financial Markets - Credit Policy of RBI - Fed Policy - Inflation Index, CPI, WPI, etc., Interest rates and their role in valuation, Money, Bond, Equity, and Foreign Exchange Markets

Module 2: Capital Market: Capital Market Primary - New Issue Market - Domestic and Global, types of issues, Private Placement, QIP, Disinvestment, Issue process, guidelines Capital Market – Secondary Market- Stock Market Operations - Indian Debt Market

Module 3: Money Market Structure, Organized and Un-Organized Market, Call Money Market, Bills market, Market for Government Securities., Money market Instruments: Treasury Bills, Repurchase Agreements / Reverse Repo, Commercial bills, Commercial Papers, Certificate of Deposit. The role of merchant banker in money market

Module 4: Commodity Market: What are Commodity Markets - Role of Commodity Markets, Commodity Market in India - Application of Derivative in Commodities - Global Commodities, Exchanges

Module 5: Other Instruments / Services Credit card, Bill discounting, Factoring, Forfeiting, Consumer finance, Reverse mortgage service, Bridge Finance. Angel Financing, Venture Capital and Private equity

Module 6: Global Financial Markets: Introduction to Global Financial Market - Role of Financial Market in Economic Development of a country - Stakeholders in Financial Market (Domestic and Global) - Indian Financial Market Scenario Equity issues in global market – ADR, GDR, EDRs – Debt issues in global markets

Text Books:

1. Vinod Kumar, Manmeet Kaur, Atul Gupta, Financial Markets Institutions and Financial Services, Taxman, 2021
2. S. Guruswamy, Merchant Banking and Financial Services by McGraw Hill Education, 2013
3. S. Guruswamy, Financial Markets and Institutions Tata McGraw Hill Education, 2011
4. S. Guruswamy, Capital Markets Tata McGraw Hill Education, 2009
5. H R Machiraju, Indian Financial System, Vikas Publishing House, 2019
6. Vasant Desai, Indian Financial System, Himalaya Publishing House. 2019
7. Gupta, L.C: Stock Exchange Trading in India; Society for Capital Market Research and Development, Delhi. 1992

HS3141	Bharatiya Nyaya Sanhita: Indian Judicial Code – An Overview	HSC	1-0-0	1 Credit

Pre-requisites: None.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand the foundational principles and structure of the Indian judicial system under the Bharatiya Nyaya Sanhita.
CO2	Recognize the rights, duties, and judicial procedures applicable in both civil and industrial settings.
CO3	Analyze the impact of laws related to employment, corporate governance, women's rights, and compensation.
CO4	Gain legal literacy relevant to professional and industrial scenarios in engineering careers.

Syllabus:

Module 1: Introduction to Bharatiya Nyaya Sanhita
Historical development: IPC to BNS, Structure and components of BNS, Importance of codified law in governance and Role of criminal law in society.
Module 2: Principles of Indian Judicial Code
Natural justice and rule of law, Equality before law and due process, Legal maxims and jurisprudence, and Role of judiciary in upholding constitutional values
Module 3: Judicial Procedures and Processes
Court structure: Supreme, High, District, and subordinate courts, Trial process: FIR, charge sheet, hearing, judgment, Legal remedies and appeals and Role of advocates and legal aid
Module 4: Rights and Duties under the Indian Judicial System
Fundamental Rights and Directive Principles, Duties of Indian citizens, Enforcement and limitations and Key case laws interpreting rights and duties
Module 5: Overview of Industrial Laws and Employee Rights
Industrial Disputes Act, The Factories Act and labor law basics, Rights of employees: Wages, safety, working conditions, and Role of unions and industrial tribunals
Module 6: Company Law, Women Care and Security, Compensation and Insurance Rules
Companies Act: Stakeholders, directors, compliance, Women's legal protections: POSH Act, IPC provisions, Compensation laws: Workmen's Compensation, Motor Vehicles Act and Staff insurance laws: ESIC, EPF, employer responsibilities

Text Books:

1. Bharatiya Nyaya Sanhita -Bare Act.2023
2. The Code of Criminal Procedure – Bare Act., 1973
3. The Constitution of India – Bare Act.
4. Companies Act – Bare Act., 2013
5. D.D. Basu – Introduction to the Constitution of India, 2019
6. A.P. Bhardwaj – Legal Awareness and Legal Reasoning, 2019
7. H.M. Seervai – Constitutional Law of India. 2015
8. Nani Palkhivala – We, the People, 1999
9. P.M. Bakshi – The Constitution of India, 2020
10. Labour and Industrial Laws – S.N. Mishra, 2020
11. Ministry of Labour website – Latest amendments, 2023
12. The Sexual Harassment of Women at Workplace Act – Govt. publication,2013
13. IRDAI Handbook – Staff Insurance Laws, 2016

HS3151	Introduction to the Constitution of India	HSC	1-0-0	1 Credit

Pre-requisites: None.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Explain the historical context and drafting process of the Indian Constitution.
CO2	Analyze the Fundamental Rights, Directive Principles, and Fundamental Duties.
CO3	Describe the federal structure and distribution of powers between Union and States.

Syllabus:

Module 1: Historical Context and Fundamental Features

Pre-Independence constitutional developments, The Constituent Assembly: Formation, composition, and key debates. B.R. Ambedkar's role and contributions- Preamble and its significance, Fundamental principles: Sovereignty, Democracy, Republic, Justice, Liberty, Equality, Fraternity, Basic structure doctrine and constitutional identity- Constitutional morality and transformative constitutionalism, Comparison with other constitutions worldwide, Adaptability and evolution of constitutional interpretation.

Module 2: Fundamental Rights, Duties and Directive Principles

Right to Equality (Articles 14-18) - Right to Freedom (Articles 19-22) Right against Exploitation (Articles 23-24) - Right to Freedom of Religion (Articles 25-28) - Cultural and Educational Rights (Articles 29-30) - Right to Constitutional Remedies (Article 32) - Directive Principles of State Policy (Articles 36-51) - Fundamental Duties (Article 51A) - Relationship between Rights, Duties, and Directive Principles

Module 3: Institutional Framework

Distribution of powers: Union, State, and Concurrent Lists, Centre-State relations and cooperative federalism, financial relations and fiscal federalism - Parliamentary system and cabinet government, President and Governors: Powers and functions, Parliament and State Legislatures: Composition and functions - Structure and hierarchy of courts, Judicial independence and appointment systems, Judicial review and activism.

Module 4: Special Provisions and Constitutional Dynamics

Special provisions for Schedule Castes, Schedule Tribes, OBCs, Special status regions and Article 370, Emergency provisions: Types, applications, and safeguards - **Amendment** procedures under Article 368, Major constitutional amendments and their impacts, Limitations on amendment powers - Election Commission, Union Public Service Commission, Comptroller and Auditor General, Other constitutional and statutory bodies.

Module 5: Contemporary Issues and Conclusion

Gender justice and constitutional interpretation, Environmental rights and constitutional provisions, Digital rights and emerging constitutional challenges - Religious freedom and secularism, Privacy as a fundamental right, Federalism in action: Recent developments - Constitutional values in contemporary India, Challenges to constitutional governance, Future directions in constitutional interpretation.

Text Books:

1. Basu, D.D. (2020). Introduction to the Constitution of India (Latest Edition). LexisNexis.
2. Austin, Granville. (1999). Working a Democratic Constitution: The Indian Experience. Oxford University Press.
3. Khosla, Madhav. (2020). India's Founding Moment: The Constitution of a Most Surprising Democracy. Harvard University Press.
4. Baxi, Upendra. (2008). The Future of Human Rights. Oxford University Press.
5. Choudhry, Sujit et al. (2016). The Oxford Handbook of the Indian Constitution. Oxford University Press.
6. Constituent Assembly Debates (selected portions)

Online Resources:

1. Constitution of India (Full text): https://legislative.gov.in/constitution-of-india/
2. Supreme Court of India Judgments: https://main.sci.gov.in/judgments
3. Ministry of Law and Justice: https://legislative.gov.in/

HS3162	**Photography**	**HSC**	**1-0-0**	**1 Credit**

The specialization of this course will be based on the instructors available at the time of course offering.

HS3172	**Pottery**	**HSC**	**1-0-0**	**1 Credit**

The specialization of this course will be based on the instructors available at the time of course offering.

HS3182	**Painting**	**HSC**	**1-0-0**	**1 Credit**

The specialization of this course will be based on the instructors available at the time of course offering.

HS3192	**Music**	**HSC**	**1-0-0**	**1 Credit**

The specialization of this course will be based on the instructors available at the time of course offering.

HS3501	Sanskrit	HSC	1-0-0	1 Credit

Pre-requisites: None.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Acquire a functional proficiency in the Sanskrit language through practical application.
CO2	Demonstrate competency in speaking, reading, and writing Sanskrit.
CO3	Comprehend and articulate the intricate structure of Sanskrit grammar.
CO4	Explore the expansive landscape of Sanskrit literature, gaining an overview of its diversity.
CO5	Analyze and elucidate the distinct characteristics inherent in Sanskrit prose.

Syllabus:

Introduction to Sanskrit Linguistics: Overview of linguistic features unique to Sanskrit, understanding linguistic evolution in ancient India. Basic Phonetics and Script: Study of the Sanskrit script, pronunciation exercises focusing on essential phonetic nuances. Introduction to Conversation Skills: Basic greetings, expressions, and common conversational phrases, role-play exercises for practical application. Noun Usage and Gender: Gender in Sanskrit, application of gender in noun usage. Vibhakthi, Verb Structures and Tenses: Comprehensive study of present, past, and future tenses, introduction to verb conjugation and usage in different contexts. Advanced Verb Forms: Detailed exploration of tvā-anta prayogaḥ and tumun-anta prayogaḥ, application exercises for varied verb forms.Thematic Conversations: Scenario-based discussions and thematic conversations, developing conversational fluency in diverse situations.

Grammatical Foundations: Panini's Aṣṭādhyāyī: Study of Pāṇini's foundational work on Sanskrit grammar; understanding the significance of Aṣṭādhyāyī in linguistic traditions. Advanced Phonetics and Sound Patterns: Exploration of complex sound patterns in Sanskrit, practical application through phonetic exercises. Advanced Vocabulary and Usage: Analysis of intricate patterns within Sanskrit vocabulary, vocabulary-building exercises.Sandhi and Samāsa: The science of combining letters (Sandhi), understanding compound words and Samāsa. Kārakas and Sentence Structure: Introduction to Kārakas (grammatical cases), analyzing sentence structures and formation.

Introduction to Sanskrit Literature: Categories of Sanskrit Literary Works: Dṛśya and Sravya: Understanding visual and auditory literary forms, categorization of Sanskrit literature.Forms of Expression: Padyam, Gadyam, and Champu: Analysis of different literary forms, exploration of their characteristics and applications. Study of Mahākāvyas: Introduction to Pancha Mahākāvyas: Raghuvamsa by Kalidasa; Kumarasmbhava by Kalidasa;Kiratarjuniyam by Bharavi;Naishadiyacharita by Sriharsha; and Shishupalavadha by Magha. Literary Exercises: Analyzing well-known Gadyam from Bāṇabhatta (śukanaśopadeśa), practical exercises on padaccheda and Samāsa from identified Sanskrit works.

Text Books:

1. Chaitanya, Krishna. A New History of Sanskrit Literature. Asia Publishing House, 2011.
2. Filliozat,P.S. The Sanskrit Language: An Overview - History and Structure, Linguistic and Philosophical Representations, Uses and Users. Indica Books, 2002.
3. Kale,M.R. Higher Sanskrit Grammar. Bharatiya Kala Prakashan. 2nd ed. 2010.
4. Kale,M.R. The Hitopadesa of Narayana. Motilal Banarsidass, New Delhi, 2015.
5. Kale, M.R. Panchatantra of Viṣṇu Sarma. Motilal Banarsidass New Delhi, 2008.
6. Krishnamachariar,M. History of Classical Sanskrit Literature. Motilal Bansari Dass. New Delhi, 2016
7. Ram, Kanshi. The Laghusiddhāntakaumudī of Varadaraja: A primer on Pāṇini's Grammar. Volumes I – III, Motilal Banarsidass Publishers (P) Ltd. Delhi, 2010.

HS3511	Introduction to Academic Writing	HSC	1-0-0	1 Credit

Pre-requisites: None.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Students will gain practical awareness of essential writing tasks expected in academic settings.
CO2	Students will strengthen their writing foundation through structured thinking and editing.

Syllabus:

Module 1: Principles of effective writing- overview of the writing process-the pre-writing step-the writing step-structuring information- structuring paragraph- argumentative writing-thesis statement-C.A.R.S. Model (John Swales)- IMRaD structure- IMRaD structure in essays and research papers

Module 2: Five moves of an abstract-global editing and revision- editing for style-first person pronouns and choosing between active and passive voice-standard punctuation-spelling and typos-using a style sheet-secondary sources-incorporating secondary sources-citing sources-avoiding plagiarism-foot notes-end notes-generative AI and writing

Text Books:

1. Bailey, Stephen. Academic Writing: A Handbook for International Students. 5th ed., Routledge, 2018
2. Crème, Phyllis, and Mary R. Lea. Writing at University: A Guide for Students. 3rd ed., Open University Press, 2008.
3. Graff, Gerald, and Cathy Birkenstein. They Say / I Say: The Moves That Matter in Academic Writing. 5th ed., W. W. Norton & Company, 2021.
4. Hacker, Diana, and Nancy Sommers. A Writer's Reference. 9th ed., Bedford/St. Martin's, 2018
5. Greene, Stuart, and April Lidinsky. From Inquiry to Academic Writing: A Text and Reader. 4th ed., Bedford/St. Martin's, 2017
6. Nayar, Pramod K., Marilyn Anderson, and Madhucchanda Sen. Critical Thinking and Academic Writing: A Workbook for Students. Pearson Education, 2009
7. Swales, John M., and Christine B. Feak. Academic Writing for Graduate Students: Essential Tasks and Skills. 3rd ed., University of Michigan Press, 2012.
8. Turabian, Kate L. A Manual for Writers of Research Papers, Theses, and Dissertations. 9th ed., University of Chicago Press, 2018.

HS3521	Contemporary Issues in Philosophy of Mind & Cognition	HSC	1-0-0	1 Credit

Pre-requisites: None.

Course Outcomes: At the end of the course, the student will be able to:

CO1	The course is designed to introduce the students about the contemporary issues in philosophy.
CO2	The course highlights the concepts of philosophy.

Syllabus:

Introduction The Transcendent Mind: 1. Revising the traditional notion of Consciousness. 2. The nature of soul in Plato and Aristotle. 3. Cartesian Dualism: res cogitans vs. res extensa, Cogito - the thinking self. 4. Immaterialism: Idealism, Parallelism.

A Materialistic Conception of Mind. 1. Behaviourism: Methodological Behaviourism and Philosophical Behaviourism; 2. Ryle's Category Mistake. 3. Mind-Body Identity theory: Sensations and Brain Processes. 4. Functionalism: the nature of mental events, Brains and Behaviour.

Minds and Machines: 1. Functionalism revisited 2. Computationalism: Can Computer Think? 3. Dennett's Multiple Draft Model 4. Chomsky and Fodor: The Language of Mind 5. Connectionism and Folk-psychology, 6. Cognitive Psychology, 7. Eliminative Materialism, 8. Artificial Intelligence

Rediscovering Consciousness 1. Biological Naturalism: locating the mind in nature 2. The structure of experience: the traditional problem revisited. 3. Intentionality: Phenomenological or Naturalistic 4. Phenomenal Consciousness: Qualia and Quining Qualia

Language, Representation and Meaning 1. Language of the Mind 2. Representation: Mental and Semantic 3. Intention Based Semantics

The non-computational/nonmechanical Mind 1. Cartesian theory of mind Revisited, 2. Emergentism and Supervenience: Addressing the notion of Parallelism. 3. Subjectivity 4. Argument against Private Sensation and Thought

Consciousness, Experience and Values 1. Personal Identity 2. Free-will and Moral Agency 3. Creativity: Human Vs Mechanical

Text Books:

1. Chalmers, David. J., The Conscious Mind, Oxford University Press, New York, 1996.
2. Chomsky, N., Language and Mind, The MIT Press, Mass., 2006.
3. Dennett, D. C., Consciousness Explained, Penguin Books, New York and London, 1991.
4. Fodor, J. A., Representations: Philosophical Essay on the Foundation of Cognitive Science, The Harvester University Press, Sussex, 1981.
5. Haugeland, John C., Artificial Intelligence: The Very Idea, The MIT Press, Massachusetts, 1985,
6. Searle, John, R., The Rediscovery of the Mind, The MIT Press, Cambridge, Mass., 1994.
7. Stainton, Robert J., Contemporary Debates in Cognitive Science, Blackwell Publishing Ltd., Mass., 2006.
8. Dr. Ranjan K.Panda, Dr. Rajakishore Nath, NPTEL: Contemporary Issues in Philosophy of Mind & Cognition, IIT Bombay.

HS3531	Psychology and Mental Health	HSC	1-0-0	1 Credit

Pre-requisites: None.

Course Outcomes: At the end of the course, the student will be able to:

CO1	The course is designed to introduce the students with the concepts of psychology and mental health.
CO2	The course also describes the stress managements techniques to keep mental health.

Syllabus:

Introduction To Psychology: Psychology: Definition, history of psychology. Psychological Perspectives: Psychodynamic, Behavioural, Humanistic, Cognitive and Sociocultural. Fields of psychology: Pure and applied psychology

Mental Health Literacy: Mental Health: Definition of health, Mental health and stigma, indicators of poor mental health. Common myths related to mental health, Strategies to improve mental health: Robert Plutchik's Feeling wheel. Reducing stress and increasing internal and external resources. Resilience: Post-traumatic growth: Benefit Finding.

Stress and Management Techniques: Sources of stress across Adolescence and Adulthood: Relationships, peer relationships, academic stress, career-related concerns, Substance use, etc. The window of tolerance and Cognitive distortion, Stress Management techniques – Grounding technique and diaphragmatic breathing

Psychological Counseling & Mental Health: Meaning and goals, Mental health professionals: Psychiatrist, psychiatric social worker, counsellor, etc. The effective counsellor: personality and self of the counsellor. Counselling process and relationship

Text Books:

1. Saundra K Ciccarelli and Glenn E Meyer, Psychology, South Asia Edition, Dorling Kindersley (India) Pvt. Ltd., Licensees of Pearson Education in south Asia. 2008
2. Feldman. R.S. Understanding Psychology, IV edition, Tata McGraw Hill Publication. 2006.
3. Robert A Baron, Psychology, III Edition, Prentice Hall Publications. 2002.
4. Leighton, S., & Dogra, N. Defining mental health and mental illness. Nursing in child and adolescent mental health, 7-18, 2009.
5. Arnett J. J. Adolescent storm and stress reconsidered. The American psychologist, 54(5), 317–326, 1999
6. Nebhinani, N., & Jain, S. Adolescent mental health: Issues, challenges, and solutions. Annals of Indian Psychiatry, 3(1), 4, 2019.

HS3541	Psychology at Work	HSC	1-0-0	1 Credit

Pre-requisites: None.

Course Outcomes: At the end of the course, the student will be able to:

CO1	The course is designed to introduce the students with the theories of motivation and stress relief techniques.
CO2	The course also describes the group behaviour at workplace to build a better team.

Syllabus:

Introduction: Basic Psychology and Work Psychology, Five traditions in psychology, work psychology today, the changing world of work, Diversity and culture

Individual Differences: Introduction, Traditional models of cognitive ability, views of personality, socio-cognitive approaches to individual differences, trends in intelligence – emotional, social, cultural intelligence.

Motivation & Goal Setting: Motivation: Meaning; Theories of Motivation: McClelland's Theory of Needs; Maslow's hierarchy of needs, Goal setting - meaning; types of goals and their effectiveness; Principles of effective goal-setting; Writing effective goal-statements.

Stress at Workplace: Meaning; Types – acute stress, episodic stress, chronic stress; Sources – internal and external; Work related stressors: Causes, Stress and Job Performance. Stress Management techniques – Physical: exercise, yoga, meditation, relaxation techniques; Psychological: 4 A's of coping with stress, Stress Inoculation Training

Group Behavior at Workplace: Definition; Group types; Key components of groups: roles, status, norms, cohesiveness; The benefits and costs of joining groups; Effects of the presence of others: social facilitation, social loafing; Coordination in groups: cooperation, conflict; Decision making by groups: the decision-making process, the downside of group decision making groupthink and group polarization.

Text Books:

1. Arnold, J. and Randall, R., Work psychology: Understanding human behaviour in the workplace. 6th ed. UK: Pearsons Limited, 2016.
2. Baron, R. A., & Branscombe, N. R. Social Psychology (Mumbai University), 12/E (With Cd). Pearson Education India, 2009.
3. Fisher, C. D. Emotions at work: What do people feel and how should we measure it?, School of Business Discussion Papers. Paper 63,1997. http://epublications.bond.edu.au/discussion_papers/63
4. Luthra, A., & Dahiya, R. Effective leadership is all about communicating effectively: Connecting leadership and communication. International Journal of Management & Business Studies, 5(3), 43-48, 2015.
5. Purohit, S., & Nayak, S. Enhancing personal effectiveness: Training instruments for students, teachers and parents. Tata McGraw-Hill Publishing Company Limited, 2003.
6. Schultz, D. P., & Schultz, S. E., Psychology and work today: An introduction to industrial and organizational psychology. Prentice Hall, 2002.
7. The role of psychology in the Workplace. GradSchools.com. (2022, February 2). Retrieved May 5,2022, from https://www.gradschools.com/get-informed/careers/workplace-psychology

HS3561	Introduction to Journalism	HSC	1-0-0	1 Credit

Pre-requisites: None.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand core journalistic principles and values and develop basic news writing and reporting skill.
CO2	Learn to identify newsworthy stories and credible source, recognize ethical considerations in journalism and gain familiarity with different journalistic formats and platforms.

Syllabus:

Session 1: Foundations of Journalism. Introduction to journalism and its role in society Historical evolution of journalism. Core principles: accuracy, fairness, independence, accountability. The changing media landscape. Activity: Analyze front pages from different news organizations.
Session 2: News Values and Story Selection- What makes something newsworthy. News values: timeliness, proximity, impact, prominence, conflict, human interest. Story types: hard news vs. features. The inverted pyramid structure. Activity: Identify newsworthy events and prioritize stories for a front page.
Session 3: Research and Sourcing. Finding and evaluating sources. Public records and freedom of information. Interview techniques and preparation.Note-taking methods. Activity: Conduct a peer interview about a campus issue.
Session 4: News Writing Fundamentals. Crafting compelling headlines and leads. Writing clear, concise copy. Attribution and quotations. Developing story structure. Activity: Write a news story based on provided information.
Session 5: Media Ethics and Law. Ethical codes in journalism. Privacy concerns and consent Avoiding bias and maintaining objectivity. Legal considerations: defamation, copyright. Activity: Ethical decision-making scenarios.
Session 6: Digital Journalism. Multimedia storytelling. Social media as a journalistic tool. Fact-checking in the digital age. Introduction to data journalism. Activity: Create a news story for social media platforms.
Session 7: The Future of Journalism and Final Project. Emerging trends and technologies. Business models for journalism. Career paths in media. Final project presentations. **Assessment:** News writing assignments (40%), Source identification and interview exercise (20%), Ethical case study analysis (15%), Final news story project (25%).

Text Books:

1. Downing, Michael. Intro to Journalism Handbook. PA-ADOPT, 2024
2. Fleming, Carole, et al. An Introduction to Journalism. South Asia Edition, SAGE India, 2024
3. Harrower, Tim. *Inside Reporting: A Practical Guide to the Craft of Journalism*. McGraw-Hill Education, 3rd ed., 2013.
4. Hiro, Erin Massey. Broccoli and Chocolate: A Beginner's Guide to Journalism News Writing. Palomar College Journalism, 2024
5. Mencher, Melvin.*News Reporting and Writing*. McGraw-Hill Education, 12th ed., 2015.
6. Shakuntala Rao (Ed).Indian Journalism in a New Era: Changes, Challenges, and Perspectives. Oxford University Press, 2019
7. Zinsser,William.On Writing Well: The Classic Guide to Writing NonFiction. Harper Perennial, 2011

HS3561	Introduction to Film Studies	HSC	1-0-0	1 Credit

Pre-requisites: None.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand key concepts and terminology in film analysis.
CO2	Recognize formal elements of film language and their expressive functions.
CO3	Develop critical viewing and analytical skills
CO4	Explore major movements, genres, and developments in film history
CO5	Appreciate cinema's cultural, social, and artistic significance

Syllabus:

Session 1: Film Language and Analysis. Introduction to film studies as a discipline-Basic film terminology. Elements of mise-en-scène (setting, lighting, costume, acting). Cinematography fundamentals (framing, camera movement, composition). Screening and analysis: Selected film sequences.
Session 2: Film Form and Narrative. Narrative structure in cinema. Editing techniques and their effects. Sound design and music. Time and space in film. Workshop: Analyzing narrative techniques in short film excerpts.
Session 3: Film History: Early Cinema to Classical Hollywood. Origins of cinema and early experimentation. Development of narrative filmmaking. The studio system and classical Hollywood cinema. Auteur theory and director's vision. Screening: Selected works from early cinema through Golden Age Hollywood.
Session 4: Genre and Representation. Film genre theory and conventions. Representation of gender, race, and class. Stereotyping and subversion in cinema. Case study: Evolution of a specific genre. Activity: Genre analysis exercise.
Session 5: National Cinemas and Movements. Introduction to world cinema. Major film movements (German Expressionism, Italian Neorealism, French New Wave). Cultural context and national identity in film. Transnational cinema in a global age. Screening: Selected international film sequences.
Session 6: Contemporary Cinema and Technology. New Hollywood and American independent cinema. Digital filmmaking and visual effects. Changing exhibition formats and platforms. Emergence of streaming and its impact. Discussion: The future of cinema.
Session 7: Documentary, Experimental, and Beyond. Documentary film approaches and ethics. Experimental and avant-garde cinema. Animation techniques and styles. Transmedia storytelling. Final discussion: The continuing evolution of film as art and media.
Assessment Methods: Class participation and discussion (20%), Film sequence analysis assignment (25%), Genre or movement research presentation (25%), Final analytical essay (30%).

Text Books:

1. Corrigan, Timothy, and Patricia White. *The Film Experience: An Introduction*. 5th ed., Bedford/St. Martin's, 2017.
2. Nichols, Bill. *Introduction to Documentary.* 3rd ed., Indiana UP, 2017.
3. Zettl, Herbert. *Sight, Sound, Motion: Applied Media Aesthetics*. 8th ed., Cengage Learning,2017.

HS3571	Introduction to Anthropology	HSC	1-0-0	1 Credit

Pre-requisites: None.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Trace the meaning, scope and development of anthropology.
CO2	Understand its major branches and their scope.
CO3	Identify the relationship between anthropology and other disciplines.
CO4	Appreciate the interdisciplinary and Integrated nature of anthropology.
CO5	Comprehend the relevance of anthropology in the contemporary global context.

Syllabus:

Module 1: Meaning and Nature of Anthropology

- Anthropology, the Study of Humans
- Identity of Anthropology: Is Anthropology a Science or Humanities?
- Anthropology, the Human Science, Field Science, People's Science …
- Bio-social nature of Anthropology with Comparative, Integrative and Holistic Perspective

Module 2: Origin and Development of Anthropology – Part I

- Roots of Anthropology in Human Curiosity
- Early Anthropological Thoughts in Greek Philosophical and Ancient Indian Traditions
- Early Anthropological Thoughts during the Medieval Period

Module 3: Origin and Development of Anthropology – Part II

- Emergence of different Streams of Anthropological Underpinnings
    - European Explorations, Evangelic Missions and Cultural Encounters: Early Accounts of ethnographic Narratives
    - Excavations and Expeditions to unveil the human Past
    - Looking for Evidences of Human Origins; Publication of the Origin Species

Module 4: Origin and Development of Anthropology – Part III

- Convergence of Human Science into a singular Discipline with Integrated Perspective
- Four-Field Approach to Anthropology
    - Biological Anthropology
    - Social-Cultural Anthropology
    - Archaeological Anthropology
    - Linguistic anthropology

Module 5: Culture and Society

- What is Culture?
    - Meaning and Definition
    - Aspects and Attributes
- Understanding Human Culture
    - Cultural Diversity
- Understanding Human Races
- Social Cultural Aspects and Approaches: Family, Economy, Polity, Religion, Ecology, Health and Development
- Understanding Indigenous Peoples and Cultures

Module 6: Bio-Dimensions of Humans

- Humans as a Biological Organism: Human Evolution and Variation
- Bio-social Adaptation
- The Place of Humans in the Animal Kingdom
- Human Genetics: Inheritance, and Morphological and Genetic Variation

Module 7: The Human Past

- Pre-history, Protohistory, History
- Pre-historic Cultures: Palaeolithic, Mesolithic and Neolithic
- Reconstructing Human Past: Tools, Artefacts, Assemblages, Sites and Industries
- Ethno-Archaeology

Module 8: Language as a Means of Communication

- Language as a system of Symbolic Communication
- Language as a Vehicle of Culture
- Origin and Development of Language vis-à-vis Culture

Module 9: Anthropology as a Co-ordinating Science

- Relationship of Anthropology with Biological, Earth and Medical Sciences: Biology, Zoology, Geology, Anatomy, Physiology, Medicine and public health
- Relationship of Anthropology with Social Sciences and Humanities: Philosophy, History, Sociology, Psychology, Political Science, Economics, Linguistics**Module 10: Anthropology as a Field Science**
- Field Work Tradition in Anthropology
- Emergence of Ethnographic Methodology and Approaches in Anthropology: Participant Observation, Emic and Etic Approaches
- Ethnographic classics in Anthropology
- Critical Ethnography
- New Trends in Ethnographic Studies

Module 11: Integrated and Holistic perspective in Anthropology

- Unity and Diversity; Universal and Particular
- Being and Becoming; Nature and Nurture; Biology and Culture; Past and Present; Symbolic Expressions
- Approaching Human Being and Behaviour as an Integrated Whole

Module 12: Application and Relevance of Anthropology Today

- Molecular Anthropology: Genomics Study and Human Diversity
- Development Anthropology: Human Development: Whose Reality Counts?
- Environmental Anthropology: Ethno-Ecology, Climate Change and Greening the Earth
- Medical Anthropology: One Planet One Health
- Digital Anthropology: Digital World and AI

Text Books:

1. Alexander Alland (Jr)To be human: An Introduction to Anthropology. New York.1980. https://archive.org/details/tobehumanintrodu0000alla_x7f5/page/n7/mode/2up?view=theater
2. Basu Roy Indrani. 2005. Anthropology - The study of Man. New Delhi: S.Chand
3. Beals R L and Harry Hoijer. Introduction to Anthropology. New York: Mac Millan. 1971. https://archive.org/details/in.gov.ignca.12230/page/n7/mode/2up
4. Chambers, Robert. Whose Reality Counts? Putting the First Last. London: Intermediate Technology Publications. . 1997 https://archive.org/details/whoserealitycoun0000cham/page/n7/mode/2up
5. Ember Carol R., Melvin Ember and Peter N. Peregrine. Anthropology. New Jersey: Prentice Hall. 2002. https://archive.org/details/anthropology0010embe_o0l0/page/n3/mode/2up
6. GOK, Anthropology: Higher Secondary Course – CLASS – XI. Department of Education. Government of Kerala 2016 https://www.academia.edu/43769658/Anthropology_Higher_Secondary_Course_CLASS_XI
7. GOK,.Anthropology: Higher Secondary Course – CLASS – XII. Department of Education. 2016. Government of Kerala https://www.academia.edu/43769657/Anthropology_Higher_Secondary_Course_CLASS_XII
8. IGNOU.Anthropology.https://egyankosh.ac.in/browse?type=subject&order=ASC&rpp=20&value=Anthropology
9. Sarana Gopala. Introducing Anthropology. Calcutta: Indian Anthropological Society. 1977.
10. Sharma, R.N. and R.K. Sharma. Anthropology. New Delhi: Atlantic-1997

HS3581	Ethics for AI	HSC	1-0-0	1 Credit

Pre-requisites: None.

Course Outcomes: At the end of the course, the student will be able to:

CO1	To understand the importance of ensuring privacy, security, and interpretability in AI algorithms and models.
CO2	To gain insights into the role of human oversight and governance in maintaining the trustworthiness of AI systems.

Syllabus:

Responsible and Explainable AI: Introduction to Responsible AI, Responsible AI Principles, Introduction to Explainable AI, Techniques in Explainable AI

Privacy concerns, Algorithmic bias, Fairness, Human rights, Accountability and Transparency

EU AI Act: Introduction to EU AI Act, Applicability of EU Act in India, AI regulation in India

Reading List:

1. Mark Coeckelbergh, AI ETHICS, MIT Press, 2020
2. https://artificialintelligenceact.eu/
3. Sina Fazelpour and David Danks, https://compass.onlinelibrary.wiley.com/doi/10.1111/phc3.12760?af=R
4. Algorithmic injustice - Abeba Birhane https://www.sciencedirect.com/science/article/pii/S2666389921000155
5. Inherent Trade-Offs in the Fair Determination of Risk Scores – Jon Kleinberg, Sendhil Mullainathan, Manish Raghavan https://arxiv.org/abs/1609.05807
6. Transparency in Complex Computational Systems – Kathleen Creel https://www.cambridge.org/core/journals/philosophy-of-science/article/abs/transparency-in-complex-computational-systems/4DB040EB28172CADF5F2858B62D0952C
7. A modern Pascal's wager for mass electronic surveillance. David Danks https://static1.squarespace.com/static/5f6d0320212a261d8716949f/t/62131914690779 4d4dba3724/1645418773886/Telos-PascalsWager-Pub.pdf
8. Ethical Issues in Advanced Artificial Intelligence - Nick Bostrom https://nickbostrom.com/ethics/ai

HS3591	Introduction to Sociology	HSC	1-0-0	1 Credit

Pre-requisites: None.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand key sociological concepts and theoretical perspectives and recognize how social structures influence individual and group behavior.
CO2	Apply sociological imagination to everyday social phenomena and develop critical thinking skills about social arrangements and inequalities.

Syllabus:

Session 1: The Sociological Perspective. Introduction to sociology as a discipline. The sociological imagination (C. Wright Mills). Levels of sociological analysis: micro, meso, and macro. Key questions in sociology. Activity: Applying sociological imagination to personal experiences
Session 2: Sociological Theory Classical sociological theory: Marx, Durkheim, Weber. Contemporary theoretical perspectives. Functionalism. Conflict theory. Symbolic interactionism. Discussion: Analyzing social events through multiple theoretical lenses.
Session 3: Culture and Socialization. Elements of culture: norms, values, language, symbols. Cultural variation and ethnocentrism. The socialization process and agents of socialization. Social construction of reality. Exercise: Identifying cultural norms across different settings
Session 4: Social Structure and Interaction. Social roles, statuses, and institutions. Groups and organizations. Social interaction in everyday life. Dramaturgical approach (Goffman). Workshop: Observing social interactions in public spaces
Session 5: Social Stratification. Systems of social inequality. Class, status, and power. Social mobility. Global inequality. Case study: Analyzing contemporary class structures
Session 6: Social Institutions. Family and kinship. Education and economy. Politics and religion. Health and medicine. Activity: Institutional interconnections and their effects
Session 7: Social Change and Contemporary Issues. Collective behavior and social movements. Globalization and technology. Environmental sociology. Applying sociology to current social problems. Final discussion: The future of society and sociology
Assessment Methods: Class participation and discussion (25%), Sociological observation assignment (25%), Analysis of a social issue (25%), Final reflection paper (25%).

Text Books:

1. Bhushan Vidya and R.Sachdeva. Fundamentals of Sociology. Pearson, 2012.
2. Conerly, Tonja R., et al. Introduction to Sociology 3e. OpenStax, 2021. Giddens, Anthony, et al. I*ntroduction to Sociology*. Seagull Books, 10th ed., 2021.
3. Henslin, James M. Sociology: A Down-to-Earth Approach. 13th ed., Pearson Education, 2017.
4. Ritzer, George and Jeffery Stepiski. *Sociological Theory*. McGraw-Hill Education, 9th ed., 2017.
5. Rousseau, Nathan. Society Explained: An Introduction to Sociology. Rowman & Littlefield, 2014.
6. Singh, J.P. Contemporary Sociology: Concepts, Theories, and Perspectives. Motilal Banarsidass Publishing House, 2023.

HS3601	Personal Finance	HSC	1-0-0	1 Credit

Pre-requisites: None.

Course Outcomes: At the end of the course, the student will be able to:

CO1	To set financial goals and develop a financial plan based on income and expenses.
CO2	To develop investment plan for future goals such as higher studies, marriage and retirement.

Syllabus:

Introduction to behavioural economics and finance: the concept of expected utility, the Von Neumann Morgenstern framework.

Understanding the Time Value of Money.

Non-expected utility preferences and its applications in finance.

Beliefs, biases and heuristics in financial markets.

Basics of personal finance, Insurance Policies, financial planning, and budgeting.

Investment decision making and behavioral finance

Investment strategies (FDs, Securities Markets, Stocks, Bonds and Mutual Funds) for individual investors.

Measuring Financial Health and Making a Plan – case studies

Text Books:

1. William Forbes, Behavioral Finance, Wiley, 2009.
2. L. F. Ackert and R. Deaves, Behavioral Finance: Psychology, Decision-Making and Markets, South-Western College Publication.
3. H K Baker and V Ricciardi, Investor Behavior: The Psychology of Financial Planning and Investing, Wiley, 2018.
4. Jack Kapoor, Les Dlabay and R. J. Hughes, McGraw Hill, Personal Finance (11th ed.).

HS3611	Introductory Economics	HSC	1-0-0	1 Credit

Pre-requisites: None.

Course Outcomes: At the end of the course, the student will be able to:

CO1	This course is designed to expose students to the basic principles of economics.
CO2	The course will illustrate how economic concepts can be applied to analyze real-life situations.

Syllabus:

Module I: Basics of Economics

Economics-Definitions- Importance of economics-relation with other social sciences- Basic Problems of an economy - Micro versus Macro economics

Module II: Demand and Supply

Demand and supply Utility, utility function, marginal utility, law of diminishing marginal utility-demand, law of demand. Elasticity of demand-Cost, cost function, opportunity cost, variable cost, fixed cost, total cost, marginal cost, average cost, supply, supply function, supply curve, Elasticity of supply- Equilibrium price, market and its classification

Module III: Production and distribution

Factors of Production-Production function, types of production function (short run and long run), economies of scale- Distribution-Marginal productivity theory.

Module IV: National Income

Concepts and Meaning National Income-Meaning and Significance- Concepts of National Income- Importance of the estimation of national income-difficulties in estimation of national income.

Module V: Classical Vs Keynesian economics

Assumptions of Classical economists-Say‘s Law of Market, Full employment, wage-price flexibility - Keynesian revolution-major concepts of Keynes, Post-Keynesian developments

Reading List:

1. Salvetor D and EA Diulio – Principals of Economics, Schuam’s Outline Series, 2020
2. Gregory Mankiw, Principles of Macroeconomics, Worth Publishers, 2018
3. Gregory Mankiw, Principles of Microeconomics, South-Western Pub, 2017
4. Paul Samuelson and William D Nordhaus, Economics, Tata McGraw Hill Education Pvt. Ltd, New Delhi, 2010
5. A. Koutsoyannis, Modern Microeconomics, Palgrave Macmillan, 1979
6. INTRODUCTORY ECONOMICS – I, UNIVERSITY OF CALICUT, https://sde.uoc.ac.in/sites/default/files/sde_videos/II%20Sem.%20-%20Introductory%20Economics%20I%20-%202019%20Admn..pdf, 25.04.2025
7. Arleen J Hoag, Introductory Economics, 4th Edition, World Scientific Connect, 2006
8. K.N. Verma, Introductory Economics, Vishal Publishing Co. 2023
9. Prof. Angan Sengupta, Economics of Health and Health Care, NPTE.

HS3621	Cyber Law for Engineers	HSC	1-0-0	1 Credit

Pre-requisites: None.

Course Outcomes: At the end of the course, the student will be able to:

CO1	To understand different cyber crimes and the corresponding laws.
CO2	To understand the importance of data privacy and influence of technology on all stake holders.

Syllabus:

Introduction to Law, Information Technology Act - An Overview, Introduction to Cyber Crimes.

Law relating to Cyber Crimes: Cyber Crime Jurisdiction, Hacking, Obscenity & Pornography, Cyber Stalking, Theft of Identity, Cyber Fraud, Mischief, Cyber Defamation, Cyber Terrorism, Breach of Confidentiality and Privacy, Offences of/by Companies, Liability of Intermediaries.

Internet and Social Media: Freedom of Expression in Internet, Hate speech, Sedition, Libel, Subversion, Privacy Issues, Regulating social media.

Emerging and Contemporary issues in Cyber Space: Data Protection- data privacy, emerging technologies such as Quantum Computing, Artificial Intelligence, IOT (Internet of things), BIGDATA, Block chain technology, GDPR, HIPAA and DPDP Act 2023.

Text Books:

1. Prashant Mali; Cyber Law & Cyber Crimes, 7th edition, Cyber Infomedia
2. Van Kessel, P. Is cyber security about more than protection? EY Global Information Security Survey 2018-2019.
3. Acquisti, A., John, L. K., & Loewenstein, G. What is privacy worth? The Journal of Legal Studies, 2013
4. Xu H., Luo X.R., Carroll J.M., Rosson M.B. The personalization privacy paradox: An exploratory study of decision making process for location-aware marketing. Decision Support Systems, 2011.
5. Johnston, A.C. and Warkentin, M. Fear appeals and information security behaviours: An empirical study. MIS Quarterly, 2010.
6. Smith, H. J., Dinev, T., & Xu, H. Information privacy research: an interdisciplinary review. MIS Quarterly, 2011.
7. Subramanian R. Security, privacy and politics in India: a historical review. Journal of Information Systems Security (JISSec), 2010.
8. Ishaan D. Joshi, AI, Ethics & Predictive Policing : Moral Responsibility in Tech-Powered Law Enforcement

HS3631	Food and Nutrition	HSC	1-0-0	1 Credit

Pre-requisites: None.

Course Outcomes: At the end of the course, the student will be able to:

CO1	The goal of this course is to give students a foundation in food and nutrition concepts and their significant influence on human health and wellbeing.
CO2	The science underlying nutrients, the body's food processing, the relationship between diet and health, and the more general facets of food safety and nutrition policy will be covered.

Syllabus:

Module 1: Introduction to Food & Nutrition
Introduction to Food & Nutrition, Human Biology, Vital Parameters and Health Check.
Module 2: Nutrients and Their Role in Health
Nutrients: Classification - Macronutrients and Micronutrients, Water, Carbohydrates, Nutrients – Proteins (Structure & Classification), Lipids and Fats, Source of Fats and Oil, Fat Soluble Vitamins, Water Soluble Vitamins, Minerals (their sources, functions, deficiency symptoms, and impact on health).
Module 3: Energy Metabolism and Nutrient Absorption
Energy Metabolism: Understanding energy needs, BMR, and the role of food in energy production. Digestion and Absorption: How the body breaks down and absorbs nutrients.
Module 4: Diet and Health
Diet and Health: Food Group, Balance Diet, Balanced Diet and Deficiency, Nutrition Requirements for Susceptible Population, Therapeutic Nutrition.
Module 5: Nutrition Across the Lifespan and Culinary Health
Food for Patients- Malnutrition and Obesity, Diabetic, BP, Cardio, Orthopedic etc., (various health conditions) and its impact. Nutrition Across the Lifespan: Specific nutritional needs in different life stages. Phytochemicals and health benefits, Spices and Health Benefits, Cooking Methods.
Module 6: Food Safety, Labelling, and Awareness
Food Safety and Security: Introduction to quality attributes of food, Principles of food safety and hygiene. Nutrition Labelling and Food Laws, Psycho social Aspects of Food.

Reading List:

1. Foods Facts and Principles, N. Shakunthala Manay and M. Shadaksharaswamy, 2001.
2. Food Science, Third edition, B. Srilakshmi,2003.
3. Food Science, Fourth edition, Norman N. Potter,2013.
4. Nutrition Facts, Karen Frazier, Aug 2015.
5. Modern Food Microbiology, Seventh edition, James M. Jay Martin J. Loessner, David A. Golden,2005.
6. Food Processing, Carl J. Schaschke, 2011.

Reference Course:

1. Swayam Course - Food and Nutrition - By Dr. Asna Urooj, University of Mysore https://onlinecourses.swayam2.ac.in/cec19_ag02/preview

HS3641	Youth, Gender and Identity	HSC	1-0-0	1 Credit

Pre-requisites: None.

Course Outcomes: At the end of the course, the student will be able to:

CO1	The course is designed to introduce the students about gender-based education and orientations.
CO2	The course also describes the various issues associated with youth and gender and remedial measures.

Syllabus:

Introduction: Concepts of Youth: Transition to Adulthood, Extended Youth in the Indian context. Concepts of Gender: Sex, Gender Identity, Sexual Orientation, Gender Roles, Gender. Role Attitudes, Gender Stereotypes. Concepts of Identity: Multiple identities

Youth and Identity: Family: Parent-youth conflict, sibling relationships, intergenerational gap. Peer group identity: Friendships and Romantic relationships. Workplace identity and relationships. Youth culture: Influence of globalization on Youth identity and Identity crisis. Youth and education, modernity, masculinities, popular culture, media etc.

Gender and Identity: Issues of Sexuality in Youth, Gender discrimination, Culture and Gender: Influence of globalization on Gender identity

Issues related to Youth, Gender and Identity: Youth, Gender and violence, enhancing work-life balance, Changing roles and women empowerment. Encouraging non-gender stereotyped attitudes in youth

Law and Youth: Juvenile Justice act, LGBT rights in India, UNICEF programs for youth

Reading List:

1. Berk, L. E. Child Development (9th Ed.). New Delhi: Prentice Hal, 2010.
2. Baron, R.A., Byrne, D. & Bhardwaj.G Social Psychology (12th Ed). New Delhi: Pearson, 2010.
3. Elizabeth Herlock, Developmental Psychology,, McGraw-Hill, 2015.
4. NayanaJoshi, Handbook of Juvenile Justice, Lawmanns Publication, 2019.
5. Nakassis, C. V., Doing style: Youth and mass mediation in South India. University of Chicago Press/Orient Blackswan, 2016.
6. Lukose, R. A., Liberalization's children: Gender, youth, and consumer citizenship in globalizing India. Duke University Press, 2020.
7. Jeffrey, C. Timepass: Youth, class, and the politics of waiting in India. Stanford University Press, 2010.
8. Sharma, A., School worlds: An ethnographic study. SAGE Publications India, 2016.
9. Venkatraman, S., Social media in south India (p. 256). UCL press, 2017.
10. https://www.sju.edu.in/uploads/userfiles/OE_Psychology_2023.pdf

HS3652	Dance	HSC	1-0-0	1 Credit

The specialization of this course will be based on the instructors available at the time of course offering.

HS3662	Theatre Arts	HSC	1-0-0	1 Credit

The specialization of this course will be based on the instructors available at the time of course offering.

HS3672	Sculpture	HSC	1-0-0	1 Credit

The specialization of this course will be based on the instructors available at the time of course offering.

HS3682	Introduction to Animation	HSC	1-0-0	1 Credit

Pre-requisites: None.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Select and use appropriate tools and technologies for the development of animation projects.
CO2	Design, create and animate objects and characters with naturalistic and expressive movements and poses.

Syllabus:

Fundamental of Animation, Concepts of Graphics and illustrations, Typography design, Digital art, Concepts of 2D digital animation, Anatomy study, Character design, Magic with images, Digital sound track, Editing digital video, Digital art and animation, Storyboarding and animatics

Reading List:

1. Liz Blazer, Animated Storytelling: Simple Steps For Creating Animation and Motion Graphics, Peachpit Press; 2nd edition, 2019
2. Gordon Fisher, Blender 3D Basics - Second Edition, Packt Pub Ltd, 2nd edition, 2014.
3. Richard William, Animator's Survival Kit, Faber; Main - Revised edition, 2019
4. Peter Lord and Brian Sibley, Creating 3-D Animation: The Aardman Book of Filmmaking, Harry N. Abrams; Revised edition, 2004
5. Oscar Baechler, Blender 3D By Example - Second Edition: A project-based guide to learning the latest Blender 3D, EEVEE rendering engine, and Grease Pencil, Packt Publishing; 2nd ed. edition, 2020
6. https://onlinecourses.swayam2.ac.in/cec20_cs08/preview

HS2052	National Service Scheme	HSC	1-0-0	1 Credit

Pre-requisites: None.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand the real-world problems and brain storm to address the problems with innovative ideas.
CO2	Create awareness on various social issues to the community and youth effectively.
CO3	Use their expertise to devise the solution and implement on the real time problems.

Syllabus:

Module I: Wastes management services

- Wastes segregation and composting methods
- Posters and sign boards, and competition to display environmental issues and awareness
- Recycling, reduce, and reuse (3R) concepts, Environmental article writing competition
- Zero wastes day celebration
- Virtual demonstration of different eco-friendly approaches for sustainable living
- Summary of article or book on recent environmental issues.

Module II: Community engagement and social responsibility

- Conducting awareness programme on health issues, communicable diseases, etc.
- Conducting consumer awareness and legal provisions
- Woman empowerment programme, forms of harassment, Adolescent health and population education, Children educations
- Any activities in collaboration with NGOs and Charity.
- Awareness on Road Safety and First – Aid
- Visit to hospitals & support activities
- Health awareness and conduct of health camps / yoga camps
- Blood donation & blood grouping
- Visit to old age homes, orphanages & institutions for differently abled
- Swacch Bharat Mission – maintaining cleanliness in the campus
- Campus beautification & planting of saplings

Modules III: Internet Security awareness

- Internet and its uses - Schemes
- Cyber security issues and awareness programme
- Digital services and accounting (Banking, health, Central/state govt services)

Module IV: Training Youth

- Imparting Basic Technical Training to Rural Youth in Simple Trades
- Self-Employment Training to Rural Women
- Training on Disaster Management
- Soft Skills / Technical Skills to Rural Youth
- Career Guidance to Educated / Uneducated Youth
- Cultural and Sports Activities
- Conducting one day special camp in villages, Survey, identification of potential problem, rendering help to solve via self-media-authorities-experts etc.

Text Books:

1. Certification of Yoga Professionals - Official Guide Book (For Level I &II Instructor and Level II Teacher), Excel Books Pvt. Ltd., 2024.
2. Brown, F. Y. (2000). How to use yoga. Delhi: Sports Publication.
3. Thirumalai Kumar. S and Indira. S (2011) Yoga in Your Life, Chennai: The Parkar Publication
4. Helen Purperhart (2004), The Yoga Adventure for Children. Netherlands: A Hunter House book.