Scheme of Instruction, Evaluation

and

Syllabi of

B.E. ELECTRICAL AND ELECTRONICS ENGINEERING

With effect from Academic Year 2025-26

DEPARTMENT OF ELECTRICAL ENGINEERING
UNIVERSITY COLLEGE OF ENGINEERING
(Autonomous)
Osmania University
Hyderabad – 500 007, TG, INDIA

Estd. 1917

Estd. 1929

UNIVERSITY COLLEGE OF ENGINEERING

The University College of Engineering (UCE) has the distinction of being the oldest and the biggest among the Engineering Colleges of the State of Andhra Pradesh. Established in the year 1929, eleven years after the formation of Osmania University, it was the 6th Engineering College to be established in the whole of British India. The College moved to its present permanent building in the year 1947. Today it is the biggest among the campus colleges of Osmania University. The Golden Jubilee of the College was celebrated in 1979, the Diamond Jubilee in 1989 and the Platinum Jubilee in 2004. The College was made autonomous in 1994.

The College offers four-year engineering degree courses leading to the award of Bachelor of Engineering (B.E.) in Biomedical Engineering, Civil Engineering, Computer Science and Engineering, Electrical and Electronics Engineering, Electronics and Communications Engineering and Mechanical Engineering. The College also offers courses leading to Master of Computer

Applications, Master of Science by Research and also Ph.D., in the various branches of Engineering. Part-time courses are offered both at undergraduate and postgraduate levels.

Vision

The Vision of the institute is to generate and disseminate knowledge through harmonious blending of science, engineering and technology. To serve the society by developing a modern technology in students' heightened intellectual, cultural, ethical and humane sensitivities, fostering a scientific temper and promoting professional and technological expertise.

Mission

- To achieve excellence in Teaching and Research
- To generate, disseminate and preserve knowledge
- To enable empowerment through knowledge and information
- Advancement of knowledge in Engineering, Science and Technology
- Promote learning in free thinking and innovative environment
- Cultivate skills, attitudes to promote knowledge creation
- Rendering socially relevant technical services to the community
- To impart new skills of technology development
- To inculcate entrepreneurial talents and technology appreciation programmes
- Technology transfer and incubation

DEPARTMENT OF ELECTRICAL ENGINEERING

The Department of Electrical Engineering started in 1949 to offer B.E in Electrical Engineering. Presently, the Department is offering B.E. in Electrical & Electronics Engineering. Continuing Education for employed diploma holders was started in 1963 through the four-year Part-Time Degree course in Electrical Engineering; The Post-graduate course in Electrical Machines was started in 1966. Later, in the year 1987, B.E in Instrumentation was offered.

With a view to provide diversity and industrial orientation to the Post Graduate program, currently the Department is offering M.E. courses in Industrial Drives & Control and Power Systems, which were introduced in 1971. Department also offers part time PG courses in Industrial Drives & Control and Power Systems for the working academicians and engineers. A new PG program in Power Electronic Systems is introduced in the year 2008. The Part-Time Ph.D. program in Electrical Engineering is being offered since 1972.

The Department has eighteen regular faculty members who are highly experienced and actively involved in research activities. The Department is also equipped with state-of-art equipment and well qualified technical staff. The department is accredited by NBA for 5 years from the year 2013 and reaccredited for 3 years from the year 2019 and further in 2022 for BE(EEE) program. PG Programs in Industrial Drives & Control and Power Systems are accredited by NBA for 3 years from the year 2021.

Vision

To strive for excellence in education and research; meet the requirement of industry in the field of electrical engineering to serve the nation.

Mission

- To provide knowledge-based technology and serve to meet the needs of society in electrical and allied industries.
- To help in building national capabilities for excellent energy management and to explore non-conventional energy sources.
- To create research-oriented culture and to provide competent consultancy.
- To create and sustain environment of learning in which students acquire knowledge and learn to apply it professionally with due consideration of ethical and economic issues.
- To be accountable through self-evaluation and continuous improvement.

Programme Educational Objectives (PEO):

PEO1: To provide students with a solid foundation in Mathematics, Sciences and Electrical Engineering which prepares students for further studies and hence research in Electrical Engineering and for a wide range of career opportunities in Industries and academics.

PEO2: To train the students with good engineering breadth so as to comprehend, analyze, innovate and design new products in electrical domain, to provide technical solutions to real life problems and to render technical services to the needs of the society.

PEO3: To inculcate professional and ethical attitude, creative, effective communication and presentation skills and enhanced ability to work in teams to pursue complex, open-ended investigations and research in electrical engineering for effective knowledge transfer.

PEO4: To provide students with an academic environment aware of excellence, proactiveness, leadership positions in multidisciplinary teams, entrepreneurial talent and lifelong learning for successful professional career.

PROGRAM OUTCOMES (POs)

POs	Engineering 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, review 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 modeling 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	**Lifelong learning:** Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.
	PROGRAM SPECIFIC OUTCOMES (PSOs)
PSO1	Find solutions for effective operations and control of power systems to achieve quality and reliable power supply
PSO2	Provide solutions for effective and intelligent control of electric drives and renewable energy systems with electronic circuits for domestic and industrial applications

SCHEME OF INSTRUCTION AND EVALUATION
B.E. (Electrical and Electronics Engineering)

VII– Semester

S.No	Code	Course Title	Scheme of Instruction			Contact Hrs/Wk	Scheme of Evaluation			Credits
			L	T	P		Hrs	CIE	SEE	
Theory										
1	PC 701 EE	Power System Operation and Control	3	-	-	3	3	40	60	3
2	PC 702 EE	Electric Drives and Static Control	3	-	-	3	3	40	60	3
3	PC 703 EE	Smart Grid Technologies	3	-	-	3	3	40	60	3
4	PC 704 EE	Power Electronic Converters for Renewable Energy	3	-	-	3	3	40	60	3
5	**Professional Elective – IV**		3	-	-	3	3	40	60	3
	PE 701 EE	Energy Management Systems								
	PE 702 EE	Sensors and Transducers								
	PE 703 EE	Switched Mode Power Supplies								
6	**Open Elective –II**		3	-	-	3	3	40	60	3
	OE 701BM	Basic Medical Equipment								
	OE702BM	Artificial Intelligence in Health Care								
	OE 701 CE	Green Building Technology								
	OE 702 CE	Plumbing Technology								
	OE 701 CS	Cloud Computing								
	OE 702 CS	Data Base Management Systems								
	OE 701 EC	Embedded Systems Design								
	OE 702 EC	Basics of IoT								
	OE 701 EE	Optimization Techniques								
	OE 702 EE	Non-Conventional Energy Sources								
	OE 701ME	Nano Technology								
	OE 702ME	Startup Entrepreneurship								

Practicals										
7	PC 751 EE	Power Systems Lab	-	-	2	2	3	25	50	1
8	PC 752 EE	Electrical Simulation Lab	-	-	2	2	3	25	50	1
9	PW 761 EE	Project Work - I	-	-	6	6	-	50	-	3
10	PW 762 EE	Summer Internship	-	-	-	-	-	50	-	2
Total			**18**	**-**	**10**	**28**	**24**	**390**	**460**	**25**

With effect from Academic Year 2025-26

DEPARTMENT OF ELECTRICAL ENGINEERING, UNIVERSITY COLLEGE OF ENGINEERING (AUTONOMOUS), OSMANIA UNIVERSITY, HYDERABAD

Overall Scheme for B.E (EEE.) I-Sem to VIII-Sem, the students admitted in the college during the Academic Year 2022-2023 to 2025-2026

	I-Sem				II-Sem	
S. No	**Theory**	**Credits**		**S. No**	**Theory**	**Credits**
1	Engineering Mathematics – I	3		1	Engineering Mathematics-II	3
2	Applied Physics	3		2	Engineering Chemistry	3
3	Programming for Problem Solving	3		3	Communicative English	3
4	Electrical Wiring Estimation and Automation	3		4	Digital Electronics and Logic Design	3
5	Electrical and Electronics Engineering Materials	3				
	Practicals				**Practicals**	
6	Applied Physics Lab	1.5		5	Engineering Chemistry Lab	1
7	Programming for Problem Solving Lab	1		6	Communicative English Lab	1
8	Engineering Graphics	4		7	Workshop Practice	2
				8	Computer Aided Electrical Drawing Lab	1
	Total	**21.5**			**Total**	**17**
	III-Sem				**IV-Sem**	
S. No	**Theory**	**Credits**		**S. No**	**Theory**	**Credits**
1	Electrical Circuits – I	3		1	Electrical Circuits – II	3
2	Electrical Machines – I	3		2	Electrical Machines II	3
3	Electromagnetic Fields	3		3	Power Systems – I	3
4	Linear Integrated Circuits	3		4	Linear Control Systems	3
5	Signals and Systems	3		5	Microprocessors and Microcontrollers	3
6	Analog Electronics	3		6	Electrical Measurements and Instrumentation	3
				7	**Professional Elective – I**	3
	Practicals				**Practicals**	
7	Digital Electronics and Logic Design Lab	1		8	Electrical Circuits Lab	1
8	Linear Integrated Circuits Lab	1		9	Electrical Machines Lab – I	1
9	Analog Electronics Lab	1		10	Microprocessors and Microcontrollers Lab	1
	Total	**21**			**Total**	**24**
	V-Sem				**VI-Sem**	
S. No	**Theory**	**Credits**		**S. No**	**Theory**	**Credits**
1	Electrical Machines-III	3		1	Utilization of Electrical Energy	3
2	Power Systems – II	3		2	Switchgear and Protection	3
3	Power Electronics	3		3	Electric and Hybrid Vehicles	3
4	Digital Signal Processing Applications	3		4	AI Techniques in Electrical Engineering	3
5	Basic Python Programming	3		5	FACTS Controllers and HVDC Transmission	3
6	**Professional Elective – II**	3		6	**Professional Elective – III**	3
	Practicals			7	**Open Elective – I**	3
7	Electrical Machines Lab-II	1			**Practicals**	
8	Electrical Measurements Lab	1		8	Power Electronics Lab	1
9	Control Systems Lab	1		9	Digital Signal Processing Lab	1
	---			10	Mini-Project	3
	Total	**21**			**Total**	**26**
	VII-Sem				**VIII-Sem**	
S. No	**Theory**	**Credits**		**S. No**	**Theory**	**Credits**
1	Power System Operation and Control	3		1	**Mandatory Course – I** (Environmental Science)	0
2	Electric Drives and Static Control	3		2	**Mandatory Course – II**	0
3	Smart Grid Technologies	3		3	**Mandatory Course – III**	0
4	Power Electronic Converters for Renewable Energy	3		4	Project Work – II	6
5	**Professional Elective – IV**	3			**Total**	**6**
6	**Open Elective – II**	3				
	Practicals					
7	Power Systems Lab	1				
8	Electrical Simulation Lab	1				
9	Summer Internship	2				
10	Project Work – I	3				
	Total	**25**				

Credit Summary									
Semester	**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**TOTAL**
Credits	21.5	17	21	24	21	26	25	06	**161.5**

Course Code	Course Title						Course Type
PC 701EE	POWER SYSTEM OPERATION AND CONTROL						core
Prerequisite	Contact hours per week			Duration of SEE (Hours)	Scheme of Evaluation		Credits
	L	T	P		CIE	SEE	
	3	-	-	3	40	60	3

Course Objectives

- To understand the concepts and Importance of Load flow studies.
- To study the economic operation of thermal power units.
- To understand the load frequency control mechanism in a power system.
- To analyze angle stability and voltage stability of the power system.
- To study various compensation techniques in a power system.

Course Outcomes: After completion of this course, the students shall be able to:

1. Analyze load flow methods, economic operation and load frequency control of power system.
2. Evaluate the load distribution between generating units economically.
3. Understand the effect of closed loop control of frequency of power system.
4. Determine the stability of power system under various types of disturbances.
5. Understand various compensation methods required in a power system.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	2	2	2		2	2	2	3	3	
CO2	3	3	2	1	2	2	2		2	2	2	3	3	
CO3	3	3	2	1	2	2	2		2	2	2	3	3	
CO4	3	3	2	2	2	2	2		2	2	2	3	3	
CO5	3	3	2	2	2	2	2		2	2	2	3	3	

UNIT I

Load Flow Studies: Introduction, Bus classification, Nodal Admittance matrix, Static Load flow equations, Gauss Seidel method, Newton Raphson method, Decoupled and Fast decoupled methods of load flow analysis. Comparison of methods.

UNIT II

Economic Operation of Power System: Generator input output curves, Heat rates and incremental cost curves, Economic operation neglecting transmission losses. Loss coefficients, Economic operation including transmission losses.

UNIT III

Load Frequency Control: Mathematical model of speed-governing system, Turbine models. Concept of control area, Flat Frequency control, Flat tie line frequency control, Tie line bias control. Single area load frequency control, Steady state and dynamic responses, Closed loop control, Two area load frequency control.

UNIT IV

Power System Stability: Steady State Stability, Dynamic Stability, Transient Stability, Swing equation, Equal area criterion, Application of equal area criterion, Step-by-Step solution of the swing equation, Factors affecting transient stability. Introduction to voltage stability.

UNIT V

Compensation in Power System: Loading capability, Load compensation, Line compensation, Series compensation, Shunt compensation, FACTS controllers –Principle of Operation of SVC, STATCOM, SSSC, UPFC**.**

Suggested Reading:

1. C.L.Wadhwa, Electric Power Systems, New Age International (P) Ltd., Third Edition 2002.
2. Nagarath and Kothari, Electrical Power Systems, Tata McGraw Hill Co., Third Edition, 2004.
3. Elgerd 0, Electric Energy System Theory, McGraw Hill,1971.
4. Hingorani, Understanding FACTS, Standard Publishing, New Delhi,2000.
5. Hadi Saadat, Power System Analysis, Tata McGraw-Hill Edition,2002.

Course Code	Course Title					Course Type
PC 702EE	ELECTRIC DRIVES AND STATIC CONTROL					core
Prerequisite	Contact hours per week			Duration of SEE (Hours)	Scheme of Evaluation	Credits
	L	T	P		CIE	SEE	
	3	-	-	3	40	60	3

Course objectives

• .To understand the concepts and classification of motor – load combination.
• To study the concepts and characteristics of starting and braking methods of DC & AC motors.
• To study the static control methods of DC motor and four quadrant operation by dual converters.
• To study the speed control, variable frequency control of induction motor and slip power recovery schemes.
• To study the various modes of Self-controlled and separately controlled synchronous motor drives

Course outcomes: After completion of this course, the students shall be able to:

1. Understand the concepts of electrical drives and analyze the motor–load combination.
2. Analyze the starting and braking techniques of DC and AC motors.
3. Design the drive circuits for single phase and three phase , controlled rectifier fed DC motor drives.
4. Implement speed control for Induction motors using variable frequency sources and slip power recovery schemes.
5. Analyze the various modes of variable frequency control, linear induction motor and Permanent Magnet Synchronous Motor drives.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	-	-	-	1	-	-	-	-	-	2	-	2
CO2	3	1	1	1	-	1	-	-	-	-	-	2	-	2
CO3	3	1	-	1	-	2	-	-	-	-	-	2	-	2
CO4	3	-	-	1	-	1	1	-	-	-	-	1	-	3
CO5	3	1	1	1	-	1	1	-	--	-	2	1	-	3

UNIT-I

Electric Drives: Concept and classification of Electrical Drives: Types of loads, Speed- Torque curves of various loads. Dynamics of Motor Load combination. Characteristics of DC motors: Basic characteristics of dc shunt motors and series motors Modified Speed-Torque characteristics of D.C. Shunt motors and D.C series motors and Induction motors.

UNIT II

Starting of Electric Motors: Methods of Starting Electric Motors, Acceleration time, Energy relations during starting, D.C Shunt & Series motors and Induction motors, Methods to reduce the energy loss during starting.

Electric Braking: Types of Braking - Braking of D.C and A.C motors, Energy relations during braking. Regenerative Braking operation of separately exited motor, dynamic braking and plugging operation of separately exited motor and series motor.

UNIT III

D.C motor drives: Controlled rectifier fed dc drives: continuous conduction mode of Single-phase fully controlled and half controlled rectifier control of dc separately exited motor, three phase fully controlled and half controlled rectifier control dc separately exited motor. Dual converter control of dc separately exited motor: Circulating current and Non- Circulating current modes of operation. Closed loop control for dc drives.

UNIT IV

Induction Motor Control: Speed control of 3- phase Induction motor with A.C voltage regulators, Voltage sources inverters and Cyclo - converters, Static rotor resistance control, Slip power recovery schemes: Static Kramer drive and Scherbius drive, Variable frequency drives.

UNIT V

Synchronous Motor Control: Self-controlled and separately controlled synchronous motors, linear induction motors, Permanent magnet synchronous motor drives and Applications.

Suggested Reading:

1. S.K. Pillai, A First Course in Electrical Drives, New Age International (P) Limited, Publishers, 2000.
2. G.K.Dubey, *Power Semi-Converter Controlled Drives,* Prentice Hall, Eaglewood, liffs,1989.
3. M.D.Singh and K.B. Khanchandani, Power Electronics, Tata McGraw Hill Publishing Company Ltd., 2000.
4. Bimal. K. Bose, Modern Power Electronics and AC Drives, Pearson Education Asia, 2002.

Course Code	Course Title						Course Type
PC703EE	SMART GRID TECHNOLOGIES						core
Prerequisite	**Contact hours per week**			**Duration of SEE (Hours)**	**Scheme of Evaluation**		**Credits**
	L	**T**	**P**		**CIE**	**SEE**	
	3	**-**	**-**	**3**	**40**	**60**	**3**

Course Objectives

- To study the components of smart grid and its architecture.
- To acquire the knowledge smart energy resources like microgrids, electric vehicles.
- To understand smart substation equipment and standards thereof.
- To understand smart transmission system and its protection.
- To understand smart distribution system and its control.

Course Outcomes: After completion of this course, the students shall be able to:

1. Understand features of Smart Grid in the context of Indian Grid.
2. Understand various types of energy resources suitable for smart grid.
3. Learn about the new equipment used in substations in a smart grid.
4. Differentiate the working of EMS in traditional and smart grid set up.
5. Understand how voltage control and fault detection are implemented in a smart grid.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	1	1	2	2		2	2	2	3	3	3
CO2	2	2	3	2	3	2	2		2	3	1	3	3	3
CO3	2	2	3	3	3	2	2		2	3	1	3	3	3
CO4	3	3	3	3	3	2	2		2	3	1	3	3	3
CO5	3	3	3	3	3	2	2		2	3	1	3	3	3

UNIT-I

Introduction to Smart Grid: Working definitions of Smart Grid and Associated Concepts, Smart Grid Functions, Comparison of P0wer Grid and Smart Grid-New Technologies for Smart Grid, Advantages, Present development and international policies in Smart Grid, Indian Smart Grid. Key Challenges for Smart Grid, Architecture of Smart Grid-Description, Components and their functions.

UNIT-II

Smart Energy Resources: Renewable Energy Needs in a Smart Grid, Energy Storage Systems Applications - Technologies, Electric Vehicles-Vehicle to Grid, Microgrid – Benefits and challenges, Energy Resources Integration Challenges, Solutions, and Benefits.

UNIT-III

Smart Substations: Protection, Monitoring, and Control Devices (IEDs), Sensors, SCADA, Substation Technology Advances, Platform for Smart Feeder Applications, Interoperability and IEC 61850.

UNIT-IV

Smart Transmission Systems: Energy Management Systems- History and current technology, FACTS and HVDC, Wide Area Monitoring, Phasor Measurement Unit (PMU), Phasor Estimation Techniques, Protection and Control, Role of Transmission Systems in Smart Grid.

UNIT-V

Smart Distribution Systems: Distribution Management Systems – SCADA, Current and Advanced DMS, Volt/VAr Control - Equipment inside the Substation and Distribution Feeders, Fault Detection, Isolation, and Service Restoration (FDIR).

Suggested Reading:

1. Stuart Borlase, Smart Grids, Infrastructure, Technology and Solutions, CRC Press,2013.
2. A Keyhani, M Marwali, Smart Power grids, Springer, 2011.
3. A.G. Phadke and J.S. Thorp, Synchronized Phasor Measurements and their Application, Springer Edition,2010.
4. Nikos Hatziargyriou, Microgrids Architecture and control, Wiley-IEEE Press.
5. Fang Lin Luo, Hong Ye, Renewable Energy Systems, CRC Press.
6. Smart Grid Handbook for Regulators and Policy Makers (https://www.indiasmartgrid.org/smart-grid-handbook)

Course Code	Course Title						Course Type
PC704EE	POWER ELECTRONIC CONVERTERS FOR RENEWABLE ENERGY						core
Prerequisite	Contact hours per week			Duration of SEE (Hours)	Scheme of Evaluation		Credits
	L	T	P		CIE	SEE	
	3	-	-	3	40	60	3

COURSE OBJECTIVES:

1. To understand the fundamentals of a solar cell
2. To analyze different techniques for maximum power extraction from the PV system
3. To gain knowledge of different Standalone PV Systems & Grid connected PV Systems
4. To provide a broad overview of the technology covering aspects of wind energy conversion systems.
5. To develop a clear understanding of the Power Quality and Stability challenges in WECS and its mitigation techniques.

COURSE OUTCOMES:

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

CO 1: Understand the principle of direct solar energy conversion to electric power using PV technology.
CO 2: Understand the working principle of Standalone PV Systems & Grid connected PV Systems with and without storage systems.
CO 3: Understand the fundamentals of wind turbine design, characteristics and operation.
CO 4: Analyze the implementation of wind generators and role of power electronic converters.
CO 5: Analyze the Power Quality and Stability challenges in WECS

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	1	2	-	-	2	-	-	-	-	-	3	3
CO2	2	3	1	1	2	-	2	-	-	-	-	1	3	3
CO3	2	3	3	1	1	-	2	-	-	-	-	1	3	3
CO4	2	3	2	2	1	-	2	-	-	-	-	1	3	3
CO5	2	3	2	2	1	-	2	-	-	-	-	1	3	3

UNIT I Introduction to solar photo voltaic system

Photovoltaic effect, Solar PV cell , I-V & P-V characteristics, effect of insolation, temperature, fill factor, modeling of solar cell, series and parallel connection of cells, I-V & P-V curve of interconnected cells, PV modules, PV arrays, mismatch in cell/module: mismatch in series and parallel connection, blocking diode and bypass diodes, effect of partial shading on PV string with series and parallel connected modules.

UNIT II Power Electronics in Solar MPPT & Standalone PV Systems

Operating points of a solar PV module under various daylight conditions connected to a resistive load, DC-DC converters for control for maximum power point tracking**,** Algorithms for maximum power point tracking, Battery Charging and discharging methods**,** MPPT (maximum power point tracking) charge controllers. Standalone PV systems-Standalone system with battery and AC/DC load, 3-Port Converters.

UNIT III Power Electronics in Grid connected PV Systems

Grid connected Inverters: 1-phase, 3-ph inverters with & without transformer, basic full-bridge, H5, Heric, H6, multilevel neutral point clamp, PLL and synchronization, Grid connection issues: leakage current, Islanding, harmonics, active/reactive power feeding.

UNIT IV Power Electronics in Wind Turbines

Principles of Aerodynamics of wind turbine blades, Power Content, Betz's Limit, Wind data analysis, Standalone operation of fixed and variable speed wind energy conversion systems, Power electronic converters for PMSM and DFIG wind generators, Control techniques, MPPT, Grid connected and Islanding mode.

UNIT V Power Quality and Stability of Wind Energy

Power electronics-based controllers used with WECS, power quality, impact of constant and variable speed wind turbines on transient stability of power system, wind system economic components, economic analysis methods, cost of on-shore and off-shore wind turbines.

Suggested Reading:

[1] Remus Teodorescu, Marco Liserre, Pedro Rodriguez, Grid Converters for Photovoltaic and Wind Power Systems, John Wiley and Sons, Ltd., 2011.

[2] Chetan Singh Solanki, Solar Photovoltaics: Fundamentals, Technologies and Applications' PHI Learning Publications, 2nd Edition, 2011.

Course Code	Course Title						Course Type
PE 701EE	ENERGY MANAGEMENT SYSTEMS						Professional elective
Prerequisite	Contact hours per week			Duration of SEE (Hours)	Scheme of Evaluation		Credits
	L	T	P		CIE	SEE	
	3	-	-	3	40	60	3

Course Objectives

- To understand the functions of energy management systems.
- To understand the intricacies of power generation scheduling.
- To understand the components, requirements and applications of SCADA.
- To acquire knowledge about functioning of SCADA.
- To study about communication requirements of SCADA.

Course Outcomes: After completion of this course, the students shall be able to:

1. Outline energy management systems and unit commitment and its solution techniques.
2. Discuss power generation scheduling with limited energy.
3. Describe the architecture, functions and applications of supervisory control and data acquisition (SCADA).
4. Apply SCADA in power system automation and communications.
5. Understand SCADA communication requirements and protocols.

Course Articulation Matrix

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	-	2	-	2	2	1
CO2	3	3	2	1	-	-	-	-	-	-	-	2	2	2
CO3	3	2	-	-	2	-	-	-	-	-	-	2	3	2
CO4	3	2	2	2	3	-	-	-	1	2	2	2	3	3
CO5	2	2	-	-	2	-	-	-	-	3	-	2	2	2

UNIT-I

Introduction to Energy Management Systems: Energy management centers: Energy management centers and their functions, architectures, recent developments, characteristics of power generating units and economic dispatch, unit commitment (spinning reserve, thermal, hydro and fuel constraints), solution techniques of unit commitment.

UNIT-II

Power Generation Scheduling: Generation scheduling: Generation scheduling with limited energy, energy production cost models, budgeting and planning, practical considerations, interchange evaluation for regional operations, types of interchanges, exchange costing techniques.

UNIT-III

Introduction to SCADA: Supervisory control and data acquisition - Introduction to supervisory control and data acquisition, SCADA functional requirements and components. SCADA Application: General features, functions and applications, benefits of SCADA, architectures of SCADA, applications of SCADA.

UNIT-IV

Configurations of SCADA: SCADA and power systems: Configurations of SCADA, RTU (remote terminal units) connections, power systems SCADA and SCADA in power system automation.

UNIT-V

SCADA Communication: SCADA communication requirements, SCADA communication protocols: past present and future, structure of a SCADA communications protocol.

Suggested Reading:

1. Handschin E, Energy Management Systems‖, Springer Verlag, 1st Edition, 1990.
2. Handschin E, Real Time Control of Electric Power Systems, Elsevier, 1st Edition, 1972.
3. John D Mc Donald, Electric Power Substation Engineering, CRC press, 1stEdition, 2001.
4. Wood, A J and Wollenberg, B F, Power Generation Operation and Control, John Wiley and Sons, 2ndEdition 2003.
5. Green, J N Wilson, R, Control and Automation of Electric Power Distribution Systems, Taylor and Francis, 1stEdition, 2007.
6. Turner, W C, Energy Management Handbook, Fairmont Pres, 5thEdition, 2004.

Course Code	Course Title						Course Type
PE 702EE	SENSORS AND TRANSDUCERS						Professional elective
Prerequisite	Contact hours per week			Duration of SEE (Hours)	Scheme of Evaluation		Credits
	L	T	P		CIE	SEE	
	3	-	-	3	40	60	3

Course Objectives

• To acquire the knowledge of Resistive sensors.
• To acquire the knowledge of Inductive sensors
• To acquire the knowledge of capacitive sensors.
• To acquire the knowledge of Thermal sensors.
• To acquire the knowledge of Magnetic and Radiation sensors.

Course Outcomes: After completion of this course, the students shall be able to:

1. Understand the Classification of Sensors and working of Resistive sensors.
2. Understand the working of Inductive sensors and LVDT sensors
3. Understand the working of capacitive sensors.
4. Understand the working of Thermal sensors.
5. Understand the working of Magnetic and Radiation sensors.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	1	1				1		2	3	2
CO2	3	2	2	2	1	1				1		2	3	2
CO3	3	2	2	2	1	1				1		2	3	2
CO4	3	3	2	2	1	1				1		2	3	2
CO5	3	3	2	2	1	1				1		2	3	2

UNIT-I

Definition, principle of sensing & transduction, classification.

Mechanical and Electromechanical sensor: Resistive (potentiometric type): Forms, material, resolution, accuracy, sensitivity. Strain gauge: Theory, type, materials, design consideration, sensitivity, gauge factor, variation with temperature, adhesive, rosettes.

UNIT-II

Inductive sensor: common types- Reluctance change type, Mutual inductance change type, transformer action type, Magnetostrictive type, brief discussion with respect to material, construction and input output variable, Ferromagnetic plunger type, short analysis.
LVDT: Construction, material, output input relationship, I/O curve, discussion.

UNIT-III

Capacitive sensors: variable distance-parallel plate type, variable area- parallel plate, serrated plate/teeth type and cylindrical type, variable dielectric constant type, calculation of sensitivity. Stretched diaphragm type: microphone, response characteristics. Piezoelectric element: piezoelectric effect, charge and voltage co-efficient, crystal model, materials, natural & synthetic type, their comparison, force & stress sensing, ultrasonic sensors.

UNIT-IV

Thermal sensors: Material expansion type: solid, liquid, gas & vapor. Resistance change type: RTD materials, tip sensitive & stem sensitive type, Thermister material, shape, ranges and accuracy specification. Thermoemf sensor: types, thermoelectric power, general consideration, Junction semiconductor type IC and PTAT type.Radiation sensors: types, characteristics and comparison. Pyroelectric type.

UNIT-V

Magnetic sensors: Sensor based on Villari effect for assessment of force, torque, proximity, Wiedemann effect for yoke coil sensors, Thomson effect, Hall effect, and Hall drive, performance characteristics.
Radiation sensors: LDR, Photovoltaic cells, photodiodes, photo emissive celltypes, materials, construction, response. Geiger counters, Scintillation detectors. Introduction to smart sensors.

Suggested Reading:

1. D. Patranabis, Sensor & transducers, PHI,2nd edition.
2. H.K.P. Neubert, Instrument transducers, Oxford University press.
3. E.A.Doebelin, Measurement systems: application & design, Mc Graw Hill.
4. DVS Murthy, Transducers and Instrumentation, PHI 2nd Edition.

Course Code	Course Title						Course Type
PE 703EE	SWITCHED MODE POWER SUPPLIES						Professional elective
Prerequisite	Contact hours per week			Duration of SEE (Hours)	Scheme of Evaluation		Credits
	L	T	P		CIE	SEE	
	3	-	-	3	40	60	3

Course objectives

• .To understand the concepts of DC-DC converters and switched mode converter topologies.
• To study the concepts of voltage control, current-mode control and frequency control
• To study the Soft Switching : ZVS/ZCS schemes and resonant converters.
• To study the concepts of Switch –Mode Inverters(single-phase half bridge &full bridge)
• To study the various types of multilevel Inverters & their PWM Techniques

Course outcomes: After completion of this course, the students shall be able to:

1. Analyze the concepts of DC-DC converters and switched mode converter topologies.
2. Analyze the voltage control, current-mode control and frequency control methods of Switch –Mode converters .
3. Understand the concepts of Soft Switching ZVS/ZCS schemes and resonant converters.
4. Understand the concepts of Switch –Mode Inverters.
5. Analyze the various various types of multilevel Inverter topologies along with SVM and other PW/M techniques.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	3	-	-	-	-	-	2	-	3
CO2	3	2	3	1	-	3	-	-	-	-	-	2	-	2
CO3	3	1	2	1	-	2	1	-	-	-	-	2	-	2
CO4	3	-	2	1	-	1	1	-	-	-	-	1	-	3
CO5	3	1	3	1	-	1	1	-	--	-	2	1	-	3

UNIT –I

DC-DC Switch-mode converters: Control of DC/DC Converters, Step down(Buck) Converter, Step up(Boost) Converter, Buck-Boost Converter, Cuk DC/DC Converter, DC/DC Converter Comparison, Isolated DC/DC converter topologies: Full Bridge DC/DC Converter, Fly black Converters, Forward Converters, Push-Pull Converter, Half Bridge Topologies.

UNIT –II

Control of Switch mode DC power supplies, Linearization of the power stage including the output filter using state space averaging, Transfer function of the direct duty ratio pulse width Modulation, Compensation of the feedback system using a direct duty ratio pulse width modulation, Voltage feed forward PWM control, Current Mode Control.

UNIT –III

Switch-Mode Inductive Current Switching Zero-Voltage & Zero-Current Switching, Classification of Resonant Converters, Basic Resonant Circuit concepts, Series resonant converter, Series resonant circuit with capacitor-Parallel load, Frequency characteristic of Series resonant circuits, Parallel Resonant Circuits, Frequency characteristic of Parallel resonant circuits, Series load Resonant DC-DC Converters & parallel load Resonant DC-DC Converters, Continuous Conduction mode, Steady state operating characteristics.

UNIT –IV

Basic Concepts of Switch –Mode dc-ac Inverters, Pulse Width Modulation Scheme, Square Wave Switching Scheme, Half Bridge Inverter(Single-Phase), Full Bridge Inverter(Single-Phase),PWM with Bipolar Switching, PWM with Unipolar Switching.

UNIT –V

Three-Phase Inverters, PWM in Three-Phase Square Wave Inverter, Sinusoidal PWM Method and SVM Technique.

Suggested Reading:

1. Mohan. Udeland. Robbins, Power Electronics Converters Applications, Wiley India Pvt. Ltd.
2. Bimal. K. Bose, Modern Power Electronics and AC Drives, Pearson Education Asia, 2002.
3. Daniel W.Hart , Introduction To Power Electronics ,Printice-Hall International, INC
4. M.D. Singh and K.B. Khanchandani, Power Electronics, Tata McGraw Hill Publishing Company Ltd., 2000.
5. Bin Wu, Mehdi Narimani, High Power Converters and AC Drives, IEEE Press, Wiley Publishers

With effect from Academic Year 2025-26

Course Code	Course Title						Course Type
OE701BM	BASIC MEDICAL EQUIPMENT						Elective
Prerequisite	Contact hours per week			Duration of SEE (Hours)	Scheme of Evaluation		Credits
	L	T	P		CIE	SEE	
	3	-	-	3	40	60	3

Course Objectives:	
The course is taught with the objectives of enabling the student to:	
1	To make the students understand the need for several Biomedical equipment.
2	To make the students understand the operating principles of a wide range of Biomedical Equipment
3	To familiarize students with the design and functional aspects of medical imaging systems and therapeutic devices.
4	To develop the ability to assess the appropriate biomedical equipment needed for specific clinical and therapeutic applications.
5	To enable students to understand the operating principles and clinical use of therapeutic devices like pacemakers, dialysis machines, and lithotripters.

Course Outcomes:	
On completion of this course, the student will be able to :	
CO-1	arn about various physiological parameters, monitoring and recording.
CO-2	Assess the need and operating principle of equipment used in physiotherapy
CO-3	Interpret the working principle and operating procedure and applications of Medical Imaging equipment.
CO-4	rceive the governing principles and functions of critical care equipments.
CO-5	arn about the various Therapeutic Equipment used for different applications

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	3	3	-	1	1	1	-	2
CO2	3	2	2	2	2	2	-	1	1	1	-	2
CO3	3	3	3	3	3	2	1	1	2	2	1	3
CO4	3	3	3	2	3	3	1	2	2	2	2	3
CO5	3	2	3	2	3	3	1	2	2	2	2	3

Correlation rating: Low / Medium / High: 1 / 2 / 3 respectively.

UNIT–I
Medical Monitoring and recording: Patient monitoring: System concepts, bedside monitoring systems, central monitors, heart rate and pulse rate measurement. Temperature measurement Blood pressure measurement: Direct and indirect methods. Respiration rate measurement: Impedance pneumograph, Apnoea detectors. Ambulatory monitoring: Arrhythmia monitor

UNIT–II
Physiotherapy and Electrotherapy Equipment: Diathermy machines: Short wave diathermy, Microwave diathermy and ultrasonic diathermy Electro diagnostic/Therapeutic apparatus: Nerve muscle stimulator, Functional electrical stimulator.

UNIT–III
Medical Imaging Equipment: X-Ray machines: Properties and production of X-Rays, X-ray machine, Image Intensifier. X-ray computed tomography: basic principle and construction of the components. Ultrasonic Imaging: Physics of ultrasonic waves, medical ultrasound, and basic pulse echo apparatus. Magnetic Resonance Imaging: Principle, Image reconstruction techniques, Basic NMR components, Biological effects, Merits.

UNIT-IV
Critical Care Equipment: Ventilators: Mechanics of respiration, artificial ventilators, Positive pressure ventilator, Types and classification of ventilators. Drug delivery system: Infusion pumps, basic components, implantable infusion system, closed-loop control in infusion pump. Cardiac Defibrillators: Need for defibrillators, DC defibrillator, Implantable defibrillators, Defibrillator analyzer.

UNIT – V
Therapeutic Equipment: Cardiac pacemakers: Need for cardiac pacemakers, External and implantable pacemakers, types. Dialysis Machine: Function of the kidney, artificial kidney, Dialyzers, Membranes, Hemodialysis machine. Lithotripters: The stone disease problem, Modern Lithotripter systems, extra corporeal shockwave therapy.

SUGGESTED READING:

1	R.S. Khandpur, Hand book of Biomedical Instrumentation, Tata McGraw-Hill, Second Edition, 2014.
2	John G.Webster, Medical Instrumentation Application and design, Wiley India Edition, 2009.
3	**Leslie Cromwell,***Biomedical Instrumentation and Measurements, 2nd Edition, Prentice Hall of India,*

With effect from Academic Year 2025-26

Course Code	Course Title						Course Type
OE702BM	ARTIFICIAL INTELLIGENCE IN HEALTH CARE						Elective
Prerequisite	Contact hours per week			Duration of SEE (Hours)	Scheme of Evaluation		Credits
	L	T	P		CIE	SEE	
	3	-	-	3	40	60	3

Course Objectives:	
The course is taught with the objectives of enabling the student to:	
1	To introduce students to the fundamentals of Artificial Intelligence (AI) with a focus on healthcare applications.
2	To explore AI techniques in clinical diagnostics and decision-making.
3	To understand the role of AI in medical imaging, disease prediction, patient monitoring, and personalized medicine.
4	To examine ethical, legal, and regulatory considerations in the deployment of AI in healthcare.
5	To enable students to design and evaluate AI-based healthcare solutions for improving patient outcomes and operational efficiency

Course Outcomes:	
On completion of this course, the student will be able to :	
CO-1	Understand and explain the fundamental AI concepts and techniques relevant to healthcare.
CO-2	Apply machine learning and deep learning methods to analyze medical data and assist in clinical decision-making.
CO-3	Analyze AI-based diagnostic tools used in medical imaging and disease prediction.
CO-4	Evaluate the implementation challenges and ethical implications of AI in healthcare systems.
CO-5	Design AI-driven healthcare applications and propose data-driven solutions to real-world health problems.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	2	2	1	2	1	1	-	2
CO2	3	3	3	3	3	2	-	1	2	2	-	2
CO3	3	3	3	2	3	2	-	1	2	2	2	2
CO4	2	2	1	2	2	3	2	3	2	2	2	2
CO5	3	3	3	2	3	3	2	2	3	3	1	3

Correlation rating: Low / Medium / High: 1 / 2 / 3 respectively.

UNIT–I
Introduction to Artificial Intelligence: Definition. AI Applications, AI representation. Properties of internal Representation, General problem solving, production system, control strategies: forward and backward chaining. Uninformed and informed search techniques. A* and AO* Algorithm

UNIT–II
Machine Learning and Deep Learning for Healthcare: Supervised, unsupervised, and reinforcement learning. Classification and regression techniques in clinical datasets. Neural networks, CNNs, RNNs and their applications. Case studies: Diabetes prediction, cancer classification, readmission prediction. Model evaluation: accuracy, precision, recall, ROC curves

UNIT–III
AI in Medical Imaging and Diagnostics: Image processing fundamentals and feature extraction. AI in radiology: X-rays, CT, MRI, Ultrasound. Computer-aided diagnosis systems. Deep learning for medical image segmentation and classification. Real-world tools: Google DeepMind, IBM Watson Health.

UNIT-IV
Natural Language Processing in Healthcare: Basics of NLP and its significance in healthcare**.** Clinical text mining and named entity recognition (NER). Chatbots and virtual health assistants. AI in Electronic Health Record (EHR) processing. Case study: Predictive analysis from clinical notes.

UNIT – V
Ethical, Legal, and Future Perspectives. Ethical concerns: bias, transparency, and ability. Data privacy and security in AI systems. Regulatory aspects: FDA, HIPAA, CDSCO. Human-AI collaboration in clinical settings. Future directions: AI in genomics, telemedicine, and wearable technologies.

SUGGESTED READING:

1	Eugene, Charniak, Drew Mcdermott: Introduction to artificial intelligence.
2	Elaine Rich and Kerin Knight, Nair B., "Artificial Intelligence (SIE)", Mc Graw Hill-2008.
3	Mathias Goyen, *Artificial Intelligence in Healthcare: Past, Present and Future*, Elsevier, 2021.
4	Eric Topol, *Deep Medicine: How Artificial Intelligence Can Make Healthcare Human Again*, Basic Books, 2019
5	Parashar Shah, *AI in Healthcare: A Practical Guide*, BPB Publications, 2021.

Course Code	Course Title						Course Type
OE701CE	GREEN BUILDING TECHNOLOGY						Elective
Prerequisite	Contact hours per week			Duration of SEE (Hours)	Scheme of Evaluation		Credits
	L	T	P		CIE	SEE	
	3	-	-	3	40	60	3

Course Objectives:	
The course is taught with the objectives of enabling the student to:	
1	Exposure to the green building technologies and their significance.
2	Understand the judicial use of energy and its management.
3	Educate about the Sun-earth relationship and its effect on climate.
4	Enhance awareness of end-use energy requirements in the society.
5	Develop suitable technologies for energy management.

Course Outcomes:	
On completion of this course, the student will be able to:	
CO-1	Understand concept of Energy in Buildings, factors on energy usage and Management.
CO-2	Environmental, Air conditioning and Auditory requirement indoors
CO-3	Climate, radiation, wind in connection with Energy
CO-4	End use energy requirements in buildings, concepts of heat gain and thermal performance
CO-5	Energy audit, energy management.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	1	3	3	3	2	1	2	1	3	1	1
CO2	3	2	3		1		3	2	2	2		3	1	2
CO3	2	1	3	1	1	2	3	2	3	1	1	2	1	1
CO4	2	2	3	1	1	3	2	2	2	2			2	2
CO5	3	3	3	2	1	3	3	2	2	2	2	1	2	2

Correlation rating: Low/ Medium/High:1/2/3 respectively

UNIT-I

Overview of the significance of energy use and energy processes in building: Indoor activities and environmental control - Internal and external factors on energy use and the attributes of the factors - Characteristics of energy use and its management - Macro aspect of energy use in dwellings and its implications.

UNIT-II

Indoor environmental requirement and management: Thermal comfort - Ventilation and air quality – Air-conditioning requirement - Visual perception - Illumination requirement – Auditory requirement.

UNIT-III

Climate, solar radiation and their influences: Sun-earth relationship and the energy balance on the earth's surface - Climate, wind, solar radiation, and temperature - Sun shading and solar radiation on surfaces - Energy impact on the shape and orientation of buildings.

UNIT-IV

End-use, energy utilization and requirements: Lighting and day lighting - End-use energy requirements - Status of energy use in buildings Estimation of energy use in a building - Heat gain and thermal performance of building envelope - Steady and non-steady heat transfer through the glazed window and the wall - Standards for thermal performance of building envelope-Evaluation of the overall thermal transfer

UNIT-V

Energy management options: Energy audit and energy targeting - Technological options for energy management.

Suggested Readings:

1. Michael Bauer, Peter Mösle and Michael Schwarz, *"Green Building–Guide book for Sustainable Architecture"*, Springer, Heidelberg, Germany, 2010.
2. Norbert Lechner, *"Heating, Cooling, Lighting-Sustainable Design Methods for Architects",* Wiley, New York, 2015.
3. Mike Montoya, *"Green Building Fundamentals* ‖, Pearson, USA, 2010.
4. Charles J.Kibert, *"Sustainable Construction-Green Building Design and Delivery*‖, John Wiley & Sons, New York, 2008.
5. Regina Leffers, *"Sustainable Construction and Design*‖, Pearson / Prentice Hall, USA 2009
6. James Kachadorian, *"The Passive Solar House: Using Solar Design to Heat and Cool Your Home",* Chelsea Green Publishing Co., USA, 1997.

Course Code	Course Title						Course Type
OE702CE	PLUMBING TECHNOLOGY						Elective
Prerequisite	Contact hours per week			Duration of SEE (Hours)	Scheme of Evaluation		Credits
	L	T	P		CIE	SEE	
	3	-	-	3	40	60	3

Course Objectives:	
The course is taught with the objectives of enabling the student to:	
1.	Understand plumbing components for various systems such as water supply, waste water, high rise buildings
2.	Study various plumbing fixtures materials, tools and equipment
3.	Study the codes and standards in the building industry for plumbing

Course Outcomes:	
On completion of this course, the student will be able to:	
CO-1	Understand and identify the various plumbing related systems, component and types,
CO-2	Ability to understand various plumbing terminology for water supply
CO-3	Ability to understand various plumbing fixtures materials, tools and equipment.
CO-4	Understand about different pumping systems available.
CO-5	Comprehend the importance of codes, the key responsibilities of a plumbing sector and plumber

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1		1	3	-	2	2	3	-	1	1	2
CO2	2	2	1		1	3	-	2	2	3	-	1	1	2
CO3	2	1		1	1		1	1	2	2	1	2	1	2
CO4	2	1		1	1		1	1	2	2	1	2	1	2
CO5	1	1		1		2	2		1	1		2		

Correlation rating: Low/ Medium/High:1/2/3 respectively.

UNIT – I

Building Plumbing - Introduction to Plumbing Systems, components of plumbing systems, and basic physics as related to plumbing. Various types of home plumbing systems for water supply and waste water disposal, high rise building plumbing, Pressure reducing valves, Break pressure tanks, Storage tanks, Building drainage for high rise buildings, various kinds of fixtures and fittings used.

UNIT – II

Plumbing Terminology: Definitions, use/purpose of Plumbing Fixtures - accessible, readily accessible, aerated fittings, AHJ, bathroom group, carrier, flood level rim, floor sink, flushometer valve, flush tanks, lavatories, macerating toilet, plumbing appliances, plumber.

Traps: indirect waste, vent, blow off, developed length, dirty arm, FOG, indirect waste, receptors, slip joints, trap, and vent.

Water supply: angle valve, anti-scald valve, backflow, bypass, check valve, cross connection, ferrule, gate valve, gray water, joints

UNIT– III

Plumbing Fixtures and Fittings: Definitions of plumbing fixtures, fittings, appliances and appurtenances; maximum flow rates, water closets, bidets, urinals, flushing devices, washbasins, bath/shower, toilets for differently abled, kitchen sinks, water coolers, drinking fountain, clothes washer, dishwasher, mop sink, overflows, strainers, prohibited fixtures, floor drains, floor slopes, location of valves, hot water temperature controls, installation standard dimensions in plan and elevation.

UNIT – IV

Pumping Systems : Terminology, pump heads, types of Pumps, applications, pump selection, pump characteristics, pumps and motors, pump efficiency, motor efficiency, Hydro Pneumatic Systems(HPS), Zoning, Storm Water and Drainage Pumps, introduction to starters and control panels.

UNIT – V

Codes and Standards: Scope, purpose; codes and standards in the building industry, UIPC-I, NBC and other codes, Local Municipal Laws, approvals, general regulations, standards, water supply, protection of pipes and structures, waterproofing.

Introduction to the Sector and the Job Role:

Overview of the Plumbing Sector- Importance and scope of plumbing in construction and maintenance, career opportunities in plumbing.

Understanding the Job Role of a Plumber – Duties and responsibilities of a plumber, Skills and attributes required for a plumber.

Safety Measures and Regulations –Importance of safety in plumbing, Basic safety regulations and practices.

Tools and Equipment – Introduction to basic plumbing tools and equipment, Proper use and handling of plumbing tools.

Reference books and codes:

- Uniform Illustrated Plumbing Code-India (UIPC- I) published by IPA and IAPMO (India)
- National Building Code (NBC) of India
- IS17650 Part1 and Part2 for Water Efficient Plumbing Products
- Water Efficient Products-India (WEP-I) published by IPA and IAPMO (India)
- Water Efficiency and Sanitation Standard (WE. Stand) published by IPA and IAPMO (India)
- Water Pollution, Berry, CBS Publishers.

- 'A Guide to Good Plumbing Practices', a book published by IPA.
- Elements of Water Pollution Control Engineering, O.P. Gupta, Khanna Book Publishing, New Delhi
- Plumbing Engineering. Theory, Design and Practice, S.M.Patil,1999
- Water supply and sewerage system– G. Birdie

Learning Website:

1. www.nptel.co.in
2. https://ndrfandcd.gov.in/Cms/NATIONA0LBUILDINGCODE.aspx

With effect from Academic Year 2025-26

Course Code	Course Title						Course Type
OE701CS	CLOUD COMPUTING						Elective
Prerequisite	Contact hours per week			Duration of SEE (Hours)	Scheme of Evaluation		Credits
	L	T	P		CIE	SEE	
	3	-	-	3	40	60	3

Course Objectives :	
1	To introduce basic concepts cloud computing and enabling technologies
2	To learn about Auto-Scaling, capacity planning and load balancing in cloud
3	To introduce security, privacy and compliance issues in clouds
4	To introduce cloud management standards and programming models

Course Outcomes :	
On completion of this course, the student will be able to :	
CO-1	Understand the basic approaches and Core ideas of Cloud Computing.
CO-2	Understand the Challenges and approaches in the management of the Cloud environments.
CO-3	Familiarize with advanced paradigms and solutions necessary for building and managing modern Cloud environments.
CO-4	Envision use of Cloud environment in Enterprise.

UNIT– I
Introduction, Benefits and challenges, Cloud computing services, Resource Virtualization, Resource pooling sharing and provisioning.

UNIT – II
Scaling in the Cloud, Capacity Planning, Load Balancing, File System and Storage,

UNIT – III
Multi-tenant Software, Data in Cloud, Database Technology, Content Delivery Network, Security Reference Model, Security Issues, Privacy and Compliance Issues

UNIT – IV
Portability and Interoperability Issues, Cloud Management and a Programming Model Case Study, Popular Cloud Services

UNIT –V
Enterprise architecture and SOA, Enterprise Software , Enterprise Custom Applications, Workflow and Business Processes, Enterprise Analytics and Search, Enterprise Cloud Computing Ecosystem.

Suggested Reading:

1	Cloud Computing - Sandeep Bhowmik, Cambridge University Press, 2017.
2	Enterprise Cloud Computing - Technology, Architecture, Applications by Gautam Shroff, Cambridge University Press, 2016.
3	Kai Hwang, Geoffrey C.Fox, Jack J.Dongarra, ―Distributed and Cloud Computing From Parallel Processing to the Internet of Things‖, Elsevier, 2012.
4.	https://aws.amazon.com/about-aws/
5.	https://cloud.google.com/why-google-cloud?hl=en
6.	https://azure.microsoft.com/en-gb/

Course Code	Course Title						Course Type
OE702CS	DATA BASE MANAGEMENT SYSTEMS						Elective
Prerequisite	Contact hours per week			Duration of SEE (Hours)	Scheme of Evaluation		Credits
	L	T	P		CIE	SEE	
	3	-	-	3	40	60	3

Course Objectives:

- To introduce three schema architecture and DBMS functional components.
- To understand the principles of ER modeling and design.
- To learn query languages of RDBMS.
- To familiarize theory of serializablity and implementation of concurrency control and recovery.
- To study different file organization and indexing techniques.

Course Outcomes:

Student will be able to:

1. Understand the mathematical foundations on which RDBMS are built.
2. Model a set of requirements using the Entity Relationship Model (ER), transform into a relational model, and refine the relational model using theory of Normalization.
3. Develop Database application using SQL and Advanced SQL.
4. Understand the working of concurrency control and recovery mechanisms in RDBMS.
5. Use the knowledge of indexing and hashing to improve database application performance.

UNIT I: Introduction to DBMS:

- **Introduction:** Database System Applications, Purpose of Database Systems, View of Data, Database Languages, Database Design, Database Engine, Database and Application Architecture, Data Base Users and Administrators.
- **Introduction to the Relational Model:** Structure of Relational Databases, Database Schema, Keys, Schema Diagram, Relational Query Languages, The Relational Algebra

UNIT II: Data Models and Database Design:

- **Entity-Relationship (ER) Model**: The Entity-Relational Model, Complex Attributes, Mapping Cardinalities, Primary key, Removing Redundant Attribute in Entity Set, Reducing E-R diagrams to Relational Schemas, Extended E-R features, Entity-Relationship Design Issues, Alternative Notations for Modelling Data.
- **Relational Model**: Features of Good Relational Designs, Decomposition Using Functional Dependencies, Normal Forms, Functional-Dependency Theory, algorithms for Decomposition using Functional Dependencies, Decomposition Using multivalued Dependencies, Atomic Domains and First Normal Form, Database-Design process, Modelling Temporal Data

UNIT III: SQL and Querying:

- **SQL Basics**: Data definition, data manipulation, and data control languages. functions in sql (single row and multirow& conversion functions), Creating Tables, keys, integrity constraints (column level and table level)
- **Advanced SQL**: Joins, subqueries, aggregate functions, and views. Synonyms
- **Stored Procedures and Triggers**: Concepts and usage.

UNIT IV: Transaction Management and Concurrency Control:

- **Transaction Concepts**: Transaction Concept, transaction states, A simple transaction Model, Implementation of Atomicity and Durability, Implementation of Isolation, Serializability (view Serializability, conflict serializability)
- **Concurrency Control**: Locking mechanisms, Lock-based protocol, Timestamp-Based Protocol, Validation Based Protocol, Multiple Granularity, deadlock handling.
- **Recovery Techniques**: Failure Classification, Storage Structure, Recovery and Atomicity, Recovery Algorithm, Buffer Management, Failure with Loss of Non-Volatile Storage, High Availability Using Remote Backup Systems, ARIES, Early Lock Release and Logical Undo Operations, Recovery in Main-memory Databases.

UNIT-V: Indexing and Hashing:

Database-System Architectures: Centralized Database Systems, Server System Architectures, Parallel Systems, Distributed Systems, Transaction Processing in Parallel and Distributed Systems, Cloud-Based Services.

Introduction to Big Data: Big Data Storage Systems, The MapReduce Paradigm, Beyond MapReduce, Algebraic Operations, Streaming Data, Graph Databases

Reference Books:

1) Database System Concepts Seventh Edition Abraham Sliberschantz, Henry f. Korth,S. Sudarshan, 7th Edition, 2024.
2) Rama krishnan, Gehrke, "*Database Management Systems"*, McGraw-Hill International Edition, 3rd Edition, 2003.
3) Elma sri, Nava the, Somayajulu, "*Fundamentals of Database Systems"*Pearson Education, 4th Edition, 2004.

Course Code	Course Title						Course Type
OE 701 EC	**EMBEDDED SYSTEMS DESIGN**						Elective
Prerequisite	**Contact hours per week**			**Duration of SEE (Hours)**	**Scheme of Evaluation**		**Credits**
	L	**T**	**P**		**CIE**	**SEE**	
Microprocessors and Microcontrollers	**3**	**-**	**-**	**3**	**40**	**60**	**3**

Course Objectives:	
1	understand the processor selection criteria for Embedded System Design.
2	provide a clear understanding of role of firmware, operating systems in correlation h hardware systems.
3	gain the knowledge of tool chain for embedded systems.
4	understand the importance of RTOS in building real time systems
5	gain knowledge on internal working procedure of RTOS

Course Outcomes:	
On completion of this course, the student will be able to :	
1	derstand the working of a simple embedded system and embedded system applications
2	sign an Embedded System firmware
3	e Embedded Software Development Tools for Designing Embedded System plications
4	derstand RTOS and its use in Embedded environment
5	derstand RTOS concepts like Task Communication and Task Synchronization.

Course Articulation Matrix:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	2	1	-	-	-	1	-	1	1	1
CO2	3	1	2	2	-	1	-	1	-	2	1	1
CO3	3	1	2	2	1	1	-	1	-	2	1	1
CO4	3	1	2	1	1	1	-	1	-	1	1	1
CO5	3	2	2	1	-	1	-	1	-	1	1	1

Correlation rating: Low / Medium / High: 1 / 2 / 3 respectively.

UNIT–I
Introduction to Embedded Systems: Embedded systems Vs General computing systems, History of Embedded systems, classification, Characteristics and quality attributes of Embedded Systems Challenges in Embedded System Design, Application and Domain specific Embedded Systems.

UNIT–II
Embedded firmware and Design and Development: Embedded Firmware Design Approaches and Development languages and Programming in Embedded C

UNIT–III
Embedded Software Development Tools: Host and Target Machines, Cross Compilers, Cross Assemblers, Tool Chains, Linkers/Locators for Embedded Software, Address Resolution, Locator Maps. Getting Embedded Software Into Target System: PROM programmer, ROM emulator, In Circuit- Emulators, Monitors, Testing on Your Host Machine - Instruction Set Simulators, Logic Analyzers.

UNIT-IV
Introduction to Real Time Operating Systems: **Tasks and task states, tasks and Data, Semaphores and shared data. Operating system services: Message queues, mailboxes and pipes, timer functions, events, memory management, Interrupt routines in an RTOS environment.**

UNIT – V
TASK COMMUNICATION: **Shared Memory, Message Passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication/Synchronization Issues, Task Synchronization Techniques, Device Drivers, How to Choose an RTOS.**

SUGGESTED READING:

1	Shibu, K.V., Introduction to Embedded Systems, 1st Ed., TMH, 2009
2	Raj Kamal, Embedded Systems – Architecture, Programming and Design, 2nd Edition, TMH, 2008
3	An Embedded Software Primer - David E. Simon, Pearson Education.
4	Jean.J.Labrosse, MicroC/OS-II, Taylor & Francis, 2002

With effect from Academic Year 2025-26

Course Code	Course Title						Course Type
OE 702 EC	BASICS OF IOT						elective
Prerequisite	Contact hours per week			Duration of SEE (Hours)	Scheme of Evaluation		Credits
	L	T	P		CIE	SEE	
	3	-	-	3	40	60	3

Course Objectives :	
The course is taught with the objectives of enabling the student to:	
1	To understand the concepts of the Internet of Things and be able to build IoT applications
2	To learn the programming and use of Arduino and Raspberry Pi boards Design And detail the deep beams.
3	To study about various IoT case studies and industrial applications.

Course Outcomes:	
On completion of this course, the student will be able to:	
CO-1	Known basic protocols in sensor networks.
CO-2	To Know the Architecture and Protocols of IoT.
CO-3	Python programming and interfacing for Raspberry Pi.
CO-4	Interfacing sensors and actuators with different IoT architectures.
CO-5	Compare IOT Applications in Industrial &real world

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	2	1
CO2	3	2	2	-	2	-	2	-	-	-	1	1	1	2
CO3	2	3	3	2	3	-	-	-	-	-	-	-	-	3
CO4	3	3	2	2	2	-	-	-	-	-	-	-	1	3
CO5	-	-	2	-	-	-	-	-	-	-	-	-	-	3

UNIT–I

Introduction to the Internet of Things, Characteristics of IoT, Physical design of IoT, Functional blocks of IoT, Sensing, Actuation, Basics of Networking, Communication Protocols.

UNIT–II

IoT Architecture: Physical and Logical design of IoT, IoT frameworks, IoT Protocols – MQTT, COAP, 6LOWPAN

UNIT–III

Introduction to Python programming, Introduction to Raspberry Pi, Interfacing Raspberry Pi with basic peripherals, Implementation of IoT with Raspberry Pi..

UNIT–IV
IoT applications in home, Infrastructures, Buildings, Security, Industries, Home appliances, other IoT electronic equipment's.

UNIT–V
Prototyping and Programming for IoT: Sensors, Actuators, Micro Controllers, SoC, Choosing a platform, prototyping hardware platforms- Arduino, Raspberry Pi, Prototype in Physical design- Laser Cutting, 3D-Printing, CNC milling, techniques for writing Embedded code

Suggested Reading:

1	Raj Kamal, "Internet of Things – Architecture and Design Principles", McGraw Hill Education Pvt. Ltd., 2017
2	"Makesensors":Terokarvinen,kemo,karvinenandvilleyvaltokari,1stedition, maker media, 2014.
3	IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, Cisco Press, 2017
4	Internet of Things – A hands-on approach, ArshdeepBahga, Vijay Madisetti, Universities Press, 2015
5	Rao, M. (2018). Internet of Things with Raspbery Pi 3: Leverage the power of Raspberry Pi 3 and JavaScript to build exciting IoT projects. Packt Publishing Ltd
6	Internet of Things and Data Analytics, HwaiyuGeng, P.E, Wiley Publications, 2017

Course Code	Course Title						Course Type
OE701EE	**OPTIMIZATION TECHNIQUES**						Elective
Prerequisite	**Contact hours per week**			**Duration of SEE (Hours)**	**Scheme of Evaluation**		**Credits**
	L	**T**	**P**		**CIE**	**SEE**	
	3	**-**	**-**	**3**	**40**	**60**	**3**

Course Objectives:	
The course is taught with the objectives of enabling the student to:	
1	To understand the need and basic concepts of operations research and classify the optimization problems.
2	To study about the linear programming and non-linear programming concepts and their applications.
3	To understand various constrained and un-constrained optimization techniques and their applications.
4	To understand the concepts and implementation of Genetic Algorithms to get the optimum solutions.
5	To study the concepts of Metaheuristics Optimization techniques.

Course Outcomes:	
On completion of this course, the student will be able to:	
CO-1	Analyze any problem of optimization in an engineering system and able to formulate a mathematical model to the problem and solving it by the techniques that are presented.
CO-2	Solve problems of L.P. by graphical and Simplex methods.
CO-3	Apply various constrained and un-constrained optimization techniques for the specific problems.
CO-4	Implement the Genetic Algorithms to solve the for optimum solution.
CO-5	Understand the concepts to use the Metaheuristics Optimization techniques.

Articulation matrix of Course Outcomes with POs:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	3	2	2	2	1	-	-	-	-	1	2	3	2
CO 2	3	3	2	2	2	-	-	-	-	-	-	1	2	2
CO 3	3	3	3	2	2	-	-	-	-	-	-	1	3	3
CO 4	3	3	3	3	3	-	-	-	2	1	1	2	3	3
CO 5	3	2	2	2	3	-	-	-	-	-	1	2	3	3

UNIT–I
Introduction: Definitions, Characteristics, Objective function, Classification of optimization problems, Engineering applications and limitations. Single-Variable Optimization, Multivariable Optimization with No Constraints, Multivariable Optimization with Equality Constraints and Multivariable Optimization with Inequality Constraints: Kuhn–Tucker Condition.

UNIT–II
Linear Programming: Definitions and Formulation of the LPP, Construction of L.P. Models, Slack and surplus variables, Standard form, Canonical form and matrix form of LP Problems. Artificial Variables, solution by the Big-M method, Duality principle, Dual problems and numerical problems.

UNIT–III
Random Search Methods Concepts: Direct Search Methods - Univariate Method, Gradient of a Function, Indirect Search Methods - Gradient of a Function, Steepest Descent (Cauchy) Method, Newton's Method.

UNIT-IV
Binary Genetic Algorithm: Genetic Algorithms Natural Selection on a Computer, Components of a Binary Genetic Algorithm. Selecting the Variables and the Cost Function. Variable Encoding and Decoding, The Population, Natural Selection, Selection, Mating. Mutations, the Next Generation and Convergence, Components of a Continuous Genetic Algorithm.

UNIT – V
Metaheuristics Optimization: Concepts of Simulated Annealing, Theoretical approaches, Advantages and disadvantages, applications, Ant Colony Algorithms - Introduction, Collective behavior of social insects, Formalization and properties of ant colony optimization.

Suggested Reading:

1	Rao, S.S. (2009). "Engineering Optimization: Theory and Practice." John Wiley & Sons, Inc.
2	Taha, H.A. (2008). "Operations Research, Pearson Education India." New Delhi, India.
3	Randy L. Haupt and Sue Ellen Haupt, "Practical genetic algorithms" second edition, a John Wiley & sons, inc., publication -2004.
4	Sharma J.K. (2013). "Operation Research: Theory and Applications." Fifth Edition, Macmillan Publishers, New Delhi, India.
5	J. Dreo A. Petrowski, P. Siarry E. Taillard. "Metaheuristics for Hard Optimization" Springer.

With effect from Academic Year 2025-26

Course Code	Course Title						Course Type
OE702EE	NON-CONVENTIONAL ENERGY SOURCES						Elective
Prerequisite	Contact hours per week			Duration of SEE (Hours)	Scheme of Evaluation		Credits
	L	T	P		CIE	SEE	
	3	-	-	3	40	60	3

Course Objectives:	
The course is taught with the objectives of enabling the student to:	
1	To understand the different types of energy sources.
2	To understand the need of non-conventional energy sources and their principles.
3	To understand the limitations of non-conventional energy sources.
4	To outline division aspects and utilization of renewable energy sources for diriment application.
5	To analyze the environmental aspects of renewable energy resources.

Course Outcomes:	
On completion of this course, the student will be able to :	
CO-1	Know the different energy resources and need of renewable energy resources.
CO-2	Understand the concepts of working of fuel cell systems along with their applications.
CO-3	Describe the use of solar energy and the various components and measuring devices used in the energy production and their applications.
CO-4	Appreciate the need of Wind Energy and their classification and various components used in energy generation and working of different electrical wind energy system.
CO-5	Understand the concept of OTEC technology, Biomass energy resources and different types of biogas Plants used in India.

Course Articulation Matrix:

CO	PO 1	PO 2	PO 3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	2	-	2	-	-	-	-	1	3	2
CO2	3	3	-	-	2	-	2	-	-	-	-	1	2	2
CO3	3	3	-	2	3	-	2	-	-	-	-	2	3	3
CO4	3	2	-	2	2	-	3	-	-	-	-	2	3	3
CO5	2	2	-	-	2	-	3	-	-	-	-	2	2	3

Correlation rating: Low / Medium / High: 1 / 2 / 3 respectively.

UNIT–I
Review of Conventional and Non-Conventional energy sources, Need for non-conventional energy sources Types of Non-conventional energy sources, Fuel Cells, Principle of operation with special reference to H2O2 Cell, Classification and Block diagram of fuel cell systems, Ion exchange membrane cell, Molten carbonate cells, Solid oxide electrolyte cells, Regenerative system, Regenerative Fuel Cell, Advantages and disadvantages of Fuel Cells, Polarization, Conversion efficiency and Applications of Fuel Cells.

UNIT–II
Solar energy, Solar radiation and its measurements, Solar Energy collectors, Solar Energy storage systems, Solar Pond, Application of Solar Pond, Applications of solar energy.

UNIT–III
Wind energy, Principles of wind energy conversion systems, Nature of wind, Power in the Wind, Basic components of WECS, Classification of WECS, Site selection considerations, Advantages and disadvantages of WECS, Wind energy collectors, Wind electric generating and control systems, Applications of Wind energy, Environmental aspects.

UNIT–IV
Energy from the Oceans, Ocean Thermal Electric Conversion (OTEC) methods, Principles of tidal power generation, Advantages and limitations of tidal power generation, Ocean waves, Wave energy conversion devices, Advantages and disadvantages of wave energy, Geo- thermal Energy, Types of Geo-thermal Energy Systems, Applications of Geo-thermal Energy.

UNIT–V
Energy from Biomass, Biomass conversion technologies / processes, Photosynthesis, Photosynthetic efficiency, Biogas generation, Selection of site for Biogas plant, Classification of Biogas plants, Details of commonly used Biogas plants in India, Advantages and disadvantages of Biogas generation, Thermal gasification of biomass, Biomass gasifies.

Suggested Reading:

1	Rai G.D, Non-Conventional Sources of Energy, Khandala Publishers, New Delhi, 1999.
2	M.M.El-Wakil, Power Plant Technology. McGraw Hill, 1984.

Course Code	Course Title						Course Type
OE701ME	NANO TECHNOLOGY						Elective
Prerequisite	Contact hours per week			Duration of SEE (Hours)	Scheme of Evaluation		Credits
	L	T	P		CIE	SEE	
	3	-	-	3	40	60	3

Course Objectives:

- To familiarize Nano materials and technology.
- To understand Nano structures, fabrication and special Nano materials.

Course Outcomes:

UNIT-I

Introduction: Nanoscale, Properties at Nanoscale, advantages and disadvantages, importance of Nano Technology, Bottom-up and Top-down approaches, challenges in Nano Technology.

UNIT-II

Materials of Nano Technology: Introduction-Si-based materials, Ge-based materials, Smart materials, metals, Ferroelectric materials, Polymer materials, GaAs & InP (III-V) group materials, Nano tribology and Materials, Principles and analytical techniques of XRD, SEM, TEM and STM/AFM.

UNIT-III

Nano Structures: Zero dimensional Nano structure (Nano Particles)- Synthesis procedure, characterization techniques, properties and applications of Nano Particles One dimensional Nano structures (Nano Wires, Nano Tubes)- Various Synthesis procedure, characterization procedure and principles involved, properties and applications of Nano Wires, Types of Nano Tubes, Synthesis procedure, characterization properties and applications of Nano Tubes.

UNIT-IV

Nano Fabrication: Introduction, Basic fabrication techniques (Lithography, thin film deposition, and doping) MEMS fabrication techniques, Nano fabrication techniques (E-beam Nano-imprint fabrication, Epitaxy and strain engineering, Scanned probe techniques).

UNIT-V

Special Nano Materials: Nano Composites: Introduction, Synthesis procedures, various systems (metal-polymer, metal- ceramics and polymer-Ceramics), Characterization procedures, applications. Nano Biomaterials: Introduction, Biocompatibility, anti-bacterial activity, principles involved, applications.

Suggested Reading:

1. A.K.Bandyopadyay, Nano Materials, New Age Publications, 2007.
2. T. Pradeep, Nano: The Essentials: Understanding Nanoscience and Nanotechnolgy, Tata McGraw-Hill, 2008.
3. Carl. C. Koch, Nano Materials Synthesis, Properties and Applications, Jaico Publishing House,2008.
4. Willia Illsey Atkinson, NanoTechnology, Jaico Publishing House, 2009.

Course Code	Course Title						Course Type
OE702ME	START UP ENTREPRENEURSHIP						Elective
Prerequisite	Contact hours per week			Duration of SEE (Hours)	Scheme of Evaluation		Credits
	L	T	P		CIE	SEE	
	3	-	-	3	40	60	3

Course Objectives:

- To motivate students to take up entrepreneurship in future
- To learn nuances of starting an enterprise & project management
- To understand the behavioural aspects of entrepreneurs and time management

Course Outcomes: Student will

1. Understand the behavioural aspects of entrepreneurs and time management
2. Creative thinking and transform ideas into reality
3. Importance of innovation in new business opportunities
4. Create a complete business plan and workout the budget plan.
5. write a project proposal with budget statement

UNIT I

Creativity & Discovery: Definition of Creativity, self test creativity, discovery and delivery skills, The imagination threshold, Building creativity ladder, Collection of wild ideas, Bench marking the ideas, Innovative to borrow or adopt, choosing the best of many ideas, management of tradeoff between discovery
and delivery, Sharpening observation skills, reinventing self, Inspire and aspire through success stories

UNIT II

From Idea to Startup : Introduction to think ahead backward, Validation of ideas using cost and strategy, visualizing the business through value profile, activity mapping, Risks as opportunities, building your own road map

UNIT III

Innovation career lessons : Growing & Sharing Knowledge, The Role of Failure In Achieving Success, Creating vision, Strategy, Action & Resistance: Differentiated Market Transforming Strategy; Dare to Take Action; Fighting Resistance; All About the startup Ecosystem; Building a Team; Keeping it Simple and Working
Hard.

UNIT IV

Action driven business plan: Creating a completed non-business plan (a series of actions each of which moves your idea toward implementation), including a list of the activities to be undertaken, with degrees of importance (scale of 1 to 3, where 1 is ‘most important’). A revision of the original product or service idea, in light of information gathered in the process, beginning to design the business or organization that will successfully implement your creative idea. Preparing an activity map.

UNIT V

Startup financing cycle: Preparing an initial cash flow statement, showing money flowing out (operations; capital) and flowing in. Estimate your capital needs realistically. Prepare a bootstrapping option (self financing). Prepare a risk map. Prepare a business plan comprising five sections: The Need; The Product; Unique Features; The Market; Future Developments. Include a Gantt chart (project plan –

detailed activities and starting and ending dates); and a project budget.

Suggested Readings:

1. Vasant Desai, "Dynamics of Entrepreneurial Development and Management", Himalaya Publishing House, 1997.
2. Prasanna Chandra, "Project – Planning , Analysis, Selection, Implementation and Review", TataMcGraw-Hill Publishing Company Ltd., 1995.
3. B. Badhai, "Entrepreneurship for Engineers", Dhanpath Rai & Co., Delhi, 2001.
4. Stephen R. Covey and A. Roger Merrill, "First Things First", Simon and Schuster, 2002.
5. Robert D. Hisrich and Michael P.Peters, " Entrepreneurship", Tata McGRaw Hill Edition, 2002.

Course Code	Course Title					Course Type
PC751EE	POWER SYSTEMS LAB					core
Prerequisite	Contact hours per week			Duration of SEE (Hours)	Scheme of Evaluation		Credits
	L	T	P		CIE	SEE	
	-	-	2	3	25	50	1

List of Experiments

1. Performance characteristics of 3-phase transmission line model
2. Determination of A B C D parameters of 3-phase transmission line model.
3. IDMT Characteristics of an over current (Electromagnetic)Relay.
4. Differential Protection of 1-phasetransformer.
5. Determination of positive, negative, zero sequence impedances of 3-phasetransformer.
6. Determination of positive, negative, zero sequence impedances of 3-phasealternator.
7. Transient stability analysis using MAT LAB Simulink
8. Fault analysis on an un-loaded 3-phasealternator.
9. Load Frequency control of a single Area system using MAT LAB Simulink
10. Load Frequency control of two area system using MAT LAB Simulink
11. Economic load dispatch using power world simulator/software
12. Fault analysis using PSCAD
13. Operating Characteristics of Directional Over Current Relay
14. Characteristics of different relays using relay protection test set.

Note: At least ten experiments should be conducted.

Course Code	Course Title						Course Type
PC752EE	**ELECTRICAL SIMULATION LAB**						core
Prerequisite	**Contact hours per week**			**Duration of SEE (Hours)**	**Scheme of Evaluation**		**Credits**
	L	**T**	**P**		**CIE**	**SEE**	
	-	**-**	**2**	**3**	**25**	**50**	**1**

Simulation experiments should be conducted in the following areas using MAT LAB / Simulink (with DSP Tool Box, Control System Tool Box & Power System Tool Box) PSpice/PSCAD / SABER / EDSA/ MOTORPRO / CASPOC / PSSE.

1. Verification of Network theorems
    a. Thevenin's theorem
    b. Super position theorem
    c. Maximum power transfer theorem.
2. Transient responses of Series RLC, RL and RC circuits with Sine and Step inputs.
3. Series and Parallel resonance.
4. Bode plot, Root-Locus plot and Nyquist plot.
5. Transfer function analysis (i) Time response for Step input (ii) Frequency response for Sinusoidal input.
6. Design of Lag, Lead and Lag – Lead compensators.
7. Load flow studies.
8. Fault analysis.
9. Transient stability studies.
10. Generation of Basic signals using DSP.
11. Calculation of DFT using different methods.
12. Design of filters (Low pass filter).
13. Chopper fed dc motor drives.
14. VSI /CSI Fed induction motors drives. Doubly fed Induction motor, PWM.
15. Phase Control I Chopper control on DC motor Drives.
16. Control of BLDC motor.

Note: At least ten experiments should be conducted.

Course Code	Course Title						Course Type
PW761EE	PROJECT WORK - I						core
Prerequisite	Contact hours per week			Duration of SEE (Hours)	Scheme of Evaluation		Credits
	L	T	P		CIE	SEE	
	-	-	6	-	50	-	3

Course Objectives:

- To enhance practical and professional skills.
- To familiarize tools and techniques of systematic Literature survey and documentation.
- To expose the students to industry practices and team work.
- To encourage students to work with innovative and entrepreneurial ideas.

Course Outcomes: After completion of this course, the students shall be able to:

1. Demonstrate the ability to synthesize and apply the knowledge and skills acquired in the academic program to real-world problems.
2. Evaluate different solutions based on economic and technical feasibility.
3. Effectively plan a project and confidently perform all aspects of project management.
4. Demonstrate effective written and oral communication skills.

The department can initiate the project allotment procedure at the end of VI semester and finalize it in the first two weeks of VII semester.

The department will appoint a project coordinator who will coordinate the following:

1. Collection of project topics/ descriptions from faculty members (Problems can also be invited from the industries)
2. Grouping of students (max 3 in a group) Allotment of project guides

The aim of project work is to develop solutions to realistic problems applying the knowledge and skills obtained in different courses, new technologies and current industry practices. This requires students to understand current problems in their domain and methodologies to solve these problems. To get awareness on current problems and solution techniques, the first 4 weeks of VII semester will be spent on special lectures by faculty members, research scholars, post graduate students of the department and invited lectures by engineers from industries and R&D institutions. After completion of these seminars each group has to formalize the project proposal based on their own ideas or as suggested by the project guide.

Seminar schedule will be prepared by the coordinator for all the students from the 5^{th}week to the last week of the semester which should be strictly adhered to.

Each group will be required to:

1. Submit a one-page synopsis before the seminar for display on notice board.
2. Give a 30 minutes presentation followed by 10 minutes discussion.
3. Submit a technical write-up on the talk

At least two teachers will be associated with the Project Seminar to evaluate students for the award of sessional marks which will be on the basis of performance in all the 3 items stated above.

The seminar presentation should include the following components of the project:

- Problem definition and specification
- Literature survey
- Broad knowledge of available techniques to solve a particular problem.
- Planning of the work, preparation of bar (activity) charts
- Presentation- oral and written.

With effect from Academic Year 2025-26

SCHEME OF INSTRUCTION AND EVALUATION

B.E. (Electrical and Electronics Engineering)

VIII-Semester

S.No	Code	Course Title	Scheme of Instruction			Contact Hrs/Wk	Scheme of Evaluation			Credits
			L	T	P		Hrs	CIE	SEE	
Theory										
1	MC 801CE	Mandatory Course-I (Environmental Science)	3	-	-	3	3	40	60	NC
2	MC 80X XX	Mandatory Course-II	3	-	-	3	3	40	60	NC
3	MC 80X XX	Mandatory Course-III	3	-	-	3	3	40	60	NC
Practicals										
4	PW 861 EE	Project Work -II	-	-	12	12	-	50	100	6
Total			**9**	**-**	**12**	**21**	**9**	**170**	**280**	**6**

Mandatory Courses

S.No.	Code		Course Title
1	MC801CE	**Mandatory Course-I**	Environmental Science
2	MC802HS	**Mandatory Course-II** **&** **Mandatory Course-III** **(**Any 2 courses from the list)	Intellectual Property Rights
3	MC803HS		English for Technical Paper Writing
4	MC804HS		Constitution of India
5	MC805HS		Essence of Indian Traditional Knowledge
6	MC806HS		Stress Management by Yoga
7	MC807HS		Sports

Course Code	Course Title						Course Type
MC-I MC801CE	**ENVIRONMENTAL SCIENCE**						Mandatory course
Prerequisite	**Contact hours per week**			**Duration of SEE (Hours)**	**Scheme of Evaluation**		**Credits**
	L	**T**	**P**		**CIE**	**SEE**	
	3	**-**	**-**	**3**	**40**	**60**	**NC**

Course Objectives:	
The course is taught with the objectives of enabling the student to:	
1.	Comprehend the need of environmental science, ethics and issues
2.	Realize the availability and utilization of various natural resources
3.	Illustrate the characteristics and functions of Ecosystem
4.	Study various environmental pollution effects, prevention and control acts
5.	Understand the concepts of Biodiversity and its conservation needs

Course Outcomes:	
On completion of this course, the student will be able to:	
CO-1	Application and awareness of various environmental issues for sustainable society
CO-2	Acquaintance with utilization of various natural resources
CO-3	Capacity to understand and practice for sustainability of ecosystem.
CO-4	Knowledge of social and environment related issues and their preventive measures
CO-5	Ability in conserving and protecting the biodiversity

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO2
CO1	3	2		2		1	3	1	2	1		3	1	2
CO2	3	2		2		1	3	2	1	1		3	1	2
CO3	3	2		2		1	3	1	1	1		1	1	1
CO4	3	2		2		1	3	1	1	1		3	1	1
CO5	3	2		2		1	3	1	1	1		1	1	1

Correlation rating: Low/ Medium/High: 1/2/3 respectively.

UNIT-I

Multidisciplinary nature of Environmental studies:

Definition, scope and importance, Need for public awareness, Environmental ethics: issues and possible solutions, Global Warming and Climate change, Acid rain, Ozone layer depletion. Environment and human health, Population growth, Sustainable development and SDGs

UNIT-II

Natural Resources:

Types of Natural Resources, Role of individual in conservation of natural resources, Equitable use of resources for sustainable life styles, Natural resources and associated problems.

Land Resources: Land as a resource, land degradation, soil erosion and desertification.

Forest resources: Use and Overexploitation, Deforestation, Timber Extraction, Mining, Dams, and their Effects on Forests and Tribal People

Water resources: Water Resources: Use and Overutilization of Surface and Ground Water, Floods, Drought, Conflicts over Water, Dams – Benefits and problems

Mineral Resources: Use and Exploitation, Environmental Effects of Extracting and using Mineral Resources

Food Resources: World Food Problems, Changes Caused by Agriculture and Overgrazing, Effects of Modern Agriculture, Fertilizer-Pesticide Problems, Water Logging, Salinity, Energy Resources.

UNIT-III

Ecosystems:

Concept of an Ecosystem, Types, Structure and function of an ecosystem, Producers, consumers, decomposers. Energy flow in the ecosystems, Ecological succession, Food chains, food webs and ecological pyramids.

Introduction, types, characteristic features, structure and functions - Forest ecosystem, Grass land ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

UNIT-IV

Environmental Pollution:

Definition, Causes, effects and control measures - Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards,

Environmental Protection: Air (prevention and control of pollution) Act, Water (prevention and control of pollution) Act, Wildlife conservation and protection act, Forest conservation and protection act, Role of an individual's, communities and NGOs in prevention of pollution

Solid waste Management: Causes, effects and control measures of urban and industrial wastes

UNIT-V

Biodiversity and its Conservation:

Definition: genetics, species and ecosystem diversity, Spatial Patterns of Species Richness, Shannon's, Simpson's Diversity Index. Bio-geographically classification of India. Value of biodiversity - consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, national and local level. India as a mega diversity nation. Hot-spots of biodiversity,

Threats to biodiversity: habitats loss, poaching of wild life, man wildlife conflicts. Endangered and endemic spaces of India.

Conservation of biodiversity: in-situ and ex-situ conservation of biodiversity, Biological Diversity Act, 2002.

Suggested Reading:

1.	Erach Bharucha., Textbook of Environmental Studies, UGC, New Delhi and Bharathi Vidyapeeth Institute of Environment Education and Research, Pune.
2.	Mahua Basu and Xavier Savarimuthu SJ., Fundamentals of Environmental Studies,Cambridge University Press, New Delhi, 2017**.**
3.	Mishra D D., Fundamental Concepts in Environmental Studies, S Chand & Co Ltd., New Delhi, 2010.
4.	Botkin and Keller., Environmental Science, Wiley India Pvt., Ltd., New Delhi, 2012.
5.	Gilbert, M. Masters., Introduction to Environmental Engineering and Science, Prentice- Hall of India Pvt., Ltd., New Delhi, 1995.
6.	Sasi Kumar, K. and Sanoop Gopi Krishna., Solid waste Management, Prentice-Hall of India Pvt., Ltd., New Delhi, 2009.
7.	Daniel D. Chiras, Environmental Science, Jones & Bartlett Learning Publishers Inc, Burlington, MA, 2014.

With effect from Academic Year 2025-26

Course Code	Course Title					Course Type
MC802HS	**INTELLECTUAL PROPERTY RIGHTS**					Mandatory course
Prerequisite	**Contact hours per week**			**Duration of SEE (Hours)**	**Scheme of Evaluation**	**Credits**
	L	**T**	**P**		**CIE**	**SEE**	
	3	**-**	**-**	**3**	**40**	**60**	**NC**

Course Objectives :	
The course is taught with the objectives of enabling the student to:	
1	Acquaint the students with basics of intellectual property rights with special reference to Indian Laws and its practices.
2	Compare and contrast the different forms of intellectual property protection in terms of their key differences and similarities.
3	Provide an overview of the statutory, procedural, and case law underlining these processes and their interplay with litigation.

Course Outcomes :	
On completion of this course, the student will be able to :	
CO-1	Understand the concept of intellectual property rights.
CO-2	Develop proficiency in trademarks and acquisition of trade mark rights.
CO-3	Understand the skill of acquiring the copy rights, ownership rights and transfer.
CO-4	Able to protect trade secrets, liability for misappropriations of trade secrets.
CO-5	Apply the patents and demonstration of case studies.

Course Articulation Matrix:

Course outcome	**Program Outcome**					
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**
CO-1						
CO-2						
CO-3						
CO-4						
CO-5						

UNIT – I
Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

UNIT – II
Trade Marks: Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting, and evaluating trade mark, trade mark registration processes.

UNIT – III
Law of copy rights: Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law. Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer**.**

UNIT – IV
Trade Secrets: Trade secrete law, determination of trade secrete status, liability for misappropriations of trade secrets, protection for submission, trade secrete litigation. Unfair competition: Misappropriation right of publicity, false advertising.

UNIT –V
New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

Suggested Reading:

1	lbert, “Resisting Intellectual Property”, Taylor & Francis Ltd, 2007.
2	Mayall, “Industrial Design”, McGraw Hill,1992
3	Niebel, “Product Design”, McGraw Hill,1974.
4	simov, “Introduction to Design”, Prentice Hall,1962.
5	obert P. Merges, Peter S. Menell, Mark A. Lemley, “Intellectual Property in New Technological Age”,2016.
6	Ramappa, “Intellectual Property Rights Under WTO”, S. Chand,2008

With effect from Academic Year 2025-26

Course Code	Course Title						Course Type
MC 803 HS	ENGLISH FOR TECHNICAL PAPER WRITING						Mandatory course
Prerequisite	Contact hours per week			Duration of SEE (Hours)	Scheme of Evaluation		Credits
	L	T	P		CIE	SEE	
	3	-	-	3	40	60	NC

Course Objectives:	
1.	Understand that how to improve your writing skills and level of readability. Learn about what to write in each section.
2	Understand the skills needed when writing a Title Ensure the good quality of paper at very first-time submission.

Course Outcomes:	
1.	Able to plan and prepare paragraphs, avoiding ambiguity and grammatical errors
2.	Writing of abstracts, paraphrasing and plagiarism
3.	Providing critical and thorough review of literature, discussions and conclusions
4.	Able to exhibit key skills for writing titles, introduction, abstract.
5.	Able to show key and necessary skills for paper writing, phrases, results.

UNIT-I

Root Words, Synonyms and Antonyms, One word substitutes, importance of Punctuation, Sentence Structure, Subject Verb Agreement, Noun Pronoun Agreement, Redundancy, Cliche

UNIT-II

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness,

UNIT-III

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

UNIT-IV

Describing, Defining, Classifying, Providing examples or evidence, Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check,

UNIT-V

Key skills are needed when writing a Title, Abstract, Introduction, Review of the Literature, Methods, Results, Discussion, Conclusions -Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission

Suggested Reading:

1. Norman Lewis, Word Power Made Easy, Anchor Books, New York, Reprint Edition, 2014.
2. C.R. Kothari and Gaurav Garg, Research Methodology: Methods and Techniques, 4th Edition, New Age International Publishers, New Delhi, 2019.
3. P.C. Wren and H. Martin, A Comprehensive Grammar of the English Language, Revised and Updated by N.D.V. Prasada Rao, S. Chand Publishing, New Delhi, Latest Edition.
4. Goldbort R, Writing for Science, Yale University Press (available on Google Books), 2006.
5. Day R, How to Write and Publish a Scientific Paper, Cambridge University Press, 2006.
6. Highman N Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book. 1998
7. Adrian Wallwork English for Writing Research Papers, Springer New York Dordrecht Heidelberg, London. 2011.

With effect from Academic Year 2025-26

Course Code	Course Title					Course Type
MC804HS	**CONSTITUTION OF INDIA**					**Mandatory course**
Prerequisite	**Contact hours per week**			**Duration of SEE (Hours)**	**Scheme of Evaluation**	**Credits**
	L	**T**	**P**		**CIE**	**SEE**
	3	**-**	**-**	**3**	**40**	**60**	**NC**

Course Objectives:

1.	*Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective*
2.	*To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role*
3.	*Entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.*

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

1.	*Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.*
2.	*Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.*
3.	*Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru*
4.	*The eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.*
5.	*Discuss the passage of the Hindu Code Bill of 1956.*

Course Articulation Matrix:

Course outcome	Program outcome					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1						
CO2						
CO3						
CO4						
CO5						

Row wise cumulative percentage weightage should be equal to 1.0.

UNIT – I
History of Making of the Indian Constitution: History, Drafting Committee, (Composition & Working) Philosophy of the Indian Constitution: Preamble, Salient Features.
UNIT – II
Contours of Constitutional Rights & Duties: Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

UNIT – III
Organs of Governance: Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications. Powers and Functions.
UNIT – IV
Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative CEO of Municipal Corporation, Panchayat raj: Introduction, PRI: Zilla Panchayat, Elected officials and their roles, CEO Zilla Panchayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.
UNIT – V
Election Commission: Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

References:

1	*"The Constitution of India",* 1950 (Bare Act), Government Publication.
2	Dr. S. N. Busi, *"Dr. B. R. Ambedkar framing of Indian Constitution",* 1st Edition, 2015.
3	M. P. Jain, "*Indian Constitution Law",* 7th Edn., Lexis Nexis, 2014.
4	D.D. Basu, *"Introduction to the Constitution of India",* Lexis Nexis, 2015.

Course Code	Course Title						Course Type
MC 805HS	**ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE**						**Mandatory course**
Prerequisite	**Contact hours per week**			**Duration of SEE (Hours)**	**Scheme of Evaluation**		**Credits**
	L	**T**	**P**		**CIE**	**SEE**	
	3	**-**	**-**	**3**	**40**	**60**	**NC**

Cou rse Objectives:

The course aims at enabling the students to

1. Comprehend the Basic fundamental aspects of Society, Culture and Heritage.
2. Understand the significant aspects of Traditional Hindu Social Organization and vedic literature both at individual level and societal level.
3. Inculcate a philosophical insight through shad darshanas and a spiritual outlook through Yoga Sutras.
4. Realize the significance and the utilitarian aspect of the traditional knowledge system through case studies.
5. Appreciate the significance and necessity for the preservation of traditional knowledge system.

Course Outcomes: Student will be able to

1. Know the fundamental concepts of Society with regard to values, norms, cultural and nature of Indian culture.
2. Understand the connect between the vedic literature and the traditional structural organization guiding at the various phases of life of an individual.
3. Recognize the importance of Darshanas and significance of Yoga sutra in building up a holistic life perspective.
4. To inculcate a pursuit of looking deeper into IKS for addressing the multi faceted contemporary issues both at local and global platform.
5. Analyze the significance and the measures for the preservation of Traditional Knowledge System.

UNIT - I

Fundamental Concepts : Society, Definition and its Characteristics; Values- Norms, Role-Status, Order and Stability, Habits, Custom; Understanding difference between Belief and Ritual, Tradition and Heritage; Culture : Definition and its Characteristics; Characteristics of Indian Culture; Concept of Unity in Diversity;.

UNIT - II

Indian Traditional System: Traditional Hindu Organization: Purusharthas, Varna Dharma and Ashrama Dharma. Indian Traditional Scriptures and their Classification; General Understanding of Vedas: Rig veda, Sama veda, Yajur Veda, and Atharva veda, Upanishads; Smritis : Itihasa, Puranas, Agamas, Upvedas, and Vedangas.

UNIT - III

Traditional Philosophies / School of thoughts: Darshanas : philosophies of 6 Schools : Nyaya, Vaisheshika, Samkhya, Yoga, Mimamsa and Vedanta; Nastika School of Philosophy : Charvaka, Jainism and Bhuddhism; Yoga and Spirituality.

UNIT - IV

Traditional Knowledge System: Definition of Traditional knowledge, Indigenous Knowledge System; Case studies of Ancient traditional Knowledge System Astronomy,Vastu-Shatras, Wootz Steel lost technology of IKS, Water Management, and Agriculture.

UNIT - V

Protection of Traditional Knowledge - Significance and Need of Protection of Traditional Knowledge ; and measure for protection of TK, Role of the Government to harness TK. Documentation and Preservation of IKS , Approaches for conservation and Management of nature and bio-resources, Approaches and strategies to protection and conservation of IKS.

Suggested Books for Reference:

1. V. Sivaramnkrishna (Ed.). Cultural Heritage of Lndia-Course Material, Bharatiya Vidya Bhavan, Mumbai. 5th Edition, 2014
2. Swami Jirntmanand. Modern Physics and Vedant, Bharati ya Vidya Bhavan
3. Fritzof Capra. Tao of Physics
4. Fritzof Capra, The wave of Life
5. V N Jba (Eng. Trans.). Tarkasangraha of Annam Bhana, lnernational Chinmay Foundation, Velliamad. Amaku.am
6. Yoga Sutra of Patanjali, Ramakrishna Mission. Kolkatta
7. GN Jha (Eng. Trans.) Ed. R N Jha, Yoga-darshanam with VyasaBhashya. Vidyanidhi Prakasham, Delhi, 2016
8. RN Jha. Science of Consciousness Psychotherapy and Yoga Practices. Vidya nidhi Prakasham, Delhi. 2016
9. P R Sha.min (English translation). Shodashang Hridayam

With effect from Academic Year 2025-26

Course Code	Course Title						Course Type
MC 806HS	STRESS MANAGEMENT BY YOGA						Mandatory course
Prerequisite	Contact hours per week			Duration of SEE (Hours)	Scheme of Evaluation		Credits
	L	T	P		CIE	SEE	
	3	-	-	3	40	60	NC

Course Objectives :	
The course is taught with the objectives of enabling the student to:	
1	Creating awareness about different types of stress and the role of yoga in the management of stress.
2	Promotion of positive health and overall wellbeing (Physical, mental, emotional, social and spiritual).
3	Prevention of stress related health problems by yoga practice.

Course Outcomes :	
On completion of this course, the student will be able to :	
CO-1	To understand yoga and its benefits.
CO-2	Enhance Physical strength and flexibility.
CO-3	Learn to relax and focus.
CO-4	Relieve physical and mental tension through Asanas
CO-5	Improve work performance and efficiency.

Course Articulation Matrix:

Course outcome	Program Outcome					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	-	-	-	-	-	
CO-2	-	-	-	-	-	1
CO-3	-	-	-	1	-	1
CO-4	-	-	-	-	1	1
CO-5	-	-	-	-	1	1

UNIT – I
Meaning and definition of Yoga - Historical perspective of Yoga - Principles of Astanga Yoga by Patanjali.

UNIT – II
Meaning and definition of Stress - Types of stress - Eustress and Distress. Anticipatory Anxiety and Intense Anxiety and depression. Meaning of Management- Stress Management.

UNIT – III
Concept of Stress according to Yoga - Stress assessment methods - Role of Asana, Pranayama and Meditation in the management of stress.

UNIT – IV
Asanas- (5 Asanas in each posture) - Warm up - Standing Asanas - Sitting Asanas - Prone Asanas - Supine asanas - Surya Namaskar.

UNIT – V
Pranayama- Anulom and Vilom Pranayama - Nadishudhi Pranayama – Kapalabhati-Pranayama - Bhramari Pranayama - Nadanusandhana Pranayama.
Meditation techniques: Om Meditation - Cyclic meditation : Instant Relaxation technique (QRT), Quick Relaxation Technique (QRT), Deep Relaxation Technique (DRT).

Suggested Reading:

1	"Yogic Asanas for Group Training - Part-I": Janardhan Swami Yogabhyasi Mandal, Nagpur
2	"Rajayoga or Conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata
3	Nagendra H.R nad Nagaratna R, "Yoga Perspective in Stress Management", Bangalore, Swami Vivekananda Yoga Prakashan

Web resource:

1	https://onlinecourses.nptel.ac.in/noc16_ge04/preview
2	https://freevideolectures.com/course/3539/indian-philosophy/11

With effect from Academic Year 2025-26

Course Code	Course Title						Course Type
MC807HS	SPORTS						Mandatory course
Prerequisite	Contact hours per week			Duration of SEE (Hours)	Scheme of Evaluation		Credits
	L	T	P		CIE	SEE	
	3	-	-	3	40	60	NC

Course Objectives:

1. To develop an understanding of the importance of sport in the pursuit of a healthy and active lifestyle at the College and beyond.
2. To develop an appreciation of the concepts of fair play, honest competition and good sportsmanship.
3. To develop leadership skills and foster qualities of co-operation, tolerance, consideration, trust and responsibility when faced with group and team problem-solving tasks.
4. To develop the capacity to maintain interest in a sport or sports and to persevere in order to achieve success.
5. To prepare each student to be able to participate fully in the competitive, recreational and leisure opportunities offered outside the school environment.

Course Outcomes:

- Students' sports activities are an essential aspect of university education, one of the most efficient means to develop one's character and personal qualities, promote the fair game principles, and form an active life position.
- Over the past year, sports have become much more popular among our students. Let us remember the most memorable events related to sports and physical training.
- Special attention was paid to team sports. Our male and female games and sports have achieved remarkable progress at a number of competitions.
- Our teams in the main sports took part in regional and national competitions. Special thanks to our team in track and field athletics, which has been revitalized this year at ICT and which has won Javelin competition.
- Staff of our faculties and students of Sports, Physical Development, & Healthy Lifestyle of Faculty congratulates everyone on the upcoming New Year and wishes you robust health and new victories in whatever you conceive.

I. Requirements:

i) Track Paint (students should bring)

ii) Shoes

iii) Volley Ball, Foot Ball and Badminton (Shuttle)

iv) Ground, Court, indoor stadium and swimming pool

II. Evaluation Process:

Total Marks 50

i) 20 marks for internal exam (continuous evaluation)

a) 8 marks for viva

b) 12 marks for sports & fitness

ii) 30 marks for end exam

a) 10 marks for viva

b) 20 marks for sports & fitness

Course Code	Course Title						Course Type
PW861EE	PROJECT WORK - II						Mandatory course
Prerequisite	Contact hours per week			Duration of SEE (Hours)	Scheme of Evaluation		Credits
	L	T	P		CIE	SEE	
	-	-	12	-	50	100	6

Course Objectives

To enhance practical and professional skills

To familiarize tools and techniques of systematic Literature survey and documentation.

To expose the students to industry practices and teamwork.

To encourage students to work with innovative and entrepreneurial ideas.

Course Outcomes: After completion of this course, the students shall be able to:

1. Demonstrate the ability to synthesize and apply the knowledge and skills acquired in the academic program to real-world problems.
2. Evaluate different solutions based on economic and technical feasibility.
3. Effectively plan a project and confidently perform all aspects of project management.
4. Demonstrate effective written and oral communication skills.

The aim of project stage –II is to implement and evaluate the proposal made as part of project stage - II. Students can also be encouraged to do full time industrial internship as part of project stage -II based on the common guidelines for all the departments. The students placed in internships need to write the new proposal in consultation with industry coordinator and project guide within two weeks from the commencement of instruction.

The department will appoint a project coordinator who will coordinate the following:

1. Re-grouping of students - deletion of internship candidates from groups made as part of project work-I
2. Re-Allotment of internship students to project guides Project monitoring at regular intervals

All re-grouping/re-allotment has to be completed by the 1nd week of VIII-Semester so that students get sufficient time for completion of the project.

All projects (internship and departmental) will be monitored at least twice in a semester through student presentation for the award of sessional marks. Sessional marks are awarded by a monitoring committee comprising of faculty members as well as by the supervisor. The first review of projects for 25 marks can be conducted after completion of five weeks. The second review for another 25 marks can be conducted after 12 weeks of instruction. Common norms will be established for the final documentation of the project report by the respective departments. The students are required to submit draft copies of their project report within one week after completion of instruction.