TKR COLLEGE OF ENGINEERING AND TECHNOLOGY
AN AUTONOMOUS INSTITUTION
Accredited by NAAC with 'A+' Grade.
(Sponsored by TKR Educational Society, Approved by AICTE, Affiliated to JNTU H)
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Value Added Courses Syllabus

2021-22

1. Wind Energy Conversion Systems

Course Objective: To provide students with knowledge of wind energy resources, wind turbine technologies, electrical generators, control systems, grid integration, and emerging trends in wind power generation.

UNIT – I: Introduction to Wind Energy and Resource Assessment
Global and Indian energy scenario
Need for renewable energy sources
Fundamentals of wind energy
Origin and characteristics of wind
Wind speed measurement techniques
Wind resource assessment
Wind data analysis and Weibull distribution
Site selection criteria for wind power plants
Wind energy potential in India

UNIT – II: Wind Turbine Technology
Principles of wind energy conversion
Aerodynamics of wind turbines
Betz limit and power coefficient
Classification of wind turbines
Horizontal Axis Wind Turbines (HAWT)
Vertical Axis Wind Turbines (VAWT)
Components of wind turbines
Rotor, blades, nacelle, tower, gearbox
Performance characteristics and power curves
Pitch control and stall control methods

UNIT – III: Electrical Systems in Wind Energy Conversion (6 Hours)
Electrical generators used in WECS
Squirrel Cage Induction Generator (SCIG)
Doubly Fed Induction Generator (DFIG)
Permanent Magnet Synchronous Generator (PMSG)
Power electronic converters in WECS
AC–DC–AC conversion systems
Variable-speed wind energy systems
Energy storage options for wind power plants

UNIT – IV: Wind Farm Integration, Control and Protection (6 Hours)
Wind farm layout and design considerations
Grid integration requirements
Reactive power compensation
Voltage and frequency control
Protection schemes for wind turbines
SCADA systems for wind farm monitoring
Fault ride-through capability
Smart grid applications in wind energy

UNIT – V: Economics, Environmental Impact and Emerging Trends (6 Hours)
Economic analysis of wind power projects
Cost components of wind farms
Life cycle assessment of wind turbines
Environmental impacts of wind energy
Offshore wind energy systems
Hybrid renewable energy systems
Wind–Solar integrated systems
Recent advancements in wind turbine technology
Future trends and challenges in wind energy development

After successful completion of the course, students will be able to:
CO1: Explain the fundamentals of wind energy, wind characteristics, and the principles of wind energy conversion systems (WECS).
CO2: Analyze the aerodynamic performance of wind turbines, including power extraction, rotor design, and control mechanisms such as pitch and yaw control.
CO3: Evaluate the operation and performance of fixed-speed and variable-speed wind energy conversion systems employing induction and synchronous generators.
CO4: Apply power electronic interfaces, control strategies, and energy management techniques for efficient wind energy conversion and utilization.
CO5: Assess grid integration requirements, power quality issues, protection schemes, and the role of wind energy in modern sustainable power systems.

2. Environmental Studies

Course Objectives
To create awareness about environmental issues and sustainable development.
To understand ecosystems, natural resources, biodiversity, and environmental pollution.
To study environmental laws, policies, and management practices.
To promote environmental responsibility among engineering students.
To understand the role of technology in environmental protection and sustainability.

UNIT – I: Introduction to Environment and Ecosystems (6 Hours)
Definition, scope, and importance of environmental studies
Components of environment: Atmosphere, Hydrosphere, Lithosphere, Biosphere
Ecosystem concept, structure, and functions

Types of ecosystems: Forest, Grassland, Desert, Aquatic ecosystems
Food chains, food webs, and ecological pyramids
Energy flow in ecosystems
Sustainable development goals (SDGs)

UNIT – II: Natural Resources and Conservation (6 Hours)
Natural resources: Renewable and non-renewable resources
Forest resources and conservation
Water resources: Utilization, conservation, and rainwater harvesting
Mineral resources and sustainable utilization
Land resources and soil conservation
Energy resources: Conventional and renewable energy sources
Resource management strategies

UNIT – III: Biodiversity and Environmental Issues (6 Hours)
Biodiversity: Definition, types, and importance
Levels of biodiversity: Genetic, species, and ecosystem diversity
Biodiversity hotspots in India
Threats to biodiversity
Endangered and endemic species
Conservation of biodiversity: In-situ and Ex-situ methods
Environmental ethics and ecological balance

UNIT – IV: Environmental Pollution and Control (6 Hours)
Air pollution: Sources, effects, and control measures
Water pollution: Causes, impacts, and treatment methods
Soil pollution and management
Noise pollution and its control
Solid waste management
E-waste management and recycling
Climate change, global warming, ozone layer depletion, and acid rain

UNIT – V: Environmental Management, Laws and Sustainability (6 Hours)
Environmental Impact Assessment (EIA)
Environmental Management Systems (EMS)
ISO 14001 Standards
Environmental legislation in India
Water Act, Air Act, Environment Protection Act
Environmental policies and sustainable engineering practices
Green technologies and green energy initiatives
Role of engineers in environmental protection and sustainable development

After completing the course, students will be able to:
CO1: Explain the importance of environmental studies and sustainable development.
CO2: Analyze the utilization and conservation of natural resources.

CO3: Understand biodiversity conservation and ecosystem functions.
CO4: Identify sources and impacts of environmental pollution and suggest control measures.
CO5: Apply environmental management principles and environmental laws in engineering practice

3. Constitution of India

Course Objectives
To provide basic knowledge of the Constitution of India and its significance.
To familiarize students with the Fundamental Rights, Duties, and Directive Principles.
To understand the structure and functioning of the Indian Government.
To create awareness about democratic values, governance, and citizen responsibilities.
To develop ethical and constitutional values among engineering students.

UNIT – I: Introduction to the Constitution of India (6 Hours)
Historical background of the Indian Constitution
Constituent Assembly and constitution-making process
Preamble of the Constitution
Salient features of the Constitution
Union and its Territories
Citizenship and constitutional values
Significance of the Constitution in a democratic nation

UNIT – II: Fundamental Rights, Duties and Directive Principles (6 Hours)
Fundamental Rights and their significance
Right to Equality
Right to Freedom
Right against Exploitation
Right to Freedom of Religion
Cultural and Educational Rights
Constitutional Remedies
Fundamental Duties
Directive Principles of State Policy (DPSP)

UNIT – III: Structure of Government and Constitutional Bodies (6 Hours)
Parliamentary system of government
President of India: Powers and Functions
Prime Minister and Council of Ministers
Parliament: Lok Sabha and Rajya Sabha
State Government: Governor, Chief Minister, and State Legislature
Constitutional bodies:
Election Commission of India
Finance Commission
Union Public Service Commission (UPSC)
Comptroller and Auditor General (CAG)

UNIT – IV: Judiciary, Governance and Local Administration (6 Hours)

Structure of Indian Judiciary
Supreme Court, High Courts, and Subordinate Courts
Judicial Review and Judicial Activism
Rule of Law
Public Interest Litigation (PIL)
Panchayati Raj Institutions
Urban Local Bodies and Municipal Administration
E-Governance and Good Governance

UNIT – V: Constitutional Values, Rights of Citizens and Contemporary Issues (6 Hours)
Constitutional morality and ethical citizenship
Human Rights and Right to Information (RTI)
Consumer Rights and Responsibilities
Gender justice and social equality
Constitutional provisions for weaker sections
Environmental protection under the Constitution
National Integration and Unity in Diversity
Role of engineers in nation building and constitutional governance

After successful completion of the course, students will be able to:
CO1: Explain the historical background and salient features of the Indian Constitution.
CO2: Understand Fundamental Rights, Fundamental Duties, and Directive Principles of State Policy.
CO3: Describe the structure and functions of the Legislature, Executive, and Judiciary.
CO4: Analyze constitutional provisions related to governance, elections, and local self-government.
CO5: Apply constitutional values and ethical principles in professional and social life.

4. Human Values & Professional Ethics

Course Objectives
To develop a value-based approach to life and profession among engineering students.
To understand the importance of human values in personal, social, and professional life.
To create awareness about ethical responsibilities in engineering practice.
To promote integrity, accountability, leadership, and social responsibility.
To encourage ethical decision-making in technological and professional environments.

UNIT – I: Human Values and Self-Development
Meaning, significance, and sources of human values
Self-exploration and self-awareness
Values in personal life
Harmony within oneself
Character development and personality enhancement
Importance of honesty, integrity, empathy, and compassion
Value-based decision making

UNIT – II: Family, Society and Social Responsibility
Values in family relationships
Responsibilities towards family and society
Social harmony and mutual respect
Cooperation, teamwork, and community participation
Respect for diversity and cultural values
Gender sensitivity and social inclusion
Corporate Social Responsibility (CSR) and community development

UNIT – III: Professional Ethics and Engineering Ethics
Meaning and importance of ethics
Ethics, morals, values, and law
Engineering profession and ethical responsibilities
Code of ethics for engineers
Professional competence and accountability
Ethical dilemmas in engineering practice
Case studies on engineering ethics

UNIT – IV: Leadership, Workplace Ethics and Professional Excellence
Leadership qualities and ethical leadership
Workplace ethics and organizational values
Professional communication and interpersonal skills
Time management and discipline
Conflict resolution and decision-making
Team building and collaborative work culture
Excellence in professional practice

UNIT – V: Technology, Sustainability and Ethical Challenges
Ethics in science and technology
Environmental ethics and sustainable development
Ethical issues in emerging technologies
Intellectual Property Rights (IPR) and plagiarism
Data privacy and cyber ethics
Professional responsibility towards society and environment
Role of engineers in nation building and sustainable growth

After successful completion of the course, students will be able to:
CO1: Understand the significance of human values and ethical principles in daily life.
CO2: Apply moral values and ethical reasoning in personal and professional situations.
CO3: Analyze professional ethics and responsibilities of engineers.
CO4: Demonstrate leadership, teamwork, and social responsibility in engineering practice.
CO5: Evaluate ethical issues related to technology, society, and sustainable development.