DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME

2015 -2016 onwards

III YEAR

V SEMESTER

ELECTIVE THEORY

32073 – RENEWABLE ENERGY SOURCES AND ENERGY CONSERVATION

CURRICULUM DEVELOPMENT CENTRE

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING

Course Code : 1020

Subject Code : 32073

Semester : V

Subject Title : RENEWABLE ENERGY SOURCES AND ENERGY CONSERVATION

TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 15 Weeks

Subject	Instructions		Examination			
Renewable Energy Sources and Energy Conservation	Hours /Week	Hours/ Semester	Marks			Duration
	5	75	Internal Assessment	Board Examination	Total	3 Hrs
			25	75	100	

Topics and Allocation of Hours:

Unit	Topics	Hours
I	FUNDAMENTALS OF ENERGY, WIND ENERGY	14
II	SOLAR ENERGY,APPLICATION,STORAGE	14
III	SOLAR PHOTOVOLTAIC SYSTEM AND DESIGN,OCEN,TIDAL,WAVE ENERGY	14
IV	BIO-ENERGY	13
V	ENERGY CONSERVATION TECHNIQUES AND ENERGY AUDIT	13
	REVISION AND TEST	7
	TOTAL	**75**

RATIONALE:

Electrical Energy requirement is the major crisis and hence any saving in Electrical energy is equivalent to production of Electrical Energy. Saving can be achieved by the utilization of Renewable Energy Sources.

OBJECTIVES:

- Study about the fundamentals of Energy.
- Study of construction and principle of Wind energy, Solar energy, Tidal energy and Bio energy.
- Understand the PV design and its components.
- Understand the energy management and auditing techniques.
- Study the energy conservation process.

RENEWABLE ENERGY SOURCES AND ENERGY CONSERVATION

DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topic	Hours
I	**FUNDAMENTALS OF ENERGY**	**14**
	Introduction to Energy-Energy consumption and standard of living-classification of energy resources-consumption trend of primary energy resources-importance of renewable energy sources- energy for sustainable development.	
	WIND ENERGY	
	Introduction-Basic principles of wind energy conversion: Nature of the wind, power in the wind, forces on the blades and wind energy conversion-wind data and energy estimation-site selection-classification of wind energy conversion systems- components of conversion systems-Advantages and Disadvantages-Types of wind machines-Horizontal axis machine-Vertical axis machine-Generating system-Energy Storage–Application of wind energy-Safety and environmental aspects.	

II SOLAR ENERGY **14**

Introduction – Solar radiation at the earth's surface-Solar Radiation measurements-Estimation of average solar Radiation.

Solar energy collectors- Classifications-Flat plate collectors - Concentrating collectors-performance parameter-tracking system-compound parabolic concentrator-parabolic trough concentrators-concentrator with point focus-heliostats-comparisons of various collectors-efficiency of collector-selection of collector for various applications.

Solar Thermal Application: Solar water heaters-Solar industrial heating system – Solar Refrigeration and Air-Conditioning Systems-Solar cookers-Solar furnaces-Solar greenhouse-Solar Distillation-Solar pond Electric power plant-Distributed Collector- Solar thermal Electric power plant.

Solar thermal energy storage: sensible storage-latent heat storage-thermo chemical storage.

III Solar photovoltaic System and Design: **14**

Solar photovoltaic a brief history of PV,PV in silicon: basic principle, crystalline PV; reducing cost and raising efficiency, thin film PV, other innovative technologies, electrical characteristics of silicon PV cells and modules, grid connected PV system, cost of energy from PV ,Environmental impact and safety.

System design of solar photovoltaic system: Load analysis-solar array Design-Battery Design-Simple formulas. System design procedure. Case Studies: Designing solar home lighting system - Designing stand alone solar PV Power plant - Designing solar PV water pumping system - Only arriving load capacity - solar array sizing - Battery sizing - Inverter capacity and mountings.

Ocean energy, Tidal & Wave energy

Ocean energy resources – principle's of ocean thermal energy conversion (OTEC) – Methods of Ocean thermal electric power generation – Energy utilisation – basic principle of tidal power – components and operations of tidal power plant – Energy and Power forms of waves – Wave energy conversion devices.

IV	**BIO – ENERGY**	**13**
	Introduction – photo synthesis – usable forms of bio mass, their composition and fuel properties-Biomass resources – Biomass conversion technologies – Urban waste to energy conversion – Biomass gasification – biomass liquification – biomass to ethanol production – Biogas production from waste Biomass – types of bio gas plants - applications – Bio diesel production – Biomass energy programme in India.	
V	**Energy Management and Audit, Conservation:** Definition, Energy audit - need, Types of energy audit, Energy management (audit) approach-understanding energy costs, Bench marking, Energy performance, Matching energy use to requirement, Maximizing system efficiencies, Optimizing the input energy requirements, Fuel and energy substitution, Energy audit instruments Energy Conservation Techniques- Need and importance of energy conservation -Principles of energy conservation- Methods of energy conservation-Cogeneration and its application-Combined cycle system-Concept of energy management-Study of different energy management techniques like-Analysis of input-Reuse and recycling of waste. Economic approach of Energy Conservation-Costing of utlities like steam, compressed air, electricity and water-Ways of improving boiler efficiency-Thermal insulation, Critical thickness of insulation-Waste heat recovery systems, their applications, criteria for installing unit-An introductory approach of energy conservation in compressed air, refrigeration, air conditioning, pumps and fans.	**13**

Text Books:

1) Non Conventional Energy Sources - G.D. Rai – Khanna Publishers, New Delhi,1999.
2) Non Conventional Energy Sources and Utilisation - R.K. Rajput - S.Chand & Company Ltd., 2012.
3) Renewable Energy Sources - Twidell, J.W. and Weir, A. - EFN Spon Ltd., 1986.

4) Non-Conventional Energy Resources - B.H.Khan - Tata Mc Graw Hill, 2nd Edn, 2009.
5) Industrial energy conservation- D. A. Ray- Pergaman Press
6) Energy resource management- Kirpal Singh Jogi- Sarup and sons