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Choice Based Credit System (CBCS) in the Light of NEP-2020
Diploma (Solar Engineering)
(w.e.f.A.Y.2023)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING &EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
DTSE301	DCC	Energy Source	60	20	20	0	0	3	1	0	4

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; C - Credit.
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Educational Objectives(CEOs):
The objective of this course is -
1. To know the various energy sources.
2. To understand world energy scenario.
3. To understand the need of solar energy in the world.

Course Outcomes(COs):
Upon completion of the course, the student shall be able to
1. To get the knowledge of energy conversion process.
2. To get the knowledge of conventional energy sources.
3. To get the knowledge of commercial energy sources.
4. To acquire knowledge of solar energy sources.

Syllabus

UNIT I 9 Hours

Introduction to Energy:
Definition and units of energy and power, conversion, energy terms, calorific value, forms of energy, classification of energy sources quality and concentration of energy sources, energy and Thermodynamics, Energy Parameters, conservation of energy, Energy flow diagram to the earth.

UNIT II 10 Hours

Energy sources: Conventional energy sources Hydro Electric, Thermal, Nuclear, Non-Conventional Energy SourcesBiomass, geo-thermal, solar, wind energy, ocean energy, wave energy, advantages and disadvantages, challenges.

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			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
DTSE301	DCC	Energy Source	60	20	20	0	0	3	1	0	4

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; C - Credit.
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

UNIT III 8 Hours

Commercial and Non-commercial energy sources:
Commercial energy sources, fossil-fuels coal, oil, natural gas, hydroelectric power, nuclear, Non-commercial energy sources, wood, animal wastes, agricultural waste, cost of raw materials, transport problems, issues.

UNIT IV 8 Hours

Solar system: Energy from the sun, solar window, atmospheric effects, diffused radiations, Air mass, effect of Air Mass, seasonal effects, environmental effects on standard test conditions.

UNIT V 8 Hours

Energy use & climate change: Global warming,Greenhouse gas emission, impacts, mitigation, Causes of global, regional and local climate change.

References:

1. Renewable energy; power for a sustainable future; oxford; Stephen peake; oxford university press- 2017.
2. Renewable energy systems; Devid M. Buchla, Thomas E kissell, Thomas, L Floyd; Pearson IndiaEducation Services Pvt. Ltd. 2017
3. Fundamentals of Renewable Energy Systems Paperback – D.Mukherjee, New Age International
Publisher; First edition (2011)
4. Solar Power Handbook, Dr. H. Nagana gouda(2014)

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			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
DTSE302	DCC	**Principles of Solar Photovoltaic Systems**	60	20	20	0	0	3	1	0	4

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; C - Credit.
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Educational Objectives(CEOs):
The objective of this course is -
1. To know basic of Solar Photovoltaic system.
2. To understand solar conversion and green construction.
3. To understand Solar photovoltaic applications.

Course Outcomes(COs):
Upon completion of the course, the student shall be able to
1. To get the knowledge of Solar Photovoltaic system
2. To comprehend the construction, operations and working of Solar Photovoltaic system.
3. To understand the characteristics of Solar Photovoltaic system.

Syllabus

UNIT I 10 Hours
Introduction,Sun movement over the day, shadowing effects.Photovoltaic Cell.Advantages & disadvantages of photo-voltaic conversion.Use of solar cell in various instruments.Photo-voltaic array & its connections, arrangements of array according to the voltage.

UNIT II 10 Hours
Solar Photovoltaic energy conversion and utilization, solar power generation systems a) off-grid systems b) grid connected systems c) power control and management systems, economics of solar photovoltaic systems.

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			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
DTSE302	DCC	**Principles of Solar Photovoltaic Systems**	60	20	20	0	0	3	1	0	4

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; C - Credit.
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

UNIT III 10 Hours

Introduction, Why Solar Energy generation, solar radiation, radiation measuring instruments, radiation measurement and predictions, atmospheric effects, seasonal effects, environmental effects on standard test conditions, Solar PV production and cost.

UNIT IV 8 Hours

Solar Photovoltaic system: Check the functions of different parts up to the performance level expected.Balance of Solar PV Systems:

UNIT V 8 Hours

Electrical Storage: Battery technology, Batteries for Photovoltaic systems, DC – DC converters, Charge Controllers, DC – AC inverters; single phase, three phase, MPPT.

References:

1. Solar Photovoltaic; ChetanSinghSolanki; PHI, Learning private ltd., New Delhi- 2018.
2. Non-conventional Sources of Energy, G.D Rai, Khanna Publishers, Delhi, 2012.
3. Solar Power Handbook, Dr. H. Naganagouda (2014).
4. Renewable Energy Technologies; A Practical Guide for Beginners, Chetan Singh Solanki, PHI School Books (2008).
5. Renewable Energy Sources and Emerging Technologies, Kothari D.P., and Signal K.C New Arrivals –PHI; 2 Edition (2011).

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			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
DTSE303	DCC	Fundamentals of Safety and Protective Equipments	60	20	20	30	20	3	0	2	4

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; C - Credit.
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Educational Objectives (CEOs):
The objective of this course is -

1. To know National Policy on Safety, Health, and Environment.
2. To understand Solar panels and its functions.
3. To understand the various tests on solar panels.

Course Outcomes (COs):
Upon completion of the course, the student shall be able to

1. To get the knowledge of National Policy.
2. To get the knowledge of Electrical Safety Electrical safety Rules,
3. To understand the various tests on solar plants.

Syllabus

UNIT I 10 Hours

National Policy on Safety, Health, and Environment at Workplace (NPSHEW), Major OSH Laws & Regulations, Educational and awareness-raising arrangements to enhance preventive safety and health culture, including promotional initiatives, National Safety Day activities.

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COURSE CODE	CATEGORY	COURSE NAME	TEACHING &EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
DTSE303	DCC	**Fundamentals of Safety and Protective Equipments**	60	20	20	30	20	3	0	2	4

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; C - Credit.
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

UNIT II 9 Hours

Electrical Safety, Electrical safety Rules, Simple First Aid, General safety of tools and equipment PPEs, Fire extinguishers, Type of fire extinguishers. Electricity Basics, Fundamental of Earthing system, PV module.

UNIT III 8 Hours

Fundamental types of modules and their applications, PV components and configuration etc. System components & inspection, Site layout & marking.

UNIT IV 9 Hours

Types and Importance of Safety helmet, Safety belt, Nose mask, Safety goggles, Ear plug, PVC hand glove, Cotton hand glove, Reflective jacket, First aid kit, Gum boots, Construction of cable trenches & conduits, Cable Tray support & Tray Erection, General Safety Guidelines for O&M.

UNIT V 10 Hours

Study of work method for the followings: String Testing- Pre-checks, Short Circuit Test- Work Method, Inverter Testing- Work Method, Check list preparation, Pre -requirement of installation of sub-station equipment.

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COURSE CODE	CATEGORY	COURSE NAME	TEACHING &EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
DTSE303	DCC	**Fundamentals of Safety and Protective Equipments**	60	20	20	30	20	3	0	2	4

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; C - Credit.
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

References:

1. Solar Power Handbook, Dr. H. naganagouda (2022 Edition)
2. Green Power: Eco-Friendly Energy Engineering", Khartchenko. N.V, "Tech Books, and New Delhi, 2008.
3. Handbook of energy and environment in India; Banerjee BP, Oxford University press-2005 India.

List of Experiments:

1. Test an LED and a Photodiode to verify the photo emitting effect and light sensitivity.
2. Test a Photo voltaic cell for different illumination levels and verify photovoltaic property.
3. Plot I-V curve for photovoltaic cell based on the illumination at constant temperature.
4. Plot I-V curve for photovoltaic cell based on temperature at constant illumination.
5. Test photovoltaic cell in sunlight at various angles of inclination and direction.
6. Test different rated Photovoltaic modules (Panels) and plot I-V curve.
7. Record specification of different solar panels and compare specifications to select a panel.
8. Test different types of PV panels such as, mono crystalline, poly crystalline, amorphous silicon and thin film modules. Prepare a report on panel.

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COURSE CODE	CATEGORY	COURSE NAME	TEACHING &EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
DTEE304N	DCC	Electrical Engineering Drawing	0	0	0	30	20	0	0	4	2

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; C - Credit.
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Educational Objectives (CEOs):

1. To draw assembled view of dissembled parts of electrical machines and transformers.
2. To develop the ability to identify different parts of electrical machines and prepare list of materials for various parts.
3. To draw circuit diagram for different AC motor starters.
4. To follow BIS and REC standard to supportthing installation and SP and DP Structures and stay sets for line supports.
5. To use various symbols to draw the single line diagram of 33/11kV substations.

Course Outcomes (COs):

After the successful completion of this course students will be able to

1. A technical person takes help of an engineering drawing to understand the constructional features of machines and accessories.
2. Electrical drawing is introduced for the Diploma students to be familiar with different assembled and dissembled views of electrical machine like: Three phase alternator, Induction motors, Transformers, Circuit diagrams of AC motors starters, Development of stator windings of single phase and three phase motors and alternators, with conventional symbols.
3. Sketching as to BIS and REC specification and symbol of electrical earthing installations, SP and DP structures and substations of 132/33 kV and 33/11 kV type.
4. This will enable them to follow engineering drawing in the working environment.

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COURSE CODE	CATEGORY	COURSE NAME	TEACHING &EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
DTEE304N	DCC	Electrical Engineering Drawing	0	0	0	30	20	0	0	4	2

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; C - Credit.
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

List of Experiments:

1. Draw the winding diagram of a Single Layer Lap and Single Layer Wave connected D C Machine.
2. Draw the different Industrial Electrical symbols.
3. Draw the different types of poles and Towers with feeders and Distributors and Lightning Arrestors.
4. Draw the different types of earthing's.
5. Draw different core sections of a transformer.
6. Draw the Battery Charging Circuit with Battery.
7. Draw the Single, Double and Triple pole types, Main Switches, Energy meters.
8. Sketches of C.T., P.T. and other Relays with feeders and distributors.
9. Draw the single line diagram of 33/11 kV substation.
10. Stay Arrangement and guard wires arrangement for roads and rail lines crossing.

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ML307 ENVIRONMENTAL MANAGEMENT AND SUSTAINABILITY

SUBJECT CODE	CATEGORY	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
ML-307	Compulsory	Environmental Management and Sustainability	60	20	20	0	0	4	0	0	4

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher's Assessment** shall be based upon following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Objective

1. To create awareness towards various environmental problems.
2. To create awareness among students towards issues of sustainable development.
3. To expose students towards environment friendly practices of organizations.
4. To sensitize students to act responsibly towards environment.

Examination Scheme

The internal assessment of the students' performance will be done out of 40 Marks. The semester Examination will be worth 60 Marks. The question paper and semester exam will consist of two sections A and B. Section A will carry 36 Marks and consist of five questions, out of which student will be required to attempt any three questions. Section B will comprise of one or more cases / problems worth 24 marks.

Course Outcomes

1. The course will give students an overview of various environmental concerns and practical challenges in environmental management and sustainability.
2. Emphasis is given to make students practice environment friendly behavior in day-to-day activities.

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COURSE CONTENT

Unit I: Introduction to Environment Pollution and Control

1. Pollution and its types (Air, Water, and Soil): Causes, Effects and Control measures
2. Municipal Solid Waste: Definition, Composition, Effects
3. Electronic Waste: Definition, Composition, Effects
4. Plastic Pollution: Causes, Effects and Control Measures

Unit II: Climate Change and Environmental Challenges

1. Global Warming and Green House Effect
2. Depletion of the Ozone Layer
3. Acid Rain
4. Nuclear Hazards

Unit III: Environmental Management and Sustainable Development

1. Environmental Management and Sustainable Development: An overview
2. Sustainable Development Goals (17 SDGs)
3. Significance of Sustainable Development
4. Environment Friendly Practices At Workplace and Home (Three Rs' of Waste Management, Water Conservation, Energy Conservation)

Unit 1V: Environmental Acts

1. The Water (Prevention and Control of Pollution) Act, 1974: Objectives, Definition of Pollution under this act, Powers and Functions of Boards
2. The Air (Prevention and Control of Pollution) Act, 1981:Objectives, Definition of Pollution under this act, Powers and Functions of Boards
3. The Environment (Protection) Act, 1986: Objectives, Definition of important terms used in this Act, Details about the act.
4. Environmental Impact Assessment: Concept and Benefits

Unit V:Role of Individuals, Corporate and Society

1. Environmental Values
2. Positive and Adverse Impact of Technological Developments on Society and Environment
3. Role of an individual/ Corporate/ Society in environmental conservation
4. Case Studies: The Bhopal Gas Tragedy, New Delhi's Air Pollution, Arsenic Pollution in Ground Water (West Bengal), Narmada Valley Project, Cauvery Water Dispute,Fukushima Daiichi Disaster (Japan), Ozone Hole over Antarctica, Ganga Pollution, Deterioration of Taj Mahal, Uttarakhand flash floods

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Suggested Readings:

1. Rogers, P.P., Jalal, K.F. , Boyd, J.A.(Latest Edition) . **An Introduction to Sustainable Development.** Earthscan
2. Kalam, A.P.J. (Latest Edition) .***Target 3 Billon: Innovative Solutions Towards Sustainable Development.*** Penguin Books
3. Kaushik , A. and Kaushik (Latest Edition).***Perspectives in Environmental Studies***. New Delhi: New Age International Publishers.
4. Dhameja, S.K. (Latest Edition). ***Environmental Studies***. S.K. Kataria and Sons.New Delhi
5. Bharucha,E. (Latest Edition). ***Environmental Studies for Undergraduate Courses.*** New Delhi: University Grants Commission.
6. Wright, R. T. (Latest Edition). ***Environmental Science: towards a sustainable future*** .New Delhi: PHL Learning Private Ltd.
7. Rajagopalan, R. (Latest Edition). ***Environmental Studies***. New York: Oxford University Press.

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