Maharashtra State Board of Technical Education, Mumbai

Teaching and Examination Scheme

Programme Name : Advanced Diploma in Energy Management and Audit

Programme Code : EW **With Effect From Academic Year: 2023 - 24**

Duration of Program : One Year (Two Semesters) **Pattern : Semester (Full Time)** **Duration : 16 Weeks**

Semester : First **Scheme : I**

S. N.	Course Title	Course Abbreviation	Course Code	Teaching Scheme			Credit (L+T+P)	Examination Scheme													Grand Total
								Theory										Practical			
								Exam Duration in Hrs.	ESE		PA		Total		ESE		PA		Total		
				L	T	P			Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	
a	b	c	d	e	f	g	h(e+f+g)	i	j	k	l	m	n(j+l)	o	p	q	r	s	t(p+r)	u	v(n+t)
1	Basics of Electrical & Renewable Energy sources	BER	28013	3	--	4	7	--	--	--	--	--	--	--	50#$	25	50	25	100	50	100
2	Theory of Electrical & Thermal Utilities	TET	28110	4	2	--	6	1.5	70*#	35	30*	00	100	50	--	--	--	--	--	--	100
3	Energy Audit & Instruments	EAI	28014	4	--	4	8	--	--	--	--	--	--	--	50#$	25	50	25	100	50	100
4	Energy & Finance Management	EFM	28111	3	--	--	3	1.5	70*#	35	30*	00	100	50	--	--	--	--	--	--	100
5	Global Energy Scenario & Sustainability	GES	28015	2	--	4	6	--	--	--	--	--	--	--	50@	25	50	25	100	50	100
			Total	**16**	**02**	**12**	**30**	--	**140**	--	**60**	--	**200**	--	**150**	--	**150**	--	**300**	--	**500**

Student Contact Hours Per Week: **30 Hrs.** **Theory and practical periods of 60 minutes each.** Medium of Instruction: **English** Total Marks : **500**

Abbreviations: ESE- End Semester Exam, PA- Progressive Assessment, L - Lectures, T - Tutorial, P - Practical

@Internal Assessment, # External Assessment, *# On Line Examination

* The average of 2 test to be taken during the semester for the assessment.

#$ External PR ESE and average of 2 Skill tests / Practicals.

@$ Internal PR ESE and average of 2 Skill tests / Practicals.

If student remaining absent in PR-ESE shall be considered as ABSENT in PR-ESE.

- **Candidates not securing minimum marks for passing the "PA" part of practical of any course is declared as "Detained" for that semester.**
- **During Internship and Project period students shall attend Institute one day in a week to meet the mentor and appraise about the progress. The log book, Project Diary and Internship performance shall be recorded by the mentor for progressive assessment.**

Maharashtra State Board of Technical Education, Mumbai

Teaching and Examination Scheme

Programme Name : Advanced Diploma in Energy Management and Audit

Programme Code : EW **With Effect From Academic Year: 2023 - 24**

Duration of Program : One Year (Two Semesters) **Pattern : Semester (Full Time)** **Duration : 16 Weeks**

Semester : Second **Scheme : I**

S. N.	Course Title	Course Abbreviation	Course Code	Teaching Scheme			Credit (L+T+P)	Examination Scheme												Grand Total
								Theory							Practical					
								Exam Duration in Hrs.	ESE		PA		Total		ESE		PA		Total		
				L	T	P			Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	
a	b	c	d	e	f	g	h(e+f+g)	i	j	k	l	m	n(j+l)	o	p	q	r	s	t(p+r)	u	v(n+t)
1	Performance Assessment of Utilities & Energy Conservation Techniques	PAU	28207	4	2	--	6	1.5	70*#	35	30*	00	**100**	50	--	--	--	--	--	--	**100**
2	Project	PEW	28066	--	--	8	8	--	--	--	--	--	--	--	50#	25	50	25	**100**	50	**100**
3	Industrial Training	IAI	28067	--	--	16	16	--	--	--	--	--	--	--	100#	50	100	50	**200**	100	**200**
			Total	**04**	**02**	**24**	**30**	--	**70**	--	**30**	--	**100**	--	**150**	--	**150**	--	**300**	--	**400**

Student Contact Hours Per Week: **30 Hrs.** **Theory and practical periods of 60 minutes each.** Medium of Instruction: **English** Total Marks : **400**

Abbreviations: ESE- End Semester Exam, PA- Progressive Assessment, L - Lectures, T - Tutorial, P - Practical

@Internal Assessment, # External Assessment, *# On Line Examination

* The average of 2 test to be taken during the semester for the assessment.

#$ External PR ESE and average of 2 Skill tests / Practicals.

@$ Internal PR ESE and average of 2 Skill tests / Practicals.

If student remaining absent in PR-ESE shall be considered as ABSENT in PR-ESE.

- **Candidates not securing minimum marks for passing the "PA" part of practical of any course is declared as "Detained" for that semester.**
- **During Internship and Project period students shall attend Institute one day in a week to meet the mentor and appraise about the progress. The log book, Project Diary and Internship performance shall be recorded by the mentor for progressive assessment.**

Note : The Institute is required to sign MOU with related local industries for Internship/Industrial Training

PROGRAMME NAME : ADVANCED DIPLOMA IN ENERGY MANAGEMENT AND AUDIT

PROGRAMME CODE : EW

SEMESTER : FIRST

COURSE TITLE : BASICS OF ELECTRICAL & RENEWABLE ENERGY SOURCE

COURSE CODE : 28013

1. RATIONALE

Considering energy crises, the usage of renewable energy sources are essential. This subject will cover different streams of solar, wind energy and role of Government all over the world to promote use of the renewable energy sources.

This subject includes over all view of electrical power supply link from generation to end use. Selection of energy efficient electrical systems for operation & control is essential for saving in bills & thus it enumerates energy saving opportunities in industry.

2. COMPETENCY

- Use electrical utilities efficiently and promote renewable energy practices.

3. COURSE OUTCOMES

- Promote renewable energy sources
- Use of different streams of solar energy
- Use of different streams of wind energy
- Improve performance of power system
- Operate electrical machines efficiently
- Use lighting system efficiently

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit	Examination Scheme													
				Theory							Practical						
L	T	P	(L+T+P)	Paper Hrs.	ESE		PA		Total		ESE		PA		Total		
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
3	--	4	7	--	--	--	--	--	--	--	50#$	25	50	25	**100**	50	

(*): Under the theory PA, 30 marks is the average of 2 class tests of 30 marks each to be taken during the semester for the assessment.

***(#$) or (@$)** : Under the practical ESE - 50 Marks (100%)*
1) 30 Marks (60%) - For Practical – ESE
2) 20 Marks (40%) - Average of 2 Skill tests / Practicals of 30 marks each is to be conducted during the semester, and then should be converted to 20 marks.

Note: If student Remaining absent in PR-ESE shall be considered as ABSENT in PR-ESE

***Legends:** L-Lecture, T – Tutorial/Teacher Guided Theory Practice, P – Practical, ESE -End Semester Examination, PA - Progressive Assessment*
*@Internal Assessment, #External Assessment, *#Online Examination*

5. LIST OF PRACTICALS/ EXERCISES/ASSIGNMENTS/CASE STUDIES

Sr. No.	Name of Practical/ Exercise/ Assignment/ Case Study
1	Calculation of Electricity bills for various types of consumers or by various utility
2	Determination of kVAr rating of Power factor improvement devices.-capacitors
3	Perform load test and draw the characteristics of 3 phase induction motor.
4	Perform load test on transformer and determine efficiency
5	Study of various types of starters for Induction Motors.
6	Connect DOL starter for Induction Motors, start and reverse the direction
7	Start Induction Motors by star- delta starter and measure current in starting and running condition
8	Control Speed of Induction Motor by Voltage variation
9	Control Speed of Induction Motor by Frequency variation
10	Control Speed of Slip ring Induction Motor by Rotor Resistance Variation
11	Control Speed of Induction Motor by VFD
12	Case study of illumination system (lighting loads).
13	Design a Grid-connected rooftop solar PV system
14	Compare power consumption of Lamp by using conventional ballast and electronic ballast
15	Prepare report on different schemes implemented by Government Bodies (Like MNRE, BEE,MEDA)
16	Measurement of solar radiation by solar measurement kit
17	Measure voltage available across given solar cell, PV module and array for various combinations.
18	Collect the information on generators used in wind power plant
19	Visit to wind power plant & Identify components and sub components of wind power plant.
20	Collect the information on current Indian and World Energy Scenario and prepare report on it
21	Collect information about PV cells available in market & compare on the basis of rating ,cost , application & life etc.
22	Estimate ILER for given Premises by measuring lux level & lighting parameters
23	Visit to Solar Photovoltaic Installation (Industrial or residential)

Note: *Perform minimum 16 Experiments from the suggested list or Course Teacher can add few more experiments related to course.*

6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

Sr. No.	Equipment Name with Broad Specifications
1	1 phase Induction Motor
2	Capacitor Bank
3	3 phase Induction Motor
4	1 phase transformer
5	DOL starter
6	Star- delta starter
7	VFD
8	FTL Tube, conventional ballast and electronic ballast
9	Solar radiation kit
10	Solar cell, PV module
11	Rotor Resistance starter
12	Autotransformer
13	Alternator/ variable frequency source

7. THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to attain the identified competencies.

Unit	Topic and contents	Hours
I	**Role of Government Agencies for RE Implementation** 1.1 Current Energy Scenario & Need of renewable energy sources 1.2 Role of State & Central Govt. agencies 1.3 Facilitators 1.4 Scope for Entrepreneurship Development	**03**
II	**Electrical Renewable Sources– Solar Energy** 2.1 Fundamentals of Solar Thermal energy and Photovoltaic (PV) Technologies 2.2 Solar Energy potential, Solar Insolation & Solar Constant, solar radiation, and Measurement, types of solar energy collectors 2.3 Solar water heating systems for Industrial, Commercial and residential sectors 2.4 Solar thermal energy conversion 2.5 Solar photovoltaic system	**09**

Unit	Topic and contents	Hours
III	**Electrical Renewable Sources– Wind Energy, Bio-energy and Hydrogen Energy** 3.1 Wind Energy • Scope for Wind energy in India • Basic principles of wind energy generation • Site selection considerations for Wind Energy Generation • Basic components of wind energy conversion (generation) system • Types of wind turbine and wind turbine generators • Solar & wind hybrid system 3.2 Hydrogen Energy 3.3 Bioenergy 3.4 Battery Energy Storage	**09**
IV	**Basics of Electrical Power System** 4.1 Introduction to Electric Power Supply Systems 4.2 Concept of Power Grid 4.3 Concept of Maximum Demand and Power Factor 4.4 Electricity Billing & Tariff 4.5 Electrical Load Management & Maximum Demand Control 4.6 Power factor improvement- Methods & Benefits 4.7 System Distribution Losses (T & D Loss)	**09**
V	**Electrical Machines** 5.1 Electric Motors • Classification of Electric Motors • Induction Motor Characteristics • Speed control of Induction Motors • Motor Efficiency • Motor Selection • Factors affecting energy efficiency & minimizing motor losses • Energy Efficient Motors • BLDC Motors • Star Labeling of Motors • Rewinding effects on motor efficiency 5.2 D.G. Sets • Induction Generators • Synchronous Generators • D. C. Generators 5.3 Transformers • Types of Transformers, Transformer rating, • Losses and efficiency • Efficient operation of Transformers • Star labeling of Transformers	**09**
VI	**Lighting System** 6.1 Basic Terms of Illumination 6.2 Lamp Types– FTL, CFL, LED 6.3 Recommended Illumination levels for various tasks/activities 6.4 Lighting methods 6.5 Energy efficient lighting	**09**

Unit	Topic and contents	Hours
	6.6 Case Study Examples- Evaluation of number of lamps by considering factors. Estimation of ILER	
	Total	**48**

8. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (MOOCs) may be used to teach various topics/sub topics.

b. About 15-20% of the topics/sub-topics which is relatively simpler or descriptive in nature is to be given to the students for self-directed learning and assess the development of the COs through classroom presentations (see implementation guideline for details).

9. SUGGESTED LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication
1	Solar Energy - Principles of thermal collection and storage	S. P. Sukhatme & J. K. Nayak	McGraw Hill Education (India) Private Limited ISBN: 978-0-07-026064-1
2	Non-Conventional Energy Sources	G. D. Rai	Khanna Publication ISBN: 81-7409-073-8
3	Non-Conventional Energy Resources	B. H. Khan	McGraw Hill Education (India) Private Limited ISBN: 978-0-07-014276-3
4	Renewable Energy Technologies - A practical Guide for Beginners	Chetan Singh Solanki	PHI Learning Limited ISBN: 978-81-203-3434-2
5	Principles of Power System	V. K. Mehta	S. Chand Co. New Dehli ISBN: 978-81-219-2496-2
6	Electrical Technology : Ac And Dc Machines (volume - 2): AC and DC Machines	B L Theraja	S. Chand Co. New Dehli ISBN: 978-81-219-2437-5
7	Electrical Installation Estimation and Costing	J. B. Gupta	S.K. Kataria & Sons, ISBN: 978-93-501-4279-0

10. SOFTWARE/LEARNING WEBSITES

- http://www.freesunpower.com
- https://mnre.gov.in
- www.bee-india.com
- https://www.energy.gov/energysaver/water-heating/solar-water-heaters
- https://openei.org/wiki/Wind_energy
- https://nptel.ac.in/

PROGRAMME NAME : ADVANCED DIPLOMA IN ENERGY MANAGEMENT AND AUDIT

PROGRAMME CODE : EW

SEMESTER : FIRST

COURSE TITLE : THEORY OF ELECTRICAL AND THERMAL UTILITIES

COURSE CODE : 28110

1. RATIONALE

Thermal energy constituting a significant portion of energy consumption and Fuel bill in many industries offers huge potential. For thermal energy savings, performance evaluation of utility system is required

To evaluate performance; its basic working principle is to be known. This subject will cover basic principles of thermodynamics, and heat transfer for various thermal related applications and electrical utilities like HVAC, pump and compressor.

2. COMPETENCY

Use thermal utilities efficiently.

3. COURSE OUTCOMES

- Apply laws of thermodynamics
- Select suitable Air conditioning & refrigeration plants and cooling towers
- Determine heat capacity of gases, gaseous liquids, liquids, liquid mixtures
- Appropriate selection of Boiler, Furnaces & steam Systems
- Appropriate selection of Compressors
- Select suitable Pumps

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit	Examination Scheme													
				Theory							Practical						
L	T	P	(L+T+P)	Paper Hrs.	ESE		PA		Total		ESE		PA		Total		
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
4	2	--	6	1.5	70*#	35	30*	00	**100**	50	--	--	--	--	--	--	

(*): Under the theory PA, 30 marks is the average of 2 class tests of 30 marks each to be taken during the semester for the assessment.

***(#$) or (@$)** : Under the practical ESE - 50 Marks (100%)*
1) 30 Marks (60%) - For Practical – ESE
2) 20 Marks (40%) - Average of 2 Skill tests / Practicals of 30 marks each is to be conducted during the semester, and then should be converted to 20 marks.

Note: If student Remaining absent in PR-ESE shall be considered as ABSENT in PR-ESE

***Legends:** L-Lecture, T – Tutorial/Teacher Guided Theory Practice, P –Practical, **ESE** -End Semester Examination, **PA** - Progressive Assessment*
*@Internal Assessment, #External Assessment, *#Online Examination*

5. TUTORIAL ASSIGNMENTS

Tutorials should be planned to enhance learning. The faculty shall decide suitable assignments minimum one per unit based on the curriculum.

6. THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to attain the identified competencies.

Unit	Topic and contents	Hours	Marks
I	**Basics of thermodynamics and heat transfer** 1.1 Laws of thermodynamics 1.2 Thermodynamic cycles and its operations duel, Otto diesel and Rankine cycles. 1.3 Laws of Conduction, Convection, Radiation and its applications.	04	10
II	**HVAC, Refrigeration& Cooling** 2.1 HVAC, Refrigeration • Types of Refrigeration System (VC/ VA) • Common refrigerants & Properties • Compressor Types & Application • Selection of a suitable Refrigeration Plant • Coefficient of Performance (COP) • Performance Assessment of refrigeration plants • Factors affecting performance & energy efficiency of refrigeration plants • Energy labeling of Air Conditioners 2.2 Cooling Towers • Introduction • Types of Cooling Towers • Cooling Tower Performance • Efficient System Operation • Flow Control Strategies	14	12
III	**Stoichiometry** 3.1 Dimensional Analysis:-Dimensions & System of units 22 mole atomic weigh, molecular Weight, equivalent weight. 3.2 Fuels & Combustion:-Properties of oil, coal, gaseous fuels, Bio-mass briquettes ,combustion of Oil, Coal& Gas, Combustion Controls, Fuel Consumption & heat recovery. 3.3 Properties of air: - Psychometric, Chart & Theoretical methods. 3.4 Energy & material balance:- Material balances, definition of terms, Sankey Diagram, electrochemical reactions, metallurgical applications energy and thermochemistry, energy balances, heat capacity of gases, gaseous liquids, liquids, liquid mixtures, concept of latent heat.	14	12
IV	**Boiler, Furnaces &steam Systems** 4.1 Boiler accessories & mountings (water tubes & fire tube)	12	12

Unit	Topic and contents	Hours	Marks
	type & performance evaluations methods blow down techniques. 4.2 Indian Boiler Regulation 4.3 Furnaces, Classification of Furnaces, Performance evaluation method 4.4 Properties of steam, Steam distribution system , steam piping features, Insulation of steam piping , selection, operation & maintenance of steam traps, efficient use of steam 4.5 Steam Phase Diagram		
V	**Compressors** 5.1 Compressor types 5.2 Compressor Performance 5.3 Compressed Air System Components 5.4 Efficient Operation of Compressed Air Systems 5.5 Compressed Air leakages and its impact on system efficiency	**10**	**12**
VI	**Pumps** 6.1 Pump Types, Pump curves- Q-H characteristics 6.2 System Characteristics 6.3 Factors affecting pump performance 6.4 Efficient pumping system operation 6.5 Flow Control Strategies 6.6 Fans & Blowers • Introduction • Fans Types • Fan Design & Selection Criteria • Flow control Strategies	**10**	**12**
Total		**64**	**70**

7. SUGGESTED SPECIFICATION TABLE FORQUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Basics of thermodynamics and heat transfer	04	02	04	04	10
II	HVAC, Refrigeration & Cooling	14	02	06	04	12
III	Stoichiometry	14	02	06	04	12
IV	Boiler, Furnaces &steam Systems	12	02	06	04	12
V	Compressors	10	02	06	04	12
VI	Pumps	10	02	06	04	12
Total		**64**	**12**	**34**	**24**	**70**

Legends: R-Remember, U-Understand, A-Apply and above (Bloom's Revised taxonomy)
Note: The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

8. SUGGESTED LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication
1	Heat and Mass transfer	V. M. Domkundawar	Dhanpat Rai & sons, Dehli
2	Refrigeration and Air-conditioning	V.M.Domkundawar	Dhanpat Rai &Sons, Dehli
3	Power Plant Engineering	P.K .Nag	Tata McGraw Hill
4	Stoichiometry	B.Bhatt, S.M Vora	Tata McGraw Hill

9. SOFTWARE/LEARNING WEBSITES

- https://www.beeindia.gov.in/sites/default/files/3Ch4.pdf
- https://beeindia.gov.in/sites/default/files/3Ch7.pdf
- https://www.beeindia.gov.in/sites/default/files/2Ch2.pdf
- https://www.beeindia.gov.in/sites/default/files/2Ch3.pdf
- https://beeindia.gov.in/sites/default/files/3Ch3.pdf

PROGRAMME NAME : ADVANCED DIPLOMA IN ENERGY MANAGEMENT AND AUDIT

PROGRAMME CODE : EW

SEMESTER : FIRST

COURSE TITLE : ENERGY AUDIT AND INSTRUMENTS

COURSE CODE : 28014

1. RATIONALE

Considering current energy scenario, it becomes essential to judiciously use the available fuel stocks & look at other sources of energy viz. renewable. In this context the energy audit becomes an important tool to evaluate /assess the present consumption of energy & then suggest cost effective measures to reduce the energy consumption without affecting production & quality. The Students will be able to earn various technically proven ways to conserve energy & then prioritize them Based on the cost benefit analysis.

This subject will enables the students to Measure different parameters in energy auditing by various meters. Student will also learn simulation packages commonly used in energy management.

2. COMPETENCY

Use Energy Audit Instruments & Perform Energy Audit

3. COURSE OUTCOMES

- Use energy chart
- Carry out material & energy balance
- Use Energy Audit Instruments for Electrical Quantity
- Use relevant measuring instrument for gas analysis, temperature and light intensity measurements
- Use relevant measuring instrument for Pressure, velocity, Flow (Clear Liquid and Gaseous mediums), humidity and leakage detection system
- Follow Energy Action Planning steps

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit	Examination Scheme											
				Theory						Practical					
L	T	P	(L+T+P)	Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
4	--	4	8	--	--	--	--	--	--	--	50#$	25	50	25	100	50

(*): Under the theory PA, 30 marks is the average of 2 class tests of 30 marks each to be taken during the semester for the assessment.

***(#$) or (@$)** : Under the practical ESE - 50 Marks (100%)*
1) 30 Marks (60%) - For Practical – ESE
2) 20 Marks (40%) - Average of 2 Skill tests / Practicals of 30 marks each is to be conducted during the semester, and then should be converted to 20 marks.

Note: If student Remaining absent in PR-ESE shall be considered as ABSENT in PR-ESE

***Legends: L**-Lecture, **T** – Tutorial/Teacher Guided Theory Practice, **P** –Practical, **ESE** -End Semester Examination, **PA** - Progressive Assessment*
*@Internal Assessment, #External Assessment, *#Online Examination*

5. LIST OF PRACTICALS/ EXERCISES/ASSIGNMENTS/CASE STUDIES

Sr. No.	Name of Practical/ Exercise/ Assignment/ Case Study
1	Measure Current ,voltage & power of 1 phase circuit
2	Measure Current ,voltage & power of 3 phase circuit
3	Measure Power &power factor of Circuit
4	Measure power by tri-vector meter
5	Measure speed of Motor by contact / non-contact type tachometer
6	Measure Light intensity by Lux meter
7	Measure flue gas parameter
8	Measure temperature by thermometer and thermistor
9	Measure temperature by thermometer and RTD
10	Measure temperature by thermometer and thermocouple
11	Measure pressure by Bourdon Tube
12	Measure Liquid flow by Venturi Tube
13	Measure Liquid flow by Orifice
14	Measure Liquid flow by Rota meter
15	Measure velocity by Anemometer
16	Measure Humidity by Hygrometer
17	Prepare report on steps involved in energy audit with suitable example
18	Consider suitable example for energy process flow chart
19	Case study of material and energy balance
20	Prepare report on role and responsibilities of energy manager
21	Measure water flow for pump by using ultrasonic flow meter
22	Prepare report on Energy Conservation Act 2001& The Energy Conservation (Amendment) Act 2010, Draft Energy Conservation Act 2022
23	Prepare Report on The Electricity Act 2003 and Draft Amendment 2022

***Note:** Perform minimum 16 Experiments from the suggested list or Course Teacher can add few more experiments related to course.*

6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

Sr. No.	Equipment Name with Broad Specifications
1	Bourdon Tube set up with foot pump
2	Venturi Tube set up with manometer
3	Orifice Flow set up with manometer , flanges
4	Rota meter
5	Anemometer
6	Hygrometer
7	Tri-vector meter
8	Ammeter
9	Voltmeter
10	Wattmeter
11	Power factor meter
12	Tachometer contact type
13	Stroboscope / non-contact type tachometer
14	Lux meter
15	Clamp on meter
16	Ultrasonic flow meter

7. THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to attain the identified competencies.

Unit	Topic and contents	Hours
I	**Energy Audit** 1.1 Energy Audit – Types & Methodology 1.2 Energy Audit Reporting format 1.3 Understanding energy charts 1.4 Benchmarking & energy performance 1.5 Matching energy usage to requirement 1.6 Maximizing System 1.7 Fuel & Energy Substitution	**10**
II	**Material & Energy Balance** 2.1 Sankey Diagram & its use 2.2 Method for preparing process flow chart 2.3 Facility as an energy system 2.4 How to carry out material & energy balance	**10**

Unit	Topic and contents	Hours
III	**Energy Audit Instruments : Electrical Quantity Measurement** 3.1 Principal and working of Electrical Measuring Instruments (Voltmeter, ammeter, Clamp on meter, Wattmeter, Power Factor meter, Tri-vector meters, Tachometer contact / non- contact type) 3.2 Power Analyzer 3.3 Power Measurement Methods	10
IV	**Energy Audit Instruments for Measurement of gas analysis, temperature and light intensity** 4.1 Flue gas analyzer , Principal of measurements by Chemical Methods & Electronic Methods 4.2 Temperature Measurement - Contact type methods & Non – Contact type methods 4.3 Lux Measurement Methods	10
V	**Energy Audit Instruments for Measurement of Pressure, velocity, humidity and leakage detection system** 5.1 Pressure and velocity Measurement (Bourdon gauge, Manometers, Anemometer) 5.2 Flow Measurement methods - steam, water and air 5.3 Humidity Measurement 5.4 Water / Steam / Air Leakage detecting method	10
VI	**Energy Action** 6.1 Energy action planning steps 6.2 Top Management Support • Motivation of Employees • Location of energy Manager • Energy Manager–Responsibilities & duties to be assigned under Energy Conservation Act2001 6.3 Energy Policy and planning • Create action plan • Force Field Analysis 6.4 Implementation • Communicating • Training • Motivation	14
Total		**64**

8. SUGGESTED LEARNING RESOURCES

Sr. No	Title of Book	Author	Publication
1	Handbook on Energy audit &Management	Albert Thumann	River Publishers ISBN: 978-1466561625
2	Energy Management Handbook	Waynec.Turner	A Wiley Inter science Publication John Wiley & Sons.
3	Electrical Measurements	A.K.Sawhney	Khanna Publications
4	Introduction to chemical Engineering	Salil K. Ghosal, Shyamal Sanyal, Siddhartha Datta	Tata McGraw Hill Education Private Limited ISBN: 978-0074601402
5	Chemical Engineering	Coulson & Richardson	Butterworth-Heinemann ISBN: 978-0081010990

9. SOFTWARE/LEARNING WEBSITES

- https://beeindia.gov.in
- https://www.beestarlabel.com/
- https://nptel.ac.in

PROGRAMME NAME : ADVANCED DIPLOMA IN ENERGY MANAGEMENT AND AUDIT

PROGRAMME CODE : EW

SEMESTER : FIRST

COURSE TITLE : ENERGY AND FINANCE MANAGEMENT

COURSE CODE : 28111

1. RATIONALE

It is essential to identify the benefits of the proposed measure with reference to not only energy savings but also other associated benefits such as increased productivity, improved product quality. There commendation of Energy Audit will be meaningful only when they are Implementable. For this to happen, financial management becomes necessary, as the primary object of any organization would be to maximize the wealth at minimum cost.

This subject will correlate technical recommendations with financial aspects, packaging so as to make the investment in energy in cost effective manner.

2. COMPETENCY

Select appropriate technical recommendations and achieve the cost effective investment in energy.

3. COURSE OUTCOMES

- Use Energy Management Strategies
- Initialize and Organize Energy Management Programs
- Monitor and Target energy consumption
- Plan and monitor energy project
- Use Basics of Finance for implementing energy project
- Select Financing option for implementing energy efficiency projects

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit	Examination Scheme											
				Theory							Practical				
L	T	P	(L+T+P)	Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	--	--	3	1.5	70*#	35	30*	00	**100**	50	--	--	--	--	--	--

(*): Under the theory PA, 30 marks is the average of 2 class tests of 30 marks each to be taken during the semester for the assessment.

***(#$) or (@$)** : Under the practical ESE - 50 Marks (100%)*
1) 30 Marks (60%) - For Practical – ESE
2) 20 Marks (40%) - Average of 2 Skill tests / Practicals of 30 marks each is to be conducted during the semester, and then should be converted to 20 marks.

Note: If student Remaining absent in PR-ESE shall be considered as ABSENT in PR-ESE

***Legends:** L-Lecture, **T** – Tutorial/Teacher Guided Theory Practice, **P** –Practical, **ESE** -End Semester Examination, **PA** - Progressive Assessment*
*@Internal Assessment, #External Assessment, *#Online Examination*

5. THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to attain the identified competencies.

Unit	Topic and contents	Hours	Marks
I	**Energy Management** 1.1 Definition and Objective of Energy Management 1.2 Principle of Energy Management 1.3 Energy Management skills 1.4 Energy Management Strategies	03	10
II	**Initializing and Organizing** 2.1 Managing Energy Management Programs 2.2 Organizing Energy Management Programmers 2.3 Initializing Energy Management Programmers 2.4 Initializing Planning, Leading, Controlling, Promoting, Monitoring and Reporting.	09	12
III	**Energy Monitoring and Targeting** 3.1 Elements of Monitoring and Targeting System 3.2 A rationale for Monitoring, Target and Reporting 3.3 Data and Information Analysis 3.4 Relating Energy Consumption and Production Cumulative 3.5 KUSUM Technique 3.6 Case Study	09	12
IV	**Project Implementation** 4.1 Elements of project management 4.2 Principles of project planning relevant to energy projects 4.3 Project planning & monitoring techniques	09	12
V	**Financial Management** 5.1 Investment –Need, Appraisal & criteria 5.2 Time value of money 5.3 Financial analysis Technique--- • Simple payback period • Return on Investment • Net present value method 5.4 Internal rate of return method 5.5 Comparison of Net present value method & Internal rate of return method 5.6 Salvage Value	09	12
VI	**Options for Financing EE Projects** 6.1 Assessment of project cost 6.2 Determination for means of Financing 6.3 Sensitivity Analysis 6.4 Cash flow statement 6.5 Financing option for implementing energy efficiency projects 6.6 Financing equity/cash accrual	09	12

Unit	Topic and contents	Hours	Marks
	6.7 Loans from banks/institutions 6.8 Types of Energy Performance Contracts 6.9 Third Party Financing (ESCO)		
	Total	**48**	**70**

6. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Energy Management	03	2	4	4	10
II	Initializing and Organizing	09	2	6	4	12
III	Energy Monitoring and Targeting	09	2	6	4	12
IV	Project Implementation	09	2	6	4	12
V	Financial Management	09	2	6	4	12
VI	Options for Financing EE Projects	09	2	6	4	12
Total		**48**	**12**	**34**	**24**	**70**

Legends: R-Remember, U-Understand, A-Apply and above (Bloom's Revised taxonomy)
Note:. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

7. SUGGESTED LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication
1	Energy Management Handbook	Wayne C Turner	Wiley Inter Science Publication.
2	General Aspects of Energy Management &Energy Audit	-	Bureau of Energy Efficiency
3	Projects: Planning, Analysis, Selection, Financing, Implementation, and Review	Prasanna Chandra	McGraw Hill Education ISBN : 9332902572-978
4	Projects: Planning, Analysis, Selection, Financing, Implementation, and Review	S. Choudhary	McGraw Hill Education ISBN : 978-0074600689

8. SOFTWARE/LEARNING WEBSITES

- https://beeindia.gov.in/

PROGRAMME NAME : ADVANCED DIPLOMA IN ENERGY MANAGEMENT AND AUDIT

PROGRAMME CODE : EW

SEMESTER : FIRST

COURSE TITLE : GLOBAL ENERGY SCENARIO & SUSTAINABILITY

COURSE CODE : 28015

1. RATIONALE

Sustainable development is possible by use of sustainable energy and by ensuring access to affordable, reliable, sustainable, and modern energy for citizens. This subject will includes a rapid and global transition to renewable energy technologies to achieve sustainable growth and avoid catastrophic climate change. Renewable energy sources play a vital role in securing sustainable energy with lower emissions. It is accepted that renewable energy technologies will significantly cover the electricity demand and reduce emissions.

2. COMPETENCY

Use other source of renewable energy and achieve sustainability.

3. COURSE OUTCOMES

- Promote Energy security and energy strategies for future
- Promote Sustainable Development
- Use of environmental policy instruments
- Use of different streams of co-generation
- Use of Solar Energy Applications
- Use of other sustainable energy sources

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit	Examination Scheme												
				Theory							Practical					
L	T	P	(L+T+P)	Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
2	--	4	6	--	--	--	--	--	--	--	50@	25	50	25	100	50

(*): Under the theory PA, 30 marks is the average of 2 class tests of 30 marks each to be taken during the semester for the assessment.

***(#$) or (@$)** : Under the practical ESE - 50 Marks (100%)*
1) 30 Marks (60%) - For Practical – ESE
2) 20 Marks (40%) - Average of 2 Skill tests / Practicals of 30 marks each is to be conducted during the semester, and then should be converted to 20 marks.

Note: If student Remaining absent in PR-ESE shall be considered as ABSENT in PR-ESE

***Legends: L**-Lecture, **T** – Tutorial/Teacher Guided Theory Practice, **P** –Practical, **ESE** -End Semester Examination, **PA** - Progressive Assessment*
*@Internal Assessment, #External Assessment, *#Online Examination*

5. LIST OF PRACTICALS/ EXERCISES/ASSIGNMENTS/CASE STUDIES

Sr. No.	Name of Practical/ Exercise/ Assignment/ Case Study
1	Write report on current Indian Energy Scenario
2	Collect information on Energy Policies, Pricing & Reforms in India
3	Write report on Energy security and Energy strategy for future
4	Identify Global Environmental Issue and causes of Ozone layer depletion & Global Warming and prepare brief report on it.
5	Prepare brief report on 'United Nations framework convention on climate change (UNFCCC)' and 'Kyoto protocol'.
6	Collect information on Market Related Instrument to tackle global Warming – Clean Development Mechanism (CDM)
7	Prepare brief report on Global Environment and Sustainable Development
8	Collect detailed information on The conference of the parties (COP) and Prototype Carbon Fund(PCF)
9	Write report on case study of Financing Structures for CDM Projects in India
10	Write report on case study of Economics of a Gas Turbine based co-generation System
11	Collect information on Technical Options for Co-generation and Classification of Co-generation Systems
12	Collect information on Technical Parameters for Co-generation
13	Write report on Solar Furnace case study
14	Prepare brief report on Solar street light Government project
15	Collect information on Solar Green House and Solar Lantern
16	Write report on Solar Pump System and Mukhyamantri Saur Krushi Pump Yojana 2022
17	Collect information on Solar water heater
18	Prepare brief report on Biomass (Agro-Waste) Based Power Project in Maharashtra
19	Collect information on India's Wave, Tidal and Ocean Thermal Energy power potential
20	Write report on Geothermal Energy in India- Its Cost, opportunities.
21	Collect information on MHD Generator : Design, Working Principle & Its Applications
22	Write report on Sustainable Energy Systems: The Strategic Role of Chemical Energy Conversion
23	Write a Report on Energy Saving Certificates, Trading and Power Exchanges
24	Write Report on Gas Exchange and Carbon Trading
25	Report on National Action Plan for Climate Change (NAPCC)
26	Collect information on technologies used in Battery Electric Vehicles

Note: *Perform minimum 16 Experiments from the suggested list or Course Teacher can add few more experiments related to course.*

6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

Sr. No.	Equipment Name with Broad Specifications
1	IT Facility (7 PC)

7. THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to attain the identified competencies.

Unit	Topic and contents	Hours
I	**Energy Scenario & Sustainability** 1.1 Introduction 1.2 Types of energy sources 1.3 Indian energy Scenario 1.4 Sustainable Development Goals (SDGs) and India's progress. 1.5 Energy V/s economic growth 1.6 Energy Policies, pricing & reforms. 1.7 Energy security & Govt. Initiatives 1.8 Energy strategy for future	06
II	**Global Environment &Sustainability** 2.1 Global Environmental Issue 2.2 Ozone layer depletion 2.3 Global Warming 2.4 Climate change problem–United Nations framework convention on climate change (UNFCCC) 2.5 Global Climate Change–Theory the Kyoto protocol 2.6 The conference of the parties (COP) 2.7 Clean Development Mechanism (CDM) 2.8 Prototype Carbon Fund (PCF) 2.9 Sustainable Development. 2.10 Sustainable Development Goals	06
III	**Environmental policy instruments** 3.1 Market based Instruments and Non-Market based Instruments 3.2 CDM–Market Related Instrument to tackle global warming. 3.3 CDM–A possible source to finance EE project 3.4 Carbon Remission Reduction Certificates and Carbon Trading	04
IV	**Co-generation** 4.1 Need of Co-generation 4.2 Co- Generation and Energy efficiency 4.3 Classification co-generation 4.4 Case study.	04
V	**Solar Energy Applications** 5.1 Solar Furnace 5.2 Solar Street light - basic concept & components	06

Unit	Topic and contents	Hours
	5.3 Solar Green House 5.4 Solar Lantern-basic working 5.5 Solar Dryer-basic concept & application 5.6 Advanced Solar Cooker- concept 5.7 Solar water heating and pump system 5.8 Solar Still / Distillation	
VI	**Other Sustainable Energy Sources and technologies** 6.1 Biomass and Biogas Energy • Methods of obtaining energy from biomass and Biogas generation • Factors affecting yield of biogas plants and Properties & Characteristics of Biogas • Biofuels – Ethanol and Bio-diesel 6.2 Hydropower 6.3 Hydrogen energy 6.4 Other sources of renewable energy • Tidal Energy, Wave Energy and Ocean Thermal energy • Geothermal Energy • Magneto – Hydro Dynamic energy • Chemical energy Sources 6.5 Electric Vehicles 6.6 Energy Storage Device 6.7 Fuel cell	06
Total		**32**

8. SUGGESTED LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication
1	Solar Energy Utilization	G.D. Rai	Khanna & Khanna , New Dehli, ISBN: 978-8174091840
2	Non-Conventional energy source	G.D. Rai	Khanna & Khanna, NewDehli; ISBN: 978-8174090737
3	Sustainable Energy	J.W.Tester & M.Drate	Prentice Hall of India, New Dehli; ISBN: 978-0262201537

9. SOFTWARE/LEARNING WEBSITES

- https://climatepolicyinfohub.eu/market-based-climate-policy-instruments.html
- https://beeindia.gov.in/sites/default/files/1Ch9.pdf
- www.global warming.org

PROGRAMME NAME : ADVANCED DIPLOMA IN ENERGY MANAGEMENT AND AUDIT

PROGRAMME CODE : EW

SEMESTER : SECOND

COURSE TITLE : PERFORMANCE ASSESSMENT OF UTILITY & ENERGY CONSERVATION TECHNIQUE

COURSE CODE : 28207

1. RATIONALE

Evaluation of utility system focuses on assessing performance of utility. The subject is intended to assess the performance of boiler, furnace, fans and blowers, HVAC, pumps, compressor, electrical machines and identify areas for performance improvement by selecting suitable energy conservation techniques. Students will also understand features of Energy Conservation Act.

2. COMPETENCY

Evaluate performance and select suitable energy conservation technique for utility.

3. COURSE OUTCOMES

- Control environment pollution by minimizing waste
- Use waste heat recovery equipment
- Evaluate performance of Boilers, Furnaces and HVAC
- Select suitable Energy Conservation technique for Thermal utility
- Evaluate performance of Pumps, Fans, Blowers & Compressors and suggest appropriate Energy Conservation technique
- Evaluate performance of electrical machines and lighting system and suggest appropriate Energy Conservation technique

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit	Examination Scheme													
				Theory							Practical						
L	T	P	(L+T+P)	Paper Hrs.	ESE		PA		Total		ESE		PA		Total		
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
4	2	--	6	1.5	70*#	35	30*	00	100	50	--	--	--	--	--	--	

(*): Under the theory PA, 30 marks is the average of 2 class tests of 30 marks each to be taken during the semester for the assessment.

***(#$) or (@$)** : Under the practical ESE - 50 Marks (100%)*
1) 30 Marks (60%) - For Practical – ESE
2) 20 Marks (40%) - Average of 2 Skill tests / Practicals of 30 marks each is to be conducted during the semester, and then should be converted to 20 marks.

Note: If student Remaining absent in PR-ESE shall be considered as ABSENT in PR-ESE

***Legends:** L-Lecture, **T** – Tutorial/Teacher Guided Theory Practice, **P** –Practical, **ESE** -End Semester Examination, **PA** - Progressive Assessment*
*@Internal Assessment, #External Assessment, *#Online Examination*

5. TUTORIAL ASSIGNMENTS

Sr. No.	Name of Assignments
1	Write report on Energy Conservation Act 2001- Amendment Act (2010) , Draft Energy Conservation (Amendment) Bill 2022 & its features
2	Write report on Waste Minimization for industry case study
3	Collect information on role of environment pollution control board and write report on it.
4	Identify waste heat sources and suggest suitable waste heat recovery equipment for case study and prepare brief report on it.
5	Visitor observe video for boiler system and evaluate performance of boiler.
6	Suggest energy conservation techniques for improving boiler performance evaluated in experiment 5.
7	Visit or observe video for HVAC system and evaluate performance of HVAC system.
8	Suggest energy conservation techniques for improving HVAC system performance evaluated in experiment 7.
9	Visit or observe video for furnace and evaluate performance of furnace.
10	Suggest energy conservation techniques for improving furnace performance evaluated in experiment 9.
11	Visit or observe video for pump/ compressor/ fan/ blower operation system and evaluate performance of it. Also suggest suitable energy conservation techniques to improve performance .
12	Conduct no load test on induction motor and evaluate performance of motor. Also suggest suitable energy conservation techniques to improve performance
13	Conduct no load test on transformer and evaluate performance of transformer. Also suggest suitable energy conservation techniques to improve performance.
14	Connect motor in star and delta. Observe effect on current .
15	Suggest energy conservation techniques for lighting system of your lab.

6. THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to attain the identified competencies.

Unit	Topic and contents	Hours	Marks
I	**Energy conservation and Waste Minimization** 1.1 Energy conservation & its importance 1.2 The Energy Conservation Act 2001, its amendment and features 1.3 Waste minimization-Need, method & its classification 1.4 Effects of waste on environment & Role of pollution control board	04	06
II	**Waste Heat Recovery** 2.1 Classification of waste heat based on temperature 2.2 Benefits of Waste Heat Recovery- Direct benefit and indirect benefit	07	08

Unit	Topic and contents	Hours	Marks
	2.3 Determination of waste heat potential 2.4 Commercial Waste heat recovery equipment		
III	**Performance Evaluation of Boilers, Furnaces and HVAC** Steam load calculation 3.1 Flue gas analysis 3.2 Fuel flow & its property measurement 3.3 Temperature measurement 3.4 Calculations of direct & indirect efficiency based on gross & net calorific value. 3.5 Performance evaluation of electric furnace as per relevant codes 3.6 HVAC- • Specific energy calculations of chillers • COP determination	**11**	**12**
IV	**Energy Conservation In Thermal System** 4.1 Boiler & furnace 4.2 Steam distribution system 4.3 HVAC 4.4 Waste heat recovery 4.5 Insulation of pipes and all Hot surfaces 4.6 Condensate recovery 4.7 Fuel Handling 4.8 Other heat based application	**12**	**12**
V	**Performance Evaluation and Energy conservation of Pumps, Fans, Blowers &Compressors** 5.1 Pump- • Selection criteria for efficiency • System losses calculations • Series & parallel pumping operation • Pumping head rationalization • Performance assessment technique for pump 5.2 Fans Blowers & Compressors - • Measurement of air change • Duct sizing in AHU (air handling unit) • Flow & pressure measurement location and Methodology • Leakage testing of compressor • Pump-up test • Parametric evaluation of compressor • Performance testing of fans, blowers &compressors 5.3 Energy conservation in pumps, fans, blowers, compressors	**14**	**14**
VI	**Performance Evaluation and Energy Conservation of Electrical System** Performance evaluation of induction motors as per relevant codes 6.1 Performance evaluation of transformer as per relevant codes	**16**	**18**

Unit	Topic and contents	Hours	Marks
	6.2 Performance evaluation of Lighting system- • Selection of luminaries and Optimum use of luminaries • Lighting efficiency calculations 6.3 Energy Conservation techniques in motor- • Power factor improvement techniques • Effects of harmonics • Star-Delta conversion techniques • Variable speed drive (VSD) 6.4 Energy Conservation in Lighting System & Water heating System of housing and Commercial Building 6.5 Energy efficient building concept-Green building 6.6 Introduction to ECBC, PAT scheme		
Total		**64**	**70**

7. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Energy conservation and Waste Minimization	04	02	02	02	06
II	Waste Heat Recovery	07	02	02	04	08
III	Performance Evaluation of Boilers, Furnaces and HVAC	11	02	06	04	12
IV	Energy Conservation In Thermal System	12	02	06	04	12
V	Performance Evaluation and Energy conservation of Pumps, Fans ,Blowers &Compressors	14	02	08	04	14
VI	Performance Evaluation and Energy Conservation of Electrical System	16	04	10	04	18
Total		**64**	**14**	**34**	**22**	**70**

Legends: R-Remember, U-Understand, A-Apply and above (Bloom's Revised taxonomy)
Note: The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

8. SUGGESTED LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication
1	Electrical Technology : Ac And Dc Machines (volume - 2): AC and DC Machines	B L Theraja	S. Chand Co. New Dehli ISBN: 978-81-219-2437-5
2	Energy Performance Assessment for Equipment and Utility Systems	S.K. Awasthi	South Asian Publishers, New Delhi ISBN: 9788170031031
3	Process Plant Utility	Mr. Ashutosh Pandey	Vipul Prakashan
4	BEE Guide Books 2 & 3	---	---

9. SOFTWARE/LEARNING WEBSITES

- https://beeindia.gov.in/sites/default/files/2Ch8.pdf
- https://www.beeindia.gov.in/sites/default/files/4Ch2.pdf
- https://www.indiacode.nic.in/handle/123456789/2003?sam_handle=123456789/1362
- https://beeindia.gov.in/sites/default/files/4Ch8.pdf
- https://www.beeindia.gov.in/sites/default/files/3Ch6.pdf

PROGRAMME NAME : ADVANCED DIPLOMA IN ENERGY MANAGEMENT AND AUDIT

PROGRAMME CODE : EW

SEMESTER : SECOND

COURSE TITLE : PROJECT

COURSE CODE : 28066

1. RATIONALE

The main aim of the preparation of project is to judge the knowledge gained by the students during their tenure of the programme, the transfer of learning to useful socially relevant application. This will also help in various skills such as Personal, social, professional and lifelong learning.

The students will be benefited lot by this exercise of preparation of project on their experiences which will certainly add values in their attitudes such as value for health, work commitment, hardworking, honesty, problem solving, punctuality, loyalty and independent study. The Student should also make a brief presentation about the project and the salient observations and findings.

2. COMPETENCY

Implement Energy Conservation technique and prepare Energy Audit Report.

3. COURSE OUTCOMES

The student will be able to

- Carry out energy audit and financial aspects of the project
- Improve performance of system by using energy conservation techniques
- Carry out performance tests and performances and testing assessments.
- Handle Renewable energy projects.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit	Examination Scheme													
				Theory							Practical						
L	T	P	(L+T+P)	Paper Hrs.	ESE		PA		Total		ESE		PA		Total		
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
--	--	8	8	--	--	--	--	--	--	--	50#	25	50	25	**100**	50	

(*): Under the theory PA, 30 marks is the average of 2 class tests of 30 marks each to be taken during the semester for the assessment.

***(#$) or (@$)** : Under the practical ESE - 50 Marks (100%)*
1) 30 Marks (60%) - For Practical – ESE
2) 20 Marks (40%) - Average of 2 Skill tests / Practicals of 30 marks each is to be conducted during the semester, and then should be converted to 20 marks.

Note: If student Remaining absent in PR-ESE shall be considered as ABSENT in PR-ESE

***Legends:** L-Lecture, **T** – Tutorial/Teacher Guided Theory Practice, **P** –Practical, **ESE** -End Semester Examination, **PA** - Progressive Assessment*

*@Internal Assessment, #External Assessment, *#Online Examination*

5. IMPLEMENTATION STRATEGY

Candidate should be assigned Project preferably individually or if at all not possible can form a group of maximum 3 members. Every candidate must maintain the weekly progress diary and the guide should review the progress and sign the diary regularly.

Every candidate has to submit **Synopsis Report** (of pages not more than 10) and deliver Two Presentations for the completion of the Project.

First Presentation of Synopsis - to the Internal Guide tentatively during Third Week of the Academic Term.

Second Presentation on complete Project - to be given to the Internal Guide during Second Class Test schedule.

Contents of the Synopsis - It should include the following points

1. Cover Page of the Synopsis (Title of the Project, Student and Guide Details, Institute Name, Academic Year, Maharashtra State Board of Technical Education, Mumbai)
2. Index
3. Introduction
4. Need of the Project and Objectives
5. Problem Definition
6. Methodology
7. Action Plan

Evaluation of Practical-PA will be the average of two presentations, synopsis report and weekly progress diary maintained by the candidate.

There should not be any sort of typographical, diagrammatic and any other mistake/s in the final bound copy of the project report submitted by the candidate.

PROJECT REPORT CONTENTS

The Project report should essentially consists of the following details.

- COVER PAGE OF THE PROJECT
- CERTIFICATE FROM THE INSTITUTE
- ACKNOWLEDGEMENT
- TABLE OF CONTENTS
- ABSTRACT
- INTRODUCTION
- METHODOLOGY OF PROJECT
- RESULTS
- CONCLUSION AND FUTURE SCOPE
- ABOUT THE ORGANISATION / COMPANY (IN CASE OF INDUSTRY BASED PROJECTS)

- REFERENCES / BIBLIOGRAPHY

GUIDELINES FOR PREPARING THE PROJECT REPORT

Project work is a basic requirement for the award of Advanced Diploma. Project should be prepared based on any one of the subjects of the Programme. The project work should be comprehensive and cover all aspects of the management.

COVER PAGE OF THE PROJECT

The Cover Page of the Project Report must include Title of the Project, Student and Guide Details, Institute Name, Academic Year, Maharashtra State Board of Technical Education, Mumbai.

ACKNOWLEDGEMENT

It should appear on the third page and the report writer should acknowledge the guidance provided by the project guide. Here the author may also acknowledge other persons who might have rendered help or supplied the required data or information for completion of the project. It should be brief and crisp. Generally, one page should suffice for acknowledgement.

TABLE OF CONTENTS

It must consist of Chapter No., Name of the Chapter and Page Number.

ABSTRACT

Abstract should describe the entire project work with its aim, objectives and methodology and conclusion. The abstract should be limited to one or two pages.

INTRODUCTION

Give brief description of need, significance and applications of the Project. It is recommended to limit the description to about 2 to 5 pages.

METHODOLOGY

This is the most important part of the project and forms the main body of the project report. It needs very comprehensive coverage of all aspects.

It will be prudent to mention the methodology used for the project work, e.g., collecting information of various types of equipment/components, questionnaires, detailed study, working principle, operations, block diagram, structure, material used for designing of technical specifications, results etc. thereafter, detail procedure to achieve the project output.

Write-up can include mainly on some of the following areas:

- Implementation of Energy conservation techniques for lighting system
- Implementation of Energy conservation techniques in Industry
- Solar Power Water Pump Studies for Small-scale Irrigation
- Solar PV Plant Audit
- Audit conducted for Industry.
- Audit conducted for Hospital Building.
- Audit conducted for Educational Building

- Energy conservation in textile industries using heat pumps
- Solar Inverter For Grid Application
- Microcontroller based intelligent battery charger system operating at unity power factor
- Energy efficiency of paper drying
- Waste heat recovery in glass industry
- Analytical study and power prediction for flexible PV system
- Decision support system for hybrid energy systems for electricity
- Development of energy efficient electric drive for an electric vehicle
- Design and fabrication of room evaporative cooler - cum - electric heater for domestic applications
- Energy efficiency scenario for Maharashtra power sector
- Optimal power generation and scheduling
- Optimal placement and sizing of distributed generators in micro-grid
- Solar powered high brightness led lantern
- Impact of demand side management on power planning
- DSM in central air conditioning systems
- Potential of ECBC in Maharashtra

Relevant information and data presented in the form of tables and graphs are required to supplement your project report, should be included at the end as annexures with appropriate references in the main text of the project report. If an annexure is of more than one page, it should be provided with page numbering. Page numbering should be done individually for each annexure.

RESULT

It should content the experimentation results of the project.

CONCLUSION AND FUTURE SCOPE

Based on the project work, draw inferences, and mention future scope. The future scope should be specific, relevant and practically implementable.

ABOUT THE ORGANISATION / COMPANY (IN CASE OF INDUSTRY BASED PROJECTS)

Should mention organizational structure, product / services (limit 1 to 2 pages).

REFERENCES / BIBLIOGRAPHY

Mentions books, research papers, web sites referred in the report and in this section.

PROJECT REPORT FORMAT

Paper Size	-	A4
Printing	-	Only on one side of the sheet
Line Spacing of Paragraph	-	1 ½

Font Face	-	Times New Roman
Font Size	-	12 for Normal text, 14 for Sub-headings and 16 for Headings
No of Project Report copies	-	Two
Binding	-	Hard bound copies with Black cover (Golden Embossing)

PROGRAMME NAME : ADVANCED DIPLOMA IN ENERGY MANAGEMENT AND AUDIT

PROGRAMME CODE : EW

SEMESTER : SECOND

COURSE TITLE : INDUSTRIAL TRAINING

COURSE CODE : 28067

1. RATIONALE

Industrial training course is introduced to all Advance diploma programmes with the aim to imbibe the industry culture and professional practices in the students before they enter into world of work. By exposing and interacting with the real life industrial setting, student will appreciate and understand the actual working of an industry, best practices adopted in industry and other requirements in the industry or their chosen field of training.

The industrial needs such as the soft skills, life skills and hands-on practices are intended to be inculcated in the students through this training. This short association with the industry will be instrumental in orienting the students in transforming them to be industry ready after completion of diploma programme.

2. COMPETENCY

This course is intended to develop the following competencies:

- **Soft Skills** i.e. Communication, Presentation and others.
- **Life Skills** i.e. Time management, Safety, Innovation, Entrepreneurship, Team building and others
- **Hands-on Practices** i.e. Shop floor Implementation and Quality Assurance aspects.

3. COURSE OUTCOMES

The industrial training is intended to acquire the competencies as mentioned above to supplement those attained through several courses up to fourth semester of the program:

- Communicate effectively (verbal as well as written) to execute the work.
- Prepare the industry report of the executed work.
- Exercise time management and safety in the work environment.
- Work in teams for successful completion of projects assuring quality.
- Work on case studies/live projects

4. TEACHING & EXAMINATION SCHEME

Teaching Scheme			Credit	Examination Scheme													
				Theory							Practical						
L	T	P	(L+T+P)	Paper Hrs.	ESE		PA		Total		ESE		PA		Total		
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
--	--	16	16	--	--	--	--	--	--	--	100#	50	100	50	**200**	100	

(*): Under the theory PA, 30 marks is the average of 2 class tests of 30 marks each to be taken during the semester for the assessment.

***(#$) or (@$)** : Under the practical ESE - 50 Marks (100%)*
1) 30 Marks (60%) - For Practical – ESE

2) 20 Marks (40%) - Average of 2 Skill tests / Practicals of 30 marks each is to be conducted during the semester, and then should be converted to 20 marks.

Note: If student Remaining absent in PR-ESE shall be considered as ABSENT in PR-ESE

***Legends: L**-Lecture, **T** – Tutorial/Teacher Guided Theory Practice, **P** –Practical, **ESE** -End Semester Examination, **PA** - Progressive Assessment*
*@Internal Assessment, #External Assessment, *#Online Examination*

5. GENERAL GUIDELINES FOR INDUSTRIAL TRAINING

The Industries/Organizations can be Government/Public limited or Private family enterprises.

- **Duration of Industrial Training**: 8 weeks in Final Semester as per the credits of the programme
- **Training Area:** Students should be trained in Large and Medium scale Industry / Organization. However, despite the best efforts by the Institute, if large and medium scale Industry / Organization are not available to all students then, students can also be placed in Small scale Industry / Organization.
- **Skill Knowledge Partner (SKP) :**To be identified by the Institute as per their programme areas like

1. Energy consulting Pvt Ltd
2. Solar PV Plant/ solar equipment installation/ trouble shooting
3. Manufacturing Industry where EC techniques are implemented
4. Any relevant Industry where Energy audit can be performed
5. Industry related to energy efficient product
6. RE project
7. Any other relevant industry

6. EXPECTATIONS FROM Skill Knowledge Partner(SKP)

Helping institute in developing the following competencies among students

- Soft Skills i.e. Communication, Presentation and others.
- Life Skills i.e. Time management, Safety, Innovation, Entrepreneurship, Team building and others
- Hands-on Practices i.e. Shop floor Implementation and Quality Assurance aspects.

7. ROLE OF PARENT DEPARTMENT OF THE INSTITUTE

1. Collecting information about Industry / Organization available for training along with capacity.
2. Institutions have to enter in to MOU with number of SKPs (Industries/ Organizations) for accommodating all the enrolled students for the mandatory
3. Student and mentor allocation as per the slots available for in-plant training (Desirable mentor- student ratio is 1:15).
4. Communication with Industry / Organization available for training along with capacity and its confirmation.

5. Student enrollment for training.
6. Issuing letter to the Industry / Organization for the training along with details of students and mentors.
7. Principal/ HOD/ Faculty should address students about industrial safety norms, rules and discipline to be maintained in the Industry/ Organization during the training before relieving students for training.
8. The faculty member during the visit to Industry/ Organization will check the progress of the student in the training, his/ her attendance, discipline and project report preparation.
9. Mentors to carry out progressive assessment of the students during the training through Progressive Assessment (PA).
10. End Semester Examination (ESE) assessment by mentor along with Industry / Organization expert as external examiner

8. ROLES AND RESPONSIBILITIES OF THE STUDENTS

Following should be informed to students in the letter deputing them for the training, an undertaking for this should also be taken from them

a) Students would interact with the mentor to suggest choices for suitable Industry / Organization. If students have any contact in Industry / Organization (through their parents, relatives or friends) then same may be utilized for securing placement for themselves and their peers.

b) Students have to fill the forms duly signed by authorities along with training letter and submit it to training officer in the industry on the first day of training. Student should also carry with him/her the Identity card issued by institute during training period.

c) He/she will have to get all the necessary information from the training officer regarding schedule of the training, rules and regulations of the Industry / Organization and safety procedures to be followed. Student is expected to observe these rules, regulations, procedures.

d) Students should know that if they break any rule of industry or do not follow the discipline then industry can terminate the training and send back the student.

e) It is the responsibility of the student to collect information from Industry / Organization about quality assurance methods/specifications of machines and raw materials/maintenance procedures/ production planning/work ethics/professional practices/organizational structure etc.

f) During the training period students have to keep daily record of all the useful information in Log book

g) Maintain the Diary/Logbook and get it signed from mentor as well as Industry / Organization Training in-charge.

h) In case they face any major problem in industry such as an accident or any disciplinary issue then they should immediately report the same to the institute.

i) Prepare final report about the training for submitting to the department at the time of presentation and viva-voce and get it signed from mentor as well as Industry / Organization training in-charge.

9. FORMAT FOR TRAINING REPORT

Following is the suggestive format for the training report, actual format may differ slightly depending upon the nature of Industry / Organisation. The training report may contain the following

- Title page
- Certificate
- Abstract
- Acknowledgement
- Content Page

Chapter 1. Organizational structure of Industry / Organisation and General Lay Out

Chapter 2. Introduction of Industry / Organisation (Type of products and services, history, turn over and number of employees etc.)

Chapter 3. Types of major equipment/instruments/ machines used in Industry/ Orgainzation with their specification, approximate cost and specific use and their routine maintenance.

Chapter 4. Manufacturing Processes along with production planning and control methods and standard Operating procedures.

Chapter 5. Testing of raw materials, components and finished products along with quality assurance procedures.

Chapter 6. Major material handling product and procedures.

Chapter 7. Safety procedures followed

Chapter 8. Particulars of Practical Experiences in Industry / Organisation if any in Production/ Assembly/ Testing/Maintenance.

Chapter 9. Short report/description of the project (if any done during the training)

Chapter 10. Special/challenging experiences encountered during training if any (may include students liking & disliking of work places)

- References /Bibliography

10. SUGGESTED LEARNING STRATEGIES

Students should visit the website of the industry/Private firm where they are undergoing training to collect information about products, processes, capacity, number of employees, turnover etc. They should also refer the handbooks of the major machines and operation, testing, quality control and standard operating procedures and practices used in the industry. Students may also visit websites related to other similar industries as their learning resource. The training activity may vary according to nature and size of Industry / Organization. The details of activities to be completed during 8 weeks should be planned appropriately. The evaluation of Industrial training will be done on the basis of skills acquired by the student during this 8 weeks period.

ASSESSMENT SCHEME FOR INDUSTRIAL TRAINING

Training duration	PROGRESSIVE ASSESSMENT (Weekly report of all 8 week and attendance)		END SEMESTER ASSESSMENT (Seminar and Oral)		Total marks	
Eight Weeks	Max. marks	Min. marks	Max. marks	Min. marks	Max. marks	Min. marks
	100	50	100	50	200	100

EVALUATION SHEET FOR PA OF INDUSTRIAL TRAINING

Sr. No.	Enrollment Number	Name of Student	Marks by Mentor & Industry Supervisor jointly	Marks by Industry Supervisor	Marks by Mentor Faculty	Total Marks
			Out of 40 (A)	Out of 30 (B)	Out of 30 (C)	Out of 100 (A+B+C)

DISTRIBUTION OF END-SEMESTER-EXAMINATION (ESE) MARKS OF INDUSTRIAL TRAINING

Marks for Industrial Training Report	Marks for Seminar/ Presentation	Marks for Oral/Viva-voce	Total ESE marls
25	25	50	100