SARVAJANIK UNIVERSITY

Sarvajanik College of Engineering and Technology

Bachelor of Technology

Mechanical Engineering Department

B. Tech. Semester VI

Course Name: Energy Management **Course Code: BTME19653**

Type of course: **Minors – Energy Systems**

Prerequisite: Nil

Rationale of course: This course is prepared to provide detailed understanding of 3Es (Energy, Economics and Environment) and their interaction. Students will learn and understand energy conservation, energy management, energy audit, financial management and to enhance efficiency in different thermal utilities and systems.

Teaching and Examination Scheme:

Teaching scheme				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	100
4	0	0	4	60	25	15	00	00	

CA1: Continuous Assessment (assignments/projects/open book tests/closed book tests **CA2:** Sincerity in attending classes/class tests/ timely submissions of assignments/self-learning attitude/solving advanced problems **TEE:** Term End Examination **TEP:** Term End Practical Exam (Performance and viva on practical skills learned in course) **CA3:** Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in course

Contents:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1	**Energy Management & Audit:** Importance and Definition of energy management-approach to energy conservation in industry-definition of energy auditing -types of audit, methodology analysis of past trends plant data), closing the energy balance, laws of thermodynamics, measurements, portable and on line instruments	6	10%
2	**Financial Management :** Investment-need, financial analysis techniques simple payback period, return on investment, net present value, internal rate of return, cash flows, risk and	6	10 %

Sr. No.	Topics	Teaching Hrs.	Module Weightage
	sensitivity analysis; financing options, energy performance contracts and role of Energy Service Companies (ESCOs)		
3	**Energy Efficiency in Thermal Utilities and systems:** **Boilers:** Types, combustion in boilers, performances evaluation, analysis of losses, feed water treatment, blow down, energy conservation opportunities. Boiler efficiency calculation, evaporation ratio and efficiency for coal, oil and gas. **Steam System:** Properties of steam, assessment of steam distribution losses, steam leakages, steam trapping, condensate and flash steam recovery system, identifying opportunities for energy savings. Steam utilization, Performance assessment of steam system	**15**	**25 %**
4	**Electrical Systems:** Demand control, power factor correction, load scheduling/shifting, Motor drives- motor efficiency testing, energy efficient motors, motor speed control. **Insulation and Refractories:** Insulation-types and application, economic thickness of insulation, heat savings and application criteria, Refractory-types, selection and application of refractories, heat loss. Cold insulation.	**15**	**25 %**
5	**Heat Exchangers:** Types, networking, multiple effect evaporators, condensers, distillation column, etc., Energy saving in Heat exchanger. **Waste Heat Recovery:** Classification, advantages and applications, commercially viable waste heat recovery	**13**	**22 %**

Sr. No.	Topics	Teaching Hrs.	Module Weightage
	devices (recuperates, heat wheels, heat pipes, heat pumps), saving potential. **Cogeneration:** Definition, need, application, advantages, classification, saving potentials. Heat balance, steam turbine efficiency, tri-generation, micro turbine. combined topping cycles-impact of cogeneration		
6	**Energy Conservation:** Energy conservation in pumps, fans (flow control), compressed Air Systems, refrigeration & air conditioning systems.	**5**	**8%**

Percentage Distribution of Marks as per Bloom's Taxonomy (Theory/Practical):

% Distribution of Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
15	**30**	**25**	**15**	**10**	**5**

Legends: R: Remembrance, **U:** Understanding; **A:** Application, **N:** Analyze, **E:** Evaluate **C:** Create and above Levels

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

Sr. No.	Title of book /article	Author(s)	Publisher	Publication Year	Publication Edition
1	Energy Conservation Guidebook	Dale R Patrick, Stephen W Fardo,	Rivers publishers	2020	3rd
2	Handbook of Energy Audits,	Albert Thumann,Terry Niehus,William J.Younger	River Publishers	2012	9th
3	Bureau of Energy Efficiency	BEE	BEE	-	-
4	Energy Management Handbook	W.C. Turner, John Wiley and Sons,	River publication	2020	9th
5	Energy management and conservation	K.V.Sharma & P Venkataseshaiah	Dream tech Press	2020	-

Course Outcomes (COs):

Sr. No.	CO Statement After learning this subject, students will be able to	Marks % weightage
CO-1	Infer the concept of financial management and audit.	10
CO-2	Apply the knowledge of energy audit for the energy management and operation of energy audit instruments.	10
CO-3	Analyze the energy saving area and improvement in efficiency of various thermal utilities and systems.	25
CO-4	Identify the electrical system, insulation and refractories use for preventing heat loss.	25
CO-5	Analyse the waste heat recovery systems and implementation of insulation, refractories and cogeneration with the systems	22
CO-6	Interpret energy conservation in different devices like pumps, fans and refrigeration & air conditioning systems	8

Mapping of COs with Program Outcomes (POs & PSOs)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO-1	1	1	1	1	0	2	3	1	2	2	3	3			
CO-2	3	0	0	0	0	2	3	1	1	2	3	3			
CO-3	3	0	0	1	0	2	3	1	2	1	0	3			
CO-4	3	1	0	0	0	1	1	1	1	1	0	0			
CO-5	3	1	0	0	0	2	1	1	1	1	1	1			
CO-6	3	1	0	0	0	1	3	1	1	1	1	1			
Rationale*	**16**	**4**	**1**	**2**	**0**	**10**	**14**	**6**	**8**	**8**	**8**	**11**			

***Rationale - Mapping of COs with POs and COs with PSOs:**

It will help to develop engineering knowledge of energy conservation, energy management, energy audit and financial management. It helps to find solution in societal and environmental contexts also the knowledge used life-long learning in the broadest context of technological change.

This course highly maps with Program outcomes 1,6,7,9,10,11,12, it states that the course will develop Engineering knowledge, The engineer and society, Environment and sustainability, Individual and teamwork, Communication, Project management and finance, Life-long learning.

Assignments to be given as per the requirement of the course.

List of Open learning website:

1. https://nptel.ac.in/courses/112105221
2. https://nptel.ac.in/courses/108106022
3. https://onlinecourses.nptel.ac.in/noc20_mm20/preview
4. www.beeindia.gov.in