Buddha Institute of Technology

Gorakhpur

Department of Mechanical Engineering

ALLOTTMENT BASED ON COMPETENCY SKILLS

Academic Session: August – January 2023

Name of the Staff	Mr. Puneet Kumar Bhatia
Area of Specialization	Maintenance Engineering
Subject Allotted	Energy Science & Engineering

Sl. #	Course Code	Course Title	Semester	Theory/Practical
1.	KOE033	Energy Science & Engineering	III Semester	Theory

HOD

Course Outcome and Programme Outcome

Program	: B. Tech.
Branch	: ME
Semester	: III
Session	: 2022-23
Name of the Course	: Energy Science & Engineering
Code	: KOE033
Name of the Course Instructor	: Mr. Puneet Kumar Bhatia
Designation	: Assistant Professor
Department	: Mechanical Engineering

Description of the Course Outcome:

CO	After completion of the course students will be able to:
KOE-033.1	Understand the Units and scales of energy use, Mechanical energy and transport, Heat energy and Solid-state phenomena including photo, thermal and electrical aspects
KOE-033.2	Understand the Fundamental forces in the universe, Quantum mechanics relevant for nuclear science
KOE-033.3	Understand the Introduction to solar energy, fundamentals of solar radiation and its measurement aspects, Basic physics of semiconductors, first Generation Solar Cells, Second Generation Solar Cells, Third Generation Solar Cells
KOE-033.4	Understand the Conventional & non-conventional energy source
KOE-033.5	Understand the Systems and Synthesis, concept of Green Building and Green Architecture, Energy Audit of Facilities and optimization of energy consumption

Buddha Institute of Technology, Gorakhpur			
Department: Mechanical Engineering			
Academic Semester: August – January 2022			
Semester: III	Section: A	Course Code: KOE-033	Course: Energy Science & Engineering
Course Instructor: Mr. Puneet Kumar Bhatia		Contact Hours /week: 06	# of credits: 04
CIE Marks: 30		SEE Marks:70	Exam Hours: 03

Prerequisites if any:

Code No	Course Name	Description	Semester
Nil	Nil	Nil	Nil

Content delivery:	Chalk & Board, DLP, System/Laptop with social media videos

COURSE SYLLABUS:			
ModuleNo	**Contents of Module**	**Hrs**	**COs**
1	**Energy and its Usage:** Units and scales of energy use, Mechanical energy and transport, Heat energy: Conversion between heat and mechanical energy, Electromagnetic energy: Storage, conversion, transmission and radiation, Introduction to the quantum, energy quantization, Energy in chemical systems and processes, flow of CO2, Entropy and temperature, carnot and Stirling heat engines, Phase change energy conversion, refrigeration and heat pumps, Internal combustion engines, Steam and gas power cycles, the physics of power plants. Solid-state phenomena including photo, thermal and electrical aspects	**16**	**CO1**
2	**Nuclear Energy:** Fundamental forces in the universe, Quantum mechanics relevant for nuclear physics, Nuclear forces, energy scales and structure, Nuclear binding energy systematics, reactions and decays, Nuclear fusion, Nuclear fission and fission reactor physics, Nuclear fission reactor design, safety, operation and fuel cycles	**12**	**CO2**
3	**Solar Energy:** Introduction to solar energy, fundamentals of solar radiation and its measurement aspects, Basic physics of semiconductors, Carrier transport, generation and recombination in semiconductors, Semiconductor junctions: metal-semiconductor junction & p-n junction, Essential characteristics of solar photovoltaic devices, First Generation Solar Cells, Second Generation Solar Cells, Third Generation Solar Cells	**12**	**CO3**
4	**Conventional & non-conventional energy source:** Biological energy sources and fossil fuels, Fluid dynamics and power in the wind, available resources, fluids, viscosity, types of fluid flow, lift, Wind turbine dynamics and design, wind farms, Geothermal power and ocean thermal energy conversion, Tidal/wave/hydro power	**16**	**CO4**
5	**Systems and Synthesis:** Overview of World Energy Scenario, Nuclear radiation, fuel cycles, waste and proliferation, Climate change, Energy storage, Energy conservation. Engineering for Energy conservation: Concept of Green Building and Green Architecture; Green building concepts, LEED ratings; Identification of energy related enterprises that represent the breath of the industry and prioritizing these as candidates; Embodied energy analysis and use as a tool for measuring sustainability. Energy Audit of Facilities and optimization of energy consumption	**16**	**CO5**

COURSE OUTCOMES: At the end of the Course, the Student will be able to:

KOE-033.1	Understand the Units and scales of energy use, Mechanical energy and transport, Heat energy and Solid-state phenomena including photo, thermal and electrical aspects
KOE-033.2	Understand the Fundamental forces in the universe, Quantum mechanics relevant for nuclear science
KOE-033.3	Understand the Introduction to solar energy, fundamentals of solar radiation and its measurement aspects, Basic physics of semiconductors, first Generation Solar Cells, Second Generation Solar Cells, Third Generation Solar Cells
KOE-033.4	Understand the Conventional & non-conventional energy source
KOE-033.5	Understand the Systems and Synthesis, concept of Green Building and Green Architecture, Energy Audit of Facilities and optimization of energy consumption

Mapping of CO v/s PO:

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
KOE-033.1	3	2	3	–	–	–	–	–	–	–	–	–
KOE-033.2	3	2	3	–	–	–	–	–	–	–	–	–
KOE-033.3	3	2	3	–	–	–	–	–	–	–	–	–
KOE-033.4	3	2	3	–	–	–	–	–	–	–	–	–
KOE-033.5	3	2	3	–	–	–	–	–	–	–	–	–

Correlation levels: 1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

Mapping of CO v/s PSO:

	PSO1	PSO2
KOE-033.1	3	3
KOE-033.2	3	3
KOE-033.3	3	3
KOE-033.4	3	3
KOE-033.5	3	3

Gap in the syllabus	NA

Topics to be covered beyond syllabus	NA

Assessment Methodologies:

Sl. No.	Description	Type
1	Student Assignment	Direct
2	Internal assessment	Direct
3	University exam	Direct
4	Student feedback	Indirect
5	Alumni feedback	Indirect
6	Employers feedback	Indirect

LESSON PLAN

Lecture #	Module #	Topics	RBT Levels	Course Outcome Mapping	Planned Date	Actual Date	Faculty Sign	Remarks
1.	1	**Energy and its Usage:** Units and scales of energy use	L3	CO1	**29/8/22**			
2.		Mechanical energy and transport			**31/8/22**			
3.		Conversion between heat and mechanical energy			**1/9/22**			
4.		Storage, conversion flow of CO2 ,Transmission and radiation			**2/9/22**			
5.		Transmission and radiation Energy quantization			**3/9/22**			
		Tutorial-1			**5/9/22**			
6.		Energy in chemical systems and processes			**6/9/22**			
7.		Entropy and temperature			**7/9/22**			
8.		Carnot heat engine			**8/9/22**			
9.		Stirling heat engines,			**9/9/22**			
10.		Phase change energy conversion			**10/9/22**			
		Tutorial-2			**12/9/22**			

11.		Refrigeration and heat pumps			**13/9/22**			
12.		Internal combustion engines			**14/9/22**			
13.		Gas power cycles Identification of energy related enterprises that represent the breath of the industry and prioritizing these as candidates			**15/9/22**			
14.		Steam power cycles			**16/9/22**			
15.		The physics of power plants Embodied energy analysis and use as a tool for measuring sustainability,			**19/9/22**			
		Tutorial-3			**20/9/22**			
16.		Solid-state phenomena including photo			**21/9/22**			
17.		Thermal and electrical aspects			**22/9/22**			
18.		**Nuclear Energy:** Fundamental forces in the universe			**23/9/22**			
19.		Quantum mechanics relevant for nuclear physics,			**24/9/22**			
20.		Nuclear forces, energy scales and structure			**26/9/22**			
		Tutorial-4			**27/9/22**			
21.		Energy scales and structure			**28/9/22**			
22.		Energy scales and structure	**L3**	**CO2**	30/9/22			
23.		Quantum mechanics relevant for nuclear physics, Nuclear forces			**1/10/22**			
24.		Quantum mechanics relevant for nuclear physics, Nuclear forces			**3/10/22**			
		Tutorial-5			**5/10/22**			
25.		Nuclear binding energy systematics, reactions and decays			**6/10/22**			

26.		Nuclear binding energy systematics, reactions and decays			**7/10/22**			
27.		Nuclear binding energy systematics, reactions and decays			**8/10/22**			
28.		Nuclear fusion, Nuclear fission			**8/10/22**			
29.		Reactor design, safety, operation and fuel cycles			**10/10/22**			
		Tutorial-6			**12/10/22**			
30.	**2**	**Solar Energy:** Introduction to solar energy	**L3**	**CO3**	**13/10/22**			
31.		Introduction to solar energy			**14/10/22**			
32.		Fundamentals of solar radiation and its measurement aspects			**15/10/22**			
33.		Carrier transport, generation and recombination in semiconductors			**15/10/22**			
34.		Carrier transport, generation and recombination in semiconductors			**17/10/22**			
		Tutorial-7			**19/10/22**			
35.		Semiconductor junctions Metal-semiconductor junction			**20/10/22**			
36.		P-N junction Embodied energy analysis and use as a tool for measuring sustainability,			**21/10/22**			
37.		Essential characteristics of solar photovoltaic devices, First Generation Solar Cells			**22/10/22**			
		Tutorial-8			**22/10/22**			

38.		Essential characteristics of solar photovoltaic devices, First Generation Solar Cells			**29/10/22**			
39.		Essential characteristics of solar photovoltaic devices, First Generation Solar Cells			**31/10/22**			
40.		Essential characteristics of solar photovoltaic devices, First Generation Solar Cells			**4/11/22**			
41.		Second Generation Solar Cells, Third Generation Solar Cells			**5/11/22**			
		Tutorial-9			**5/11/22**			
42.		Conventional & non-conventional energy source: Conventional & non-conventional energy source			**7/11/22**			
43.	**3**	Biological energy sources and fossil fuels	**L2**	**CO4**	**9/11/22**			
44.		Fluid dynamics and power in the wind			**10/11/22**			
45.		Fluid dynamics and power in the wind			**11/11/22**			
46.		Fluid dynamics and power in the wind			**12/11/22**			
		Tutorial-10			**12/11/22**			
47.		Available resources Embodied energy analysis and use as a tool for measuring sustainability,			**17/11/22**			

48.		Fluids, viscosity Identification of energy related enterprises that represent the breath of the industry and prioritizing these as candidates			**18/11/22**			
49.		Types of fluid flow, lift			**19/11/22**			
50.		Wind turbine dynamics and design			**19/11/22**			
51.		Wind farms			**21/11/22**			
		Tutorial-11			**22/11/22**			
52.		Geothermal power Engineering for Energy conservation			**23/11/22**			
53.		Ocean thermal energy conversion Energy storage,			**24/11/22**			
54.	**4**	Systems and Synthesis: Overview of World Energy Scenario			**25/11/22**			
55.		fuel cycles, waste proliferation, Climate change	**L3**	**CO5**	**26/11/22**			
57.		Nuclear radiation proliferation, , Climate change			**26/11/22**			
58.		Concept of Green Building and Green Architecture			**28/11/22**			
59		Identification of energy related enterprises that represent the breath of the industry			**30/11/22**			
60.		Green building concepts, LEED ratings			**1/12/22**			

61.		prioritizing these as candidates			**2/12/22**			
62.		Energy conservation			**3/12/22**			
63.		Climate change proliferation			**6/12/22**			
64.		Concept of Green Building			**7/12/22**			
65.		Green Architecture			**8/12/22**			
66.		Identification of energy related enterprises that represent the breath of the industry and prioritizing these as candidates			**9/12/22**			
67.		Energy Audit of Facilities and optimization of energy consumption			**10/12/22**			
68.		Energy Audit of Facilities and optimization of energy consumption			**12/12/22**			
69.		Energy Audit of Facilities			**13/12/22**			
70.		optimization of energy consumption			**14/12/22**			
		Tutorial-12			**15/12/22**			
71.		Revision			**16/12/22**			
72.		Revision			**17/12/22**			
73.		Revision			**19/12/22**			
74.		Revision			**20/12/22**			
75.		Revision			**21/12/22**			
76.		Revision			**23/12/22**			
77.		Revision			**27/12/22**			
78.		Revision			**30/12/22**			

79.		Revision			31/12/22			
80.		Revision			6/01/23			
81.		Revision			7/01/23			
82.		Revision			9/01/23			
83.		Revision			10/01/23			
84.		Revision			11/01/23			
85.		Revision			12/01/23			
86.		Revision			13/01/23			
87.		Revision			15/01/23			
88.		Revision			18/01/23			
89.		Revision			19/01/23			
90.		Revision			20/01/23			
91.		Revision			21/01/23			
92.		Revision			23/01/23			
93.		Revision			24/01/23			
94.		Revision			25/01/23			
95.		Revision			26/01/23			

***L1 – Remembering; L2 – Understanding; L3 – Applying; L4 – Analysing; L5 – Evaluating; L6 - Creating**

Literature:

Reference Books:

1. Energy and the Challenge of Sustainability, World Energy Assessment, UNDP, New York, (2000).

2. Perspective of Modern Physics, A. Beiser, McGraw-Hill International Editions (1968).

3. Introduction to Modern Physics, H.S. Mani and G.K.Mehta, East-West Press (1988).

4. Introduction to Electrodynamics, D. J. Griffiths, Fourth Edition, Prentice Hall (2013).

5. Introductory Nuclear Physics, R. K. Puri and V.K. Babbar, Narosa Publishing House (1996).

6. Physics of Solar Cells: From Basic Principles to Advanced Concepts by Peter Wurfel, John Wiley & Sons, 2016

7. Principles of Solar Engineering**,** D.Y. Goswami, F.Kreith and J.F. Kreider, Taylor and Francis, Philadelphia, 2000.

Sample Questions:

Question No.	Questions
1.	*Explain the Units and scales of energy use.*
2.	*Brief the Mechanical energy and transport.*
3.	*Explain the Entropy and temperature*
4.	*How you will elaborate Phase change energy conversion ?*
5.	What are the most contentious issues surrounding nuclear energy?
6.	*What kind of resources does nuclear energy require? With this in mind, is it worth the effort and the investment to acquire nuclear energy?*
7.	*Are the impacts of the Chernobyl (Ukraine) and Three Mile Island (Pennsylvania) nuclear accidents still relevant today? If so, how?*
8.	*Exactly how important is nuclear power and nuclear waste?*
9	Are there any major advances in technology on the horizon that I should hold out for? (e.g., plastics, nano, thin film, etc.)
10	*Someone told me that the energy required to make PV panels is greater than they will every produce. True?*

Assessment rubrics that is going to be adopted for direct attainment is depicted in below table

Level of Achievement	Elaboration on Course Grading Description	Bench Mark Set (Out of 100)
Excellent (A)	The Student's performance is outstanding in almost all the intended course learning outcomes	***90 above***
Good (B)	The student's performance is good in most of the intended course learning outcomes.	***60-90***
Marginal (C)	The student's performance is barely satisfactory. It marginally meets the intended course learning outcomes	***35-60***
Fail (F)	The Students performance is inadequate. Student fails to meet many of the intended course learning outcomes	***Below 35***