AC – 20/05/2025
Item No. – 6.11 (R) (a)

As Per NEP 2020

I
University of Mumbai

Syllabus for Basket of Open Electives	
Faculty of Science	
Board of Studies in Physics	
UG First Year Programme:	
Semester	**II**
Title of Paper	**Credits**
1) Energy Sources – I **OR** **2) Energy Sources – II**	**2**
From the Academic Year	**2025-26**

SEM. - II

Syllabus of Scheme II
F. Y. B. Sc. Physics
(Semester- II)

Name of the Course: Physics – Open Elective Course 2
OE II: Energy Sources - I (2 Credits)

Sr. No.	Heading	Particulars
1.	**Description the course: (Including but not limited to**)	Introduction, relevance, Usefulness, Application, interest, connection with other courses, demand in the industry, job prospects etc.
2.	**Vertical:**	Major / Minor / **Open Electives** / Skill Enhancement / Ability Enhancement / Indian Knowledge System
3.	**Type:**	Theory
4.	**Credit**:	2 credits (1 credit = 15 Hours for Theory or 30 Hours of Practical work in a semester)
5.	**Hours Allotted:**	**30 Hours**
6.	**Marks Allotted**:	**50 Marks**
7.	**Course Objectives**: The students are expected to:	
	CO 1	understand the variety of energy sources, distinguishing between renewable and non-renewable options.
	CO 2	recognize the significance of solar energy and learn techniques for harnessing it.
	CO 3	know the use of Fossil fuels & Nuclear energy for energy conservation.
8.	**Course Outcomes**: On successful completion of this course students will be able to:	
	OC 1	comprehend the varieties of energy sources and differentiate between the renewable and non- renewable sources of energy, significance of solar energy and the different techniques to harness the solar energy
	OC 2	understand the need of renewable energy, non-conventional energy sources, Wind Energy, Tidal Energy, Wave energy systems.
	OC 3	Gain the knowledge about Key features, its importance, Merits & demerits of solar energy and its applications.
9.	**Modules / Units**: - There will be One module / Unit Per Credit	
	Module / Unit - I: Non-Renewable energy sources (15 Lectures)	
	1. Energy concept-sources in general, its significance & necessity. Classification of energy sources: Primary and Secondary energy, Commercial and Non-commercial energy, Renewable and Non-renewable energy, Conventional and Non-conventional energy, Based on Origin-Examples and limitations. Importance of Non-commercial energy resources. 2. Fossil fuels & Nuclear energy- production & extraction, usage rate and limitations. Impact on environment and their issues& challenges. Overview of Indian & world energy scenario with latest statistics- consumption & necessity. Need of eco-friendly & green energy & their related technology.	
	Module / Unit-II: Renewable energy sources 15 Lectures)	

<table>
<tr><td></td><td colspan="3">1. Need of renewable energy, non-conventional energy sources. An overview of developments in Offshore Wind Energy, Tidal Energy, Wave energy systems, Ocean Thermal Energy Conversion, solar energy, biomass, biochemical conversion, biogas generation, geothermal energy tidal energy, Hydroelectricity.

2. Solar Energy-Key features, its importance, Merits & demerits of solar energy, Applications of solar energy. Solar water heater, flat plate collector, solar distillation, solar cooker, solar green houses, solar cell -brief discussion of each. Need and characteristics of photovoltaic (PV) systems, PV models and equivalent circuits, and sun tracking systems.</td></tr>
<tr><td>10.</td><td colspan="3">Reference Books:
1. Non-conventional energy sources - G.D Rai - Khanna Publishers, New Delhi
2. Solar energy - M P Agarwal - S Chand and Co. Ltd.
3. Solar energy - Suhas P Sukhative Tata McGraw - Hill Publishing Company Ltd.
4. Dr. P Jayakumar, Solar Energy: Resource Assessment Handbook, 2009</td></tr>
<tr><td>11.</td><td colspan="3">Individual Passing in Internal and External Examination</td></tr>
<tr><td rowspan="2">12.</td><td colspan="2">Internal Continuous Assessment (40%)
(20 Marks)</td><td>External Assessment, (60%)
(30 Marks)</td></tr>
<tr><td colspan="2">Continuous Evaluation through:
Quizzes, Class Tests, presentation, project, role play, creative writing, assignment etc. (at least 3)</td><td>Evaluation: through Exam at the End of the Semester / Term.</td></tr>
<tr><td rowspan="3">13.</td><td colspan="3">Format of Question Paper for Physics – OE Term End Examination for 30 Marks:
Duration of the Term End Examination: One Hour</td></tr>
<tr><td>Unit - I (15 Marks)</td><td colspan="2">Q.1 A) Attempt any Two 10 Marks
i) Theory
ii) Theory
iii) Theory
iv) Theory
B) Attempt any One 05 Marks
i) Problem / Theory
ii) Problem</td></tr>
<tr><td>Unit – II (15 Marks)</td><td colspan="2">Q.2 A) Attempt any Two 10 Marks
i) Theory
ii) Theory
iii) Theory
iv) Theory
B) Attempt any One 05 Marks
i) Problem / Theory
ii) Problem</td></tr>
</table>

Name of the Course: Physics – Open Elective Course 2
OE II: Energy Sources - II (2 Credits)

Sr. No.	Heading	Particulars
1.	**Description the course: (Including but not limited to**)	Introduction, relevance, Usefulness, Application, interest, connection with other courses, demand in the industry, job prospects etc.
2.	**Vertical:**	Major / Minor / **Open Electives** / Skill Enhancement / Ability Enhancement / Indian Knowledge System
3.	**Type:**	Theory
4.	**Credit**:	2 credits (1 credit = 15 Hours for Theory or 30 Hours of Practical work in a semester)
5.	**Hours Allotted:**	**30 Hours**
6.	**Marks Allotted**:	**50 Marks**
7.	**Course Objectives**: The students are expected to:	
	CO 1	grasp the concept of wave formation and standing wave patterns.
	CO 2	analyze both longitudinal and transverse waves. Explore wind energy and methods to generate electrical power from wind.
	CO 3	evaluate the impact of conventional energy sources on climate. Appreciate how different energy sources contribute to technological development.
	CO 4	understand the problems of global warming and its climatic consequences.
	CO 5	develop a sense of responsibility toward sustainable energy usage.
8.	**Course Outcomes**: On successful completion of this course students will be able to:	
	OC 1	gain the idea of the formation of waves and standing wave pattern, analysis of longitudinal and transverse waves, the knowledge of wind energy and the methods to tap the energy from the blowing wind to generate electrical power.
	OC 2	understand the conventional energy sources and its impact on the climate, the different energy sources and how they are beneficial for the development of Technology.
	OC 3	understand the problems of global warming and other climatic impact of the reckless usage of energy resources.
9.	**Modules / Units**: - There will be One module / Unit Per Credit	
	Module / Unit - I: Wind and Tidal Energy harvesting (15 Lectures)	
	1. Fundamentals of Wind energy, Wind Turbines and different electrical machines in wind turbines, Power electronic interfaces, and grid interconnection topologies. 2. Ocean Energy Potential against Wind and Solar, Wave Characteristics and Statistics, Wave Energy Devices. Tide characteristics and Statistics, Tide Energy Technologies, Ocean Thermal Energy.	
	Module / Unit-II: Renewable energy sources 15 Lectures)	
	Geothermal Resources, Geothermal Technologies. Hydropower resources, hydropower technologies, environmental impact of hydro power sources. Carbon captured technologies, cell, batteries, power consumption.	

<table>
<tr><td>10.</td><td colspan="3">Reference Books:
1. Godfrey Boyle, “Renewable Energy, Power for a sustainable future”, 2004, Oxford University Press, in association with The Open University.
2. J. Balfour, M. Shaw and S. Jarosek, Photovoltaics, Lawrence J Goodrich (USA).
3. http://en.wikipedia.org/wiki/Renewable_energy</td></tr>
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ii) Theory
iii) Theory
iv) Theory
B) Attempt any One 05 Marks
i) Problem / Theory
ii) Problem</td></tr>
</table>

Letter Grades and Grade Points:

Semester GPA/ Programme CGPA Semester / Programme	% of Marks	Alpha-Sign / Letter Grade Result	Grading Point
9.00 - 10.00	90.0 - 100	**O** (Outstanding)	10
8.00 < 9.00	80.0 < 90.0	**A+** (Excellent)	9
7.00 < 8.00	70.0 < 80.0	**A** (Very Good)	8
6.00 < 7.00	60.0 < 70.0	**B+** (Good)	7
5.50 < 6.00	55.0 < 60.0	**B** (Above Average)	6
5.00 < 5.50	50.0 < 55.0	**C** (Average)	5
4.00 < 5.00	40.0 < 50.0	**P** (Pass)	4
Below 4.00	Below 40.0	**F** (Fail)	0
Ab (Absent)	-	**Ab** (Absent)	0

Sd/-

Sign of the BOS Chairman
Dr. T.N. Ghorude
Board of Studies in Physics

Sd/-

Sign of the
Offg. Associate Dean
Dr. Madhav R. Rajwade
Faculty of Science & Technology

Sd/-

Sign of the
Offg. Dean
Prof. Shivram S. Garje
Faculty of Science & Technology