FOUR YEARS UNDERGRADUATE PROGRAM (2024-28)
DEPARTMENT OF PHYSICS
COURSE CURRICULUM

PART – A: INTRODUCTION

Program: Bachelor in Science (Certificate/ Diploma/ Degree/ Honors)	Semester: I/ III/ V	Session: 2024-25

1	Course Code	PHVAC-01		
2	Course Title	Renewable Energy and Energy Harvesting		
3	Course Type	Value Addition Course		
4	Pre-requisite (if any)	As per Program		
5	Course Learning Outcomes (CLO)	Objective of the course is to impart students; the knowledge of renewable energy and they are expected to learn about: ➢ Energy crisis at national and international scenario. ➢ Renewable sources of energy and their importance. ➢ Availability of renewable energy resources in India. ➢ Knowledge about energy harvesting technology.		
6	Credit Value	02 Credits	1 Credit = 15 Hours- Learning & Observation	
7	Total Marks	Maximum Marks: 50		Minimum Pass Marks: 20

PART – B: CONTENT OF THE COURSE

Total No. of Teaching–learning Periods (01 Hr. per period) - 30 Periods (30 Hours)

Unit	Topics	No. of Period
I	**Fossil fuels and Alternate Sources of energy:** Fossil fuels and nuclear energy, their limitation, need of renewable energy, non-conventional energy sources. Limitations of non-conventional energy resources. Environmental aspect of energy, World energy status, Energy scenario in India. **Geo thermal Energy**: Geothermal Resources, Geo thermal Technologies.	07
II	**Solar energy:** Solar energy, its importance, storage of solar energy, solar pond, non-convective solar pond, applications of solar pond and solar energy, solar water heater, flat plate collector, solar distillation, solar cooker, solar green houses, solar cell, absorption air conditioning. Need and characteristics of photovoltaic (PV) systems, sun tracking systems. **Hydro Energy**: Hydro power resources, hydro power technologies, environmental impact of hydro power sources.	08
III	**Biomass energy:** Biomass resources, Biomass conversion technology, biogas generation, factors affecting bio-digestion, working of biogas plant (with block diagram), biogas from plant waste, biomass energy programme in India, Biodiesel production from non-edible oil seeds. **Ocean Energy**: Ocean Energy Potential against Wind and Solar, Wave Characteristics and Statistics, Wave Energy Devices.	08
IV	**Wind Energy harvesting**: Fundamentals of Wind energy, Wind Turbines and different electrical machines in wind turbines. grid interconnection topologies. **Piezoelectric Energy harvesting:** Introduction, Physics and characteristics of piezoelectric effect, piezoelectric materials, Piezoelectric Energy harvesting applications.	07
Keywords:	Fossil fuel, Renewable energy sources, Solar energy, Biomass energy, Electromagnetic Energy Harvesting, Piezoelectric Energy harvesting.	

Signature of Convener & Members (CBoS):

PART – C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended-

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. Godfrey Boyle, "Renewable Energy, Power for a sustainable future", 2004, Oxford University Press, in association with The Open University.
5. Dr. P Jayakumar, Solar Energy: Resource Assesment Handbook, 2009
6. J. Balfour, M. Shaw and S. Jarosek, Photovoltaics, Lawrence J Goodrich (USA).

Reference Books Recommended-

1. Non-Conventional Energy Resources by B.H. Khan
2. Renewable Energy Sources and Emerging Technologies by D.P. Kothari, K.C. Singal, and Rakesh Ranjan
3. Solar Energy: Fundamentals, Design, Modelling and Applications by G.N. Tiwari
4. Hydropower Development in India: A Sector Assessment by Pradeep Chaturvedi
5. Biomass Conversion: The Interface of Biotechnology, Chemistry and Materials Science by Samir K. Khanal, edited by B.C. Meikap and P.K. Bhattacharya
6. Ocean Energy: Technology, Environmental Impact and Renewable Energy by Pranav Kumar and T. Balaji
7. Wind Energy: Theory and Practice by S. Rao and Dr. B.B. Parulekar
8. Piezoelectric Materials and Devices: Applications in Engineering and Medical Sciences by Arun Ghosh

Online Resources (e-books/ learning portals/ other e-resources)

1. http://en.wikipedia.org/wiki/Renewable_energy
2. Renewable Energy Engineering: Solar, Wind And Biomass Energy Systems - Course (nptel.ac.in)
3. Technologies For Clean And Renewable Energy Production – NPTEL+
4. NPTEL :: Mechanical Engineering - NOC:Selection Of Nanomaterials For Energy Harvesting And Storage Application
5. Wind energy Labs : Mechanical Engineering : Amrita Vishwa Vidyapeetham Virtual Lab
6. Virtual Labs (vlabs.ac.in)
7. https://youtu.be/uY3x7Tycyps

PART – D: ASSESSMENT AND EVALUATION

Suggested Continuous Evaluation Methods:

Maximum Marks:	**50 Marks**
Continuous Internal Assessment (CIA):	**15 Marks**
End Semester Exam (ESE):	**35 Marks**

Continuous Internal Assessment (CIA): (By course teacher)	Internal Test/ Quiz- (2): **10 + 10** Assignment/ Seminar+ Attendance- **05** Total Marks- **15**	Better marks out of the two Test / Quiz + marks obtained in Assignment shall be considered against **15** Marks.
End Semester Examination (ESE):	**Two section – A & B** Section **A**: **Q1**. Objective – **05 x1= 05** Mark; **Q2**. Short answer type- **5x2 =10Marks** Section **B**: Descriptive answer type qts.,**1 out of 2** from each unit- **4x05 =20 Marks**	

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