P.R. GOVERNMENT COLLEGE (A), KAKINADA
III B.Sc Physics Paper – VIII(C 3) – Semester – VI
w.e.f. 2017-18 ADMITTED BATCH
Course Code : Cluster Elective VIII(C 3) **No. of credits : 03**

Cluster Elective Paper VIII(C 3): Energy storage devices

No. of Hours per week: 03 **Total Lectures:45**

UNIT-I (5 hrs)
1. Energy Storage: Need of energy storage; Different modes of energy storage, Flywheel storage, Electrical and magnetic energy storage: Capacitors, electromagnets

UNIT-II (5 hrs)
2. Chemical Energy storage: Thermo-chemical, photo-chemical, electro-chemical, Hydrogen for energy storage.

UNIT-III (9 hrs)
3. Electrochemical Energy Storage Systems: Batteries: Primary, Secondary, Lithium, Solid-state and molten solvent batteries; Lead acid batteries; Nickel Cadmium Batteries; Advanced Batteries. Role of carbon nano-tubes in electrodes

UNIT-IV (9 hrs)
4. Magnetic and Electric Energy Storage Systems: Superconducting Magnet Energy Storage(SMES) systems; Capacitor and battery: Comparison and application; Super capacitor.

UNIT-V (8 hrs)
5. Fuel Cell: Fuel cell definition, difference between batteries and fuel cells, fuel cell components, principle and working of fuel cell, performance characteristics, efficiency, Advantages and disadvantages of fuel cell.

UNIT-VI (9 hrs)
6. Types of Fuel Cells: Classification, Alkaline fuel cell, phosphoric acid fuel cell, molten carbonate fuel cell; solid oxide fuel cell, proton exchange membrane fuel cell, applications of fuel cells.

Reference Books:

1. J. Jensen and B. Squrensen, Fundamentals of Energy Storage, John Wiley, NY, 1984.
2. M. Barak, Electrochemical Power Sources: Primary and Secondary Batteries by, P. Peregrinus,IEE,1980.
3. P.D.Dunn, Renewable Energies, Peter Peregrinus Ltd, London, 1986.
4. B.Viswanathan and M. A. Scibioh, Fuel Cells-Principles and Applications, University Press, 2006.
5. Hart, A.B and G.J.Womack, Fuel Cells: Theory and Application, Prentice Hall, NewYork, 1989.

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Energy storage devices

Note:- Set the question paper as per the blue print given at the end of this model paper.

Time: 2 1/2 Hrs. Max. Marks: 60

Section	Questions to be given	Questions to be answered	Marks
A	5	3	3 x 10M = 30M
B	9	6	6 x 5 M = 30M
Total	14	9	60M

Blue Print

Module	Essay Questions 10 marks	Short Questions 5 marks	Marks allotted
I	1	---	10
II	---	2	10
III	1	2	20
IV	1	1	15
V	1	2	20
VI	1	2	20
Total			95

QUESTION BANK

SUBJECT: PHYSICS **PAPER: VIII C3** **SEMESTER: VI**

Energy storage devices

UNIT – I (Energy Storage)

Essay Questions – 10 M

1. Explain Flywheel storage, Electrical and Magnetic energy storages.
2. Explain how capacitors and electromagnets are used for energy storage.

UNIT – II (Chemical Energy storage)

Short Questions – 5 M

3. Explain thermo - chemical energy storage.
4. Explain photo - chemical energy storage.
5. Explain electro - chemical energy storage.
6. Explain how Hydrogen is used as energy storage.

UNIT – III (Electrochemical Energy Storage Systems)

Essay Questions – 10 M

7. Discuss solid state and molten solvent batteries.
8. Discuss Lead acid batteries and Nickel Cadmium Batteries.

Short Questions – 5 M

9. Discuss the role of carbon nano tubes in electrodes.
10. Write a note on Lithium batteries.
11. What are Primary & Secondary cells? What are its uses and defects.

UNIT – IV (Magnetic and Electric Energy Storage Systems)

Essay Questions – 10 M

12. Explain super conducting magnet energy storage(SMES) systems.
13. Compare capacitor and battery and write its applications.

Short Questions – 5 M

14. Write a note on super capacitors.

UNIT – V (Fuel Cell)

Essay Questions – 10 M

15. Explain the principle and working of a fuel cell. Derive the efficiency of a fuel cell.

Short Questions – 5 M

16. Write the differences between Batteries and fuel cells.
17. Write the advantages and disadvantages of fuel cells.
18. What is fuel cell? Write its components.

UNIT – VI (Types of Fuel Cells)

Essay Questions – 10 M

19. Classify fuel cells. Explain Alkaline fuel cell and Phosphoric acid fuel cell.
20. Classify fuel cells. Explain Molten carbonate fuel cell and Solid oxide fuel cell.

Short Questions – 5 M

21. Explain proton exchange membrane fuel cell.
22. Write application of fuel cells.