



SRI KRISHNADEVARAYA UNIVERSITY:: ANANTAPURAMU

UG CBCS SYLLABUS

VI Semester

(2017-2018)

B.Sc., PHYSICS

VI SEMESTER- SYLLABUS

(AS PER CBCS AND SEMESTER SYSTEM)

III YEARS

w.e.f. 2017-2018



**AP STATE COUNCIL OF HIGHER EDUCATION
CBCS - PATTERN FOR PHYSICS**

Andhra Pradesh State Council of Higher Education
B.Sc. PHYSICSSYLLUBUS UNDER CBCS
w.e.f. 2015-16 (Revised in April 2016)

First Semester

Paper I : Mechanics & Properties of Matter

Practical I (Lab-1)

Second Semester

Paper II: Waves & Oscillations

Practical 2 (Lab2)

Third Semester

Paper III: Wave Optics

Practical 3.(Lab 3)

Fourth Semester

Paper IV: Thermodynamics & Radiation Physics

Practical 4.(Lab 4)

Fifth Semester

Paper V: Electricity, Magnetism & Electronics

Paper VI: Modern Physics

Practical 5.(Lab 5)

Practical 6.(Lab 6)

Sixth Semester

Paper VII: Elective (One)

Paper VIII: Cluster Electives (Three)

Practical 7(Lab 7)

Practical 8.(Lab 8)

Proposed Electives in Semester - VI

Paper – VII (one elective is to be chosen from the following)

Paper VII-(A): Analog and Digital Electronics

Paper VII-(B): Materials Science

Paper VII-(C): Renewable Energy

Paper – VIII (one cluster of electives (A-1,2,3 or B-1,2,3 or C-1,2,3) to be chosen *preferably* relating to the elective chosen under paper – VII (A or B or C))

Cluster 1.

Paper VIII-A-1. Introduction to Microprocessors and Microcontrollers

Paper VIII-A-2. Computational Physics and Programming

Paper VIII-A-3. Electronic Instrumentation

Cluster 2

Paper VIII-B-1. Fundamentals of Nanoscience

Paper VIII-B-2. Synthesis and Characterization of Nanomaterials

Paper VIII-B-3. Applications of Nanomaterials and Devices

Cluster 3

Paper VIII-C-1. Solar Thermal and Photovoltaic Aspects

Paper VIII-C-2. Wind, Hydro and Ocean Energies

Paper VIII-C-3. Energy Storage Devices

NOTE: Problems should be solved at the end of every chapter of all Units.

1. Each theory paper is of 100 marks and practical paper is also of 50 marks.

Each theory paper is 75 marks University Exam (external) + 25 marks mid Semester Exam (internal). Each practical paper is 50 marks external

2. The teaching work load per week for semesters I to VI is 4 hours per paper for theory and 2 hours for all laboratory (practical) work.

3. The duration of the examination for each theory paper is 3.00 hrs.

4. The duration of each practical examination is 3 hrs with 50 marks, which are to be distributed as 30 marks for experiment

10 marks for viva

10 marks for record

Practicals**50 marks**

Formula & Explanation

6

Tabular form +graph +circuit diagram

6

Observations

12

Calculation, graph, precautions & Result

6

Viva-Voce

10

Record

10

*****NOTE: Practical syllabus is same for both Mathematics and Non Mathematics combinations**

B.Sc. (Physics) (Maths Combinations)

Scheme of instruction and examination to be followed w.e.f. 2015-2016

S. No	Semester	Title of the paper	Instruction hrs/week	Duration of exam(hrs)	Max Marks (external)
Theory					
1	First	Paper I: Mechanics & Properties of Matter	4	3	75
2	Second	Paper II: Waves & Oscillations	4	3	75
3	Third	Paper III: Wave Optics	4	3	75
4	Fourth	Paper IV: Thermodynamics & Radiation Physics	4	3	75
5	Fifth	Paper V: Electricity, Magnetism & Electronics	4	3	75
		Paper VI: Modern Physics	4	3	75
6	Sixth	Paper VII: Elective (One)	4	3	75
		Paper VIII: Cluster Electives (Three)	4	3	75
Practicals					
1	First	Practical I	2	3	50
2	Second	Practical II	2	3	50
3	Third	Practical III	2	3	50
4	Fourth	Practical IV	2	3	50
5	Fifth	Practical V	2	3	50
6		Practical VI	2	3	50
7	Sixth	Practical VII	2	3	50
8		Practical VIII	2	3	50

Model question Paper for all theory papers

Time : 3 hrs

Max marks : 75

Section-A (Essay type)

**Answer All questions with internal choice from all units Marks :10x5 = 50
(Two questions are to be set from each unit with either or type)**

Section-B (Short answer type)

**Answer any three out of 5 questions from all units (I to V) Marks: 5 x3 = 15
At least one question should be set from each unit.**

Section-C

Answer any two out of 5 questions set from all units Marks: 5x2 = 10

Elective VII-(C) :(Renewable Energy)

Semester –VI

Elective Paper –VII-(C) :Renewable Energy

No. of Hours per week: 04

Total Lectures:60

UNIT-I (12 hrs)

1. Introduction to Energy: Definition and units of energy, power, Forms of energy, Conservation of energy, second law of thermodynamics, Energy flow diagram to the earth. Origin and time scale of fossil fuels, Conventional energy sources, Role of energy in economic development and social transformation.

2. Environmental Effects:Environmental degradation due to energy production and utilization, air and water pollution, depletion of ozone layer, global warming, biological damage due to environmental degradation. Effect of pollution due to thermal power station, nuclear power generation, hydroelectric power stations on ecology and environment.

UNIT-II (12 hrs)

3. Global Energy Scenario: Energy consumption in various sectors, projected energy consumption for the next century, exponential increase in energy consumption, energy resources, coal, oil, natural gas, nuclear and hydroelectric power, impact of exponential rise in energy usage on global economy.

4. Indian Energy Scene: Energy resources available in India, urban and rural energy consumption, energy consumption pattern and its variation as a function of time, nuclear energy - promise and future, energy as a factor limiting growth, need for use of new and renewable energy sources.

UNIT-III (12 hrs)

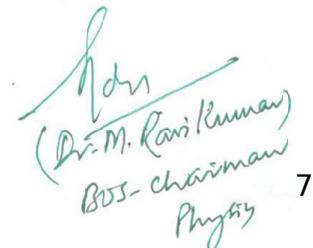
5.Solar energy: Solar energy, Spectral distribution of radiation, Flat plate collector, solar water heating system, Applications, Solar cooker. Solar cell, Types of solar cells, Solar module and array, Components of PV system, Applications of solar PV systems.

6. Wind Energy: Introduction, Principle of wind energy conversion, Components of wind turbines, Operation and characteristics of a wind turbine, Advantages and disadvantages of wind mills, Applications of wind energy.

UNIT-IV (12 hrs)

7. Ocean Energy: Introduction, Principle of ocean thermal energy conversion, Tidal power generation, Tidal energy technologies, Energy from waves, Wave energy conversion, Wave energy technologies, advantages and disadvantages.

8. Hydrogen Energy:History of hydrogen energy - Hydrogen production methods - Electrolysis of water, Hydrogen storage options – Compressed and liquefied gas tanks, Metal hydrides; Hydrogen safety - Problems of hydrogen transport and distribution - Uses of hydrogen as fuel.


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UNIT-V (12 hrs)

9. Bio-Energy

Energy from biomass – Sources of biomass – Different species – Conversion of biomass into fuels – Energy through fermentation – Pyrolysis, gasification and combustion – Aerobic and anaerobic bio-conversion – Properties of biomass – Biogas plants – Types of plants – Design and operation – Properties and characteristics of biogas.

References:

1. Solar Energy Principles, Thermal Collection & Storage, S.P.Sukhatme: Tata McGraw Hill Pub., New Delhi.
2. Non-Conventional Energy Sources, G.D.Rai, New Delhi.
3. Renewable Energy, power for a sustainable future, Godfrey Boyle, 2004,
4. The Generation of electricity by wind, E.W. Golding.
5. Hydrogen and Fuel Cells: A comprehensive guide, Rebecca Busby, Pennwell corporation (2005)
6. Hydrogen and Fuel Cells: Emerging Technologies and Applications, B.Sorensen, Academic Press (2012).
7. Non-Conventional Energy Resources by B.H. Khan, Tata McGraw Hill Pub., 2009.
8. Fundamentals of Renewable Energy Resources by G.N.Tiwari, M.K.Ghosal, Narosa Pub., 2007.

Elective Paper-VII-C: Practical: Renewable Energy 2hrs/Week

Minimum of 6 experiments to be done and recorded

1. Preparation of copper oxide selective surface by chemical conversion method.
2. Performance testing of solar cooker.
3. Determination of solar constant using pyrheliometer.
4. Measurement of I-V characteristics of solar cell.
5. Study the effect of input light intensity on the performance of solar cell.
6. Study the characteristics of wind.


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Physics

Semester –VI
Cluster Electives VIII-C
Cluster Elective Paper –VIII-C-1 :Solar Thermal and Photovoltaic Aspects

No. of Hours per week: 04

Total Lectures:60

UNIT-I (12 hrs)

1. Basics of Solar Radiation: Structure of Sun, Spectral distribution of extra terrestrial radiation, Solar constant, Concept of Zenith angle and air mass, Definition of declination, hour angle, solar and surface azimuth angles; Direct, diffuse and total solar radiation, Solar intensity measurement – Thermoelectric pyranometer and pyr heliometer.

2. Radiative Properties and Characteristics of Materials: Reflection, absorption and transmission of solar radiation through single and multi covers; Kirchoff's law – Relation between absorptance, emittance and reflectance; Selective Surfaces - preparation and characterization, Types and applications; Anti-reflective coating.

UNIT-II (14 hrs)

3. Flat Plate Collectors (FPC) : Description of flat plate collector, Liquid heating type FPC, Energy balance equation, Efficiency, Temperature distribution in FPC, Definitions of fin efficiency and collector efficiency, Evacuated tubular collectors.

4. Concentrating Collectors: Classification, design and performance parameters; Definitions of aperture, rim-angle, concentration ratio and acceptance angle; Tracking systems; Parabolic trough concentrators; Concentrators with point focus.

Unit-III (14 hrs)

5. Solar photovoltaic (PV) cell: Physics of solar cell –Type of interfaces, homo, hetero and schottky interfaces, Photovoltaic Effect, Equivalent circuit of solar cell, Solar cell output parameters, Series and shunt resistances and its effect on cell efficiency; Variation of efficiency with band-gap and temperature.

6. Solar cell fabrication: Production of single crystal Silicon: Czochralski (CZ) and Float Zone (FZ) methods, Silicon wafer fabrication, Wafer to cell formation, Thin film solar cells, Advantages, CdTe/CdS cell formation, Multi-junction solar cell; Basic concept of Dye-sensitized solar cell, Quantum dot solar cell.

UNIT-IV (8 hrs)

Solar PV systems: Solar cell module assembly – Steps involved in the fabrication of solar module, Module performance, I-V characteristics, Modules in series and parallel, Module protection – use of Bypass and Blocking diodes, Solar PV system and its components, PV array, inverter, battery and load.

UNIT-V (12 hrs)

Solar thermal applications: Solar hot water system (SHWS), Types of SHWS, Standard method of testing the efficiency of SHWS; Passive space heating and cooling concepts, Solar desalinator and drier, Solar thermal power generation.

Solar PV applications: SPV systems; Stand alone, hybrid and grid connected systems, System installation, operation and maintenances; Field experience; PV market analysis and economics of SPV systems.

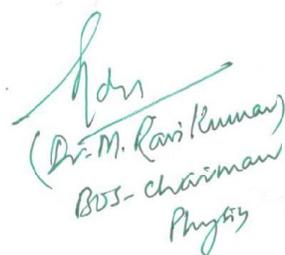
Reference Books:

1. Solar Energy Utilization, G. D. Rai, Khanna Publishers
2. Solar Energy- Fundamentals, design, modeling and applications, G.N. Tiwari, Narosa Pub., 2005.
3. Solar Energy-Principles of thermal energy collection & storage, S.P. Sukhatme, Tata Mc-Graw Hill Publishers, 1999.
4. Solar Photovoltaics- Fundamentals, technologies and applications, Chetan Singh Solanki, PHI Learning Pvt. Ltd.,
5. Science and Technology of Photovoltaics, P. Jayarama Reddy, BS Publications, 2004.

**Cluster Elective Paper- VIII-C-1: Practical: Solar Thermal and Photovoltaic Aspects
2hrs/Week**

Minimum of 6 experiments to be done and recorded

1. Measurement of direct solar radiation using pyrhelimeter.
2. Measurement of global and diffuse solar radiation using pyranometer.
3. Measurement of emissivity, reflectivity and transsivity.
4. Measurement of efficiency of solar flat plate collector.
5. Performance testing of solar air dryer unit.
6. Effect of tilt angle on the efficiency of solar photovoltaic panel.
7. Study on solar photovoltaic panel in series and parallel combination.


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Semester - VI
Cluster Elective Paper –VIII-C-2 :Wind, Hydro and Ocean Energies

No. of Hours per week: 04

Total Lectures:60

UNIT-I

1. **Introduction:** Wind generation, meteorology of wind, world distribution of wind, wind speed variation with height, wind speed statistics, Wind energy conversion principles; General introduction; Types and classification of WECS; Power, torque and speed characteristics.
2. Wind Measurements: Eolian features, biological indicators, rotational anemometers, other anemometers, wind measurements with balloons.

UNIT-II

3. Wind Energy Conversion System: Aerodynamic design principles; Aerodynamic theories; Axial momentum, blade element and combine theory; Rotor characteristics; Maximum power coefficient; Prandtl's tip loss correction.
4. Design of Wind Turbine: Wind turbine design considerations; Methodology; Theoretical simulation of wind turbine characteristics; Test methods.

UNIT-III

5. Wind Energy Application: Wind pumps: Performance analysis, design concept and testing; Principle of wind energy generation; Standalone, grid connected and hybrid applications of wind energy conversion systems, Economics of wind energy utilization; Wind energy in India; Environmental Impacts of Wind farms.

UNIT-IV

6. Small Hydropower Systems: Overview of micro, mini and small hydro systems; Hydrology; Elements of pumps and turbine; Selection and design criteria of pumps and turbines; Site selection; Speed and voltage regulation; Investment issues load management and tariff collection; potential of small hydro power in India. Wind and hydro based stand-alone hybrid power systems.

UNIT-V

7. Ocean Thermal, Tidal and Wave Energy Systems: Ocean Thermal - Introduction, Technology process, Working principle, Resource and site requirements, Location of OCET system, Electricity generation methods from OCET, Advantages and disadvantages, Applications of OTEC,
8. Tidal Energy - Introduction, Origin and nature of tidal energy, Merits and limitations, Tidal energy technology, Tidal range power, Basic modes of operation of tidal systems. Wave Energy – Introduction, Basics of wave motion, Power in waves, Wave energy conversion devices, Advantages and disadvantages, Applications of wave energy.

Reference Books:

1. Dan Charis, Mick Sagrillo, Lan Woofenden, "Power from the Wind", New Society Pub., 2009.
2. Erich Hau, "Wind Turbines-Fundamentals, Technologies, Applications, Economics", 2nd Edition, Springer Verlag, Berlin Heidelberg, NY, 2006.

3. Joshue Earnest, Tore Wizelius, Wind Power and Project Developmen”, PHI Pub., 2011.
4. T. Burton, D. Sharpe, N. Jenkins, E. Bossanyi, Wind Energy Handbook, John Wiley Pub., 2001.
5. Paul Gipe, “Wind Energy Basics”, Chelsea Green Publications, 1999.
6. Khan, B.H., “Non-Conventional Energy Resources”, TMH, 2nd Edition, New Delhi, 2009.
7. Tiwari, G.N., and Ghosal, M.K, Renewable Energy Resources – Basic Principles and applications, Narosa Publishing House,2007.

Cluster Elective Paper- VIII-C-2: Practical: Wind, Hydro and Ocean Energies
2hrs/Week

Minimum of 6 experiments to be done and recorded

1. Estimation of wind speed using anemometer.
2. Determination of characteristics of a wind generator
3. Study the effect of number and size of blades of a wind turbine on electric power output.
4. Performance evaluation of vertical and horizontal axes wind turbine rotors.
5. Study the effect of density of water on the output power of hydroelectric generator.
6. Study the effect of wave amplitude and frequency on the wave energy generated.


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Semester - VI
Cluster Elective Paper –VIII-C-3 :Energy Storage Devices

No. of Hours per week: 04

Total Lectures:60

UNIT-I (12 hr)

1. Energy Storage:Need of energy storage; Different modes of energy storage, Flywheel storage, Electrical and magnetic energy storage: Capacitors,electromagnets; Chemical Energy storage: Thermo-chemical, photo-chemical, bio-chemical,electro-chemical, fossil fuels and synthetic fuels. Hydrogen for energy storage.

UNIT-II (12 hrs)

2. Electrochemical Energy Storage Systems:Batteries: Primary, Secondary, Lithium, Solid-state and molten solvent batteries; Leadacid batteries; Nickel Cadmium Batteries; Advanced Batteries. Role of carbon nano-tubes in electrodes.

UNIT-III (12 hrs)

3. Magnetic and Electric Energy Storage Systems:Superconducting Magnet Energy Storage(SMES) systems; Capacitor and battery:Comparison and application; Super capacitor: Electrochemical Double Layer Capacitor(EDLC), principle of working, structure, performance and application.

UNIT-IV (12 hrs)

4. Fuel Cell: Fuel cell definition, difference between batteries and fuel cells, fuel cell components, principle and working of fuel cell, performance characteristics,efficiency, fuel cell stack, fuel cell power plant: fuel processor, fuel cell powersection, power conditioner, Advantages and disadvantages.

UNIT-V (12 hrs)

5. Types of Fuel Cells: Alkaline fuel cell, polymer electrolyte fuel cell, phosphoric acid fuel cell,molten carbonate fuel cell; solid oxide fuel cell,proton exchange membrane fuel cell, problems with fuel cells, applications of fuel cells.

REFERENCE BOOKS

1. J. Jensen and B. Squirensen, 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, New York, 1989.

Cluster Elective Paper –VIII-C-3: Practical: Energy Storage Devices
2hrs/Week

Minimum of 6 experiments to be done and recorded

1. Study of charge and discharge characteristics of storage battery.
2. Study of charging and discharging behavior of a capacitor.
3. Determination of efficiency of DC-AC inverter and DC-DC converters
4. Study of charging characteristics of a Ni-Cd battery using solar photovoltaic panel.
5. Performance estimation of a fuel cell.
6. Study of effect of temperature on the performance of fuel cell.


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3 Hours

Model Paper

Max Marks 75

PART A

5 x 5 = 25 Marks

Answer any FIVE questions

- Q. 1. UNIT I
- Q. 2. UNIT I
- Q. 3. UNIT II
- Q. 4. UNIT II
- Q. 5. UNIT III
- Q. 6. UNIT III
- Q. 7. UNIT IV
- Q. 8. UNIT IV
- Q. 9. UNIT V
- Q. 10. UNIT V

PART B

5 x 10 = 50 Marks

Answer any five questions (2 questions from each unit for paper setting)

- Q. 11. UNIT I
(or)
UNIT I

- Q. 13. UNIT II
(or)
UNIT II

- Q. 15. UNIT III
(or)
UNIT III

- Q. 17. UNIT IV
(or)
UNIT IV

- Q. 19. UNIT V
(or)
UNIT V

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