SRI VENKATESWARA UNIVERSITY

B.Sc DEGREE COURSE IN PHYSICS

IV SEMESTER – W.E.F. 2021-22

Course IV: ELECTRICITY, MAGNETISM AND ELECTRONICS

(For Non-Maths Combinations)

Work load: 60 hrs per semester **4 hrs/week**

Course outcomes:

On successful completion of this course, the students will be able to:

- *Develop an understanding on the concepts of Electricity, Magnetism and Electronics and their applications.*
- *Understand the Gauss's law in electrostatics and the concepts of electric potential, equipotential surfaces and the classifications of dielectric materials.*
- *Distinguish between magnetic effect of electric current and electromagnetic induction and apply the related laws in appropriate circumstances.*
- *Comprehend the role and importance of Faraday's laws and Lenz 's law in electromagnetic induction.*
- *Understand Biot and Savart's law and Ampere's circuital law to describe and explain the generation of magnetic fields by electrical currents.*
- *Understand theKirchoff's laws and its application to Wheatstone's bridge*
- *Disseminate the fundamentals of digital electronics and principles of p-n junction diodes and transistors.*

UNIT-1:

1. **Electric field and Potential (12 Hrs)**

Coulomb's law ; Electric field and Electric lines of force, Electric flux; Gauss's law statement and its proof; Deduction of Coulomb's law from Gauss's law, Applications of Gauss Law: Electric field intensity due to (i) Uniformly charged sphere (ii) an infinite conducting sheet of charge (No Derivation- qualitative ideas only); Electrical potential; Equipotential surfaces with examples; Potential due to electric dipole.

UNIT-II:

2. **Capacitance and Dielectrics(12 Hrs)**

Electric capacitance ; Principle of condenser, Capacity of a parallel plate capacitor with and without dielectric; Energy stored in a capacitor, Electric dipole moment; Di-electrics and examples, Types of dielectrics; Effect of electric field on dielectrics; Electric displacement D, electric polarization P, Dielectric constant, Permeability & Susceptibility (Definitions only); Relation between D,E and P

UNIT-III:

3. **Current Electricity(12 Hrs)**

Electric current and current density, drift velocity; Relationship between current density and drift velocity, Electrical resistance and resistivity, conductivity, Ohm's law and its limitations; Kirchhoff's laws –Statements and explanations; Application of Kirchhoff's laws to Wheatstone bridge, sensitivity of Wheatstone bridge

UNIT-IV:

4. **Electromagnetism: (12 Hrs)**

Biot-Savart's law-Explanation; Application of Biot-Savart's law to circular coil carrying current (No derivation-qualitative treatment only); Ampere's law; Force on (i) charged particles and (ii) current carrying conductor in the magnetic field, Hall effect and its applications.

5. **Electromagnetic induction:** Faraday's laws of electromagnetic induction, Lenz's law, Phenomena of Self induction and Mutual induction, Self inductance of a long solenoid, Transformer-Principle and working; Energy stored in a magnetic field.

UNIT-V:

6. **Basic Electronics: (06Hrs)**

PN junction diode and its V-I characteristics, Half and full wave rectifiers (working - qualitative ideas only); Action of filters- L-type and π- type filters; Transistors- PNPand NPN transistors& their working; CE, CC and CB Configurations, CE transistor –Input and output characteristics, Transistor as an amplifier.

7. **Digital Electronics: (06 Hrs)**

Number system, conversion of binary to decimal and vice versa, De Morgan's theorems Statements & Proofs; Basic Logic gates and their verification of truth tables, NAND and NOR gates as universal gates, Half and Full adders.

REFERENCE BOOKS

- B.Sc., Physics, Vol.3, Telugu Academy, Hyderabad
- Modern Physics by R. Murugeshan and Kiruthiga Siva Prasath – S. Chand & Co.
- Electricity and Magnetism, Brijlal and Subramanyam. Ratan Prakashan Mandir.
- Principles of Electronics, V.K. Mehta, S.Chand& Co.,
- Digital Principles and Applications, A.P. Malvino and D.P.Leach, McGrawHill Edition.

SRI VENKATESWARA UNIVERSITY

B.Sc DEGREE COURSE IN PHYSICS

IV SEMESTER

(CBCS) REVISED SYLLABUS – 2021-22

Practical Course IV: Electricity, Magnetism and Electronics

Work load: 30 hrs **2 hrs/week**

Course outcomes (Practicals):

On successful completion of this practical course, the student will be able to;

- *measure the current sensitivity and figure of merit of a moving coil galvanometer.*
- *observe the resonance condition in LCR series and parallel circuits.*
- *learn how a sonometer can be used to determine the frequency of AC-supply.*
- *observe the variation of magnetic field along the axis of a circular coil carrying*

  current using Stewart and Gee's apparatus.
- *understand the operation of PN junction diode, Zener diode and a transistor and their V-I characteristics.*
- *construct the basic logic gates, half adder and full adder and verify their truth tables. Further, the student will understand how NAND and NOR gates can be used as universal building blocks.*

Minimum of 6 experiments to be done and recorded:

1. Figure of merit of a moving coil galvanometer.
2. LCR circuit series/parallel resonance, Q factor.
3. Determination of ac-frequency –Sonometer.
4. Verification of Kirchoff's laws and Maximum Power Transfer theorem.
5. Field along the axis of a circular coil carrying current-Stewart & Gee's apparatus.
6. PN Junction Diode Characteristics

7. Zener Diode –V-I Characteristics
8. Zener Diode as a voltage regulator
9. Transistor CE Characteristics- Determination of hybrid parameters
10. Logic Gates- OR, AND,NOT and NAND gates. Verification of Truth Tables.
11. Verification of De Morgan's Theorems.
12. Construction of Half adder and Full adders-Verification of truth tables

RECOMMENDED CO-CURRICULAR ACTIVITIES:

MEASURABLE

1. Assignments (in writing and doing forms on the aspects of syllabus content and outside the syllabus content. Shall be individual and challenging)
2. Student seminars (on topics of the syllabus and related aspects (individual activity)
3. Quiz (on topics where the content can be compiled by smaller aspects and data (Individuals or groups as teams)
4. Field studies (individual observations and recordings as per syllabus content and related areas (Individual or team activity)
5. Study projects (by very small groups of students on selected local real-time problems pertaining to syllabus or related areas. The individual participation and contribution of students shall be ensured (team activity)
6. General
7. Group Discussion
8. Visit to Research Stations and related industries
9. Others

RECOMMENDED ASSESSMENT METHODS

Some of the following suggested assessment methodologies could be adopted;

1. The oral and written examinations (Scheduled and surprise tests),
2. Practical assignments and laboratory reports,
3. Observation of practical skills,
4. Efficient delivery using seminar presentations,
5. Viva voce interviews.

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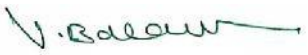

BOS Chairman

SRI VENKATESWARA UNIVERSITY

B.Sc DEGREE COURSE IN PHYSICS

IV SEMESTER – W.E.F. 2021-22

Course V: MODERN PHYSICS

(For Non-Maths Combinations)

Work load: 60 hrs per semester **4 hrs/week**

Course outcomes:

On successful completion of this course, the students will be able to:

- *Develop an understanding on the concepts of Atomic and Modern Physics, basic elementary quantum theory and nuclear physics.*
- *Develop critical understanding of concept of Matter waves and Uncertainty principle.*
- *Get familiarized with the phenomenon of photoelectriceffect and Compton effect*
- *Examine the basic properties of nuclei, characteristics of Nuclear forces, salient features of Nuclear models and different nuclear radiation detectors.*
- *Classify Elementary particles based on their mass, charge, spin, half life and interaction.*
- *Increase the awareness and appreciation of superconductors and their practical applications.*
- *Develop an understanding on the nanomaterials, their properties and applications.*
- *Conduct experiments using skills appropriate to the units*

UNIT-I:

1. Atomic and Molecular Physics: (12 hrs)

Bohr's theory of Hydrogen atom; Spectral series of Hydrogen atom and energy levels, Elementary ideas of Sommerfeld elliptical theory, Vector atom model-Quantum numbers associated with vector atom model; Zeeman effect –Experimental arrangement, Paschen- Back effect and Stark effect (Elementary ideas only); Raman effect, Quantum theory of Raman effect; Experimental arrangement to observe Raman effect and its applications.

UNIT-II :

2. Fundamentals of Quantum theory: (12 hrs)

Inadequacy of classical physics, spectral radiation, Plank's quantum theory, Photoelectric effect; Experimental demonstration, Laws of photoelectric emission- Threshold frequency and work function; Einstein's Photoelectric equation and its verification by Millikan's experiment ; Compton effect (no derivation) and its experimental verification

UNIT-III:

3. Matter Waves and Uncertainty principle (12 hrs)

Dual nature of radiation- de Broglie's theory of matter waves, expression for wavelength, Properties of matter waves, Davisson and Germer experiment on electron diffraction – Discussion of results, Wave velocity and group velocity.

Heisenberg's uncertainty principle for position and momentum (x and p), energy and time (E and t); Experimental illustrations of uncertainty principle, Complementary principle of Bohr.

UNIT-IV:

4. Nuclear Physics (12 hrs)

Nuclear Structure: General Properties of Nuclei, Mass defect, Binding energy; *Nuclear forces*: Characteristics of nuclear forces; Nuclear Models: Liquid drop model, The Shell model, Magic numbers; *Nuclear Radiation detectors*: G.M. Counter, Cloud chamber, Solid State detector; *Elementary Particles*: Elementary Particles and their classification

UNIT-V:

5. Nanomaterials: (7hrs)

Nanomaterials – Introduction, Electron confinement-Size effect - Surface to volume ratio; Classification of nano materials – (0D, 1D, 2D); Examples: CNT, Graphene, nano wires; Distinct properties of nano materials (Mention-*mechanical, optical, electrical, and magnetic properties*); Applications of nanomaterials

6. Superconductivity: (5 hrs)

Superconductivity: Introduction; Experimental facts, critical temperature, critical field, Meissner effect; Isotope effect; Type I and type II superconductors; BCS theory (Elementary ideas only); Applications of superconductors

REFERENCE BOOKS

- B.Sc Physics, Vol.4, Telugu Academy, Hyderabad.
- Molecular Structure and Spectroscopy by G. Aruldhas. Prentice Hall of India, New Delhi.
- Physics for Biology & Premedical Students –D.N. Burns & SG Mac Donald, Addison Wiley.
- S.K. Kulkarni, Nanotechnology: Principles & Practices (Capital Publ.Co.)
- K.K. Chattopadhyay and A. N. Banerjee, Introduction to Nanoscience and Technology(PHI Learning Priv.Limited).
- Nano materials, A K Bandopadhyay. New Age International Pvt Ltd (2007) Textbook of Nanoscience and Nanotechnology, BS Murthy, PShankar, BaldevRaj,BBRath and J Murday- Universities Press-IIM

B.Sc DEGREE COURSE IN PHYSICS

IV SEMESTER

(CBCS) REVISED SYLLABUS – 2021-22

Practical Course V: Modern Physics

Work load: 30 hrs **2 hrs/week**

On successful completion of this practical course, the student will be able to;

- *measure charge of an electron ande/m value of an electron by Thomson method.*
- *understand how the Planck's constant can be determined using Photocell and LEDs.*
- *study the absorption of a-rays and ß-rays, Range of ß-particles and thecharacteristics of GM counter*
- *determine the Energy gap of a semiconductor using thermistor and junction diode.*

Minimum of 6 experiments to be done and recorded:

1. e/m of an electron by Thomson method.
2. Determination of Planck's Constant (photocell).
3. Verification of inverse square law of light using photovoltaic cell.
4. Determination of the Planck's constant using LEDs of at least 4 different colours.
5. Determination of work function of material of filament ofdirectly heated vacuum diode.
6. Study of absorption of α-rays.
7. Study of absorption of β-rays.
8. Determination of Range of β-particles.
9. Determination of M & H.
10. Analysis of powder X-ray diffraction pattern to determine properties of crystals.
11. Energy gap of a semiconductor using junction diode.
12. Energy gap of a semiconductor using thermistor
13. GM counter characteristics

RECOMMENDED CO-CURRICULAR ACTIVITIES:

MEASURABLE

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3. Quiz (on topics where the content can be compiled by smaller aspects and data (Individuals or groups as teams)
4. Field studies (individual observations and recordings as per syllabus content and related areas (Individual or team activity) Study projects (by very small groups of students on selected local real-time problems pertaining to syllabus or related areas. The individual participation and contribution of students shall be ensured (team activity)

GENERAL

1. Group Discussion
2. Visit to Research Stations and related industries
3. Others

RECOMMENDED ASSESSMENT METHODS

Some of the following suggested assessment methodologies could be adopted;

1. The oral and written examinations (Scheduled and surprise tests),
2. Practical assignments and laboratory reports,
3. Observation of practical skills,
4. Individual and group project reports,
5. Efficient delivery using seminar presentations,
6. Viva voce interviews.

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BOS Chairman

NOTE:

1. The duration of the examination for each theory course is 3.00 hrs. The duration of each practical examination is 3 hrs with 50 marks

2. Each course in theory is of 100 marks and practical course is of 50 marks.
   - Semester End University Examination in Theory Course: 75 marks [External evaluation]
   - Mid-Semester Examination in Theory Course at the college level: 25 marks [Internal evaluation]

3. The University (external) examination for both Theory and Practical shall be conducted at the end of each Semester.

4. In each semester the evaluation in Practical courses shall be done by an external examiner appointed by the University. There shall not be internal valuation in any semester end practical examinations.

5. The candidate shall prepare and submit at the time of practical examination a certified Record based on the practical course with a minimum of **6** experiments from each semester.

6. Numerical Problems must be solved at the end of every chapter of all Units.

7. The minimum passing marks in each theory course is 40 (External:30 and Internal:10) The minimum passing marks in each Practical/Lab course is 20.

8. The teaching work load per week for semesters I to IV is 4 hours for theory course and 2 hours for all laboratory (practical) courses.

9. Visits to industry, national research laboratories, and scientific

exhibitions should be encouraged.

10. The syllabus for Practical courses is same for both Mathematics and Non-Mathematics combinations.

11. The marks distribution for the Semester End practical examination is as follows:

(i) Formula/ Principle / Statement with explanation of symbols and	05
(ii) Diagram/ Circuit Diagram / Tabular Columns … … …	10
(iii) Setting up of the experiment and taking readings/ Observations	10
(iv) Calculations (explicitly shown) + Graph + Result with Units…	10
(v) Viva-voce … … … … … … … … … … … … … … … … …	05
(vi) Class Records (to be valued at the time of practical	10
Total Marks :	**50**

B.Sc. PHYSICS

[For Non-Mathematics combinations]

W.E.F. 2021-22

MODEL QUESTION PAPER

Time: 3 hrs *Max marks: 75*

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer any five of the following questions in Part A.
Part B consists of 5 Units. Answer one full question (A or B) from each unit (i.e., Q.No 9 from Unit – I, Q.No 10 from Unit – II, Q.No 11 from Unit – III, Q.No 12 from Unit – IV, Q.No 13 from Unit – V). Each question carries
10 marks.

PART – A

Answer any *Five* of the following question. **(5X5=25M)**

1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	

(P.T.O)

PART – B

Answer All The Questions. Each question carries 10 marks (5X10= 50M)

9.	(A) OR (B)
10.	(A) OR (B)
11.	(A) OR (B)
12.	(A) OR (B)
13.	(A) OR (B)