DR VS KRISHNA GOVERNMENT DEGREE AND PG COLLEGE
(An Autonomous Institution Affiliated to Andhra University)
Reaccredited by NAAC with A Grade (3rd Cycle).
District Resource Center and Centre for Research Studies
Maddilapalem, VISAKHAPATNAM 530013, Andhra Pradesh
Programme: B.Sc. Honours in Physics (Major)
w.e.f. AY 2023-24
SEMESTER-V COURSE CODE: 23PHYM51

APPLICATIONS OF ELECTRICITY AND MAGNETISM

Theory **Credits:3** **3hrs/week**

COURSE OBJECTIVE:

The objective of the course on Applications of Electricity and Magnetism is to provide students with a comprehensive understanding of the practical applications of electricity and magnetism in various fields. The course aims to develop students' knowledge and skills in applying electrical and magnetic principles to real-world problems and technologies.

LEARNING OUTCOMES:

Students after successful completion of the course will be able to:

1. Identify various components present in Electricity& Electronics Laboratory.
2. Acquire a critical knowledge of each component and its utility (like resistors, capacitors, inductors, power sources etc.).
3. Demonstrate skills of constructing simple electronic circuits consisting of basic circuit elements.
4. Understand the need & Functionality of various DC & AC Power sources.
5. Comprehend the design, applications and practices of various electrical & Electronic devices and also their trouble shooting.

Unit-I: Introduction to Passive Elements

a) **Passive elements** Resistor - Types of Resistors, Color coding, Combination of Resistors – Series combination (Voltage division), Parallel combination (Current division), Ohms Law and its limitation. Inductor - Principle, EMF induced in an Inductor, Energy stored in Inductor, Phase relation between V and I, Combinations of Inductors, Types of Inductors. Capacitor - Principle, Charging and discharging of a Capacitor, Types of Capacitors, Color coding

b) **Applications of Passive elements:**
Applications of a Resistor as a heating element in heaters and as a fuse element. Open circuit, Short circuit, Applications of Inductors, Application of choke in a fan and in a radio tuning circuit, Series resonance circuit as a Radio tuning circuit. Applications of Capacitor in power supplies, motors (Fans) etc.

Unit-II Power Sources (Batteries)

a)Power sources:

Types of power sources-DC & AC sources, Different types of batteries, Rechargeable batteries –Lead acid batteries, Li-ion batteries Series, Parallel & Series-Parallel configuration of batteries, b)Network Theorems for DC circuits Thevenin's theorem, Norton's theorem, Maximum Power transfer theorem, Constant Voltage source-Constant Current Source-Applications of Current sources & Voltage sources, SMPS used in computers.

Unit-III Alternating & Direct Currents

a) A.C Generator, Construction and its working principle, Types of AC Generators, DC Generator, Construction and its working principle, advantages and disadvantages, Applications, Types of DC Generators, Losses associated with DC generators, Differences between DC and AC generators

b) Transformers- Construction and its working principle, EMF equation, Open circuit and short circuit tests, Types of Transformers - Step-down and Step-up Transformers, Relation between primary turns and secondary turns of the transformer with emf, Use of a Transformer in a regulated Power supplies, Single phase motor – working principle, Applications of motors (like water pump, fan etc).

Unit-IV Modulation Circuits

a) Need for modulation, Types of modulation, Amplitude modulation, modulation index, Waveforms, Power relations, Demodulation, Diode detector, AM transmitter, AM Receiver, Frequency modulation, modulation index, Waveforms, FM Transmitter, FM Receiver

b) **Transmitters and Receivers:**
AM transmitter, AM Receiver, Frequency modulation, modulation index, Waveforms, FM Transmitter, FM Receiver

Unit-V Applications of EM Induction & Power Supplies

a) DC motor – Construction and operating principle, Calculation of power, voltage and current in a DC motor, Design of a simple Motor (for example Fan) with suitable turns of coil

b) Working of a DC regulated power supply, Construction of a 5 volts regulated power supply, Design of a step-down (ex:220-12V) and step-up (ex:120-240V) transformers-Simple Design of FM Radio circuit using LCR series resonance (tuning) circuit, Checking the output voltage of a battery eliminator using a Multimeter. (Trouble shooting), Design of a simple 5 volts DC charger, Power supply for computers (SMPS)

References:

1. Grob's Basic Electronics by Mitchel Schultz, TMH or McGraw Hill
2. Electronic and Electrical Servicing by Ian Robertson Sinclair, John Dunton, Elsevier Publications
3. Troubleshooting Electronic Equipment by R.S.Khandapur ,TMH
4. Web sources suggested by the teacher concerned and the college librarian including reading material.

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Programme: B.Sc. Honours in Physics (Major)

w.e.f. AY 2023-24

SEMESTER-V COURSE CODE: 23PHYM51:

APPLICATIONS OF ELECTRICITY AND MAGNETISM

Practical **Credits:12hrs/week**

COURSE OBJECTIVE:

The objective of the practical course on Applications of Electricity and Magnetism is to provide students with hands-on experience and practical skills in applying electrical and magnetic principles to real-world applications. The course aims to develop students' proficiency in working with electrical circuits, electromagnetic devices, and related technologies through practical experimentation and project-based activities.

LEARNING OUTCOMES:

On successful completion of this practical course, student shall be able to:

1. List out, identify and handle various equipment in Electrical & Electronics laboratory.
2. Learn the procedures of designing simple electrical circuits.
3. Demonstrate skills on the utility of different electrical components and devices.
4. Acquire the skills regarding the operation, maintenance and troubleshooting of various Devices in the lab.
5. Understand the different applications of Electromagnetic induction.

Practical (Laboratory) Syllabus:

1. Acquainting with the soldering techniques
2. Design and Construction of a 5 Volts DC unregulated power supply

3. Construction of a Step down Transformer and measurement of its output voltage.

   And to compare it with the calculated value.

4. Connect two or three resistors or capacitors or inductors and measure the Series, Parallel Combination values using a Multimeter and compare the values with the Calculated values.
5. Use the Digital Multimeter and Analog Multimeter to measure the output voltage of an AC &DC power supply and also the voltage and frequency of a AC signal using CRO.
6. Use the Multimeter to check the functionality of a Diode and Transistor. Also test whether the given transistor is PNP or NPN. Construct a series electric circuit with R, L and C having an AC source and study the frequency response of this circuit. Find the Resonance Frequency.
7. Construct a Parallel electric circuit with R, L & C having an AC source and study the frequency response of this circuit .Find the resonant frequency.
8. Test whether a circuit is a Open circuit or Short Circuit by measuring continuity with a Multimeter and record your readings.

Lab References:

1. Laboratory Manual for Introductory Electronics Experiments by Maheshwari, L.K. Anand, M.M.S., New Age International (P) Ltd.
2. Electricity-Electronics Fundamentals: A Text-lab Manual by Paul B. Zbar,JosephSloop,&Joseph G. Sloop , McGraw-Hill Education
3. Laboratory Manual Basic Electrical Engineering by Umesh Agarwal, Notion Press
4. Basic Electrical and Electronics Engineering by S.K. Bhattacharya, Pearson Publishers.
5. Web sources suggested by the teacher concerned.

STUDENT ACTIVITIES

Co-Curricular Activities:

(a) Mandatory:(*Training of students by teacher in field related skills: (lab:10 + field: 05*)

1. **For Teacher**: Training of students by the teacher (if necessary, by a local expert) in laboratory/field for not less than 15 hours on the understanding of various electronic &electrical components and devices. And also understand the functional knowledge of these components and devices so that the student can safely handle these electronic components.

2. **For Student**: Students shall (individually) visita local Radio, TV or Mobile repair shop to understand the testing and soldering techniques and different electronic components in the devices that we use daily life. And also to understand the troubleshooting and working of domestic appliances such as cell phone chargers, fan, electric iron, heater, inverter, micro oven, washing machine etc.(Or)Students shall also visit the Physics/Electronics or Instrumentation Labs of nearby local institutions and can get additional knowledge by interacting with the technical people working there. (Or)Students shall also visit the local motor winding shop to understand the motor winding and working of different types of motors. After the observations, a hand- written Fieldwork/Project work not exceeding 10 pages in the given format to be submitted to the teacher.
3. Max marks for Fieldwork/Project work: 05.
4. Suggested Format for Fieldwork/Project work: *Title page, student details, index page, details of place visited, observations, findings and acknowledgements.*
5. Unit tests (IE).

(b)Suggested Co-Curricular Activities

1. Training of students by related industrial experts. Assignments (including technical assignments like identifying various electrical

and electronic components &devices and their handling, operational techniques with safety and security)

2. Seminars, Group discussions, Quiz, Debates etc. (on related topics).
3. Preparation of videos on tools and techniques in Electrical & Electronic Appliances in daily life.
4. Collection of material/figures/photos related to Electrical products like Heaters, Motors, Fans etc. and writing and organizing them in a systematic way in a file.
5. Visits to nearby electrical or electronic industries or laboratories in universities, research organizations, private firms, etc.
6. Invited lectures and presentations on related topics by field/industrial experts

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Programme: B.Sc. Honours in Physics (Major)

w.e.f. AY 2023-24

SEMESTER-V COURSE CODE: 23PHYM51:

APPLICATIONS OF ELECTRICITY AND MAGNETISM

BLUE PRINT

Max Marks-60 Time-3Hrs Credits:3

Learning level wise Weightage				
Bloom's Taxonomy level	**Weightage**	**Marks**	**Essay type**	**Short answer type**
Knowledge/ Remember	**33%**	**20**	**2(two out of four)**	**1(one out of two**
Understanding/ Comprehension	**27%**	**16**	**2(two out of four)**	
Application	**20%**	**12**	**1(one out of two)**	**1(one out of two**
Analysis	**13%**	**8**		**2(two out of four)**
Synthesis/ Evaluate	**7%**	**4**		**1(one out of two**
Total	**100**	**60**	**5(each question has internal choice)**	**5 outb of 10 questions**

Chapter wise Weightage

S.No	Module/ Chapter	Name of the chapter	8 marks	4 marks
1	I	Introduction to Passive Elements	2(one out of two)	2
2	II	Power Sources(Batteries)	2(one out of two	2
3	III	Alternating & Direct Currents	2(one out of two	2
4	IV	Modulation Circuits	2(one out of two	2
5	V	Applications of EM Induction & Power Supplies	2(one out of two	2
		TOTAL QUESTIONS	5(each question has internal choice)	5 out of given 10

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Programme: B.Sc. Honours in Physics (Major)

w.e.f. AY 2023-24

SEMESTER-V COURSE CODE: 23PHYM51:

APPLICATIONS OF ELECTRICITY AND MAGNETISM

Model Paper

DURATION::3 hrsMAX.MARKS :: 60

SECTION-A

Answer any FIVE questions of the following **(5 X 4 = 20 M)**

1.

2.

3.

4.

5.

6.

7.

8.

9.

10.

SECTION-B

Answer ALL the questions Of the following **(5 X 8 = 40 M)**

11. (a)

[OR]

(b)

12 (a)

[OR]

(b)

13(a)

[OR]

(b)

14 (a)

[OR]

(b

15 (a)

[OR]

(b)

Dr. V S KRISHNA GOVERNMENT DEGREE COLLEGE

VISAKHAPATNAM

B.Sc. PHYSICS SYLLABUS UNDER CBCS

[2023-24 Batch onwards]

Course Code: 23(PHY)M52

III Year B.Sc (Hons.)-PHYSICS

SEMESTER-V COURSE 13: ELECTRONIC INSTRUMENTATION

Theory Credits: 3 3 hrs/week

COURSE OBJECTIVE:

The objective of the course on Electronic Instrumentation is to provide students with a comprehensive understanding of various electronic instruments used for measurement, data acquisition, and control applications. The course aims to develop students' knowledge and skills in the design, operation, calibration, and application of electronic instruments.

LEARNING OUTCOMES:

Students after successful completion of the course will be able to:

1. Identify various facilities required to set up a basic Instrumentation Laboratory.
2. Acquire a critical knowledge of various Electrical Instruments used in the Laboratory.
3. Demonstrate skills of using instruments like CRO, Function Generator, Multimeter etc. through hands on experience.
4. Understand the Principle and operation of different display devices used in the display systems and different transducers
5. Comprehend the applications of various biomedical instruments in daily life like B.P.
   meter, ECG, Pulse oximeter etc. and know the handling procedures with safety and security.

UNIT-I INTRODUCTION TO INSTRUMENTS: (12Hours)

a) Basic of measurements:

Instruments accuracy, precision, sensitivity, resolution, range, errors in measurement, Classification of Instruments, Analog instruments & Digital Instruments, Construction and working of an Analog Multimeter and Digital Multimeter (Block diagram approach), DC Voltmeter and AC Voltmeter, Sensitivity, 3½ display and 4½ display Digital Multimeter, Sources of errors in the Measurement of resistance, voltage and current, Specifications of Multimeter and their significance.

b) Balancing and damping Moving iron instruments & PMMC instruments.

UNIT-II OSCILLOSCOPE: (12Hourse)

a) Cathode ray oscilloscope – Principle and block diagram of CRO - Cathode Ray Tube – functioning – various controls

b) Applications CRO: Measurement of voltage (dc and ac), frequency & time period, Different types of oscilloscopes and their uses, Digital storage Oscilloscope

UNIT-III TRANSDUCERS AND BRIDGES: (12Hourse)

a) Linear Variable Differential Transformer (LVDT), Resistive, Capacitive & Inductive transducers, Piezoelectric transducer.

b) DC Bridge -Wheatstone's bridge, AC Bridges - Measurement of Inductance and Capacitance –

Maxwell's bridge, Schering Bridge, Measurement of frequency – Wien's bridge.

UNIT-IV ADC AND DAC & DISPLAY INSTRUMENTS: (12Hourse)

a) A/D & D/A converters - Binary ladder, A/D converters –successive approximation type.

b) Introduction to Display devices, LED Displays, Seven Segment Displays, Construction and operation (Display of numbers), Types of SSDs (Common Anode & Common Cathode type), Limitations of SSDs, Liquid Crystal Displays, Principle and working, Applications of LCD modules.

UNIT-V AMPLIFIERS, OSCILLATORS & BIOMEDICAL INSTRUMENTS: (12Hrs.)

a) Amplifiers – Classification of amplifiers, Coupling amplifiers – RC Coupled amplifier – frequency response characteristics (no derivation), Feedback in Electronic circuits – Positive and Negative feedback, expressions for gains, advantages of negative feedback, Barkhausen criteria, RC phase shift oscillator.

b) Basic operating principles and uses of (i) ECG machine (ii) Radiography (iii) Ultrasound scanning (iv) Ventilator (v) Pulse oximeter.

REFERENCE BOOKS:

1. Electronic Instrumentation by H.S.Kalsi ,TMH Publishers
2. Electronic Instrument Hand Book by Clyde F. Coombs ,McGraw Hill
3. Introduction to Biomedical Instrumentation byMandeep Singh, PHI Learning.
4. Electronic Instrumentation – WD Cooper
5. Electrical and Electronic Instrumentation – AK Sawhany
6. A text book in electrical technology by B.L.Thereja (S.Chand&Co)
7. *Biomedical Instrumentation* and Measurements by Leslie *Cromwell ,Prentice Hall India.*
8. Electronic Measurements and Instrumentation by Kishor, K Lal, Pearson, New Delhi
9. Electrical and Electronic Measurements by Sahan, A.K., Dhanpat Rai, New Delhi
10. Electronic Instruments and Measurement Techniques by Cooper, W.D. Halfrick, A.B., PHI Learning, New Delhi
11. Web sources suggested by the teacher concerned and the college librarian including reading material.

Course Code: 23(PHY)M52P

SEMESTER-V

COURSE 13: ELECTRONIC INSTRUMENTATION

Practical Credits: 1 2 hrs/week

COURSE OBJECTIVE:

The objective of the practical course on Electronic Instrumentation is to provide students with hands-on experience in using electronic instruments for measurement, data acquisition, and control applications. The course aims to develop students' practical skills in operating, calibrating, and troubleshooting electronic instruments commonly used in scientific, engineering, and industrial settings.

LEARNING OUTCOMES:

1. Familiarize students with a range of electronic instruments, including multimeters, oscilloscopes, signal generators, and data acquisition systems.
2. Learn the basic operation, functions, and features of each instrument.
3. Gain hands-on experience in connecting, configuring, and using different instruments for various measurement tasks.
4. Develop proficiency in performing common electrical measurements, such as voltage, current, resistance, frequency, and temperature measurements.
5. Learn specialized measurement techniques, including impedance measurements, time and frequency measurements, and power measurements.
6. Gain practical experience in selecting appropriate measurement techniques and instruments for specific applications.

PRACTICAL SYLLABUS

1. Familiarization of digital multimeter and its usage in the measurements of (i) resistance (ii) current, (iii) AC & DC voltages
2. Measure the AC and DC voltages, frequency using a CRO and compare the values measured with other instruments like Digital multimeter.
3. Formation of Sine, Square wave signals on the CRO using Function Generator and measure their frequencies. Compare the measured values with actual values.
4. Display the numbers from 0 to 9 on a single Seven Segment Display module by applying voltages.
5. Displacement transducer-LVDT
6. A.C - Impedance and Power Factor.
7. Maxwell's Bridge – Determination of Inductance.
8. Measurement of body temperature using a digital thermometer and list out the error and corrections.
9. Measurement of Blood Pressure of a person using a B.P. meter and record your values and analyze them.
10. Display the letters **a** to **h** on a single Seven Segment Display module by applying voltages.
11. Get acquainted with an available ECG machine and study the ECG pattern to understand the meaning of various peaks
12. Observe and understand the operation of a Digital Pulseoxymeter and measure the pulse rate of different people and understand the working of the meter.

VI. Lab References:

1. Electronic Measurement and Instrumentation by J.P. Navani. ,S Chand & Co Ltd

2. Principles of Electronic Instrumentation by A De Sa, Elsevier Science Publ.

3.Electronic Measurements and Instrumentation by S.P.Bihari, YogitaKumari, Dr. Vinay Kakka, Vayu Education of India .

4. Laboratory Manual For Introductory Electronics Experiments by Maheshwari, New Age International (P) Ltd., Publishers.

5. Electricity-Electronics Fundamentals: A Text-lab Manual by Paul B. Zbar ,Joseph Sloop, & Joseph G. Sloop , McGraw-Hill Education.

6. Web sources suggested by the teacher concerned.

STUDENT ACTIVITIES

Co-Curricular Activities

(a) Mandatory:(*Training of students by teacher in field related skills: (lab:10 + field:05)* 1. **For Teacher**: Training of students by the teacher in the in the laboratory/field for not less than 15 hours on the field techniques/skills of understanding the operation, Maintenance and utility of various electrical and electronic instruments both in the Laboratory as well as in daily life.

For Student: Students shall (individually)visit a local electrical and electronics shop or small firm to familiarize with the various electrical and electronic instruments available in the market and also to understand their functionality, principle of operation and applications as well as the troubleshooting of these instruments.(Or) Student shall visit a diagnostic centre and observe the ECG machine and the ECG pattern(Or) Student shall visit a diagnostic centre and observe the CT scan and MRI scan.(Or) Student shall visit a mobile smart phone repair shop and observe the different components on the PCB(Motherboard), different ICs (chips) used in the motherboard and trouble shooting of touch screen in smart phones. Observations shall be recorded in a hand-written Fieldwork/Project work not exceeding 10 pages in the given format to be submitted to the teacher.

2. Max marks for Fieldwork/Project work: 05.

3. Suggested Format for Fieldwork/Project work: *Title page, student details, index page, details of place visited, observations, findings and acknowledgements*. 4. Unit tests (IE)

(b) Suggested Co-Curricular Activities

1. Training of students by related industrial / technical experts.
2. Assignments (including technical assignments like identifying different measuring
   instruments and tools and their handling, operational techniques with safety and security.
3. Seminars, Group discussions, Quiz, Debates etc. (on related topics).
4. Making your own stethoscope at home.
5. Making seven segment display at home.
6. Preparation of videos on tools and techniques in various branches of instrumentation.
7. Collection of material/figures/photos related to products of Measuring Instruments, Display Modules and Biomedical Instruments and arrange them in a systematic way in a file.
8. Visits to Instrumentation Laboratories of local Universities or Industries like Cement, Chemical or Sugar Plants etc. or any nearby research organizations, private firms, etc.
9. Invited lectures and presentations on related topics by Technical /industrial experts

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Dr V.S.Krishna Govt. Degree College(A),
Visakhapatnam 2022-2023
Course Code: 23(PHY)M52

BLUE PRINT (ELECTRONIC INSTRUMENTATION)

IIIB.Sc. (Hons.) Physics- SEM-V/Course : 13
Max Marks-75 Time-3Hrs. Credits:3

		TOPIC	SECTION-A	SECTION-B	
S.No.	UNIT		ESSAY QUESTIONS 10 MARKS	SHORT QUESTIONS 5MARKS	TOTAL MARKS
1.	I	UNIT-I INTRODUCTION TO INSTRUMENTS	2	2	30
2.	II	UNIT-II OSCILLOSCOPE	2	2	30
3.	III	UNIT-III TRANSDUCERS AND BRIDGES	2	2	30
4.	IV	UNIT-IV ADC AND DAC & DISPLAY INSTRUMENTS	2	2	30
5.	V	UNIT-V AMPLIFIERS, OSCILLATORS & BIOMEDICAL INSTRUMENTS	2	2	30
6.		TOTAL QUESTIONS	10	10	150

[Note: Question Paper setters are instructed to add Numerical Problems (each of 4 marks) with a maximum weightage of 8 marks cither in Section-A or Section-B covering all the five units in the syllabus]

Dr. V S KRISHNA GOVERNMENT DEGREE COLLEGE (A) VISAKHAPATNAM

B.Sc. PHYSICS SEMESTER END EXAMINATION

[2023-24 Batch onwards]

Course Code: 23(PHY)M52

III Year B.Sc (Hons.)- PHYSICS

SEMESTER-V COURSE 13: ELECTRONIC INSTRUMENTATION

Time: 3 hrs. Maxmarks:60

SECTION – A

Answer all Questions of the following **[5 X 8 = 40]**

1. a)

[OR]

b)

2. a)

[OR]

b)

3. a)

[OR]

b)

4. a)

[OR]

b)

5. a)

[OR]

b)

SECTION – B

Answer any FIVE Questions of the following **[5 X 4 = 20]**

6. a)
7. a)
8. a)
9. a)
10. a)
11. a)
12. a)
13. a)
14. a)
15. a)

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(COURSE CODE: 23PHYM53A)

Dr. VS KRISHNA GOVT. DEGREE COLLEGE (A), VISHAKAPATNAM

BLUE PRINT

Programme: B.Sc. Honors in Physics (Major) -2023-2024

SEMESTER-V

COURSE 14A: OPTICAL INSTRUMENTS AND OPTOMETRY

MAX MARKS – 60 TIME – 3 HOURS (CREDITS- 3)

S.NO	UNIT	TOPIC	ESSAY TYPE QUESTIONS (SECTION-B) Each one 8 marks	SHORT ANSWER QUESTIONS (SECTION-A) Each one 4 marks
1	I	Optical microscopes	1	2
2	II	Telescopes	1	2
3	III	Applications of optical instruments	1	2
4	IV	Optical vision	1	2
5	V	Ophthalmic techniques and optometry	1	2
			5 (internal choice)	5 (five to be answered out of ten questions)

$$Percentage\ of\ choice = \frac{120-60}{120} \times 100 = 50\%$$

Note: one numerical problem should be given in section-A

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(COURSE CODE: 23PHYM53A)

SEMESTER-V COURSE 14A: OPTICAL INSTRUMENTS AND OPTOMETRY

Theory Credits: 3 3 hrs/week

COURSE OBJECTIVE:
The objective of the course on Optical Instruments and Optometry is to provide students with a comprehensive understanding of the principles, design, and application of optical instruments used in various fields, with a specific focus on optometry

LEARNING OUTCOMES:
Students at the successful completion of the course will be able to:

1. Understand the construction and working principles of various optical instruments used in daily life.
2. Acquire a critical knowledge on the various defects of eye and their correcting methods with suitable lenses.
3. Demonstrate skills of using biological microscope through hands on experience.
4. Understand the various techniques used in optometry and computer based eye testing.
5. Comprehend the various applications of microscopes and telescopes.

SYLLUBUS

UNIT-I Optical Microscopes

Simple Microscope-Construction, Magnifying power, normal adjustment; Compound

Microscope-Construction, Magnifying power, normal adjustment, Phase contrast microscope-

Operating principle, travelling microscope-Construction, working and uses

UNIT-II Telescopes

Refracting Telescopes and Reflecting telescopes, Construction, working and magnifying power of Astronomical Telescope and Terrestrial Telescopes, Binoculars – working principle and applications.

(COURSE CODE: 23PHYM53A)

UNIT-III Applications of Optical Instruments

Introductory ideas and applications of various microscopes *viz.*, (i) Optical microscopes

(Compound microscope, Stereo microscope, confocal microscope) (ii) Electron microscopes (TEM, SEM), (iii) Scanning Probe microscope (iv) Scanning Acoustic microscope and (v) X-ray microscope. Introductory ideas and applications of various telescopes *viz.*, (i) Optical telescopes (ii) Radio telescopes (iii) Solar telescopes (iv) Infrared telescope (v) Ultraviolet telescope

UNIT-IV Optical Vision

Introduction to optical Vision, Eye as an optical instrument, Formation of image in the eye and the camera, Ophthalmic lenses, Myopia and Hypermetropia defects, Removal of defects in vision using ophthalmic lenses, Contact lenses-Working principle, Different types of Contact lenses.

UNIT-V Ophthalmic Techniques and Optometry

Ophthalmoscope and keratometer and their working principles, Evaluation of eye disorders, Guidelines for standardized eye chart preparation, Simple phoropter and its working principle and its uses, Principles of Computer based eye testing

Reference Books

1. Optics and Optical Instruments: An Introduction by B. K. Johnson, Dover Publications. 2. Modern Optical Instruments and their construction by or ford Henry-Publisher: Biblio Life, LLC.
3. A Text Book of Optics by Brj Lal and N.Subramanyam, S.Chand & Co.
4. Practical Optics by Menn Naftly, Elsevier Science Publishing.
5. Applications of Optics in daily life | CK-12 Foundation. https://flexbooks.ck12.org ›
6. Web sources suggested by the teacher concerned and the college librarian including Reading material.

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(COURSE CODE: 23PHYM53A)

SEMESTER-V COURSE 14 A: OPTICAL INSTRUMENTS AND OPTOMETRY

(COURSE CODE: 23PHYM53AP)

Practical Credits: 1 2 hrs/week

COURSE OBJECTIVE:

The objective of the practical course on Optical Instruments and Optometry is to provide students with hands-on experience and practical skills in the operation, calibration, and application of optical instruments used in optometry

Learning Outcomes:

On successful completion of this practical course, student shall be able to:

1. List out, identify and handle various equipment like binoculars, telescopes and microscopes.
2. Learn the procedures of operation of various optical instruments.
3. Demonstrate skills on testing the power of lenses, improving the resolution of telescopes and microscopes.
4. Acquire skills in observing and measuring the power, focal length and different refractive errors of eye.
5. Perform some techniques related to testing the blood and other biological samples.
6. Understand the technique of operation of Computer eye testing and evaluation.
7.

Practical (Laboratory) Syllabus:

1. Evaluation of magnifying power of simple microscope.
2. Measurement of reflection and transmission coefficient of certain materials using a microscope.
3. Resolving power of telescope
4. Determination of radii of different capillary tubes using travelling microscope.
5. Refractive index of a liquid (water) using (i) concave mirror and (ii) convex lens and a plane mirror.
6. Removal of refractive errors of eye using combination of lenses.
7. Determination of power of a convex lens by finding its focal length.

Lab References:

1. A Practical Guide to Experimental Geometrical Optics byYuriy A. Garbovskiy-Cambridge Univ. Press

2. https://physics.columbia.edu/sites/default/files/content/Lab%20Resources/1292%20Lab

%20Manual.pdf

3. https://www.lnmiit.ac.in/Department/Physics/uploaded_files/lab-manual.pdf

4. Basic Optics Experiments -http://www.phys.unm.edu › Optics Lab › Basics

5. A Practical Guide to Experimental Geometrical Optics by Yuriy A. Garbovskiy, Anatoliy V. Glushchenko, Cambridge Univ. Press

6. Web sources suggested by the teacher concerned. http://www.phy.olemiss.edu/~thomas/weblab/Optics_lab_Items/Telescope_Microscope _PROCED_Spring_2018.pdf

STUDENT ACTIVITIES

Co-Curricular Activities

(a) Mandatory: (*Training of students by teacher in field related skills: (lab:10 + field: 05)*

1. **For Teacher**: Training of students by the teacher (if necessary, by a local expert) in laboratory/field for a total of not less than 15 hours on the field techniques/skills on the familiarization of various optical instruments available in the laboratory; construction of different types of telescopes and their comparison in construction, operation and their utility and limitations; the details of construction of eye and various defects in the eye sight, emerging techniques in the design of eye lenses including contact lenses and making the student to understand on the testing of a biological sample using a clinical microscope.

(COURSE CODE: 23PHYM53A)

For Student: Students shall (individually) visit and observe the functioning of optical instruments at any one of the following places /centres like (a) pathological laboratory **or** (b) a local ophthalmologist **or** (c) a local optician to understand the various types of eye lenses **or** (d) a local computer based eye testing centre **or** (e) an optician, who fixes contact lenses **or** (f) a local cinema theatre **or** (g) a planetarium. Student shall write the observations and submit a hand-written Fieldwork/Project work not exceeding 10 pages in the given format to the teacher.

2. Max marks for Fieldwork/Project work: 05.
3. Suggested Format for Fieldwork/Project work: *Title page, student details, index page, details of place visited, observations, findings and acknowledgements.*
4. Unit tests (IE).

(b) <u>Suggested Co-Curricular Activities</u>

1. Training of students by related industrial experts.
2. Assignments (including technical assignments like identifying tools in the lens grinding, frame fitting, lens cleaning culture and other operational techniques with safety and security, IPR)
3. Seminars, Group discussions, Quiz, Debates etc. (on related topics).
4. Preparation of videos on tools and techniques in optical instruments and optical lenses, contact lenses.
5. Making a model microscope and measuring its magnification.
6. Making a simple astronomical telescope using two convex lenses.
7. Checking the power of your spectacles or lenses at home.
8. Students shall take up making their own (i) Telescope and (ii) Binoculars with the accessories available at home.

https://paksc.org/pk/science-experiments/physics-experiments/how-to-make-astronomical- telescope

https://kids.nationalgeographic.com/nature/article/make-a-telescope

https://learning-center.homesciencetools.com/article/how-to-make-a-telescope-optical- science-project/

http://scipop.iucaa.in/Amateurs/telemaking.html

9. Collection of material/figures/photos related to various types of lenses and their power.
10. Visit to any eye research laboratories, if available
11. Invited lectures and presentations on related topics by field/industrial experts

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(COURSE CODE: 23PHYM53A)

Programme: B.Sc. Honorus in Physics (Major) -2023-2024

SEMESTER-V

COURSE 14A: OPTICAL INSTRUMENTS AND OPTOMETRY

Theory Credits: 3 3 hrs/week

Model Paper **Max Marks: 60**

Section A

Answer any five questions from the following ($4M \times 5 = 20M$)

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.

Section B

Answer all the questions ($8M \times 5 = 40M$)

11. (A) **(OR)**

    (B)
12. (A) **(OR)**

    (B)
13. (A) **(OR)**

    (B)
14. (A) **(OR)**

    (B)
15. (A) **(OR)**

    (B)

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Programme: B.Sc. Honours in Physics (Major)

w.e.f. AY 2023-24 **COURSE CODE 23PHYM53B**

SEMESTER-V COURSE 14B: OPTICAL IMAGING AND PHOTOGRAPHY

Theory Credits: 3 3 hrs/week

Course Objective:

- The objective of the course on Optical Imaging and Photography is to provide students with a comprehensive understanding of the principles, techniques, and applications of optical imaging and photography.
- The course aims to develop students' theoretical knowledge and practical skills in capturing, processing, and interpreting images using optical devices and imaging technologies.

Learning outcomes:

On Completion of the course, the students will be able to		Knowledge level (Bloom's Taxonomy)
CO 1	Identify the different types of cameras and camera lenses according to different purposes	Level 2 (Understanding)
CO 2	Identify and understand the focal length of the different types of lenses	Level 2 (Understanding)
CO 3	Acquire a critical knowledge on natural and artificial sources of light and their application in photography.	Level 2 (Understanding) Level 3 (Applying)
CO 4	Demonstrate skills of camera usage especially Digital Cameras. To understand the various Image development and editing techniques.	Level 2 (Understanding)
CO 5	Comprehend the concept of different types of common shooting techniques.	Level 2 (Understanding)

Unit-I: Introduction to Photography:

Working principle of a camera, Image formation in simple camera and human eye, Types of cameras Pin-hole camera, Single Lens Reflex (SLR) camera, Twin Lens Reflex (TLR) camera, Digital Single-lens reflex camera (DSLR), Digital camera, Drone flying cameras, Care, and maintenance of camera.

Unit-II: Digital Photography:

Different types of Digital cameras and their parts. Working of DSLR camera. Types of lenses- Normal, Wide angle, telephoto, Zoom lenses. Digital Image formation. Digital camera image sensors. Size of the image. Depth of focus. Depth of field. Exposure time. Aperture. Shutter speed, ISO, filters, knowledge on pixels and their uses, resolution.

Unit-III: Photographic Light Sources:

Need for the light in photography, Light sources- Natural light, Sun light, Moon light, Ambient light, Artificial light sources-Flood light, Spot light, Halogen light, Halogen flash light, Digital lights, Exposure, Studio photography

Unit-IV: Photographic Shooting Techniques:

Significance and role of Camera lens in photo shooting, Arrangement of lenses in a Camera- Positioning, Techniques involved in the use of DSLR cameras, Usage of Filters, Techniques of Photomicrography, High speed Photography with motor driven camera. Basic ideas on Underwater Photography, Medical Photography, Astronomical Photography.

Unit-V: Photo Manipulation:

Developing and printing the photographs, equipment and materials used in developing and printing, image mixing and printing, Image editing through image editing software's like Adobe Photoshop – Adjustment of Brightness, Contrast, Tonal and Colour Values, Methods of storing and processing, Image transportation through Pendrive, CD, HDD and CLOUD [Internet]

Course with focus on Employability/ Entrepreneurship /Skill development modules					
Skill development		Employability		Entrepreneurship	

Reference Books:

1. Object and image; An introduction to photography by George M Craven, PHI
2. An Introduction to Digital Photo Imaging Agfa, 1994
3. Advance Photography by M. Langford.
4. Digital Photography-A hands on Introduction by Phillip Krejcarek, Delmer Publishers
5. Multimedia – An Introduction by John Villamil, PHI
6. https://www.adobe.com/in/creativecloud/photography/discover/dslr-camera.html

Web sources suggested by the teacher concerned and the college librarian including reading material

CO-PO Mapping 1- Low, 2- Moderate, 3- High, '-' No Correlation									
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9
CO 1									
CO 2									
CO 3									
CO 4									
CO 5									

CO-PSO Mapping 1- Low, 2- Moderate, 3- High, '-' No Correlation					
	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1					
CO 2					
CO 3					
CO 4					
CO 5					

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COURSE CODE 23PHYM53B STUDENT ACTIVITIES

Co-Curricular Activities

(a) Mandatory:(*Training of students by teacher in field related skills: (lab:10 + field: 05*):

1. **For Teacher**: Training of students by the teacher (if necessary, by a local expert) in laboratory/field for not less than 15 hours on the field techniques/skills of Image formation by using lenses and mirrors. Also to make students to understand the construction, operation and the Physics principles involved in a normal Camera and Digital Camera.

2. **For Student**: Students shall (individually) visit a local Photo studio or any such facility in a university/research organization/private and observe (i) the operation of different digital cameras, compact and SLR and in taking photographs using different types of lenses by varying aperture, shutter speed for still camera, video camera, CCTV and spy camera **or**

(ii) The use of natural light, tungsten light, fluorescent light, electronic flash reflectors, exposure meters, studio flash and its accessories **or** (iii) the usage of various lighting techniques for different lenses and will do practice on special areas of photography in outdoor and indoor conditions **or** (iv) the different processes viz., Audio video recording, mixing, editing, dubbing of sound, using different types of microphones **or** (v) the handling of the digital video cameras, DVD, HDD, accessories and exposure to take different common shots, dimension of images and movements as per requirement **or** (v) the computer system by digital editing software, printing the photographs taken by digital cameras and the image transportation to the storage media, sending photographs through E- mail and Scanning the photographs, capture frames and analysis of images and record their observations and submit a hand-written Fieldwork/Project work not exceeding 10 pages in the given format to the teacher.

3. Max marks for Fieldwork/Project work: 05.
4. Suggested Format for Fieldwork/Project work: *Title page, student details, index page, details of place visited, observations, findings and acknowledgements*.
5. Tests (IE).

(b) Suggested Co-Curricular Activities:

1. Training of students by a related skilled person from a Photo studio.
2. Assignments (including technical assignments like identifying the tools &techniques involved in photography and handling, operational techniques of different Cameras with safety and security)
3. Seminars, Group discussions, Quiz, Debates etc. (on related topics).
4. Preparation of videos on tools and techniques related to Image formation and Photographic Techniques.

5. Practice taking outdoor photographs with a digital camera in (i) Black & White and (ii) Colour in the following conditions:

Landscapes – Street / Building – Sculpture – Insect / Animal movement – Industrial plant (outside view) – Children, birds (close up / long shot / model photography)- slow and fast moving objects-Night photography etc.

6. Shooting of different areas and topics such as sports, wildlife, modeling, drama, documentary, serial, story board making, news, interview, seminar/ workshop, industrial, live broadcasting, musical event, advertisement, etc.
7. Collection of material/figures/
8. photos related to various components of a Camera, writing and organizing them in a systematic way in a file.
9. Visits to any local Photo Studio or any Lab in universities, research organizations, private firms, etc.
10. Invited lectures and presentations on related topics by field/industrial experts.

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COURSE CODE 23PHYM53BP

SEMESTER-V COURSE 14B: OPTICAL IMAGING AND PHOTOGRAPHY

Practical Credits: 1 2hrs/week

COURSE OBJECTIVE:

- The objective of the practical course on 0ptical Imaging and Photography is to provide students with hands-on experience and practical skills in capturing, processing, and interpreting optical images using various imaging techniques and equipment.
- The course aims to develop students' proficiency in operating optical imaging devices, utilizing image processing software, and analyzing images for different applications.

Learning outcomes:

On Completion of the course, the students will be able to		Knowledge level (Bloom's Taxonomy)
CO 1	List out, identify and understand various image formation techniques including Eye.	Level 1 (Knowledge)
CO 2	Learn the procedures of using Analog and Digital cameras.	Level 2 (Understanding)
CO 3	Demonstrate the focusing techniques of Analog and Digital cameras	Level 2 (Understanding)
CO 4	Acquire skills in the editing and development of photos and videos	Level 2 (Understanding)
CO 5	Perform some experimental skills related to images, videos using the equipment available in the lab or in a local studio	Level 3 (Applying) Level 4 (Analysing)

Minimum of 6 experiments to be done and recorded

1. Construction of a simple pin hole Camera and study it's working.
2. Capture an image using a Digital Camera and apply editing techniques.
3. Understanding various image formats and convert one image format in to other

(For ex: JPEG to BMP)

4. Convert a video stream into image stream by using a suitable editing software.
5. Evaluate the number of pixels and size of digital Image.
6. Comparison of the quality of a 8-bit, 16-bit and 32 bit images.
7. Perform the reduction and enlargement of a given Digital Image.
8. Change the appearance of an image by applying the filters (For ex: from the IR image of the given digital Image by suitable IR filter)

Lab References:

1. DSLR Photography for Beginners by Brian Black
2. The Art of Photography by Bruce Barnbaum
3. Photoshop for Photographers by John Slavio
4. https://www.youtube.com/channel/UCwWyFRy2l6aUFMsRemP51Sw. You Tube resource.
5. https://www.udemy.com/course/complete-photography-course/ 6. Web sources suggested by the teacher concerned.

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Programme: B.Sc. Honours in Physics (Major)

w.e.f. AY 2023-24 **COURSE CODE 23PHYM53B**

COURSE 14B: OPTICAL IMAGING AND PHOTOGRAPHY

Theory Credits: 3 3 hrs/week

Blue Print for Semester End Theory Examinations

S.No	Type of question	No of questions given			No of questions to be answered		
		No of questions	Marks allotted to each question	Total marks	No of questions	Marks allotted to each question	Total marks
1	Section A Short answer questions	10 (Two questions from each unit)	4	40	5 (Any five out of 10 questions)	4	20
2	Section B Long answer questions	10 (Two questions from each unit with only internal choice)	8	80	5 (Answer one question from each unit)	8	40
Total				120			60

Percentage of choice given $= \frac{(120-60)}{120} \times 100 = 50\%$

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Programme: B.Sc. Honours in Physics (Major)

w.e.f. AY 2023-24 **COURSE CODE 23PHYM53B**

COURSE 14B: OPTICAL IMAGING AND PHOTOGRAPHY

BLUE PRINT FOR SEMESTER END EXAMINATIONS PAPER SETTING

Learning level wise Weightage				
Bloom's Taxonomy level	Weightage	Marks	Essay type	Short answer type
Knowledge/ Remember	33%	20	2(two out of four)	I (one out of two)
Understanding/ Comprehension	27%	16	2(two out of four)	
Application	20%	12	I (one out of two)	I (one out of two)
Analysis	13%	8		2(two out of four)
Synthesis/ Evaluate	7%	4		I (one out of two)
Total	IOO	60	5(each question has internal choice)	5 out of 10 questions

Chapter wise Weightage				
Sl. No.	Module/ Chapter	Name of the chapter	8 Marks	4 Marks
1	**I**		2(one out of two)	2
2	**II**		2(one out of two)	2
3	**III**		2(one out of two)	2
4	**IV**		2(one out of two)	2
5	**V**		2(one out of two)	2
			5(each question has internal choice)	5 out of given 10

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COURSE 14B: OPTICAL IMAGING AND PHOTOGRAPHY

Theory Credits: 3 3 hrs/week

Max Marks: 60

Section A

Answer any five questions from the following (4M× 5 = 20*M*)

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.

Section B

Answer all the questions (8M× 5 = 40*M*)

11. (a)

(OR)

(b)

12.(a)

(OR)

(b)

13.(a)

(OR)

(b)

14.(a)

(OR)

(b)

15.a)

(OR)

(b)

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Programme: B.Sc. Honours in Physics (Major)
w.e.f. AY 2023-24
SEMESTER-V COURSE CODE: 23PHYM54A:

LOW TEMPERATURE PHYSICS & REFRIGIRATION

Theory **Credits:3** **3hrs/week**

COURSE OBJECTIVE:

The objective of the course on Low Temperature Physics & Refrigeration is to provide students with a comprehensive understanding of the fundamental principles, concepts, and applications of low-temperature physics and refrigeration systems. The course aims to develop students' theoretical knowledge and practical skills in working with low temperatures, understanding cryogenic phenomena, and operating refrigeration systems.

LEARNING OUTCOMES:

Students after successful completion of the course will be able to

1. Identify various methods and techniques used to produce low temperatures in the Laboratory.
2. Acquire a critical knowledge on refrigeration and air conditioning.
3. Demonstrate skills of Refrigerators through hands on experience and learns about refrigeration components and their accessories.
4. Understand the classification, properties of refrigerants and their effects on environment.
5. Comprehend the applications of Low Temperature Physics and refrigeration.

UNIT-I Production Of Low Temperature

Production of low temperatures-Introduction, Freezing mixtures, Joule-Thomson effect, Regenerative cooling, Different methods of

liquefaction of gases, liquefaction of air, Production of liquid hydrogen and nitrogen, Adiabatic demagnetization, Properties of materials at low temperatures

UNIT-II Measurement of Low Temperature

Gas thermometer and its correction and calibration, Secondary thermometers, resistance thermometers, thermocouples, Vapour pressure thermometers, Magnetic thermometers, Advantages and drawbacks of each type of thermometer.

UNIT-III Principles of Refrigeration

Introduction to Refrigeration- Natural and artificial refrigeration , Stages of refrigeration, Types of refrigeration - Vapor compression and vapor absorption refrigeration systems, Refrigeration cycle and explanation with a block diagram, Introductory ideas on air-conditioning.

Refrigerants-Introduction, Ideal refrigerant, Properties of refrigerant, Classification of refrigerants, commonly used refrigerants, Eco-friendly refrigerants

UNIT-IV Components of Refrigerator

Refrigerator and its working, Block diagram, Coefficient of Performance (COP), Tons of refrigeration (TR) and Energy Efficiency Ratio (EER), Refrigerator components: Types of compressors, evaporators, condensers, and their functional aspects, defrosting in a refrigerator, Refrigerant leakage and detection

UNIT-V Applications of Low Temperature & Refrigeration

Applications of Low temperatures: Preservation of biological material, Food freezing, liquid nitrogen and liquid hydrogen in medical field, Superconducting magnets in MRI- Tissue ablation (cryosurgery) - Cryogenic rocket propulsion system. *Applications of refrigeration*: Domestic refrigerators, Water coolers, Cold storages, Ice plants, Food preservation methods, Chemical and Process industries, Cold treatment of metals, Construction field, Desalination of water, Data centers.

References

1. Heat and Thermodynamics by BrijLal&N.Subramanyam, S.Chand Publishers.
2. Thermal Physics by S C Garg, R M Bansal & C K Ghosh, McGrawHill Education, India
3. Heat and Thermodynamics by M MZemansky,McGrawHill Education (India).
4. Low-Temperature Physics by Christian E. & Siegfried H., Springer.

5. Thermal Engineering by S. Singh, S.Pati, Ch:18 Introduction to Refrigeration.

6. The Physics Hyper Text Book. Refrigerators.https://physics.info/refrigerators/

7. Refrigeration and Air Conditioning by Manohar Prasad, New age international (P) limited, New Delhi

8. A course in Refrigeration and Air Conditioning by S.C. Arora and S. Domkundwar, Dhanpatrai and sons, Delhi

9. https://trc.nist.gov/cryogenics/Papers/Review/2017-Low Temperature Applications and Challenges.pdf

10. https://nptel.ac.in/content/storage2/courses/112105129/pdf/RAC%20Lecture%203.pdf

11. Other Web sources suggested by the teacher concerned and the reading material.

https://nptel.ac.in

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Programme: B.Sc. Honours in Physics (Major)
w.e.f. AY 2023-24

SEMESTER-V COURSE CODE: 23PHYM54AP: **LOW TEMPERATURE PHYSICS & REFRIGIRATION**

Practical **Credits:1** **2hrs/week**

COURSE OBJECTIVE:

The objective of the practical course on Low Temperature Physics & Refrigeration is to provide students with hands-on experience and practical skills in working with low temperatures, operating refrigeration systems, and conducting experiments in the field of low temperature physics. The course aims to develop students' proficiency in handling cryogenic equipment, performing temperature measurements, and conducting experiments at low temperatures.

LEARNING OUTCOMES: On completion of practical course, student shall be able to

1. List out, identify and handle equipment used in refrigeration and low temperature lab.
2. Learn the procedures of preparation of Freezing Mixtures.
3. Demonstrate skills on developing various Freezing mixtures and materials and their applications in agriculture, medicine and day to day life.
4. Acquire skills in observing and measuring various methodologies of very low temperatures
5. Perform some techniques related to Refrigeration and Freezing in daily life.

Practical (Laboratory) Syllabus: *(30 hrs. Max marks: 50)*)

Record the Principles and applications of Refrigerators and Freezers.

1. Measure the temperatures below Melting point of Ice using a thermometer available in the Lab.
2. Make a freezing mixture by adding different salts viz., Sodium chloride, Potassium Hydrate (KOH), Calcium chloride to ice in different proportions and observe the temperature changes.
3. Study the operation of a refrigerator and understand the working of different parts.
4. Study the properties of refrigerants like chlorofluorocarbons-hydrochlorofluoro- carbons and record the lowest temperatures obtained.
5. Consider a simple faulty refrigerator and try to troubleshoot the simple problems by understanding its working.
6. Understand the practical problem of filling the Freon Gas into the Refrigerator.
7. Get the Liquid Nitrogen or Liquid Helium from nearby Veterinary Hospital and measure their temperatures using chromel-alumel thermocouple or mercury thermometer and observe their physical properties like colour, smell etc and precautions to be taken for their safe handling.
8. Preparation of freeze drying food with Dry ice and liquid nitrogen
9. Preparation of freeze drying food with liquid nitrogen

STUDENT ACTIVITIES

Co-Curricular Activities:

(a)Mandatory:(*Training of students by teacher in field related skills: (lab:10 + field: 05*)

1. **For Teacher**: Training of students by the teacher in the in the laboratory/field for a total of not less than 15 hours on the techniques/skills of Low Temperature Production, methods used and applications of Low temperatures and refrigeration in day to day life and other applications in medicine and industry.

For Student: Student shall (individually) visit (i) a small ice plant or a cold storage plant (ii) Air Conditioner (AC) repair shop or (iii) Refrigerator repair shop to understand the construction, working principle and the trouble shooting of these devices after interacting with the technicians. **Or** Student shall observe the various thermodynamic processes taking place while working with the refrigerator and observe the leak detection in refrigeration

2. system by different methods, air removal and charging of a refrigeration unit and testing of a refrigeration system to find out the Refrigerating capacity/Ton of refrigeration (TR) and the Power input. **Or** Student shall identify the refrigerant cylinder by color coding and standing pressure. **Or** Student shall visit the freezer aisle of a supermarket and observes the bags of different frozen fruits. Student shall write the observations and submit a handwritten Fieldwork/Project work not exceeding 10 pages in the given format to the teacher.

3. Max marks for Fieldwork/Project work: 05.
4. Suggested Format for Fieldwork/Project work: *Title page, student details, index page, details of place visited, observations, findings and acknowledgements.*
5. Unit tests (IE).

(b)Suggested Co-Curricular Activities

1. Training of students by related Factory, industrial experts.
2. Assignments (including technical assignments like identifying tools in Refrigerators, Freezers and their handling, operational techniques with safety and security)

3. Seminars, Group discussions, Quiz, Debates etc. (on related topics).
4. Preparation of videos on tools and techniques in Low Temperatures and applications.
5. Collection of material/figures/photos related to substances used in Freezing Mixtures, their Properties and availability etc., writing and organizing them in a systematic way in a file.
6. Visits to Ice plants and labs in universities, research organizations, private firms, etc.
7. Making your own mini refrigerator at home
8. Build your own water cooler with the materials available at home.
9. Making hand launched liquid nitrogen rockets
10. Experiments with Liquid nitrogen and strawberry/ banana/ lemon/ onion/ mushroom/ egg etc. (*To be tried under professional supervision only*).
11. Invited lectures and presentations on related topics by field/industrial experts
12. Identification of different Ozone-depleting substances (ODS) that damage the ozone layer in the upper atmosphere.
13. Demonstration to illustrate the greenhouse effect and the role of carbon dioxide as a greenhouse gas using plastic water bottles, flood light lamp, beakers and temperature sensors and observe the temperature changes. https://edu.rsc.org/experiments/modelling-the-greenhouse-effect/1543.articlehttps://sealevel.jpl.nasa.gov/files/archive/activities/ts1hiac1.pdf

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Programme: B.Sc. Honours in Physics (Major)

w.e.f. AY 2023-24

SEMESTER-V COURSE CODE: 23PHYM54A: **LOW TEMPERATURE PHYSICS & REFRIGIRATION**

BLUE PRINT

Learning level wise Weightage				
Bloom's Taxonomy level	**Weightage**	**Marks**	**Essay type**	**Short answer type**
Knowledge/ Remember	**33%**	**20**	**2(two out of four)**	**1(one out of two**
Understanding/ Comprehension	**27%**	**16**	**2(two out of four)**	
Application	**20%**	**12**	**1(one out of two)**	**1(one out of two**
Analysis	**13%**	**8**		**2(two out of four)**
Synthesis/ Evaluate	**7%**	**4**		**1(one out of two**
Total	**100**	**60**	**5(each question has internal choice)**	**5 outb of 10 questions**

Chapter wise Weightage

S.No	Module/ Chapter	Name of the chapter	8 marks	4 marks
1	I	Production of Low temperature	2(one out of two)	2
2	II	Measurement of Low temperature	2(one out of two	2
3	III	Principles of Refrigeration	2(one out of two	2
4	IV	Components of Refrigerator	2(one out of two	2
5	V	Applications of Low Temperature & Refrigeration	2(one out of two	2
		TOTAL QUESTIONS	5(each question has internal choice)	5 out of given 10

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Programme: B.Sc. Honours in Physics (Major)

w.e.f. AY 2023-24

SEMESTER-V COURSE CODE: 23PHYM54A:

LOW TEMPERATURE PHYSICS & REFRIGIRATION

MODEL PAPER

DURATION::3 hrsMAX.MARKS :: 60

SECTION-A

Answer any FIVE questions of the following (5 X 4 = 20 M)

1.

2.

3.

4.

5.

6.

7.

8.

9.

10.

SECTION-B

Answer ALL the questions Of the following (5 X 8 = 40 M)

11. (a)

[OR]

(b)

12 (a)

[OR]

(b)

13(a)

[OR]

(b)

14 (a)

[OR]

(b

15 (a)

[OR]

(b)

Dr V S KRISHNA GOVERNMENT DEGREE COLLEGE(A)
VISAKHAPATNAM

Major Courses offered w.e.f. AY 2023-24

Theory

SEMESTER-V COURSE CODE :23PHYM54B

COURSE 15B: SOLAR ENERGY AND ITS APPLICATIONS

Credits: 3 3 hrs/week

COURSE OBJECTIVE:

The objective of the course on Solar Energy and Its Applications is to provide students with a comprehensive understanding of solar energy technologies, their principles, and their applications. The course aims to develop students' knowledge and skills in harnessing solar energy for various purposes, including electricity generation, heating, and cooling.

LEARNING OUTCOMES:

After successful completion of the course, the student will be able to:

- Understand Sun structure, forms of energy coming from the Sun and its measurement.
- Acquire a critical knowledge on the working of thermal and photovoltaic collectors.
- Demonstrate skills related to callus culture through hands on experience
- Understand testing procedures and fault analysis of thermal collectors and PV modules.
- Comprehend applications of thermal collectors and PV modules

Unit - I: Basic Concepts of Solar Energy

Spectral distribution of solar radiation, Solar constant , zenith angle and Air-Mass, standard time, local apparent time, equation of time, direct, diffuse and total radiations. Pyrheliometer - working principle, direct radiation measurement, Pyranometer-working Principle, diffuse radiation measurement, Distinction between the two meters.

Unit - II: Solar Thermal Collectors

Solar Thermal Collectors-Introduction, Types of Thermal collectors, Flat plate collector – liquid heating type, Energy balance equation and efficiency, Evacuated tube collector, collector overall heat loss coefficient, Definitions of collector efficiency factor, collector heat-removal factor and collector flow factor, Testing of flat-plate collector, solar water heating system, natural and forced circulation types.Concentrating collectors, Solar cookers, Solar dryers, Solar desalinators.

Unit - III: Fundamentals of Solar Cells

Semiconductor interface, Types, homo junction, hetero junction and Schottky barrier, advantages and drawbacks, Photovoltaic cell, equivalent circuit, output parameters, conversion efficiency, quantum efficiency, Measurement of I-V characteristics, series and shunt resistance, their effect on efficiency, Effect of light intensity, inclination and temperature on efficiency

Unit -IV: Types of Solarcells and Modules

Types of solar cells, Crystalline silicon solar cells, I-V characteristics, poly-Si cells, Amorphous silicon cells, Thin film solar cells-CdTe/CdS and CuInGaSe2/CdS cell configurations, structures, advantages and limitations, Multi junction cells – Double and triple junction cells. Module fabrication steps, Modules in series and parallel, Bypass and blocking diodes

Unit – V: Solar Photovoltaic Systems

Energy storage in PV systems, Energy storage modes, electrochemical storage, Batteries, Primary and secondary, Solid-state battery, Molten solvent battery, lead acid battery and dry batteries, Mechanical storage – Flywheel, Electrical storage –Super capacitor

References:

1. Solar Energy Utilization by G. D. Rai, Khanna Publishers
2. Solar Energy- Fundamentals, design, modelling and applications by G.N. Tiwari, Narosa Publications, 2005.
3. Solar Energy-Principles of thermal energy collection & storage by S.P. Sukhatme, Tata Mc-Graw Hill Publishers, 1999.
4. Science and Technology of Photovoltaics, P. Jayarama Reddy, CRC Press (Taylor & Francis Group), Leiden &BS Publications, Hyderabad, 2009.
5. Solar Photovoltaics- Fundamentals, technologies and applications, Chetan Singh Solanki, PHI Learning Pvt. Ltd.,
6. Web sources suggested by the teacher concerned and the college librarian including reading material.
   (a) https://courses.edx.org/c4x/DelftX/ET.3034TU/asset/solar_energy_v1.1.pdf
   (b) https://www.sku.ac.ir/Datafiles/BookLibrary/45/John%20A.%20Duffie,%20William%20A.%20Beckman(auth.)-Solar%20Engineering%20of%20Thermal%20Processes,%20Fourth%20Edition%20(2013).pdf

Dr. V. S. Krishna Govt. Degree College (Autonomous)

Visakhapatnam-13

(Affiliated To Andhra University, Visakhapatnam)

BLUE PRINT FOR SEMESTER END EXAMINATIONS PAPER SETTING

Learning level wise Weightage				
Bloom's Taxonomy level	**Weightage**	**marks**	**Essay type**	**Short answer type**
Knowledge/ Remember	33%	20	2	1(one out of two)
Understanding/ Comprehension	27%	16	2	
Application/	20%	12	1	1(one out of two)
Analysis	13%	8		2(two out of four)
Synthesis/ Evaluate	7%	4		1(one out of two)
Total	100	60		5 out of 10 questions

Chapter wise Weightage				
Sl. No.	**Module/ Chapter**	**Name of the chapter**	**8 Marks**	**4 Marks**
1	UNIT-I		2(one out of two)	2
2	UNIT-II		2(one out of two)	2
3	UNIT-III		2(one out of two)	2
4	UNIT-IV		2(one out of two)	2
5	UNIT-V		2(one out of two)	2

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SEMESTER END EXAMINATIONS MODEL PAPER

(Programme)_____ **SEMESTER- (__)**

Time: 3 hours **Course title**_____. **Course code**_____

Maximum Marks: 60

PART- A

Answer any **five** of the following questions. Each question carries **Four** marks. 5 X 4 = 20 Marks

1. –
2. –
3. –
4. ---
5. –
6. –
7. ---
8. –
9. –
10. --

PART- B

Answer **all the following** questions. Each carries **Eight** marks 5 X 8 = 40 Marks

11. (A).

(Or)

(b)

12. (A)

(Or)

(b)

13. (A)

(Or)

(b)

14. (A)

(Or)

(b)

15. (a).

(Or)

(b)