

SEMESTER-V
COURSE12:APPLICATIONS OF ELECTRICITY AND MAGNETISM

Theory

Credits:2

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

Passive and Active Elements-Examples, 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, Combination of Inductors, Types of Inductors. Capacitor - Principle, Charging and discharging of a Capacitor, Types of Capacitors, Color coding. 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)

Different types of batteries, Rechargeable batteries – Lead acid batteries, Li-ion batteries, Li-PO Batteries, Series, Parallel & Series-Parallel configuration of batteries, Thevenin's theorem without proof, Norton's theorem without proof, Constant Voltage source and its application- Constant Current Source and its application.

Unit-III Alternating & Direct Currents

Fleming's Right Hand Rule, A.C Generator, Construction and its working principle, DC Generator, Applications, Types of AC & DC Generators, Losses associated with DC generators, Differences between DC and AC generators. Transformers-Construction and its working principle, EMF equation, Relation between primary turns and secondary turns of the transformer with emf, Use of a transformer in a regulated power supply, single phase motor-working principle, Applications of motors.

Unit-IV Modulation Circuits

Need for modulation, Amplitude modulation, modulation index, Upper and Lower side frequencies, Upper and Lower side Bands, Power relations in AM Wave, Demodulation, Diode detector, AM transmitter, AM Receiver, Frequency modulation, modulation index, FM

Transmitter, FM Receiver

Unit-V Applications of EM Induction & Power Supplies

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.

Construction of 5V volts regulated power supply, Simple Design of FM Radio circuit using LCR series resonance(tuning) circuit, Design of a simple 5 volts DC charger, Power supply for computers (SMPS).

References:

1. Grob's Basic Electronics by Mitchel Schultz, T M H or McGraw Hill
2. Electronic and Electrical Servicing by Ian Roberts on Sinclair, John Dunton, Elsevier Publications
3. Trouble shooting Electronic Equipment by R.S. Khandapur, TMH
4. Websources suggested by the teacher concerned and the college librarian including reading material.

SEMESTER-V
COURSE12:APPLICATIONS OF ELECTRICITY AND MAGNETISM

Theory **Credits:2** **3hrs/week**

SEMESTER V: BLUE PRINT

Unit no	Essay answer questions	Short answer questions	Numerical problem
Unit I	2 (with internal choice)	2	0
Unit II	2 (with internal choice)	1	1
Unit III	2 (with internal choice)	2	0
Unit IV	2 (with internal choice)	2	0
Unit V	2 (with internal choice)	2	0

QUESTION BANK

Essay Questions: UNIT I

1. What is a Fusible Resistor. Explain its working and give its applications.
2. What is motor starting capacitor and give its applications.
3. Explain the principle of inductor. And also explain the application of choke in a fan and in a radio tuning circuit.

UNIT II

1. Explain about series, parallel & series-parallel configuration of Batteries.
2. Explain the construction and working of (i) Lead acid batteries (ii) Li-Ion (iii) Li-Po batteries.
3. Explain Constant Voltage Source and Constant Current Source with applications.

UNIT III

1. What is AC Generator. Explain the construction and working principle of generator. And write the applications of generators.
2. What is electrical transformer. Explain the basic principle, construction and working of electrical transformer.
3. Explain the construction of single-phase induction Motor. Mention the applications of Motor.

UNIT IV

1. Define modulation index and describe the Upper and Lower Side Bands and derive expression for total power in AM.
2. Describe the working of an AM transmitter and Receiver with diagrams.
3. Describe the working of a FM transmitter and Receiver with Block diagrams.

UNIT V

1. How to make a simple charger circuit diagram of 5V DC from 230AC.
2. Explain the design of FM Radio Circuit.
3. Explain DC Motor principle, construction and derive the expression for its efficiency.

Short Answer Questions: UNIT I

1. Describe active and passive elements with examples.
2. Briefly explain the colour (4 band) coding in Resistors.
3. What is the principle of inductor and describe various types of inductors.
4. What is the principle of capacitor and describe various types of capacitors.
5. Explain various types of resistors.

UNIT II

1. State Thevenin's theorem.
2. State Norton's theorem.
3. Write a short note on types of batteries.

UNIT III

1. Explain Fleming's Right-hand rule.
2. Briefly explain about AC generator and DC generators.
3. Explain the use of transformer in regulated power supply.

4. Explain the EMF equation of transformer and relation between primary and secondary turns.

UNIT IV

1. Explain Need for modulation in Communication Systems.
2. Describe Amplitude Modulation (AM) with a diagram.
3. Describe Frequency Modulation (FM) with a diagram.
4. Explain the role of diode detector in demodulation.

UNIT V

1. Explain the term SMPS (power supply for computers)
2. Explain Wireless power transfer in Inductive Charging.
3. Design a simple motor with suitable turns of coil.

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B.Sc(PHYSICS) Honours

SEMESTER-5

MODEL QUESTION PAPER

COURSE 12: APPLICATIONS OF ELECTRICITY AND MAGNETISM

Theory

Credits:2

3hrs/week

Section-A

Answer any Five of the following Questions

5 X 4=20 M

1. Describe active and passive elements with examples.
2. What is the principle of capacitor and describe various types of capacitors.
3. State Thevenin's theorem.
4. Write a short note on types of batteries.
5. Explain Fleming's Right-hand rule.
6. Explain the EMF equation of transformer and relation between primary and secondary turns.
7. Explain Need for modulation in Communication Systems.
8. Explain the EMF equation of transformer and relation between primary and secondary turns.
9. Explain the term SMPS (power supply for computers)
10. Explain Wireless power transfer in Inductive Charging.

Section – B

Answer ALL the questions

5 X 8 = 40 M

1. (a) 1. What is a Fusible Resistor. Explain its working and give its applications.

Or

(b) Explain the principle of inductor. And also explain the application of choke in a fan and in a radio tuning circuit.

2. (a) Explain about series, parallel & series-parallel configuration of Batteries.

Or

(b) Explain Constant Voltage Source and Constant Current Source with applications.

3. (a) What is AC Generator. Explain the construction and working principle of generator. And write the applications of generators.

Or

(b) What is electrical transformer. Explain the basic principle, construction and working of electrical transformer.

4. (a) Describe the working of an AM transmitter and Receiver with diagrams.

Or

(b) Describe the working of a FM transmitter and Receiver with Block diagrams.

5. (a) How to make a simple charger circuit diagram of 5V DC from 230AC.

Or

(b) Explain DC Motor principle, construction and derive the expression for its efficiency.

SEMESTER-V
COURSE12:APPLICATIONS OFELECTRICITYAND MAGNETISM
Practical Credits:1 2hrs/week

COURSEOBJECTIVE:

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.

LEARNINGOUTCOMES:

On successful completion of this practical course, students 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 trouble shooting 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.
7. 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.
8. 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.
9. Test whether a circuit is an Open circuit or Short Circuit by measuring continuity with a Multimeter and record your readings.

I. LabReferences:

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, Joseph Sloop, & 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) visit a 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, microwave, 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.
2. Assignments (including technical assignments like identifying various electrical and electronic components & devices 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 Electrical & Electronic Appliances in daily life.
5. 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.
6. Visits to nearby electrical or electronic industries or laboratories in universities, research organizations, private firms, etc.
7. Invited lectures and presentations on related topics by field/industrial expert.

SEMESTER-V
COURSE13: ELECTRONIC INSTRUMENTATION

Theory

Credits:2

3hrs/week

COURSEOBJECTIVE:

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.

LEARNINGOUTCOMES:

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

1. Identify various facilities required to setup 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

Static characteristic of instruments,(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, $3\frac{1}{2}$ display and $4\frac{1}{2}$ display Digital Multimeter,Sources of errors in the Measurement of resistance, voltage and current, Specifications of Multimeter and their significance. Balancing and damping Moving iron instruments & PMMC instruments.

UNIT-II Oscilloscope

Cathode ray oscilloscope-Principle and block diagram of CRO-cathode Ray Tube-functioning-various controls, **Vertical and horizontal deflections systems**. Applications of CRO: Measurement of voltage (dc and ac), frequency & time period, Digital Storage Oscilloscope.

UNIT-III Transducers and Bridges

Linear Variable Differential Transformer (LVDT),MEMS accelerometers/gyros (wearables/IoT applications),Piezo- electric transducer.AC Bridges - Measurement of Inductance and Capacitance – Maxwell's bridge, Schering Bridge, Measurement of frequency – Wien's bridge.

UNIT-IVADC and DAC & Display Instruments

D/Aconverters- Binaryladder, A/Dconverters – successive approximation type. 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

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.

Basic operating principles and uses of (i) ECG machine (ii) Radiography (iii) Ultrasound scanning (iv) Ventilator

REFERENCEBOOKS:

1. Electronic Instrumentation by H.S. Kalsi, TMH Publishers
2. Electronic Instrument Hand Book by C lyde F. Coombs, McGraw Hill
3. Introduction to Biomedical Instrumentation by Mandeep Singh, PHI Learning.
4. Electronic Instrumentation– W D 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. Halfbrick, A.B., PHI Learning, New Delhi
11. Websources suggested by the teacher concerned and the college librarian including reading material.

SEMESTER-V
COURSE13:ELECTRONICINSTRUMENTATION

Practical

Credits:1

2hrs/week

COURSEOBJECTIVE:

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.

LEARNINGOUTCOMES:

1. Familiarize students with arrange 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.

PRACTICALSYLLABUS

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 Pulse oximeter and measure the pulse rate of different people and understand the working of the meter.

VI. LabReferences:

- Electronic Measurement and Instrumentation by J.P.Navani.,S Chand & CoLtd
- Principles of Electronic Instrumentation by A De Sa,Elsevier Science Publ.
- Electronic Measurements and Instrumentation by S.P. Bihari,Yogita Kumari,Dr.Vinay Kakka, Vayu Education of India.
- Laboratory Manual For Introductory Electronics Experiments by Maheshwari, New Age International (P) Ltd., Publishers.
- Electricity – Electronics Fundamentals: AText-lab Manual by Paul B.Zbar,Joseph Sloop, &Joseph G. Sloop , McGraw-Hill Education.
- Websources 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))*

For Teacher: Training of students by the teacher 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 troubleshooting 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.

1. Max marks for Fieldwork/Project work: 05.
2. Suggested Format for Fieldwork/Project work: *Title page, student details, index page, details of place visited, observations, findings and acknowledgements.*
3. 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
3. instruments and tools and their handling, operational techniques with safety and security.
4. Seminars, Group discussions, Quiz, Debates etc. (on related topics).
5. Making your own stethoscope at home.
6. Making seven segment display at home.
7. Preparation of videos on tools and techniques in various branches of instrumentation.
8. 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.
9. Visits to Instrumentation Laboratories of local Universities or Industries like Cement, Chemical or Sugar Plant etc. or any nearby research organizations, private firms, etc.
10. Invited lectures and presentations on related topics by Technical/industrial experts

SEMESTER-V
COURSE13:ELECTRONIC INSTRUMENTATION

Theory

Credits:2

3hrs/week

SEMESTER V: BLUE PRINT

Unit no	Essay answer questions	Short answer questions	Numerical problem
Unit I	2 (with internal choice)	2	0
Unit II	2 (with internal choice)	2	0
Unit III	2 (with internal choice)	2	0
Unit IV	2 (with internal choice)	2	0
Unit V	2 (with internal choice)	2	0

SEMESTER-V
COURSE13:ELECTRONIC INSTRUMENTATION

Theory

Credits:2

3hrs/week

QUESTION BANK

Essay Questions: UNIT I

1. Describe the construction and working of an analog multi-meter and digital multi-meter.
2. Explain the construction, working and applications of a PMMC (permanent Magnet Moving Coil) instrument.
3. Explain the concepts of Balancing and damping Moving iron instruments.

UNIT II

1. What is a CRO? Explain the working of a basic CRO with a Block Diagram.
2. Define a Digital Storage Oscilloscope? Explain it's with the help of a Block Diagram.
3. Write a brief note on vertical and horizontal deflection systems in CRO.

UNIT III

1. Explain the construction and working of LVDT's (Linear Variable Differential Transformer).
2. How is an unknown inductance measured in terms of a known capacitor by using AC Maxwell's Bridge? Explain.
3. How is an unknown capacitor measured in terms of a known capacitor by using AC Schering Bridge.

UNIT IV

1. Explain the working of:
(a) Digital to Analog Convertor using Binary Ladder Method. and
(b) Analog to digital convertor using Successive approximation method.
2. What are liquid crystals? Explain their Structure and working.? Write the applications of Liquid Crystal Displays.
3. Describe the construction and working of seven segment display and explain different types of seven segment display modules.

UNIT V

1. Explain the construction and working of RC Coupled amplifier and discuss its frequency response characteristics.
2. Describe the construction and working of RC Phase shift Oscillator.
3. Write the basic operating principle and uses of (i) ECG machine (ii) Radiography (iii) Ultrasound scanning (iv) Ventilator

Short Answer Questions: UNIT I

1. Write a short note on Static Characteristics of measuring instruments.
2. Explain about $3\frac{1}{2}$ and $4\frac{1}{2}$ display concepts in digital instruments.
3. Write a short note on Sources of errors in measurements.
4. Explain the construction and working of DC Voltmeter
5. Explain the construction and working of AC Voltmeter

UNIT II

1. What are the applications of CRO.
2. Explain the function of various controls of Cathode Ray Tube.

UNIT III

1. What is the concept of MEMS accelerometers and gyroscopes in wearables and IoT applications?
2. How is AC frequency determined using Wien's Bridge.
3. Write a short note on piezo electric transducer.

UNIT IV

1. Write a short note on LED display.
2. What is display device and give its examples.
3. What are the limitations of SSDs.

UNIT V

1. Write a short note on positive and negative feedback circuits.
2. What are the advantages of negative feedback and explain Barkhausen criteria.
3. Define Amplifiers. Classify amplifiers based on various criteria.

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B.Sc(PHYSICS) Honours

SEMESTER-5

MODEL QUESTION PAPER

COURSE 13: ELECTRONIC INSTRUMENTATION

Theory

Credits:2

3hrs/week

SECTION-A

Answer any Five of the following questions

5x4M = 20M

1. Short answer type question from Unit-I
2. Short answer type question from Unit-I
3. Short answer type question from Unit-II
4. Short answer type question from Unit-II
5. Short answer type question from Unit-III
6. Short answer type question from Unit-III
7. Short answer type question from Unit-IV
8. Short answer type question from Unit-IV
9. Short answer type question from Unit-V
10. Short answer type question from Unit-V

SECTION-B

Answer all the following questions.

5x8M = 40M

- 11 Essay type question from Unit-I
- Or
- 12) Essay type question from Unit-I
- 13) Essay type question from Unit-II
- Or
- 14) Essay type question from Unit-II
- 15) Essay type question from Unit-III
- Or
- 16) Essay type question from Unit-III
- 17) Essay type question from Unit-IV
- Or
- 18) Essay type question from Unit-IV
- 19) Essay type question from Unit-V
- Or
- 20) Essay type question from Unit-V

SEMESTER-V
COURSE14A:OPTICALINSTRUMENTSANDOPTOMETRY

Theory

Credits:2

3hrs/week

COURSEOBJECTIVE:

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

LEARNINGOUTCOMES:

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.

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.

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

ReferenceBooks

1. Optics and Optical Instruments:An IntroductionbyB.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 BrjLal 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. Websources suggested by the teacher concerned and the college librarian including Reading material.

SEMESTER-V
COURSE14A:OPTICALINSTRUMENTS AND OPTOMETRY

Practical

Credits:1

2hrs/week

COURSEOBJECTIVE:

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

LearningOutcomes:

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

1. Listout, 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.

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. Resolvingpower 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.

LabReferences:

1. A Practical Guide to Experimental Geometrical Optics byYuriyA.Garbovskiy-Cambridge Univ. Press
2. <https://physics.columbia.edu/sites/default/files/content/Lab%20Resources/1292%20ab%20Manual.pdf>
3. https://www.lnmiit.ac.in/Department/Physics/uploaded_files/lab-manual.pdf
4. BasicOpticsExperiments-http://www.phys.unm.edu›OpticsLab› Basics
5. APracticalGuidetoExperimentalGeometricalOpticsbyYuriyA.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_Microscop ePROCED_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

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.

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

(b) Suggested Co-Curricular Activities

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

SEMESTER-V
COURSE14B:OPTICALIMAGINGANDPHOTOGRAPHY

Theory

Credits:2

3hrs/week

COURSEOBJECTIVE:

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.

LEARNINGOUTCOMES:

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

1. Identify the different types of cameras and camera lenses according to different purposes.
2. Identify and understand the focal length of the different types of lenses
3. Acquire a critical knowledge on natural and artificial sources of light and their application in photography.
4. Demonstrate skills of camera usage especially Digital Cameras. To understand the various Image development and editing techniques.
5. Comprehend the concept of different types of common shooting techniques.

Unit-I: Introduction toPhotography:

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:DigitalPhotography:

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:PhotographicLight 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:PhotographicShootingTechniques:

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: PhotoManipulation:

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]

III ReferenceBooks:

1. Objectandimage;AnintroductiontophotographybyGeorgeM Craven, PHI
2. AnIntroductiontoDigitalPhotoImagingAgfa, 1994
3. AdvancePhotographybyM. Langford.
4. DigitalPhotography-Ahandson IntroductionbyPhillipKrejcerek, DelmerPublishers
5. Multimedia–AnIntroduction byJohnVillamil, PHI
6. <https://www.adobe.com/in/creativecloud/photography/discover/dslr-camera.html>
7. Websourcessuggestedbytheteacherconcernedandthecollegelibrarianincluding readingmaterial.

SEMESTER-V
COURSE14B:OPTICALIMAGINGANDPHOTOGRAPHY

Practical

Credits:1

2hrs/week

COURSEOBJECTIVE:

The objective of the practical course on Optical 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.

LEARNINGOUTCOMES:

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

1. List out, identify and understand various image formation techniques including Eye.
2. Learn the procedures of using Analog and Digital cameras.
3. Demonstrate the focusing techniques of Analog and Digital cameras.
4. Acquire skills in the editing and development of photos and videos.
5. Perform some experimental skills related to images, videos using the equipment available in the lab or in a local studio.

Practical(Laboratory) Syllabus:

1. Construction of a simple pinhole Camera and study its working.
2. Capture an image using a Digital Camera and apply editing techniques.
3. Understanding various image formats and convert one image format into 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 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)

V.LabReferences:

1. DSLR Photography for Beginners by Brian Black
2. The Art of Photography by Bruce Barnbaum
3. Photoshop for Photographers by John Slawo
4. <https://www.youtube.com/channel/UCwWyFRy2l6aUFMsRemP5lSw>. YouTube resource.
5. <https://www.udemy.com/course/complete-photography-course/>
6. Web sources suggested by the teacher concerned.

SEMESTER-V

COURSE14B:OPTICALIMAGINGANDPHOTOGRAPHY STUDENT ACTIVITIES

Co-CurricularActivities

(a) **Mandatory:**(*Trainingofstudentsbyteacherinfieldrelatedskills:(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 understandtheconstruction, 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 suchfacility in a university/research organization/private and observe (i) the operationofdifferent digital cameras, compact and SLR and in taking photographs using different types of lenses byvarying 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, dubbingof 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, sendingphotographsthroughE-mailandScanningthephotos, captureframesand 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. MaxmarksforFieldwork/Projectwork: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) **SuggestedCo-CurricularActivities:**

1. Trainingofstudents byarelatedskilled personfrom aPhoto 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,Groupdiscussions, Quiz,Debatesetc.(onrelatedtopics).
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. Collectionof material/figures/
8. photosrelatedto various componentsofaCamera, writingandorganizingthemina systematic way in a file.
9. VisittoanylocalPhotoStudiooranyLabinuniversities,researchorganizations, private firms, etc.
10. Invitedlecturesandpresentations onrelatedtopicsbyfield/industrialexperts.

COURSE15A: LOW TEMPERATURE PHYSICS & REFRIGERATION

Theory

Credits:2

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 student's 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

Introduction, Joule-Thomson effect, Regenerative cooling, Different methods of liquefaction of gases, liquefaction of air (Linde's method), 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, 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, Eco-friendly refrigerants

UNIT-IV Components of Refrigerator

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, liquid nitrogen and liquid hydrogen in medical field, Superconducting magnets in MRI- Tissue ablation (cryosurgery) - Cryogenic rocket propulsion system.

Applications of refrigeration: Domestic refrigerators, Cold storages, Ice plants, Food preservation methods, Chemical and Process in industries, Desalination of water, Data centers.

References

1. Heat and Thermodynamics by Brij Lal & N. Subramanyam, S. Chand Publishers.
2. Thermal Physics by S. C. Garg, R. M. Bansal & C. K. Ghosh, McGraw Hill Education, India
3. Heat and Thermodynamics by M. M. Zemansky, McGraw Hill 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/2017Low_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>

SEMESTER-V
COURSE15A: LOW TEMPERATURE PHYSICS & REFRIGERATION
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.
2. **For Student:** Students 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 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 observe the bags of different frozen fruits. Student shall write the observations and submit a hand-written Fieldwork/Project work not exceeding 10 pages in the given format to the teacher.
3. Max marks for Field work/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.article><https://sealevel.jpl.nasa.gov/files/archive/activities/ts1hiac1.pdf>

**COURSE15A: LOW TEMPERATURE PHYSICS & REFRIGERATION
BLUE PRINT**

Unit no	Essay answer questions	Short answer questions
Unit I	2 (with internal choice)	2
Unit II	2 (with internal choice)	2
Unit III	2 (with internal choice)	2
Unit IV	2 (with internal choice)	2
Unit V	2 (with internal choice)	2

Percentage of choice: 50 %.

SRR & CVR Government Degree College, Vijayawada

MODEL QUESTION PAPER

COURSE15A: LOW TEMPERATURE PHYSICS & REFRIGERATION

Semester V – w.e.f. 2025 – 2026.

SECTION-A

Answer any Five of the following questions

5x4M = 20M

1. Short answer type question from Unit-I
2. Short answer type question from Unit-I
3. Short answer type question from Unit-II
4. Short answer type question from Unit-II
5. Short answer type question from Unit-III
6. Short answer type question from Unit-III
7. Short answer type question from Unit-IV
8. Short answer type question from Unit-IV
9. Short answer type question from Unit-V
10. Short answer type question from Unit-V

SECTION-B

Answer all the following questions.

5x8M = 40M

- 11 Essay type question from Unit-I
- Or
- 12) Essay type question from Unit-I
- 13) Essay type question from Unit-II
- Or
- 14) Essay type question from Unit-II
- 15) Essay type question from Unit-III
- Or
- 16) Essay type question from Unit-III
- 17) Essay type question from Unit-IV
- Or
- 18) Essay type question from Unit-IV
- 19) Essay type question from Unit-V
- Or
- 20) Essay type question from Unit-V

COURSE15A: LOW TEMPERATURE PHYSICS & REFRIGERATION QUESTION BANK

UNIT-I PRODUCTION OF LOW TEMPERATURE

Long Answer Questions.

1. What is Joule-Thomson effect? Obtain an expression for the cooling produced when a gas suffers Joule-Thomson effect?
2. What is adiabatic demagnetization? Give its theory and working?
3. Explain the production of liquid hydrogen and liquid nitrogen.

Short Answer Questions.

1. Write a short note on regenerative cooling?
2. List out the properties of substances at low temperatures.
3. Explain the liquefaction of air by Linde's method.

UNIT-II MEASUREMENT OF LOW TEMPERATURE

Long Answer Questions.

1. With the help of neat diagram explain in detail about the gas thermometer. Also write its correction and calibration.
2. Discuss the role of resistance thermometer in obtaining the lower temperature with neat sketch and also write its advantages and drawbacks
3. What is a Thermocouple and give its working principles. What are the advantages, disadvantages and applications of thermocouples?

Short Answer Questions.

1. What is the functioning of magnetic Thermometer?
2. How does vapour pressure Thermometer work?
3. Write a short note on secondary thermometers

UNIT-III PRINCIPLES OF REFRIGERATION

Long Answer Questions.

1. Write a note on
 - (a) Vapour compression refrigeration system
 - (b) Vapour absorption refrigeration system
2. Explain the classification of refrigerants. What are eco-friendly refrigerants?
3. Explain Refrigeration Cycle along with its Block diagram.

Short Answer Questions.

1. Distinguish between Natural and artificial refrigeration.
2. Discuss the concept of air conditioning
3. What are the properties of ideal refrigerants?

UNIT-IV COMPONENTS OF REFRIGERATOR

Long Answer Questions.

1. What are the types of compressors and analyze their functional aspects?
2. What is condenser and explain about different types of condensers.
3. Classify the evaporators with functional mechanism.

Short Answer Questions.

1. What is Coefficient of Performance (COP) of a Refrigerator?
2. Define Tons of Refrigeration (TR).
3. Write a short note on refrigerant leakage and detection.
4. Explain the defrosting in refrigerator.

UNIT-V APPLICATIONS OF LOW TEMPERATURE AND REFRIGERATION

Long Answer Questions.

1. (a) Describe about the cryogenic rocket propulsion system (b) Mention the medical applications of liquid nitrogen and liquid hydrogen.
2. Analyse the importance of preservation of biological materials at low temperatures under various conditions.
3. What is cold storage? How does it work? what are the uses of cold storages?

Short Answer Questions.

1. What is meant by Desalination of water?
2. Explain working of water cooler.
3. What are the applications of Refrigeration in Data centers?

SRR & CVR GOVT DEGREE COLLEGE (A), VIJAYAWADA.
DEPARTMENT OF PHYSICS & ELECTRONICS
SEMESTER-V- PHYSICS
COURSE 15B: SOLAR ENERGY AND ITS APPLICATIONS

Theory

Credits:2

3hrs/week

COURSEOBJECTIVE:

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 student's knowledge and skills in harnessing solar energy for various purposes, including electricity generation, heating, and cooling.

LEARNINGOUTCOMES:

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 photo voltaic collectors.
- ❖ Demonstrate skills related to call us 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, 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. solarcookers, Solardryers, Solardesalinators.

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:TypesofSolar cellsand Modules

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

Unit–V: Solar Photo voltaic Systems:

Energy storage in PV systems, Energy storage modes, electrochemical storage, Batteries, Primary and secondary, Solid-state battery, drybatteries,Mechanical storage – Flywheel, Electrical storage –Super capacitor

References:

1. Solar Energy Utilization by G.D.Rai, Khanna Publishers
2. Solar Energy-Fundamentals, design, modeling 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 Photo voltaics, P.Jayarama Reddy, CRC Press (Taylor & Francis Group), Leiden &BS Publications, Hyderabad, 2009.
5. Solar Photovoltaic's- 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

SEMESTER-V
COURSE 15B: SOLAR ENERGY AND ITS APPLICATIONS

Practical

Credits:1

2hrs/week

COURSE OBJECTIVE:

The objective of the practical course on Solar Energy and Its Applications is to provide students with hands-on experience and practical skills in working with solar energy systems, performing measurements and analysis, and implementing solar energy projects. The course aims to develop students' proficiency in solar energy system installation, maintenance, performance analysis, and practical application.

LEARNING OUT COMES:

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

1. List out and identify various components of solar thermal collectors and systems, solar photovoltaic modules and systems.
2. Learn the procedures for measurement of direct, global and diffuse solar radiation, I -V characteristics and efficiency analysis of solar cells and modules.
3. Demonstrate skills acquired in evaluating the performance of solar cell/module in connecting them appropriately to get required power output.
4. Acquire skills in identification and elimination of the damaged panels without affecting the output power in a module / array.
5. Perform procedures and techniques related to general maintenance of solar thermal and photovoltaic modules.

Practical (Laboratory) Syllabus:

1. Measurement of direct radiation using pyrheliometer.
2. Measurement of global and diffuse radiation using pyranometer.
3. Evaluation of performance of a Solar cooker
4. Evaluation of solar cell/module efficiency by studying the I–V measurements.
5. Determination of series and shunt resistance of a solar cell/ module.
6. Determination of efficiency of two solar cells/modules connected in series.
7. Determination of efficiency of two solar cells/modules connected in parallel.
8. Study the effect of input intensity on the performance of solar cell/ module.
9. Study the influence of Cell/ module temperature on the efficiency.
10. Study the effect of cell/ module inclination on the efficiency.

Lab References:

1. Solar Photovoltaic-A lab training manual, C.S. Solanki et al., Foundation Books Publishers, 2012.
2. Laboratory Manual on Solar thermal experiments, HP Garg, TCK and pal, Narosa Publishing House 2000.
3. Web sources suggested by the teacher concerned.
<https://renewablelab.niu.edu/experiments/solarPanelDevelopmentof simple solar hot water collector>
4. <https://www.youtube.com/watch?v=WP8H5IOTwYU> <https://www.instructables.com/Solar-Water-Heater-From-Scratch/>

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 related to measurement of direct, diffused and global solar radiation; demonstration of procedures used in the performance evaluation of solar flat plate collectors, solar photovoltaic cells and modules measurement of different parameters in the calculation of efficiency.
2. **For Student:** Students shall visit to solar thermal and photovoltaic laboratories in universities/research organizations/ nearby industries to observe and understand the techniques and procedures used for evaluation of solar collector, solar cell and module efficiencies. They shall write their observations and submit to the teacher hand-written Fieldwork/Project work not exceeding 10 pages in the given format.
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/ technical experts using guest lectures /invited talks.
2. Assignments (including technical assignments like identifying components of a solar hot water and solar photovoltaic systems and their handling, operational techniques and maintenance procedures with safety and security)
3. Seminars, Group discussions, Quiz, Debates etc. On related topics.
4. Preparation of videos on thermal and photovoltaic systems and technical procedures.
5. Collection of brochures/figures/photos related to products and applications of solar energy and organizing them in a systematic way in a file.
6. Making a (i) solar panel (ii) solar light (iii) solar cooker (iv) solar oven (v) solar inverter at Home.
7. Visits to nearby solar thermal system as well as solar photovoltaic power stations, firms, research organizations etc.

COURSE 15B: BLUE PRINT
SOLAR ENERGY AND APPLICATIONS

Unit no	Essay answer questions	Short answer questions	Numerical problem
Unit I	2 (with internal choice)	2	0
Unit II	2 (with internal choice)	2	0
Unit III	2 (with internal choice)	1	1
Unit IV	2 (with internal choice)	2	0
Unit V	2 (with internal choice)	2	0

Percentage of choice :50 %.

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DEPARTMENT OF PHYSICS AND ELECTRONICS
SEM V- SOLAR ENERGY & ITS APPLICATIONS
QUESTION BANK

LONG ANSWER QUESTIONSUNIT-1

1. Explain spectral distribution of solar radiation.
2. Explain the principle and working of pyrheliometer.
3. Explain the principle and working of pyranometer.

UNIT-2

4. Explain the principle and working of liquid type flat plate collector.
5. How can you explain about natural and forced circulation systems?
6. Explain the principle and working of Box type solar cooker.

UNIT-III

7. Explain V-I characteristics of solar cell.
8. Explain the output parameters of a solar cell.
9. Explain the effects of series resistance and shunt resistance on the performance of solar cell.

UNIT- IV

10. Explain the steps involved in fabrication of solar modules.
11. Give the configurations, structures, advantages and limitations of CdTe.
12. Write applications of solar cells in different fields.

UNIT V

13. What is the principle & working behind Super capacitor storage method in Solar PV systems?
14. Give a brief account of types of PV systems.
15. Explain Flywheel energy storage system.

SHORT ANSWER QUESTIONSUNIT-I

1. Write a brief note on Air mass and solar constant.
2. Define Direct, Diffuse, and Global radiations.
3. Write a brief note on standard time, local apparent time.

UNIT-II

4. Write a brief note on classification of solar thermal collectors.
5. What is collector heat-removal factor?
6. Explain briefly about solar dryers.

UNIT-III

7. Explain about the quantum efficiency of solar cell.
8. Define the solar cell efficiency and explain its dependencies.
9. Explain the effect of light intensity on performance of solar cell.
10. Explain the effect of temperature on performance of solar cell.

UNIT-IV

11. What is the difference between double and Multi junction solar cells?
12. Write a brief note on solar cells array.
13. What is the purpose of Bypass and blocking diodes?

UNIT-V

14. What are the different energy storage methods in solar photovoltaic systems?
15. What are primary and secondary storage systems in solar PV systems?
16. Write a short note on mechanical storage method.
17. Explain briefly electrical storage methods.

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SEM V- SOLAR ENERGY & APPLICATIONS
MODEL QUESTION PAPER

SECTION -A

Answer any Five of the following questions.

5 X 4=20Marks

1. Define Direct, Diffuse, and Global radiations.
2. Explain Standard time and local apparent time.
3. Write a brief note on applications of solar thermal collectors.
4. Write short note on solar dryers.
5. Explain the effect of temperature on performance of solar cell.
6. Explain about the quantum efficiency of solar cell.
7. What is the purpose of Bypass and blocking diodes?
8. Write a brief note on solar cells array.
9. Write Module fabrications steps of solar cells.
10. Write a short note on mechanical storage method.

SECTION - B

Answer all questions.

5 X 8=40Marks

11. (A) What is meant by Solar constant? Explain spectral distribution of solar radiation.

OR

- (B) Explain the principle and working of pyrheliometer with neat diagram.

12. (A) What is a solar collector? Explain the principle and working of liquid heating type flat plate collector.

OR

- (B) Explain the principle and working of Box type solar cooker.

13. (A) Explain V-I characteristics of a solar cell.

OR

- (B) How series resistance and shunt resistance effects on the performance of solar cell.

14. (A) Give the configurations, structures, advantages and limitations of CdTe.

OR

- (B) Explain the steps involved in fabrication of solar modules.

15. (A) What is the principle & working behind Super capacitor storage method in Solar PV systems?

OR

- (B) Explain Construction and working of Flywheel energy storage system