Davangere University

Shivagangothri, Davangere- 577007

PROGRAM /COURSE STRUCTURE AND SYLLABUS

of

PHYSICS

as per the Choice Based Credit System (CBCS) designed in accordance with

Learning Outcomes-Based Curriculum Framework (LOCF) of National Education Policy (NEP) 2020

Bachelor of Science (B. Sc. Physics)

w.e.f.

Academic Year 2021-22 and onward

B. Sc. III Semester

	Program Outcomes:
	Disciplinary knowledge
	Communication Skills
	Critical thinking, Reflective thinking, Analytical reasoning, Scientific reasoning
	Problem-solving
	Research-related skills
	Cooperation/ Teamwork/ Leadership readiness/Qualities
	Information/ Digital literacy/Modern Tool Usage
	Environment and Sustainability
	Multicultural competence
	Multi-Disciplinary
	Moral and ethical awareness/Reasoning
	Lifelong learning / Self Directed Learning

	Course Learning Outcomes
	At the end of the course students will be able to:
	Identify different types of waves by looking into their characteristics.
	Formulate a wave equation and obtain the expression for different parameters associated with waves.
	Explain and give a mathematical treatment of the superposition of waves under different conditions, such as, when they overlap linearly and perpendicularly with equal or different frequencies and equal or different phases.
	Describe the formation of standing waves and how the energy is transferred along the standing wave in different applications, and mathematically model in the case of stretched string and vibration of a rod.
	Give an analytical treatment of resonance in the case of open and closed pipes in general and Helmholtz resonators in particular.
	Describe the different parameters that affect the acoustics in a building, measure it and control it.
	Give the different models of light propagation and phenomenon associated and measure the parameters like the wavelength of light using experiments like Michelson interferometer, interference, and thin films.
	Explain diffraction due to different objects like singles slit, two slits, diffraction of grating, oblique incidence, circular aperture and give the theory and experimental setup for the same.
	Explain the polarization of light and obtain how the polarization occurs due to quarter wave plates, half wave plates, and through the optical activity of a medium.

Course Articulation Matrix

Mapping of Course Outcomes (CO) Program Outcomes

Course Outcomes / Program Outcomes	1	2	3	4	5	6	7	8	9	10	11	12
Identify different types of waves by looking into their characteristics.	X	X	X	X	X	X					X	X
Formulate a wave equation and obtain the expression for different parameters associated with waves.	X	X	X	X	X	X					X	X
Explain and give a mathematical treatment of the superposition of waves under different conditions such as when they overlap linearly and perpendicularly with equal or different frequencies and equal or different phases.	X	X	X	X	X	X					X	X
Describe the formation of standing waves and how the energy is transferred along the standing wave in different applications, and mathematically model in the case of stretched string and vibration of a rod.	X	X	X	X	X	X					X	X
Give an analytical treatment of resonance in the case of open and closed pipes in general and Helmholtz resonators in particular.	X	X	X	X	X	X					X	X
Describe the different parameters that affect the acoustics in a building, measure it and control it.	X	X	X	X	X	X					X	X
Give the different models of light propagation and phenomenon associated and measure the parameters like the wavelength of light using experiments like Michelson interferometer, interference, and thin films.	X	X	X	X	X	X					X	X
Explain diffraction due to different objects like singles slit, two slits, diffraction grating, oblique incidence, circular aperture and give the theory and experimental setup for the same.	X	X	X	X	X	X					X	X
Explain the polarization of light and obtain how the polarization occurs due to quarter wave plates, half wave plates, and through the optical activity of a medium.	X	X	X	X	X	X					X	X

SEMESTER-III										
Categ ory	Course code	Title of the Paper	Marks			Teaching hours/wee k			Credit	Duration of exams (Hrs)
			IA	SE E	Total	L	T	P		
DSC1	21BSC3C3PHY3L	Wave Motion and Optics	40	60	100	4	-	-	4	2
	21BSC3C3PHY3P	Practical III	25	25	50	-	-	4	2	3
Total Marks					150	Semester Credits		6		

Course Content Semester – III

Wave Motion and Optics

Course Title: Wave Motion and Optics	Course Code: **21BSC3C3PHY3L**
Total Contact Hours: 56 (48 hrs Lecture + 8 hrs Activities)	Duration of ESA: 2 hours
Formative Assessment Marks: 40	Summative Assessment Marks: 60
Model Syllabus Authors: Physics Expert Committee	Course Credits:4

Unit – 1 - Waves and Superposition of Harmonic Waves

Chapter 1-Waves: Types of waves-Plane and Spherical Waves. Longitudinal and Transverse Waves. Characteristics of wave motion, Plane Progressive (Travelling) Wave and its equations, Wave Equation – Differential form (derivation). Particle and Wave Velocities: Relation between them, Energy Transport – Expression for intensity of progressive wave, Newton's Formula for Velocity of Sound. Laplace's Correction (Derivation), effect of temperature, density, and humidity on the velocity of the sound. Brief account of Ripple and Gravity Waves. Problems. **(6 Hours)**

Chapter 2- Superposition of Harmonic Waves: Linearity and Superposition Principle. Superposition of two collinear oscillations having (1) equal frequencies and (2) different frequencies (Beats) – Analytical treatment. Superposition of two perpendicular Harmonic Oscillations: Lissajous Figures with Equal Time period and Time periods in the ratio 1:2- Analytical treatment. Uses of Lissajous' figures. Problems. **(6 Hours)**

Note: Activities in all the Units

Make groups among students and assign each group the activity. Provide a few days to complete the activity. On the specific day, each group must make a ppt presentation of the following three slides. On the day of the presentation select a member from each group randomly to make the presentation. Based on the work and presentation, teacher shall assign marks to each group, wherein all members of the group will get equal marks.

1. The first slide will explain the process of doing the experiment.

2. In the second slide. Students will show the graph / flow charts/circuits/diagrams and measurements.

3. In the third slide, they will list three observations from that study.

4. Each student has to make a report of the entire activity for submission.

Activities	
Activity 1	We know that sound is produced because of vibration. Look into at least 4 (musical instruments (Two String type and Two Tabala type) and identify the regions of vibrations that produces the sound and those parts which enhances the sound because of reverberation. 1. Identify one common element in all of these. 2. Identify equipment's which creates beats and try to explain the underlying basic principles. Demonstrate the examples of beats using two tuning forks. 3. Make your observations sketch them and comment on it in a report.
Activity 2	Take smooth sand, place a pointed edged pen vertically on the sand. To the mid of the pen, connect two perpendicular threads. Pull these perpendicular threads by varying the forces and timings. Note down the different shapes produced on the sand. Try to interpret the shapes. Make a report of it.
Activity 3	Take a stretched spring. Stretch it across two edges. Put a weight on the spring, pluck it and measure the amplitude of the vibration. All group will measure the total damping time of oscillating spring. (Using mobile or scale). 1. Plot a graph of the varying load on the spring and amplitude at the centre. 2. Vary the load in the centre of the spring and measure the amplitude at the centre. Make a report of it.

Unit – 2 - Standing Waves and Acoustics

Chapter 3- Standing Waves: Velocity of transverse waves along a stretched string (derivation), Standing (Stationary) Waves in a String - Fixed and Free Ends (qualitative). Theory of Normal modes of vibration in a stretched string, Energy density and energy transport of a transverse wave along a stretched string. Vibrations in rods – longitudinal and transverse modes (qualitative). Velocity of Longitudinal Waves in gases (derivation). Concept of Resonance, Theory of Helmholtz resonator. Problems. **(9 Hours)**

Chapter 4- Acoustics: Absorption coefficient, Reverberation and Reverberation time, Sabine's Reverberation formula (derivation), Factors affecting acoustics in buildings, Requisites for good acoustics. **(2 Hours)**

Activities	
Activity 1	Identify the phenomena and reason for standing waves. identify the standing waves in musical instruments. Make a report of them. Also List different phenomena where standing waves are found in nature. Make a report of them.

Activity 2	Take a bowl of different liquids (water, milk, kerosene, salt water, Potassium Permanganate (KMNO4) solution. Place a small non oily floating material (ex: thin plastic) on the surface of the liquid. Drop a marble on the liquid at the centre of the bowl. Repeat the experiment by dropping the marble from the different heights. Plot a graph of- 1. Height v/s time of oscillation. 2. Weight of the marble v/s time of oscillation.
Activity 3	Take two marbles of same weight. Drop both the marbles on the surface of the liquid from some height. With the help of the mobile take the picture and measure the position of interface of two wave fronts formed in the liquid. Plot graphs for different activities by doing the following activities. 1. By dropping two marbles of same weight from different heights. 2. By dropping two marbles of different weight from the same height

Unit – 3 – Nature of light and Interference

Chapter 5- Nature of light: The corpuscular Theory of light, The wave theory of light, Maxwells electromagnetic wave theory, quantum theory of light (qualitative), Wave Particle Duality.

(3 Hours)

Chapter 6- Interference of light by division of wave front: Concept of wave-front, types of wave-fronts, Huygen's Principle, Coherence, Interference of light by division of wave-front. Fresnel's Biprism construction and its theory. Determination of distance between coherent sources.

(4 Hours)

Chapter 7- Interference of light by division of amplitude: Interference by division of amplitude: Interference by a plane parallel air film illuminated by a plane wave (reflected light), Interference by a film with two non-parallel reflecting surfaces (air wedge). Newton's rings- (Reflected light)- Michelson Interferometer: Construction and working and Determination of wavelength of light. Colour of thin films (brief)

(5 Hours)

Activities

Activity 1	In the table given below explore the nature of light which explains the given phenomenon and Make a report of it.

Sl No	Phenomenon	Particle of Light	Wave Nature	Dual Nature
1	Pinhole camera			
2	Formation of images on lenses			
3	Formation of images on mirror			
4	Interference			
5	Polarization			
6	Diffraction due to single slit			

7	Black body radiation			
8	Photoelectric effect			
9	De-Broglie hypothesis			
10	Davison & Germer Experiment			

Activity 2	Explore beautiful colors and light interference. Make a report of it. **Reference: https://youtu.be/r9FJ_2SqGlw**
Activity 3	Recreate one of the most important experiments in the history of physics–the two-slit experiment–by shining a laser pointer through two narrow slits and observing the interference pattern on a distant screen and take a photograph. Study the pattern for different distances. Make a report of it.

Unit – 4 - Diffraction and Polarisation

Chapter 8- Fraunhofer diffraction: Introduction, Fraunhofer diffraction- Single slit diffraction pattern-position of Maxima and Minima. Theory of plane transmission grating-normal and oblique incidence- Resolving power and dispersive power of a grating. Comparison between prism spectrum and grating spectra. **(6 Hours)**

Chapter 9- Fresnel Diffraction- Fresnel half period zones (brief), Diffraction by a circular aperture, diffraction by an opaque disc. Construction and theory of zone plate, comparison between zone plate and convex lens. **(3 Hours)**

Chapter 10- Polarisation: Introduction, mention of methods of production of plane polarized light. Phenomenon of double refraction, Theory of plane, circularly and elliptically polarised light (derivation). Quarter wave plates and half wave plates. Optical activity- Fresnel's theory of optical rotation. Specific rotation using polarimeter. The wire Grid polarizer and Polaroids (brief). **(4 Hours)**

Activities	
Activity 1	What is the physics behind making 3D movies? Group Discussion (https://www.slideserve.com/rae/physics-behind-3d-movies-powerpoint-ppt-presentation) Make a report of it.
Activity 2	Obtain the diffraction spectra using a CD and design an experiment to find the distance between the tracks on it. Make a report of it. (Ref: https://www.brighthubeducation.com/science-lessons-grades-9-12/39347-diffraction-experiment-measuring-groove-spacing-on-cds/, https://silo.tips/download/diffraction-from-a-compact-disk)
Activity 3	Identify any 3 sharp edges of varying thickness. Shine a laser light pointing towards the edge of the needle. Observe the patterns formed on the wall or screen and measure the distance between the bands. Correlate the distance between the bands formed with the thickness of the edge and the distance from

	the edge to the screen. By this, calculate the wavelength of the laser light used. Make a report of it.

Textbooks

Sl No	Title of the Book	Authors Name	Publisher	Year of Publication
1	The Physics of Waves and Oscillations,	N K Bajaj	Tata McGraw-Hill Publishing Company Ltd., Second Edition,	1984
2	Waves and Oscillations	N Subramanyam and Brij Lal	Vikas Publishing House Pvt. Ltd., Second Revised Edition	2010
3	A Text Book of Sound	D R Khanna and R S Bedi	Atma Ram & Sons, Third Edition	1952
4	Oscillations and Waves	Satya Prakash	Pragathi Prakashan, Meerut, Second Edition	2003
5	Optics	Ajoy Ghatak	McGraw Hill Education (India) Pvt Ltd	2017
6	A text Book of Optics	Brij Lal, M N Avadhanulu & N Subrahmanyam	S. Chand Publishing	2012

References Books

Sl No	Title of the Book	Authors Name	Publisher	Year of Publication
1	Berkeley Physics Course – Waves,	Frank S Crawford Jr.	Tata Mc Graw-Hill Publishing Company Ltd., Special Indian Edition,.	2011
2	Optics	Eugene *Hecht*	Pearson Paperback	2019
3	Introduction To Optics	Pedrotti and Frank L ,	Pearson India	3rd Edition
4	Fundamentals of Optics	Francis Jenkins Harvey White	McGraw Hill Education	2017

Formative Assessment	
Assessment	**Marks**
Internal Assessment	20
REU based Group Activity (Conduct, Report, Presentation)	20
Total	40

	List of Experiments to be performed in the Laboratory Minimum 8 Experiments to be performed.
1.	Velocity of sound through a wire using Sonometer.
2.	Frequency of AC using Sonometer.
3.	Study of Lissajous' Figures.
4.	To verify the laws of transverse vibration using Melde's apparatus.
5.	Helmholtz resonator using tuning fork.
6.	Helmholtz resonator using electrical signal generator.
7.	To determine refractive index of the Material of a prism using Mercury source.
8.	To determine the Cauchy constants of the material of a prism using mercury source.
9.	To determine the wavelength of sodium source using Michelson's interferometer.
10.	To determine wavelength of sodium light using Fresnel Biprism.
11.	To determine wavelength of sodium light using Newton's Rings
12.	To determine the thickness of a thin paper by measuring the width of the interference fringes produced by a wedge-shaped Film.
13.	To determine wavelength of spectral lines of Hg source using plane diffraction grating (Minimum Deviation Method).
14	To determine dispersive power of a plane diffraction grating.
15	Polarimeter- Determination of Specific rotation of sugar solution.

Reference Book for Laboratory Experiments

Sl No	Title of the Book	Authors Name	Publisher	Year of Publication
1	Advanced Practical Physics for students	B.L. Flint and H.T. Worsnop	Asia Publishing House.	1971
2	A Text Book of Practical Physics	I. Prakash & Ramakrishna	Kitab Mahal, 11th Edition	2011
3	Advanced level Physics Practicals	Michael Nelson and Jon M. Ogborn	Heinemann Educational Publishers, 4th Edition	1985
4	A Laboratory Manual of Physics for undergraduate classes	D.P.Khandelwal	Vani Publications.	1985

OPEN ELECTIVE

OPTICAL INSTRUMENTS

Course Title: OPTICAL INSTRUMENTS		Time: 3 hrs./week	
Course Code: 21BSC3O3PHY3	**Contact Hours: 42**		**Credits:03**
Formative Assessment Marks: 40	Summative Assessment Marks: 60		Duration of ESA/Exam: 2 Hours
Unit -1			

	14
Basics of Optics Scope of optics, optical path, laws of reflection and refraction as per Fermat's principle, magnifying glass, Lenses (thick and thin), convex and concave lenses, Lens makers formulae for double concave and convex lenses, lens equation. Focal and nodal points, focal length, image formation, combination of lenses, dispersion of light: Newton's experiment, angular dispersion and dispersion power. Dispersion without deviation. (Expressions need not be derived, but have to be discussed qualitatively).	

Unit -2	
Camera and microscopes Human eye (constitution and working), Photographic camera (principle, construction and working), construction, working and utilities of Simple microscopes, Compound microscope, Electron microscopes, Binocular microscopes **Self study** Experimental determination of magnifying power of a microscope. (Construction part can be discussed through block diagrams)	14

Unit -3	
Telescopes and Spectrometer Construction, working and utilities of Astronomical telescopes Terrestrial telescopes Reflecting telescopes, Construction, working and utilities of Eyepieces or Oculars (Huygen, Ramsden's, Gauss) Spectrometer - Construction, working and utilities, measurement of refractive index. **Self Study:** Telescopes used at different observatories in and outside India.	14
Activities: Find position and size of the image in a magnifying glass and magnification. Observe rain bows and understand optics. Create a rainbow. Find out what makes a camera to be of good quality. Observe the dispersion of light through prism. Make a simple telescope using magnifying glass and lenses. Learn principle of refraction using prisms. Check bending of light in different substances and find out what matters here. Learn about different telescopes used to see galaxies and their ranges. Many more activities can be tried to learn optics by going through you tubes and webistes such as https://spark.iop.org, http://www.yenka.com, https://publiclab.org etc.	

B.Sc. IV Semester

Program Outcomes:

1.	Disciplinary knowledge
2.	Communication Skills
3.	Critical thinking, Reflective thinking, Analytical reasoning, Scientific reasoning
4.	Problem-solving
5.	Research-related skills
6.	Cooperation/ Teamwork/ Leadership readiness/Qualities
7.	Information/ Digital literacy/Modern Tool Usage
8.	Environment and Sustainability
9.	Multicultural competence
10.	Multi-Disciplinary
11.	Moral and ethical awareness/Reasoning
12.	Lifelong learning / Self Directed Learning

Course Learning Outcomes

At the end of the course students will be able to:

i.	Apply the laws of thermodynamics and analyze the thermal system.
ii.	Apply the laws of kinetic theory and radiation laws to the ideal and practical thermodynamics systems through derived thermodynamic relations.
iii.	Use the concepts of semiconductors to describe different Semiconductor devices such as diode transistors, BJT, FET etc and explain their functioning.
iv.	Explain the functioning of OP-AMPS and use them as the building blocks of logic gates.
v.	Give the use of logic gates using different theorems of Boolean Algebra followed by logic circuits.

Course Articulation Matrix
Mapping of Course Outcomes (CO) Program Outcomes

Course Outcomes / Program Outcomes		1	2	3	4	5	6	7	8	9	10	11	12
i	Apply the laws of thermodynamics and analyze the thermal system.	X	X	X	X	X	X					X	X
ii	Apply the laws of kinetic theory and radiation laws to the ideal and practical thermodynamics systems	X	X	X	X	X	X					X	X

	through derived thermodynamic relations.												
iii	Use the concepts of semiconductors to describe different Semiconductor devices like diode transistors, BJT, FET etc and explain their functioning.	X	X	X	X	X	X					X	X
iv	Explain the functioning of OP-AMPS and them as the building blocks of logic gates.	X	X	X	X	X	X					X	X
v	Give the use of logic gates using different theorems of Boolean Algebra followed by logic circuits.	X	X	X	X	X	X					X	X

SEMESTER-IV

Category	Course code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams (Hrs)
			IA	SEE	Total	L	T	P		
DSC1	21BSC4C4PHY4L	Thermal Physics and Electronics	40	60	100	4	-	-	4	2
	21BSC4C4PHY4P	Practical IV	25	25	50	-	-	4	2	3
Total Marks					**150**	**Semester Credits**			**6**	

Course Content Semester – IV Thermal Physics and Electronics	
Course Title: Thermal Physics and Electronics	Course Code: **21BSC4C4PHY4L**
Total Contact Hours: 56 (48 hrs Lecture + 8 hrs Activities)	Duration of ESA: 2 hours
Formative Assessment Marks: 40	Summative Assessment Marks: 60
Model Syllabus Authors: Physics Expert Committee	Course Credits: 4

Unit 1

Chapter 1: Laws of Thermodynamics: Review of the concepts of Heat and Temperature. Zeroth law. **(1 Hours)**

Chapter 2: First Law of Thermodynamics: Statement, Differential form, Internal Energy. Application of first law to isothermal, adiabatic, isobaric, and isochoric processes. Mention of Equation of state for an isothermal and adiabatic processes, Work Done during Isothermal and Adiabatic Processes (derivation). Problems. **(4 Hours)**

Chapter 3: Second Law of Thermodynamics: Kelvin-Planck and Clausius Statements and their Equivalence. Reversible and Irreversible processes with examples. Heat Engines: Carnot engine & efficiency (derivation). Refrigeration & coefficient of performance, Applications of Carnot engine in locomotion. Concept of Entropy, Second Law of Thermodynamics in terms of Entropy. Problems. **(6 Hours)**

Chapter 4: Third Law of Thermodynamics: Statement, Significance and Unattainability of Absolute Zero. **(2 Hours)**

Note: Activities in all the Units

Make groups among students and assign each group the activity. Provide a few days to complete the activity. On the specific day, each group must make a ppt presentation of the following three slides. On the day of the presentation select a member from each group randomly to make the presentation. Based on the work and presentation, teacher shall assign marks to each group, wherein all members of the group will get equal marks.

1. The first slide will explain the process of doing the experiment.

2. In the second slide. Students will show the graph / flow charts/circuits/diagrams and measurements.

3. In the third slide, they will list three observations from that study.

4. Each student must make a report of the entire activity for submission.

Activities

Activity 1	Take four different sizes of same metal, preferable of same shape and give one piece to each group. Heat it uniformly on a hot plate. Keep a beaker of water with a thermometer immersed in it. Drop one hot metal into the water and record the temperature with time. Repeat the experiment for the other heated metal pieces of different sizes. 1. Plot a graph for the volume of the metal piece used v/s respective temperature change observed.

	2. Determine the heat capacity and specific heat of the metal used. Make a report of in each case.
Activity 2	Take ice cubes of different size and immerse in water and measure the temperature change with time and repeat the experiment. From the graph of temperature vs time list the observations. Make a report of it.
Activity 3	I feel cold because coldness enters my body. Discuss the statement in day-to-day life. Approximately give examples of a) open system b) closed system and c) isolated system Discuss when the temperature of the body is locked until what time you hold the thermometer in contact with a body. Discuss it in contact with laws of thermodynamics. Make a report of in each case. Discuss why when a person works or does exercise, he sweats. Reason it with the laws of thermodynamics.

Unit 2

Chapter 5: Kinetic Theory of Gases: Distribution of Velocities: explanation of Maxwell-Boltzmann Law of Distribution of Velocities in an Ideal Gas. Expression for Mean, RMS and Most Probable Speeds. Degrees of Freedom, Law of Equipartition of Energy. Specific heats of Gases and relation between them. Problems. **(4 Hours)**

Chapter 6: Maxwell's Thermodynamic Relations: Derivations and applications of Maxwell's Relations-First order Phase Transitions with examples, Clausius - Clapeyron Equation. Joule-Thomson Effect and Joule-Thomson coefficient (derivation). Vander Walls gas equation (deivation). Attainment of low temperature by liquefaction of Helium gas. Adiabatic demagnetization (brief). Problems. **(5 Hours)**

Chapter 7: Radiation: Blackbody radiation, explanation of spectral distribution of black body radiation, statements of Wien's law, Wien's displacement law, Stefan-Boltzmann law, Rayleigh-Jeans law. Planck's law of radiation (derivation). The concept of energy density and pressure of radiation, Ultraviolet Radiation catastrophe (brief). Problems. **(3 Hours)**

Activities	
Activity 1	1. Measuring the Solar Constant Materials: Simple flat sided Jar and Thermometer. Activity: Bottle containing water is exposed to solar radiation. The rise in temperature and time taken are noted. Calculate the heat absorbed by water and relate it to the output of the Sun. 2. Thermo emf Materials: Suitable two dissimilar metal wires, voltage measuring device. Activity: In this experiment student will assemble the thermocouple and study the three effects namely, Seebeck, Peltier, and Thompson. 3. Inverse square law of radiation

	Materials: A cardboard with a grid, cardboard with a hole, supporting clips, a ruler, candle. Activity: Students set the device. They count the lighted squares on the cardboard with the grid by varying the distance. And make necessary measurements and calculations to arrive at the inverse square law of radiation. Ref: Activity Based Physics Thinking Problems in Thermodynamics: Kinetic Theory. Make a report in each case. http://www.physics.umd.edu/perg/abp/think/thermo/kt.htm
Activity 2	Take two dissimilar metal wires. Spot weld them forming two junctions. Dip one junction in ice and heat the other junction with a burner. Plot a graph of time of heating v/s Thermo EMF generated in the voltmeter. Make a report of it.

Unit 3

Chapter 8: Semiconductor devices: Review of Intrinsic and Extrinsic semiconductors, p-n junction diode and its Characteristics, Diode approximations (brief), Half-wave rectifier and Full-wave rectifier (construction and working), Zener diode as voltage regulator-Regulator circuit with no load, Loaded Regulator. **(5 hours)**

Chapter 9: Junction Transistors: Basics of Bipolar Junction Transistors (BJT), BJT operation, Common Base, Common Emitter and Common Collector Characteristics. Single stage CE Amplifier. Field Effect Transistor (FET) and its characteristics. **(6 hours)**

Activities	
Activity 1	**Build your own Regulated DC power supply (5V)** Components required: 1.Step down transformer- 1 No. (5 V tapping, 100 – 500 mA current rating), BY 127 semiconductor diodes – 4 Nos, Inductor -1, Capacitor - 1, 3 pin 5V regulator-1 Wire a DC power supply on a bread board or groove board to give a regulated output voltage of + 5 V. Search for circuit diagram in books/net. Make a report of it.
Activity 2	Take any 3 diode. Measure its resistance when dipped in ice and heating the ice till it boils. Using this data, plot calibration curve of temperature v/s resistance and the cooling curve of temperature V/s time for the diode. Make a report of it.
Activity 3	1. Learn to identify the terminals of different types (packages) of BJTs. 2. In the case of power transistors, learn how to fix a heat sink for the transistor. Make a report of it.

Unit 4	

Chapter 10: Electronics: Integrated Circuits (Analog and Digital), Operational Amplifier, Ideal characteristics of Op-Amp, Inverting and Non-Inverting Configurations - expression for gain. Applications- Voltage Follower, Addition, Subtraction, differentiator, and integrator (brief). Problems. **(4 hours)**

Chapter 11: Digital Electronics: Switching and Logic Levels, Types of Digital Waveforms. Number Systems: Decimal Number System, Binary Number System, Converting Decimal to Binary. Hexadecimal Number System: Converting Binary to Hexadecimal, Hexadecimal to Binary.

(4 hours)

Chapter 12: Boolean Algebra: Digital Circuits: Explanation of Logic gates (using diodes and transistors) with logic symbols and truth table: OR Gate, AND Gate, NOT Gate, NOR Gate, NAND Gate. NAND and NOR gates as universal gates and their implementation. De Morgan's theorems.
(4 hours)

Activities	
Activity 1	**Operational Amplifiers** (i)Understand the concept of virtual ground of an OP-AMP. (ii)Learn the different types of op-amps used for different applications. (iii)What is a buffer? Prepare a report on buffers and its application in instrumentation electronics. Make a report of it.
Activity 2	a. A man must take a wolf, a goat, and some cabbage across a river. His rowboat has enough room for the man plus either the wolf or the goat or the cabbage. If he takes the cabbage with him, the wolf will eat the goat. If he takes the wolf, the goat will eat the cabbage. Only when the man is present are the goat and the cabbage safe from their enemies. All the same, the man carries wolf, goat, and cabbage across the river. How? Write the truth table for the above story and implement using gates. b. A locker has been rented in the bank. Express the process of opening the locker in terms of digital operation. c. A bulb in a staircase has two switches, one switch being at the ground floor and the other one at the first floor. The bulb can be turned ON and also can be turned OFF by and one of the switches irrespective of the state of the other switch. The logic of switching of the bulb resembles. Make a report of all these activities.

Textbooks	
Sl No	**Title of the Book**
1.	Electronic Devices and Circuits, David A. Bell, 2004, PHI, New Delhi
2.	Integrated Electronics, Jacob Millman and CC Halkias
3.	Digital Fundamentals, Floyd, 2001, PHI, New Delhi

References Books	
Sl No	**Title of the Book**
1.	Heat and Thermodynamics, M.W. Zemansky, Richard Dittman, 1981, McGraw-Hill.
2.	Thermal Physics, S. Garg, R. Bansal and Ghosh, 2nd Edition, 1993, Tata McGraw-Hill
3.	A Treatise on Heat, Meghnad Saha, and B.N.Srivastava, 1958, Indian Press
4.	Modern Thermodynamics with Statistical Mechanics, Carl S. Helrich, 2009, Springer.
5.	Thermodynamics, Kinetic Theory & Statistical Thermodynamics, Sears & Salinger. 1988, Narosa.
6.	An Introduction to Thermal Physics, Daniel V Schroeder, 2020, Oxford University Press

Formative Assessment	
Assessment	**Marks**
Internal Assessment	20
REU based Group Activity (Conduction, Report, Presentation)	20
Total	**40**

	List of Experiments to be performed in the Laboratory Minimum 8 Experiments to be performed.
1.	Mechanical Equivalent of Heat by Callender and Barne's method.
2.	Coefficient of thermal conductivity of Copper by Searle's apparatus.
3.	Coefficient of thermal conductivity of a bad conductor by Lee and Charlton's disc method.
4.	Determination of Stefan's constant/ Verification of Stefan's law.
5.	Variation of thermo-emf across two junctions of a thermocouple with temperature.
6.	Verification of Clausius –Clapeyron equation and determination of specific enthalpy.
7.	V-I Characteristics of PN Junction diodes and Zener Diode (FB & RB).
8.	Characteristics of BJT in Common Emitter Configuration.
9.	Half Wave and Full Wave Rectifier Without Filter. Half Wave and Full Wave Rectifier with choke, L-section and Pie-section Filters.
10.	Gain of Non-inverting and Inverting op-amp circuits.
11.	Truth table verification of basic logic gates using Diodes and Transistors.
12.	Frequency response of CE Amplifier.
13.	Frequency response of CC Amplifier (Emitter Follower).
14.	Op-Amp as Voltage follower, Adder and Subtractor circuits.

Reference Book for Laboratory Experiments	
Sl No	**Title of the Book**
1	Basic Electronics Lab (P242) Manual 2015-16, National Institute of Science Education and Research, Bhubaneswar, 2015.
2	**Suggested Readings:** 1. B.L. Worsnop, H.T. Flint, "Advanced Practical Physics for Students", Methuen & Co., Ltd., London, 1962, 9e. 2. S. Panigrahi, B. Mallick, "Engineering Practical Physics", Cengage Learning India Pvt. Ltd., 2015, 1e.

OPEN ELECTIVE

PHYSICS FOR ALL

Course Title: PHYSICS FOR ALL		Time: 3 hrs./week
Course Code: 21BSC4O4PHY4	**Contact Hours: 42**	**Credits:03**
Formative Assessment Marks: 40	**Summative Assessment Marks: 60**	**Duration of ESA/Exam: 2 Hours**

Unit I	
Energy and Power Explosions and energy; Energy, heat and its units; Energy table and discussions; Discussion of cost of energy; Measuring energy; Power; Different power sources; Kinetic energy.	**14 Hours**

Unit II	
Gravity, Force and Space The force of Gravity; Newton's third law; Weightlessness; Low earth orbit; Geosynchronous satellites; Spy satellites; Medium Earth Orbit satellite; Circular Acceleration; momentum; Rockets; Airplanes, helicopters and fans; Hot air and helium balloons; angular momentum and torque.	**14 Hours**

Unit III	
Nuclei and radioactivity Radioactivity; Elements and isotopes; Radiation and rays; Seeing radiation; The REM – The radiation poisoning; Radiation and cancer; The linear hypothesis; Different types of radiation; The half-life rule; Smoke detectors; measuring age from radioactivity; Environmental radioactivity; Glow of radioactivity; Nuclear fusion.	**14 Hours**
References This course is extracted from the book titled "Physics and Technology for Future Presidents: An Introduction to the Essential Physics Every World Leader Needs to Know" by Richard A Muller, WW Norton and Company, 2007. (Unit-1 to 4 are from chapters 1, 3, 4 and 10, respectively).	

Scheme of Evaluation

Scheme of Evaluation for Theory Internal Assessment

Sl. No.	Particulars	Marks Allotted
1.	First Internal test (After 8 week)	10
2.	Second Internal test (After 12 week)	10
3.	Activities	15
4.	Attendance	05
	Total	**40**

Scheme of Evaluation for Practical Internal Assessment

Sl. No.	Particulars	Marks Allotted
1.	Internal test	20
2.	Journal	05
	Total	**25**

Scheme of Evaluation for Practical Examination

Sl. No.	Particulars	Marks Allotted
1.	Basic formula with description, nature of graph if any & indication of unit	04
2.	Tracing of schematic ray diagram/Circuit diagram with description	02
3.	Tabular column	02
4.	Experimental skill & connection	05
5.	Record of observation	04
6.	Calculation including drawing graph	04
7.	Accuracy of result with unit	02
8.	Oral performance	02
	Total	**25**

B. Sc. QUESTION PAPER PATTERN

B.Sc. _____ Semester Degree Examination; December, 2023

(CBCS Scheme; New Syllabus: 2020-21)

SUBJECT: _____ Paper: _____ Paper Code: _____

Time: 3 Hours   Max. Marks: 60

PART-A

1. Answer any **FIVE** questions.   5×2=10M

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

Note: Minimum Two questions from each unit.

PART-B

II. Answer any **FIVE** of the following questions.   5×4=20 M

9.
10.
11.
12.
13.
14.
15.
16.

Note: Minimum Two questions from each unit.

PART-C

III. Answer any **Three** of the following questions.   3×10=30 M

[Each question should contain two sub questions (a) and (b)]

17.
18.
19.
20.
21.

Note: Minimum one question from each unit.