To

Date: 13.10.22

The Registrar
Tumkur University
Tumkur

From,

Dr. H. Nagabhushana
Professor and Chairman (UG-BoS)
Department of Physics
Tumkur University
Tumkur-572103

Dear Sir,

Sub: Submission of B.Sc., 3 and 4th Sem syllabus approved by BoS-reg

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With reference to the above cited subject, I am here with submitting the B.Sc., 3 and 4th Sem syllabus copy approved by BoS for further needful.

Thanking you,

Chairman

Dr. H. NAGABHUSHANA
Professor & Chairman
BOS in Physics
Tumkur University.
TUMKUR-572103

Enclosures: Approved 3 and 4th Sem syllabus copy

TUMKUR UNIVERSITY

TUMAKURU

Course Structure and Content

Multi-Disciplinary program as per National Educational Policy

B. Sc., (Physics)

September 2022, Tumakuru

Core Course for Semester – III

PHYDSC03: Wave Motion and Optics

Course Title	**Wave Motion and Optics**
Course code	**PHYDSC03**
Course credits	**4+2**
Total Contact Hours	**52+52**
Formative Assessment Marks	**40**
Summative Assessment Marks	**60**

Chapter Number	Topics to be covered	Contact hours
Unit – 1- Waves and Superposition of Harmonic Waves		
Chapter-1 **Waves**	Plane and Spherical Waves. Longitudinal and Transverse Waves. Characteristics of wave motion, Plane Progressive (Travelling) Wave and its equation, Wave Equation – Differential form (derivation). Particle and Wave Velocities: Relation between them, Energy Transport – Expression for intensity of progressive wave, Longitudinal waves in gases (derivation). Newton's Formula for Velocity of Sound. Laplace's Correction (Derivation). Brief account of Ripple and Gravity Waves. Problems.	7
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 and unequal frequency- Analytical treatment. Uses of Lissajous' figures. Problems.	6
Suggested Activities for students		
Activity-1	We know that sound is produced because of vibration. Look into at least 10 musical instruments 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 which creates beats and try to explain the underlying basic principles. Demonstrate the examples of beats usingtwo tuning forks. 3. Identify what will happen when you drop a stone in a standing water,and when your drop two stones side by side. Make your observations sketch them and comment on it in a report.	

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Professor & Chairman
DOSR in Physics

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Activity-2	Draw two sine waves (Amplitude vs time) one shifted with other in phase. Identity where the resonation occurs for each phase shift. Plot phase vs time taken for resonance
Activity-3	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-4	Hang a pot with sand, which has a hole in the bottom. Gently pull the pot on one sideand observe the pattern formed by the sand on the floor. Report the observations
Activity-5	Design a coupled pendulum. Study the impact of the motion of one pendulum over the other pendulum by varying the length, direction of the motion of one pendulum and mass of pendulum and observe the resultant changes. Trace thepath of the bobs and make a report.
Activity-6	**Note for the teachers for the activity:** Make 3 groups among students and assign eachgroup the activity of drawing one of the 3 graphs given below. Provide a few days to complete the activity. One the specific day, each group has to make a ppt presentationof the following three slides. One 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 of measurement. 3. In the third slide, they will list three observations from that study. **Activity:** Take a stretched spring. Stretch it across two edges. Put a weight on the string, pluck it and measure the amplitude of the vibration. All group will measure thetotal damping time of oscillating spring. (Using mobile or scale) And plot a graph of the- 1. Varying load on the spring and amplitude at the center. 2. Take another weight and put that in another place and measure the amplitude of vibration at the center. Vary the load in the center of the spring and measure the amplitude at the center
Unit – 2 Standing Waves and Acoustics		
Chapter-3 **Standing Waves**	Velocity of transverse waves along a stretched string (derivation), Stationary Waves in a String – condition for nodes and antinodes; Theory of Normal modes of vibration in a stretched string, Energy density of a transverse wave along stretched string. Vibrations in rods – longitudinal and transverse modes (qualitative). Vibrations of air columns Normal Modes of vibrations in Open and Closed Pipes – Analytical treatment. Concept of Resonance, Theory of Helmholtz resonator. Problems.	9

Chapter-4 **Acoustics**	Absorption coefficient, Reverberation and Reverberation time, Sabine's Reverberation formula (derivation), Factors affecting acoustics in buildings, Requisites for good acoustics. Acoustic measurements – intensity and pressure levels. Problems.	4
Suggested Activities for students		
Activity-7	List different phenomenon where standing waves are found in nature. Identifythe phenomena and reason for standing waves. Also identify the standing waves in musical instruments. Make a report	
Activity-8	**1.** Go to 5 different newly constructed houses when they are not occupiedand when they are occupied. Make your observations on sound profileon each room. Give the reasons. Make a report. Visit three very good auditoriums, list out different ways in which the acoustic arrangements have been done (as decoration and Civil works).Look for the reasons in Google and identifywhich is acoustically the best auditorium among the three you visited. Make a report.	
Activity-9	**Note for the teachers for the activity:** Make 3-4 groups among students and assign each group the activity of drawing one of the graphs given below. Provide a few days to complete the activity. One the specific day, each group has to make a ppt presentation of the following three slides. One 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 of measurement. 3. In the third slide, they will list three observations from that study. **Activity:** Take a bowl of different liquids (water, milk, kerosene, salt water, PotassiumPermanganate (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. Plota graph of- 1. Height v/s time of oscillation Weight of the marble v/s time of oscillation	
Activity-10	**Note for the teachers for the activity:** Make 3-4 groups among students and assign each group the activity of drawing one of the graphs given below. Provide a few days to complete the activity. One the specific day, each group has to make a ppt presentation of the following three slides. One 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 of measurement. In the third slide, they will list three observations from that study. **Activity:** 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 measurethe 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. 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 model of light-The Huygens's wave model (Concept of wave front-types), Maxwells electromagnetic wave theory, Plank's theory, Wave Particle Duality. Problems.	2
Chapter-6 **Interference of light by division of wave front**	Interference of light waves by division of wave-front- Young's double slit experiment- derivation of expression for fringe width-Fresnel Biprism: description of Biprism; Determination of wavelength of monochromatic light using Fresnel's biprism- Interference with white light. Problems.	5
Chapter-7 **Interference of light by division of amplitude**	Interference by division of amplitude-Interference by a plane parallel film illuminated by a plane wave, Interference by a film with two non-parallel reflecting surfaces, color of thin films—Newton's rings-(Reflected light)-Michelson Interferometer-Determination of wavelength of light. Problems.	6
Suggested Activities for students		
Activity-11	In the table given below explore which phenomenon can be explained by whatand Make a report	
Activity-12	Why colour strips are seen in paddles on roads in rainy seasons try to simulatethe same. Give the reasons. Make a report	
Activity-13	**Note for the teachers for the activity:** Make 3-4 groups among students and assign eachgroup the activity of drawing one of the graphs given below.	

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	Blackbody radiation			
8	Photoelectric effect			
9	De-Broglie hypothesis			
10	Davisson & Germer experiment			

	Provide a few days to complete the activity. One the specific day, each group has to make a ppt presentationof the following three slides. One 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 of measurement. 3. In the third slide, they will list three observations from that study. **Activity:** 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 two marbles of same weight (mass) from the same height on to the surface of the water but at the different time intervals. Plot graphfor the different observations. **For teachers:** Demonstrate the formation of Lissajous Figure using a CRO. Give different shapes of Lissajous Figure with varying frequency and amplitude. Ask the students to comment on the observations.	
Unit – 4 Diffraction and Polarisation		
Chapter-8 **Fraunhofer diffraction**	Introduction; Fraunhofer diffraction - Single slit diffraction pattern – expression for position of Maxima and Minima; Two slit diffraction pattern- expression for position of Maxima and minima; Theory of plane diffraction Grating: Grating spectrum-normal and oblique incidence, Resolving power and dispersive power of a grating, Single slit; Double Slit. Problems.	5
Chapter-9 **Fresnel Diffraction**	Fresnel half period zones-Diffraction by a circular aperture-diffraction by an opaque disc-The zone plate -comparison between zone plate and convex lens. Problems.	4
Chapter-10 **Polarisation**	Introduction; Production and detection of different types of polarized light, Polarization by reflection, refraction, double refraction, Nicol prism and Polaroid. Quarter wave plates and half wave plates; Theory of optical activity. Problems.	4
Suggested Activities for students		
Activity-14	Explain polarization of light through a chart. List out the surfaces that reflect polarized light. Learn how polarization of light can be done by both transmission and reflection.Perform an experiment and make a report. USING CDs AND DVDs AS DIFFRACTION Gratings Ref:https://www.nnin.org/sites/default/files/files/Karen_Rama_USING_CDs_AN_D_DVDs_AS_DIFFRACTION_GRATINGS_0.pdf Obtain the diffraction spectra using a CD and design an experiment to find the distancebetween the tracks on 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-15	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
Activity-16	List out different types of zone plates and look for their applications in day to daylife. Make a report
Activity-17	Collect information and study how optically polarizing lenses are made. Visit a nearby lens making facility. Learn the principle behind sunglasses. Make a report
Activity-18	**Note for the teachers for the activity:** Make 3 groups among students and assign each group the activity of drawing one of the graphs given below. Provide a few days to complete the activity. One the specific day, each group has to make a ppt presentation ofthe following three slides. One 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 of measurement. 3. In the third slide, they will list three observations from that study. **Activity:** Identify any 3 sharp edges of varying thickness and assign them to 3 groups. Shine a laser light pointing towards the edge of the needle. Observe the patterns formedon 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 fromthe edge to the screen. By this, calculate the wavelength of the laser light used.

Textbooks

Sl. No.	Title of the Book	Authors Name	Publisher	Year of Publication
1.	The Physics of Waves andOscillations,	N K Bajaj	Tata McGraw-Hill PublishingCompany 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 RS Bedi	Atma Ram & Sons, ThirdEdition	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

List of Experiments to be performed in the Laboratory	
1.	Velocity of sound through a wire using Sonometer.
2.	Frequency of AC using Sonometer.
3.	Study of Lissajous' Figures (Mechanical or electrical approach)
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 sodium source.
8.	To determine the dispersive power.
9	To determine the Cauchy constants using mercury source.
10.	To determine the wavelength of sodium source using Michelson's interferometer.
11.	To determine wavelength of sodium light using Fresnel Biprism.
12.	To determine radius of curvature of a lens by Newton's Rings
13.	To determine the thickness of a thin paper by measuring the width of the interference fringes produced by a wedge-shaped Film.
14	To determine wavelength of (1) Na source and (2) spectral lines of Hg source using plane diffraction grating.
15	To determine dispersive power and resolving power of a plane diffraction grating.
16.	Determination of specific rotation of sugar solution using polarimeter.

(Minimum EIGHT experiments have to be carried out)

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 andJon M. Ogborn	Heinemann Educational Publishers, 4th Edition	1985
4.	A Laboratory Manual of Physics for undergraduate classes	D.P.Khandelwal	Vani Publications.	1985

Formative assessment should be based on continuous evaluation of student's performance. It should include internal test, assignments, seminars, performing activities and any other component as necessary.

Students should be given multiple chances to improve his or her formative assessment marks.

Core Course for Semester – IV

PHYDSC04: Thermal Physics and Electronics

Course Title	**Thermal Physics and Electronics**
Course code	**PHYDSC04**
Course credits	**4+2**
Total Contact Hours	**52+52**
Formative Assessment Marks	**40**
Summative Assessment Marks	**60**
Model Syllabus Authors	**State Physics Expert Committee**

Chapter Number	Topics to be covered	Contact hours
Unit – 1		
Chapter-1 **Laws of Thermodynamics**	Review of the concepts of Heat and Temperature. **First Law of Thermodynamics:** Differential form, Internal Energy. Equation of state for an adiabatic process, Work Done during Isothermal and Adiabatic Processes. **Second Law of Thermodynamics**: Kelvin-Planck and Clausius Statements and their Equivalence. Reversible and Irreversible processes with examples. Heat Engines: Carnot engine & derivation for the expression of efficiency. Refrigeration & coefficient of performance, Applications of Carnot engine in locomotion, Thermodynamic Scale of Temperature and its Equivalence to Perfect Gas Scale. Concept of Entropy, Second Law of Thermodynamics in terms of Entropy **Third Law of Thermodynamics**: Statement, Significance and Unattainability of Absolute Zero. Problems.	13
Suggested Activities for students		
Activity-1	I feel cold because coldness enter my body. Discuss the statement in day-to-day life. Approximately give examples of **(i)** open system **(ii)** closed system and **(iii)** 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. Discuss why when a person works or does exercise, he sweats. Reason it with the laws of thermodynamics.	
Activity-2	**Note for the teachers for the activity:** Make 3-4 groups among students and assign each group the activity of drawing one of the graphs given below.	

	Provide a few days to complete the activity. One the specific day, each group has to make a ppt presentation of the following three slides. One 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. **(i)** The first slide will explain the process of doing the experiment. **(ii)** In the second slide. Students will show the graph of measurement. **(iii)** In the third slide, they will list three observations from that study. **Activity:** 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 witha 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. **(i)** Plot a graph for the volume of the metal piece used v/s respectivetemperature change observed. Determine the heat capacity and specific heat of the metal used.	
Activity-3	**Note for the teachers for the activity:** Make 3-4 groups among students and assign each group the activity of drawing one of the graphs given below. Provide a few days to complete the activity. One the specific day, each group has to make a ppt presentation of the following three slides. One 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. **(i)** The first slide will explain the process of doing the experiment. **(ii)** In the second slide. Students will show the graph of measurement. **(iii)** In the third slide, they will list three observations from that study. **Activity:** Take ice cubes of different size and immerse in water and measure the temperature change with time and repeat the experiment. Graph the observations.	
Unit – 2		
Chapter-2 **Thermodynamic Potentials**	Internal Energy, Enthalpy, Helmholtz Free Energy, Gibb's Free Energy.Properties and Applications. Problems.	2
Chapter-3 **Maxwell's Thermodynamic Relations**	Derivations and applications of Maxwell's Relations (1) First order Phase Transitions with examples, Clausius - Clapeyron Equation (2) Values of Cp-Cv (3) Joule-Thomson Effect and Joule-Thomson coefficient. Derive an equation for Vander Walls gas. Attainment of low temperature by liquefaction of gases and adiabatic demagnetization (qualitative). Problems	4
Chapter-4 **Kinetic Theory of Gases**	Distribution of Velocities: Maxwell-Boltzmann Law of Distribution of Velocities in an Ideal Gas: Mean, RMS and Most Probable Speeds. Degrees of Freedom, Law of Equipartition of Energy. Specific heats of Gases. Problems	3
Chapter-5 **Radiation**	Blackbody radiation, spectral distribution, the concept of energy density and pressure of radiation, Wien's law, Wien's displacement law, Stefan-Boltzmann law, Rayleigh-Jeans law,	4

	Ultraviolet Radiation catastrophe and Planck's law of radiation. Problems.	
Suggested Activities for students		
Activity-4	**(i)** 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. **(ii)** Thermo emf Materials: Suitable two dissimilar metal wires, voltage measuring device. Activity: In this experiment student will assemble the thermocouple and studythe three effects namely, Seebeck, Peltier, and Thompson. **(iii)** Inverse square law of radiation Materials: A cardboard with a grid, cardboard with a hole, supporting clips, aruler, candle. **(iv)** 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: KineticTheory http://www.physics.umd.edu/perg/abp/think/thermo/kt.htm	
Activity-5	**Note for the teachers for the activity:** Make 3-4 groups among students and assign each group the activity of drawing one of the graphs given below. Provide a few days to complete the activity. One the specific day, each group has to make a ppt presentation of the following three slides. One 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. **(i)** The first slide will explain the process of doing the experiment. **(ii)** In the second slide. Students will show the graph of measurement. **(iii)** In the third slide, they will list three observations from that study. **Activity:** 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 EFM generated in the voltmeter	
Activity-6	**Note for the teachers for the activity:** Make 3-4 groups among students and assign each group the activity of drawing one of the graphs given below. Provide a few days to complete the activity. One the specific day, each group has to make a ppt presentation of the following three slides. One 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. **(i)** The first slide will explain the process of doing the experiment. **(ii)** In the second slide. Students will show the graph of measurement. In the third slide, they will list three observations from that study. **Activity:** Make 4 groups and give different-sized balloons to each group. Fit different-sized nozzles into the mouth of the large balloons. Measure the	

	temperature or the EMF generated using a thermocouple placed at the mouth of the nozzle as the pressurised gas is released. Plot a graph of time v/s temperature. Vary the volume of the balloon and repeat the experiment. Plot the graph of volume v/s temperature difference created.	
Unit – 3 Semiconductor Physics		
Chapter-6 **Semiconductor devices**	Review of Intrinsic and Extrinsic semiconductors, p-n junction: Biasing of p-n junction (Explanation based on energy band diagram), p-n junction Characteristics and Parameters, Half-wave rectifier, Full-wave rectifier, Zener diode (Construction, working and characteristics) and its application as voltage regulators (line regulation and load regulation): Regulator circuit with and without load.	6
Chapter-7 **Junction Transistors**	Basics of Bipolar Junction Transistors (BJT), BJT operation, Common Base, Common Emitter and Common Collector Characteristics. Transistor biasing: Methods (Base resistor, feedback resistor and voltage divider bias), AC and DC load lines, Transistor as an amplifier (CE mode). Field Effect Transistor (FET) and its characteristics.	7
Suggested Activities for students		
Activity-7	Wire a regulated DC power supply on a bread board or groove board to give a regulated output voltage of + 5 V; +15 V; Dual power output : ± 5 V; Dual poweroutput : ± 15 V. Use: 3-pin voltage regulators. Components required: 1. Step down transformer- 1 No. (5 V tapping, 100 – 500 mA current rating), BY127 semiconductor diodes – 4 Nos, Inductor -1, Capacitor - 1, 3 pin 5V regulator-1 Search for circuit diagram in books/net. **Note for the teachers for the activity:** Make 3-4 groups among students and assign eachgroup the activity of drawing one of the graphs given below. Provide a few days to complete the activity. One the specific day, each group has to make a ppt presentationof the following three slides. One 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. **(i)** The first slide will explain the process of doing the experiment. **(ii)** In the second slide. Students will show the graph of measurement. In the third slide, they will list three observations from that study. **Activity:** Form 3 groups and tell them to make a DC supply of low current of differentvoltages like 5V, 10V, and 15V on a breadboard	
Activity-8	**(i)** Learn to identify the terminals of different types (packages) of BJTs. **(ii)** In the case of power transistors, learn how to fix a heat sink for thetransistor. **(iii)** Learn the difference between BJT and FET in its operational characteristics.	
Activity-9	**Note for the teachers for the activity:** Make 3-4 groups among students and assign eachgroup the activity of drawing one of the graphs given below. Provide a few days to complete the activity. One the specific day, each group	

	has to make a ppt presentationof the following three slides. One 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. **(i)** The first slide will explain the process of doing the experiment. **(ii)** In the second slide. Students will show the graph of measurement. **(iii)** In the third slide, they will list three observations from that study. **Activity:** Take any 3 diode and assign one to each group. 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 also the cooling curve of temperature V/s time for the diode by each group	
Unit – 4		
Chapter-8 **Integrated Circuits**	Integrated Circuits (Analog and Digital), Operational Amplifier, Ideal characteristics of Op-Amp, Open loop and closed loop configurations, Inverting and Non-Inverting amplifier using op-amp. Applications- Addition and Subtraction,	5
Chapter-9 **Number systems**	Switching and Logic Levels, Digital Waveform. Number Systems: Decimal, Binary, Octal and Hexadecimal number systems. Conversion from one number system to another.	3
Chapter-10 **Digital electronics**	Digital Circuits: Basic gates and their construction using diodes and transistors. Universal gates and realization of various gates using universal gates. Boolean algebra: De Morgan's theorem (Statement and proof using truth table). Algebraic Simplification. K-maps: Simplification using K-map (Up to four variables).	5
Suggested Activities for students		
Activity-10	Learn how to implement logic functions (AND, OR, NOT) using just diodes and resistors. With a circuit diagram show how different types of gates can be built by X-NORgates	
Activity-11	**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. What is a buffer? Prepare a report on buffers and its application in instrumentation electronics	
Activity-12	**(i)** A man has to take a wolf, a goat, and some cabbage across a river. Hisrowboat has enough room for the man plus either the wolf or the goator the cabbage. If he takes the cabbage with him, the wolf will eat thegoat. If he takes the wolf, the goat will eat the cabbage. Only when theman 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. **(ii)** A locker has been rented in the bank. Express the process of opening the locker in terms of digital operation.	

	(iii) 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.

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

List of Experiments to be performed in the Laboratory	
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 (FB & RB) or V-I Characteristics of Zener Diode.
8.	Characteristics of BJT in Common Emitter
9.	CE amplifier: Study of frequency response and determination of band width.

10.	Half Wave and Full Wave Rectifier with and without Filter (Determination of ripple factor).
11.	Applications of Operational Amplifier as non-inverting and Inverting amplifiers.
12	Adder and subtractor using op-amp.
13.	Construction of basic gates using diodes and transistors.
14.	Realization of AND, OR, NOT, NOR and XOR gates using NAND gate.
15.	ICs.Transfer characteristics of a TTL gate using CRO.

A minimum of eight experiments to be performed in the lab

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.

Proceedings of BOS committee

Proceedings of Board of Studies (BOS) in Physics was held at Department of Physics, Tumkur University, Tumkur on 13th October 2022 to discuss B.Sc., 3rd and 4th Semester syllabus.

The following BOS members were present for the meeting

1. Chairman, DOSR in Physics, Tumkur University, Tumkur
2. Sri. T.S. Shashidhara, Assistant Professor, Sri. Siddaganga Arts, Science and Commerce College, Tumkur
3. Sri. M.S. Raju, Assistant Professor, Department of Physics Govt. First grade College for Women, Tumkur
4. Sri. Chandrashekaraiah, Assistant Professor, Department of Physics, Govt. First grade College, Kunigal
5. Dr. J.R. Jayaramaiah, Assistant Professor, Department of Physics, Govt. First grade College, Tiptur
6. Mrs. M. Mamatha, Assistant Professor, Department of Physics, Govt. First grade College, Gubbi

The Chairman of the BOS committee welcomed the members and briefed them about the agenda of the meeting; syllabus discussion of B.Sc., 3 and 4th semester syllabus. The meeting was concluded with vote of thanks by Chairman.

Sl. No	Name of the Member	Signature
1	Chairman	Dr. H. NAGABHUSHANA Professor & Chairman DOSR in Physics Tumkur University Tumkur-572103.
2	Sri. T.S. Shashidhara	TUMKUR
3	Sri. M.S. Raju	
4	Sri. Chandrashekaraiah	
5	Dr. J.R. Jayaramaiah	
6	Mrs. M. Mamatha	