THIRUVALLUVAR UNIVERSITY

SERKKADU, VELLORE–632115

B.Sc. PHYSICS

SEMESTER - II

SYLLABUS

FROM THE ACADEMIC YEAR

2023 – 2024

S.No.	Part	StudyComponents CourseTitle		Ins. Hrs /week	Credit	Title ofthePaper	MaximumMarks		
							CIA	Uni. Exam	Total
SEMESTER II									
1.	I	Language	Paper-2	6	3	Tamil/OtherLanguages	25	75	100
2.	II	English	Paper-2	4	3	English	25	75	100
3.	II	NMSDC: Language Proficiency for Employability	Paper-1	2	2	Overview of English Communication	25	75	100
4.	III	Core Course –CC III (Theory)	Paper-2	5	5	Heat, Thermodynamics and Statistical Physics	25	75	100
5.	III	Core Course –CC IV (Practical)	Practical-2	5	5	Heat, Thermodynamics and Statistical Physics Practical	25	75	100
6.	III	Elective II Generic/ Discipline Specific (Allied Course II)	Elective II (Allied Paper-2)	6	3	Mathematics II	25	75	100
7.	IV	Skill Enhancement Course SEC-2	Paper2	2	2	Choose any one Course from A. Astrophysics B. Physics of medical Instruments	25	75	100
8.	IV	Skill Enhancement Course SEC-3 (Discipline Specific)	Paper 1	2	2	Communication Systems	25	75	100
		Sem. Total		**32**	**25**		**200**	**600**	**800**

COURSE	SECOND SEMESTER – CORE-III
COURSETITLE	Heat, Thermodynamics and Statistical Physics – Core 3
CREDITS	5
COURSE OBJECTIVES	The course focuses to understand a basic in conversion of temperature in Celsius, Kelvin and Fahrenheit scales. Practical exhibition and explanation of transmission of heat in good and bad conductor. Relate the laws of thermodynamics, entropy in everyday life and explore the knowledge of statistical mechanics and its relation

UNITS	COURSEDETAILS
UNIT-I	**CALORIMETRY:** specific heat capacity – specific heat capacity of gases C_P & C_V – Meyer's relation – Joly's method for determination of C_V – Regnault's methodfor determination of C_P **LOWTEMPERATUREPHYSICS:** Joule-Kelvin effect – porous plug experiment – Joule-Thomson effect –Boyletemperature – temperature of inversion – liquefaction of gas by Linde's Process – adiabatic demagnetisation.
UNIT-II	**THERMODYNAMICS-I:** zeroth law and first law of thermodynamics – P-V diagram – heat engine –efficiency of heat engine – Carnot's engine, construction, working and efficiency of petrol engine and diesel engines – comparison of engines.
UNIT-III	**THERMODYNAMICS-II:** second law of thermodynamics – entropy of an ideal gas – entropy change in reversible and irreversible processes – T-S diagram –thermodynamicalscale of temperature – Maxwell's thermodynamical relations –Clasius-Clapeyron's equation (first latent heat equation) – third law of thermodynamics – unattainability of absolute zero – heat death.
UNIT-IV	**HEATTRANSFER:** modes of heat transfer: conduction, convection and radiation. *Conduction*: thermal conductivity – determination of thermal conductivity of a good conductor by Forbe's method – determination ofthermal conductivity of a bad conductor by Lee's disc method. *Radiation*: black body radiation (Ferry's method) – distribution of energy in black body radiation – Wien's law and Rayleigh Jean's law –Planck's law of radiation – Stefan's law.
UNIT-V	**STATISTICALMECHANICS:** definition of phase-space – micro and macro states – ensembles –definition of different types of ensembles – classical and quantum Statistics – Maxwell-Boltzmann statistics – expression for distribution function – Bose-Einstein statistics – expression for distribution function – Fermi-Dirac statistics –expression for distribution function – comparison of three statistics.

TEXT BOOKS	1. Brijlal &N. Subramaniam, 2000, Heat and Thermodynamics, S.Chand& Co. 2. Narayanamoorthy&KrishnaRao, 1969,Heat,Triveni Publishers, Chennai. 3. V.R.Khanna&R.S.Bedi, 1998 1st Edition, Text book of Sound, Kedharnaath Publish & Co, Meerut 4. Brijlal and N. Subramanyam, 2001, Waves and Oscillations,Vikas Publishing House, New Delhi. 5. Ghosh, 1996, Text Book of Sound, S.Chand&Co. 6. R.Murugeshan & Kiruthiga Sivaprasath, Thermal Physics, S.Chand& Co.
REFERENCE BOOKS	1. J.B.Rajam & C.L.Arora, 1976, Heat and Thermodynamics, 8th edition, S.Chand& Co. Ltd. 2. D.S.Mathur, Heat and Thermodynamics, Sultan Chand & Sons. 3. Gupta, Kumar, Sharma, 2013, Statistical Mechanics, 26th Edition, S. Chand & Co. 4. Resnick, Halliday&Walker,2010, Fundamentals of Physics, 6th Edition. 5. Sears, Zemansky, Hugh D. Young,Roger A. Freedman, 2021 University Physics with Modern Physics 15th Edition, Pearson.
WEBLINKS	1. https://youtu.be/M_5KYncYNyc 2. https://www.youtube.com/watch?v=4M72kQulGKk&vl=en

METHOD OF EVALUATION:

Continuous InternalAssessment	End Semester Examination	Total	Grade
25	**75**	**100**	

COURSE OUTCOMES:
Attheendofthe course the studentwillbeableto:

COURSEOUT COMES	**CO1**	Acquires knowledge on how to distinguish between temperature and heat. Introduce him/her to the field of thermometry and explain practical measurements of high temperature as well as low temperature physics. Student identifies the relationship between heat capacity, specific heat capacity. The study of Low temperature Physics sets the basis for the students to understand cryogenics, superconductivity, superfluidity and Condensed Matter Physics
	CO2	Derive the efficiency of Carnot's engine. Discuss the implications of the laws of Thermodynamics in diesel and petrol engines
	CO3	Able to analyze performance of thermodynamic systems viz efficiency by problems. Gets an insight into thermodynamic properties like enthalpy, entropy

	CO4	Study the process of thermal conductivity and apply it to good and bad conductors. Quantify different parameters related to heat, relate them with various physical parameters and analyse them
	CO5	Interpret classical statistics concepts such as phase space, ensemble, Maxwell-Boltzmann distribution law. Develop the statistical interpretation of Bose-Einstein and Fermi-Dirac . Apply to quantum particles such as photon and electron

MAPPING WITH PROGRAM OUT COMES:

Mapcourseoutcomes(**CO**)foreachcoursewithprogramoutcomes(**PO**)inthe3-pointscaleofSTRONG(**S**),MEDIUM(**M**)andLOW(**L**).

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	S	M	S	S	S	M	M	S	M

COURSE	SECOND SEMESTER – CORE-IV
COURSETITLE	CORE PRACTICALS
CREDITS	5
COURSE OBJECTIVES	Apply their knowledge gained about the concept of heat and sound waves, resonance, calculate frequency of ac mains set up experimentation to verify theories, quantify and analyse, able to do error analysis and correlate results

HEAT, OSCILLATIONS, WAVES & SOUND(Any Eight of the below list)

1. Determination of specific heat by cooling – graphical method.
2. Determination of thermal conductivity of good conductor by Searle's method.
3. Determination of thermal conductivity of bad conductor by Lee's disc method.
4. Determination of thermal conductivity of bad conductor by Charlaton's method.
5. Determination of specific heat capacity of solid-method of mixtures.
6. Determination of specific heat of liquid by Joule's electrical heating method (applying radiation correction by Barton's correction/graphical method),
7. Determination of Latent heat of a vaporization of a liquid.
8. Determination of Stefan's constant for Black body radiation.
9. Verification of Stefan's-Boltzmans law.
10. Determination of thermal conductivity of rubber tube.
11. Helmholtz resonator.
12. Velocity of sound through a wire using Sonometer.
13. Determination of velocity of sound using Kunds tube.
14. Determination of frequency of an electrically maintained tuning fork
15. To verify the laws of transverse vibration using sonometer.
16. To verify the laws of transverse vibration using Melde's apparatus.
17. To compare the mass per unit length of two strings using Melde's apparatus.
18. Frequency of AC by using sonometer.

- Choose minimum of any 8 experiments

METHOD OF EVALUATION:

Continuous InternalAssessment	End Semester Examination	Total	Grade
25	75	100	

COURSE OUTCOMES:
Attheendofthecourse,the studentwillbeableto:

	CO1	Understand various postulates of special theory of relativity.
	CO2	Appreciate the importance of transformation equations and also the general theory of relativity.**.**
COURSEO UTCOMES	CO3	Realise the wave nature of matter and understand its importance
	CO4	Derive Schrodinger equation and also realize the use of operators.
	CO5	Apply Schrödinger equation to simple problems.

MAPPING WITH PROGRAM OUT COMES:

Mapcourseoutcomes(**CO**)foreachcoursewithprogramoutcomes(**PO**)inthe3-pointscaleofSTRONG(**S**),MEDIUM(**M**)andLOW(**L**).

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	S	S	M	S	M	M	S	M	M	M
CO3	M	M	S	M	S	S	M	S	S	S
CO4	M	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	M	M	S	M	M	S

SKILL ENHANCEMENT COURSE SEC-2

A. ASTROPHYSICS	
Learning Objective: This course intends tointroduce principles of astrophysics describing the science of formation and evolution of stars and interpretation of various heavenly phenomena and provide an understanding of the physical nature of celestialbodies along with the instrumentation and techniques used in astronomical research	
UNITS	**COURSE DETAILS**
UNIT-I	**TELESCOPES:** Optical telescopes – magnifying power, brightness, resolving power and f/a ratio – types of reflecting and refracting telescopes – detectors and image processing – radio telescopes – Hubble space telescope.
UNIT-II	**SOLAR SYSTEM:** Bode's law of planetary distances – meteors, meteorites, comets, asteroids – Kuiper belt – Oort cloud – detection of gravitational waves – recent advances in astrophysics.
UNIT-III	**ECLIPSES:** types of eclipses – solar eclipse – total and partial solar eclipse – lunar eclipse – total and partial lunar eclipse – transits. **THE SUN:**physical and orbital data – solar atmosphere – photosphere – chromosphere – solar corona – prominences – sunspots – 11year solar cycle – solar flares.
UNIT-IV	**STELLAR EVOLUTION:** H-R diagram – birth & death of low mass, intermediate mass and massive stars – Chandrasekar limit – white dwarfs – neutron stars – pulsars – black holes – supernovae. **GALAXIES:** classification of galaxies – galaxy clusters –interactions of galaxies, dark matter and super clusters – evolving universe.
UNIT-V	**ACTIVITIES IN ASTROPHYSICS:** (i) Basic construction of telescope (ii) Develop models to demonstrate eclipses/planetary motion (iii) Night sky observation (iv) Conduct case study pertaining to any topic in this paper (v) Visit to any one of the National Observatories Any three activities to be done compulsorily.
TEXT BOOKS	1. BaidyanathBasu, (2001). <u>An introduction to Astrophysics</u>, Second printing, Prentice – Hall of India (P) Ltd, New Delhi 2. K.S.Krishnaswamy, (2002), <u>Astrophysics – a modern perspective,</u> New Age International (P) Ltd, New Delhi. 3. Shylaja, B.S. &Madhusudan, H.R.,(1999), <u>Eclipse: A Celestial Shadow Play</u>, Orient BlackSwan,

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B. PHYSICS OF MEDICAL INSTRUMENTS	
Learning Objective: The students will be exposed to instruments like ECG,EEG,EMG, medical imaging, diagnostic specialties, operation theater and its safety which will kindle interest to specialize in instrument servicing.	
UNITS	**COURSE DETAILS**
UNIT-I	**BIO-POTENTIALS AND ELECTRODES:** transport of ions through cell membrane- resting and action potential - Characteristics of resting potential – bio-electric potential – design of medical instruments – components of bio-medical instrumentation – electrodes – electrode potential – metal microelectrode – depth and needle electrodes – types of surface electrode – the pH electrode.
UNIT-II	**Bio-potential based Instrumentation:**Electrocardiography (ECG) – origin of cardiac action potential - ECG lead configuration –block diagram of ECG recording set up (qualitative) – Electroencephalography (EEG) – origin of EEG – action and evoked potentials - brain waves – block diagram of modern EEG set up – electromyography (EMG) – block diagram of EMG recording setup.
UNIT-III	**OPERATION THEATRE AND SAFETY:** diathermy – block diagram of the electrosurgical diathermy– shortwave, microwave, ultrasonic diathermy – ventilators – servo controlled systems – **RADIATION SAFETY:** units of radiation - pocket dosimeter – pocket type radiation alarm – thermo-luminescence dosimeter.
UNIT-IV	**MEDICAL IMAGING:** nuclear imaging technique –computer tomography (CT) – principle – mathematical basis of image construction –block diagram of CT scanner – ultrasonic imaging systems – construction of transducer – display modes – MRI principle and instrumentation.
UNIT-V	**DIAGNOSTICS AND SPECIALITIES:**X-rays in radiography – fluoroscopy – comparison– image intensifiers – angiography – applications of X-ray examination (*problems*). **LASER IN MEDICINE:**laser interactions with biomolecules – advantages of laser surgery – endoscopy – types of endoscopes with their operation (qualitative).
TEXT BOOKS	1. Biomedical Instrumentation and measurement, Leslie Cromwell, PHI, 2015 2. Medical Instrumentation, M. Arumugam, Anuradha agencies, 1992 3. Medical Electronics, M.J.Kumar Doss, Prathibha Publishers, 1987 4. Medical Physics, John R. Cameron and James G. Skofronick, Thrift books, Atlanta, 1985 5. Electronic Instruments and Instrumentation Technology, M. M.M.Anand, PHI, 2015

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SKILL ENHANCEMENT COURSE SEC-3

COMMUNICATION PHYSICS	
Learning Objective: To get a thorough knowledge on transmission and reception of radio waves, the different types of communication like fibre optic, radar, satellite, cellular	
UNITS	**COURSE DETAILS**
UNIT-I	**RADIO TRANSMISSION AND RECEPTION:** transmitter – modulation - types of modulation – amplitude modulation – limitations of amplitude modulation – frequency modulation – comparison of FM and AM – demodulation- essentials in demodulation – receivers: AM radio receivers – types of AM radio receivers –superheterodyne radio receiver, advantages – FM receiver – difference between FM and AM receivers.
UNIT-II	**FIBER OPTIC COMMUNICATION:** introduction – basic principle of fiber optics – advantages – construction of optical fiber – classification based on the refractive index profile – classification based on the number of modes of propagation – losses in optical fibers – attenuation–advantages of fiberoptic communication.
UNIT-III	**RADAR COMMUNICATION:** introduction - basic radar system –radar range equation – antenna scanning –pulsed radar system – search radar –tracking radar – moving target indicator- Doppler effect-MTI principle – CW Doppler radar.
UNIT-IV	**SATELLITE COMMUNICATION:** introduction- history of satellites – satellite communication systems– satellite orbits – basic components of satellite communication system – commonly used frequency in satellite – communication –multiple access communication – satellite communication in India.
UNIT-V	**MOBILE COMMUNICATION:** introduction – concept of cell – basic cellular mobile radio system – cellphone – facsimile – important features of fax machine – application of facsimile – VSAT (very small aperture terminals) modem IPTV (internet protocol television) -Wi-Fi-4G (basic ideas)
TEXT BOOKS	1. V.K.Metha, Principles of Electronics, S. Chand & CoLtd., 2013 2. Anokh Singh and Chopra A.K., Principles of communication Engineering, S.Chand& Co, 2013
REFERENCE BOOKS	1. J.S. Chitode, Digital Communications, 2020, Unicorn publications 2. Senior John. M, Optical Fiber Communications: Principles and Practice, 2009, Pearson Education.

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Continuous InternalAssessment	End Semester Examination	Total	Grade
25	**75**	**100**	