

Programme Class: Certificate	Year: First	Semester: Second
Subject: PHYSICS		
Course Code: (B010201T)	Course title: Thermal Physics & Semiconductor Devices	
Course Outcomes: <ul style="list-style-type: none">• Recognize the difference between reversible and irreversible processes.• Understand the physical significance of thermodynamical potentials.• Comprehend the kinetic model of gases w.r.t. various gas laws.• Study the implementations and limitations of fundamental radiation laws.• Utility of AC bridges.• Recognize the basic components of electronic devices.• Design simple electronic circuits.• Understand the applications of various electronic instruments.		
Credits: 4	Core Compulsory / Elective	
Max. Marks: 25+75	Min. Passing Marks:	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 4-0-0		
Unit	Topics	No. of Lectures
Part A: Thermodynamics & Kinetic Theory of Gases		
I	0th & 1st Law of Thermodynamics: State functions and terminology of thermodynamics. Zeroth law and temperature. First law, internal energy, heat and work done. Work done in various thermodynamical processes. Enthalpy, relation between C _p and C _v . Carnot's engine, efficiency and Carnot's theorem. Efficiency of internal combustion engines (Otto and diesel).	8
II	2nd & 3rd Law of Thermodynamics: Different statements of second law, Clausius inequality, entropy and its physical significance. Entropy changes in various thermodynamical processes. Third law of thermodynamics and unattainability of absolute zero. Thermodynamical potentials, Maxwell's relations, conditions for feasibility of a process and equilibrium of a system. Clausius- Clapeyron equation, Joule-Thompson effect.	8
III	Kinetic Theory of Gases: Kinetic model and deduction of gas laws. Derivation of Maxwell's law of distribution of velocities and its experimental verification. Degrees of freedom, law of equipartition of energy (no derivation) and its application to specific heat of gases (mono, di and poly atomic).	7
IV	Theory of Radiation: Blackbody radiation, spectral distribution, concept of energy density and pressure of radiation. Derivation of Planck's law, deduction of Wien's distribution law, Rayleigh-Jeans law, Stefan-Boltzmann law and Wien's displacement law from Planck's law.	7
PART B: Circuit Fundamentals & Semiconductor Devices		
V	DC & AC Circuits: Growth and decay of currents in RL circuit. Charging and discharging of capacitor in RC, LC and RCL circuits. Network Analysis - Superposition. Reciprocity. Thevenin's and Norton's theorems. AC	7

	Bridges - measurement of inductance (Maxwell's, Owen's and Anderson's bridges) and measurement of capacitance (Schering's, Wein's and de Sauty's bridges).	
VI	Semiconductors & Diodes: P and N type semiconductors, qualitative idea of Fermi level. Formation of depletion layer in PN junction diode, field & potential at the depletion layer. Qualitative idea of current flow mechanism in forward & reverse biased diode. Diode fabrication. PN junction diode and its characteristics, static and dynamic resistance. Principle, structure, characteristics and applications of Zener, Light Emitting, and Photo diodes. Half and Full wave rectifiers, calculation of ripple factor, rectification efficiency and voltage regulation. Basic idea about filter circuits and voltage regulated power supply.	8
VII	Transistors: Bipolar Junction PNP and NPN transistors. Study of CB, CE & CC configurations w.r.t. active, cutoff & saturation regions; characteristics; current, voltage & power gains; transistor currents & relations between them. Idea of base width modulation, base spreading resistance & transition time. DC Load Line analysis and Q-point stabilization. Voltage divider bias circuit for CE amplifier.	8
VIII	Electronic Instrumentation: Multimeter: Principles of measurement of dc voltage, dc current, ac voltage, ac current and resistance. Specifications of a multimeter and their significance. Cathode Ray Oscilloscope: Block diagram of basic CRO. Construction of CRT, electron gun, electrostatic focusing and acceleration (no mathematical treatment). Front panel controls, special features of dual trace CRO, specifications of a CRO and their significance. Applications of CRO to study the waveform and measurement of voltage, current, frequency & phase difference.	7

Suggested Readings:

1. M.W. Zemansky, R. Dittman, "Heat and Thermodynamics", McGraw Hill, 1997, 7e
2. F.W. Sears, G.L. Salinger, "Thermodynamics, Kinetic theory & Statistical thermodynamics", Narosa Publishing House, 1998
3. Enrico Fermi, "Thermodynamics", Dover Publications, 1956
4. S. Garg, R. Bansal, C. Ghosh, "Thermal Physics", McGraw Hill, 2012, 2e
5. Meghnad Saha, B.N. Srivastava, "A Treatise on Heat", Indian Press, 1973, 5e

PART B

6. R.L. Boylestad, L. Nashelsky, "Electronic Devices and Circuit Theory", Prentice-Hall of India Pvt. Ltd., 2015, 11e
7. J. Millman, C.C. Halkias, Satyabrata Jit, "Electronic Devices and Circuits", McGraw Hill, 2015, 4e
8. B.G. Streetman, S.K. Banerjee, "Solid State Electronic Devices", Pearson Education India, 2015, 7e
9. J.D. Ryder, "Electronic Fundamentals and Applications", Prentice-Hall of India Private Limited, 1975, 5e
10. A. Sudhakar, S.S. Palli, "Circuits and Networks: Analysis and Synthesis", McGraw Hill, 2015, 5e
11. S.L. Gupta, V. Kumar, "Hand Book of Electronics", Pragati Prakashan, Meerut, 2016, 43e

Books of local authors:

1. Heat and Thermodynamics, Brij Lal Subrahmanyam
2. Refresher Course in Physics, C.L. Arora (for U.P. State Universities), S.Chand Publication
3. Kinetic Theory and Thermodynamics, Agrawal, Jain & Sharma, Krishna Prakashan, Meerut
4. Circuit fundamentals & Basic Electronics, Agrawal, Jain & Sharma, Krishna Prakashan, Meerut
5. अणुगति सिद्धान्त एवं ऊष्मागतिकी, अग्रवाल, जैन व शर्मा, कृष्णा प्रकाशन, मेरठ
6. परिपथ के मूल सिद्धान्त व बेसिक इलेक्ट्रॉनिक्स, अग्रवाल, जैन व शर्मा, कृष्णा प्रकाशन, मेरठ

Suggestive Digital Platforms / Web Links:

- MIT Open Learning - Massachusetts Institute of Technology, <https://openlearning.mit.edu/>

- National Programme on Technology Enhanced Learning (NPTEL), <https://www.youtube.com/user/nptelhrd>
- Uttar Pradesh Higher Education Digital Library, <http://heecontent.upsdc.gov.in/SearchContent.aspx>
- Swayam Prabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current_he/8

Suggested Continuous Evaluation Methods:

Continuous internal evaluation shall be based on allotted assignment and class tests. The marks shall be as follows:

Quiz/ Assignment	(05 marks)
Class Test-I	(10 marks)
Class Test-II	(10 marks)

- The course is elective and can be opted as an elective, which is open to all students.
- **PREREQUISITE:** Physics in 12th / Chemistry in 12th

Programme Class: Certificate	Year: First	Semester: Second
Subject: PHYSICS		
Course Code: (B010202P)	Course Title: Thermal Properties of Matter & Electronic Circuits	
Course Outcomes: Experimental physics has the most striking impact on the industry wherever the instruments are used to study and determine the thermal and electronic properties. Measurement precision and perfection is achieved through Lab Experiments. Online Virtual Lab Experiments give an insight in simulation techniques and provide a basis for modeling.		
Credits: 2	Core Compulsory / Elective	
Max. Marks: 25+75	Min. Passing Marks:	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 0-0-4		
Unit	Topics	No. of Lectures
Lab Experiment List		
	<div>1. Mechanical Equivalent of Heat by Callender and Barne’s method</div> <div>2. Coefficient of thermal conductivity of copper by Searle’s apparatus</div> <div>3. Coefficient of thermal conductivity of rubber</div> <div>4. Coefficient of thermal conductivity of a bad conductor by Lee and Charlton’s disc method</div> <div>5. Value of Stefan’s constant</div> <div>6. Verification of Stefan’s law</div> <div>7. Variation of thermo-emf across two junctions of a thermocouple with temperature</div> <div>8. Temperature coefficient of resistance by Platinum resistance thermometer</div> <div>9. Charging and discharging in RC and RCL circuits</div> <div>10. A.C. Bridges: Various experiments based on measurement of L and</div>	60

	<p>C</p> <ol style="list-style-type: none"> 11. Resonance in series and parallel RCL circuit 12. Characteristics of PN Junction, Zener, Tunnel, Light Emitting and Photo diode 13. Characteristics of a transistor (PNP and NPN) in CE, CB and CC configurations 14. Half wave & full wave rectifiers and Filter circuits 15. Unregulated and Regulated power supply 16. Various measurements with Cathode Ray Oscilloscope (CRO) <p>Online Virtual Lab Experiment List/Link</p> <p>Thermal Properties of Matter: Virtual Labs at Amrita Vishwa Vidyapeetham https://vlab.amrita.edu/?sub=1&brch=194</p> <ol style="list-style-type: none"> 1. Heat transfer by radiation 2. Heat transfer by conduction 3. Heat transfer by natural convection 4. The study of phase change 5. Black body radiation: Determination of Stefan's constant 6. Newton's law of cooling 7. Lee's disc apparatus 8. Thermo-couple: Seebeck effects <p>Semiconductor Devices: Virtual Labs an initiative of MHRD Govt. of India http://vlabs.iitkgp.ac.in/be/#</p> <ol style="list-style-type: none"> 9. Familiarisation with resistor 10. Familiarisation with capacitor 11. Familiarisation with inductor 12. Ohm's Law 13. RC Differentiator and integrator 14. VI characteristics of a diode 15. Half & Full wave rectification 16. Capacitative rectification 17. Zener Diode voltage regulator 18. BJT common emitter characteristics 19. BJT common base characteristics 20. Studies on BJT CE amplifier 	
<p>Suggested Readings:</p> <ol style="list-style-type: none"> 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 3. R.L. Boylestad, L. Nashelsky, "Electronic Devices and Circuit Theory", Prentice-Hall of India Pvt. Ltd., 2015, 11e 4. A. Sudhakar, S.S. Palli, "Circuits and Networks: Analysis and Synthesis", McGraw Hill, 2015, 5e <p>Suggestive Digital Platforms / Web Links: Virtual Labs at Amrita Vishwa Vidyapeetham, https://vlab.amrita.edu/?sub=1&brch=194 Virtual Labs an initiative of MHRD Govt. of India, http://vlabs.iitkgp.ac.in/be/# Digital Platforms /Web Links of other virtual labs may be suggested / added to this lists by individual Universities</p>		
<p>Suggested Continuous Evaluation Methods: Continuous internal evaluation shall be based on allotted assignment and class tests. The marks shall be as follows:</p>		