



GOVT. DIGVIJAY AUTO. PG COLLEGE
RAJNANDGAON (CHHATTISHGARH)

SYLLABUS AND MARKING SCHEME FOR B.Sc. WITH PHYSICS
SESSION 2025-26
SEMESTER - III

• **THEORY PAPER :**

Class	Paper	Course title	Course code	Credit value	Theory marks	Internal marks	Passing marks
Sem.-III	DSC	HEAT AND THERMODYNAMICS	PHSC-03T	3	70	30	40
Sem.-III	DSE	INTRODUCTION TO STATISTICAL MECHANICS	PHSE-01	4	70	30	40
Sem.-III	VAC	RENEWABLE ENERGY AND ENERGY HARVESTING	PHVAC-01	2	35	15	20

• **PRACTICAL / PROJECT PAPER :**

Class	Paper	Course title	Course code	Credit value	Practical + viva marks + Sessional	Internal assessment	Passing marks
Sem.-III	DSC	HEAT AND THERMODYNAMICS	PHSC-03P	1	35	15	20

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FOUR YEARS UNDERGRADUATE PROGRAM (2024-28)

DEPARTMENT OF PHYSICS

COURSE CURRICULUM

PART – A: INTRODUCTION			
Program: Bachelor in Science (Diploma/ Degree/ Honors)		Semester: III	Session: 2024-25
1	Course Code	PHSC-03T	
2	Course Title	Heat and Thermodynamics	
3	Course Type	Discipline Specific Course	
4	Pre-requisite (if any)	As per Program	
5	Course Learning Outcomes (CLO)	After going through the course, the student should be able to: <ul style="list-style-type: none"> <input type="checkbox"/> Demonstrate a deep comprehension of the fundamental principles of thermodynamics, including concepts such as energy, entropy and laws of thermodynamics. <input type="checkbox"/> Apply the laws of thermodynamics to analyze and solve problems related with energy transfer, heat engines, refrigeration system and other thermodynamic processes. <input type="checkbox"/> Analyze basic aspects of kinetic theory and transport phenomenon in gases. 	
6	Credit Value	03 Credits	1 Credit= 15 Hours for Learning & Observation
7	Total Marks	Maximum Marks: 100	Minimum Pass Marks: 40

PART – B: CONTENT OF THE COURSE

Total No. of Teaching-learning Periods (01 Hr. per period) - 45 Periods (45 Hours)

Unit	Topics (Course contents)	No. of Period
I	Historical background: A brief historical background of thermodynamics and statistical physics in the context of India and Indian culture, Contribution of S. N. Bose in Statistical mechanics. Laws of Thermodynamics: Thermodynamic Description of system, Zeroth Law of thermodynamics and temperature. First law and internal energy, conversion of heat into work, various Thermodynamical Processes, Work Done during Isothermal and Adiabatic Processes, Reversible & irreversible processes. Second law of thermodynamics & Entropy, Carnot's cycle, Carnot's theorem, Entropy changes in reversible & irreversible processes, Entropy-temperature diagrams, Third law of thermodynamics.	12
II	Thermodynamic Potentials: Internal Energy, Enthalpy, Helmholtz Free Energy and Gibbs function. Maxwell's relations & applications, Clausius- Clapeyron Equation, Expression for ($C_p - C_v$), C_p/C_v , TdS equations, Thermodynamic energy equation- change in internal energy of an ideal and Vander Waal's gas, Joule-Thompson Effect, Cooling by adiabatic demagnetization.	11
III	Kinetic Theory of Gases: Maxwellian distribution of speeds in an ideal gas: distribution of speeds and velocities, experimental verification, distinction between mean, rms and most probable speed values, Molecular Collision and Mean Free Path. Transport Phenomena in gases: Viscosity, Conduction and Diffusion, Law of equipartition of energy.	11
IV	Theory of Radiation: Blackbody radiation, Spectral distribution, Concept of Energy Density, Stefan Boltzmann Law, Newton's law of cooling from Stefan Boltzmann's law. Wien's displacement law and Rayleigh-Jeans Law (Only qualitative). Planck's radiation Law, Deduction of Wien's distribution law and Rayleigh- Jeans Law from Planck's law. Experimental verification of Planck's radiation law.	11
Keywords: Zeroth and First Law of Thermodynamics, Second Law of Thermodynamics, Entropy, Thermodynamic Potentials, Maxwell's Thermodynamic Relations, Kinetic Theory of Gases, Distribution of Velocities, Molecular Collisions, Real Gases, Laws of radiation		

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Signature of Convener & Members (CBoS) :

PART – C: LEARNING RESOURCES

Text Books, Reference Books and Others

Text Books

1. Heat and Thermodynamics: Singhal, Agrawal and Satya Prakash, Pragati Prakashan 1984
2. Physics (Part-2): Editor, Prof. B.P.Chandra, M.P. Hindi Granth Academy
3. Unified Physics –II, R.P.Goyal, Shival Agrawal & Sons
4. Unified Physics – II. Novbodh Prakashan

Reference Books

1. Thermodynamics, Kinetic theory & Statistical thermodynamics, F.W.Sears & G.L.Salinger. 1988, Narosa
2. Energy Science in Vedas: A Treatise on Vedic Thermodynamics and Free Energy (Exploring Lost Science and Technology in Vedas), Ramesh Kumar Mineria, Priya Veda Publications

Online Resources (e-books/ learning portals/ other e-resources)

1. Basics of thermodynamics
<https://www.youtube.com/watch?v=9GMBpZZtjXM&list=PLD8E646BAB3366BC8>
2. Thermodynamics <https://www.youtube.com/watch?v=E9cOAMhFUz0>
3. Second law of thermodynamics https://www.youtube.com/watch?v=F_lGosPY8o
4. NPTEL Online Lectures: <https://archive.nptel.ac.in/courses/115/105/115105129/>
5. <https://archive.nptel.ac.in/courses/115/106/115106090/>
6. <https://bsc.hcverma.in/course/penopcyc>
7. Vedic Science and Thermodynamics : <https://www.puranavedas.com/vedic-physics/>
8. <https://www.amazon.in/Vedic-Physics-Raja-Ram-Mohan/dp/0968412009?asin=1988207045&revisionId=&format=4&depth=2>
9. <https://ia903100.us.archive.org/3/items/wholelottabooks/The%20Astronomical%20Code%20of%20the%20Rgveda%20-%20Shubash%20Kak.pdf>

PART – D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: 100 Marks

Continuous Internal Assessment (CIA): 30 Marks

End Semester Examination (ESE): 70 Marks

Continuous Internal Assessment (CIA): (By course teacher)	Internal Test/ Quiz (2): 20 Marks Assignment/ Seminar (1): 10 Total Marks: 30	Better marks out of the two Test / Quiz+ marks obtained in Assignment shall be considered against 30 Marks
End Semester Exam (ESE):	Two section – A & B Section A: Q1. Objective – 10 x 1 = 10 Mark; Q2. Short answer type- 5x4 = 20 Marks Section B: Descriptive answer type, 1 out of 2 from each unit- 4x10 = 40 Marks	

Name and Signature of Convener & Members of CBoS:

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FOUR YEARS UNDERGRADUATE PROGRAM (2024 – 28)

DEPARTMENT OF PHYSICS

COURSE CURRICULUM

PART – A: INTRODUCTION			
Program: Bachelor in Science (Diploma/ Degree/ Honors)		Semester: III	Session: 2024-25
1	Course Code	PHSC- 03P	
2	Course Title	Heat and Thermodynamics	
3	Course Type	Discipline Core Course	
4	Pre-requisite (if any)	As per Program	
5	Course Learning Outcomes (CLO)	<ul style="list-style-type: none"> ➤ Lab Proficiency: Thermometers, pressure gauges, calorimeters, heat transfer apparatus, experimental setup, data acquisition. ➤ Hands-on Learning**: Heat transfer, work done, entropy, phase transitions, experiments. ➤ Data Analysis: Experimental data, theoretical discrepancies, analysis. ➤ Predictive Skills: Thermodynamic behavior, varying conditions, experimentation. ➤ Theory-Practice Integration: Theoretical knowledge, practical lab work, synthesis, applications. 	
6	Credit Value	01 Credit	1 Credit = 30 Hours Laboratory Work
7	Total Marks	Maximum Marks: 50	Minimum Pass Marks: 20
PART – B: CONTENT OF THE COURSE			
Total No. of learning-Training/performance Periods -30 Periods (30 Hours)			
Sr. No.	Objects (At least 10 of the following or related Experiments)	No. of Periods	
1	To determine the thermal conductivity of a non-conducting material by Lee's disc method.	30	
2	To study the variation of thermo emf across two junctions of a thermocouple with temperature.		
3	To verify Newton's law of cooling.		
4	To determine the temperature co-efficient of resistance by Platinum resistance thermometer.		
5	To determine the coefficient of thermal conductivity(k) of a rubber tube.		
6	To study the heat efficiency of an electric kettle with varying voltage.		
7	To determine the ratio of specific heat at constant pressure and constant volume ($\gamma = C_p/C_v$) of air Clement and Desorme's method.		
8	To determine the coefficient of thermal conductivity of copper by Searle's Apparatus.		
9	To study the variation of thermos-Emf of thermos couple with Difference of Temperature of its Two Junctions.		
10	To determine Mechanical Equivalent of Heat, J, by Callender and Barne's constant flow method.		
11	Measurement of Planck's constant using black body radiation.		
12	To determine Stefan's Constant.		
Keywords:		Thermal conductivity, Thermocouple, Newton's law of cooling, Temperature coefficient of resistance, Heat efficiency, Specific heat ratio, Mechanical equivalent of heat, Planck's constant	

Signature of Convener & Members (CBoS):

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PART – C: LEARNING RESOURCES

Text Books, Reference Books and Others

Text Books Recommended-

1. Advanced Practical Physics for students, B.L.Flint&H.T.Worsnop, 1971, Asia Publishing House.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
3. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.
4. A Laboratory Manual of Physics for Undergraduate Classes, D.P. Khandelwal, 1985, Vani Publication.
5. Unified Practical Physics B.Sc II : R P Goyal, Shivalal Agrawal & Sons Publications

Reference Books Recommended-

1. Practical Physics by C.L. Arora
2. Practical Physics by S.L. Gupta and Vijay Kumar
3. Advanced Practical Physics for Students by B.L. Worsnop and H.T. Flint

Online Resources (e-books/ learning portals/ other e-resources)

Link for e-Books for Physics Practical and Virtual labs

1. Thermal Physics and Statistical Mechanics: Laboratory Collection <https://egyankosh.ac.in/handle/123456789/67450>
2. Virtual Lab : <https://vlab.amrita.edu/index.php?sub=1&brch=194>
3. <https://vlab.amrita.edu/index.php?sub=1&brch=194&sim=802&cnt=1>
4. <https://vlab.amrita.edu/index.php?sub=1&brch=194&sim=801&cnt=4>
5. <https://srmap.edu.in/seas/physics-virtual-lab/>
6. <https://sites.google.com/view/vlab-bnmitmech/home/heat-transfer-lab>
<https://www.pbslearningmedia.org/resource/lsp07-sci-phys-thermalenergy/thermal-energy-transfer/#.WdJiOJlrIU>

PART – D: ASSESSMENT AND EVALUATION

Suggested Continuous Evaluation Methods:

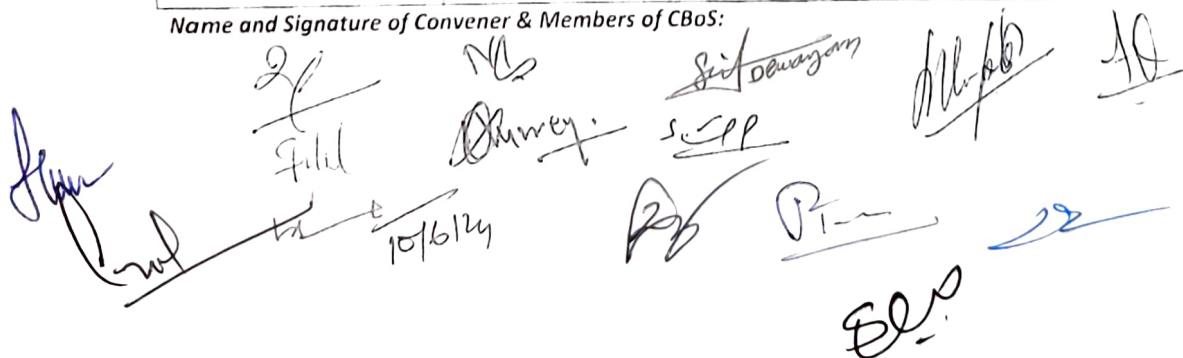
Maximum Marks: 50 Marks

Continuous Internal Assessment(CIA):15 Marks

EndSemester Exam(ESE):35 Marks

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): 10 & 10 Assignment/Seminar + Attendance –05 Total Marks - 15	Better marks out of the two Test / Quiz + Marks obtained in Assignment shall be considered against 15 Marks
End Semester Exam (ESE):	Laboratory Performance: On spot Assessment Performed the Task based on lab. work - 20 Marks Spotting based on tools & technology (written) – 10 Marks Viva-voce (based on principle/technology) - 05 Marks	Managed by Course teacher as per lab. status

Name and Signature of Convener & Members of CBoS:



FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF PHYSICS
COURSE CURRICULUM

PART-A: INTRODUCTION

Program : Bachelor in Science (Diploma / Degree/Honors)		Semester - III	Session: 2024-2025
1	Course Code	PHSE-01	
2	Course Title	Introduction to Statistical Mechanics	
3	Course Type	Discipline Specific Elective	
4	Pre-requisite (if, any)	As per Program	
5	Course Learning Outcomes(CLO)	<ul style="list-style-type: none"> ➤ Differentiate between macrostate and microstate and calculate their numbers ➤ Comprehend the concept of ensembles and its requirement in study of physical phenomenon ➤ Correlate and compare the classical and quantum statistical distribution laws. ➤ Apply concepts of statistical distribution laws for different physical systems. 	
6	Credit Value	4 Credits	Credit = 15 Hours -learning & Observation
7	Total Marks	Max. Marks: 100	Min Passing Marks: 40

PART -B: CONTENT OF THE COURSE

Total No.of Teaching-learning Periods (01 Hr. per period) – 60 Periods (60 Hours)

Unit	Topics (Course Contents)	No. of Period
I	Maxwellian Distribution of Speeds In An Ideal Gas: Distribution of speeds and velocity, experimental verification, distinction between mean, rms and most probable speeds, Doppler broadening of spectral lines, transport phenomena in gases: molecular collision, collision cross section, estimates of molecular diameter and mean free path; transport of mass , momentum and energy and inter-relationship, dependence on temperature and pressure. Behaviour of Real Gases : deviation from ideal gas equation, the Virial equation, Andrew's experiment on CO ₂ gas; critical constants.	15
II	Macrostate & Microstate Macrostate, Microstate, Number of accessible microstates and Postulate of equal a priori. Concept of Ensemble: Concept of Gibb's ensemble, postulate of ensemble average, Micro Canonical, Canonical & Grand Canonical ensembles. Thermodynamic Probability, Postulate of Equilibrium and Boltzmann Entropy relation. Phase space, Phase trajectory, Volume element in phase space, Quantization of phase space and number of accessible microstates for free particle in 1D, free particle in 3D.	15

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III	<p>Transition to quantum statistics: h as a natural constant and its implications, cases of particle in 1D and 1Dimensional harmonic oscillator,</p> <p>Quantum Statistical Distribution Laws: In-distinguishability of particles and its consequences, Bose-Einstein & Fermi Dirac statistics. Comparison of statistical distribution laws and their physical significance. Canonical Distribution Law: Boltzmann's Canonical Distribution Law, Boltzmann's Partition Function, Proof of Equipartition Theorem (Law of Equipartition of energy) and relation between Partition function and Thermodynamic potentials.</p>	15
IV	<p>Bose-Einstein Distribution Law and its Applications: Bose-Einstein Statistics: Heat capacity, Bose Einstein condensation, Radiation as a photon gas, Quantum Theory of Radiation: Spectral Distribution of Black Body Radiation. Planck's Quantum Postulates. Planck's Law of Blackbody Radiation: Deduction of (1) Wien's Distribution Law, (2) Rayleigh-Jeans Law, (3) Stefan-Boltzmann Law, (4) Wien's Displacement law from Planck's law</p> <p>Fermi-Dirac Distribution Law and its Applications: Free electrons in a metal, Definition of Fermi energy, Determination of Fermi energy at absolute zero, Kinetic energy of Fermi gas at absolute zero and concept of Density of States, Specific Heat of Metals (Density of Orbitals).</p>	15
Keywords	Macrostate & Microstate, ensemble, distribution laws, Bose-Einstein Statistics, Fermi-Dirac Statistics	

Name and Signature of Convener & Members of CBoS:

PART-C: LEARNING RESOURCES

Text Books, Reference Books and Others

Text Books Recommended –

1. Unified Physics –II, R P Goyal, Shivlal Agrawal & Sons Publication
2. Unified Physics-II, Yugbodh Prakashan
3. Unified Physics-II, Navbodh Prakashan

Reference Books Recommended–

1. F. Reif, "Statistical Physics (In SI Units): Berkeley Physics Course Vol 5", McGraw Hill, 2017
2. B.B. Laud, "Fundamentals of Statistical Mechanics", New Age International Private Limited, 2020
3. B.K. Agarwal, M. Eisner, "Statistical Mechanics", New Age International Private Limited, 2007

Online Resources–e-Resources / e-books and e-learning portals

1. MIT Open Learning - Massachusetts Institute of Technology, <https://ocw.mit.edu/courses/8-333-statistical-mechanics-i-statistical-mechanics-of-particles-fall-2013/>
2. National Programme on Technology Enhanced Learning (NPTEL), <https://archive.nptel.ac.in/courses/115/103/115103113/>,
3. https://onlinecourses.nptel.ac.in/noc19_ph10/preview,
4. <https://archive.nptel.ac.in/courses/115/106/115106126/>
5. Uttar Pradesh Higher Education Digital Library, <http://heecontent.upsdc.gov.in/SearchContent.aspx>
6. Swayam Prabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current_he/8

PART-D: ASSESSMENT AND EVALUATION

Suggested Continuous Evaluation Methods:

Maximum Marks: 100 Marks

Continuous Internal Assessment(CIA): 30 Marks

End Semester Exam (ESE): 70 Marks

Continuous Internal Assessment(CIA): (By Course Teacher)	Internal Test / Quiz-(2): 20 & 20 Assignment/Seminar- 10 Total Marks - 30	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 30 Marks
End Semester Exam (ESE):	Two section – A & B Section A: Q1. Objective – 10 x1= 10 Mark; Q2. Short answer type- 5x4 =20Marks Section B: Descriptive answer type qts., 1out of 2 from each unit-4x10=40Marks	

Name and Signature of Convener & Members of CBoS:

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FOUR YEARS UNDERGRADUATE PROGRAM (2024-28)
DEPARTMENT OF PHYSICS
COURSE CURRICULUM

PART – A: INTRODUCTION			
Program: Bachelor in Science (Certificate/ Diploma/ Degree/ Honors)		Semester: I/ III/ V	Session: 2024-25
1	Course Code	PHVAC-01	
2	Course Title	Renewable Energy and Energy Harvesting	
3	Course Type	Value Addition Course	
4	Pre-requisite (if any)	As per Program	
5	Course Learning Outcomes (CLO)	Objective of the course is to impart students; the knowledge of renewable energy and they are expected to learn about: <ul style="list-style-type: none"> ➤ Energy crisis at national and international scenario. ➤ Renewable sources of energy and their importance. ➤ Availability of renewable energy resources in India. ➤ Knowledge about energy harvesting technology. 	
6	Credit Value	02 Credits	1 Credit = 15 Hours- Learning & Observation
7	Total Marks	Maximum Marks: 50	Minimum Pass Marks: 20
PART – B: CONTENT OF THE COURSE			
Total No. of Teaching-learning Periods (01 Hr. per period) - 30 Periods (30 Hours)			
Unit	Topics		No. of Period
I	Fossil fuels and Alternate Sources of energy: Fossil fuels and nuclear energy, their limitation, need of renewable energy, non-conventional energy sources. Limitations of non-conventional energy resources. Environmental aspect of energy, World energy status, Energy scenario in India. Geo thermal Energy: Geothermal Resources, Geo thermal Technologies.		07
II	Solar energy: Solar energy, its importance, storage of solar energy, solar pond, non-convective solar pond, applications of solar pond and solar energy, solar water heater, flat plate collector, solar distillation, solar cooker, solar green houses, solar cell, absorption air conditioning. Need and characteristics of photovoltaic (PV) systems, sun tracking systems. Hydro Energy: Hydro power resources, hydro power technologies, environmental impact of hydro power sources.		08
III	Biomass energy: Biomass resources, Biomass conversion technology, biogas generation, factors affecting bio-digestion, working of biogas plant (with block diagram), biogas from plant waste, biomass energy programme in India, Biodiesel production from non-edible oil seeds. Ocean Energy: Ocean Energy Potential against Wind and Solar, Wave Characteristics and Statistics, Wave Energy Devices.		08
IV	Wind Energy harvesting: Fundamentals of Wind energy, Wind Turbines and different electrical machines in wind turbines. grid interconnection topologies. Piezoelectric Energy harvesting: Introduction, Physics and characteristics of piezoelectric effect, piezoelectric materials, Piezoelectric Energy harvesting applications.		07
Keywords:	Fossil fuel, Renewable energy sources, Solar energy, Biomass energy, Electromagnetic Energy Harvesting, Piezoelectric Energy harvesting.		

Signature of Convener & Members (CBoS):

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PART – C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended-

1. Non-conventional energy sources - G.D Rai - Khanna Publishers, New Delhi
2. Solar energy - M P Agarwal - S Chand and Co. Ltd.
3. Solar energy - Suhas P Sukhative Tata McGraw - Hill Publishing Company Ltd.
4. Godfrey Boyle, "Renewable Energy, Power for a sustainable future", 2004, Oxford University Press, in association with The Open University.
5. Dr. P Jayakumar, Solar Energy: Resource Assesment Handbook, 2009
6. J. Balfour, M. Shaw and S. Jarosek, Photovoltaics, Lawrence J Goodrich (USA).

Reference Books Recommended-

1. Non-Conventional Energy Resources by B.H. Khan
2. Renewable Energy Sources and Emerging Technologies by D.P. Kothari, K.C. Singal, and Rakesh Ranjan
3. Solar Energy: Fundamentals, Design, Modelling and Applications by G.N. Tiwari
4. Hydropower Development in India: A Sector Assessment by Pradeep Chaturvedi
5. Biomass Conversion: The Interface of Biotechnology, Chemistry and Materials Science by Samir K. Khanal, edited by B.C. Meikap and P.K. Bhattacharya
6. Ocean Energy: Technology, Environmental Impact and Renewable Energy by Pranav Kumar and T. Balaji
7. Wind Energy: Theory and Practice by S. Rao and Dr. B.B. Parulekar
8. Piezoelectric Materials and Devices: Applications in Engineering and Medical Sciences by Arun Ghosh

Online Resources (e-books/ learning portals/ other e-resources)

1. http://en.wikipedia.org/wiki/Renewable_energy
2. Renewable Energy Engineering: Solar, Wind And Biomass Energy Systems - Course (nptel.ac.in)
3. Technologies For Clean And Renewable Energy Production – NPTEL+
4. NPTEL :: Mechanical Engineering - NOC:Selection Of Nanomaterials For Energy Harvesting And Storage Application
5. Wind energy Labs : Mechanical Engineering : Amrita Vishwa Vidyapeetham Virtual Lab
6. Virtual Labs (vlabs.ac.in)
7. <https://youtu.be/uY3x7Tycyps>

PART – D: ASSESSMENT AND EVALUATION

Suggested Continuous Evaluation Methods:

Maximum Marks: 50 Marks

Continuous Internal Assessment (CIA): 15 Marks

End Semester Exam (ESE): 35 Marks

Continuous Internal Assessment (CIA): (By course teacher)	Internal Test/ Quiz- (2):	10 + 10	Better marks out of the two Test / Quiz + marks obtained in Assignment shall be considered against 15 Marks.
	Assignment/ Seminar+ Attendance-	05	
	Total Marks-	15	
End Semester Examination (ESE):	Two section – A & B Section A: Q1. Objective – 05 x1= 05 Mark; Q2. Short answer type- 5x2 =10Marks Section B: Descriptive answer type qts., 1 out of 2 from each unit- 4x05 =20 Marks		

Signature of Convener & Members (CBOS):

[Handwritten signatures and initials of the Convener and Members (CBOS) are present below the signature line.]



GOVT. DIGVIJAY AUTO. PG COLLEGE
RAJNANDGAON (CHHATTISHGARH)

SYLLABUS AND MARKING SCHEME FOR B.Sc. WITH PHYSICS
SESSION 2025-26
SEMESTER - IV

• **THEORY PAPER :**

Class	Paper	Course title	Course code	Credit value	Theory marks	Internal marks	Passing marks
Sem.-IV	DSC	WAVE AND OPTICS	PHSC-04T	3	70	30	40
Sem.-IV	DSE	MATHEMATICAL PHYSICS-I	PHSE-02	4	70	30	40

• **PRACTICAL / PROJECT PAPER :**

Class	Paper	Course title	Course code	Credit value	Practical + viva marks+ Sessional	Internal assessment :	Passing marks
Sem.-II	DSC	WAVE AND OPTICS	PHSC-04P	1	35	15	20

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20/6/2025

FOUR YEARS UNDERGRADUATE PROGRAM (2024-28)
DEPARTMENT OF PHYSICS
COURSE CURRICULUM

PART – A: INTRODUCTION			
Program: Bachelor in Science (Diploma/ Degree/ Honors)		Semester: IV	Session: 2024-25
1	Course Code	PHSC-04T	
2	Course Title	Waves and Optics	
3	Course Type	Discipline Specific Course	
4	Pre-requisite (if any)	As per Program	
5	Course Learning Outcomes (CLO)	After going through the course, the student should be able to: <ul style="list-style-type: none"> ➤ Analyze the behavior of waves propagating through different mediums and predict how factors such as density, elasticity, and temperature affect wave propagation. ➤ Demonstrate an understanding of interference phenomena, including constructive and destructive interference, and apply this knowledge to solve problems involving wave superposition. ➤ Explain the concept of diffraction and its implications for wave propagation, including how waves bend around obstacles and spread out after passing through narrow openings. ➤ Describe the polarization of waves, including linear, circular, and elliptical polarization, and apply polarization concepts to analyze and manipulate electromagnetic waves. 	
6	Credit Value	03 Credits	1 Credit= 15 Hours - Learning & Observation
7	Total Marks	Maximum Marks: 100	Minimum Pass Marks: 40

PART – B: CONTENT OF THE COURSE

Total No. of Teaching-learning Periods (01 Hr. per period) - 45 Periods (45 Hours)

Unit	Topics (Course contents)	No. of Period
I	Contribution of C. V. Raman: Brief biography of C. V. Raman with his contribution in field of acoustics and optics. Waves in Medium: Speed of transverse waves on uniform string, Speed of longitudinal waves in a fluid, Energy density and energy transmission in waves. Group velocity and phase velocity and relationship between them. Reflection, refraction and diffraction of sound: Acoustic impedance of a medium, percentage reflection & refraction at a boundary, diffraction of sound, principle of a sonar system.	11
II	Interference: Principle of superposition, Division of wavefront and division of amplitude, Young's Double Slit experiment. Fresnel's Biprism, Phase change on reflection, Stokes' treatment. Interference in Thin Films: parallel and wedge-shaped films. Fringes of equal inclination (Haidinger Fringes); Fringes of equal thickness (Fizeau Fringes). Newton's Rings, measurement of wavelength and refractive index. Michelson's Interferometer, Formation of fringes, Determination of wavelength, Wavelength difference.	12
III	Diffraction: Fresnel Diffraction; Half-period zones. Zone plate. Fresnel Diffraction pattern of a straight edge, a slit and a wire using half-period zone analysis. Fraunhofer diffraction; Single slit, Double slit. Multiple slits & Plane Diffraction Grating, Resolving Power of Grating.	11
IV	Polarization: Polarized light and its mathematical representation, Electromagnetic theory of double refraction, Nicol Prism, Double image prism, Polaroid, Phase retardation plates, Circular and elliptical polarization. Polarization by double refraction and Huygens's theory, Rotation of plane of polarization, Biquartz polarimeter.	11

Keywords: Longitudinal and transverse waves, principle of superposition, Haidinger Fringes, Fresnel Diffraction, Fraunhofer diffraction, Polarization

Signature of Convener & Members (CBOS):

28/6/2025

GOVT. LIGALY COLLEGE
RAJNANDGAON (C.G.)
 (An Autonomous College Affiliated With
 Hemchandra Yadao Vishwavidyalaya, Durg)

FOUR YEARS UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF PHYSICS
COURSE CURRICULUM

PART – A: INTRODUCTION			
Program: Bachelor in Science (Diploma/ Degree/ Honors)		Semester: IV	Session: 2024-25
1	Course Code	PHSC- 04P	
2	Course Title	Waves and Optics	
3	Course Type	Discipline Specific Course	
4	Pre-requisite (if any)	As per program	
5	Course Learning Outcomes (CLO)	After the completion of the course, Students are expected to understand laws and principles behind various optical phenomena, specially related to wave nature of light. The students will also be able to <ul style="list-style-type: none"> ➤ Gain proficiency in operating laboratory equipment such as light source i.e. mercury, sodium and Laser, spectrometers, polarimeter, demonstrating competence in setting up experiments, calibrating instruments, and collecting accurate data. ➤ Develop a deep understanding of optical principles such as refraction, diffraction, dispersion, and interference, as well as their applications in various scientific disciplines ➤ Analyze recorded data and formulate it to get desired results. 	
6	Credit Value	01 Credit	1 Credit = 30 Hours Laboratory Work
7	Total Marks	Maximum Marks: 50	Minimum Pass Marks: 20

PART – B: CONTENT OF THE COURSE

Total No. of learning-Training/performance Periods -30 Periods (30 Hours)		
Sr. No.	Objects (At least 10 of the following or related Experiments)	No. of Period
1	To determine the Frequency of AC mains with the help of Sonometer.	30
2	Determination of angle of prism using spectrometer.	
3	To determine the Refractive Index of the Material of a given Prism using Spectrometer.	
4	To determine Dispersive Power of the Material of a given Prism using Spectrometer	
5	To determine the value of Cauchy Constants of a material of a prism.	
6	To determine the Resolving Power of a Prism.	
7	To determine wavelength of sodium light using Fresnel Biprism.	
8	To determine wavelength of sodium light using Newton's Rings Method.	
9	To determine the wavelength of Laser light using Single Slit Diffraction.	
10	To determine wavelength of Sodium light by laser diffraction.	
11	To determine wavelength of spectrum of Mercury light using plane diffraction Grating and Spectrometer.	
12	To determine the Resolving Power of a Plane Diffraction Grating.	
13	To determine the thickness of a thin paper by measuring the width of the interference fringes produced by a wedge-shaped Film.	
14	Determination of resolving power telescope.	
15	Study of polarization of sugar solution using polarimeter.	
Keywords: Waves Motion – General, Velocity of Waves, Wave Optics, Interference, Interferometer, Diffraction, Polarization, Spectrometer.		

Signature of Convener & Members (CBoS):

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PART – C: LEARNING RESOURCES

Text Books, Reference Books and Others

Text Books Recommended

1. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House
2. A Text Book of Practical Physics, I. Prakash & Ramakrishna, 11th Ed., 2011, Kitab Mahal
3. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
4. A Laboratory Manual of Physics for undergraduate classes, D.P.Khandelwal, 1985, Vani Pub.
5. Practical Physics B.Sc II : R P Goyal, Shival Publications

Reference Books Recommended

1. Practical Physics by S.L. Gupta and V. Kumar
2. Advanced Practical Physics for Students by B.L. Worsnop and H.T. Flint
3. B.Sc. Practical Physics by C.L. Arora
4. Experimental Physics: Modern Methods by R.A. Dunlap

Online Resources (e-books/ learning portals/ other e-resources)

1. Link for e-Books for Physics: Physics Practical: <https://egyankosh.ac.in/handle/123456789/82374>;
https://www.lightandmatter.com/lab_223.pdf;
2. Virtual Lab : <https://vlab.amrita.edu/index.php?sub=1&brch=281>
3. <https://www.compadre.org/books/?ID=70&FID=63273>
4. <https://www.edutech.com/category/higher-education/engineering-labs/virtual-labs-1>
5. <https://phet.colorado.edu/en/simulations/wave-interference>
6. <https://egyankosh.ac.in/handle/123456789/82374>

PART – D: ASSESSMENT AND EVALUATION

Suggested Continuous Evaluation Methods:

Maximum Marks: 50 Marks

Continuous Internal Assessment(CIA):15 Marks

EndSemester Exam(ESE):35 Marks

Continuous Internal Assessment(CIA): (By Course Teacher)	Internal Test / Quiz-(2): 10 & 10 Assignment/Seminar +Attendance -05 Total Marks - 15	Better marks out of the two Test / Quiz +Marks obtained in Assignment shall be considered against 15 Marks
End Semester Exam (ESE):	Laboratory Performance: On spot Assessment Performed the Task based on lab. work - 20 Marks Spotting based on tools & technology (written) – 10 Marks Viva-voce (based on principle/technology) - 05 Marks	Managed by Course teacher as per lab. status

Name and Signature of Convener & Members of CBOS:



FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF PHYSICS
COURSE CURRICULUM

PART-A: INTRODUCTION

Program: Bachelor in Science (Diploma /Degree/Honors)		Semester - IV	Session: 2024-2025
1	Course Code	PHSE-02	
2	Course Title	Mathematical Physics-I	
3	Course Type	Discipline Specific Elective	
4	Pre-requisite (if, any)	As per Program	
5	Course Learning Outcomes(CLO)	<ul style="list-style-type: none"> ➤ Revise and apply the knowledge of calculus, vectors, vector calculus, probability and probability distributions in various cases. ➤ Illustrate proficiency in writing and solving Differential equation and solving them for a given physical system. ➤ Apply and interpret the curvilinear coordinates in problems with spherical and cylindrical symmetries. ➤ Use Dirac Delta function for various physical situation, especially in quantum mechanical approaches. 	
6	Credit Value	4 Credits	Credit = 15 Hours -learning & Observation
7	Total Marks	Max. Marks: 100	Min Passing Marks: 40

PART -B: CONTENT OF THE COURSE

Total No. of Teaching-learning Periods(01 Hr. per period) – 60 Periods (60 Hours)		
Unit	Topics (Course Contents)	No. of Period
I	Calculus: Recapitulation: Limits, continuity, average and instantaneous quantities, differentiation. Plotting functions, Intuitive ideas of continuous, differentiable, etc. functions and plotting of curves. Approximation: Taylor and binomial series (statements only). Calculus of functions of more than one variable: Partial derivatives, exact and inexact differentials. Integrating factor, with simple illustration. Constrained Maximization using Lagrange Multipliers. Origin and Evolution of Mathematical concepts in Ancient India: Bhaskaracharya, the Inventor of Calculus: some examples on calculus	16
II	First Order and Second Order Differential equations: First Order Differential Equations and Integrating Factor. Homogeneous Equations with constant coefficients. Wronskian and general solution. Statement of existence and Uniqueness Theorem for Initial Value Problems.Particular Integral. Orthogonal Curvilinear Coordinates: Orthogonal Curvilinear Coordinates. Derivation of Gradient, Divergence, Curl and Laplacian in Cartesian, Spherical and Cylindrical Coordinate Systems.	16

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III	Introduction to probability: Independent random variables: Probability distribution functions; binomial, Gaussian, and Poisson, with examples. Mean and variance. Dependent events: Conditional Probability. Bayes' Theorem and the idea of hypothesis testing.	15
IV	Dirac Delta function and its properties: Definition of Dirac delta function. Representation as limit of a Gaussian function and rectangular function. Properties of Dirac delta function. Problems based on dirac-delta function and its application	13
Keywords	Calculus, Lagrange Multipliers, Homogeneous Equations, Particular Integral, Probability distribution, Dependent events, Dirac delta function	

Signature of Convener & Members (CBoS):

















PART-C: LEARNING RESOURCES

Text Books, Reference Books and Others

Text Books Recommended–

1. Advanced Engineering Mathematics, D.G. Zill and W.S. Wright, 5 Ed., 2012, Jones and Bartlett Learning
2. Mathematical Physics, Goswami, 1st edition, Cengage Learning
3. Engineering Mathematics, S. Pal and S.C. Bhunia, 2015, Oxford University Press
4. Advanced Engineering Mathematics, Erwin Kreyszig, 2008, Wiley India.
5. Essential Mathematical Methods, K. F. Riley & M.P.Hobson, 2011, Cambridge Univ. Press.
6. Mathematical Physics, H.K. Dass and R. Verma, S. Chand & Company

Reference Books Recommended–

1. Mathematical Methods for Physicists, G.B. Arfken, H.J. Weber, F.E. Harris, 2013, 7th Edn., Elsevier.
2. An introduction to ordinary differential equations, E.A. Coddington, 2009, PHI learning
3. Differential Equations, George F. Simmons, 2007, McGraw Hill.
4. Mathematical Tools for Physics, James Nearing, 2010, Dover Publications.

Online Resources–e-Resources / e-books and e-learning portals

1. NPTEL online Courses: <https://archive.nptel.ac.in/courses/115/105/115105097/>
2. NPTEL online Courses: <https://nptel.ac.in/courses/115103036>
3. e-gyankosh- <https://egyankosh.ac.in/handle/123456789/97951>
4. Origin and Evolution of Calculus in India: <http://mathematical-forum.org/wp-content/uploads/2021/01/Paper-1.pdf>
5. <https://iks.iitgn.ac.in/wp-content/uploads/2016/02/Development-of-Calculus-in-India-K-Ramasubramanian-MD-Srinivas-2010.pdf>
6. Indian Mathematics: NPTEL Course : <https://nptel.ac.in/courses/111101080>

PART-D: ASSESSMENT AND EVALUATION

Suggested Continuous Evaluation Methods:

Maximum Marks: 100 Marks

Continuous Internal Assessment (CIA): 30 Marks

End Semester Exam (ESE): 70 Marks

Continuous Internal Assessment(CIA): (By Course Teacher)	Internal Test / Quiz-(2): 20 & 20	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 30 Marks
	Assignment/Seminar- 10 Total Marks - 30	
End Semester Exam (ESE):	Two section – A & B Section A: Q1. Objective – 10 x1= 10 Mark; Q2. Short answer type- 5x4 =20Marks Section B: Descriptive answer type qts., 1 out of 2 from each unit-4x10=40Marks	

Name and Signature of Convener & Members of CBoS:

