

Board of Studies in Physics

FACULTY OF SCIENCE AND TECHNOLOGY

GONDWANA UNIVERSITY,

GADCHIROLI



Syllabus of

B. Sc. Semester III & Semester IV

SUBJECT – PHYSICS

AS PER NEP 2020

Session 2025-2026

LIST OF MEMBERS OF BOS IN PHYSICS

Sr. No.	Names	Members
1.	Dr. Sanjay R. Gawali Dr. Ambedkar College of Arts, Commerce and Science, Chandrapur	Working Chairman
2.	Dr. Pandurang R. Moharkar Dr. Khatri Mahavidyalaya, Tukum, Chandrapur	Member
3.	Dr. Urvashi P. Manik Professor, Sardar Patel College, Chandrapur	Member
4.	Dr. Kundan C. Patil Professor, Janata Mahavidyalaya, Chandrapur	Member
5.	Dr. Dilip S. Choudhary Professor, Dhote Bandhu Science College, Gondia	Member
6.	Dr. Ajay B. Lad Professor, Amolakchand Mahavidyalaya, Yeotmal	Member
7.	Dr. Ashok A. Mistry Professor, Anand Niketan College, Anandwan, Warora	Member
8.	Dr. Vishal G. Dudhe Professor, Shri Shivaji College, Rajura Dist. Chandrapur	Member
9.	Dr. Chhagan D. Mungmode Professor M. G. Arts, Science and Late N. P. Commerce College, Armori	Member
10.	Dr. Ajay D. Dahegaonkar N. S. Science and Arts College, Bhadrawati Dist. Chandrapur	Member
11.	Dr. Kartik N. Shinde N. S. Science and Arts College, Bhadrawati Dist. Chandrapur	Member
12.	Dr. Nitin K. Labhshetwar Chief Scientist and Head, Energy and Resource Management Division, CSIR-NEERI, Nagpur	Member
13.	Mr. Prashant M. Deshpande Director Global Marketing, Nagpur	Member



Gondwana University, Gadchiroli
NEP 2020 U.G. PROGRAMME SESSION 2025-26

Faculty of Science and Technology
Programme Name - B.Sc. Sem III (Level-5), Programme Code:GUGSTUGPHY

Sr. No.	Course Category	Subject Name	Total Credit	Teaching Scheme (Hrs)			Examination Scheme										Total Marks
				Theory	Practical /Tutorial	Total Hrs.	Theory					Practical					
							UA	CA	Total Mark	Min. Passing	Duration of Exam (Hrs.)	UA	CA	Total Mark	Min. Passing		
1	Major Subject ANNEXURE-I	Paper I : Thermal Physics Code:STUG03PHY001	02	02	--	02	40	10	50	20	03	--	--	--	--	50	
		Practical Based on Paper I	02	--	04	04	--	--	--	--	--	30	20	50	25	50	
		Paper II : Radiation and Statistical Physics Code:STUG03PHY002	02	02	--	02	40	10	50	20	03	--	--	--	--	50	
		Practical Based on Paper II	02	--	04	04	--	--	--	--	--	30	20	50	25	50	
2	Minor Subject ANNEXURE-II	Paper I : Properties of Matter and Kinetic Theory of Gases Code:STUG03PHY003	02	02	--	02	40	10	50	20	02	--	--	--	--	50	
		Practical Based on Minor Paper I	02	--	04	04	--	--	--	--	--	30	20	50	25	50	
3	OE ANNEXURE-III	Group-A Climate Science Code:STUG03PHY004	02	02	--	02	40	10	50	20	02	--	--	--	--	50	
4	VSC ANNEXURE-IV	Based on Major subject Code:STUG03PHY005	02	--	04	04	-	--	--	--	--	30	20	50	25	50	
5	AEC ANNEXURE-V	English/Marathi/Hindi/Bengali/ <u>Pali</u>	02	02	--	02	40	10	50	20	02	--	--	--	--	50	
6	FP	Based on Major Subject (30 hrs/credit) Code:STUG03PHY006	02	--	04	04	--	--	--	--	--	30	20	50	25	50	
7	CC ANNEXURE-VI	NCC/NSS/Yoga/Sports	02	--	04	04	--	--	--	--	--	--	50	50	25	50	
Total			22	10	24	34	200	50	250	100	12	150	150	300	150	550	

Note: For non-practical subjects, Major and Minor papers will be of 4 theory Credits.

 Gondwana University, Gadchiroli NEP 2020 U.G. PROGRAMME SESSION 2025-26 Faculty of Science and Technology Programme Name - B.Sc. Sem IV (Level-5), Programme Code:GUGSTUGPHY																
Sr. No.	Course Category	Subject Name	Total Credit	Teaching Scheme (Hrs)			Examination Scheme								Total Marks	
				Theory	Practical /Tutorial	Total Hrs.	Theory					Practical				
							UA	CA	Total Mark	Min. Passing	Duration of Exam (Hrs.)	UA	CA	Total Mark	Min. Passing	
1	Major Subject ANNEXURE-VII	Paper III : Waves and Acoustics Code:STUG04PHY001	02	02	--	02	40	10	50	20	03	--	--	--	--	50
		Practical Based on Paper III	02	--	04	04	--	--	--	--	--	30	20	50	25	50
		Paper IV : Optical Physics Code:STUG04PHY002	02	02	--	02	40	10	50	20	03	--	--	--	--	50
		Practical Based on Paper IV	02	--	04	04	--	--	--	--	--	30	20	50	25	50
2	Minor Subject ANNEXURE-VIII	Paper II : Basic Electrostatics and LASER Code:STUG04PHY003	02	02	--	02	40	10	50	20	02	--	--	--	--	50
		Practical Based on Minor Paper II	02	--	04	04	--	--	--	--	--	30	20	50	25	50
3	OE ANNEXURE-IX	Group-A Sports Science Code:STUG04PHY004	02	02	--	02	40	10	50	20	02	--	--	--	--	50
4	SEC ANNEXURE-X	Renewable Energy and Energy Harvesting Code:STUG04PHY005	02	02	--	02	40	10	50	20	02	--	--	--	--	50
5	AEC ANNEXURE-XI	English/Marathi/Hindi/Bengali/Pali	02	02	--	02	40	10	50	20	02	--	--	--	--	50
6	CEP	Community engagement 30 hrs/credit Code:STUG04PHY006	02	--	04	04	--	--	--	--	--	30	20	50	25	50
7	CC ANNEXURE-XII	NCC/NSS/Yoga/Sports	02	--	04	04	--	--	--	--	--	--	50	50	25	50
Total			22	12	22	30	240	60	300	120	14	120	130	250	125	550

Note: For non-practical subjects, Major and Minor papers will be of 4 theory Credits.

Abbreviations: OE: Generic/ Open Electives, SEC: Skill Enhancement Courses, VSC: Vocational Skill Courses, AEC: Ability Enhancement Courses, FP: Field Project, CEP: Community Engagement Programme, CC: Co-curricular Courses

Instructions of Examination Scheme for B. Sc. Semester III and IV:

- The marks on internal assessment (CA) of the theory of the student shall be compounded with the theory paper (UA). The passing marks for theory will be 40 % marks. The marks on internal assessment (CA) of the practical of the student shall be compounded with the practical (UA). The passing marks for practical will be 50 % marks.
- The distribution of marks of theory College Assessment (CA) of Core subject, Minor Subject, OE and SEC for B. Sc. Sem III and Sem IV is as follows:

Sr. No.	Work Assigned	Marks Distribution for Core, Minor, OE and SEC
1.	Assignment	02
2.	Class Test	05
3.	Active Participation Seminar/Routine Activity etc.	03
Total		10

- A student will have to perform at least seven experiments per semester for core subject, minor subject and VSC. At the time of Practical examination, every student has to perform two experiments of Core, Minor and VSC, each of six hours duration.

4. The distribution of marks of practical University Assessment (UA) of Core subject, Minor Subject and VSC for B. Sc. Semester III and IV is as follows:

Sr. No.	Work Assigned	Marks Distribution
1.	Record Book	06
2.	Experiment 1 & 2	9+9
3.	Viva-voce	06
Total		30

5. The distribution of marks of practical College Assessment (CA) of Core subject, Minor Subject and VSC for B. Sc. Semester III and IV is as follows:

Sr. No.	Work Assigned	Marks Distribution
1.	Seminar on any one practical	10
2.	Viva-voce	05
3.	Report Submission	05
Total		20

5. The internal assessment (CA) of theory and practical shall be done by respective college and the marks shall be sent to the university at the appropriate time.

6. The guidelines regarding the Field Project (FP)

As per NEP 2020, students of B Sc. II Semester III need to perform a Field Project (FP) for TWO (2) credits i.e. 50 Marks. The guidelines regarding the field project are as follows:

- The total time allocation for the student to carry out Field Project (FP) is 60 hours.
- Students should participate in field-based projects under the supervision of faculty.
- Assignment of project topics to individual students or group of students (3 to 5 students in one group) and one faculty member from the department will act as Guide for the student or group of students.
- For a SURVEY based project, the related questionnaire (15 or more questions) should be prepared.
- The /guide should check the questions and finalize the questionnaire. The question that may create unnecessary complications should be avoided. The questions should be qualitative as well as quantitative.
- If the project is related to work that does not involve survey work, then the questionnaire part can be replaced accordingly (e.g. Sample collection/Data collection/ Experimental base).
- The student should compile all the relevant data and carry out its analysis.
- A project report should be written individually in the standard format (2 Copies): Index,

Introduction, Materials, Methods, Result, Conclusion/output, References (Numeric citation type) etc.

- i) The project report should include Title page, Certificate, Declaration, Acknowledgement, Index etc. Submit the project report with the signature of Guide and HOD to the department.
- j) The oral /poster presentation for all the projects should be arranged in the department. To evaluate the project, examiner should be appointed by HOD.
- k) The total project work including preparation of questionnaire to presentation should be evaluated for 2 credits (50 Marks).
- l) The scheme of evaluation for field project is given below –

Sr. No	Evaluation type	Marks
1	Student Overall Performance (CA)	20
2	Submission of FP Report (UA)	20
3	Presentation (PPT or Poster) (UA)	10
	Total	50

7. The guidelines regarding the CEP

As per NEP 2020, students of B Sc. Semester IV need to perform a Community Engagement Program (CEP) for TWO (2) credits i.e. 50 Marks. The guidelines regarding the CEP are as follows:

- a) The total time allocation for the student to carry out CEP is 60 hours.
- b) Students should participate in CEP activities under the supervision of faculty.
- c) Assignment of CEP topics to individual students or groups of students (3 to 5 students in one group) and one faculty member from the department will act as Guide for the student or group of students.
- d) CEP may include awareness programs, lectures, workshops on e-waste, e-learning, Solar energy, Wind energy, Atomic energy, Home appliances etc.
- e) For a SURVEY based CEP, activity related a questionnaire (15 or more questions) should be prepared.
- f) The guide should check the questions and finalize the questionnaire. The question that may create unnecessary complications should be avoided.
- g) Students should maintain the documentation and record properly which includes dairy, photographs, certificates, feedback of beneficiaries, news in local paper.
- h) A CEP report should be written individually in the standard format (2 Copies) which include Title page, Certificate, Declaration, Acknowledgement, Index, Introduction, details of activities, photographs, signature sheets of beneficiaries, feedback of beneficiaries, own feedback, summary /output, etc. It should be submitted with signature of Guide and HOD to the department.

- i) The oral /poster presentation for all the CEP activities should be arranged in the department. To evaluate the project, examiner should be appointed by HOD.
- j) The total work including preparation of questionnaire to presentation should be evaluated for 2 credits (50 Marks).
- k) The scheme of examination for CEP is given below –

Sr. No	Evaluation type	Marks
1	Student Overall Performance (CA)	20
2	Submission of CES Report (UA)	20
3	Presentation (PPT or Poster) (UA)	10
	Total	50

8. The theory question paper shall be of 3 hours duration for Core Subject and 2 hours for others and comprise of 5 questions with internal choice and with equal weightage to all units. The pattern of question paper shall be as follows.

Pattern of Question Paper for Core, Minor subjects, OE and SEC

B. Sc. Sem. III and Sem. IV

Subject: Physics

Time: 3 o r 2 Hours

Maximum Marks :40

Question No.

Marks Allotted

Qu. 1 EITHER

- A (From Unit – I)
(Two or Three bits i, ii, iii)

08

OR

- B (From Unit – I)
[Four bits (a),(b), (c), (d)]

2 x 4

Qu. 2 EITHER

- A (From Unit – II)
(Two or Three bits i, ii, iii)

08

OR

- B (From Unit – II)
[Four bits (a),(b), (c), (d)]

2 x 4

Qu. 3 EITHER

- A (From Unit – III)
(Two or Three bits i, ii, iii)

08

OR

- B (From Unit – III)
[Four bits (a),(b), (c), (d)]

2 x 4

Qu. 4 EITHER

- A (From Unit – IV)
(Two or Three bits i, ii, iii)

08

OR

- B (From Unit – IV)
[Four bits (a),(b), (c), (d)]

2 x 4

Qu. 5 Attempt any *eight* questions from the followings.

- | | |
|------------------|---|
| a) From Unit I | 1 |
| b) From Unit I | 1 |
| c) From Unit I | 1 |
| d) From Unit II | 1 |
| e) From Unit II | 1 |
| f) From Unit II | 1 |
| g) From Unit III | 1 |
| h) From Unit III | 1 |
| i) From Unit III | 1 |
| j) From Unit IV | 1 |
| k) From Unit IV | 1 |
| l) From Unit IV | 1 |

Programme Name – B. Sc. Sem III
Major Subject : Paper I: Thermal Physics (STUG03PHY001)

Credit: 02 Theory Hrs: 30

Course Objectives:

- The aim of this course is to study fundamentals of thermodynamics.
- Students must have understanding of thermodynamic fundamentals before studying their application in applied thermodynamics.
- The understanding of thermodynamic properties and processes will assist students in other related coursework.

Course Outcomes:

Upon completing this course, students will be able :

- To understand the basic concepts of thermodynamic such as temperature, pressure, system, properties, process, state, cycles and equilibrium.
- To apply the first Law of Thermodynamics on closed and control volume systems.
- To apply Second Law of Thermodynamics and entropy concepts in analyzing the thermal efficiencies of heat engines such as Carnot cycles.
- To apply the laws of thermodynamics to heat engines and estimate thermal efficiency.
- To analyze Maxwell's thermo dynamical relations and their applications

Unit I

7 Hrs

Kinetic Theory of Gases: Assumptions of Kinetic theory of gases, expression for pressure exerted by gas molecules, kinetic interpretation of temperature, deduction of gas laws from kinetic theory of gases, Degree of Freedom (Mono, Di and Polyatomic gases), Law of Equipartition of energy and its applications to specific heat of gases; mono-atomic and diatomic Gases.

Transport Phenomena Transport of momentum (viscosity η of gas) (derivation), transport of energy (thermal conductivity K) (derivation), relation between η and K , dependency of η and K on temperature and pressure, Transport of mass (diffusion D) (No derivation).

Numericals.

Unit II

8 Hrs

Concept of Thermodynamics: Thermodynamic variables (Intensive and Extensive), Thermodynamic process (Isothermal, Adiabatic, Isobaric, Isochoric), Zeroth law of thermodynamics and its importance.

Concept of Internal Energy, Internal Energy as a state function, First law of Thermodynamics and its applications and limitations, Derivation of Work done during isothermal and adiabatic process, Specific heat (Definition), General relation between C_P and C_V .

Numericals.

Unit III

7 Hrs

Second and Third laws of Thermodynamics: Reversible and irreversible process, Second law of Thermodynamics (Statements), Heat Engine and its efficiency, Carnot's cycle, Carnot's Theorem (Only statement).

Concept of entropy: Second law of Thermodynamics in terms of entropy, Entropy changes in reversible and irreversible process, T-S diagram and derivation of Work done and efficiency, Third law of Thermodynamics (Only statement).

Numericals.

Unit IV

8 Hrs

Thermodynamics Functions: Internal energy function, Enthalpy function, Gibb's function, Helmholtz function, Derivations of Maxwell's thermodynamics relations.

Latent heat (definition), Clausius - Clapeyron equation, Joule-Thomson effect, Porus-Plug experiment and its application (To show enthalpy constant).

Numericals.

Text Books & Reference Books:

1. S. Garg, R. Bansal and C. Ghosh, "Thermal Physics", McGraw Hill Education 1993.
2. Meghnad Saha, and B.N. Srivastava, "A Treatise on Heat" Indian Press 1969.
3. Enrico Fermi, "Thermodynamics" Dover Publications, 2013.
4. M.W. Zemansky and R. Dittman, "Heat and Thermodynamics" McGraw- Hill College 1996.
5. F.W. Sears & G.L. Salinger, "Thermodynamics, Kinetic Theory & Statistical thermodynamics", Pearson 1975.
6. S.K. Roy, "Thermal Physics and Statistical Mechanics", New Age International Publishers, New Delhi.
7. J.K.Sharma and K.K. Sarkar, "Thermodynamics and Statistical Physics", Himalaya Publishing House, Bombay.
8. C.L. Arora, Dr P.S. Hemne, "Physics for Degree students B.Sc. Second Year", S. Chand Publication.

Practical Based on Major Paper I : Thermal Physics

Credit: 02

Practical

Hrs: 60

List of Experiments (Perform any Seven Experiments):

1. To determine the coefficient of thermal conductivity of copper. (by Searle's Apparatus or other method).
2. To determine the coefficient of thermal conductivity of a bad conductor (Ebonite Disc) by Lee's disc method.
3. To determine the coefficient of thermal conductivity of rubber tube.
4. To determine the temperature co-efficient of resistance by Platinum resistance thermometer.
5. To determine the energy band gap of a semiconductor using junction diode (Germanium).
6. To study the variation of thermo-emf across two junctions of a thermocouple with temperature.
7. To determine heating efficiency of electrical kettle using voltages.
8. To determine Mechanical Equivalent of Heat (J) by Joule's Calorimeter.
9. To determine Activation Energy of Thermistor (NTC type)

Note: The teacher can introduce new and relevant experiments which are not in the above list.

Text Books & Reference Books:

1. B. L. Flint & H. T. Worsnop, "Advanced Practical Physics for students", 1971, Asia Publishing House.
2. Michael Nelson and Jon M. Ogborn, "Advanced level Physics Practicals", 4th Edition, reprinted 1985, Heinemann Educational Publishers.
3. Indu Prakash and Ramakrishna, "A Text Book of Practical Physics", 11th Edition, 2011, Kitab Mahal, New Delhi.
4. D. P. Khandelwal, "A Laboratory Manual of Physics for Undergraduate Classes", 1985, Vani Publication.
5. Dr. P. S. Hemne, Harnam Singh, "B.Sc. Practical Physics", S. Chand Publication.

Major Subject Paper II: Radiation and Statistical Physics (STUG03PHY002)

Credit: 02

Theory

Hrs: 30

Course Objectives :

- To understand the importance of theory of radiation.
- To expose the students to classical and quantum mechanics and introduce different applications

Course Outcomes:

Upon completing this course, students will be able :

- To understand the radiation and its effect on matter.
- To understand the statistical basis of thermodynamics.
- To familiar with MB, BE and FD Statistics and its applications.

Unit I

7 Hrs

Theory of Radiation : Black body radiation, Spectral distribution, Concept of energy density, Derivation of Planck's law, Wien's distribution law, Rayleigh-Jeans law, Stefan's Boltzmann law and Wien's displacement law from Planck's law. *Numericals.*

Unit II

8 Hrs

Statistical Basis of Thermodynamics : Probability and thermodynamic probability, Principle of equal priori probabilities, μ -space, Phase space, macrostate and microstate, Constraint, Accessible and inaccessible states, Entropy and thermodynamic probability, Equilibrium between two systems in thermal contact. *Numericals.*

Unit III

7 Hrs

M-B Statistics: Fundamental postulates of statistical mechanics, M-B statistics applicable to ideal gas, Maxwell-Boltzmann energy distribution law, Most probable speed, Average speed and root mean square speed, Maxwell-Boltzmann law of distribution of velocity. *Numericals.*

Unit IV

8 Hrs

B-E and F-D Statistics: Fundamental postulates of B-E statistics, Bose-Einstein's energy distribution law, Photon gas, Planck's radiation law.

Postulates of Fermi-Dirac statistics, F-D energy distribution law, Fermi energy, Expression for Fermi energy of electrons in metal, Fermi energy for electron at absolute zero (E_{F0}), Comparison between M-B, B-E and F-D statistics. *Numericals.*

Text Books & Reference Books:

1. Halliday, Resnick & Walker, "Fundamentals of Physics", Wiley Publication (6th edition).
2. H.C. Verma, "Concepts of Physics Vol. I and II", Bharti Bhavan Publisher.
3. Brij Lal, N. Subrahmanyam, "Properties of Matter", Eurasia Publication.
4. Chaudhari R.N., "Waves and Oscillations", New Age International Publisher.
5. C.L. Arora, Dr P.S. Hemne, "Physics for Degree Students B.Sc. First Year", S. Chand Publication.
6. C.L. Arora, Dr P.S. Hemne, "Physics for Degree Students B.Sc. Second Year", S. Chand Publication.
7. F. W. Sears, M. W. Zemansky and HD Young, "University Physics", Pearson.
8. Ronald Lane Reese, "University Physics", Brooks/Cole Publisher.

Practical Based on Major Paper II : Radiation and Statistical Physics**Credit: 02****Practical****Hrs: 60****List of Experiments (Perform any Seven Experiments):**

1. To measure the Planck's constant using black body radiation.
2. To determine Stefan's Constant.
3. To verify the Stefan's law of variation by using an incandenscent lamp
4. To verify the laws of probability distribution throwing one coin and two coins.
5. To show the deviation of probability from theoretical value decrease with increase in the number of event.
6. To study the statistical distribution from the given data and to find most probable and average value.
7. To study the random decay of nuclear disintegration and determination of decay constant using dices.
8. To record and analyze the cooling temperature of an hot object as a function of time.(cooling law).

Note: The teacher can introduce new and relevant experiments which are not in the above list.

Text Books & Reference Books:

1. B. L. Flint & H. T. Worsnop, "Advanced Practical Physics for students", 1971, Asia Publishing House.
2. Michael Nelson and Jon M. Ogborn, "Advanced level Physics Practicals", 4th Edition, reprinted 1985, Heinemann Educational Publishers.

3. Indu Prakash and Ramakrishna, “A Text Book of Practical Physics”, 11th Edition, 2011, Kitab Mahal, New Delhi.
4. D .P. Khandelwal, “A Laboratory Manual of Physics for Undergraduate Classes”, 1985, Vani Publication.
5. Dr. P.S. Hemne, Harnam Singh, “B.Sc. Practical Physics”, S. Chand Publication.

Minor Paper I : Properties of Matter and Kinetic Theory of Gases (STUG03PHY003)

Credit: 02

Theory

Hrs: 30

Course Objective:

- This course will introduce viscosity and surface tension of liquid to the students.
- To discuss kinetic theory of gases, transport phenomena involved in ideal gases.

Course Outcomes:

After completing the course, the student will be able to,

- Apply knowledge in understanding the flow of liquid and surface tension applied on the surface of liquid.
- Know the fundamentals of the kinetic theory of gases, Maxwell-Boltzman distribution law, equipartition of energies, mean free path of molecular collisions, viscosity, thermal conductivity, and diffusion.

Unit I

7 Hrs

Viscosity: Streamline and Turbulent flow, Coefficient of viscosity, Reynold's number, equation of continuity, Bernoulli's theorem and its applications (Lift of an Aeroplane and Atomizer), Poiseuille's equation. *Numericals*

Unit II

7 Hrs

Surface Tension: Surface tension and its molecular interpretation, Angle of contact, Excess of pressure inside a liquid drop, bubble in air and liquid, wetting and spreading, determination of surface tension by Jaegar's method, variation of surface tension with temperature. *Numericals*

Unit III

8 Hrs

Kinetic Theory of Gases: Assumptions of Kinetic theory of gases, expression for pressure exerted by gas, kinetic interpretation of temperature, deduction of gas laws from kinetic theory of gases, Degree of Freedom (Mono, Di and Polyatomic gases), Law of equipartition of energy, Mean free path, Expression for mean free path and its dependency on temperature and pressure. *Numericals*

Unit IV

8 Hrs

Transport Phenomena: Transport of momentum (viscosity η of gas) (derivation), transport of energy (thermal conductivity K) (derivation), relation between η and K , dependency of η and K on temperature and pressure, Transport of mass (diffusion D) (No derivation). *Numericals*

Text Books & Reference Books:

1. F.W. Sears and G.L. Salinger, "Thermodynamics, Kinetic theory & Statistical Thermodynamics", 1988, Narosa, New Delhi 1988.
2. Garg S C, Bansal R M and Ghosh C K, "Thermal Physics: with Kinetic Theory, Thermodynamics and Statistical Mechanics", 2nd Edition, McGraw Hill Education (2017).
3. R. Murugesan, "Properties of Matter for B.Sc. Students", S Chand Publishing.

4. Dr. D.C. Tayal and Praveen Tayal, “Properties of Matter and Sound”, Himalaya Publishing House.
5. Brij Lal and N. Subrahmanyam, “Properties of Matter”, S.Chand and Co 2003.

Practical Based on Minor Paper I : Properties of Matter and Kinetic Theory of Gases

Credit: 02 Practical Hrs: 60

List of Experiments (Perform any Seven Experiments):

1. To determination of Surface Tension by Jaeger’s Method.
2. To determine coefficient of viscosity of a liquid by Poiseuille’s flow method.
3. To determination of Surface tension of water by Capillary rise method.
4. To determine the surface tension of a liquid and the interfacial tension between two liquids using drop weight method.
5. To determine the surface tension of a liquid by method of ripples.
6. To determine the surface tension of mercury by Quinck’s method.
7. To determine the coefficient of thermal conductivity of a metal rod by Forbe’s method.
8. To determine the coefficient of thermal conductivity of a bad conductor by Lee Disc method.
9. To determine the coefficient of thermal conductivity of rubber in the form of a tube,
10. To determine the coefficient of viscosity of water by rotating cylinder method.

Note: The teacher can introduce new and relevant experiments which are not in the above list.

Text Books & Reference Books:

1. H. Singh and P.S. Hemne, “B.Sc. Practical Physics”, S. Chand Publication, 2011.
2. B. Saraf, “Physics through experiments”, Vikas Publications, 2013.
3. C. L. Arora, “A lab manual of Physics for undergraduate classes, 1st Edition, Vikas Publications.
4. C.L. Arora, “B. Sc. Practical Physics”, S. Chand & Co., Revised Ed 2007.
5. D. Chatopadhyay, P.C. Rakshit, and B. Saha, “An Advanced Course in Practical Physics”, New Central Book Agency Pvt Ltd., 2002.

OE: Group-A Climate Science (STUG03PHY004)

Credit: 02 Theory Hrs: 30

Course Objectives:

- To provide the students a basic understanding about the climate system: its attributes, underlying processes, and the drivers of climate change.
- To understand the physics behind the climate system, how climate has changed in the past and reasons why contemporary climate change is different.

- To provide an overview of the physical, ecological, biological, social and economic impacts of climate change.

Course Outcomes:

Upon completing this course, students will be able:

- To understand the green house effect as a natural phenomenon caused by an insulating layer of greenhouse gases.
- To understand the current climate change as an anthropogenic phenomenon resulting from increased greenhouse gas emissions.
- To explain ecosystem dynamics and the environmental, social, economic and ethical impact of climate change.
- To encourage others to protect the climate.

Unit I

7 Hrs

Atmospheric Science (Meteorology) as a multidisciplinary science. Physical and dynamic meteorology, difference between weather and climate, weather and climate variables. Green house gases. Structure (layers) of the atmosphere. Temperature variation in the atmosphere, temperature lapse rate, mass, pressure and density variation in the atmosphere.

Unit II

8 Hrs

Measurement of temperature, humidity, wind speed direction and pressure. Surface weather stations, upper air observational network, satellite observation. Overview of clouds and precipitation, aerosol size and concentration, nucleation, droplet growth and condensation. Cloud seeding, lightning and discharge.

Unit III

7 Hrs

Formation of trade winds, cyclones. Global Climate Change Green house effect and global warming, Enhancement in concentration of carbon dioxide and other green house gases in the atmosphere, Conventional and non-conventional energy sources and their usage.

Unit IV

8 Hrs

Causes for global warming: Deforestation, fossil fuel burning, industrialization. Manifestations of global warming: Sea level rise, melting of glaciers, variation in monsoon patterns, increase in frequency and intensity of cyclones.

Text Books Reference Books:

1. Don J. Easterbrook, "Evidence-Based Climate Science: Data Opposing CO₂ Emissions as the Primary Source of Global Warming", Elsevier Publications 2016
2. A Chandrasekhar, "Basics of Atmospheric Science", PHI Learning Private Ltd. New Delhi, 2010.
3. Mark Z Jacobson, "Fundamentals of Atmospheric Modeling", Cambridge University Press, 2000.
4. Joseph M. Moran, "Climate Studies: Introduction to Climate Science", American Meteorological Society 2010.
5. M.H. Syed, "Climate Change", Shubhi Publications 2012.

VSC: Practical Based on Major subject (STUG03PHY005)

Credit: 02 Practical Hrs: 60

List of Experiments (Perform any Seven Experiments):

1. To determine the coefficient of thermal conductivity of a bad conductor (Glass Disc) by Lee's disc method.
2. To determine the coefficient of thermal conductivity of glass tube.
3. To determine the thermal conductivity of a metal rod using Forbe's method.
4. To determine the energy band gap of a semiconductor using junction diode (Silicon).
5. To study the variation of Total radiation with temperature of an incandescent lamp..
6. To determine the Boltzmann's constant using P-N junction diode.
7. To determine the energy band gap of a semiconductor (Germanium) using four probe method.
8. To calibrate Resistance Temperature Device (RTD) using Null Method/Off-Balance Bridge.
9. To determine Mechanical Equivalent of Heat (J). (by Callender and Barne's constant flow method or other method).
10. To verify the laws of probability distribution throwing one coin and ten coins.
11. To study the statistical distribution from the given data and to find most probable and rms value.

Note: The teacher can introduce new and relevant experiments which are not in the above list.

Course Objectives:

- To introduce the fundamentals of wave motion, phenomenon and their properties
- To analyze Wave Equations and propagation from a more advanced perspective.
- To introduce the concept of superimposing harmonic oscillations, which lays the foundation for understanding the physics behind travelling and standing waves.
- To provides an in-depth understanding of Ultrasonic waves, their production, applications and basic phenomena related to acoustics.

Course Outcomes:

Upon completion of the course successfully, students will be able to

- Understand the basic concepts of wave motion and superposition of SHMs.
- Understand progressive and standing waves on a string and normal Modes of vibration of the string.
- Understand the concepts of Group velocity and Phase velocity.
- Learn the Fourier Theorem and its applications.
- Learn the basics of Ultrasonic waves and their applications.
- Understand the fundamentals of Noise, music and auditorium acoustics.

Unit I

7 Hrs

Superposition of two Harmonic Oscillations: Simple harmonic motion (SHM), Superposition Principle, Superposition of two SHMs having slightly different frequencies along the same line (Beats), Lissajous's Figures, Superposition of two Perpendicular Harmonic Oscillations and important cases- Graphical and Analytical Methods with equal (1:1) frequencies and unequal (1:2) frequencies, Formation of Lissajous's Figures by CRO and optical method. Application of Lissajous's Figures. *Numericals*

Unit II

8 Hrs

Wave Motion: Plane and Spherical Waves. Longitudinal and Transverse Waves, Plane Progressive (Travelling) Waves, Wave Equation. Particle and Wave Velocities, Pressure of a Longitudinal Wave. Energy Transport, Intensity of Wave.

Standing (Stationary) Waves in a String: Fixed and Free Ends, Analytical Treatment, Phase and Group Velocities, Changes with respect to Position and Time, Energy of Vibrating String, Transfer of Energy, Normal Modes of Stretched Strings, Longitudinal Standing Waves and Normal Modes, Open and Closed Pipes, Superposition of N Harmonic Waves. *Numericals*

Unit III

7 Hrs

Ultrasonic and Fourier's Theorem: Classification of Sound waves, Ultrasonic waves and their properties, Production by Magnetostriction method and piezoelectric effect method, detection by Quartz crystal method, Thermal Detectors, Kundt's tube method and Sensitive flame method, applications: depth of sea, signalling, SONAR and medical uses.

Periodic functions, Fourier's Theorem statement, Dirichlet's conditions, evaluation of Fourier coefficients, Fourier series for even and odd functions, Its application to saw tooth wave and square wave, Limitations.

Numericals

Unit IV

8 Hrs

Acoustics: Classification of sound waves, properties of sound, Human auditory system, Noise and music, characteristics of musical sound, Intensity and loudness of sound, Bel and Decibels, limits of audibility, musical notes, musical scale, diatonic scale, tempered scale.

Echo, Reverberation and time of reverberation, Sabine's formula, Absorption of sound, Absorption Coefficient, Acoustical absorbers, Requirements of good auditorium. Electrical analogy of acoustic vibration, Specific acoustic impedance, Power relation, Transient response of an oscillator.

Numericals.

Text Books and Reference Books:

1. R. Resnick and D. Halliday, "Fundamentals of Physics", Wiley Publisher, (6th edition).
2. H.C. Verma, "Concepts of Physics Vol. I and II", Bharti Bhavan.
3. Chaudhari R.N., "Waves and Oscillations", New Age International Publisher.
4. C.L. Arora, P.S. Hemne, "Physics for Degree Students B.Sc. Second Year", S. Chand and Co.
5. Brijlal and Subrahmanyam, "Waves and Oscillations", Vikas Publishing House Pvt. Ltd., Second Revised Edition.
6. M. Ghosh, D. Bhattacharya, "A Textbook Of Oscillations, Waves And Acoustics", S. Chand and Co., 5th Edition.
7. Subrahmanyam and Brijlal, "A text book of Sound", S. Chand Publisher, 2nd edition.
8. R.K. Ghose, "The mathematics of waves and Vibrations".
9. N. K. Bajaj, "The Physics of Waves and Oscillations", Tata McGraw-Hill Publishing Company Ltd., Second Edition.
10. Satya Prakash, "Oscillations and Waves", Pragati Prakashan.

Practical Based on Major Paper III : Waves and Acoustics

Credit: 02

Practical

Hrs: 60

List of Experiments (Perform any Seven Experiments):

1. To determine the frequency of an electric tuning fork by Melde's experiment and verify λ^2-T law.
2. To study Lissajous Figures by using CRO.
3. To determine the frequency of a tuning fork using a sonometer.
4. To determine the Frequency of AC mains using Sonometer.
5. To investigate the motion of coupled oscillations.
6. To determine the velocity of a transverse wave on a stretched string using a sonometer.
7. To determine the velocity of sound by using a resonance tube.
8. To determine the velocity of ultrasonic waves in a given liquid.
9. To measure the velocity of sound by Kundt's tube method.
10. To determine the unknown frequency by using a Helmholtz resonator.
11. To study the characteristics of loudspeaker.
12. To measure the coefficient of absorption of sound for different materials (cork, thermocol, mica, paper etc.)
13. To study the directional characteristics of Microphone.

Note: The teacher can introduce new and relevant experiments which are not in the above list.

Text Books & Reference Books:

1. B.L. Flint & H.T. Worsnop, "Advanced Practical Physics for students", Asia Publishing House 1971.
2. Michael Nelson and Jon M. Ogborn, "Advanced level Physics Practicals", 4th Edition, reprinted 1985, Heinemann Educational Publishers.
3. Indu Prakash and Ramakrishna, "A Text Book of Practical Physics", 11th Edition, 2011, Kitab Mahal, New Delhi.
4. Dr. P.S. Hemne, Harnam Singh, "B.Sc. Practical Physics", S. Chand Publication.

Major Subject Paper IV : Optical Physics (STUG04PHY002)

Course Objectives:

- To understand the concept of wave front and superposition of light.
- To study the theory and applications of Interference, diffraction and polarization.

Course Outcomes:

After completing the course, the student will be able:

- To handle the interferometers and other optical instruments.
- To distinguish between Fresnel's and Fraunhofer's diffraction.
- To understand the Nicol prism as Polariser and Analyser.
- To be conversant with production and detection of different types of polarized light.
- To understand the working of selected optical instruments like biprism, interferometer, and diffraction grating.

Unit I

7 Hrs

Interference of Light: Definition and Properties of wave front, Huygens Principle of propagation of wave front, Principle of superposition and interference of light, Division of amplitude and division of wave front, Fresnel's Biprism, Phase change on Reflection- Stokes' treatment, Interference in Thin Films: due to reflected and transmitted light in parallel film, Fringes of equal inclination (Haidinger Fringes), Interference in wedge-shaped film, Fringes of equal thickness (Fizeau Fringes). *Numericals*.

Unit II

8 Hrs

Newton's Rings: Newton's Rings: Experimental Fresnel's Diffraction: setup & theory, application of Newton's ring for measurement of wavelength and refractive index.

Michelson's Interferometer: Construction and working, types of fringes (circular and localized), Determination of wavelength, difference in wavelength and Refractive index. Visibility of fringes. *Numericals*.

Unit III

7 Hrs

Diffraction : Basic concept of diffraction, types of diffraction, Definition, Half-period zones, Zone plate, Diffraction due to straight edge and narrow slit. Fraunhofer's diffraction: Definition, Single slit, Double Slit, Diffraction Grating: construction, theory, its application to determine wavelength. *Numericals*.

Unit IV

8 Hrs

Polarization : Concept of polarization, Plane polarized light(PPL), production of PPL by reflection, double refraction in uniaxial crystal, Brewster's law, Uniaxial and biaxial crystal, positive and negative crystal, Nicol's prism: construction and working, Nicol as a polarizer and analyzer, Circular and elliptical polarization, phase retardation (quarter and half wave plate). *Numericals*.

Text Books & Reference Books:

1. F A Jenkins and H E White, "Fundamentals of Optics", McGraw-Hill 1976.
2. B.K. Mathur, "Principles of Optics", Gopal Printing 1995.
3. H. R. Gulati and D.R. Khanna, "Fundamentals of Optics", R. Chand Publication 1991.
4. F. W Sears, M. W Zemansky and H. D Young, "University Physics", Addison-Wesley 1986.
5. N. Subramanyam and Brijlal, "A Text Book of Optics", S. Chand Publication.
6. M. K. Bagde and S. P. Singh, "A Text Book of First year Physics", S. Chand Publication.

7. R. Murugesan, "Optics and Spectroscopy", S. Chand Publication.
8. C. L. Arora and Dr. P. S. Hemne, "Physics for Degree Students, B. Sc. Second Year", S. Chand Publications.
9. Satya Prakash, "Optics", Pragati Prakashan, Forth Edition 2015.

Practical Based on Major Paper IV : Optical Physics

Credit: 02

Practical

Hrs: 60

List of Experiments (Perform any Seven Experiments):

1. To determine the Refractive Index of the Material of a given Prism using Sodium Light.
2. To determine Dispersive Power of the Material of a given Prism using Mercury Light.
3. To determine the value of Cauchy Constants of a material of a prism.
4. To determine the Resolving Power of a Prism.
5. To determine wavelength of sodium light using Fresnel Biprism.
6. To determine wavelength of sodium light using Newton's Rings.
7. To determine wavelength of (1) Sodium & (2) spectrum of Mercury light using plane diffraction Grating.
8. To determine the Resolving Power of a Plane Diffraction Grating.
9. To determine focal length of long focus convex lens using short focus convex lens.
10. To determine the thickness of a thin paper by measuring the width of the interference fringes produced by a wedge-shaped Film.
11. To determine the wavelength of sodium source using Michelson's interferometer.
12. To determine the resolving power of a Telescope.

Note: The teacher can introduce new and relevant experiments which are not in the above list.

Text Books & Reference Books:

1. B.L. Flint and H.T. Worsnop, "Advanced Practical Physics for Students", Asia Publishing House, 1971.
2. I. Prakash & Ramakrishna, "A Text Book of Practical Physics", Kitab Mahal, 11th Edition, 2011.
3. Michael Nelson and Jon M. Ogborn, "Advanced level Physics Practicals", Heinemann Educational Publishers, 4th Edition, 1985.
4. D.P. Khandelwal, "A Laboratory Manual of Physics for Undergraduate Classes", Vani Publications, 1985.
5. H. Singh and P.S. Hemne, "B.Sc. Practical Physics", S. Chand Publication, 2011.

Minor Subject Paper II : Basic Electrostatics and LASER (STUG04PHY003)

Credit: 02

Theory

Hrs: 30

Course Objectives:

- To introduce students to the fundamental concepts of Electrostatics and its applications.
- To understand the concepts like electric field lines equipotential lines and how electric fields interact with charges and conductor.
- To teach students about the basic principles, applications and operation of Lasers

Course Outcomes:

After completing the course, the student will be able:

- To determine the force between two point charges and derive expression for electric field for line charge, circular ring and charge disc.
- To understand the Gauss's theorem of electrostatics, its applications.
- To have the knowledge of Electric Field in dielectric media.
- To have the knowledge of Laser operation, properties and applications

Unit I

7 Hrs

Electrostatics- I : Definitions of electric field, electric field intensity, electric potential, electric dipole, electric dipole moment, electric quadrupole. Electric field intensity due to electric dipole, electric field as a negative gradient of potential, conservative nature of electric field, torque on a dipole in a uniform electric field. Potential energy of an electric dipole, electrostatics field energy. *Numericals*

Unit II

8 Hrs

Electrostatics- II : Gauss's theorem of electrostatics(no derivation), applications of Gauss theorem- Electric field due to point charge, infinite line of charge, uniformly charged spherical shell and solid sphere. Electric potential due to a point charge, electric dipole (along axial line and equatorial line), uniformly charged spherical shell and solid sphere. *Numericals*

Unit III

7 Hrs

Electric Field in Dielectric : Capacitance of an isolated spherical conductor. Parallel plate, spherical and cylindrical condenser. Energy per unit volume in electrostatic field. Dielectric medium, Polarisation of dielectric, Displacement vector. Parallel plate capacitor completely filled and partially filled with dielectric. *Numericals.*

Unit IV

8 Hrs

Laser : Coherence, spatial and temporal coherence, Einstein's coefficients (absorption, spontaneous and stimulated emission), population inversion, optical pumping, characteristics of laser beam, Ruby laser, Semiconductor laser, He-Ne Laser, applications of lasers. *Numericals.*

Text Books & Reference Books:

1. Edward M. Purcell and David J. Morin, "Electricity and Magnetism", Cambridge University Press 3rd Edition,
2. J.H. Fewkes & J. Yarwood, "Electricity and Magnetism", University Tutorial Press.
3. Dr P. S. Hemne, Harnam Singh, "B.Sc. Practical Physics" S. Chand Publication.
4. D. C. Tayal, "Electricity and Magnetism", S. Chand Publication.
5. C. L. Arora, Dr P. S. Hemne, "Physics for Degree Students B.Sc. First Year", S. Chand Publication.
6. S.S. Atwood, "Electric and Magnetic Fields", Dover Publications Inc.
7. A.S. Mahajan and A.A. Rangwala, "Electricity and Magnetism", McGraw Hill
8. Brijlal and Subramanyam, "Electricity and Magnetism", S. Chand Publication.
9. D.N. Wasudeva, "Fundamentals of Magnetism and Electricity: for B. Sc. And Engineering Students", S. Chand Publication.
10. K. Thyagarajan and Ajoy Ghatak, "Lasers: Fundamentals and Applications", Springer
11. K. R. Nambiar, "Lasers: Principles, Types and Applications", New Age International (P) Ltd.
12. F A Jenkins and H E White, "Fundamentals of Optics", McGraw-Hill 1976.
13. B.K. Mathur, "Principles of Optics", Gopal Printing 1995.
14. N. Subramanyam and Brijlal, "A Text Book of Optics", S. Chand Publication.
15. R. Murugesan, "Optics and Spectroscopy", S. Chand Publication.
16. C. L. Arora and Dr. P. S. Hemne, "Physics for Degree Students, B. Sc. Second Year", S. Chand Publications.

Practical Based on Minor Subject Paper II : Basic Electrostatics and LASER**Credit: 02****Practical****Hrs: 60****List of Experiments (Perform any Seven Experiments):**

1. To determine wavelength of He-Ne LASER using grating element.
2. To determine wavelength of He-Ne LASER using measuring scale/ruler.
3. To determine spot size of LASER using knife edge.
4. To study the divergence of LASER beam.
5. To determine energy and power of LASER beam.
6. To measure the diameter of wire using LASER.
7. To measure contamination in liquid sample using LASER beam.
8. Use of LASER in optical fiber communication.
9. To study the total internal reflection using LASER.
10. To study the double slit interference by He-Ne LASER.
11. To study the Polarization nature of LASER beam.

12. To study diffraction by Single Slit/Double Slit/Groove spacing of CD.
13. To study of refractive Index of thin film using LASER.
14. To measure the thickness of thin film sample using LASER.
15. To study LASER as a monochromatic coherent source (To find the wedge angle of glass plate).
16. To determine wavelength of a Semiconductor LASER beam using plane diffraction grating.

Note: The teacher can introduce new and relevant experiments which are not in the above list.

OE : Group-A Sports Science (STUG04PHY004)

Credit: 02

Theory

Hrs: 30

Course Objectives:

- To learn the importance of measurement, evaluation, and testing in physical education.
- To develop concepts about nutrition, nutrients (both macro & micro) and energy generation
- To understand personalized nutrition, diet planning and softwares employed.
- To provide right concept about health and factors influencing health.

Course Outcomes:

Upon completing this course, students will be able:

- To understand need to exert sufficient force to overcome the inertia of stationary objects, like pushing a bobsled at the start of a race.
- To understand the inertia in developing effective starting techniques in sprinting or swimming.
- To be familiar with the structure, composition and nutritional role of food groups.
- To interpret and apply nutritional concepts to evaluate and improve the nutritional health of sports persons.

Unit I

7 Hrs

Measurement: Physical quantities. Standards and Units. International system of Units. Standards of time, length and mass. Precision and significant figures.

Unit II

8 Hrs

Newton's laws of motion: Newton's first law. Force, mass, Newton's second law, Newton's third law. Mass and weight, Applications of Newton's laws.

Projectile motion: Shooting a falling target. Physics behind Shooting, Javelin throw and Discus throw.

Unit III

8Hrs

Conservation laws: Conservation of linear momentum, collisions, elastic and inelastic (Definition & Characteristics). Angular momentum. (Physics behind Carom, Billiards, Racing). Centre of mass: Physics behind Cycling, rock climbing, skating.

Gravitation: Origin, Newton's law of gravitation. Archimedes's principle, Buoyancy (Physics behind swimming)

Unit IV

7 Hrs

Food and Nutrition: Proteins, Vitamins, Fat, Blood pressure. Problems due to the deficiency of vitamins. Energy: Different forms of Energy, Conservation of mass-energy.

Physical exercises: Walking, Jogging and Running, Weight management.

Text Books & Reference Books:

1. Yaakov Perelman, "Physics Everywhere", Prodinova Publications 2014.
2. M.Swaminathan, "Handbook of Food and Nutrition", Bangalore Press 2012.
3. B. Srilakshmi, "Food Science", New Age International Publications 2015.
4. Vassilios Mc Innes S. Pathopoulos, "An Introduction to the Physics of Sports", Create Space Independent Publishing Platform 2013.
5. Yaakov Perelman, "Mechanics for Entertainment", Prodinova 2014.
6. Walter Lewin, "For the love of Physics", Taxmann Publications Private Limited 2012.

SEC: Renewable Energy and Energy Harvesting (STUG04PHY005)

Credit: 02

Theory

Hrs: 30

Course Objectives:

- To understand the concept of renewable energy sources.
- To explore the knowledge of Fossil fuels and Alternate Sources of energy, Solar Energy, wind energy, ocean energy and hydro energy.
- To provide the knowledge of solar energy harvesting and their fundamentals understanding.

Course Outcomes:

Upon completing this course, students will be able:

- To identify different renewable sources of energy and technologies to harness them.
- To identify and explain the different resources of solar energy harvesting
- To explain and analysis the basic technology of solar energy.

Unit I

7 Hrs

Fossil fuels and Alternate Sources of energy: Fossil fuels and Nuclear Energy, their limitation, need of renewable energy, non-conventional energy sources. An overview of developments in Offshore Wind Energy, Tidal Energy, Wave energy systems, Ocean Thermal Energy Conversion, solar energy, biomass, biochemical conversion, biogas generation, geothermal energy tidal energy, Hydroelectricity.

Unit II**8 Hrs**

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.

Unit III**7 Hrs**

Wind Energy Harvesting: Fundamentals of Wind energy, Wind Turbines and different electrical machines in wind turbines, Power electronic interfaces, and grid interconnection topologies. Geothermal Energy: Geothermal Resources, Geothermal Technologies.

Unit IV**8 Hrs**

Ocean Energy: Ocean Energy Potential against Wind and Solar, Wave Characteristics and Statistics, Wave Energy Devices.

Hydro Energy: Hydropower resources, hydropower technologies, environmental impact of hydro power sources.

Text Books & Reference Books:

1. G. D. Rai, "Non-conventional Energy Sources", Khanna Publishers, New Delhi.
2. M. P. Agarwal Solar Energy", S. Chand and Co. Ltd.
3. Suhas P. Sukhative, "Solar energy", 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)

CEP : Community Engagement in Physics (STUG04PHY006)**Credit: 02****Practical****Hrs: 60****Course Objectives:**

- To explore the intersection of physics and community engagement, focusing on how physics principles can address societal challenges and inspire community-based learning.
- To develop projects that apply physics to solve practical problems, enhance public understanding of science, and promote sustainability through outreach and education.

Course Outcomes:

Upon completion of the course successfully, students will be able :

- To apply physics concepts to real-world issues within community contexts.
- To engage communities in understanding physics through education, outreach, and projects.

- To develop skills in collaborative problem-solving and science communication.
- To reflect on the ethical and social responsibilities of physicists in community engagement.

Weekly Topics and Schedule:

Week 1: Introduction to Physics and Community Engagement

- Role of physics in addressing community needs
- Overview of science communication and public outreach
- Examples of physics-based community projects

Week 2: Renewable Energy and Sustainability

- Physics of renewable energy (solar, wind, hydro)
- Engaging communities in sustainable energy practices
- Designing small-scale renewable energy solutions for underserved areas

Week 3: Physics in Everyday Life

- Demonstrating basic physics concepts to non-scientific audiences
- Developing community workshops on mechanics, electricity, and magnetism
- Tools for making physics relatable and engaging

Week 4: Physics and Technology for Development

- Applications of physics in low-cost technology development (e.g., water purification, energy storage)
- Prototyping simple physics-based solutions for community challenges
- Case studies: Physics and technology in rural development

Week 5: Climate Change and Environmental Physics

- Physics of climate change and its impact
- Community-based projects for monitoring environmental changes (e.g., temperature, water quality)
- Educating the public about the physics behind global warming

Week 6: Astronomy and Community Engagement

- Introducing communities to astronomy and space science
- Organizing stargazing events and astronomy workshops
- Using portable telescopes and apps to connect people with the night sky

Week 7: Physics Education Outreach

- Developing STEM education materials for schools
- Organizing science fairs and physics demonstrations
- Strategies for engaging underrepresented groups in STEM

Week 8: Physics of Infrastructure and Safety

- Physics of structural integrity: bridges, buildings, and earthquake safety

- Educating communities on disaster preparedness using physics
- Assessing local infrastructure challenges through physics principles

Week 9: Measuring Impact of Physics Outreach

- Tools for assessing the effectiveness of community engagement efforts
- Reflection on how physics projects benefit communities
- Sustaining community interest and involvement in physics

Week 10: Capstone Project Presentations

- Presentation of physics-based community projects
- Peer and instructor feedback
- Final reflection on community engagement in physics

Course Requirements:

1. Participation (20%): Active engagement in class discussions, workshops, and community events.
2. Service-Learning Project (30%): Design and implement a project that applies physics principles to a community issue.
3. Reflection Essays (20%): Reflect on experiences in applying physics to real-world challenges.
4. Group Presentation and Final report submission (30%): Collaborative presentation on a physics outreach initiative or case study and Comprehensive report on a chosen topic related to community engagement in Physics.

Fieldwork and Service-Learning Component :

Students are required to dedicate 20–30 hours to a service-learning project, which could involve:

- Developing renewable energy prototypes for a local community.
- Organizing physics education workshops for schools or community groups.
- Assisting in public science events such as stargazing nights or science fairs.

Grading Scale :

- A: 90–100%
- B: 80–89%
- C: 70–79%
- D: 60–69%
- F: Below 60%

Course Policies :

1. Attendance: Active participation in fieldwork and class activities is essential.
2. Safety: Adhere to safety guidelines while working on physics experiments and projects.
3. Ethics: Ensure honesty, respect, and professionalism in all community engagements and project work.

Text Books & Reference Books:

1. Richard A. Muller, “Physics for Future Presidents: The Science Behind the Headlines”, W. W. Norton and Company New York, London.
2. Martin A. Green, “Renewable Energy and Climate Change”.
3. Martin J. Bush, Climate Change and Renewable Energy”, Palgrave Macmillan.
4. Ajankumar Sahu and Dr S. P. Nanda, “Renewable Energy and Green Technology”, Notion Press.
5. Martin Kaltschmitt, Wolfgang Strichar, “Renewable Energy Technology, Energy and Environment”, Springer.